U.S. GLOBAL COMPETITIVENESS: STEEL SHEET AND STRIP INDUSTRY

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on Finance, U.S. Senate,
Investigation No. 332-231
Under Section 332(g)
of the Tariff Act of 1930

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PREFACE

On September 8, 1986, at the request of the Committee on Finance of the U.S. Senate 1/ and in accordance with section 332(g) of the Tariff Act of 1930 (19 U.S.C. 1332(g)), the U.S. International Trade Commission instituted investigation No. 332-231, U.S. Global Competitiveness: Steel Sheet and Strip Industry. The Commission was asked to provide information on, and analyze, measures of the current competitiveness of the U.S. industry in domestic and foreign markets; the competitive strengths of U.S. and major foreign competitors in these markets; the nature of the main competitive problems facing the U.S. industry; the sources of these problems and to what extent they are transitory or reversible situations as opposed to fundamental or structural problems; and the competitive strategies of U.S. and foreign industries and the importance of global markets to future competitiveness.

This investigation is one of a series requested by the Finance Committee which address the question of the global competitiveness of U.S. industries. The Finance Committee indicated that the industries to be studied should be "pivotal to U.S. industrial and technological strength." The criteria used in selecting the industries were that they either be "pathbreaking in the development of leading edge technologies that will shape future competitiveness of other U.S. industries," or that the industries be suppliers of "critical equipment or material used in other important industries." The steel industry falls in the latter category, as a basic raw material contained in products which are used in virtually all segments of the U.S. economy.

In view of the size and complexity of the industry, as well as the considerable analysis that has previously been done on steel, the Commission, in consultation with the Finance Committee staff, narrowed the focus of the study to the sheet and strip segment of the industry. This segment is the industry's most important in terms of the volume of products sold, accounting for 58 percent of shipments in 1986; moreover, the manner in which companies adjust to changing competitive conditions in the sheet and strip market is likely to be a key factor in determining the viability of the major steel producers, all of whom produce the subject products.

Notice of the investigation was given by posting copies of the notice of investigation in the Office of the Secretary, U.S. International Trade Commission, Washington, DC, and by publishing the notice in the Federal Register (51 F.R. 27264, July 30, 1986). 2/

The Commission held a public hearing on this investigation as well as the four others in this series (investigations Nos. 332-229 through 332-233) at the U.S. International Trade Commission Building in Washington, DC, on February 24, 1987. Two interested parties testified at the hearing: Inland Steel Industries and the Association of Cold Rolled Strip Producers.

1/ The request from the Committee on Finance is reproduced in app. A.
2/ A copy of the Commission's Notice of Investigation is reproduced in app. B.

In the course of this investigation, the Commission collected data and information from questionnaires sent to producers of steel sheet and strip, end users of steel sheet and strip, and intermediate processers of steel sheet and strip. In addition, information was gathered from various public and private sources; industry meetings; foreign fieldwork in Belgium, Canada, France, Japan, Korea, and West Germany; interviews with industry executives representing producers and end users of steel sheet and strip; and public data gathered in other Commission studies and from other sources.

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The information and analyses provided in this report are for the purpose of this report only. Nothing in this report should be construed to indicate how the Commission would find in an investigation conducted under other statutory authority covering the same or similar subject matter.

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Statistical Measures

Table A presents data on various statistical measures which can be used to gain insights into the competitive position of the seven industries examined in this study. The table shows that in addition to being a major world producer of sheet and strip (accounting for 11 percent of world production), the United States is also a major net importer, accounting for 19 percent of world imports, but only 1 percent of world exports. Following is a summary of the primary structural and market factors underlying the U.S. industry's competitive position.

Structural Factors

Production costs

- The U.S. sheet and strip industry is currently one of the more cost competitive among the major industrialized countries (table A). Its costs, however, are considerably above those of Korea and Brazil. The current U.S. position reflects considerable improvement over previous periods; the sharp decline in the value of the dollar against European currencies and the Japanese yen are largely responsible for the improvement.

- With respect to the various components of cost, U.S. raw materials costs are currently estimated to be among the highest of the principal competing countries, as they are exceeded only by those of West Germany. Labor costs, traditionally a major source of higher relative U.S. costs, are more comparable with other major producers in developed countries currently than in past periods, reflecting in large part the decline in the value of the dollar. Brazil and Korea, however, have a clear competitive advantage, as compensation in these countries totals only $3 per hour, as compared with U.S. compensation of $23 per hour.

- U.S. labor productivity in the sheet and strip industry is currently estimated to be the highest among the principal competing countries, a factor which tends to narrow the total U.S. labor cost disadvantage. The greater flexibility which U.S. producers have in adjusting manning levels during non-peak operating periods is one of the principal factors underlying the productivity advantage in the U.S. industry vis-a-vis other industrialized countries. While the same holds true relative to developing countries, the effort by governments in these countries to create and maintain employment in industries such as steel also tends to lower productivity.

Technology

- With respect to the technology employed to produce sheet and strip products, the U.S. industry is at a competitive disadvantage relative to its principal competitors, as the industry generally operates mills that are older than its foreign counterparts. Although many of these older mills can be and have been modernized, the complexity of the steelmaking process makes it difficult to achieve optimal results through retrofitting, as integration of a

Table A

Steel: Selected measures of competitive position and international competitiveness, by countries and by specified time period [1]

Measure	Time period	Brazil	Canada	France	West Germany	Japan	South Korea	United States
Aggregate steel operations:								
Crude Steel:								
Share of world production (percent)	1984-86	3	2	3	5	14	2	11
Share continuously cast (percent)	1986	46	46	90	85	93	71	55
Steel sheet and strip:								
Net profit (loss) to sales [2] (percent)	1984-86	[3] -6.6	4.7	-15.5	0.7	0.7	3.0	-3.5
Hot strip mills:								
Number	1987	4	8	3	6	21	3	38
Share of world capacity (percent)	1984	3	3	4	7	19	2	21
Capacity utilization (percent)	[4] 1987	95	80	75	80	60	100	60
Production:								
Share of world production [5] (percent)	1983-85	3	3	4	7	21	2	15
Share exported (percent)	1984-86	[6] 28	20	58	44	38	56	1
Hot rolled products: [6]								
Costs:								
Materials (dollars per metric ton)	[4] 1987	137	185	198	223	201	153	210
Labor (dollars per metric ton)	[4] 1987	20	79	114	75	72	20	85
Financial (dollars per metric ton)	[4] 1987	96	42	63	49	126	79	39
Total (dollars per metric ton)	[4] 1987	253	306	375	347	399	252	334
Labor:								
Productivity (man-hours per metric ton)	[4] 1987	6.4	4.4	5.0	4.2	4.3	6.0	3.7
Cost (dollars per hour)	[4] 1987	3	18	23	18	17	3	23
Trade:								
Share of world exports [6] (percent)	1984-86	5	3	7	13	25	3	1
Share of world imports [6] (percent)	1984-86	([7])	2	5	8	2	2	19
Ratio of exports to imports	1984-86	[6] 58.2	2.2	1.6	1.7	7.0	1.3	([8])
Import penetration [9] (percent)	1984-86	[6] 1	10	45	32	8	50	18
Share of world consumption [6] [10] (percent)	1983-85	2	2	3	7	17	2	19

[1] All data reflect annual averages for the specified time periods, except as noted.
[2] Aggregate corporate data for selected companies producing steel sheet and strip.
[3] 1983-85.
[4] Data as of early 1987.
[5] Includes steel plates.
[6] Includes steel plates and excludes coils for rerolling.
[7] Less than 0.5 percent.
[8] Less than 0.05.
[9] Imports as a percent of apparent consumption in the respective home markets.
[10] Foreign trade in coils for rerolling is not reflected in consumption calculations.

Source: United Nations, United Kingdom Iron and Steel Statistics Bureau, International Iron and Steel Institute, American Iron and Steel Institute, World Steel Dynamics, and various individual country sources.

variety of newer technologies in an optimal configuration often requires the construction of entirely new facilities.

o In the primary steelmaking phase of operations, the more competitive U.S. facilities produce steel products whose quality is equal to that produced in leading competitor countries. One area in which considerable progress has been made is in the adoption of continuous casters, a key technology that results in energy savings, higher productivity, and higher quality steel. Many U.S. producers are equipped with recently constructed, state-of-the-art casters, with additional facilities to become operational in the near future. The share of U.S. steel production produced with casters, however, still lags significantly behind that of other producers, including the Japanese and West German industries (table A).

o With respect to rolling mills, recent U.S. modernization programs have upgraded certain domestic "hot-strip" mills 1/ to highly competitive status, but state-of-the-art facilities are more widespread among the principal foreign competitors. The U.S. industry has invested heavily, however, in new coating facilities to take advantage of rapidly growing demand for certain zinc-plated (i.e., electrogalvanized) steel products.

Financial performance

o A key measure of competitiveness is the profitability of companies over time. Although government intervention diminishes the value of profitability as a measure to evaluate the industry's relative competitive position and exchange-rate fluctuations increase its variability, it can nonetheless provide useful insights into the financial health of firms. During 1984-86, the U.S. industry was among the three principal competing countries which sustained losses (table A). Developments in 1987, however, suggest a return to profitability for the U.S. industry, at least for the near term.

Market Factors

o From the steel purchasers' point of view, the U.S. steel industry's strengths lie in its historical ties with suppliers, the lower transportation costs and shorter delivery times associated with domestic purchases, and the availability of products. Engineering and technical assistance were assessed as better than average by the purchasers. In all other aspects that are significant to purchasers (such as price and the ability of producers to meet customer quality specifications), the U.S. industry was rated as average.

Government Involvement

o Government policies are an important factor influencing the competitive position of steel producers worldwide. This involvement has resulted in the construction of facilities that otherwise would probably not

1/ Hot strip mills are one of the more important facilities associated with sheet and strip production.

have been built, and the continued operation of facilities that otherwise would have been closed. One of the more common forms of involvement is through subsidization. A review of the unfair trade investigations conducted by the U.S. Government in recent years indicates that subsidization in the industry is widespread. Of the six principal foreign competitors, four (Brazil, France, West Germany, and Korea) were subject to countervailing duty investigations on sheet and strip products; affirmative findings were made in each of the cases. Margins ranged from de minimis in the case of West Germany to 17 to 37 percent in the case of Brazil.

o Governments have also intervened frequently to assist in the restructuring and modernization of their respective steel industries during the 1970's and 1980's through a variety of measures, including internal price and production controls and measures affecting foreign trade. U.S. Government involvement has generally been limited to the latter; measures have included quotas and/or tariffs on high-valued specialty steel (1976-80 and 1983 to the present), a price monitoring system (i.e., the trigger price mechanism) applicable to imports of carbon steel imports (1978-82), and formal restraint agreements involving U.S. imports of high volume carbon steel (in effect from 1982, when an initial arrangement was negotiated with the EC, to the present).

o Analysis conducted by the Commission and other industry analysts suggests that the trade measures implemented by the U.S. Government resulted in reductions in the level of imports into the U.S. market. However, the level of imports has also been influenced by other factors, such as exchange rate movements. For example, the changes which have occurred in imports of sheet and strip as a percent of apparent U.S. consumption during 1981-87 generally have been accompanied by corresponding changes in the value of the dollar against major foreign currencies. The Commission examined the effect of the current VRA's on the industry. Assuming that the restraints resulted in a 3-percentage point decline in sheet and strip import penetration (which approximates the decline from 1984 to 1987), the VRA's may have resulted in a 3-5 percent increase in sales revenue of domestic sheet and strip producers, a 0.05 - 1.25 percent increase in domestic producers' prices, and up to a 3 percent increase in employment.

o At the international level, the role of the World Bank, a major intergovernmental lending institution, has shifted in recent years. In lieu of assisting in financing capacity expansions in developing countries, the Bank is currently focusing on providing technical and advisory assistance to developing countries as they formulate their longer term objectives with respect to steel.

o Another form of government intervention involves regulatory policy. In the steel industry, compliance with environmental regulations has been particularly costly. Recent studies, however, indicate that similar expenditures have been made by all major foreign industries in industrialized countries; moreover, Commission fieldwork indicates that developing countries such as Brazil and Korea are also experiencing increased costs in this area.

Comparative Strengths and Competitive Position of the U.S. Industry and Major Foreign Competitors

As discussed below, the competitive positions of the seven major sheet and strip producing countries depend on a number of factors. Although some countries (such as Brazil and Korea) rely on low production costs to provide their competitive edge, others (such as France and West Germany) benefit significantly from technologically advanced facilities. The strategies set forth by the producing countries for maintaining and/or improving competitiveness vary depending on such factors as industry profitability and capacity utilization levels. However, one common goal cited by most producers is to increase production of higher value specialized products as competition from lower cost producers (developing countries) for lower value sheet products continues to intensify. Ironically, the developing countries themselves have also indicated intentions to increase participation in the markets for the higher value products.

Brazil

Trade position

o During 1984-86, Brazil exported 28 percent of its production of flat-rolled products (i.e., plates, sheets, and strip); the United States was the leading foreign market in 1986, accounting for 19 percent of the export total. Imports, which are controlled by the Government, are minimal, accounting for less than 1 percent of Brazilian apparent consumption.

o During 1984-86, Brazil was the sixth largest foreign supplier of sheet and strip products to the U.S. market, accounting for 4 percent of total U.S. imports (or 1 percent of apparent U.S. consumption). Relative competitiveness was highest in lower value, uncoated steel products where import shares were 6 to 7 percent; shares in coated and stainless sheet products were each less than 1 percent.

Competitive position

o Relatively low labor costs and access to high grade iron ore are the competitive strengths underlying the Government-owned industry's position as one of the lowest cost producers in the world. Brazilian sheet and strip producers are not among the most profitable, however, as price controls in the country have created an environment in which profits have proved elusive.

o As a major world steel producer, Brazilian industry officials have indicated their intention to double production by the end of the century. Realization of these plans depends, however, on the ability of the companies to generate investment funds. The industry indicates that the focus of future investment will be on upgrading the mix of sheet products produced.

Canada

Trade position

o During 1984-86, Canada exported 20 percent of its sheet and strip production; the United States was the leading foreign market, accounting, in 1986, for 76 percent of the export total. Increased imports from Brazil, Korea, and EC countries have resulted in an increase in import market share in recent years from 7.7 percent in 1982, to 11.4 percent in 1986.

o During 1984-86, Canada was the third largest foreign supplier of sheet and strip products to the U.S. market, accounting for 9 percent of total U.S. imports (or 2 percent of apparent U.S. consumption). Relative competitiveness was highest in coated and hot-rolled products, where import shares totaled 10 and 15 percent, respectively.

Competitive position

o High operating rates and relatively strong financial performance have been the characteristic competitive strengths of the Canadian sheet and strip industry in recent years. The relatively strong performance of the industry can be attributed to generally restrained capacity expansions that have kept the industry well sized for its markets, and tax and trade policies that, in the past, favored industry growth.

o The Canadian industry, which is noted for its commitment to the application of new technology, has nonetheless been subject to competitive pressures that have resulted in the closure of certain primary steelmaking facilities, as well as the closure of facilities producing products other than sheet and strip. Expenditures have continued to be made, however, in new plant and equipment in order to improve product quality. Rising aggregate labor costs and a reliance on the North American market, where demand is not growing, are factors that could inhibit further growth in the Canadian industry.

France

Trade position

o During 1984-86, France exported 58 percent of its sheet and strip production; in 1985, some 11 percent of these exports were destined for the U.S. market. Imports, which have been subject to EC government controls, have accounted for an average 45 percent of apparent French consumption in recent years.

o During 1984-86, France was the fifth largest foreign supplier of sheet and strip products to the U.S. market, accounting for 7 percent of total U.S. imports (or 1 percent of apparent U.S. consumption). Relative competitiveness was greatest in high-value stainless sheet products and lower value hot-rolled products, where import shares were 21 and 14 percent, respectively.

Competitive position

o The French steel industry, nationalized since 1981, has undergone substantial modernization and restructuring in recent years. These efforts, which were assisted significantly by the EC and the French Government, have resulted in sizable gains in productivity and sharp declines in the size of the work force.

o Although French sheet and strip facilities are among the most technologically advanced in Europe, profitability has proved elusive, a phenomenon that could continue in light of rising labor costs and a loss in relative cost competitiveness due to the decline in the value of the dollar.

West Germany

Trade position

o During 1984-86, West Germany exported 44-percent of its sheet and strip production; the United States was the leading foreign market in 1985, accounting for 12 percent of the export total. West Germany is also, however, the world's second leading importer of sheet products; imports, which have been subject to EC government controls, have accounted for 32 percent of apparent West German consumption in recent years.

o During 1984-86, West Germany was the second largest foreign supplier of sheet and strip products to the U.S. market, accounting for 12 percent of total U.S. imports (or 2 percent of apparent U.S. consumption). Import shares in carbon steel products ranged from 10 to 15 percent; the share of stainless imports, however, was lower (8 percent).

Competitive position

o The West German steel industry, which is comprised of some of the most diversified steel companies in the world, has long been recognized for its technological leadership. While the industry has undergone substantial restructuring in recent years, the sheet and strip segment of the industry has remained intact, as most capacity closures have affected other product lines and certain primary steelmaking facilities.

o The increasing focus of the industry on sheet products reflects the relative strength of the market for these products, and the effects of competition from lower cost producers for less sophisticated products (such as steel rods and bars).

o Performance of the industry has been affected in recent years by production and trade restrictions imposed by the EC, as well as by the state-aided modernization of major EC competitors.

Japan

Trade position

o During 1984-86, Japan exported 38 percent of its sheet and strip production; in 1985, some 18 percent of these exports were destined for the U.S. market. Import penetration in the Japanese market has increased in recent years, from 5 percent in 1982 to 7-9 percent in subsequent years.

o During 1984-86, Japan was the largest foreign supplier of sheet and strip products to the U.S. market, accounting for 32 percent of total U.S. imports (or 6 percent of apparent U.S. consumption). Japan's share of imports ranged from a low of 19 percent in stainless sheet products, to a high of 52 percent in coated steel products.

Competitive position

o Despite Japan's competitive strengths in its relatively modern, large-scale facilities and its reputation as a world leader in cost-efficient, high-quality steel production, the industry has experienced competitive problems in recent years. Sluggish world steel markets coupled with the yen's rapid appreciation in the past 2 years and restrictions limiting exports have created an environment of economic uncertainty that is limiting the industry's ability to plan future investments and is constraining its ability to implement restructuring plans.

o Current rationalization plans, which are based on an exchange rate of 150 yen per dollar, call for a lowering of employment levels by an average of 25 percent, a reduction in capacity, and diversification of operations to nonsteel activities such as ceramics, electronics, and services.

o Japanese industry analysts indicate that further significant reductions in employment levels and capacity are likely if the yen appreciates much more than the 150 yen per dollar rate.

Korea

Trade position

o During 1984-86, Korea exported 56 percent of its sheet and strip production; some 29 percent of these exports were destined for the U.S. market in 1986. Import penetration in the Korean market increased from 30 percent in 1982, to 54 percent in 1984, before declining to 46 percent in 1986.

o During 1984-86, Korea was the fourth largest foreign supplier of sheet and strip products to the U.S. market, accounting for 8 percent of total U.S. imports (or 1 percent of apparent U.S. consumption). Korea's share of imports ranged from a low of 5 percent in coated sheet products, to a high of 10 percent in cold-rolled steel products.

Competitive position

o Although heavily reliant on imports of the primary raw materials used in steelmaking (i.e., iron ore and coal), the Korean steel industry, like the Japanese industry before it, has established itself as one of the most modern, cost-competitive industries in the world. Even the Japanese are currently measuring their industry's competitiveness in terms of the Korean industry.

o Relatively low wage rates and modern facilities are the primary strengths explaining Korea's high level of competitiveness, but the industry has also benefited from relatively high domestic demand, which in recent years has enabled producers to operate at nearly full capacity.

o In addition to expanding capacity, the industry is focusing its efforts on achieving self-sufficiency in the production of high-quality steel, most of which is currently imported from Japan. Although the United States is a major foreign market for Korea, Japan is the largest; moreover, discussions with Korean producers suggest that Japan is the "natural" market in which further expansion in trade is likely to develop.

United States

Trade position

o The United States is a relatively small factor in sheet and strip export markets, accounting for 1 percent of world exports. The country is the world's largest importer of sheet and strip products, however. Imports as a share of U.S. consumption rose from 11 percent in 1980 to 20 percent in 1984 before declining (during a period of trade restraints) to 17 percent in 1986.

o Although not a major factor in international markets, the U.S. industry accounts for the majority of shipments to U.S. consumers; the share of the domestic market served by the industry in each of the major product markets ranges from 80 to 85 percent.

Competitive position

o The U.S. sheet and strip industry's proximity to major domestic steel markets in the Midwest and long-standing ties to consumers are among the factors which have enabled it to maintain a relatively large share of the U.S. market, despite being one of the world's highest cost producers during much of the past several decades.

o The U.S. industry is characterized by a wide diversity in the competitive posture of firms and facilities, reflecting differences in the firms' market orientations, financial conditions, and physical plants. Although significant progress has been made in reducing costs and improving productivity and product quality at many facilities, various barriers (especially financial constraints) have precluded the industry as a whole from upgrading and modernizing many facilities to a fully competitive status.

o In an effort to mitigate the problems encountered as a result of restricted financial resources and to improve competitiveness, producers have increased their level of cooperation and the number of joint ventures in several areas, including production facilities, research and development, and customer interaction; partners have included both foreign steel producers (notably the Japanese) and other domestic firms. Restructuring has also entailed the closure or sale of facilities; the rate of closure, however, has been slowed by high exit costs (see discussion on the nature and sources of competitive problems below).

Nature and Sources of Competitive Problems

A variety of problems confront domestic steel sheet and strip producers in their efforts to compete. Some of these problems stem from factors that are transitory in nature, such as shifts in exchange rates or profitability. Others emerge from structural problems, such as the need to modernize the physical plants of the industry, and prospects for little, if any, growth in domestic demand.

Transitory Problems

Exchange rates

o The dollar's 50-percent appreciation (in real terms) during 1980 to 1985 contributed significantly towards the doubling (to 20 percent penetration) of imports in the U.S. market. Many foreign firms took this opportunity to either acquire a greater share in the U.S. market or earn higher profits. The recent weakening of the dollar has lessened foreign competitive pressures; the shifts that have occurred are the single most important factor in the increased cost competitiveness of U.S. producers relative to other major producers in Japan and EC countries.

o Analysis of the changes in exchange rates and changes in import prices suggests that linkage between the two is relatively weak, reflecting, in part, the effects of U.S. trade measures on import volumes and prices.

Profitability

o Profitability is comprised of two basic ingredients--the costs of inputs and prices received for products. Although the domestic industry has made significant strides in reducing costs (from an estimated $595 per metric ton in 1983 to $488 per metric ton in November 1987), as indicated above, losses have been substantial in recent years partly because of price levels that have been relatively low since the early 1980's.

o As a result of the weakening of the dollar, increased demand, and the effects of import limitation agreements, the domestic industry has been successful in raising prices on sheet and strip products on several different instances during 1987; this, together with one-time investment tax credit refunds, have contributed to improved domestic profitability.

Structural Problems

Investment

o Many of the structural problems encountered by the domestic integrated sheet and strip industry are related to the need to modernize facilities. Modernization has been hampered by the low profitability of the industry throughout the 1980's and the cost of financing investment.

o Relatively high interest rates are an ongoing problem for the domestic industry. As a result of poor financial results, conventional loans are extended to domestic producers at several points above the prime rate, if they are extended at all. Several producers indicated that they have difficulties acquiring conventional financing, regardless of the interest rate or other terms. Bond ratings of the sheet and strip producers are marginal and have been declining steadily since the early 1980's.

Minimills 1/

o Some of the sheet and strip industry's structural problems are the result of developments in other product lines. Many of the markets for "long" products (such as bars, rods, and light structurals) have been taken over by the minimill segment, forcing closures of integrated production facilities and associated costs.

o The economics of producing sheet and strip products have traditionally favored production in large scale operations, a factor which has effectively precluded minimills from competing in these markets. Recent technological developments which enable the casting of thin slabs, 2/ however, appear to have reduced barriers significantly, a development which could have major implications for the industry.

Exit costs

o A major component of the integrated sheet and strip industry's restructuring involves reductions in capacity. In addition to the social problems associated with closures, a variety of factors dominated by labor-related issues result in the producers being responsible for formidable costs when closing a facility. Estimates of the costs encountered by integrated firms when shutting down a steel facility run from $75,000 to $100,000 per employee, mainly for separation and pension allowances, or $150 million to $200 million for a 2,000-employee facility.

1/ Minimills are relatively small steel producers that produce steel using ferrous scrap as a principal raw material.
2/ Slabs are semifinished steel products which are processed on rolling mills into sheet and strip products.

Reconstituted mills

o "Reconstituted" steel mills are steel facilities that have been restructured through bankruptcy proceedings, or have been sold to independent operators. Lower pension obligations and the renegotiation of contracts affecting labor and raw materials often mean that the reconstituted companies can be operated at lower overall costs, a development that has put significant competitive pressures on other firms in the industry.

Foreign financial assistance

o Foreign government financing of shutdowns, operating losses, and modernization programs have placed the U.S. industry at a great disadvantage. Firms benefiting from such assistance have been able to avoid costs which otherwise might have led to business failures, while enhancing their respective competitive positions.

Demand

o The long-term outlook for steel sheet and strip demand indicates that there is little prospect for growth in domestic demand. The short-term (1990) projection made by consuming firms indicates a 2-percent increase in demand; the projections depend critically on general economic conditions, however, as they are based largely on anticipated increases in the production of goods containing sheet products (such as automobiles, appliances, and machinery and equipment).

Competitive Strategies

o In addition to reducing costs and modernizing, U.S. producers have indicated a number of other strategies for improving their competitive position, such as improving product quality, improving and expanding technical assistance and support for their products, increasing production of higher value-added products, and targeting specific geographic areas and specialized end-user markets. In particular, the automotive market is being targeted by U.S. producers, as is evidenced by the construction of five new electrogalvanizing lines in 1986.

Industry Outlook

o The restructuring of the integrated steel companies in the United States is far from complete. Although capacity in primary steelmaking operations is likely to continue to decline, the prospects for reductions in sheet and strip rolling and finishing capacity appear to be limited, reflecting the relative strength of the market for these products; the focus of restructuring in the sheet and strip sector is likely to continue to be on modernization of facilities.

o Modernization of facilities which are to remain operational appears to be a long term proposition which will severely test the financial resources of the U.S. producers. The current profitability of companies is, as indicated above, a transitory phenomenon which in part reflects significant improvements in costs relative to Japanese and European producers, and the effects of import restraints on the industry. Demand developments, exchange rates and U.S. trade policy (to the extent that such policy acts to reduce imports into the U.S. market) would therefore appear to remain important determinants of the U.S. industry's future financial and market positions.

o As indicated above, the technological advances which have been made in producing sheet and strip products economically on a relatively small scale could have significant long term implications on the industry. In the short term, competition from minimills is likely to be limited to lower-value, commercial grade products. The availability and price of scrap are factors which could act to limit the extent to which minimills can expand market share, at least in the short run.

o Internationally, it would appear that steel issues are far from being resolved, as significant government involvement and overcapacity appear to be situations which are likely to continue for at least the next several years. As the relative importance of the steel industries in the industrialized countries as a source of employment and economic activity declines, however, government involvement could well lessen, thereby facilitating a return to more open steel markets in these countries.

o With respect to trade, information gathered by the Commission through discussions with major domestic and foreign producers, analysts, and government officials suggests that companies in all countries are preparing to compete in the markets for higher-value steel products, a development which could lead to further trade problems in the event that restrictions worldwide are lifted.

CHAPTER 1. DESCRIPTION AND USES

Steel is a generic term used to describe a variety of iron-carbon alloys. Although steel may contain other elements intended to enhance one or more properties (such as hardness, strength, or corrosion resistance) and may contain certain elements retained from raw materials, iron must predominate by weight. The different grades of steel are generally classified in four categories: carbon, stainless, tool, and other alloy.

After production, steel is generally solidified into semifinished shapes prior to rolling, drawing, or welding into such products as sheets and strip (used widely by the automotive industry), plates (used in construction, machinery, and industrial equipment), wire and wire products, rails and accessories, and pipe and tubing. Steel products are used in virtually all sectors of an industrial economy; their use far exceeds that of any other metal.

The most important segment of the industry is the steel sheet and strip segment which accounted for more than half of total domestic shipments of steel mill products in 1986. Sheet and strip products are the mainstay of the large, integrated steel mills, which account for the bulk of industry shipments of all products. Such products are also important as a source of intermediate materials for most major U.S. industries, including the construction, transportation, machinery and equipment, container, and pipe and tube industries, which each consume millions of tons of steel sheet and strip annually.

The sheet and strip products covered in this study include those which have been hot-rolled or cold-rolled, as well as those which have been coated with zinc, tin, or other material. Specific products are further described and defined in appendix C.

Hot-rolled sheet and strip products are used primarily by the construction and automotive industries. Cold-rolled products are a thinner, more smoothly finished product having a higher strength-to-weight ratio than can be achieved solely by hot-rolling. Their principal end uses are in the automotive industry, and the electrical equipment and appliance industries. Coated products (of which tinplate and zinc plated galvanized sheet and strip are the main items) are used in applications requiring protection against corrosion, such as automobile parts, food and beverage containers, kitchen utensils, and electrical equipment. Stainless steel sheets and strip, a high valued alloy product, are used in food-processing equipment, chemical fertilizer tanks, liquid gas storage tanks, hospital equipment, and defense material. Stainless steel strip is used in automobiles, appliances, industrial equipment, and defense applications.

New products in the sheet and strip market include high-strength low-alloy (HSLA) products which have superior strength while maintaining formability and ductility standards. These steels are being used increasingly by appliance and auto manufacturers. Various coated steels which provide improved surfaces and increased resistance to corrosion have also been introduced recently in the sheet and strip market. Coated sheets are used by appliance and automobile manufacturers and in construction markets for architectural panels and doors.

CHAPTER 2. PRODUCTION PROCESSES AND PRODUCTION TECHNOLOGY

Description of Production Process and Technology 1/

The production of steel is a capital-intensive process, requiring investment in facilities costing millions of dollars. The last greenfield facility built in North America, Stelco's Lake Erie Works in Nanticoke, Canada, which was constructed during November 1974-June 1980, cost Can$829 million (US$620 million) for a 1.3-million-ton-complex dedicated to the production of hot rolled coils. 2/ Incremental investments raised the investment to Can$1.1 billion (US$825 million) by 1986, and an additional Can$40 million (US$30 million) modernization is underway. 3/ The investment required and the relatively low rate of return in recent years are factors that have effectively precluded a facility being built in the United States. The last integrated plant in the United States was built by Bethlehem Steel Corp. in the early 1960's. Even retrofitting existing facilities, however, is an expensive proposition. Modern blast furnace and coke oven batteries cost on the order of $250 million apiece. A ladle metallurgy station costs up to $60 million. Hot strip mills represent another significant cost component; a modern 3 million annual ton facility would require an investment of $270 million or more. 4/

Molten steel is produced by one of two methods. In the integrated process, iron ore and coke (a coal product that has been processed in a coke oven) are smelted in a blast furnace to produce "pig" iron. The pig iron is further refined in steelmaking furnaces (generally a basic oxygen furnace) to produce steel. In the nonintegrated process steel scrap is melted and refined in electric furnaces. The latter method is used to produce high-value specialty steels and lower value bars, rods, and structural shapes. Although bars, rods and structurals are also produced at integrated plants, the principal products produced at integrated plants are flat-rolled plates and sheet products. The economies of scale associated with the integrated process have effectively limited the extent to which carbon steel flat rolled products (particularly sheets) have been produced at smaller scrap-based facilities such as the minimills. Recent technological developments, however, may make smaller scale production economically viable in the near future (see "Technological Innovation" section).

1/ This section is based largely on material provided in chapter 33, "The Manufacture of Hot-Strip Mill Products," The Making, Shaping and Treating of Steel, published under the auspices of the Association of Iron and Steel Engineers by Herbick & Held, Pittsburgh, PA, 10th edition. A glossary of technical terms is presented in app. D.
2/ "Lake Erie Works," Stelco publication.
3/ Royal Bank of Canada, May 1986.
4/ Construction in the United States of a full complement of facilities capable of making, shaping, and treating steel would cost on the order of $12 billion for a modest 6 million ton per year facility.

The metallurgical composition of the steel is determined in the primary ironmaking and steelmaking stages. Improvements in steel purity and quality at this stage allow a producer to take full advantage of downstream processing abilities. Certain elements in the steel's chemistry (sulfur, nitrogen, carbon, oxygen and phosphorus) must be minimized for demanding sheet applications. New blowing practices (i.e., bottom, combined, or independent) and stirring practices (i.e., argon or magnetic) aid steelmakers in this pursuit. Sulfur and phosphorus can be controlled in the liquid steel stage; however, technologies are also evolving to control these elements in the hot metal (iron) stage.

Through the raw steelmaking stage, the process of producing sheet and strip is similar to the production of other steel products. Once that stage is passed, manufacturing processes begin to diverge. Although ladle metallurgy practices are used to produce steel for products other than sheet, their importance in meeting current sheet specifications has prompted widespread use of such equipment, in varying degrees, among major producers of quality sheet. It is at this point that discussion of the production process and technology for sheet and strip proceeds.

Ladle Metallurgy

Subsequent to refining in a steelmaking furnace, but prior to casting into a semifinished form, molten steel may pass through a ladle metallurgy station. Ladle metallurgy is not a single process, but rather encompasses a wide variety of specific refining processes practiced subsequent to the primary steelmaking stage. Installations range from generally simple equipment to complex facilities incorporating a variety of processes. The use of ladle metallurgy (also referred to as ladle refining or secondary steelmaking) offers two major advantages to a steelmaker: improved quality and greater effective capacity for the primary steelmaking vessel. Figure 2-1 illustrates one example of a ladle metallurgy installation.

The concept of ladle metallurgy is to allow the basic oxygen or electric furnace to concentrate on rapidly refining the heat of steel to only an approximation of the final specifications. The steel is then teemed into a ladle and transferred to the ladle metallurgy station. If the steelmaker does not have ladle-refining capability, the final specifications must be met out of the primary steelmaking furnace, requiring longer cycles for each heat. The shorter heat times made possible by using ladle refining methods result in a higher effective production capability as the steelmaking furnace cycles faster and more often. At the ladle metallurgy station, the final refining is performed and adjustments to the steel's chemistry are made.

A steelmaker usually has several major goals when engaging in ladle metallurgy practices. Many of these goals involve the removal or transformation of undesirable elements in the molten steel. 1/ Additionally,

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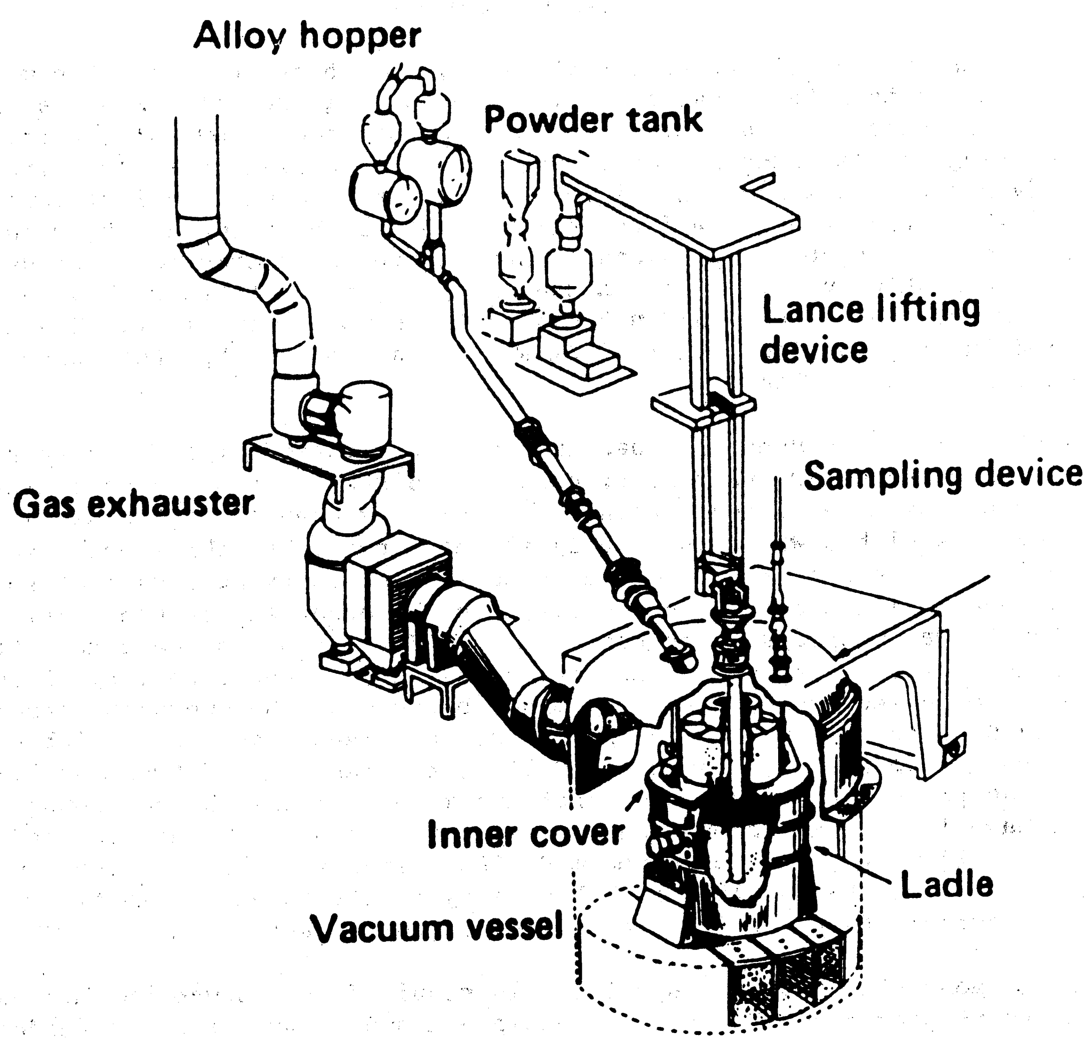
1/ Specifically, removal of oxygen (deoxidation), removal of hydrogen (degassing), removal of carbon (decarburization), removal of sulfur (desulfurization), removal of oxide and sulfide compounds (microcleanliness), and transformation of detrimental oxides that cannot be removed (inclusion morphology) are major objectives of ladle metallurgy processes.

Figure 2-1.
Major components of a multifunctional ladle metallurgy station



Source: **Kohtan, T., in "The Changing World of Steelmaking," Proceedings from the 21st annual conference of the International Iron and Steel Institute, Oct. 4-7, 1987.**

alloying agents are often added; with some equipment, molten steel temperature can be adjusted for optimum continuous casting performance. Ladle metallurgy is required to produce the increasingly popular tight specification steel chemistries such as low carbon, deep drawing steels.

Slab Production

Upon achievement of the proper chemistry in a heat of steel, the molten metal is cast into a form that can enter the rolling process. Two casting processes are currently in use: ingot casting and continuous slab casting. Ingot casting is the older process, entailing the casting of a form with a generally square cross section (fig. 2-2). Ingots are cast in individual molds in which they are allowed to solidify before the molds are "stripped" or removed from the ingot. Ingots can either be stored at this point or sent directly to soaking pits. While in soaking pits, the ingots are heated to the proper temperature for rolling in the slabbing or breakdown mill. The ingot is rolled in the slabbing mill to form a slab, a semifinished form with a rectangular cross section.

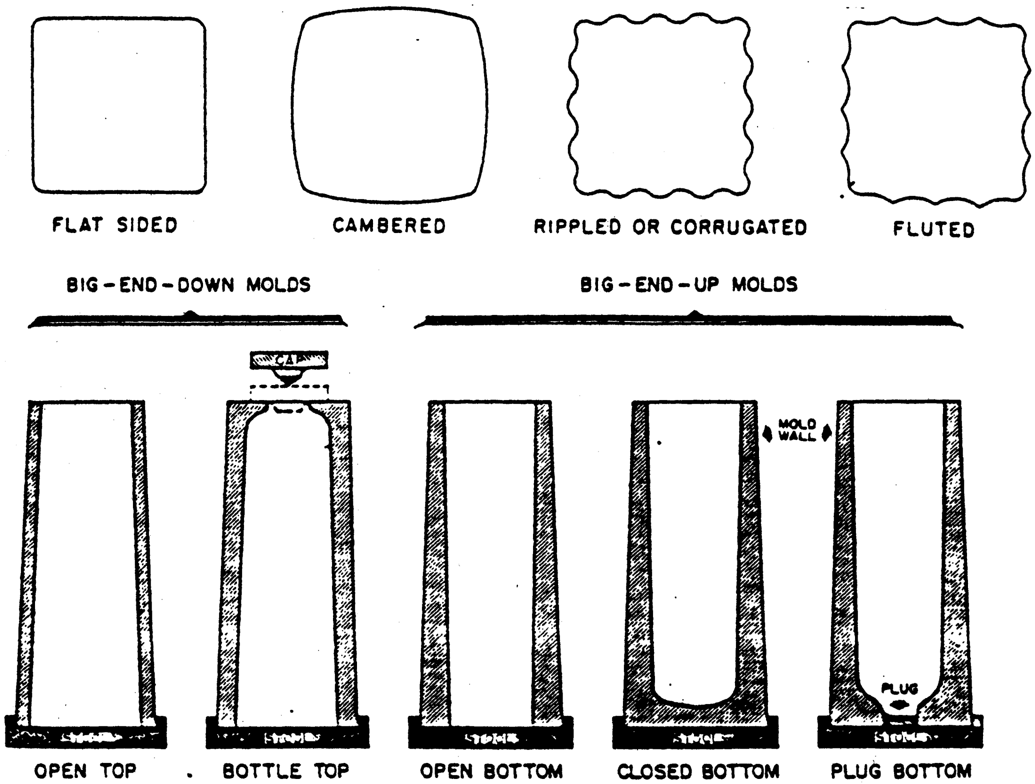
Slab casting bypasses the soaking pits and slabbing mill. A flat-sided form with a rectangular cross section is cast directly from the molten metal on a machine which has a rectangular mold which is open on both ends (fig. 2-3). A slab's width is usually at least twice its thickness. Molten steel enters one end of the mold and is cooled, solidifying a skin of solid metal around a liquid core. The metal exits the other end of the machine and is cooled by water sprays, completing the solidification to the core. At regular intervals, sections of the cast strand are cut off, forming slabs not unlike those rolled from ingots. However, because of the operating practices and designs of continuous casting machines, the slabs produced by slab casting are generally superior, in terms of quality, to slabs rolled from ingot. The quality and productivity increases that are made available by continuous casting have led to widespread usage throughout the world. The U.S. industry has been particularly active in the mid-1980's in installing new continuous casting equipment, but still lags behind many of its foreign competitors in terms of percent of production that is continuously cast.

Continuous slab casting capability is required to produce the highest quality sheet products. The energy, equipment and labor savings afforded by this technology virtually require its adoption in order to stay competitive in sheet markets. Although the U.S. industry is continually increasing this capability, possession of a caster does not guarantee successful production of the highest quality slabs. Upstream refining facilities, caster features, and caster operating practices can result in significant variations in continuous cast slabs (especially surface condition) which can have a decisive impact on quality and productivity in downstream operations.

Once slabs are formed by either process, the procedures converge and the subsequent operations are basically the same. The slabs are usually conditioned through a process of scarfing, in which undesirable surface characteristics of the slabs are either burned or chiseled away. 1/ The slabs

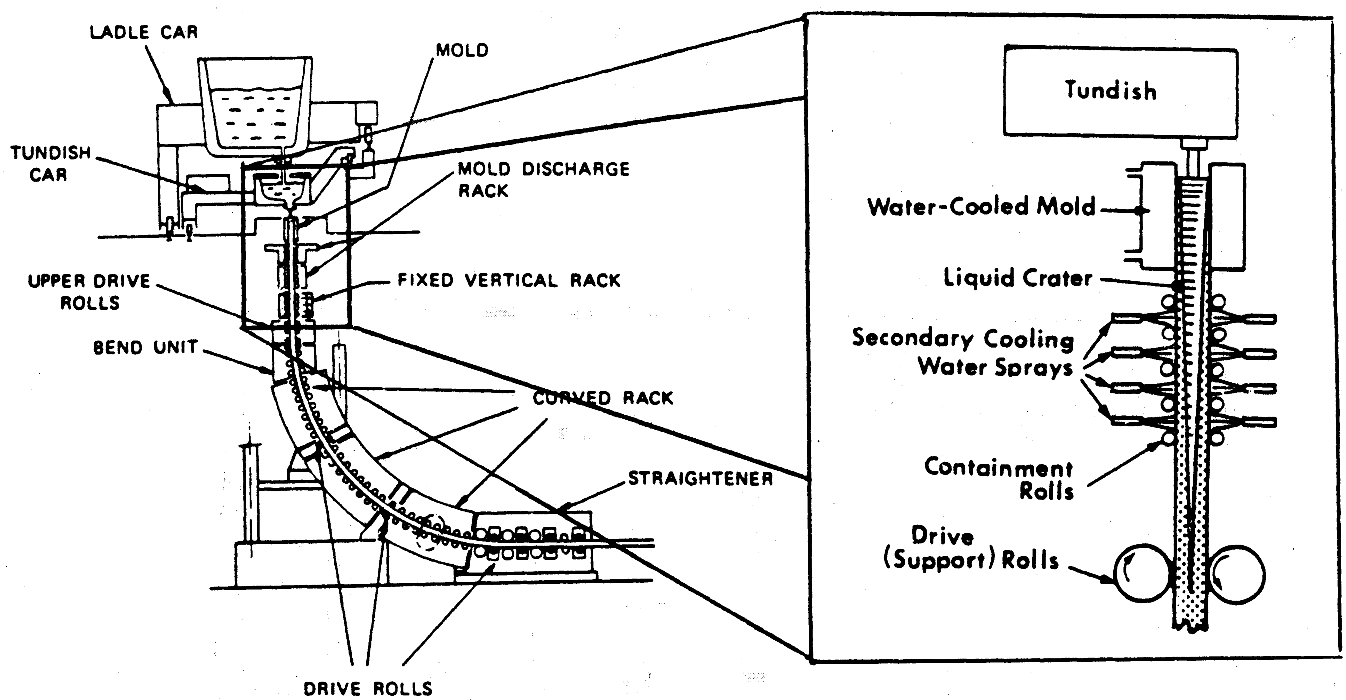
1/ Recently, some steel companies have been able to produce slabs of such high quality that conditioning is not required.

Figure 2-2.
Cross Sections of Various Ingot and Mold Types



Source: The Making, Shaping and Treating of Steel, 10th Edition.

Figure 2-3.
Schematic of a Typical Continuous Casting Machine



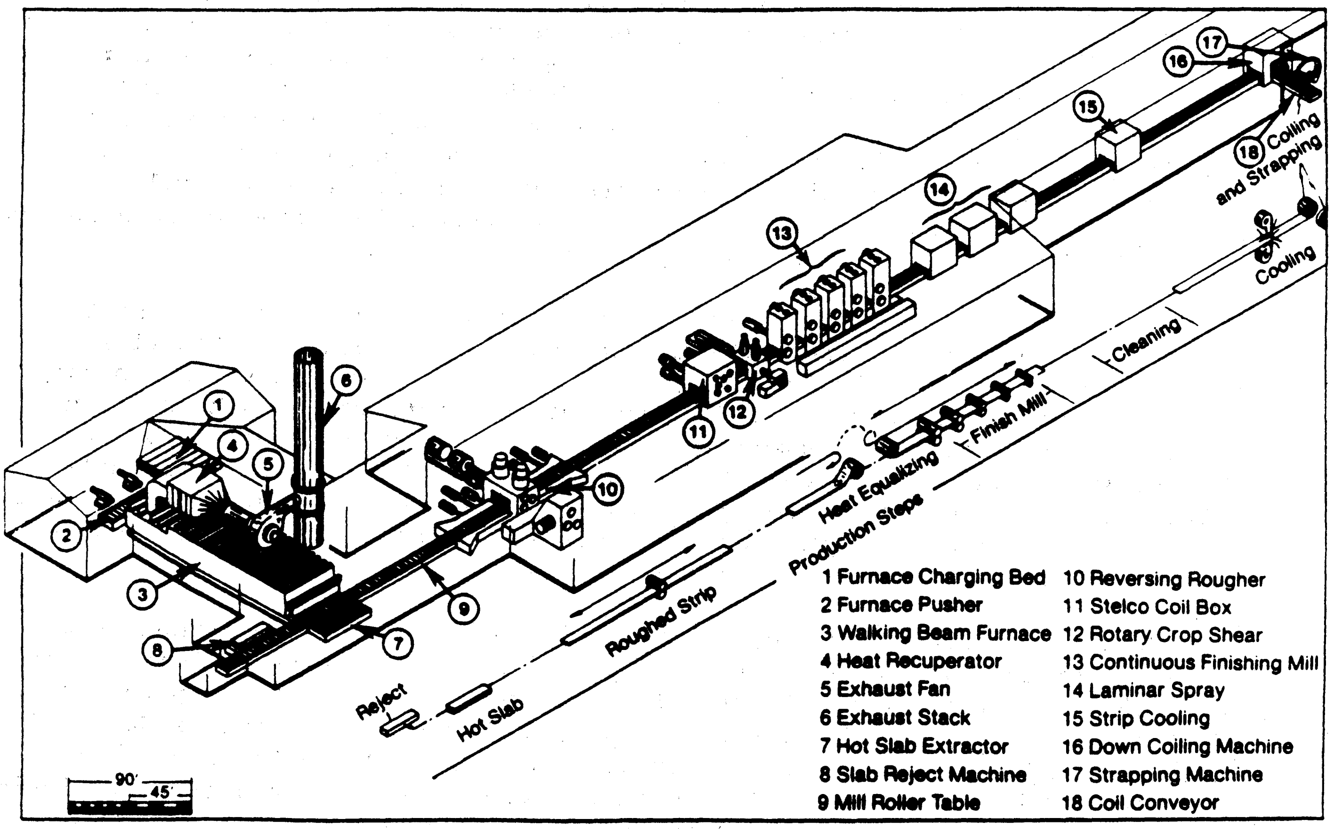
Source: The Making, Shaping, and Treating of Steel, 10th Edition.

are then reheated to a proper rolling temperature and are fed into the roughing train of the hot strip mill. This process is known as hot charging. If the slab is hot enough and does not require conditioning, it can bypass the reheat furnace and be "direct rolled" on mills equipped with edge reheaters.

Hot Rolling

In the steel industry, the term "strip" has more than one meaning. In finished products, strip refers to a product that has definite width and gauge specifications. Strip is either rolled directly in narrow widths or formed by slitting sheet, which is wider than strip, in order to acquire a narrow product. However, the distinctions between sheet and strip do not come into play when discussing the rolling mill upon which these products are formed. Regardless of the product being rolled on the mill--sheet, strip, skelp (for pipemaking), or bands (hot-rolled products destined for cold rolling)--the mill is referred to as a strip mill. Since the slabs are fed into the mill at an elevated temperature, the mill is known as a "hot strip mill" (HSM). Figure 2-4 depicts the layout of a modern hot strip mill now under construction in the United States. Numbers in parentheses throughout this section refer to legends in figure 2-4.

Figure 2-4.
Layout of a modern 1.2 million ton per year hot strip mill 1/



1/ This is a relatively small mill; existing domestic strip mills range from 130,000 to 4.5 million tons per year. The average (mean) size of these hot strip mills is slightly less than 2 million short tons per year.

Source: 33 Metal Producing, October 1985.

Hot strip mills are fairly standardized in their construction. Slabs from one or more reheating furnaces (step 3 of fig. 2-4) are fed onto the entry table, which consists of powered rolls for the conveyance of the steel. Roller tables (step 9 of fig. 2-4) are situated between each working section of the mill. The slab passes through a scalebreaker, which removes oxides from the surface of the slab. Next comes the roughing train, which typically consists of four or five rolling stands that reduce the slab's thickness from 8 to 10 inches to 1 to 2 inches. The form the steel is now in is referred to as a transfer bar. Sometimes the roughing operation is performed on a single reversing stand (step 10 of fig. 2-4), in which case the slab is passed repeatedly back and forth through the stand until the desired thickness of transfer bar is obtained. Some hot strip mills are equipped with a coilbox (step 11), a recent innovation that lowers both the capital costs and operating costs of newly constructed hot strip mills. Detailed information on the coilbox is presented later in this chapter.

The finishing train (step 13) of a hot strip mill usually has four to seven stands that reduce the transfer bar from 1 to 2 inches to the final thickness of the hot rolled sheet, strip, or band. Final thickness can vary, but typically the product is on the order of one-tenth of an inch (3mm) in thickness. Finishing trains can also consist of a reversing mill; however, this is an unusual occurrence. The installation costs of a hot strip mill utilizing reversing stands are lower than mills utilizing several stands in a continuous operation; however, as the operation is less continuous, capacity is usually less and operating costs are higher.

The flat-rolled product exits the finishing train onto the runout table where the product is subjected to a combination of water sprays, laminar jets (step 14), and/or air cooling (step 15) in order to reduce the temperature of the steel. At the end of the runout table, the steel is fed into a downcoiler (step 16) that coils the material for banding (step 17) and transfer to the next operation. Hot strip mills are categorized by vintage and characteristics of major components. Earlier generation mills, which predominate the U.S. industry, are more difficult to modernize than later generation mills. However, because of the high costs of a new mill, many U.S. firms are retrofitting their hot strip mills with better control technology.

Pickling

During the production of hot-rolled coils, exposure to water and the atmosphere results in the formation of oxides on the surface of the steel. Further rolling of the product without removing the oxides would result in final products with poor surface quality. The oxides are removed through a process known as pickling. Pickling involves passing the hot-rolled product through a series of acid baths that remove the oxides. Subsequent to the acid treatment, the material is dried, oiled to prevent reformation of oxides, and recoiled.

Cold (Reduction) Rolling

The term "cold rolling" refers to any process in which the product is fed into a rolling mill at ambient temperature. The name is somewhat of a misnomer, as energy imparted from friction and the deformation of the material

2-8

results in a temperature gain in the product. Upon exiting a cold reduction mill, product temperature can be as high as 400° Fahrenheit. Cold rolling can be performed for a variety of reasons, including a reduction in product thickness, imparting specific mechanical properties, or imparting a specific surface texture.

Cold reduction involves a fairly large reduction in the thickness of a hot-rolled material; the reduction may range, for example, from 25 to 90 percent. Like hot mills, cold reduction mills come in a variety of forms. Differences in a number of variables, including the number of rolls in each stand (two high, four high, cluster, etc.), the number of stands (one to six) and the path the material travels (continuous or reversing) result in a variety of configurations.

Annealing

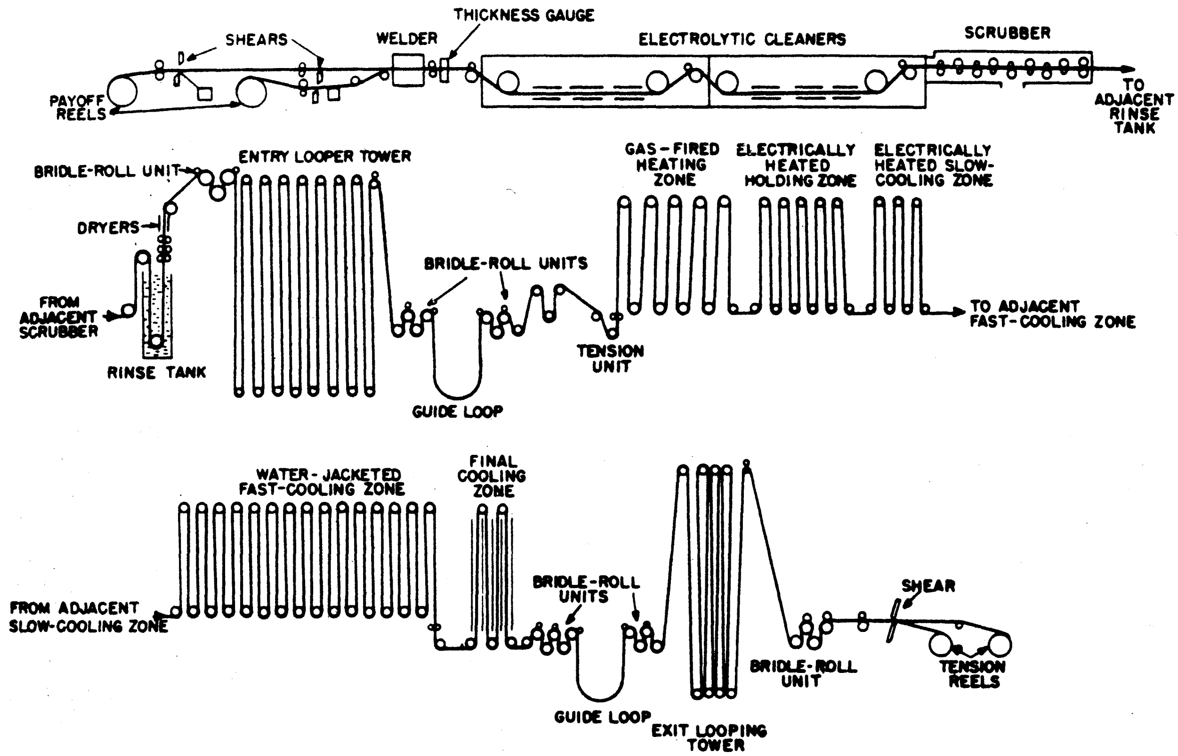
The process of cold rolling steel results in changes in the steel's microstructure. These changes render the material stiffer and more brittle. Most applications for sheet and strip products cannot be fulfilled by the "full hard" material that comes off a cold reduction line. In order to produce a material with desirable working properties, the steel must be made more ductile. This is accomplished through a heat-treating process known as annealing. Through the process of annealing, various transformations in the microstructure of the steel can be obtained, depending on the temperatures and cycle times employed. The annealing process involves controlled heating and cooling of the steel, shortening the grain size in the steel, and relieving the internal stresses imparted by the cold rolling process, thereby yielding a more malleable material.

There are two basic annealing processes, batch and continuous. Batch annealing, the older technology, involves placing cold-rolled steel products into a furnace and slowly bringing the material up to a specified temperature. The steel is held at a peak temperature and slowly cooled. It can take up to 7 days to complete a cycle in this process.

Continuous annealing (figure 2-5) is slowly replacing the batch annealing process for a variety of reasons. In the continuous annealing process, the heating and cooling process requires several minutes, which is far shorter than the days required in the batch annealing process. For many years following the advent of continuous annealing technology, it was used exclusively for coated products where ductility was not a critical specification. However, modifications in steel chemistries and hot-rolling practices have broadened the range of material that can be adequately processed by the continuous process. For most grades of low-carbon, cold-rolled steel, contemporary continuous annealing technology can match the results of batch annealing.

In some areas, such as uniformity throughout the coil and processing time, continuous annealing holds distinct advantages over batch annealing. However, batch annealing offers greater latitude in both the material to be treated and the product of the process. Although many producers are convinced of the overall superiority of the continuous process, others are equally convinced that the batch process is superior. Japanese producers have embraced continuous annealing, the West Germans remain unconvinced, and the

Figure 2-5
Schematic of a Typical Continuous Annealing Line



Source: The Making, Shaping, and Treating of Steel, 10th Edition.

U.S. industry is split in its opinion of the relative superiority of continuous annealing. To some extent, the decision is driven by a producer's primary markets.

Temper (Skin) Rolling

After cold-reduced sheet has been annealed, it usually is subjected to a second cold-rolling process. This stage of processing is referred to as temper or skin rolling. This process is performed for a variety of reasons, the primary one being to eliminate the tendency of fully annealed sheet to exhibit surface markings after passing through a stamping operation. Other reasons for temper rolling are to impart a specific surface texture, alter the shape and flatness, or to replace a desired degree of stiffness to the material. The degree of stiffness in a cold rolled steel is directly related to the reduction in thickness accomplished during the cold rolling process.

In temper rolling, the amount of reduction is very slight, and is measured by the amount of extension in the length of the material as a result of reducing the thickness. Typical extension coefficients run in the 0.5 to 1.5 percent range. Actual reduction in the thickness of the material during temper rolling is usually less than 5 percent.

2-10

Temper rolling is typically performed on a four or six high mill with either one or two stands. Temper mills with the best technology allow variation in the work roll profile in order to make corrections to shape and profile of the sheet being processed.

Slitting, Shearing, and Leveling

Slitting and shearing are operations that involve the cutting of metal. Cutting across the width of the coil is called shearing, and cutting along the length of the coil is referred to as slitting. Shearing is usually done in order to produce unit sheets (as opposed to a coil of sheet), or to remove coils at the end of a continuous processing line. Slitting is practiced in order to make strip or narrow sheet from coils, or to trim edges of a coil to achieve consistent edges and a more precise and consistent width.

Shearing is usually accomplished through the use of one of two types of shear: guillotine or rotary. Guillotine shears are self-explanatory; rotary shears consist of two parallel cylinders fitted with blades, one on each side of the sheet. The cylinders are rotated in order to bring the blades together at the appropriate time to cut the material. Rotary shears are able to operate at higher (up to three times) line speeds than guillotine shears.

Slitting is accomplished with matched circular blades that overlap from opposite sides of the sheet. Special slitters, know as side trimmers, are often fitted onto other machinery, especially the exit end of continuous pickling lines. These trimmers remove stock from both sides of the sheet.

For certain applications, rolling mills do not produce material that is sufficiently flat. Wavy edges or buckles in the material must be removed prior to subsequent manufacturing operations. These imperfections are removed from the sheet product through leveling operations. Several methods of leveling sheet have been used throughout the years, but the most common newly installed technology today is the tension leveler, which combines aspects of both stretch leveling and multiroll leveling. A tension leveler consists of two sets of large powered "brindle" rolls flanking a set of nondriven rolls that are aligned to bend the material back and forth. The rotation of the brindle rolls is controlled in order to exert stress on the sheet in order to achieve the desired elongation. As the sheet is stretched and worked through the bending rolls, differentials in the sheet are eliminated, and the material is flattened.

Coatings

Steel sheet and strip is increasingly being coated with organic (including resins, pigments, and oils), inorganic (including vitreous enamels and cements), or metallic (including zinc, aluminum, copper, tin, and lead) coatings. Occasionally more than one type of coating is applied; this process is known as "piggybacking." These coatings are applied for various reasons, including aesthetics, corrosion resistance, and anticipation of downstream forming operations. There are basically three methods for coating steel: dipping, electrolytic deposition, and mechanical deposition, such as spraying or roll coating.

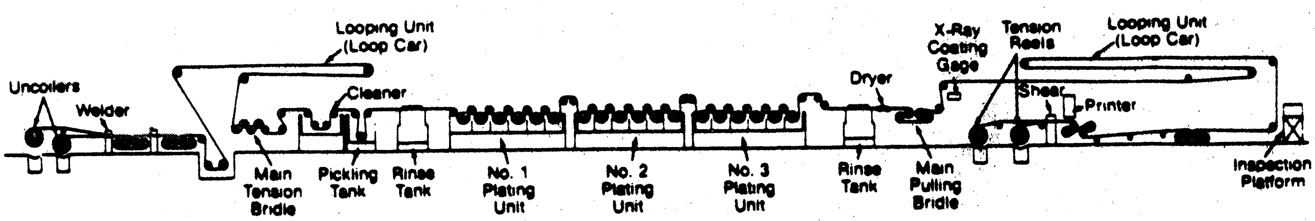
The fastest growing area in coated steels at this point in time is electrolytic galvanized steel. Although electrogalvanizing technology is not a new technology, until recently almost all galvanized products were coated by the hot-dip process. Hot-dipped galvanized steel is produced by immersing steel in a molten bath of zinc. Although great strides have been made in the quality of hot-dipped galvanized sheet, the demand by consumers, especially in the automotive market, for thinner, more uniform coatings with better surface characteristics has resulted in a rapid increase in electrogalvanizing capacity in the United States and other major steel industries. U.S. producers brought online over 2 million annual tons of new capacity in 1986, at a total cost of around $500 million, prompting some fears of overcapacity.

In the electrogalvanizing process (fig. 2-6), the sheet is given an electrical charge and passed through a bath of acidic chemicals. Bars of zinc immersed in the chemical bath have the opposite electrical charge, and because of the electrical differential created by the opposing charges and the bath's chemical composition, the zinc bars are dissolved and a thin zinc coating is deposited on and bonded to the steel sheet. Electrolytic galvanizing generally yields a superior finish on the steel product and provides a better surface for painting than hot-dipped material.

Most prepainted or preprimed sheet has the coating applied by the roll-coating process. In this process, a roller passes through a reservoir of paint and is then pressed against the sheet as the material moves past the roll. This process requires that sheet be flat to permit an even coating. Sheet that is coated by this method is often subjected to a leveling process prior to the coating step.

Recently, a new technology has been developed for painting coils. This technology involves an extrusion process to apply the paint to the material. This process is said by some to yield better quality finishes than the roll coating method; this has not been firmly established, however, as the process has a limited production history.

Figure 2-6.
Schematic Diagram of a Continuous Electrogalvanizing Line



Source: The Making, Shaping, and Treating of Steel, 10th edition.

Generic Technological Trends

Three technology "concepts" are having an impact on various areas of process technology: process control, continuous processes, and coupling of processes. Process control involves the implementation of a statistical process control system throughout the operations of a plant, and sometimes includes supplier's operations. Sensors and computers are required to generate and manipulate the data, in addition to controlling production equipment adjustments.

Continuous processes, as opposed to batch processes, allow superior consistency and higher productivity. Continuous technology has been developed in many process areas, including electric furnace steelmaking, pickling, cold rolling and annealing.

Process coupling involves integration of separate process steps. Coupling is being pursued with the objective of reducing capital expenditures, coil handling, coil inventory, and process time. Several coupling "packages" are emerging, including:

- o pickling - tandem rolling;
- o pickling - continuous annealing-temper rolling-finishing; and
- o slab caster - hot strip mill (HSM).

The slab caster-HSM connection began with direct rolling, in which the slab is fed from the caster directly into the HSM, bypassing the conditioning and reheat furnace operations. Recent developments are geared toward attaining "schedule-free" rolling. This connection requires heavy edge reduction and work roll shifting capability on the hot strip mill. Implementation allows joint scheduling of caster and HSM operations, and yields cost reductions through increased caster productivity, reduced energy consumption and improved yield.

Rolling and finishing operations require many variables to be addressed in order to achieve the highest levels of quality and productivity. Features which contribute to state-of-the-art facilities for various process steps are identified in appendix E.

Steel Sheet and Strip Equipment Technology

Major World Steel Sheet and Strip Mill Equipment Manufacturers

Most steel sheet and strip producers do not make or manufacture any of the equipment required for their mills. This equipment is usually built by firms that specialize in equipment manufacturing. The major world producers of steel sheet and strip machinery and equipment are listed on the following pages. The list was compiled based on discussions with equipment manufacturers and industry consultants. 1/ Industry sources indicate that, with the exception of the drive and control equipment manufacturers, nearly all machinery producers provide a complete product line for rolling mills. In addition, almost all of these companies are diversified and, consequently, not solely dependent on the steel sheet and strip industry for their revenues.

Specialty	Company	Country
Mill automation-2/....	Clecim, Inc................	France
	Davy McKee Corp...........	United Kingdom
	BBC Brown Boveri/Asea AB 3/...................	Switzerland/Sweden
	Siemens Energy and Automation Inc. 4/......	United States
	Toshiba Corp..............	Japan
	GE 5/.....................	United States
	Westinghouse Electric.....	United States
Control equipment 2/..	Siemens, AG...............	West Germany
	Brown Boveri/Asea.........	Switzerland/Sweden
	Toshiba Electric, Ltd.....	Japan
	Hitachi Ltd...............	Japan
	Westinghouse Electric.....	United States
	GE........................	United States
	Reliance Electric Corp....	United States

1/ Information in this section is based on discussions with officials of the following companies: Mannesmann Demag Corp.; GE; Davy McKee Corp.; United Engineering; Blaw Knox-Aetna Standard; Association of Iron and Steel Engineers; George McManus of Iron Age; W.L. Roberts, professional engineer, Murrysville, PA; and Department of Energy and Department of Commerce officials. Information was also developed through discussions with steel industry executives.

2/ According to industry sources, the difference between "control equipment and mill automation" is as follows. There are four levels of controls. Level 1 usually deals with the control of the drive levels; level 2 deals with area automation and is not processed control. Control equipment usually encompasses levels 1 and 2; level 3 is control process modeling, which is usually mill automation; level 4 is a production entity of a business that includes the first three levels.

3/ According to published sources, a merger between the two companies will take effect Jan. 1, 1988. When merged, the new company will be one of the largest in the electrical engineering sector. The new operating company will be named Asea Brown Boveri.

4/ The parent company is Siemens AG of West Germany. Siemens Energy and Automation is located in Atlanta, GA and produces programmable controls for steel mill automation.

5/ General Electric Co. was renamed GE in 1986.

Specialty	Company	Country
Designer, builder & manufacturer of rolling-mills	Clecim, Inc................	France
	Danieli & Co. S.P.A.......	Italy
	Mitsubishi Heavy Industries, Ltd.........	Japan
	Sumitomo Heavy Industries, Ltd.........	Japan
	Hitachi Ltd................	Japan
	Davy McKee Corp...........	United Kingdom
	SMS Schloemann-Siemag, AG..............	West Germany
	Blaw Knox Foundry & Mill Machinery, Inc.....	United States
	Manesmann Demag Corp. 1/..	United States
	Bliss-Salem, Inc..........	United States
	United Engineering Inc....	United States
Rebuilder/refurbisher of rolling mill equipment 2/	Tippins, Inc..............	United States

Industry Leaders

All of the above-named major world producers are advanced in their respective areas of expertise. The choice of one manufacturer over another is accomplished by weighting and ranking a wide range of technical, financial, marketing, production, and cost factors in accordance with the personal preferences of the purchaser. Typically, according to industry sources, the procurement decision is often based on individual preferences for the particular subcontractor that is chosen to work with the primary manufacturer of the steel sheet and strip equipment. For example, when the equipment purchase decision is made, one of the key factors is not the primary equipment itself, but the manufacturer of the computer controls that are incorporated into the particular equipment. The purchasing company usually orders computer controls produced by a specific firm because the company is generally more familiar with that brand and/or it has a certain brand loyalty. More importantly, however, if the equipment incorporates a new computer control system, it could be costly as well as time consuming to create new software and to retrain personnel to use the new system. According to officials in the equipment industry, the basic quality of the products does not appear to vary significantly and prices appear to be comparable.

1/ The parent company is Mannesmann AG, a West German holding company. One of the affiliated companies is Mannesmann Demag AG of West Germany. This company owns 100 percent of Mannesmann Demag Corp., which is a company incorporated in the State of Michigan.
2/ On request, any machinery builder will usually rebuild its own machinery.

Licensing and Patents 1/

Licensing and patent issues are not major issues for the basic rolling processes for the steel sheet and strip equipment manufacturers. The technology being used is mature technology that has been modified considerably, but not sufficiently to warrant issuance of new patents and licenses, and the basic patents have expired. There appears to be only one notable exception--Stelco-Canada's licensing of its coilbox technology. Stelco-Canada, a major Canadian producer of flat-rolled steel, has licensing agreements with numerous equipment manufacturers worldwide.

Technological Innovation 2/

Currently, technology in the equipment manufacturing industry is being transferred through affiliated foreign companies (not necessarily subsidiaries), purchase consortiums, and countertrade arrangements. There are few technical problems to the transfer of technology worldwide; the primary impediment, at least with respect to U.S. producers, is the lack of financial resources with which to implement the necessary technological innovations. U.S. steel companies do not have the financial resources to implement modernization and cannot avail themselves of sufficient external credit, and, therefore, have turned to joint ventures and/or consortiums as a means of acquiring the necessary capital to modernize and/or build a new mill. An example of this is the USS/USX Corp. joint venture with the Korean firm POSCO in Pittsburg, CA. However, some companies, such as Tippins, Inc., have lowered costs by revamping existing equipment.

A factor encouraging the transfer of technology is the steel sheet and strip mills' demand for more sophisticated equipment that can produce a higher quality product that meets the more exacting specifications of buyers of steel sheet and strip. In addition, the automotive and appliance industries, which are the steel sheet and strip industry's largest customers, have also pushed for improvements in steel mill equipment--a factor that has forced the pace of technological innovations. 3/

Technological equipment innovations and refinements are important to the sheet and strip industry. Recent technological equipment innovations and/or refinements in the hot-strip and cold-finishing mills are enabling steel sheet and strip producers to manufacture their products in a more efficient and cost-effective manner. These innovations, made possible by sheet and strip producers working with the equipment manufacturers, have provided and should continue to provide further advancements in the areas of machinery technology and manufacturing processes. 4/ For example, the steel mills will report

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1/ Patents and licensing refer only to the equipment used in rolling mills. The existing patents in the area of software models and process technologies are too numerous to enumerate in this report.
2/ For definitions of technical terms used in this section, see glossary in app. D.
3/ Interviews and telephone conversations with industry officials.
4/ Ibid.

their views about the equipment, both the advantages and disadvantages, to the equipment suppliers, and often provide recommendations for future equipment developments. 1/

A few of the leading equipment innovators include GE and Mannesmann Demag Corp. of the United States, Davy McKee Corp. of the United Kingdom, and SMS Schloemann-Siemag, AG of West Germany. Discussed below are some of the specific areas of innovation which have experienced progress during the last few years. 2/

Control equipment

One of the major areas of technological change has been in computer systems and controls. Computer controls are utilized in controlling and tracking the product from a cold slab on the furnace table to a finished coil at the weigh station. The first computerized hot steel mill in the United States came onstream in about 1966 or 1967, but it was a rudimentary mill. Since that time, the rolling mill has become more computerized to aid in the rolling processes. The latest innovation by GE is commonly known as the "man-machine interface." This system is primarily a computerized system that is more user friendly and easier to operate than previous systems. Davy McKee's newest innovation is called the "Vidiplan Control System." It is a computerized closed loop control system for cold-rolling mills that is used to improve the flatness of the material. Not only do these systems improve the quality of the steel, but they also provide for more efficient production because the computerized system monitors and adjusts the system far more quickly than could a production worker and produces a higher yield of steel sheet and strip products as a result of the reduced amount of offgrade steel. 3/

Other developments in the electrical equipment used in mill automation include the use of electronic sensors for both quality control and shape measurement. Industry sources indicate that although electronic sensors are widely used by both aluminum producers and steel producers abroad, U.S. firms manufacturing steel sheet and strip products have been slower to adapt and use electronic sensors to monitor shape measurement and to increase quality control. According to published sources, large integrated U.S. steel producers of sheet and strip products have not, until recently, had to make major capital expenditures required to increase quality control standards. 4/ The producers have had to improve quality and shape because auto companies, among others, have recently required that the steel have tighter tolerances for thickness and flatness and that the steel be cleaner with better scale-free surface quality. 5/

1/ Ibid.
2/ Ibid.
3/ Ibid.
4/ "Upgrading Hot Mills to Update Quality," Iron Age, March 1987, pp. 25-26.
5/ "Steelmakers and Automakers Team up to Improve Quality," Iron Age, February 1987, pp. 25-32; and interviews with industry officials.

The first U.S. installation of electronic sensing devices for steel was in 1983 at the Warren, OH, plant of LTV Steel. These electronic sensing devices were used to detect variations in stress and flatness across the width of sheet products. Currently, Toshiba Corp. of Japan and the Hoesch Co. of West Germany are two of the leading companies supplying electronic sensing devices. 1/

Since the final gauge of hot-rolled strip can be influenced by many variables, such as temperature differentials and metallurgical inconsistencies and differences, automatic gauge controls have an important role in the efforts to improve strip quality and mill productivity. Several U.S. and foreign companies have developed hydraulic automatic gauge controls that compensate for manufacturing variables with increased accuracy and speed. 2/ The "Hydraulic Automatic Gauge Control" developed by Davy McKee has fast acting hydraulic cylinders that react within milliseconds to correct off-gauge strip. The acceleration rate of the hydraulic cylinders is 50 times faster than that of the electromechanical screwdowns that they replace. The fast response of the hydraulic system helps to maintain constant interstand tension, thereby avoiding tension-related gauge errors, particularly when used in conjunction with mill drive control systems. 3/ According to published sources, this type of control not only helps to ensure a more uniform gauge but also yields longer coils.

Annealing

Continuous annealing, a major breakthrough in the production of steel sheet and strip in recent years, is a process used to heat and cool certain steel products to make them less brittle. Although installation of a continuous annealing line increases productivity, it costs an estimated $50 million to install such a system. 4/

A variation of continuous annealing is a process known as "Transverse Flux Induction Heating" (TFX), introduced by the Davy McKee Corp. This method of heating metal permits a very rapid, uniform, online means of heating flat metal strip that is particularly appropriate to thin gauge material. According to the manufacturer, this electrical induction method appears to be far more efficient and compact for thin materials than conventional induction heating or gas-/oil-fired furnaces. 5/

The TFX unit is mounted in the line itself and processes the strip on a continuous basis. The manufacturer claims that the benefits from using the TFX heating method include much lower capital costs (it probably costs less than 50 percent of conventional furnace equipment); the unit uses about one-third of the energy consumed in a gas furnace; it requires less floor space than a conventional heating unit; the steel quality is improved; and the

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1/ "The Big Sheet Metal Users Want Closer Tolerances," Iron Age, December 1987, p. 28.
2/ Interviews and telephone conversations with industry officials.
3/ Ibid.
4/ Ibid.
5/ Ibid.

resultant steel strip is usually dry, oil free, and requires no further cooling. 1/ Although the TFX heating method is being used in aluminum production, industry sources indicate that this new technology has not been widely adopted by producers of steel sheet and strip products mainly because of the high cost of installation and a certain market reluctance to adopt the new technology.

Currently, there is increasing interest in induction as a heat source because such heat provides a means of ensuring precise temperature control in continuous casting tundishes, which is critical in the production of steel sheet and strip products. This control is critical in the new horizontal and near-net-shape casters. In ladle refining, induction provides a means of heating and vacuum degassing at the same time. The induction system prevents excessive heat loss and it eliminates the need to reheat the steel. Reportedly, induction heating in the continuous casting tundishes has led to an estimated 10-percent improvement in productivity and to improvements in steel quality. 2/

Rolls

Industry sources indicate that one of the greatest areas of technological innovation in recent years has been in roll technology. Rolls are used for a variety of applications in the steel sheet and strip mill, either as a backup roll or work roll. Rolls have a large impact on mill operating variables, including quality, yield, and costs. 3/

Variations of the desired profile (the distribution of strip thickness across the width of the strip consistent with the requirements of the end product) and possibly of the roll-separating forces necessarily call for a change of crown configurations in the individual stand units. The crown is important because the crown configuration directly affects the profile of the steel sheet or strip. 4/ Until recently, there was no adjusting element available to provide the range of required crowns, so that the production of specific strip profiles with only one roll crown was not possible. This problem has been solved through new developments in the performance of the rolls--developments that have enhanced the profile of the steel strip. For example, several companies have devised systems that improve shape by using hydraulic presses to vary the contours of the rolls. 5/

SMS Schloemann-Siemag, AG, has developed a continuously variable crown (CVC) that is being used at Baoshan General Iron & Steel Works in Shanghai, China, and will be used at Weirton Steel in Wheeling, WV. In the CVC roll, the two rolls of one work roll pair are ground in an identical S configuration, but arranged at a relative offset of 180 degrees. Because of horizontal and opposed shifting of the rolls, the distance between the roll surfaces within

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1/ Ibid.
2/ George McManus, "New and Varied Uses for Induction Technology," Iron Age, February 1987, pp. 34-35.
3/ Interviews and telephone conversations with industry officials.
4/ Crown refers to the shape of the roll when viewed perpendicular to the longitudinal axis. Crown is also used to describe the profile of the sheet.
5/ Interviews and telephone conversations with industry officials.

the roll gap area can be varied. Depending on the shifting direction, it is possible to set the crown in symmetrical relation to the stand centerline within wide ranges. Lateral shifting changes the crown, allowing for immediate automatic adjustment of crown shape during rolling. 1/ These types of rolls are advantageous to the producer of steel sheet and strip because the rolls are more flexible than the older type rolls, easier to maintain, and can be refitted during operation without having to shut down the mill. Such rolls help to produce flat and well-shaped steel strip. 2/

Mannesmann Demag Corp., located in Pittsburgh, PA, uses a roll-shaped system called "universal profile control" that employs lateral shifting of cigar-shaped rolls to give crown variations. 3/ Blaw-Knox, Hitachi, Ltd., Sumitomo, 4/ and others have developed rolls that employ hydraulic pressure to expand or contract crowns. Mitsubishi Heavy Industries, Ltd., varies the crown with a "pair cross mill" that changes the curvature of the roll gap by placing rolls at different angles to the strip. 5/ Wean United, Inc., changes the roll profile by inflating the edges rather than the center. 6/ According to industry sources, these developments in rolls have also led to reduced roll wear and improvement in shape.

Some of the new roll technologies include a roll sensor that can detect center buckles and wavy edges on cold-rolled sheet; usually, this sensor is mounted on the last group of stands. The stressometer developed by Asea employs an interstand sensing device that picks up variations in stress and flatness across the width of the strip. 7/ The stressometer signals by computer relay any changes that need to be made to correct flatness.

Thin slab caster

An additional breakthrough in technology has come through a new type of continuous caster developed by SMS Schloemann-Siemag AG of West Germany that produces thin slabs or sheet bar. This caster will be used by Nucor Corp. in Crawfordsville, IN, and will be the first commercial application of thin slab casting in the United States. The new machine employs a funnel-shaped mold to squeeze solidifying steel down to thicknesses of 1-1/2 to 2 inches, making it possible to eliminate the roughing operation needed for the 8- to 10- inch slabs of conventional casters. The thin slabs will go directly to a four-stand finishing train designed to eliminate reheating. There will be a holding furnace between the caster and the mill only. Using such a casting system is an important technological improvement because it cuts capital and labor costs of a hot-strip finishing train and reheating system. 8/ Nucor also has its own thin slab program with testing currently underway in

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1/ Metallurgical Plant and Technology, vol. 9, May 1986, p. 39-48.
2/ Interviews and telephone conversations with industry officials.
3/ Ibid.
4/ Sumitomo's variable crown roll is under license with Davy McKee Corp.
5/ "Upgrading Hot Mills to Update Quality," Iron Age, March 1987, p. 28.
6/ "The Revolutionary Changes in Cold Rolling," Iron Age, Dec. 5, 1986, p. 27.
7/ Ibid, pp. 27-28.
8/ George McManus, "Nucor's Big Breakthrough," Iron Age, February 1987, p. 47.

Darlington, SC. 1/ There was, in addition, a thin slab casting project, using the Hazelett twin-belt design, under development in a joint effort between Bethlehem and U.S. Steel. The Department of Energy funded approximately $17 million over a 3-year period. However, it was mutually decided in 1987 to terminate further development work on this approach because of the emergence of a successful alternative thin slab technology. 2/

Strip caster

Strip casting is similar to thin slab casting; however, the final product is thinner. Mannesmann Demag AG of West Germany has installed in West Germany a thin strip (2 inches) casting mill that requires no hot rolling--a development that, when perfected, should eliminate the need for a hot rolling mill which currently costs from $400 to $500 million to build--and is expected to have a major impact on the steel industry. It will take from 5 to 15 years before this type of casting is totally perfected for the different grades of steel. 3/

In addition, Armco and Westinghouse obtained a $2.6 million research grant from the Department of Energy to try to continuously cast thin strip steel between 0.010- and 0.187-inch thick and 72 inches wide. Five to fifty tons per day are to be produced. An extension of $800,000 for this project is currently under negotiation. 4/ According to published sources, various Japanese steel companies, as well as Western European firms, are also working on three different direct casting processes. The Japanese expect production to begin in 3 to 6 years. 5/

Coilbox

A critical problem in the hot rolling of strip is the temperature drop in the transfer bar prior to and during rolling on the finishing train. To resolve this problem, a decade ago Stelco-Canada developed the coilbox process. Users of this technology are licensed by Stelco-Canada.

According to industry sources, using a coilbox on a continuous hot-strip mill has the following advantages: (1) more uniform temperature of the transfer bar; (2) reduced energy consumption in the finishing train; (3) shorter total length of the hot strip mill (the distance between the roughing and finishing train in a conventional mill is determined by the transfer bar length); (4) fewer finishing stands; (5) wider range of dimensions, i.e., greater strip width at the same strip thickness or thinner strip gauge at the

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1/ George McManus, "Steel Makers Pursue Thin Strip Casting," Iron Age, August 1987, pp. 14-18.
2/ Interviews and telephone conversations with industry and government officials.
3/ Interviews and telephone conversations with industry officials.
4/ Ibid.
5/ Telephone conversations with industry officials and "Steel Thin Slab and Strip Casting--Major World Trials," Metal Bulletin, August 1987, p. 57.

same strip width; (6) better rolling time adjustment between the roughing train and finishing train; (7) lower rolling speeds; (8) increased yield; and (9) improved strip quality and improved thickness control. 1/

Other technologies

It should be noted that new technological developments are on the horizon, such as superconductivity, 2/ which may affect the industry and even alter the pace of the transfer of technology. 3/ The cost savings that could occur through the application of superconducting technology are particularly important in the steel industry because of the large requirements for electricity associated with refining and shaping rolled steel products.

1/ Interviews and telephone conversations with industry officials.
2/ Superconductivity is a physical state in which all electrical resistance vanishes; superconductors carry electricity with no losses, and they carry more current and generate larger magnetic fields than normal conductors. A superconductor is able to circulate electricity indefinitely without a power source. "Superconducting, The New Billion Dollar Business," High Technology, July 1987, p. 12.
3/ Interviews and telephone conversations with industry officials.

CHAPTER 3. THE GLOBAL MARKET

World Capacity

The developed countries accounted for 71.5 percent of world hot-strip mill capacity in 1984, compared with 11.5 percent for developing countries and 17.0 percent for nonmarket economy countries, as shown in the following tabulation:

	Hot-strip mill capacity in 1984 (1,000 metric tons)	Percent of total
Developed countries....	230,595	71.5
Developing countries...	37,080	11.5
Nonmarket economy countries 1/ 2/......	55,000	17.0
Total................	322,675	100.0

1/ Including Eastern Europe and the Peoples Republic of China.
2/ Estimated by the staff of the U.S. International Trade Commission.

Virtually all sheet and strip products, including cold-rolled and coated products, are first processed through hot-strip mills, which, as indicated in the section "Production Processes and Production Technology," in chapter 2, are used to reduce semifinished steel slab measuring several inches in thickness to a flat-rolled coiled product measuring 0.1 inch in thickness. The hot strip mill is therefore a key parameter for measuring production capability worldwide. Among developed countries, hot-strip mill capacity in 1984 was concentrated in the European Community (EC) (31 percent), Japan (29 percent), and the United States (28 percent) (table 3-1). 1/ In the developing countries, the majority of hot-strip mill capacity in 1984 was located in Brazil (25 percent), Korea (13 percent), India (12 percent), and Mexico (10 percent) (table 3-2). By 1990, significant capacity reductions are expected in the developed countries as the United States, the EC, and Japan undertake comprehensive restructuring efforts to reduce the sizes of their industries. Concurrently, capacity growth is projected for the developing countries, in particular Korea, Taiwan, and Brazil. Industry analysts predict that by 1995, developing country steel producers will account for 20 percent of world hot-strip mill capacity. 2/

1/ Data in tables 3-1 and 3-2 also include reversing plate mill capacity. This is to enable comparison of world production and capacity data. Data on world production are readily available only on an aggregate basis for flat-rolled products (i.e., plates, sheets, and strip).
2/ Metal Bulletin, June 30, 1987.

Table 3-1
Steel sheet and strip: Reversing plate mill, hot-strip mill, and total capacity, by developed countries, 1984

Country	Reversing plate mill capacity		Hot-strip mill capacity		Total, reversing plate mill capacity and hot-strip mill capacity	
	1984	Percent of total	1984	Percent of total	1984	Percent of total
	1,000 metric tons		1,000 metric tons		1,000 metric tons	
United States........	8,980	17.0	68,930	29.9	77,910	27.5
Japan................	20,502	38.8	61,885	26.8	82,387	29.1
EC (8):						
West Germany.......	7,520	14.4	23,280	10.1	30,800	10.9
Italy..............	3,930	7.4	10,150	4.4	14,080	5.0
France.............	920	1.7	14,200	6.1	15,120	5.3
Belgium............	1,630	3.1	9,200	4.0	10,830	3.8
United Kingdom.....	1,590	3.0	8,900	3.9	10,490	3.7
Netherlands........	600	1.1	5,600	2.4	6,200	2.2
Denmark............	600	1.1	1/	1/	600	.2
Luxembourg.........	110	.2	500	.2	610	.2
Subtotal.........	16,900	32.0	71,830	31.1	88,730	31.3
Sweden...............	800	1.5	1,500	0.7	2,300	.8
Spain................	735	1.4	3,850	1.7	4,585	1.6
Finland..............	700	1.3	1,100	.5	1,800	.6
Turkey...............	605	1.1	1,580	.7	2,185	.8
Greece...............	1/	1/	700	.3	700	.2
Austria..............	540	1.0	2,600	1.1	3,140	1.1
Yugoslavia...........	293	.6	2,540	1.1	2,833	1.0
Canada...............	1,820	3.4	10,330	4.5	12,150	4.3
Australia............	900	1.7	3,750	1.6	4,650	1.6
New Zealand..........	1/	1/	1/	1/	1/	1/
Total.............	52,775	100.0	230,595	100.0	283,370	100.0

1/ Not applicable.

Note.--Because of rounding, figures may not add to totals shown.

Source: World Steel Dynamics.

Table 3-2
Steel sheet and strip: Reversing plate mill, hot-strip mill, and total capacity, by developing countries, 1984

Country	Reversing plate mill capacity		Hot-strip mill capacity		Total, reversing plate mill capacity and hot-strip mill capacity	
	1984	Percent of total	1984	Percent of total	1984	Percent of total
	1,000 metric tons		1,000 metric tons		1,000 metric tons	
Latin America:						
Brazil.............	2,070	22.9	9,420	25.4	11,490	24.9
Mexico.............	1,020	11.2	3,900	10.5	4,920	10.7
Venezuela..........	400	4.4	2,100	5.7	2,500	5.4
Argentina..........	1/	1/	1,400	3.8	1,400	3.0
Peru...............	150	1.7	250	.7	400	0.9
Colombia...........	1/	1/	340	.9	340	0.7
Chile..............	64	.7	500	1.3	564	1.2
Subtotal.........	3,704	40.9	17,910	48.3	21,614	46.8
Africa:						
South Africa.......	1,110	12.2	4,010	10.9	5,120	11.1
Algeria............	200	2.2	1,200	3.2	1,400	3.0
Egypt..............	75	.8	500	1.3	575	1.2
Subtotal.........	1,385	15.2	5,710	15.4	7,095	15.4
Far East:						
South Korea........	2,000	22.1	5,000	13.4	7,000	15.2
India..............	1,420	15.7	4,440	12.0	5,860	12.7
Taiwan.............	460	5.1	1,800	4.9	2,260	4.9
Bangladesh.........	57	.6	1/	1/	57	0.1
Philippines........	1/	1/	420	1.1	420	0.9
Indonesia..........	40	.4	1,000	2.7	1,040	2.3
Pakistan...........	1/	1/	800	2.2	800	1.7
Subtotal.........	3,977	43.9	13,460	36.3	17,437	37.8
Total...........	9,066	100.0	37,080	100.0	46,146	100.0

1/ Not applicable.

Source: World Steel Dynamics.

Efforts undertaken to modify flat-rolling capacity in developed countries since 1984 include improvements such as the installation of hydraulic gauge controls, shape and profile sensors, and heating and cooling controls. Capacity expansions include the addition of electrogalvanizing and hot-dip galvanizing lines, cold-rolling mills, and hot-strip mills. Capacity reductions have also occurred. Tables 3-3 through 3-6 summarize the changes that are expected to occur in sheet and strip capacity by 1989. These changes are described in further detail in appendix F.

Table 3-3
World steel sheet and strip industry: Anticipated changes in hot-rolling operations and effect on capacity, by countries

Country	Action	Effect on capacity 1,000 short tons per year
United States	Expansion	+2,200
	Modernization	1/
	Closure	1/
Japan	Closure	1/
Canada	Modernization	1/
European Community	Modernization	1/
	Closure	-2,000
Finland	Expansion	+200
Turkey	Expansion	+1,400
New Zealand	Expansion	1/
Australia	Modernization	1/
Brazil	Expansion	+3,500
Korea	Expansion	+2,970
	Modernization	1/
Taiwan	Expansion	+2,900
East Germany	Modernization	1/
People's Republic of China	Expansion	+4,000

1/ Not available.

Source: Various issues of Steels Alert, an abstract of articles from industry publications, and Metal Bulletin Monthly, April 1987.

Table 3-4
World steel sheet and strip industry: Anticipated changes in cold-rolling operations and effect on capacity, by countries

Country	Action	Effect on capacity
		1,000 short tons per year
United States	Expansion	1/
	Modernization	1/
Japan	Expansion	+1,650
European Community	Expansion	+350
	Modernization	1/
	Closure	1/
Australia	Modernization	1/
Korea	Expansion	+1,000
Taiwan	Expansion	+275
Indonesia	Expansion	+850
India	Expansion	+398
People's Republic of China	Expansion	+2,100
Soviet Union	Modernization	1/

1/ Not available.

Source: Various issues of Steels Alert, an abstract of articles from industry publications, and Metal Bulletin Monthly, April 1987.

Table 3-5
World steel sheet and strip industry: Anticipated changes in coating operations and effect on capacity, by countries

Country	Type of coating facility	Action	Effect on capacity
			1,000 short tons per year
United States	Electrogalvanizing	Expansion	+2,300
	Hot-dip galvanizing	Expansion	+240
Japan	Electrogalvanizing	Expansion	+864
	Hot-dip galvanizing	Expansion	+200
European Community	Electrogalvanizing	Expansion	1/
		Modernization	
	Hot-dip galvanizing	Expansion	1/
	Color-coating	Expansion	1/
Brazil	Electrogalvanizing	Expansion	+360
Korea	Electrogalvanizing	Expansion	+300

See footnotes at end of table.

Table 3-5--Continued
World steel sheet and strip industry: Anticipated changes in coating operations and effect on capacity, by countries

Country	Type of coating facility	Action	Effect on capacity
			1,000 short tons per year
Taiwan........................	Tinning	Expansion	+60
Indonesia.....................	Tinning	Expansion	+130
Pakistan......................	Tinning	Expansion	+60

1/ Not available.

Source: Various issues of Steels Alert, an abstract of articles from industry publications, and Metal Bulletin Monthly, April 1987.

Table 3-6
World steel sheet and strip industries: Anticipated changes in other operations and effect on capacity, by countries

Country	Type of facility	Action	Effect on capacity
			1,000 short tons per year
United States.................	Coil processing	Expansion	+220
European Community............	Annealing	Expansion	+600
South Africa..................	Annealing	Expansion	1/
Taiwan........................	Annealing	Expansion	+400

1/ Not available.

Source: Various issues of Steels Alert, an abstract of articles from industry publications, and Metal Bulletin Monthly, April 1987.

The net effect of the announced actions is unclear. Restructuring and rationalization efforts in Japan, the EC, and the United States suggest that closures may occur. Many announced actions are of undisclosed magnitude.

World Production

From the 1970's through the mid-1980's, changes in economic conditions and world demand for steel brought about corresponding adjustments in the world production of sheet and strip. Economic recessions and recoveries led to large contractions or expansions of sheet and strip production. During the period, there were also shifts in the distribution of world production among various countries, as developing countries and other newly producing countries began to command a larger share of production and reduce somewhat the dominance of the established supplying countries. Yet, despite the many changes that have occurred, the data suggest that there were no radical shifts in the distribution for most countries over time, implying that any adjustment process in world sheet and strip production may be long term in nature.

Plate, sheet, and strip production is examined for the 19 largest producing nations (on the basis of 1985 production levels), and total world sheet and strip production for the period 1971-85. 1/ The analysis provides an overview of the general time trends in world production during 1971-85 and a discussion of the general distribution structure of world production.

Overview of Time Trends

As shown in table 3-7, 1971-75 2/ and 1975-80 were generally growth periods in flat-rolled product production. However, there was no consistent growth trend across major producing countries during either of the two periods. The rates of increase or decrease in both periods reflect the general shift in world production towards LDC's and new producers that occurred throughout the period examined.

Neither 1971-75 nor 1975-80 appears unequivocally "better" for flat-rolled production. Despite a greater increase in world and major supplier production in 1975-80 (table 3-7), many nations among the top 19 experienced larger percentage increases in production during 1971-75 than during 1975-80.

Although more defined patterns of growth or contraction emerged during 1980-85, it appears to have been a much more turbulent period. During the early 1980's, growth rates generally fell. The growth decline was the steepest in 1982, with a majority of the top 19 producers experiencing decreased production. The largest decreases in production during 1981-82 were experienced by France (down 35 percent), Belgium-Luxembourg (down 34 percent), West Germany (down 29 percent), and the United States (down 26 percent). The nonmarket economy countries did not experience the precipitous fall in production during 1981-82 experienced by the Western developed countries. Production declines occurred for only two such countries: the Soviet Union (down 2 percent) and Poland (down 7 percent).

1/ Data are derived from the United Kingdom Iron & Steel Statistics Bureau and include production of plate (which accounts for approximately 15 percent of flat-rolled production) in addition to sheet and strip. Hereinafter in the sections in this chapter on world production, world consumption, and trade analysis, the term flat-rolled products refers to plate, sheet, and strip products. Because of differences in data sources, production data may not be comparable with similar data presented in other sections of this study, although the relative differences in production among countries are fairly consistent for most data sources.
2/ Changes for this period are somewhat understated because of a significant decline in production in 1975.

Table 3-7
Plate, sheet, and strip production in specified countries, specified years 1971 to 1985

Country	1971	1975	1980	1981	1982	1983	1984	1985	Percentage change, 1985 from 1971	Average annual growth rate 1971-75	1975-80	1980-85
	1,000 metric tons									Percent		
Developed countries:												
Japan	44,124	52,852	59,133	54,140	53,220	52,007	56,898	57,006	29.19	4.62	2.27	-.73
United States	49,761	40,229	36,963	43,773	32,350	38,102	40,259	40,176	-19.26	-5.18	-1.68	1.68
West Germany	16,443	16,717	20,049	20,275	14,305	17,925	19,735	20,370	23.88	.41	3.70	.32
France	9,089	8,688	12,400	11,438	7,488	9,410	10,149	10,081	10.91	-1.12	7.37	-4.06
Italy	6,323	8,235	9,474	9,879	9,467	8,867	9,577	9,854	55.84	6.83	2.84	.79
Canada	4,255	5,976	6,989	6,816	5,789	5,904	7,189	7,346	72.64	8.86	3.18	1.00
Belgium-Luxembourg	6,314	5,719	7,900	7,369	4,837	5,956	7,098	7,257	14.94	-2.44	6.67	-1.68
United Kingdom	10,153	6,900	4,027	6,208	5,610	5,901	6,240	6,049	-40.42	-9.20	-10.21	8.48
Spain	1,971	4,254	5,184	5,667	5,404	3,811	3,875	3,796	92.59	21.21	4.03	-6.04
Developing countries:												
Brazil	2,222	3,116	6,910	5,686	6,154	7,154	7,915	8,320	274.44	8.82	17.27	3.78
Korea	63	429	3,398	4,742	5,187	4,807	5,560	5,504	8,636.51	61.54	51.27	10.13
Republic of South Africa	1,714	2,040	3,425	3,592	3,262	3,204	3,390	3,300	92.53	4.45	10.92	-.74
India	1,345	1,728	2,645	2,996	3,055	2,784	2,870	2,870	113.38	6.46	8.89	1.65
Nonmarket economies:												
Soviet Union	39,248	41,116	45,011	48,036	47,181	46,896	47,410	47,521	21.08	1.17	1.83	1.09
China	3,780	4,407	7,208	8,281	9,359	9,925	10,840	11,681	209.02	3.91	10.34	10.14
Poland	3,653	5,088	5,491	4,548	4,222	4,575	4,839	4,663	27.65	8.64	1.54	-3.22
Romania	1,852	3,378	4,391	4,532	5,134	4,018	4,813	4,455	140.55	16.21	5.39	.29
Czechoslovakia	2,807	4,002	3,815	3,910	4,211	4,109	4,162	4,170	48.56	9.27	-.95	1.80
East Germany	1,282	1,351	1,648	1,620	2,383	1,706	1,855	1,786	39.31	1.32	4.05	1.62
Top 19 total	206,399	216,225	246,061	253,508	228,618	237,061	254,674	256,205	24.13	1.17	2.62	.81
All other	7,934	12,937	2,909	9,813	13,921	8,957	12,779	10,291	29.71	13.00	-25.80	28.75
World total	214,333	229,162	248,970	263,321	242,539	246,018	267,453	266,496	24.34	1.69	1.67	1.37

Source: Compiled from data collected by the United Kingdom Iron & Steel Statistics Bureau.

The economic recovery during 1983 and 1984 resulted in relatively large production increases in several countries, including the United States (up 24 percent during 1982-84), West Germany (up 38 percent), Belgium-Luxembourg (up 47 percent), and France (up 36 percent).

A greater degree of stabilization seemed to emerge by 1985, as the magnitudes of both production growth and decline tended to generally decrease during 1984-85, ranging from a decline of 3 percent to an increase of almost 8 percent.

Even countries in which production grew throughout the period at a rate far above the world average, such as Korea and Brazil, had growth rates much lower than previously experienced. For most countries, stabilization occurred at production levels comparable with those during the peak period of 1980-81.

Country Shares of World Production

Plate, sheet, and strip production is concentrated among the top producing countries. As shown in table 3-8, the top 19 producing nations accounted for more than 96 percent of world flat-rolled production in 1971 and in 1985. This dominance appears relatively constant over time, as the share accounted for by the top 19 producers never dropped below 94 percent during 1971-85.

Production among the top 19 producers is dominated by a few major producers, with the top three to five nations commanding more than one-half of world production. For example, in 1971, the top three plate, sheet, and strip producers (Japan, the United States, and the Soviet Union) accounted for 62 percent of world production, and the top five (including West Germany and the United Kingdom) accounted for 74.5 percent of production. In 1980, the top five producers supplied 69.7 percent of world production. In contrast, market share for the nine smallest producing countries in the top 19 constituted less than 10 percent of world production in 1971 and 13.7 percent of world production in 1980.

Despite the fact that a few producers consistently command a majority of world production, the distribution of production for the top 19 producers has changed during 1971-85. As shown in table 3-8, throughout the period, a general shift toward relatively new producers has taken place in production. This shift occurred primarily in developing countries, particularly Korea, Brazil, and China, which raised their market share 1/ from a combined 3.5 percent of world production in 1971 to 9.6 percent in 1985. These three countries accounted for both the largest absolute and percentage increases in market share during 1971-85, showing large increases in production throughout the period, even during contractionary phases (e.g., 1982). Each of these countries expanded its market share during 1971-85 by 2 to 2.5 percentage points. 2/

1/ An increase (decrease) in market share (percentage of world production) means that a given country increased (decreased) production at a rate greater (lower) than the world average.
2/ Korea's relative market share increase is especially large because of its low production levels in the early 1970's.

Table 3-8
Share of world plate, sheet, and strip production (market share) by the top 19 producing nations, specified years 1971 to 1985

Country	1971	1975	1980	1981	1982	1983	1984	1985	Absolute change, 1985 from 1971	Percentage change, 1985 from 1971
	Percent								Percentage point	Percent
Developed countries:										
Japan	20.59	23.06	23.75	20.56	21.94	21.14	21.27	21.39	0.80	3.9
United States	23.22	17.55	14.85	16.62	13.34	15.49	15.05	15.08	-8.14	-35.1
West Germany	7.67	7.29	8.05	7.70	5.90	7.29	7.38	7.64	-.03	-.4
France	4.24	3.79	4.98	4.34	3.09	3.82	3.79	3.78	-.46	-10.8
Italy	2.95	3.59	3.81	3.75	3.90	3.60	3.58	3.70	.75	24.4
Canada	1.99	2.61	2.81	2.59	2.39	2.40	2.69	2.76	.77	38.7
Belgium-Luxembourg	2.95	2.50	3.17	2.80	1.99	2.42	2.65	2.72	-.22	-7.8
United Kingdom	4.74	3.01	1.62	2.36	2.31	2.40	2.33	2.27	-2.47	-52.1
Spain	.92	1.86	2.08	2.15	2.23	1.55	1.45	1.42	.50	54.3
India	.63	.75	1.06	1.14	1.26	1.13	1.07	1.08	.45	71.4
Developing countries:										
Brazil	1.04	1.36	2.78	2.16	2.54	2.91	2.96	3.12	2.08	200.0
Korea	.03	.19	1.36	1.80	2.14	1.95	2.08	2.07	2.04	6,800.0
Republic of South Africa	.80	.89	1.38	1.36	1.34	1.30	1.27	1.24	.44	55.0
Nonmarket economies:										
Soviet Union	18.31	17.94	18.08	18.24	19.45	19.06	17.73	17.83	-.48	-2.6
China	1.76	1.92	2.90	3.14	3.86	4.03	4.05	4.38	2.62	148.9
Poland	1.70	2.22	2.21	1.73	1.74	1.86	1.81	1.75	.05	2.9
Romania	.86	1.47	1.76	1.72	2.12	1.63	1.80	1.67	.81	94.2
Czechoslovakia	1.31	1.75	1.53	1.48	1.74	1.67	1.56	1.56	.26	19.1
East Germany	.60	.59	.66	.62	.98	.69	.69	.67	.07	11.7
Top 19 total	96.30	94.35	98.84	96.26	94.26	96.36	95.22	96.14	-.16	-.2
All other	3.70	5.65	1.17	3.73	5.74	3.64	4.78	3.86	.16	4.3
World total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	-	-

Source: Compiled from data collected by the United Kingdom Iron & Steel Statistics Bureau.

Note.--Because of rounding, figures may not add to totals shown.

3-10

Other countries that increased production are listed in the following tabulation:

	Production 1971	Production 1985
	(1,000 metric tons)	
Romania........	1,852	4,455
India..........	1,345	2,870
Spain..........	1,971	3,796
South Africa...	1,714	3,300
Canada.........	4,255	7,346
Italy..........	6,323	9,854

Romania and India are similar to China, Brazil, and Korea in that they doubled during 1971-85. In contrast, Canada and Italy represent producers that continued to grow from a previously established base, increasing their world shares by .77 and .75 percentage points, respectively. Growth in production in the developing countries mentioned above accounted for 98.7 percent of the loss in market share experienced by the developed countries.

The increased market share of the developing countries came primarily at the expense of developed countries such as the United States, Belgium-Luxembourg, France, and the United Kingdom. These countries experienced the largest decreases in market share, with their combined market share declining from 35.2 to 23.9 percent over the period. The majority of the decline is attributable to the United States, whose market share decreased from 23 percent of world production in 1971 to 15 percent in 1985. By contrast, the two largest producers, Japan and the Soviet Union, maintained relatively constant market shares throughout the period.

As shown in tables 3-7 and 3-8, most of the decrease in production and/or market share occurred in the mid-1970's to early 1980's, with the decline bottoming out in 1982. There has been some recovery for these countries since 1982, but their production apparently stabilized toward the end of the period, evidenced by their relatively lower rates of change during 1980-85.

The small shifts in combined market share for the top 19 producers over time suggests that plate, sheet, and strip production is not becoming widely dispersed throughout a large number of countries, and is not concentrated in developing countries. The data suggest that, although structural adjustment does seem to be occurring, particularly among the top 19 producers, the adjustment process is long term or gradual in nature, even for countries holding significant portions of world production such as the United States. The gradual nature of the adjustment process may be enhanced by the apparent increasing stability in production share evidenced in the mid-1980's.

World Consumption

If it can be assumed that all plate, sheet, and strip that is produced in the world in a particular year is consumed in that year, then world production can be used as a proxy for world consumption. According to the United Kingdom Iron and Steel Statistics Bureau, world consumption, as shown in table 3-9, grew at an average annual rate of 1.5 percent during 1971-85. Apparent consumption for the 19 largest consuming countries grew at an average annual rate of 1.6 percent for this same time period. Consumption declined in 1982 and recovered slightly in 1983, with full recovery in 1984. The decline in 1982, which corresponds with a worldwide recession, occurred in most of the 19 countries shown in table 3-9. Czechoslovakia, Romania, India, and East Germany experienced a decline a year later in 1983. China is the only country to show steady growth over this entire time period (9.0 percent average annual growth). The largest changes during 1971-85 were in China and South Korea, both of whom increased consumption, by 236 percent and 16,550 percent, respectively. The only two countries to show declines in consumption of steel flat-rolled products during the period were the United States (down 13.8 percent) and the United Kingdom (down 27.7 percent).

Trade Analysis

World trade of plate, sheet, and strip generally increased throughout 1971-86, yet experienced downturns during years marked by economic recessions. The country distribution of trade appears to be changing gradually in a manner reflective of changes in world production, although distinct patterns of change in trade are somewhat harder to detect. Export and import market shares were more evenly distributed over the period, particularly within the top exporting/importing countries. Despite the many changes that have occurred, trade has exhibited a degree of stability.

World exports and imports are examined for the largest 23 exporting and 28 importing nations (all identified on the basis of 1985 rankings), and for total world exports and imports for the period 1971-86. The discussion provides an overview of the general time trends in exports and imports during 1971-86 and a discussion of the structure of world trade. The relationship of exports and imports to production, consumption, and other industry performance variables is also examined. 1/

1/ World totals for exports and imports are derived from the United Kingdom Iron & Steel Statistics Bureau (with adjustments for comparability purposes) and include plate as well as sheet and strip. For consistency, total world exports equal total world imports for the purpose of the analysis. Individual country trade data have been compiled from a number of sources, including the U.N. Trade Data System, U.N. Statistics of World Trade in Steel, and the United Kingdom Iron & Steel Statistics Bureau. Because of differences in data sources, trade data may not be comparable with similar data for particular countries presented in other sections of this study, although the relative differences in exports and imports among countries are fairly consistent for most data sources.

Table 3-9
Consumption of steel plate, sheet, and strip products, by countries, 1971, 1975, and 1980-85

Country	1971	1975	1980	1981	1982	1983	1984	1985	Average annual change, 1971-85
	1,000 metric tons								Percent
Developed countries:									
United States	57,792	45,181	41,287	49,096	37,238	45,188	50,645	49,829	-1.1
Japan	33,224	39,557	47,897	44,144	42,358	39,783	43,649	46,414	2.4
West Germany	15,653	14,206	16,330	16,760	11,549	15,664	18,007	17,417	.8
Italy	6,609	7,959	10,463	9,632	9,252	8,768	9,456	9,526	2.6
France	8,633	8,494	11,577	10,792	7,747	8,955	9,236	8,896	.2
Canada	4,404	6,050	6,255	7,505	4,589	5,564	6,597	6,935	3.3
United Kingdom	8,642	7,797	5,636	6,318	6,225	6,131	6,414	6,252	-2.3
Spain	2,310	4,326	4,944	5,140	4,935	3,355	3,285	3,066	2.0
Belgium-Luxembourg	2,128	1,453	2,757	2,488	733	2,065	2,853	2,845	2.1
Developing countries:									
Brazil	2,596	4,413	6,575	5,229	4,965	4,212	4,936	6,036	6.2
Korea	30	410	2,370	446	3,726	3,542	5,061	4,995	44.1
India	2,162	2,171	3,532	4,216	4,511	3,768	3,933	4,094	4.7
Republic of South Africa	2,018	2,353	3,012	3,400	2,942	2,801	3,055	2,974	2.8
Nonmarket economies:									
Soviet Union	39,669	43,235	47,716	50,546	49,731	49,622	50,211	51,061	1.8
China	4,781	7,343	8,878	9,831	11,874	14,754	15,128	16,068	9.0
Poland	3,529	4,665	5,891	4,745	4,362	4,512	4,929	4,849	-2.3
Romania	1,861	3,364	4,441	4,101	4,994	3,941	4,457	4,018	5.7
Czechoslovakia	2,464	3,488	2,780	2,836	3,173	2,998	3,560	3,597	2.7
East Germany	1,297	1,294	1,619	1,514	2,878	1,962	2,040	1,782	2.3
Top 19 total	199,801	207,758	233,960	242,408	218,410	227,585	247,452	250,653	1.6
All other	14,532	21,404	15,010	20,913	24,129	18,433	20,001	15,843	.6
Total world	214,333	229,162	248,970	263,321	242,539	246,018	267,453	266,496	-1.5

Source: Compiled from data collected by the United Kingdom Iron & Steel Statistics Bureau.

Exports

Overview of time trends

With a few exceptions, trends in exports during 1971-86 generally mirror those in production. 1/ As shown in table 3-10, 2/ 1971-75 and 1975-80 were generally growth periods in exports as they were for production. However, trends seem to be dependent upon individual country experiences, as some countries experienced large export increases and others suffered marked decreases as shown by changes in exports during 1971-75:

Country	Absolute change (metric tons)	Percent change
South Korea.............	224,674	183.69
Spain....................	184,851	182.69
Italy....................	455,911	44.43
West Germany............	1,273,848	26.12
Japan....................	2,402,575	22.03
United States...........	-225,374	-22.28
Canada..................	-250,654	-33.00
Soviet Union............	-83,728	-44.91
United Kingdom..........	-1,311,069	-58.21
Top 23 total............	3,005,761	8.21
World total.............	2,201,593	5.80

Export growth generally occurred at a higher rate during 1975-80, although several countries such as the United Kingdom, Italy, and Japan experienced

1/ Export data for most of the Western developed countries were obtained from the U.N. Trade Data System, which is based on reported exports. Data for the East European nations, Japan, India, and the Republic of South Africa were obtained from a variety of sources, including the U.N. Trade Data System and the United Kingdom Iron & Steel Statistics Bureau. Data for the nonmarket economy countries, particularly East Germany and Romania, are understated because of lack of trade data for these countries. Some data are estimated.
2/ Eighteen of the previously identified major producers are also among the top 23 exporting countries.

Table 3-10
World exports of plate, sheet, and strip, 1/ by countries, specified years 1971 to 1986

Country	1971	1975	1980	1981	1982	1983	1984	1985	1986	Average annual growth rate 1971-75	1975-80	1980-86
	1,000 metric tons									Percent		
Developed countries:												
Japan	10,906	13,309	11,811	10,717	10,996	13,284	13,994	13,153	12,946	5.10	-2.36	.94
West Germany	4,877	6,151	8,105	7,820	6,797	6,546	7,038	7,379	6,748	5.97	5.67	-3.01
Belgium-Luxembourg	4,822	4,973	5,913	5,620	4,842	4,731	5,228	5,427	5,164	.77	3.52	-2.23
France	3,007	3,054	4,079	3,810	3,056	3,291	3,780	3,940	3,825	.39	5.96	-1.06
Netherlands	1,586	1,559	1,687	1,728	1,587	1,650	1,825	1,844	1,931	-.42	1.59	2.27
Austria	1,030	1,045	1,241	1,475	1,393	1,477	1,606	1,697	1,635	.36	3.50	4.70
Italy	1,026	1,482	1,299	1,732	1,676	1,612	1,852	1,990	1,537	9.63	-2.60	2.85
United Kingdom	2,252	941	736	1,339	1,015	1,238	1,313	1,458	1,525	-19.60	-4.80	12.91
Canada	760	509	1,314	1,022	1,739	873	1,291	1,480	1,478	-9.53	20.89	1.98
Spain	101	286	675	886	881	992	1,087	1,308	1,347	29.67	18.75	12.19
Sweden	701	806	723	699	847	944	1,032	1,112	1,058	3.56	-2.16	6.55
United States	1,011	786	1,569	1,068	605	513	433	416	523	-6.11	14.82	-16.72
Australia	223	255	616	289	808	508	377	649	379	3.34	19.32	-7.76
Denmark	116	151	445	385	316	321	318	332	371	6.98	24.08	-3.00
Finland	155	97	558	495	510	655	846	818	2/ 800	-10.96	41.77	6.2
Developing countries:												
Brazil	69	38	771	778	1,316	2,978	3,014	2,341	2,084	-13.64	82.17	18.03
Korea	122	347	1,551	1,680	1,871	1,971	1,755	1,478	1,673	29.78	34.92	1.27
Republic of South Africa	26	31	492	272	387	471	427	380	419	4.81	73.63	-2.65
Nonmarket economies:												
Czechoslovakia	454	565	1,124	1,166	1,107	1,183	647	584	509	5.60	14.76	-12.38
East Germany	43	87	234	193	168	354	501	391	306	19.09	21.99	4.54
Romania	226	197	194	539	263	152	446	475	248	-3.43	-.28	4.17
Poland	324	282	553	564	494	606	543	470	154	-3.36	14.38	-19.17
Soviet Union	186	103	574	566	492	448	441	365	76	-13.85	41.07	-28.59
Top 23 total	34,025	37,054	46,263	44,843	43,169	46,798	49,795	49,487	46,284	1.99	3.14	.075
All other	3,926	3,098	1,075	360	3,352	4,467	6,245	758	5,150	-5.75	-19.08	29.8
World total	37,951	40,152	47,338	45,203	46,521	51,265	56,040	50,245	51,434	1.42	3.35	1.39

1/ Excludes coils for re-rolling.
2/ Estimated by the staff of the USITC.

Source: Compiled from data collected by the United Kingdom Iron & Steel Statistics Bureau and the U.N. Trade Data System, except as noted.

export decreases of 22, 12, and 11 percent, respectively. Several countries experienced large export increases during 1975-80, as shown in the following tabulation:

Country	Absolute change (metric tons)	Percent change
Brazil 1/	732,117	1,906.21
South Korea	1,204,353	347.00
Canada	804,902	158.17
Spain	389.312	136.10
Denmark	293,692	194.06
Australia	361,180	141.86
Soviet Union	471,107	458.77
Republic of South Africa	460,669	1,477.97
United States	782,827	99.60
Top 23 total	6,634,787	16.74
World total	7,185,977	17.90

1/ Brazil's and the Republic of South Africa's rates of increase are relatively large because of their low export levels in 1975. By 1980, these countries' exports attained levels comparable with the other major competing countries.

A general contraction in exports occurred in the early 1980's, indicative of the economic recession of the period. Exports for the top 23 exporters decreased by almost 4 percent in both 1980-81 and 1981-82, despite the fact that world flat-rolled product trade as a whole increased by 3 percent during 1981-82. Countries experiencing the largest decreases are shown in the following tabulation, 1981-82:

Country	Absolute change (metric tons)	Percent change
United States	-462,944	-43.34
France	-753,440	-19.78
United Kingdom	-323,281	-24.15
West Germany	-1,022,209	-13.07
Belgium-Luxembourg	-777,936	-13.84

Most exporters among the top 23 experienced their sharpest export downturns during 1981-82. This pattern reversed itself during 1983-84 as exports increased concurrent with production increases. Despite the relatively large annual increases in total plate, sheet, and strip exports in 1982-83 and 1983-84 (table 3-10), the magnitude of the increases for individual countries was less than that in previous years. This reflects the fact that new producers/exporters, such as South Korea and Brazil, had entered the market, which had a stabilizing effect on the annual export increases among countries.

Since 1984, exports have declined. Despite a large number of countries experiencing modest increases, total plate, sheet, and strip exports fell by slightly more than 10 percent during 1984-85, led by decreases in Brazil (down about 22 percent), South Korea (down about 16 percent), and Japan (down 6 percent). This decrease in exports continued and intensified in 1986, as shown in the following tabulation, 1985-86:

Country	Absolute change (metric tons)	Percent change
Japan....................	-207,000	-1.60
Belgium/Luxembourg........	-262,971	-4.85
West Germany.............	-631,615	-8.56
Brazil...................	-257,800	-11.01
Czechoslovakia...........	-75,617	-12.94
Italy....................	-452,842	-22.75
Poland...................	-316,147	-67.20
Romania..................	-226,917	-47.76
Australia................	-269,734	-41.60
Soviet Union.............	-289,035	-79.16
Top 23 total 1/..........	-3,203,000	-6.50

1/ The degree of decrease in 1986 is somewhat overstated, because of understatement of nonmarket economy country trade in the 1986 data.

Country distribution of exports

As in the case of world production, world exports of steel plate, sheet, and strip are dominated by the top 23 exporting nations. 1/ These countries account for approximately 95 percent 2/ of total world exports throughout the period. Slightly more than two-thirds of this export share is held by previously identified major producers (16 of the top 19 producing countries are also among major exporting nations).

The top three exporters (Japan, West Germany, and Belgium-Luxembourg) have not constituted more than 55 percent of world export share and generally (particularly in the mid-1980's) have accounted for 45 to 50 percent of total world exports (table 3-11). The top five producers accounted for approximately 60 percent of world exports during 1971-86. As a result, although the top three nations account for a high share of exports, the distribution of exports among countries is more evenly balanced for the major nations than is distribution of production among countries.

1/ The top 23 exporting nations in 1985 are not necessarily consistent throughout the period. However, the very high percentage of world exports accounted for by this group, the stability of this percentage over time, and the fact that most of the shifts in exports occur within this group, suggest that countries which may have been marginal members of the top 23 in previous years could not have constituted a significantly larger proportion of world exports than the countries that replaced them.
2/ Market share for the 23 major exporters declined in 1986 to 88 percent of world exports. However, this is attributable mainly to the understatement of 1986 nonmarket economy country exports mentioned above.

Table 3-11
Share of world plate, sheet, and strip exports, 1/ by countries, specified years 1971 to 1986

Country	1971	1975	1980	1981	1982	1983	1984	1985	1986	Absolute change, 1986 from 1971	Percentage change, 1986 from 1971
	Percent									Percentage point	Percent
Developed countries:											
Japan	28.74	33.15	24.95	23.71	23.64	25.91	24.97	26.18	25.17	-4.44	-15.46
West Germany	12.85	15.32	17.12	17.30	14.61	12.77	12.56	14.69	13.12	.27	2.08
Belgium-Luxembourg	12.71	12.38	12.49	12.43	10.41	9.23	9.33	10.80	10.04	-2.67	-20.99
France	7.92	7.61	8.62	8.43	6.57	6.42	6.75	7.84	7.44	-.49	-6.13
Netherlands	4.18	3.88	3.56	3.82	3.41	3.22	3.26	3.67	3.75	-.42	-10.16
Austria	2.71	2.60	2.62	3.26	3.00	2.88	2.87	3.38	3.18	.46	17.11
Italy	2.70	3.69	2.74	3.83	3.60	3.14	3.30	3.96	2.99	.28	10.53
United Kingdom	5.93	2.34	1.55	2.96	2.18	2.42	2.34	2.90	2.96	-2.97	-50.05
Canada	2.00	1.27	2.78	2.26	3.74	1.70	2.30	2.95	2.87	.87	43.54
Spain	.27	.71	1.43	1.96	1.89	1.94	1.94	2.60	2.62	2.35	882.13
Sweden	1.85	2.01	1.53	1.55	1.82	1.84	1.84	2.21	2.06	.21	11.33
United States	2.66	1.96	3.31	2.36	1.30	1.00	.77	.83	1.02	-1.65	-61.81
Australia	.59	.63	1.30	.64	1.74	.99	.67	1.29	.74	.15	25.36
Denmark	.30	.38	.94	.85	.68	.63	.57	.66	.72	.42	136.72
Finland	.41	.24	1.18	1.09	1.10	1.28	1.51	1.63	1.56	1.15	4.8
Developing countries:											
Brazil	.18	.10	1.63	1.72	2.83	5.81	5.38	4.66	4.05	3.87	2,126.89
Korea	.32	.86	3.28	3.72	4.02	3.85	3.13	2.94	3.25	2.93	909.46
Republic of South Africa	.07	.08	1.04	.60	.83	.92	.76	.76	.81	.75	1,095.68
Nonmarket economies:											
Czechoslovakia	1.20	1.41	2.37	2.58	2.38	2.31	1.15	1.16	.99	-.21	-17.35
East Germany	.11	.22	.49	.43	.36	.69	.89	.78	.59	.48	423.28
Romania	.60	.49	.41	1.19	.56	.30	.80	.95	.48	-.11	-19.10
Poland	.85	.70	1.17	1.25	1.06	1.18	.97	.94	.30	-.55	-64.85
Soviet Union	.49	.26	1.21	1.25	1.06	.87	.79	.73	.15	-.34	-69.89
Top 23 total	89.68	92.28	97.73	99.20	92.79	91.29	88.86	98.48	88.99	-8.07	-8.36
All other	10.34	7.72	2.27	.80	7.21	8.71	11.14	1.51	10.01	1.23	11.90
World total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	-	-

1/ Excludes coils for re-rolling.

Source: Compiled from data collected by the United Kingdom Iron & Steel Statistics Bureau and the U.N. Trade Data System.

Note.--Due to rounding, figures may not add to totals shown.

During 1971-86, a shift occurred in exports similar to that experienced in production, with developing countries or newly producing countries commanding an increasingly large share of exports (84 percent of the export market share loss by the developed countries was offset by share increases by other countries in the top 23 exporters). As shown in table 3-11, both West Germany and Belgium-Luxembourg lost export market share after peaking in the early 1980's, and even Japan accounted for a slightly smaller percentage of world exports by the end of the period. Other established exporting nations, such as the United States and the United Kingdom, lost relatively large percentages of their export market shares. The following tabulation shows changes in world export shares for selected countries, 1971-86:

Country	Absolute change (percentage point)	Percent change
West Germany	0.27	2.08
Japan	-4.44	-15.46
Belgium/Luxembourg	-2.67	-20.99
France	-.49	-6.13
United Kingdom	-2.97	-50.05
United States	-1.65	-61.81

Much of the loss in export shares for the above countries is accounted for by share gains by developing countries and other countries as shown in the following tabulation, 1971-86:

Country	Absolute change (percentage point)	Percentage change
Brazil 1/	3.87	2,126.89
Republic of South Africa 1/	.75	1,095.68
South Korea 1/	2.93	909.46
Spain	2.35	882.13
East Germany	.48	423.28
Denmark	.42	136.72
Canada	.87	43.54

1/ Brazil, the Republic of South Africa, and South Korea all experienced relatively large percentage increases in export share because of their low 1971 export levels.

Exports from South Korea, Brazil, and Spain all seemed generally resistant to changes in economic conditions, increasing steadily even during 1982 and 1983. Brazil, the Republic of South Africa, and South Korea all experienced their largest export increases during the mid-to-late 1970's.

As a result of these shifts, the variation in export market shares among the top 23 exporting nations appears to have been more balanced by the end of the 1971-86 period, as suggested by the larger number of countries with shares between 2 and 5 percent of world production, and the decrease in exporting countries having market shares less than 1 percent (table 3-11).

Exports compared with production

Some correlation does seem to exist between the absolute size of a country's exports and the proportion of its production that is exported. As seen in table 3-12, West Germany, Japan, Belgium-Luxembourg, and France, the largest exporters throughout the period, export a greater percentage of production than the top 19 producers 1/ in total, which export about 14 to 18 percent of production. Moderate to small exporters generally show smaller export-to-production ratios. Rapidly growing exporters, such as Brazil, generally increased their percentage of production exported, suggesting that much of their production expansions were driven by exports rather than internal consumption.

The positive correlation between the size of a country's exports and the percentage of production exported is not strict. For instance, Japan exports almost twice as much flat-rolled products as any other nation, yet its export-to-production ratio in 1985 is much lower than those for West Germany, Belgium-Luxembourg, France, South Korea, and Brazil. Also, an increase in exports by a particular country often does not entail an increase in its percentage of production exported. Countries losing export share over time, such as the United States, do not consistently decrease their export-to-production ratios. For example, the United States' export share of production remains stable despite a significant decline in exports during 1971-85.

Imports

During the 1971-86 period, world imports of plate, sheet, and strip loosely followed the same basic time trends and distributional characteristics as production and exports. However, countries with similar levels of production or growth in flat-rolled products do not consistently share similar import trends. Import patterns among countries are more difficult to identify, and result mainly from individual country experiences. Moreover, imports are not as concentrated as production or exports.

Time trends

As shown in table 3-13, the 1971-75 and 1975-80 periods featured increases in plate, sheet, and strip imports for the world 2/ as well as for the top 28 import countries. 3/ Countries experiencing the largest increases in imports are shown in the following tabulation (1971-75):

1/ Analysis was limited to the top 19 producers because of lack of production data for the major exporters that were not also major producers.
2/ World imports = world exports.
3/ A larger number of countries were included for import analysis than were included for production and export analysis because of the lack of a distinct break between import levels for higher and lower level importers.

Table 3-12
Share of plate, sheet, and strip production exported by the top 19 producing nations, specified years 1971 to 1985

Country	1971	1975	1980	1981	1982	1983	1984	1985
	Percent							
Developed countries:								
Belgium-Luxembourg.....	76.38	86.95	74.85	76.27	1/	79.44	73.65	74.78
France................	33.08	35.15	32.89	33.31	40.81	34.97	37.25	39.08
West Germany..........	29.66	36.80	40.43	38.57	47.52	36.52	33.59	36.23
Spain.................	5.13	6.72	13.03	15.63	16.30	26.04	28.04	34.45
United Kingdom.........	22.18	13.64	18.27	21.56	18.10	20.99	21.05	24.10
Japan.................	24.72	25.18	19.97	19.80	20.66	25.54	24.59	20.35
Italy.................	16.23	18.00	13.71	17.54	17.71	18.18	19.34	20.20
Canada................	17.85	8.52	18.80	15.00	30.04	14.79	17.96	20.15
United States..........	2.03	1.95	4.24	2.44	1.87	1.35	1.08	1.04
Developing countries:								
Brazil................	3.11	1.23	11.15	13.68	21.38	41.62	38.08	28.14
Korea.................	1/	80.88	45.65	35.43	36.08	41.01	31.57	26.85
Republic of South Africa..............	1.51	1.53	14.36	7.58	11.86	14.69	12.60	11.52
India.................	.07	.17	.22	.06	0.01	.04	.02	.01
Nonmarket economies:								
East Germany..........	3.35	6.44	14.20	11.91	7.05	20.77	27.02	21.87
Czechoslovakia.........	16.18	14.11	29.46	29.83	26.29	28.79	15.54	14.01
Romania...............	12.22	5.83	4.42	11.89	5.12	3.77	9.27	10.67
Poland................	8.86	17.28	10.07	12.41	11.71	13.25	11.23	10.09
Soviet Union..........	.47	.25	1.27	1.18	1.04	.95	.93	.77
China.................	.17	.08	.63	.86	0.66	.26	.11	.05
Top 19 producer average...........	14.64	15.61	16.68	15.72	16.52	18.06	17.12	16.19

1/ Data sources indicate share exceeds 100.0 percent.

Source: Compiled from data collected by the United Kingdom Iron & Steel Statistics Bureau and the U.N. Trade Data System.

Table 3-13
World imports of plate, sheet, and strip, 1/ by countries, specified years 1971 to 1986

Country	1971	1975	1980	1981	1982	1983	1984	1985	1986	Average annual growth rate 1971-75	1975-80	1980-86
	1,000 metric tons									Percent		
Developed countries:												
United States	9,042	5,737	5,893	6,391	5,493	7,599	10,820	10,069	8,938	-10.75	.54	7.19
West Germany	4,088	3,640	4,386	4,305	4,041	4,285	4,095	4,426	4,706	-2.85	3.80	1.18
France	2,551	2,860	3,255	3,164	3,315	2,836	2,867	2,755	2,789	2.90	2.62	-2.54
Italy	1,312	1,206	2,288	1,485	1,461	1,513	1,731	1,662	1,966	-2.08	13.66	-2.49
United Kingdom	741	1,838	2,345	1,448	1,631	1,468	1,488	1,660	1,764	25.50	4.99	-4.63
Netherlands	985	1,205	1,299	1,139	1,135	1,097	1,260	1,356	1,393	5.16	1.51	1.17
Belgium-Luxembourg	636	707	770	739	739	840	982	1,014	1,126	2.65	1.73	6.54
Switzerland	785	499	912	824	764	899	984	942	1,016	-10.73	12.85	1.81
Sweden	940	1,150	1,056	968	1,026	954	1,017	922	993	5.19	-1.70	-1.02
Spain	441	358	435	358	412	536	496	578	981	-5.03	3.95	14.51
Canada	908	583	580	1,712	539	534	699	1,069	914	-10.50	-.11	7.89
Japan	6	13	575	721	760	1,060	745	1,006	886	22.47	112.56	7.47
Denmark	653	687	773	704	783	777	825	790	770	1.27	2.41	-.07
Norway	623	751	624	571	520	464	524	577	554	4.79	-3.64	-1.96
Austria	92	132	303	292	297	337	357	348	379	9.43	18.01	3.80
Greece	156	202	330	349	265	251	230	235	203	6.64	10.30	-7.82
Developing countries:												
Korea	89	328	523	1,054	411	706	1,257	969	1,511	38.46	9.76	19.34
India	818	446	893	1,222	1,457	985	1,064	1,224	930	-14.07	14.91	.67
Iran	505	1,050	725	555	1,296	1,945	866	1,056	586	20.10	-7.15	-3.48
Hong Kong	153	160	303	252	265	335	324	352	534	1.16	13.63	9.92
Mexico	58	276	1,048	761	411	198	419	328	398	47.51	30.59	-14.92
Pakistan	191	169	265	317	333	483	411	324	305	-3.02	9.50	2.32
Brazil	443	1,335	436	320	127	35	35	58	49	31.76	-20.06	-30.64
Nonmarket economies:												
China	1,008	2,940	1,716	1,621	2,577	4,855	4,300	4,393	4,513	30.69	-10.21	17.49
Soviet Union	608	2,221	3,279	3,076	3,042	3,174	3,242	3,905	2,265	38.27	8.10	-5.98
Yugoslavia	581	684	601	678	548	543	569	542	617	4.16	-2.58	.46
Poland	200	879	953	762	635	543	633	656	71	44.81	1.62	-35.07
East Germany	58	30	205	87	663	611	686	387	26	-15.48	47.36	-28.94
Top 28 total	28,670	32,088	36,772	35,876	34,946	39,863	42,927	43,604	41,184	2.86	2.76	1.91
All other	9,281	8,064	10,566	9,327	11,575	11,402	13,113	6,641	10,250	-3.45	5.55	-.50
World total	37,951	40,152	47,338	45,203	46,521	51,265	56,040	50,245	51,434	1.42	3.35	1.39

1/ Excludes coils for re-rolling.

Source: Compiled from data collected by the United Kingdom Iron & Steel Statistics Bureau and the U.N. Trade Data System.

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Country	Absolute change (metric tons)	Percent change
Mexico....................	217,700	373.41
Poland....................	679,270	339.75
Soviet Union..............	1,613,581	265.50
South Korea...............	238,968	267.51
Brazil....................	885,860	201.41
China.....................	1,932,138	191.73
Japan.....................	7,362	124.99
United Kingdom............	1,097,074	148.08
West Germany..............	-447,194	-10.94
United States.............	-3,305,035	-36.55
Top 28 total..............	3,417,355	11.92

For some of these countries, such as Brazil, South Korea, and China, import increases occurred concurrent with large production expansions during this period, whereas for the United States and West Germany, the two largest importers, decreased imports occurred in concert with domestic consumption decreases. The United Kingdom increased imports to satisfy growing internal demand at a time when production was decreasing by about one-third. Import growth continued during 1975-80, with the largest increases experienced as in the following tabulation, 1975-80:

Country	Absolute change (metric tons)	Percent change
Japan 1/..................	561,791	4,239.29
East Germany..............	175,500	594.29
Mexico....................	772,100	279.75
India.....................	447,127	100.31
Italy.....................	1,081,886	89.70
Hong Kong.................	143,000	89.43
Switzerland...............	413,809	83.01
West Germany..............	745,731	20.48
Top 28 total..............	4,684,266	14.60

1/ The large percentage increase in Japan's imports reflects its very low 1975 import level.

A sharp import decline occurred during the early 1980's particularly for the top 28 importing countries. However, this decline occurred principally in 1981, somewhat earlier than the decline in production or exports. Most countries experienced import declines in 1981 and 1982 (20 countries in 1981, 15 countries in 1982), with the most notable decreases shown in the following tabulation of changes in imports, 1980-82:

Country	Absolute change (metric tons)	Percent change
1980-81:		
United Kingdom..................	-896,377	-38.23
Italy...........................	-802,816	-35.09
Brazil..........................	-115,528	-26.51
Poland..........................	-191,336	-20.08
Mexico..........................	-287,000	-27.38
Western developed country total.........................	-256,610	-0.97
Top 28 total....................	-895,940	-2.44
World total.....................	-2,134,882	-4.51
1981-1982:		
United States...................	-897,875	-14.05
West Germany....................	-263,300	-6.12
South Korea.....................	643,807	-61.06
Brazil..........................	-193,540	-60.42
Canada..........................	-1,172,361	-68.49
Western developed country total.........................	-2,743,317	-10.47
Top 28 total....................	-930,336	-2.59
World total.....................	1,317,821	2.92

The total decline for the Western developed countries was much less in 1981 than in 1982 because of the import growth for the United States and Japan in 1981 and the sharp decrease for the United States in 1982.

Imports for the 1983-86 period generally mirror the pattern for exports during the period. Imports rebounded strongly during 1983, due mainly to an increase in imports by the United States, and reached their apex during 1984, as almost every nation in the top 28 (with the exception of Japan and China, which had been increasing imports even during contractionary years) increased imports as in the following tabulation, 1982-84:

Country	Absolute change (metric tons)	Percent change
1982-83:		
United States	2,105,831	38.33
India	2,278,487	88.43
South Korea	295,500	71.97
Japan	300,172	39.52
Top 28 total	4,917,741	14.07
World total	4,743,584	10.20
1983-84:		
United States	3,220,376	42.38
South Korea	550,623	77.98
Mexico	221,300	111.77
Canada	165,211	30.95
Top 28 total	3,064,006	7.69
World total	4,774,622	8.52

The 1985-86 period signaled a reversal in this trend as, led by an import decrease in the United States, total imports for the top 28 importing countries decreased by 5.5 percent during 1985-86.

Country distribution of imports

Global imports are concentrated among the top importing nations, 1/ but not to the degree as for production or exports. This wider distribution reflects the larger number of countries that import plate, sheet, and strip compared with the countries that produce and/or export the products. The top 28 importing countries consistently account for 75 to 80 percent of total imports over the 1971-80 period (compared with the 90 to 95 percent of total exports accounted for by the major exporters) (table 3-14). Imports are not dominated by the top 3 to 5 nations to the same degree as production or exports. The top two importers, West Germany and the United States, together accounted for 20 to 30 percent of world imports throughout the 1971-86 period (in contrast, the three largest exporting nations represented 45 to 50 percent of world exports, with Japan alone accounting for about 25 percent). The next largest importer, France, accounts for 5 to 7 percent of world imports, with all other nations each holding less than 4 percent of world imports.

1/ As for exports, all the identified importing countries are not among the top 28 throughout the period. However, the large percentage of total world imports accounted for by this group, the stability of this percentage over time, and the fact that most of the shifts in imports over the period occurred within this group suggest the marginal countries that may have previously been in the top 28 did not command signficantly different (larger) market shares than those that replaced them.

Table 3-14
Share of world plate, sheet, and strip imports by countries, specified years 1971 to 1986

Country	1971	1975	1980	1981	1982	1983	1984	1985	1986	Absolute change, 1986 from 1971	Percentage change, 1986 from 1971
	Percent									Percentage point	Percent
Developed countries:											
United States	23.83	14.29	12.45	14.14	11.81	14.82	19.31	20.04	17.38	-6.45	-27.07
West Germany	10.77	9.07	9.27	9.52	8.69	8.36	7.31	8.81	9.15	-1.62	-15.05
France	6.72	7.12	6.88	7.00	7.13	5.53	5.12	5.48	5.42	-1.30	-19.32
Italy	3.46	3.00	4.83	3.29	3.14	2.95	3.09	3.31	3.82	.37	10.58
United Kingdom	1.95	4.58	4.95	3.20	3.51	2.86	2.65	3.30	3.43	1.48	75.69
Netherlands	2.60	3.00	2.74	2.52	2.44	2.14	2.25	2.70	2.71	.11	4.33
Belgium-Luxembourg	1.68	1.76	1.63	1.64	1.59	1.64	1.75	2.02	2.19	.51	30.59
Switzerland	2.07	1.24	1.93	1.82	1.64	1.75	1.76	1.87	1.98	-.09	-4.50
Sweden	2.48	2.86	2.23	2.14	2.21	1.86	1.82	1.84	1.93	-.55	-22.03
Spain	1.16	.89	.92	.79	.89	1.05	.89	1.15	1.91	.75	64.25
Canada	2.39	1.45	1.22	3.79	1.16	1.04	1.25	2.13	1.78	-.62	-25.74
Japan	.02	.03	1.21	1.59	1.63	2.07	1.33	2.00	1.72	1.71	10,999.54
Denmark	1.72	1.71	1.63	1.56	1.68	1.52	1.47	1.57	1.50	-.22	-12.98
Norway	1.64	1.87	1.32	1.26	1.12	.91	.94	1.15	1.08	-.56	-34.40
Austria	.24	.33	.64	.65	.64	.66	.64	.69	.74	.49	202.91
Greece	.41	.50	.70	.77	.57	.49	.41	.47	.39	-.02	-4.44
Developing countries:											
Korea	.24	.82	1.10	2.33	.88	1.38	2.24	1.93	2.94	2.70	1,147.73
India	2.15	1.11	1.89	2.70	3.13	1.92	1.90	2.44	1.81	-.35	-16.11
Iran	1.33	2.62	1.53	1.23	2.79	3.79	1.54	2.10	1.14	-.19	-14.36
Hong Kong	.40	.40	.64	.56	.57	.65	.58	.70	1.04	.64	158.22
Mexico	.15	.69	2.21	1.68	.88	.39	.75	.65	.77	.62	403.20
Pakistan	.50	.42	.56	.70	.72	.94	.73	.65	.59	.09	17.92
Brazil	1.17	3.33	.92	.71	.27	.07	.06	.12	.09	-1.07	-91.91
Nonmarket economies:											
China	2.66	7.32	3.63	3.59	5.54	9.47	7.67	8.74	8.77	6.12	230.45
Soviet Union	1.60	5.53	6.93	6.80	6.54	6.19	5.79	7.77	4.40	2.80	175.03
Yugoslavia	1.53	1.70	1.27	1.50	1.18	1.06	1.02	1.08	1.20	-.33	-21.63
Poland	.53	2.19	2.01	1.68	1.36	1.06	1.13	1.31	.14	-.39	-73.65
East Germany	.15	.07	.43	.19	1.43	1.19	1.22	.77	.05	-.10	-66.30
Top 28 total	75.55	79.91	77.68	79.37	75.12	77.76	76.60	86.78	80.07	4.52	5.99
All other	24.46	20.08	22.32	20.63	24.88	22.24	23.40	13.22	19.93	-4.53	-18.52
World total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	-	-

Source: Compiled from data collected by the United Kingdom Iron & Steel Statistics Bureau and the U.N. Trade Data System.

Note.--Due to rounding, figures may not add to totals shown.

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The distribution of world imports did shift somewhat over the period examined. However, these shifts were less dramatic among the major nations than was the case for production and exports. Countries experiencing the largest increases in imports during the 1971-86 period are included in the following tabulation:

Country	Absolute change (percentage point)	Percent change
United Kingdom	1.48	75.69
Spain	.75	64.25
Belgium/Luxembourg	.51	30.59
Austria	.49	202.91
South Korea	2.70	1,147.73
Soviet Union	2.80	175.03
Japan 1/	1.71	10,999.54
China	6.12	230.45
Mexico	.62	403.20
Hong Kong	.64	158.22

1/ The large percentage increase in Japan's share of world imports reflects Japan's low levels of imports in 1971.

Import/consumption relationship

As shown in table 3-15, countries such as Spain, China, and Belgium-Luxembourg, which increased imports greatly over the period examined, also raised their percentage of consumption derived from imports. Also, the largest importers featured generally the largest percentage of consumption derived from imports. However, exceptions exist to both of these observations. Spain, which experienced a fairly dramatic increase in imports, did not significantly increase its imports-to-consumption ratio, which remained at a level comparable (8 to 15 percent) with the average for the countries indicated. Another contrary example is that of the United States, which exhibits, despite being the largest importing country, a percentage of consumption derived from imports lower than for several other countries. As shown in table 3-15, the proportion of consumption derived from imports for the countries identified 1/ in total increased only slightly over time.

Trade Balance

As shown in table 3-16, large year-to-year fluctuations are prevalent in the trade balances of many countries. Not only does the magnitude of the sheet and strip surplus/deficit vary, several countries also alternate from being net exporters to net importers (or vice versa) over time. 2/ Trade

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1/ Countries provided are the top 19 producers. Other countries were not included because of lack of production data.
2/ Countries analyzed are those that are both major exporters and importers. Other countries are excluded because of lack of data.

Table 3-15
Share of plate, sheet, and strip consumption imported, by countries, specified years 1971 to 1985

Country	1971	1975	1980	1981	1982	1983	1984	1985
	Percent							
Developed countries:								
Belgium-Luxembourg	29.91	48.64	27.93	29.72	1/	40.67	34.43	35.66
France	29.55	33.67	28.12	29.32	42.79	31.67	31.04	30.97
United Kingdom	8.57	23.57	41.60	22.93	26.20	23.95	23.19	26.56
West Germany	26.11	25.63	26.86	25.68	34.99	59.94	22.74	25.41
United States	15.65	12.70	14.27	13.02	14.75	16.82	21.36	20.21
Spain	19.07	8.28	8.80	6.97	8.34	15.97	15.11	18.86
Italy	19.85	15.15	21.87	15.42	15.79	17.25	18.31	17.45
Canada	20.63	9.63	9.27	22.81	11.75	9.59	10.60	15.41
Japan	.02	.03	1.20	1.63	1.77	2.66	1.71	2.17
Developing countries:								
India	37.82	20.53	25.28	28.98	32.29	26.15	27.05	29.90
Korea	1/	80.01	15.72	17.41	7.29	19.94	24.83	19.39
Republic of South Africa	16.33	14.63	2.61	2.35	2.27	2.42	3.01	1.83
Brazil	17.06	30.26	6.63	6.13	2.55	.84	.71	.96
Nonmarket economies:								
China	21.08	40.03	19.33	16.49	21.70	32.91	28.43	27.34
East Germany	4.46	2.28	12.66	5.75	23.04	31.12	33.62	21.71
Poland	5.67	9.77	16.18	16.05	14.55	12.04	12.85	13.53
Soviet Union	1.53	5.14	6.87	6.08	6.12	6.40	6.46	7.65
Romania	12.63	5.44	5.49	2.63	2.47	1.90	2.02	.94
Czechoslovakia	4.51	1.46	3.18	3.25	2.18	2.40	1.25	.31
Top 19 producer average	11.82	12.17	12.32	11.76	12.51	14.51	14.29	14.34

1/ Data sources indicate share exceeds 100.0 percent.

Source: Compiled from data collected by the United Kingdom Iron & Steel Statistics Bureau and the U.N. Trade Data System.

Table 3-16
Trade balance in plate, sheet, and strip among countries, specified years 1971 to 1986

(In thousands of metric tons)

Country	1971	1975	1980	1981	1982	1983	1984	1985	1986
Developed countries:									
Japan	10,900	13,296	11,236	9,996	10,236	12,224	13,249	12,146	12,060
Belgium-Luxembourg	4,186	4,266	5,143	4,881	4,104	3,891	4,245	4,412	4,038
West Germany	789	2,511	3,719	3,515	2,756	2,261	2,942	2,953	2,042
Austria	938	912	938	1,183	1,097	1,139	1,249	1,349	1,255
France	456	194	823	646	-259	455	913	1,185	1,036
Canada	-149	-74	734	-689	1,200	340	592	411	563
Netherlands	600	354	388	589	452	553	565	487	537
Spain	-339	-72	240	527	469	456	590	730	366
Sweden	-238	-344	-333	-269	-180	-10	15	189	65
United Kingdom	1,511	-897	-1,609	-110	-615	-230	-174	-203	-239
Denmark	-537	-535	-328	-319	-467	-456	-507	-458	-399
Italy	-286	276	-989	247	215	99	121	328	-429
United States	-8,031	-4,952	-4,324	-5,323	-4,888	-7,086	-10,386	-9,653	-8,414
Developing countries:									
Brazil	-374	-1,297	335	457	1,189	2,942	2,979	2,284	2,035
Republic of South Africa	-304	-313	413	192	320	403	335	326	359
Korea	33	19	1,028	626	1,461	1,265	499	509	163
India	-817	-443	-887	-1,220	-1,456	-984	-1,063	-1,224	-919
Nonmarket economies:									
Czechoslovakia	343	514	1,035	1,074	1,038	1,111	602	573	497
East Germany	-15	58	29	106	-495	-256	-185	4	280
Romania	-9	14	-50	431	140	77	356	437	216
Poland	124	423	-400	-197	-140	63	-90	-186	83
Soviet Union	-421	-2,119	-2,705	-2,510	-2,550	-2,726	-2,801	-3,540	-2,189
China	-1,001	-2,936	-1,670	-1,550	-2,515	-4,829	-4,288	-4,387	-4,502
Top 23 producer total	7,360	8,854	12,765	12,284	11,110	10,703	9,758	8,674	8,051

Source: Compiled from data collected by the United Kingdom Iron & Steel Statistics Bureau and the U.N. Trade Data System.

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balances conformed, although more loosely, to the general patterns exhibited by the other trade variables analyzed. Balances in the 1971-75 and 1975-80 periods were mixed, with about one-half to two-thirds of the countries identified experiencing improvements in trade balance. The total trade surplus for the countries identified increased steadily throughout the 1970's. This growth trend ceased abruptly in 1981, as almost one-half of the countries identified experienced trade balance decreases. Unlike the case for production, exports, and imports, this deterioration continued steadily after 1982, with an especially large decrease in 1985.

Major net exporters

As shown in table 3-16, Japan exhibits the largest absolute trade surplus during 1971-86. Belgium-Luxembourg consistently ran the second highest trade surplus, despite having relatively large yearly fluctuations. West Germany and Brazil are the third and fourth largest net exporters. West Germany's trade surplus remained relatively constant, whereas Brazil's net exports grew to a level comparable with West Germany's in the mid-1980's. No other country consistently experienced trade surpluses at the level attained by these nations.

Major net importers

The United States consistently experienced the largest flat-rolled product trade deficit among the countries examined. After improving by almost 40 percent during 1971-75, the U.S. deficit deteriorated during the 1981-84 period, with particularly large increases in 1983 and 1984. Both 1985 and 1986 saw improvement in the deficit, yet it nonetheless remained at a level much higher than that for any other country.

Other countries experiencing large trade deficits over time include China, the Soviet Union, and India. Despite its growing production, China has not increased its exports, and, as a result, consistently ran trade deficits. Since 1980, the Soviet Union has maintained the third largest trade deficit at a relatively stable level. Although experiencing some large fluctuations, India's deficit also stabilized during the early 1980's, at an absolute level much lower than that for the Soviet Union or China. No other country consistently ran trade deficits close to the levels of these net importing nations.

Surplus/deficit shifts

A few nations have made a lasting shift from being a net exporter to a net importer (or vice-versa). The United Kingdom is the only nation to go from a relatively large trade surplus to consistent trade deficits. These deficits peaked in 1980 and stabilized towards the end of the 1971-86 period. The only nations that shifted from large net importers to consistent net exporters are Brazil and Spain.

Factors Influencing Trade

Shipping costs and import tariffs are among the factors that influence merchandise trade. Because steel sheet and strip products have a relatively low unit value per pound, transport costs can be significant. For example, the cost of shipping sheet from Europe or the Far East to the United States represents an 8 to 14 percent of total landed value. With respect to tariffs, rates have fallen progressively over the years as a result of multilateral trade agreements. However, tariffs remain a significant cost consideration for importers of sheet and strip products in developing countries.

In addition to transport costs and tariffs, trade in sheet and strip products has also been affected by (1) shifts in exchange rates among major trading partners, (2) unfair trade practices (i.e., dumping and subsidization), and (3) import restraint measures implemented by a number of countries. Analysis of changes in exchange rates and import prices suggests that linkage between the two, at least in the case of the United States and major trading partners, has been relatively weak, reflecting in part the effect of U.S. trade measures on import volumes and prices. With respect to unfair trade practices, investigations conducted by the U.S. Government indicate that numerous producers worldwide have benefited from Government subsidies and/or have sold sheet and strip products at less than fair value (LTFV) (at least in the U.S. market) during the 1980's. Finally, the United States and EC countries have taken a number of actions affecting the terms (i.e., price and/or quantity) under which steel could be imported, whereas other countries, such as Korea and Brazil, have subjected imports to licensing requirements; a fuller discussion of these measures can be found in the discussion of the European Coal and Steel Community (ECSC) and the respective country profiles.

Exchange rates

Introduction.--The dollar's real value on foreign exchange markets has shifted dramatically during the 1980's, rising on a weighted average basis by more than 40 percent over 1980-85 and falling sharply for most of 1985-87. 1/ During the period of dollar appreciation, U.S. manufacturers suffered a deterioration in their international cost competitiveness, and import penetration increased. Since February 1985, the dollar has fallen sharply, leading many observers to anticipate a reversal in the deterioration of the U.S. trade and current accounts. For the U.S. steel industry, the dollar's sharp depreciation and the import restraints negotiated during 1984-85 have led to expectations that imports would lessen. However, after more than 2 years of dollar depreciation, the overall U.S. trade imbalance has shown no improvement measured in value terms and only modest improvement on a volume basis. Imports of sheet and strip as a share of apparent consumption fell sharply in 1985, in part because of voluntary restraint agreements (VRA's). However, import penetration levels have not fallen since 1985, and remain 50 percent above the levels of the late 1970's.

1/ Real exchange rates are rates that have been adjusted to reflect the effects of inflation on the relative value of currencies. See app. G for a further discussion of real and nominal exchange rates.

This has led to concerns that exchange-rate changes alone may be insufficient to reduce these trade imbalances. One possible explanation is that exchange-rate changes may not be fully nor immediately passed through into prices. 1/ With respect to trade in steel, the widespread use of trade restraints complicates analysis of the effects of exchange-rate changes on market performance through relative price movements.

To analyze how shifting real exchange rates have affected the competitiveness of the U.S. steel sheet and strip industry, three questions should be answered. First, to what extent did the dollar's real value shift against countries with whom the United States conducts most of its trade in steel products? Second, to what extent did foreign producers adjust their dollar prices on steel in response to the dollar's appreciation and subsequent depreciation? Finally, to what extent did changes in the dollar's value affect foreign producers' costs, relative to domestic producers?

Measuring recent dollar appreciation/depreciation

Introduction.--Recent real dollar exchange-rate changes can be examined on a multilateral basis and on a bilateral basis. Effective exchange rates are useful for analyzing changes in a country's aggregate exports and imports, whether for a specific industry or for total trade. Bilateral exchange rates can then explain why selected trading partners' shares in U.S. exports or imports may have increased or decreased.

Effective (multilateral) real dollar exchange rates.--According to an index using annual data on U.S. trade in manufactures with 40 countries, the real effective (multilateral) dollar exchange rate rose by 37 percentage points from 1980 to its peak in 1985 before declining by about 29 points by mid-1987 (table 3-17). 2/

However, movements in a real-exchange-rate index based on total U.S. trade in manufactures need not accurately measure the effect of real-exchange-rate changes on trade involving only steel, since the relative importance of each trading partner varies by product. Using annual data on bilateral U.S. exports and imports of steel sheet and strip, separate exchange-rate indices for U.S. exports and imports of sheet and strip were calculated for 1978-86. 3/

1/ Catherine L. Mann, "Prices, Profit Margins, and Exchange Rates," Federal Reserve Bulletin, June 1986, pp. 366-79.

2/ Monthly data, not tabulated, indicate a rise of nearly 50 percent from the dollar's trough in September 1980 to its peak in February 1985. On this basis, the dollar's real value in September 1987 was 9 percent above its October 1980 level.

3/ To construct the real exchange rate index corresponding to steel imports, import shares for the top 12 foreign suppliers of steel sheet and strip were calculated. The indices, for 1978-86, calculated using shifting shares, are Paasche indices. The indices for 1970-78, calculated based on 1978 trade weights, are Laspeyres indices. The 12 countries selected represented between 88 and 99 percent of total U.S. imports of sheet and strip, by volume, over the period.

A real exchange rate index corresponding to U.S. exports of steel sheet and strip was constructed using data on the nine largest markets. These accounted for at least 65 percent of the total volume of sheet and strip exports during 1978-86.

Table 3-17
Indexes of real effective exchange rates for the U.S. dollar, using total U.S. trade in manufactures, steel sheet and strip exports, steel sheet and strip imports, 1970-86

(1980=100)

Period	Real effective exchange rate indices-weights based on-- U.S. trade in manufactures	Steel sheet and strip exports	Steel sheet and strip imports
1970...............	124.3	101.3	126.1
1971...............	122.9	100.4	124.9
1972...............	115.9	104.2	116.3
1973...............	103.2	102.5	105.9
1974...............	101.9	97.3	103.5
1975...............	102.4	98.6	106.9
1976...............	108.8	101.0	108.8
1977...............	108.2	102.6	105.1
1978...............	102.4	102.0	97.4
1979...............	101.0	103.0	98.3
1980...............	100.0	100.0	100.0
1981...............	110.3	101.8	113.2
1982...............	121.2	118.0	122.0
1983...............	127.0	114.7	120.8
1984...............	133.5	112.8	126.2
1985...............	137.0	113.3	130.9
1986...............	118.4	120.2	105.6
1987.(September)...	106.6	-	-

Sources: Morgan Guaranty Trust, World Financial Markets IMF, International Financial Statistics, U.S. Department of Commerce.

The two sectoral exchange-rate indices, one each for U.S. steel sheet and strip exports and imports, behaved differently over the 1978-86 period (table 3-17). Movement of the index for sheet and strip imports roughly paralleled the real effective exchange rate index based on two-way trade in all manufactures. The steel imports index rose from 97.4 in 1978 (annual average) to 130.9 in 1985, before falling to 105.6 in 1986. The dollar's appreciation over 1980-85 contributed to a rise in U.S. sheet and strip imports relative to apparent consumption from about 11 percent in 1980-81 to about 20 percent in 1984-85.

In contrast to the index representing steel imports, the real-exchange-rate index for U.S. exports of sheet and strip increased more slowly during 1978-85 and continued to rise through 1986. Between 1978-81 this index ranged narrowly between 100.0 and 102.5, before rising abruptly to 117.1 in 1982. The index subsequently declined to 111.7 in 1984, but resumed its upward course in 1985 and 1986. Increases in the index over 1981-82 and 1985-86 principally reflected large real devaluations of the Mexican peso (Mexico has been second only to Canada as an export market for U.S. sheet and strip). Total U.S. sheet and strip exports declined from 1.5 million tons per year in 1980 to less than 400,000 tons during 1984-85 (table 3-18). Exports to Mexico declined from 200,000 tons in 1981 to an average of about 50,000 tons per year during 1983-85.

Table 3-18
Steel sheet and strip exports, imports, apparent consumption, and share of imports, from 1970-86

Period	Exports	Imports	Apparent consumption	Import share
	-----------	Thousands of tons	-----------	Percent
1980	1,487	4,846	42,687	11.4
1981	963	5,082	45,988	11.1
1982	540	4,763	36,461	13.1
1983	457	7,218	45,865	15.7
1984	385	10,225	50,719	20.2
1985	370	8,862	53,302	16.6
1986	498	8,180	47,362	17.3
1987:				
Jan.-Aug	339	5,222	32,821	15.9

Source: U.S. Department of Commerce.

The dollar's real depreciation since February 1985 has encompassed only two of the countries that have traditionally ranked high as export markets for U.S. steel sheet and strip--Italy and the United Kingdom. Exports to Italy and the United Kingdom in 1986 remained a small fraction of their levels in 1980. Therefore, the opportunity for U.S. steel exporters to capitalize on recent favorable exchange-rate movements in traditional export markets appears to be limited, though interest in exports appears to be growing. 1/

A comparison of the two steel exchange-rate indices suggests that, during 1980-85, the dollar appreciated more vis-a-vis traditional suppliers of steel to the U.S. market than against countries that were U.S. steel export destinations. Furthermore, the substantial dollar depreciation since 1985 has involved few countries that have been traditional export markets for U.S. steel producers. As a result, recent shifts in real exchange rates are more likely to have affected U.S. steel imports than exports.

Bilateral real dollar exchange rates.--Table 3-19 displays indices of real bilateral exchange rates between the U.S. dollar and the currencies of 12 principal foreign suppliers of steel to the United States over the period 1970-86. The series show a general pattern of real dollar depreciation from 1970 through 1980, followed by appreciation through 1985 and depreciation over 1985-86.

During the 1970's, the dollar strengthened only against Brazil and Canada. However, in many cases, the dollar's declines were concentrated during the early part of the decade, at a time when many currencies were newly

1/ USX recently indicated it was reactivating its international sales unit.

Table 3-19
Indexes of real exchange rates 1/ for the U.S. dollar against the currencies of 12 principal exporters of steel to the United States, 1970-86

(1980=100)

Year	Australia	Belgium	Brazil	Canada	France	West Germany	Italy	Japan	South Korea	Netherlands	South Africa	Spain
1970....	115.4	115.9	94.6	92.5	116.9	135.6	125.4	134.1	112.4	132.1	129.0	136.8
1971....	111.6	117.8	81.6	90.6	117.9	128.1	123.4	135.5	119.4	125.7	126.9	132.5
1972....	105.8	107.2	86.5	88.9	107.8	119.4	116.9	122.4	124.0	114.8	132.8	120.3
1973....	92.8	95.5	84.7	91.2	93.9	106.1	112.9	107.2	133.0	105.8	119.1	111.8
1974....	94.5	97.0	90.3	89.0	93.2	107.6	106.3	104.0	112.9	110.2	117.4	111.3
1975....	98.2	99.0	88.4	90.9	96.1	106.9	107.5	112.1	116.6	106.1	119.1	111.0
1976....	99.0	101.6	88.9	87.8	104.6	110.5	116.1	111.8	109.0	107.8	126.7	119.7
1977....	105.0	97.6	84.4	93.1	108.1	105.2	111.9	105.3	105.9	100.3	118.7	119.9
1978....	101.4	94.4	85.1	98.7	102.6	97.0	107.1	91.4	102.4	94.2	116.4	112.1
1979....	101.8	92.9	92.2	99.6	96.0	95.0	102.0	99.7	96.9	95.6	110.0	96.4
1980....	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1981....	99.6	128.0	92.0	101.5	126.4	125.8	124.2	104.7	101.6	125.4	108.2	121.5
1982....	105.8	149.3	94.0	100.5	140.4	130.2	132.4	118.5	106.3	128.4	119.9	131.5
1983....	111.5	160.7	114.1	98.3	148.5	136.7	137.2	117.0	114.0	136.5	112.7	152.1
1984....	111.2	173.1	111.3	101.6	153.9	151.6	147.2	120.0	120.4	150.8	141.0	155.6
1985....	103.5	177.2	113.0	103.9	151.5	152.7	148.4	121.5	128.3	153.2	181.5	151.8
1986....	125.4	138.4	100.5	101.8	2/	112.6	113.5	91.9	128.9	111.8	151.0	120.2

1/ The indexed real exchange rate is calculated as the nominal exchange rate adjusted for the relative movement of producer prices in the United States and each of its partners, respectively. Increases in the index value signify real dollar appreciation vis-a-vis any given partner's currency.
2/ Not available.

Source: IMF International Financial Statistics.

allowed to float. The dollar appreciated against all 12 currencies during 1980-85, although there was wide variation in degree. The dollar gained 50 percent or more against each of the European currencies examined. The rise was less than 30 percent vis-a-vis the currencies of Japan, Korea, and Brazil. Finally, the dollar strengthened only slightly against the Australian and Canadian dollars. However, European producers lost U.S. market share during this period, and Japan's market share dropped from 48 percent to 38 percent between 1980-81 and has remained virtually unchanged since. The largest gains in market share accrued to Brazil (largely in 1983, following a 20-percent cruzeiro devaluation), Canada (without benefit of large shifts in the real rate), and other foreign countries. Consequently, shifting import shares do not appear to be well explained by relative exchange-rate movements during this period.

Since 1985, the dollar has depreciated significantly against many of its major foreign steel suppliers. The dollar's declines were largest against Japanese and European currencies, and were smallest vis-a-vis the Brazilian cruzeiro and the Canadian dollar. The dollar was unchanged against the Korean won and strengthened against the Australian dollar. However, the data are inconclusive regarding shifts in market shares resulting from these most recent exchange-rate movements. Long adjustment lags by importers to changes in relative price shifts resulting from exchange-rate changes and the effects of VRA's are most likely to be involved.

Table 3-20 presents indices of real bilateral exchange rates between the U.S. dollar and the currencies of nine principal export markets for U.S. steel over the period 1970-86. Over the entire period, the dollar strengthened significantly against the Indian rupee (28 points), the Mexican peso (44 points), and the Pakistani rupee (59 points). The dollar appreciated in real terms by about 10 percent against the Canadian dollar, the Thai baht, and the Egyptian pound. The dollar weakened against the British pound and the Italian lira, while remaining virtually unchanged against the Taiwan dollar.

Analysis of steel import prices and exchange rates.--The behavior of steel import prices in response to changes in exchange rates was examined by the Commission staff for two countries, West Germany and Japan. The countries were selected on the basis of their overall importance in the U.S. market and on the basis of substantial currency shifts in real terms vis-a-vis the dollar that occurred during the past decade. The results of the Commission's

Table 3-20
Indexes of real exchange rates 1/ for the U.S. dollar against the currencies of 9 principal export markets for U.S. steel, 1970-86

(1980=100)

Year	Canada	Egypt	India	Italy	Mexico	Paki-stan	Taiwan	Thai-land	United Kingdom
1970...	92.5	61.5	99.1	125.4	110.1	68.9	118.2	120.0	142.4
1971...	90.6	63.3	96.8	123.4	109.5	67.0	121.9	123.5	132.2
1972...	88.9	65.2	93.8	116.9	111.2	115.8	122.0	119.5	128.0
1973...	91.2	69.2	92.9	112.9	108.7	118.3	106.3	108.7	137.8
1974...	89.0	64.6	89.9	106.3	105.4	113.8	89.8	98.7	138.8
1975...	90.9	65.6	97.7	107.5	104.2	101.2	103.3	104.0	130.3
1976...	87.8	63.8	111.7	116.1	110.2	98.2	105.3	105.0	144.6
1977...	93.1	61.9	107.3	111.9	121.1	95.3	108.6	103.2	133.6
1978...	98.7	58.1	108.8	107.1	113.8	96.9	107.7	103.3	119.4
1979...	99.6	106.6	108.9	102.0	108.4	99.3	106.4	104.9	109.6
1980...	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1981...	101.5	101.0	107.1	124.2	93.6	98.4	103.3	106.2	115.1
1982...	100.5	94.2	116.4	132.4	140.8	115.2	112.5	113.1	125.5
1983...	98.3	82.3	116.7	137.2	146.4	120.3	118.3	112.2	138.9
1984...	101.6	76.6	123.9	147.2	123.0	120.6	118.9	121.9	152.6
1985...	103.9	67.4	126.9	148.4	122.1	132.4	122.3	139.6	149.3
1986...	101.8	2/	2/	113.5	153.8	127.9	116.7	131.6	121.3

1/ The indexed real exchange rate is calculated as the nominal exchange rate adjusted for the relative movement of producer prices in the United States and each of its partners, respectively. Increases in the index value signify real dollar appreciation vis-a-vis any given partner's currency.
2/ Not available.

Source: IMF International Financial Statistics.

analysis 1/ indicated no close relationship between exchange rate changes and import prices (fig. 3-1 and 3-2). In fact, the correlation between landed import prices (in the U.S. market) and foreign costs was contrary to expectations. One would generally assume that rising foreign costs would be reflected in higher prices; the analysis conducted indicated otherwise.

This weak link between exchange-rate changes and prices can be attributed to a number of factors. In a recent Federal Reserve Board discussion paper, the Japanese Ministry of International Trade and Industry indicated that only 10 percent of the yen's appreciation against the dollar since 1985 has translated into rising iron and steel export prices. The authors argue that fierce international competition in world steel trade is one factor contributing to slower pass through, although falling raw material costs (chiefly petroleum) may have been most responsible. 2/ The effects of voluntary export restraints must also be considered as a possible explanation. Analysis presented in appendix H suggests that the presence of comprehensive import quotas can limit the effects of dollar depreciation on steel imports. Depreciation is shown to be ineffective until the quotas are no longer binding.

1/ The Commission staff attempted to estimate econometrically a model to predict import prices for Japanese and West German imported steel. The model was specifically designed to allow interpretation of the mean time lag between exchange rate changes and their impact on import prices.

For U.S. imports of steel from West Germany and from Japan, separate equations based on the following reduced form model were estimated using quarterly data:

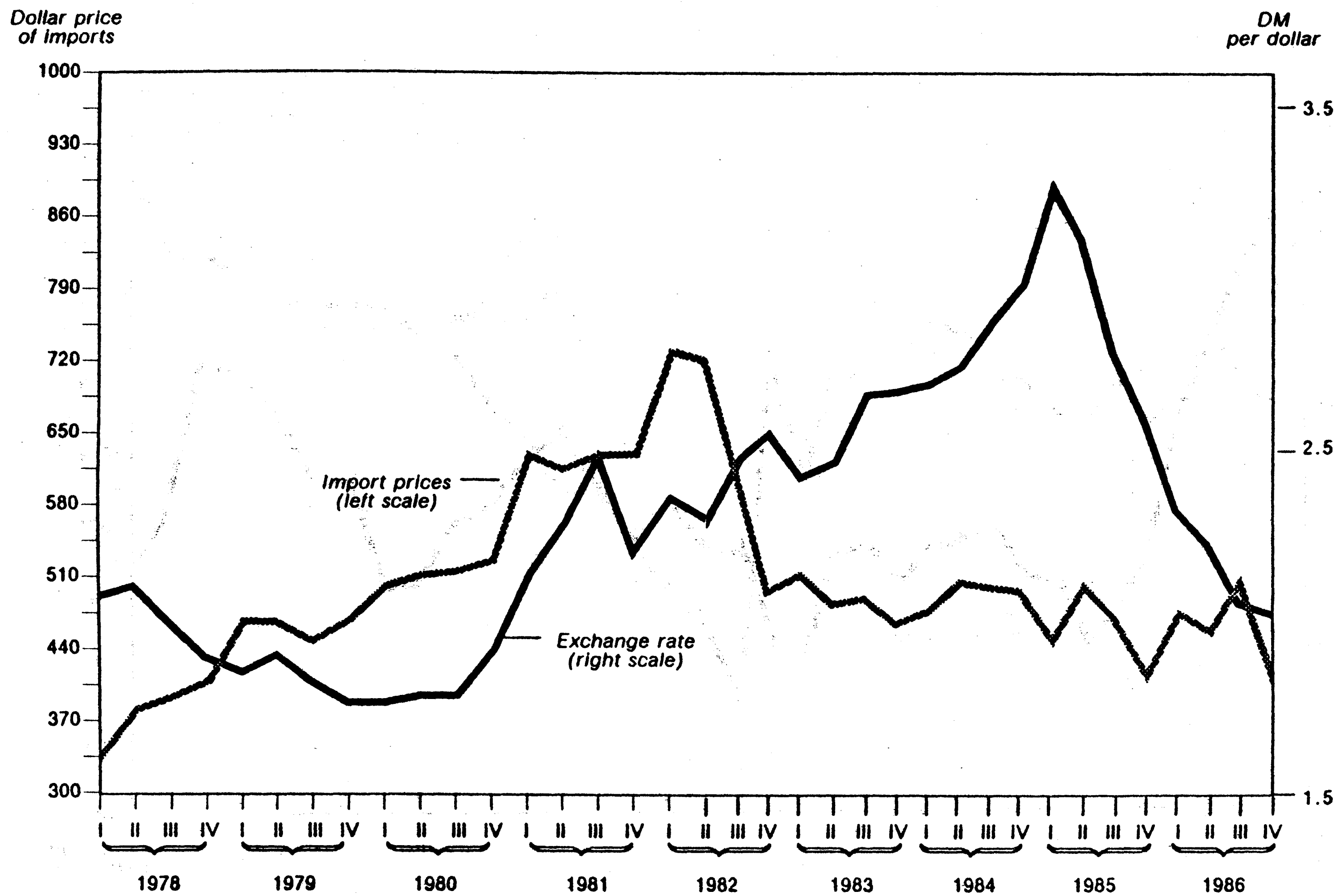
$$\$P_m = F(C^*, xr_t, GNP),$$

where: $\$P_m$ denotes the dollar price of landed imports of a fixed composite basket of steel from each exporting country;
C^* represents an index of the unit cost of production in foreign currency evaluated at the observed level of operating capacity;
xr_t is a vector of current and lagged exchange rates;
GNP is an index of the nominal U.S. gross national product.

Estimation using least squares regression included correction for first-order serial correlation of the error term. The estimated results were generally unsupportive of the model as specified. Although the model had reasonably high explanatory power based on the R^2 criterion, the coefficients for foreign costs were consistently negative and the estimated exchange rate lag patterns were indefensible on the basis of adaptive expectations or partial adjustment behavior. Efforts to bring the model into conformity with economic principles using alternate lag specifications were unsuccessful.

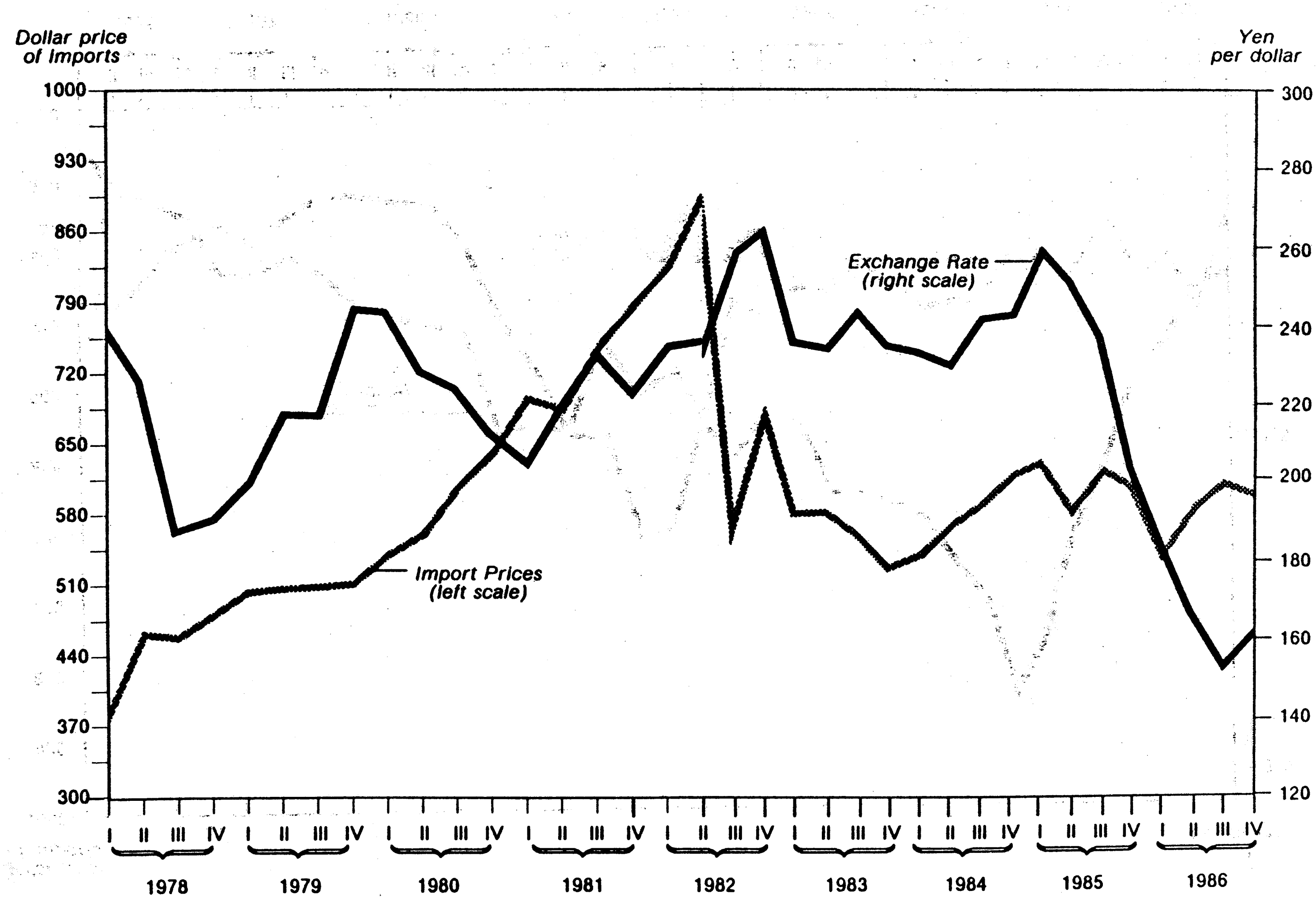
2/ Bonnie E. Loopesko and Robert A. Johnson, "Realignment of the Yen-Dollar Exchange Rate: Aspects of the Adjustment Process in Japan," International Finance Discussion Papers No. 312, Board of Governors of the Federal Reserve System, p. 31-39.

Figure 3-1
Prices for steel imports from West Germany and deutsche mark/dollar exchange rates, quarterly, 1978-86



Sources: International Monetary Fund, International Financial Statistics, and Paine Webber, World Steel Dynamics.

Figure 3-2
Prices for steel imports from Japan and yen/dollar exchange rates, quarterly, 1978-86



Sources: International Monetary Fund, International Financial Statistics, and Paine Webber, World Steel Dynamics.

Exchange rates and producer costs.--To the extent that foreign producers purchase imported inputs invoiced in dollars (e.g., petroleum, iron ore, and coking coal), dollar exchange-rate fluctuations can affect foreign costs measured in local currency. All spot market purchases of raw materials will reflect current dollar exchange-rate relations. Purchases completed under contract will reflect lagged exchange rates, although they may provide for adjustments when exchange rates change.

The global extent of markets for these traded raw materials will tend to limit the disparities in (dollar-equivalent) prices paid across countries to tariffs and transport costs. 1/ Therefore, movements in dollar exchange rates will directly affect the local currency costs of locally produced tradeable raw materials (although perhaps not in the short run; see figures 3-3 and 3-4). Dollar appreciation will raise foreign costs without directly affecting U.S. costs, whereas dollar depreciation benefits foreign producers. 2/

Tariffs

Table 3-21 presents data on the import tariffs that countries have applied to sheet and strip products in recent years. 3/ In general, it appears that rates are highest in those nations that are currently developing or expanding their steel industries, such as Korea, Brazil, India, and China. Tariff rates on sheet and strip products in these nations average 20 percent, and coils for re-rolling, about 15 percent. In contrast, countries with mature, developed industries generally have tariff rates that are about one-half those of their developing country counterparts, with sheet and strip products generally assessed a tariff of 5 to 6 percent. Rates in Eastern Europe and the U.S.S.R. range between the tariff rates imposed by these two producer groups.

Transportation

Transportation costs for sheet and strip emerge as an important factor affecting the competitive position of domestic manufacturers and foreign producers which export steel products to the United States. Because steel in general has a low value per unit of weight compared with other products, shipping the product to end users can be costly. To minimize transportation costs, steel companies often choose to locate production facilities close to either their large volume customers or their main sources of raw materials. Foreign producers, seeking to reduce their geographic disadvantage,

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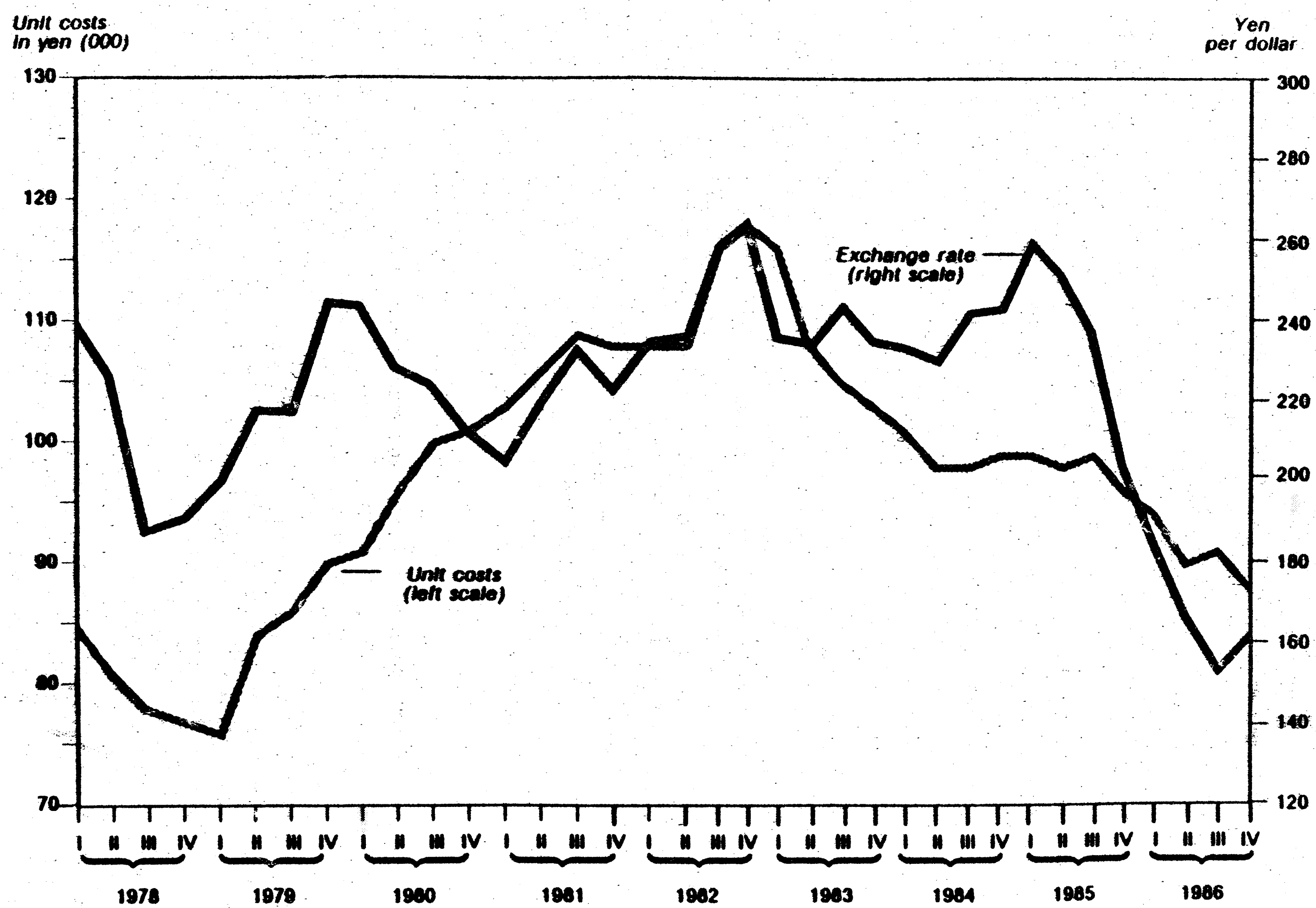
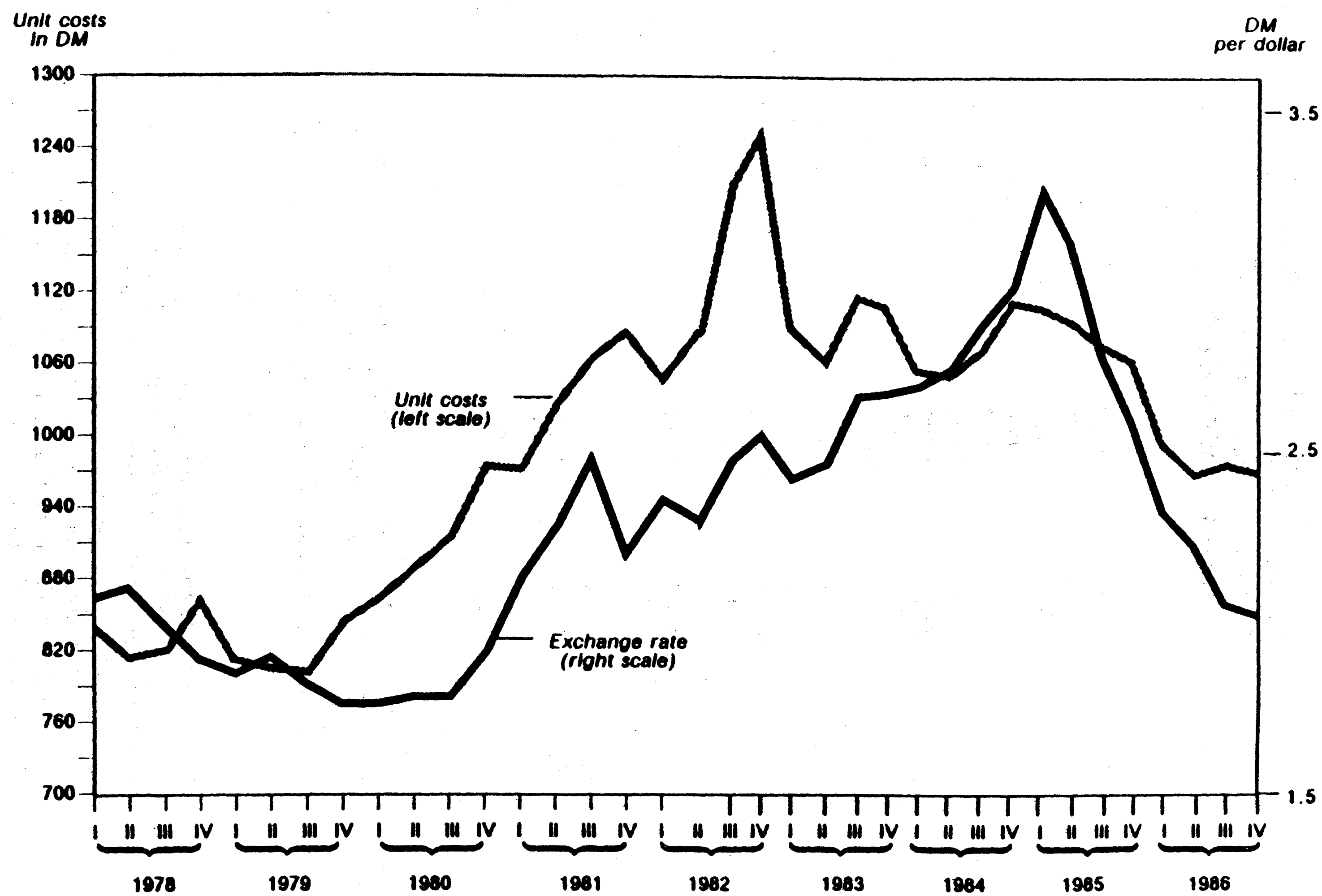
1/ Rudiger Dornbusch, "Exchange Rates and Prices," American Economic Review, March 1987, p. 94.
2/ However, this analysis does not take the effect of exchange-rate changes on supply/demand relationships into account. As a result of real dollar appreciation, for example, foreign suppliers would be willing to supply greater quantities at the higher real prices, and foreign consumers would reduce quantity demanded. Both would result in a lower equilibrium price (in dollars).
3/ In certain instances, countries may have modified their rates since publication of the source materials used.

Figure 3-3
Steel production costs in Japan and yen/dollar exchange rates, quarterly, 1978-86



Sources: International Monetary Fund, International Financial Statistics, and Paine Webber, World Steel Dynamics.

Figure 3-4
Steel production costs in West Germany and deutsche mark/dollar exchange rates, quarterly, 1978-86



Sources: International Monetary Fund, International Financial Statistics, and Paine Webber, World Steel Dynamics.

Table 3-21
Sheet and strip: Import tariffs applicable during the 1980's 1/ by country, by product

(Percent ad valorem)

Country	Carbon sheets: Coils for rerolling	Carbon sheets: Hot-rolled and cold-rolled	Galvanized	Stainless sheets
Western developed countries:				
Austria	5-6	9-10	11	8-9
Canada	5	5	6	Free
EC	3.8	4.4	4.9	5.3
Finland	2.5	Free	Free	Free
Japan	4.9	4.9	4.9	5.8
New Zealand	Free	Free	Free	
Norway	Free	Free	Free	Free
Sweden	3.2	5	5	5
United States	4.9	2.4-6	6.5	10-10.5
Eastern Europe:				
Czechlosovakia	8	8.5	7.5	3.75
Hungary	4.2	20	6-10	10.5
Poland	10-15	10-15	10-15	5-10
USSR	3-10	3-10	3-10	3-10
Developing countries:				
Argentina	16-38	16-38	16-38	16-38
Brazil	20	20	45	45
Central America: Common Market 2/	5	5	30	5
China	9-14	12-17	15-20	12-40
Korea	15	20	20	20
India	100	100	100	100
Taiwan	10	15	22.5	15
Venezuela	1	1	40	1

1/ Rates represent the most current available from the source materials used.
2/ Guatemala, El Salvador, Nicaragua and Costa Rica.

Source: Douanes International Customs Tariffs Bureau and individual country sources.

consistently shipped their sheet and strip products to ports where transportation costs reflected the lowest percentage of total costs. This is true even in cases where the port was not the closest to the foreign producer and in cases where the total cost was somewhat lower for another port. For countries as geographically extended as the United States, price differentials resulting from high transportation costs can cause consumers to choose an import from a better situated foreign source over a domestic product based on the geographic location of the supplier.

U.S. producers.--Domestically, steel is shipped primarily by truck or rail, 1/ depending primarily on the value of the product and the distance to be traveled. Shippers of high-value products have an incentive to use faster modes and thus normally ship by truck rather than rail or water. Shippers are more likely to select rail for longer hauls because of increased cost advantages with the length of haul.

Railroads were traditionally the primary shippers of steel. In the past decade the railroad industry has suffered from rising costs and increased competition from substitute modes of transportation. These factors, plus the changes introduced by deregulation in 1980 from the Staggers Act, 2/ which affects rate structure and routing, resulted in lost market share of long distance bulk goods shipments for the rail industry. In an attempt to regain market share, railroads have begun to increase their intermodal (combined road and rail) service. Intermodal services offer more flexibility than rail services and are designed to appeal to bulk shippers who have switched much of their business to trucks. For example, Conrail has begun to ship bulk commodities such as steel to warehouses and then ship smaller lots of steel by truck. Norfolk Southern and CSX have developed containers which can be used by either trucks or rails. 3/

For the United States, the transportation cost for domestic shipments is an important factor in the marketing of steel products. The geographic pattern of U.S. steel production and consumption contributes to the high transportation costs faced by U.S. shippers. Historically, the majority of steel production has been accounted for by plants located in Illinois, Indiana, Ohio and Pennsylvania. The cost of shipping steel from this area to other parts of the country can be significant, 4/ and purchasers in many areas may be closer to an importer's port of entry than to a domestic mill. Therefore, the cost of shipping steel within the United States (which is often high relative to comparable ocean freight rates) may hamper the ability of domestic producers to compete with imports, particularly in those markets which are not close to production facilities.

One steel producer, illustrating the impact of geography and high shipping costs, indicated that steel producers on the west coast face high transportation costs when shipping steel to other parts of the country. This increased cost places the producers at a significant disadvantage compared with other domestic producers. The producer claimed that its local market

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1/ The Jones Act restricts U.S. domestic waterborne traffic to U.S. ships and U.S. crews in transports between Alaska, Hawaii, Puerto Rico and the mainland. Claims have been made that the substantially higher costs that result has made shipping steel by ocean-going vessels less competitive in relation to other modes of transportation.
2/ The Staggers Rail Act of 1980 allowed railroads greater freedom to set rates and cancel unprofitable routes; however, it also required the retention of some routes and rate levels if such actions were in the public interest.
3/ "The Economist" 8/29/87.
4/ For example, information obtained in USITC investigation TA-201-51, July 1984 estimated that the cost of transportation for shipping steel sheet from this area to destinations in the United States for distances ranging from 700 to 2,300 miles comprised 9 to 28 percent of the price per ton respectively.

reflects the base price of domestic steel sold elsewhere in the United States, primarily the east and midwest. However, transportation adds an additional $35.00-$70.00/ton to the price of west coast producer's products for destinations outside the west coast due to rail, trucking and handling costs. As a result of these added costs, steel bought by domestic consumers in the Eastern United States from western steel producers can cost more than the same product purchased abroad. 1/

Foreign producers.--Steel from Korea, Japan, Brazil, France and West Germany is shipped exclusively by ocean vessel to the United States. Steel from Canada can be shipped by truck, rail or by barge. The OECD monitors export trends in maritime transport. In 1986, they reported a significant decline in steel exports to the United States. Furthermore the OECD stated that Japan and Western European countries also experienced a decline in their steel exports to non OECD countries. The organization concluded that OECD net exports of steel products via maritime transit to the world fell in 1986 by about 30 percent to their lowest level since 1973, reflecting the decline in steel traded by OECD countries. The lower volume of shipped steel could impact the future cost of transporting these goods since economies in transportation costs are achieved through large bulk shipments. Therefore, the cost to transport steel from these countries may rise in the near future. 2/ If the increased cost is reflected in prices of export to the United States, U.S. consumers may choose to purchase increased quantities of domestic steel.

To illustrate the variance in the costs to ship steel, an analysis was conducted by Commission staff to determine the costs related to shipping steel to the United States from the selected partner countries for 1982-1987. 3/ This analysis used data from the United Nations for sheet and strip shipments. To obtain transportation costs, the customs value was subtracted from the CIF value (Cost, Insurance, Freight Valuation basis) and divided by the tonnage shipped for each port. To obtain a total cost, the transportation cost was added to the unit value for sheet and strip shipped to the individual ports by each foreign producer. These calculations were performed on total shipments of sheet and strip to the United States from Korea, Japan, Brazil, France and West Germany, grouped by U.S. port of entry. 4/

As shown in table 3-22, Brazil consistently exhibited the lowest transportation cost figure, with the exception of 1982, ranging from $30.46/short ton in 1983 to $26.00/short ton in 1987. For the period 1982-84, France had the highest cost figures, $45.77/short ton in 1982 and $45.00/short ton in 1984. For 1985, Japan and West Germany exhibited the highest cost figure, $43.00/short ton; in 1986 and 1987, Japan had the highest cost figures, $43.00/short ton and $42.00/short ton respectively. The average cost figures for these five countries ranged from $38.00/short ton in 1982 to $35.00/short ton in 1987, an 8 percent decline.

1/ Questionnaire submission USITC, 1987 322-231.
2/ Maritime Transport 1986, OECD, Paris 1987.
3/ 1987 figures are based on data from January to July.
4/ Based on AISI groupings of customs ports.

Table 3-22
Transportation costs: Transportation costs per ton of sheet and strip for all shipments from Korea, Japan, Brazil, France and West Germany, 1982-87

Country	1982	1983	1984	1985	1986	1987 1/
	In U.S. dollars					
Korea.........	32.01	31.85	32.89	33.00	39.00	35.00
Japan.........	41.02	38.72	41.00	43.00	43.00	42.00
Brazil........	40.66	30.46	31.30	34.00	24.00	26.00
France........	45.77	42.57	45.00	42.00	42.00	36.00
West Germany..	29.49	40.00	39.00	43.00	39.00	37.00
average.....	38.00	37.00	38.00	39.00	37.00	35.00

1/ For the period January to July 1987.

Source: Commission generated data from United Nations data base

Shipping costs also vary by port of entry due to distance and port facilities. Shipments to offshore ports 1/ exhibited the highest figures for 1982-87. Shipments into the Gulf coast exhibited the lowest figures for the same period. Exempting the offshore ports, the highest figures for this period were: the west coast for the years 1982, 1983 and 1987; the Great Lakes for the years, 1984 and 1985 and the east coast for 1986.

In 1986, all five countries exported the highest volume of shipments of sheet and strip to the port where cost represented the lowest percent of total shipment cost. 2/ As shown in table 3-23, Korea and Japan sent the largest portion of their total shipments, 47 percent, to the west coast at a total cost of $386.66/short ton, with transportation costs representing 7 percent of the total cost for Korea and 8 percent for Japan. France sent the largest portion of their total shipments, 56 percent, to the great lakes regional port where transportation costs represented 8 percent of the total cost of $436.57/short ton. Germany also sent the largest portion of their total shipments, 46 percent, to the Great Lakes regional port where transportation costs represented 8 percent of the total cost of $470.78/short ton. In the case of both France and Germany, the total cost per ton was somewhat higher for the Great Lakes regional port than other ports but the transportation cost represented the lowest percentage of total cost. Brazil sent the majority of their shipments, 44 percent, to the east coast, where transportation costs represented 6 percent of the total cost of $324.47/short ton.

1/ Off shore ports include San Juan, P.R., Honolulu and U.S. Virgin Islands.
2/ The portion of shipments to offshore ports for each country was 2 percent or less and therefore, were not considered in this analysis.

Table 3-23
Port shipments: Volume of shipments, 1/ unit value, 2/ and shipping cost as a percent of total cost of sheet and strip products imported into the United States, 1986

Country	East Coast	West Coast	Great Lakes	Gulf Coast
		(in percent)		
Korea:				
Volume of shipments........	37	47	3/	14
Unit value.................	$408.62	$386.66	$266.00	$398.30
Shipping cost..............	10	7	10	9
Japan:				
Volume of shipments........	44	47	15	10
Brazil:				
Volume of shipments........	44	5	37	14
France:				
Volume of shipments........	26	8	46	8
West Germany:				
Volume of shipments........	34	16	46	13

1/ Percentages may not add up to 100.00 due to rounding and the elimination of Offshore ports where shipment volume is 2 percent or less.
2/ CIF landed value, per short ton.
3/ Less than 0.5.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Unfair trade

Unfair trade practices have affected trade flows in recent years. Documentation of the nature and extent of unfair trade is perhaps most readily available through a review of the findings made by the U.S. Government in connection with numerous antidumping and countervailing duty cases. During January 1, 1980-October 1, 1987, some 47 antidumping and 45 countervailing duty investigations were conducted. These investigations involved imports from 21 countries and covered most forms of steel sheet and strip (tables I-1 and I-2, app. I). Hot-rolled carbon steel sheet and strip, cold-rolled carbon steel sheet and strip, galvanized carbon steel sheet, hot-rolled stainless steel sheet and strip, and cold-rolled stainless steel sheet and strip were all subject to investigation during the period. These forms of sheet and strip represented about 82 percent of U.S. producers' shipments and 88 percent of total U.S. imports of steel sheet and strip in 1986.

Antidumping investigations.--Of the 47 antidumping investigations, 18 ended with negative determinations by the Commission, 26 were terminated prior to final rulings by the Commission (primarily to facilitate negotiated settlements between the United States and the affected countries), and 3 ended with affirmative final determinations by the Commission. The cited imports in the three affirmative cases represented 2 percent of total U.S. imports in 1986. The International Trade Administration (ITA) found sales at LTFV in all

20 of the investigations that it made rulings, although the margins were de minimis in two cases. The highest overall margin involved in an investigation was less than 5 percent in seven cases (35 percent), from 5 to 10 percent in seven cases (35 percent), and greater than 10 percent in six cases (30 percent) (table I-3).

Countervailing duty investigations.--Of the 45 countervailing duty investigations, 21 ended with negative determinations by the Commission, three ended with negative determinations by ITA (the subsidies found were considered de minimis), 10 were terminated prior to final rulings (primarily to facilitate negotiated settlements between the United States and the affected countries), and 11 ended with affirmative final determinations. The cited imports in the 11 affirmative final determinations represented 16 percent of total U.S. imports in 1986. ITA found subsidies in all 26 of the investigations that it made rulings, although the subsidies were de minimis in 3 cases. The highest overall subsidy involved in an investigation was less than 5 percent in 10 cases (38 percent), from 5 to 10 percent in 3 cases (12 percent), and greater than 10 percent in 13 cases (50 percent) (table I-4). A complete listing of the investigations conducted by the U.S. Government is contained in appendix I.

A review of the findings of the countervailing duty cases indicates that loans and special tax treatment, in forms such as tax exemptions, preferential tax rates, tax credits, and special depreciation rates, were the most common benefits conferred by governments (tables 3-24 and I-5). Capital and equity infusions, grants, and export financing were the other most common forms of benefits.

Table 3-24
Steel sheet and strip: Government programs determined by the U.S. Department of Commerce to confer subsidies to foreign steel sheet and strip producers under the countervailing duty statutes, the size of the subsidies, and the distribution of the programs, Jan. 1, 1980-Oct. 1, 1987

Government program	Size of subsidy	Distribution of program
	Percent	Percent
Loans	0.005-15.37	15
Special tax treatment	.001-10.78	15
Capital or equity infusions	.04-25.62	11
Grants	.001-4.159	11
Export financing	.01-22.36	9
Rebates (other than tax rebates)	.001-2.4	7
Labor benefits	.000002-.951	6
Research and development	.001-.178	5
Reduced transportation rates	.02-10	4
Import duty exemption	.05-2.62	3
Loan guarantees	.06-.37	3
Miscellaneous	.034-34.29	11
Total	.000002-34.29	100

Source: Compiled from data of the U.S. Department of Commerce.

CHAPTER 4. THE ROLE OF INTERNATIONAL GOVERNMENT ORGANIZATIONS IN STEEL

The United Nations Industrial Development Organization

The United Nations Industrial Development Organization (UNIDO) is a specialized agency of the United Nations mandated "to promote and accelerate the industrialization of the developing countries." 1/ UNIDO has accomplished this by responding to requests from the governments of developing countries for technical advice and cooperation with a variety of industries. In February 1986, UNIDO adopted a new constitution that gave the organization the powers of a specialized agency of the United Nations. As a specialized agency, UNIDO is now able to respond to requests for technical assistance from entities outside the governments of developing countries.

UNIDO Structure

UNIDO's membership is open to all the members of the United Nations, most of which are also members of UNIDO. The principal components of UNIDO are the General Conference, the Industrial Development Board, the Programme and Budget Committee, and the Secretariat. 2/

The General Conference (Conference), which consists of the representatives of all the members, determines the guiding principles and policies of UNIDO. The Industrial Development Board (Board), which represents 53 members that are elected by the Conference, reviews and implements a program of work and the regular and operational budgets, recommends a scale of assessments for regular budget expenditures to the Conference, reports to the Conference on its activities, and undertakes any other functions as may be necessary. The Programme and Budget Committee has 27 members elected by the Conference. Its most important function is the consideration and modification of a program of work and its corresponding budget as prepared by the Director-General. The Secretariat is comprised of the Director-General and his staff. The Director-General, who prepares an annual report on the activities of UNIDO, is the chief administrative officer of UNIDO and has the overall responsibility and authority to direct the work of UNIDO.

Funding

The funding of UNIDO activities can be divided into two categories: the regular budget and the operational budget. The regular budget provides the funding for administrative, research, and other regular expenses of UNIDO.

1/ UNIDO for Industrialization: Metallurgical Industries, UNIDO publication V. 82-25365, Austria, 1983, p. 1.
2/ Information on the structure of UNIDO is from the text of the Constitution as adopted by the United Nations Conference on the Establishment of the United Nations Industrial Development Organization as a specialized agency on Apr. 8, 1979, at Vienna. The Constitution was not adopted until February 1986.

The approved biannual regular budget for 1988 and 1989 is $116.6 million. 1/ The operational or projects and special programs budget, which typically is similar in size to that of the regular budget, supplies the funding for the cost of technical assistance and other related activities. The expenditures for technical assistance are paid by voluntary contributions to UNIDO from either member governments or independent private entities.

Activities

The bulk of UNIDO help for industrialization is in the form of technical assistance. There are three sources of assistance from UNIDO: the System of Consultations; the Investments Promotion Service; and the "traditional" form of technical assistance. 2/

System of consultations

The UNIDO System of Consultations is an action-oriented forum created to accelerate the industrialization of the developing countries by encouraging the involvement of governments and industry. At any one consultation, the system seeks to find means of dealing with the problems of industrialization in a given sector. 3/

Investment promotion service

The Investment Promotion Service focuses on investment projects that are proposed by companies as joint ventures. The proposing companies can be from either industrialized countries or developing countries. For example, "state" companies from the Soviet Union and Poland have approached this service with an expressed willingness to cooperate with African companies in the iron and steel industry. 4/

Technical assistance

UNIDO provides technical assistance upon receipt of an official request from member governments, or from companies or agencies that are willing to provide funding. UNIDO technical assistance encompasses such activities as "preparation of techno-economic master plans, pre-feasibility studies, rehabilitations of existing plants, establishment of pilot and demonstration plants, organization of in-house training programs, study tours and fellowships, etc." 5/

1/ Correspondence of Metallurgical Industries Branch, Department of Industrial Operations, Vienna, Austria, and the UNIDO Investment Promotion Service, Washington, DC, July 30, 1987.
2/ Meeting with UNIDO representatives and Commission staff, Aug. 18, 1987, New York.
3/ "UNIDO System of Consultations," UNIDO publication V.85.36646, Austria, 1985.
4/ Ibid, Note 2.
5/ Ibid, correspondence, July 30, 1987.

The 1986 Constitution

The ability to provide technical assistance for a project as requested by a private agency or company distinct from a member government is the result of new powers acquired by UNIDO from its new 1986 constitution. This places UNIDO in a position to receive direct voluntary contributions from the private sector for specific projects. In effect, a private enterprise or government agency can "hire" UNIDO for a specific project. Under the previous constitution, request of such nature had to come directly from member governments. 1/

The organizations that approach UNIDO under this new mandate value UNIDO's knowledge of the developing country's industry and government structure in which they are interested. The companies also indicate that UNIDO could best promote their activities because of past experiences with a country's government. The nature of UNIDO's work as a development organization makes working with UNIDO appealing to those governments, an asset that is valuable to interested companies. 2/

Procedure for technical assistance

There are no definitive procedures or guidelines for gaining UNIDO technical assistance. However, most technical assistance activities can be classified into two major forms. UNIDO can contract the services of internationally renowned technical consultants that develop feasibility or prefeasibility studies according to the terms of a binding contract as specified by UNIDO and the recipient, or UNIDO can provide technical advisory services of its specialized personnel.

More specifically, direct technical assistance may include a provision of expertise; a consulting firm in the form of a UNIDO "subcontractor"; equipment; individual training, workshops, seminars or special studies; or technology advisory missions. UNIDO technical assistance activities include planning, technical evaluations, expertise for efficient operation of existing plants, design of plants, computerized maintenance systems, centers or laboratories for research and development, and pilot programs.

Involvement in Steel

In promoting and accelerating the industrialization of developing countries, the bulk of UNIDO's activities in steel are carried out by the Metallurgical Industries Branch of the Division of Industrial Operations. The primary mandate of the Metallurgical Industries Branch is to "accelerate the tempo of exploitation and processing of ore resources of the developing

1/ UNIDO Expands Direct Support to Industry, press release IDO/1212, Feb. 27, 1987.
2/ Clifford Stevens, "UNIDO Turns to Private-Sector Projects, Finding Capitalism Profits Third World," The Wall Street Journal, Feb. 12, 1987.

countries to yield added-value metallic and other products for home use and export." 1/

In assisting the developing countries, the Metallurgical Industries Branch's activities are operational and supportive in nature. Operational activities are basically direct technical assistance projects. Supporting activities are of a promotional character for the industry, seeking to catalyze cooperation between industrial and developing countries.

Operational activities

The assistance of UNIDO is requested for the evaluation and assessment of projects by member governments or private enterprises. In providing technical assistance, the Metallurgical Industries Branch is concerned with the promotion of industrialization of existing resources of promising metallurgical indigenous raw materials; the establishment or expansion of domestic production facilities; and the establishment of indigenous metallurgical expertise. 2/

The Metallurgical Industries Branch regularly accounts for 7 to 10 percent of UNIDO's total expenditures on technical assistance. 3/ The delivery value of UNIDO technical assistance for the Metallurgical Industries Branch and specifically for the iron and steel industry are as in the following tabulation:

	Metallurgical	Iron and steel
	Millions of dollars	
1982	9.2	1/
1983	5.2	1/
1984	6.3	2.5
1985	7.3	2.2
1986	9.1	3.0

1/ Not available.

Source: UNIDO publication V. 86-53641.

1/ "Technical Assistance by UNIDO to the Iron and Steel Industries of Developing Countries," Apr. 29, 1987, paper provided to Commission staff.
2/ "UNIDO: The Iron and Steel Industry in Developing Countries," UNIDO publication ID/W.146/100, 1974.
3/ "UNIDO Support for the Iron and Steel Industry: Three Examples of Technical Assistance," UNIDO publication V.86-53641, Sectoral Working Paper Series No. 47, Mar. 21, 1986.

Some examples of UNIDO's work in the steel industry are as follows:

- A prefeasibility study of the establishment of a mini steel plant in the People's Democratic Republic of Yemen;

- Provision of technical assistance, a prefeasibility study, and the formulation of a capital financing plan for the Republic of Mongolia on the establishment of a mini steel plant; and

- Provision of choices and the formulation of technological process routes in Bolivia. 1/

Since 1982, more than 150 technical assistance projects involving the steel industry have been implemented by UNIDO. One of the largest running projects undertaken by UNIDO is the establishment of a pilot and demonstration plant for the production of sponge iron in India that cost approximately $25 million, $5 million of which was funded by UNIDO. The new plant operates on the new technologies of using non-coking coal, of which India has abundant reserves. 2/

Supporting activities

UNIDO also assists developing countries through the supporting activities of the Metallurgical Industries Branch. These activities support the iron and steel industry by actively promoting a continuous exchange of information on the industry. The activities stress the transfer of technology and know-how through group meetings, seminars, symposia, and studies. Within these activities, UNIDO serves as a forum for discussion between the industrialized and the developing countries to identify and remedy the obstacles to the developing countries in the industry. Over the last 10 years, UNIDO has organized 20 international meetings and generated more than 40 studies on metallurgical topics.

The Organization for Economic Co-operation and Development

Background

The Organization for Economic Cooperation and Development (OECD) is an intergovernmental institution that provides for the discussion of economic issues among the advanced industrial countries.

The OECD was created on September 30, 1961. Its predecessor, the Organization for European Economic Cooperation (OEEC), had the initial task of administering Marshall Plan aid and the integrated effort for European recovery after World War II. As the objectives of the Marshall Plan were achieved, it was decided that it would be beneficial to modify the structure

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1/ Ibid.
2/ Ibid, UNIDO for Industrialization.

of the OEEC to include other industrialized countries, including the United States. 1/

Over the years, the OECD has become a meticulous and active forecaster of short-term economic trends and their likely implications on policy. One of the more notable aspects of the OECD is a system of consultations between the members that stresses the advancement of positive adjustment policies.

Objectives

The current objectives of the new OECD are the achievement of the highest sustainable economic growth and employment and a rising standard of living in member countries; the economic development of nonmember countries; the expansion of world trade; and the elimination of obstacles to trade. 2/

Structure

The Council is the supreme body of the OECD. The Council includes representatives of all member countries and meets at either the Ministerial or Permanent Representative levels. All acts of the Council must be unanimously agreed upon and are binding upon its members.

The Council makes all general administrative decisions and then instructs its Executive Committee to initiate and implement them. The Executive Committee is comprised of 12 members designated annually by the Council. Also, the Executive Committee examines issues before they are submitted to the Council for decision.

The OECD has 10 branches in which it concentrates its activities. These are as follows:

Economic Affairs
Environment
Development Assistance
International Trade
Fiscal and Financial Affairs
Science and Education
Manpower and Social Affairs
Industry and Energy
Agriculture and Fishery
Nuclear Energy Agency

There are also special committees that are not permanent groups; rather they are given mandates for a specific number of years, usually 5. 3/ The special committees study and discuss problems that require cooperation between member governments. To that extent, the special committees examine major trends and developments in their respective sectors of industry and study closely the evolution of those industries.

1/ MacBean, A.I., and Snowden, P.N., International Institutions in Trade and Finance, London: George Allen and Unwin, 1981, p. 133.
2/ Ibid.
3/ Wittur, G.E., The OECD Steel Industry, 1967.

The Steel Committee

In 1978 the OECD established a Steel Committee in order to seek solutions to the problems experienced by the steel industry. The Steel Committee's mandated objectives included ensuring that trade in steel would remain unrestricted; facilitating close consultation between governments in crisis situations; encouraging structural adaptations; and ensuring, to the extent possible, responsible government steel policies and investments.

Membership

The 21 members of the OECD Steel Committee account for about two-thirds of the world's steel production capacity. 1/

OECD Special Committee on Iron and Steel Members

Austria	United Kingdom	Norway
Belgium	Greece	Portugal
Canada	Iceland	Sweden
Denmark	Italy	Switzerland
Finland	Japan	Turkey
France	Luxembourg	United States
West Germany	Netherlands	Yugoslavia

Activities

The functions of the Steel Committee, mostly carried out by its Working Party, are to gather and assess data on the iron and steel industry; to discuss and propose policies that would be beneficial to the industry; to study specific issues and publish special studies concerning the industry; and to prepare an annual report. 2/ Its most important function is that of a forum for the exchange of information and discussion of measures countries have taken regarding their steel industries. This ultimately has led to greater transparency and understanding of steel issues between the industrialized countries. 3/

Statistics.--The Steel Committee collects and publishes statistics on iron and steel production; trade and consumption of steel, iron ore and other raw materials; production capacity of the industry and investment projects. The data and descriptive information needed to carry out the studies are provided by the member governments. All the information is presented on a comparable basis.

Annual report.--The Annual Report outlines the state of the steel industry in member countries, broad trends in technology, policies adopted by

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1/ Ibid.
2/ Decision of the OECD Council Establishing a Steel Committee, OECD publication, 1978.
3/ Information developed from interviews with steel industry officials.

member governments and how these policies affect the industry and world trade in steel.

Special studies.--Intermittently, special studies are initiated to evaluate various problems arising in the industry. Some of the recurring areas for these special studies include capacity in relation to demand, manpower policy aspects, steel prices, steel markets and trade developments. Recent studies include the results of adaptation policies regarding the steel industries' restructuring efforts and labor policies. Specific technological assistance studies and projects have been deemphasized.

World Bank

Background

The World Bank is the world's major multilateral agency most visibly concerned with providing financial resources to developing countries. The World Bank had its origins in the Bretton Woods Agreements and originally aided postwar reconstruction of the productive capacity of Europe. The World Bank shifted its resources to developing countries with the completion of reconstruction. 1/

The World Bank's current objectives are to stimulate and nurture projects and programs in developing countries. The World Bank provides financial resources for these projects from it own funds, and at times will cofinance with other lenders.

The World Bank has also been heavily involved in technical assistance. This technical assistance ranges from improving the quality of plant efficiency to the general economic planning of recipient nations.

Implementation of Objectives

The World Bank's present approach to meet its objectives consists of sector/economic work and gathering financial resources for the developing countries steel industry.

Sector/economic

The World Bank's sector/economic work evaluates the international competitiveness of the developing countries' steel industry, the economic and financial viability of the industry, and the government's role in the industry.

Having evaluated these aspects, the World Bank recommends business and political options to the government of the developing country. Business options might include closure of facilities that are not viable, or the restructuring of those facilities that are viable. Political options would

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1/ MacBean, pp. 211-230.

include such issues as trade policies or government regulations on the industry.

In evaluating the competitiveness of a potential producer or industry, the World Bank uses an approach that compares the long-run marginal costs (LRMC) of the producer(s) with the LRMC of the world's most efficient producers. This approach is based on the assumption that the world's most efficient producer's LRMC would be approximately equivalent to world market prices in a long-term equilibrium situation. In evaluating the viability of existing facilities, the World Bank uses a somewhat similar approach focusing on the recovery of variable costs. 1/

Lending

The second element of the World Bank's approach is the financial involvement of the World Bank. The World Bank is financially involved in developing countries steel industries to the extent of technical assistance (see following section) and Structural Adjustment Loans (SAL's). SAL's are intended to support industrial development as a whole. Through these SAL's, the World Bank may influence government decisions involving their steel sectors. 2/

Many of the World Bank's analyses come to conclusions requiring the restructuring of a nation's steel industry in general, or to retool or close specific facilities. Since the World Bank has limited funds to support its recommendations, its credibility and effectiveness within the steel industries of developing countries are limited.

Involvement in Steel

The steel industry, as a primary industry with many strategic downstream linkages, is viewed by World Bank officials as an industry that helps create industrial capacity necessary for self-sustained growth. 3/ The World Bank attempts to ensure the steel industry's health and prosperity by promoting and locating financing for potential downstream industries that are needed for efficient steel growth. This also assists in the larger goal of country development by establishing a strong industrial base and creating employment. Finally, the World Bank uses its experience and technical expertise to design long-term, efficient steel plans for both specific plants and for the developing country's industry as a whole. 4/

Before 1983, the World Bank was directly involved in lending for steel projects such as new plants or upgrading existing facilities. The World Bank made direct and indirect loans for these types of projects that amounted to slightly over $1 billion. These funds covered 54 projects and represented 13

1/ Information developed through interviews with World Bank officials.
2/ Ibid.
3/ Ibid.
4/ Ibid.

percent of the total changes in steel capacities of the developing countries and less than 1 percent of global steel capacities. 1/

During the late 1970's, the World Bank began to reassess its role. The world recession and decreasing demand for steel products led to an oversupply of steel and declining prices. The Bank's appraisal of its projects, many of which were poorly managed, underutilized, or even shut down, suggested the need for a new lending strategy. World Bank policy shifted from direct project support by providing financial resources to assistance of a more technical and advisory nature.

Recently, the World Bank has changed their impetus away from discrete project lending, toward the design of long-term efficient steel strategies for countries. 2/ The design and implementation of these strategies involves close work with governments to analyze and identify the problems and solutions of a particular nation's steel industry.

World Bank Impact on Steel Industry

By concentrating on helping developing countries acquire funds from other private and multilateral agencies, the World Bank tries to mitigate its funding limitations. These types of activities are time consuming as World Bank staff members must convince financiers of the soundness of the recommended policies and coordinate lending objectives and approaches. World Bank loans to steel projects are shown in the following tabulation:

Year	Country	Capacity (mtpy)	Bank loan (US$ M)	Total investment costs (US$ M)
1972	Brazil	1.30	64.5	785.0
1972	Brazil	1.40	64.5	998.3
1972	Brazil	1.50	63.0	898.4
1972	Turkey	0.90	76.0	433.3
1973	Mexico	1.00	70.0	962.8
1974	Rumania	0.15	70.0	174.4
1975	Brazil	2.20	95.0	2,714.8
1976	Brazil	1.10	60.0	2,208.6
1978	Turkey	0.50	95.0	150.0
1979	Rumania	0.25	40.0	137.4
1980	Egypt	0.30	64.0	98.9
1981	Egypt	0.75	165.3	769.0
Total		11.35	927.3	10,430.9

Source: "Bank Operations in Steel (1970-1987)," data supplied by the World Bank to the USITC for this study.

1/ Ibid.
2/ Ibid.

Assistance such as steel sector studies, technical assistance, and structural adjustment loans are shown in the tabulation below:

Steel Sector Studies/Technical Assistance (TA)

Completed

1976	Venezuela	TA to review project proposal
1979	Saudi Arabia	TA to review project proposal
1980	Rumania	Sector study
1981	Peru	Siderperu TA loan for restructuring
1982	Togo	SNS TA for restructuring/privatization (SAL)
1983	Tunisia	TA to review expansion project (SAL)
1983	Egypt	Sector Study (part of lending operations)
1984	Philippines	TA to review sector objectives (SAL)
1984	Brazil	Sector study (part of lending operations)

In 1975 and 1980, respectively, the Bank appraised and turned down a greenfield and an expansion project in Morocco and Portugal.

Ongoing

1984	Colombia	Sector review/energy conservation
1984	Hungary	Sector study/energy conservation/efficiency improvement
1984	Indonesia	PTKS Restructuring Study
1984	Indonesia	Steel Sector Study
1985	Nigeria	Sector Study/TA for restructuring (SAL)
1985	Pakistan	Sector Study
1985	India	Sector Study/TA for restructuring
1985	Zimbabwe	Sector review (SAL)
1985	Yugoslavia	Sector review (as part of multi sectors review) (SAL)
1985	Mexico	Steel sector review (PSIR)
1985	Brazil	Steel sector review (PSIR)

Foreseen

1986	China	Sector study
1986/87	Malaysia	Sector study
1986	Morocco	SONASID restructuring
1986	Poland	Sector review

Source: "Bank Operations in Steel (1970-1987)," data supplied by the World Bank to the USITC for this study.

Inter-American Development Bank

Background

The Inter-American Development Bank (IDB) is an international public finance institution. It is the largest source of external public finance for most of the countries of Latin America and the Caribbean. The IDB's primary objective is to meet human needs and enhance the prospects for continued growth and stability in the region. 1/

In 1958, the Council of the Organization of American States (OAS) resolved: (1) to establish an Inter-American institution for economic development; (2) to cooperate with other development institutions and sources of public finance or private capital; (3) that all American States would be members, and will contribute to its capitalization; and (4) that it will furnish technical assistance. 2/

Membership

There are 43 subscription-paying member countries. Of these 43 members, 27 countries are regional and 16 are nonregional members as shown in the following tabulation:

Inter-American Development Bank member countries

Regional Members		Nonregional Members	
Argentina	Haiti	Austria	Japan
Bahamas	Honduras	Belgium	Netherlands
Barbados	Jamaica	Denmark	Portugal
Brazil	Mexico	Finland	Spain
Canada	Nicaragua	France	Sweden
Chile	Panama	West Germany	Switzerland
Colombia	Paraguay	Israel	United Kingdom
Costa Rica	Peru	Italy	Yugoslavia
Dominican Republic	Surinam		
Ecuador	Trinidad and Tobago		
El Salvador	United States		
Guatemala	Uruguay		
Guyana	Venezuela		

1/ "Basic Facts About the Inter-American Development Bank," IDB publication, March 1985.
2/ Origins, Objectives and Resources of the IDB, Administrative Department of the Inter-American Bank, July 1985. As a result of this action, the IDB was established in 1959.

Membership has been afforded to nonregional countries to increase the lending resources of the IDB, while adding a multilateral dimension to the bilateral relations of the nonregional members with Latin America. This partnership has also increased the flow of technical resources of the IDB.

The policies of the IDB are voted on by its member countries with each country's voting power linked to the size of the subscriptions it pays. As of 1984, the Latin American and Caribbean member countries had 54.17 percent of the votes, the United States had 34.54 percent, and the remainder of the votes were held by the nonregional member countries.

Structure

The basic authority of the IDB is vested in the Board of Governors. The Board of Governors comprises of one Governor and an Alternate Governor appointed by each member country. The Board of Governors meet at least once a year, and the Governors can delegate all of the Board's powers to the Board of Executive Directors.

The Board of Executive Directors is responsible for the management of the operations of the IDB. The general functions of the Board of Executive Directors are the establishment of the institutional operating policies, approval of loans and technical assistance proposals, determination of interest rates, authorization to borrow in the international capital markets, and approval of the institution's administrative budget. 1/

Objectives

The IDB uses its lending resources to accelerate the economic and social development of its member countries in the region. The IDB cooperates closely with the governments of its regional members to act as a catalyst in the mobilization of capital for the development process. The IDB also has the following functions and goals: (1) to encourage private investment and to supplement private investment funds; (2) to orient development policies toward better use of resources and increasing foreign trade; and (3) to provide technical assistance for the preparation, financing, and execution of development plans and projects. 2/

The IDB gives preferential treatment to the member countries that are relatively less developed, and to specific regions that are less developed in countries that are comparatively more advanced.

1/ "Basic Facts About the Inter-American Development Bank", p. 26.
2/ Ibid.

Lending resources

The IDB's total lending resources at the end of 1984 were $42.8 billion. The IDB relies on several sources for funds to finance its lending and technical assistance activities. Paid in subscriptions by its member countries are the key source of funds, amounting to $34.5 billion. The difference between lending resources and subscriptions is $8.3 billion, that is typically obtained from contributions. World money markets are also used to obtain funds, and the IDB administers several trust funds for some member countries. Moreover, the IDB's lending capacity is increased as it engages with other international agencies, such as the World Bank, for specific projects. 1/

Normally, the IDB finances no more than 50 percent of the cost of a given project. 2/ However, in its catalytic role, the IDB has helped to mobilize "almost three additional dollars for development projects, for every one dollar of IDB lending. 3/

Lending

In 1984 the IDB loaned $28 billion. The IDB loans are ordinary capital loans with a maximum amortization period of 15 years. Interest is at a variable rate as it reflects the cost of the money to the IDB. For this reason, borrowing from the IDB is neither very expensive nor very cheap. 4/

The loan application analysis is very detailed and takes several months to complete. The first considerations involve the member country's development plans, to see if the project falls within those plans. Once that is completed, the loan application is subjected to detailed institutional, technical, socioeconomic, financial, and legal analysis, and since 1980, the IDB has also been making a benefits distribution analysis. The IDB looks for a rate of return on investment of 12 percent. 5/

When the IDB is involved in financing projects with other international agencies and with private lenders, the IDB and the other lender provide funds for different parts of the same project. The separate lenders have no legal ties between the separate loans to the same party. 6/

The IDB is also involved with complementary financing. Complementary financing involves the participation of private commercial banks and other lending institutions. These other lenders submit competitive bids to the IDB for a loan package that the IDB has analyzed, and for which it will collect repayments and assume the responsibility for supervising the execution of the project. Although there is no IDB guarantee involved, the mere presence of

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1/ Ibid.
2/ Ibid., p. 21.
3/ Meeting: ITC and IDB Staffs, Aug. 14, 1987.
4/ Ibid.
5/ "Basic Facts About the Inter-American Development Bank," p. 16.
6/ Ibid., p. 3.

the IDB assessment and participation makes it an attractive investment for other lenders. As of 1984, the IDB's complementary loans totaled $642 million. 1/

Technical assistance

The IDB's technical assistance and cooperation has contributed to the strengthening of the industrial base of the lesser developed members, and to the economic integration of Latin America. Technical cooperation is provided to assist member countries in the implementation of development projects. The IDB furnishes technical assistance to the extent that it provides funding for the member country to enter into a contract with a specialized institution, consulting firm, or a specialist.

Technical assistance is provided on a grant, reimbursable, or contingent repayment basis. If the technical assistance leads to the development of a project funded by the IDB, then funds for the technical assistance will be withdrawn from the loan. The IDB may also provide technical assistance on a grant basis to lesser developed and needier member countries.

Beyond its technical assistance, the IDB is not involved in R&D and development to any significant extent. The IDB does provide funds for R&D in the context of outlays for industry as a whole, but not for a specific industry.

IDB Involvement in Steel

As with all other lending, IDB's loans to the steel sector of the region have been made with the intention of mobilizing other resources for development purposes. In general, the assessment of steel project loans do not pose significant problems for the IDB. By nature, these projects are large and the project feasibility studies are detailed. However, some specific country policies have been problematic. For example, the Brazilian Government's policy of using price controls has reduced the accuracy of the IDB's assessments of project feasibility and profits. Another problem is measuring market optimism. The second oil crisis in the late 1970's caused construction cost overruns of as much as 100 percent after the project had already been assessed by the IDB.

The IDB's involvement in steel has been relatively minor; loans for steel-related projects have represented only 1.15 percent of the IDB's total lending over the years (table 4-1).

1/ Meeting: ITC and IDB staffs, Aug. 14, 1987.

Table 4-1
IDB lending for steel related projects (1964-87)

Year	Loan amount	Country (company)	Increase in capacity
	US$ million		Million tons/year
1964.................	0.4	Argentina (MISIPA)	1/
1965.................	0.2	Brazil (USIBA)	1/
1969.................	5.3	Argentina (Propulsora)	1/
1971.................	43	Brazil (CSN)	0.8
1972.................	42	Brazil (USI)	1.4
1972.................	40	Brazil (Cosipa)	1.3
1972.................	18	Venezuela (SIDOR)	0.3
1974.................	40	Brazil (Cosipa)	1.2
1974.................	63	Brazil (CSN)	2.1
1975.................	70	Argentina (ACINDAR)	0.6
1976.................	95	Mexico (SICARTSA)	2.1
1985.................	40	Argentina (SIDERCA)	0.2

1/ Technical assistance loans did not involve increases in capacity.

Source: Inter-American Development Bank Press Releases.

IDB's involvement in steel began in 1964 with a loan of $400,000 for a feasibility study in Argentina, after which IDB loans gradually increased (table 4-1). The IBD has had parallel financing projects with the World Bank for the expansion of the Brazilian steel industry. The largest loan the IDB has made to the steel sector was $95 million for an expansion project in Mexico in 1976. Since that time, the IDB has made only one other loan, in 1985. 1/ Most of the loans to the steel sector have been for plant expansions.

The IDB loans to the steel sector represent approximately 4 percent of all the lending involved in those projects, reflecting the IDB's role as a catalyst to increase the confidence of other lenders. 2/ The IDB has served to mobilize funding for the industry, but it has not provided a pivotal amount of funds itself.

1/ Ibid.
2/ Ibid.

The European Coal and Steel Community

Since world overcapacity in steel evolved in the mid-1970's, the European Community (EC), through the European Coal and Steel Community (ECSC) has coordinated and aided efforts to restructure the Community's industry. Financial aid in the form of grants and low-interest loans allowed most firms to continue to operate into the 1980's while significantly improving production facilities. Additionally, maintenance of a production quota system and the linkage of state aid to the closure of production capacity eased the steel industries' adjustment to the soft steel markets of the late 1970's and 1980's.

Background

The ECSC, which coordinates and implements EC steel policies and aid, developed out of a proposal made in 1950 by France's Foreign Minister to place French and German coal and steel production under a common authority whose decisions regarding coal and steel would be binding. The ECSC, which was formalized in 1956, was one of several original proposals directed toward European unification. 1/ In 1965, the ECSC, the European Economic Community (EEC), and the European Atomic Energy Community (Euratom) merged into the EC. The ECSC operates within the larger structure of the EC; the European Community Commission is the executive and law making body of the EC as well as for the ECSC. The 12 member countries of the ECSC represent approximately 40 percent of world exports of semi-finished and finished steel products. One-third of these exports are to destinations outside of the EEC. 2/

Objectives

The stated aim of the ECSC, as expressed in article 2 of the European Coal and Steel Community Treaty, is to promote greater average productivity or efficiency in the coal and steel industries by means of greater regional specialization in the most advantageous producing districts. To facilitate this goal, all customs barriers affecting the trade in coal and steel among the member states were abolished, thereby creating, in essence, free trade in these products. In addition, import and export duties or taxes with the equivalent effect of quantitative restrictions on the movement of coal and steel are prohibited.

The ECSC objective of internal production efficiencies is to be attained while preserving employment and avoiding structural imbalances within the EC. These objectives are to be achieved by adhering to the following treaty articles summarized below:

> The Commission is to study and publish general objectives that the industries of the EC are to follow, subject to the persuasive and financial powers of the Commission. 1/

1/ Article 5, European Coal and Steel Community Treaty.

1/ Louis Lister, Europe's Coal and Steel Community, Twentieth Century Fund, New York, 1960, p. 4.
2/ International Iron and Steel Institute, Steel Statistical Yearbook, 1987.

Coal, steel, and the raw materials for steel production are treated as common resources to which all members have access on equal terms.

Tariffs, quotas, and public subsidies are to be eliminated.

Competition under the price system is subject to the following conditions: (a) producers must sell at equal prices for comparable sales; (b) agreements in restraint of trade are prohibited; and (c) excessive concentration between enterprises is controlled. 1/

1/ Article 4, European Coal and Steel Community Treaty.

Deviation from the ideal efficiency framework of the treaty is permitted when supplies are surplus or scarce. Production quotas and minimum prices may be applied during a period of oversupply. The Commission must ascertain that a "manifest crisis" exists and have the assent of the member governments, represented by the EC Council, to establish production quotas and a minimum price system. 1/ During oversupply periods, production quotas must be "equitable" and plants that exceed the quota may have to pay a levy to support those that fall below the quota. During a period of scarcity, distribution quotas and maximum price controls may be applied. 2/ Since 1980, a production quota system has been in effect for crude steel and most rolled products in an attempt to prevent oversupply. The Commission has also maintained a minimum price program.

To achieve these goals, member states ceded to federal institutions such powers as the right to determine customs duties; the right to control production, quantity, and prices; and the right to subsidize or aid industries. However, the member states retain their competence over taxation, social security, administrative aspects of third-country commercial policy (such as import and export licensing), and labor policy (such as methods for fixing wages and welfare benefits). 3/

Activities of the ECSC

General activities

To pursue the objectives of the ECSC, the Commission publishes general objectives for the EC's steel industries; approves investment projects; loans funds and guarantees loans for the construction of steel facilities; grants funds for assistance to steel workers; and conducts and funds steel research and development. To fund these activities, a duty is levied on production from coal and steel enterprises (currently 0.31 percent of production value). To supplement this revenue, the Commission may raise funds on international capital markets. Borrowed funds may only be loaned to the industries. 4/

1/ Article 58, European Coal and Steel Community Treaty.
2/ Article 59, European Coal and Steel Community Treaty.
3/ See, for example, Article 71, European Coal and Steel Community Treaty.
4/ Article 51, European Coal and Steel Community Treaty.

During particularly difficult years for the steel industry, the Commission has transferred funds from the general budget of the EC to the ECSC. 1/

To coordinate investment in steel projects, the ECSC may require advance notice of investment programs, wherein one of the major influencing powers of the ECSC regarding investment lies. If the ECSC does not approve such programs, the facility must generally self-finance the investment. Without ECSC approval, the project forgoes the possibility of ECSC loans, which are given at better than commercial terms, and subsidized interest rates. Additionally, any other lender most likely would not be prepared to provide financing when an adverse opinion had been issued. 2/

The ECSC also promotes technical and economic research relating to the production and increased use of steel and occupational safety in the steel industry. The results of such research are made available to all concerned in the EC.

Activities in support of the steel industry

After its establishment, the ECSC regulated the EC steel industry mostly by preventing anticompetitive mergers and pricing policies as well as lending money to assist in building production facilities. These ECSC policies, however, were secondary in importance to high demand and the availability of investment funds in assisting the postwar rebuilding of the steel industry. 3/

By 1974, European steel production was at its highest level (156 million tons) since the EC was formed, and capacity utilization was at 87 percent. 4/ In 1975, the recession precipitated by the oil crisis resulted in a 20-percent decline in output. Internal prices fell 35 to 40 percent and export prices fell by 50 percent; exports decreased largely because of intense competition from Japan; 5/ and imports more than doubled during 1974-76. 6/

The effects of the continuing downturn were exacerbated by the startup of new capacity that had been planned and commissioned in the early 1970's when significant growth in demand was forecasted. The difficulties facing the steel industry--declining demand, oversupply, and low prices--led the Commission to implement in 1977 the first anticrisis measures of the Community steel policy. These measures were based on voluntary undertakings by steel firms to reduce supply on the domestic market for certain products in an attempt to induce an internal price revival.

As the recession persisted, analysts increasingly suggested that the industry was suffering from structural problems evidenced by excessive

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1/ For example, in 1985, the Commission transferred approximately $120 million from the general budget to the budget of the ECSC to assist with restructuring efforts. Nineteenth General Report on the Activities of the European Communities, p. 64.
2/ Dennis Swann, Competition and Industrial Policy in the European Communities, Methuen and Co., New York, 1983, p. 166.
3/ Information developed through interviews with steel industry officials.
4/ World Steel Dynamics, Steel Strategist, No. 11, September 1985, table 2.
5/ Dennis Swann, op. cit., p. 169.
6/ World Steel Dynamics, Steel Strategist, No. 11, September 1985, table 14.

4-19

financial losses and unfavorable international productivity comparisons. 1/ In 1977, the new Commission Minister of Industry introduced a package of proposals (the Davignon Plan) that essentially called for industry restructuring by concentrating output at new, well-located plants and by eliminating old, inefficient, and poorly located plants. Additionally, excess productive capacity, estimated at 20 million tons, was to be removed.

Assisting in this restructuring was the European Association of Iron and Steel Industries (Eurofer), founded in 1977, which represents nearly all integrated European works and accounts for approximately 90 percent of total EC crude steel production. Eurofer has been useful in organizing and implementing restructuring measures, particularly amongst its members, and maintains almost daily contact with the Commission regarding restructuring efforts and future plans regarding steel. 2/

Although the granting of subsidies by states to steel industries is illegal under the ECSC treaty, subsidies were being granted excessively by all the member states. The Commission could legally fine and require the repayment of aid the industries received. Instead, recognizing that substantial aid was necessary to prevent widespread closures, it attempted to coordinate restructuring by permitting aid that contributed to EC restructuring efforts. 3/ The Commission gave low-interest loans on a large scale to finance these efforts; loans were derived from funds generated by the production duty as well as borrowed from international capital markets.

To coordinate restructuring efforts, the Commission began requiring advance notice in 1977 of state aid granted to the steel industry. The basic aid policy was that none should preserve the status quo, but aid to improve structures, modernize firms, and rationalize production would be allowed provided they did not build up excess production capacity. 4/

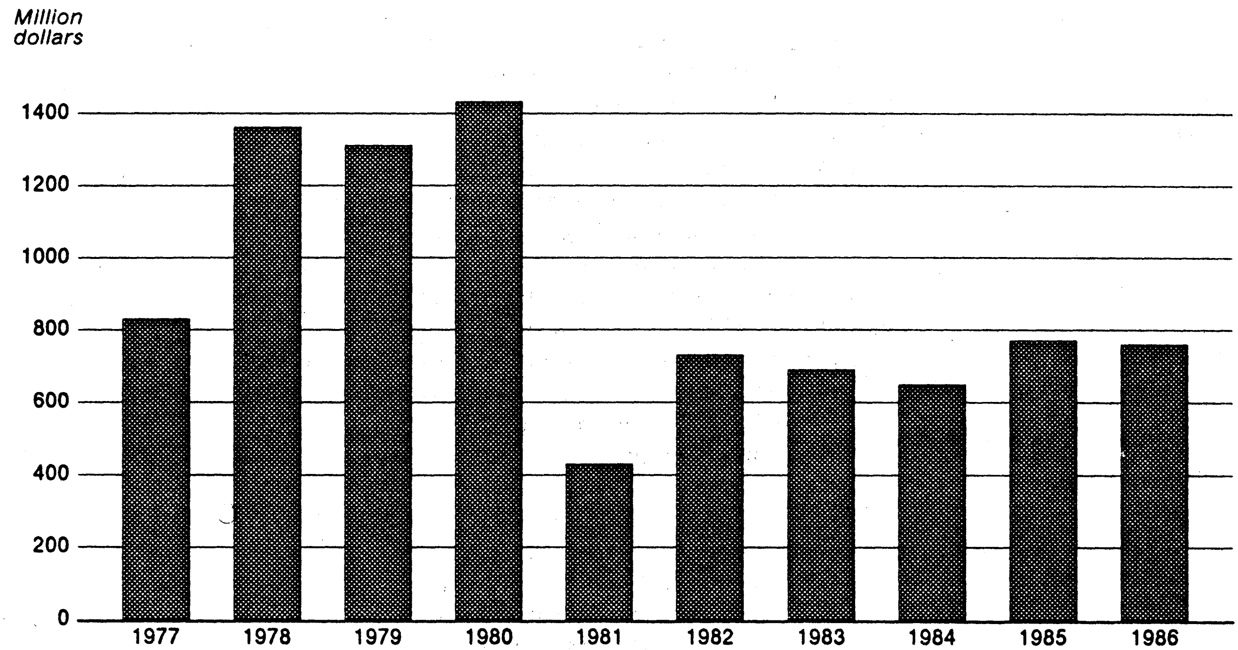
Any aid granted was subject to the condition that recipients would progressively become competitive again. The target company had to convince the Commission of its future profitability. Plans that preserved the status quo were approved only where there were pressing social reasons, such as when the steel company was a disproportionately large employer in a depressed region. 5/

Besides aid guidelines, restructuring measures included the gradual introduction of guidance prices for rolled products in an attempt to induce a price revival. Mandatory minimum prices for concrete reinforcing bars, merchant bars, and hot-rolled wide strip, which were monitored for company compliance, were introduced because prices had reached low levels out of proportion to production costs. 6/ The result of this program was a rise in

1/ Dennis Swann, op. cit., p. 169.
2/ Information developed through interviews with steel industry officials.
3/ Ibid.
4/ Eleventh General Report on the Activities of the European Communities, 1977, p. 108.
5/ Information developed through interviews with steel industry officials.
6/ Eleventh General Report on the Activities of the European Communities, 1977, p. 86.

Figure 4-1 displays the amount of loans granted to the coal and steel industries during 1977-86. 1/

Figure 4-1
Iron and steel: Value of ECSC loans to industry, 1977-86



Source: General reports of the activities of the European Communities, various issues.

1/ These figures include funds granted to the coal industry. The majority of funds, however, have been loaned to steel enterprises. For example, in 1986, $650 million was loaned to steel enterprises, whereas $102 million was loaned to coal enterprises. The purposes of these loans are discussed below under the section entitled "Additional ECSC Activities."

internal market prices despite the general deterioration of the steel market. This rise in price, however, was not totally successful, as it attracted additional imports. 1/

As a result, the Commission negotiated bilateral agreements with major steel exporting countries as well as an interim antidumping scheme to stabilize import volume and prevent imports from seriously undercutting EC steel prices. In 1977, 16 bilateral arrangements were reached accounting for approximately 75 percent of EC steel imports. 2/

These agreements, negotiated annually, are commitments on the part of foreign countries to maintain mutually acceptable import penetration levels. The foreign country can adjust its prices to the lowest published list price of EC producers as well as discount this price by 6 percent for ordinary steel and 4 percent for specialty steels. EC producers cannot discount prices from its published list prices on these foreign imports. 3/ Additionally, the import volume is not subject to antidumping or countervailing duty proceedings. The countries also pledged to abide by the so-called triple clause, which bans the exporter from exporting to only one market, exporting only one product, or exporting all of its agreed volume during one time period (deliveries must be spaced throughout the year). Violation of the agreement would lead to consultations between the relevant foreign government and the Commission. If violation continued, the product could be excluded or the agreement could be terminated and antidumping or countervailing duty cases initiated. 4/

For those countries that did not negotiate such arrangements and sold below a "basic import price" in the EC, antidumping and countervailing duty proceedings were instituted. The basic import price was fixed reflecting the "lowest production costs in third countries in which normal conditions of competition existed"--Japan's costs have traditionally been used. In addition, an automatic licensing system introduced in conjunction with the member states enables the Commission to monitor prices and quantities of imports into the EC. ECSC third country trade in steel products is shown in table 4-2.

"Manifest crisis" and the production quota system.--The world steel market further deteriorated in 1980 following the recession caused by the oil crisis of 1979-80. Following 2 years of slight growth in the EC, capacity utilization fell to 58 percent, the lowest rate ever recorded in the EC; declining demand brought a 13-percent drop in steel prices; and production costs increased by 5 percent. 5/

1/ Information developed through interviews with steel industry officials.
2/ The EC concluded agreements with Austria, Finland, Norway, Sweden, Portugal, Spain, Australia, Hungary, Poland, Rumania, Czechoslovakia, South Africa, Brazil, South Korea, Switzerland, and Japan. These arrangements have been continued on a yearly basis--in 1986, 13 bilateral agreements were concluded, covering approximately 70 percent of steel imports. Twentieth General Report on the Activities of the European Communities, p. 145.
3/ European Community Information Service.
4/ Ibid.
5/ Dennis Swann, op. cit., p. 175.

Under these circumstances, the Commission decided that the industry had reached a position of "manifest crisis" that could not be remedied by previously used measures. The Commission received the Council's approval for a system of production quotas for the EC steel industry through 1987. 1/

Quarterly production quotas were fixed for crude steel and four groups of rolled products subject to oversupply and pricing difficulties: hot-rolled wide and narrow strip, reversing mill plate, heavy sections (sheet piling, beams, and permanent way material), and light sections. Quotas were calculated on the basis of peak year 1974 production figures of each firm and were imposed on all steel firms, except those whose output did not significantly affect the state of the market. 2/

The quota system was further reinforced by the minimum price system that provided for sanctions in the case of transactions below minimum prices and the payment of a deposit that was retained when underpricing or overproduction by particular firms was ascertained. Further sanctions were included in the system to respond to other company quota violations.

Although capacity utilization turned upward to 63 percent in 1981, the most efficient companies could not cover production costs. Therefore, the quota system was continued and even extended to include merchant and concrete reinforcing bars as these products encountered oversupply difficulties. 3/

To better control restructuring and the granting of aid by member states, the Commission formally established a rules framework. These rules allowed aid to support investment, to defray the costs of closure, to facilitate continued operation during the implementation of a restructuring program, and to rescue undertakings, such as cash for immediate liabilities. However, aid was only allowed to firms implementing a restructuring program that would reduce their capacity and that appear capable of restoring their competitiveness and financial viability. 4/ The Commission was repeatedly required to impose fines under the European Economic Community Treaty to ensure that states would abide by the aids code.

The Commission informed the member states that it intended to use its powers to ensure that criteria and procedures set out in aid decisions would apply equally to any kind of general or regional scheme under which the steel industry is given assistance. The Commission was confronted by a reluctance on the part of all member states to reduce capacity, however. The Commission estimated that total overcapacity was between 30 and 35 million tons, and capacity reductions in industry restructuring plans was approximately 14 million tons. 5/ The Commission's main concern was that aid makes a genuine contribution to the restructuring of the industry and not simply keep uncompetitive firms operating. 6/

1/ Fourteenth General Report on the Activities of the European Communities, 1980, p. 97.
2/ Ibid., p. 107.
3/ Ibid., p. 91.
4/ Ibid., p. 107.
5/ Information developed through interviews with steel industry officials.
6/ Ibid.

By 1982, capacity utilization fell to below 60 percent. Wire rod was included in the quota system because of serious oversupply and resulting low prices, 1/ and the net external trade balance in steel declined by 40 percent to 10 million tons in 1982 (table 4-2). 2/ However, the EC has consistently maintained a trade surplus in steel products. This surplus varies and has recently declined sharply. This is largely due to the devaluation of the dollar, which curtailed exports and made EC markets more attractive for imports. 3/

Table 4-2
ECSC third-country trade in steel products: 1973-86

Year	Exports	Imports	Surplus
	-----------Million tons----------		
1973	18.3	6.0	12.6
1974	24.3	4.2	20.1
1975	20.8	6.1	14.7
1976	16.5	9.8	6.7
1977	21.4	9.9	11.9
1978	25.6	8.8	16.8
1979	24.6	9.4	15.2
1980	22.0	9.0	13.0
1981	23.2	6.7	16.5
1982	18.3	8.8	9.5
1983	18.8	8.3	10.5
1984	22.4	8.1	14.3
1985	24.4	8.2	16.2
1986	18.4	8.8	9.6

Source: World Steel Dynamics, Steel Strategist No. 13, March 1987, table 14.

At the same time, the continuing deterioration both of the world steel market and of its own home market brought serious reactions from the United States. The U.S. steel industry filed a number of antidumping and countervailing duty cases against EC countries that were exporting steel to the United States. The outcome of negotiations between the EC and the United States was an overall arrangement, or voluntary restraint agreement, limiting the EC's exports of 10 groups of steel products to 5.75 percent of the U.S.

1/ Bulletin of the European Communities. No. 6, 1982, point 2.1.25.
2/ Sixteenth General Report on the Activities of the European Communities, 1982, p. 88.
3/ Information developed through interviews with steel industry officials.

market in 1983, down from 6.4 percent in 1981. 1/ The arrangement, originally scheduled to expire in 1985, but subsequently extended (in modified form) through September 30, 1989, provided for the reduction of approximately 9 percent in EC steel exports to the United States.

The Commission estimated that, by 1985, surplus production capacity for finished steel products would be 58 million tons. The Commission therefore continued to tie the approval of state and EC aid to reductions in steel production capacity, particularly in hot-rolled products. 2/

By 1984, the European steel industry began to recover. Growing demand increased steel consumption by 10 percent, with production increasing from 109 million tons in 1983 to 119 million tons in 1984. The average rate of capacity utilization rose to 67 percent. The trade surplus in steel products increased by 35 percent. The Commission adjusted production quotas upwards for some products and raised minimum prices. 3/

By 1985, as the situation improved, the Commission suspended minimum prices. Production stabilized at 119 million tons and consumption at 108 million tons. The trade surplus in steel products rose by 10 percent over the previous year. The Commission estimated that closures as compensatory justification for industry aids approved under the aid code amounted to 28 million tons of hot rolled capacity. 4/

A new aid code introduced in 1986 with an expiration of December 31, 1988, provided that no aid could be granted for emergencies, continued operation, or new investment. Closure aid is authorized subject to two conditions--to cover a maximum of 50 percent of the costs that the firm must bear as a result of discharging employees and early retirement plans, and to compensate for the complete and permanent cessation of activities. Aid can also be authorized for protecting the environment and for research and development (R&D). 5/ Table 4-3 depicts total authorized state subsidies granted during 1980-85.

1/ Bulletin of the European Communities, No. 7/8, 1982, p. 18. Products covered by the agreement and percentage of projected U.S. apparent consumption are as follows: hot-rolled sheet and strip, 7.43 percent; cold-rolled sheet, 5.15 percent; plate, 5.8 percent; structurals, 10.9 percent; wire rod, 4.29 percent; hot-rolled bars, 3.01 percent; coated sheet, 3.32 percent; tin plate, 2.2 percent; rails, 8.9 percent; stainless steel sheet and strip, 4.08 percent.
2/ Seventeenth General Report on the Activities of the European Communities, 1983, p. 95.
3/ Eighteenth General Report on the Activities of the European Communities, 1984, p. 99.
4/ Nineteenth General Report on the Activities of the European Communities, p. 131.
5/ Ibid., p. 163.

Table 4-3
State-granted investment, research and development, closure, operating, and emergency subsidies, 1980-85 1/

(Million dollars)

Country	Investment	R&D	Closure	Operating	Emergency	Total
Belgium..........	732	-	120	3,104	12	4,335
Denmark..........	13	-	-	69	-	82
West Germany.....	1,141	166	630	1,978	-	3,914
France...........	3,095	-	308	5,205	702	9,309
Ireland..........	-	-	-	269	-	269
Italy............	4,079	39	231	9,761	-	14,110
Luxembourg.......	448	-	15	179	-	643
Netherlands......	238	-	-	226	-	464
United Kingdom...	1,821	50	1,055	2,818	-	5,743
Total..........	11,567	255	2,359	23,975	714	38,869

1/ Louis Schorsch, "Can Big Steel Change Bad Habits" in Challenge, July-August 1987. Calculated using exchange rates of May 1986. The EC Commission denoted state aids disbursed as totaling $28.5 billion from 1981 to 1985. Sixteenth Report on Competitive Policy, Brussels, 1987. American Minerals and Metals cites EC statistics as affirming $37 billion in aid disbursed by member states from 1980 to 1985. July 28, 1987, p. 3.

The Commission called for continued market deregulation in 1986 and for the removal of some products, such as wire rod and merchant bars, from the quota system and suspension of the guarantee system. As the dollar depreciated, however, EC export markets contracted and prices dropped while competition intensified. EC consumption fell to 101 million tons and production dropped to 125 million tons. 1/ European producers called for continued quota system protection beyond the end of the 1987 deadline.

Despite cutting capacity by approximately 32 million tons during 1980-86, the Commission estimates excess hot-rolled capacity is still likely to be 30 to 32 million tons by 1990. 2/ Most of the closures in the early 1980's were of older and high cost facilities. Now, however, most facilities are modern and efficient, making closures more problematic. 3/ The difference in efficiency between the most efficient and least efficient producers in the EC is negligible, with any closure decisions most likely based on political grounds. 4/

1/ Twentieth General Report on the Activities of the European Communities, p. 142.
2/ Metal Bulletin, July 27, 1987.
3/ Information developed through interviews with steel industry officials.
4/ Ibid.

The Commission indicates that the principal area of difficulty is hot- and cold-rolled sheet, plate, and heavy sections that have an overcapacity of 20 million tons. 1/ To have the quota system extended, Eurofer attempted to devise a "self-help" plan that would result in the voluntary reduction of capacity. However, Eurofer and the Commission could not agree as to the quantity of closures and ultimately no plan was formulated.

The Commission proposed a 3-year extension (through 1990) for quotas on hot-rolled coil, cold-rolled sheet, plate and heavy sections conditioned on capacity reductions of 30 million tons by 1990 as well as a production levy to be charged on steel covered by the quotas to contribute to a closure costs fund. This fund would consist of approximately $600 million, 70 percent of which would pay capacity closure costs and the remaining 30 percent for a series of measures to help alleviate unemployment in steel closure regions. Eurofer has rejected the Commission duty plan; instead, it advocates closures funded by selling of quotas and transfers from the EC general budget for social costs as well as reviving state aids that would entail amending the existing state aids code. 2/

Because this Commission plan aroused widespread opposition and the quota system was due to expire at the end of 1987, the Commission appointed a three member board of non-EC experts to determine where capacity reductions could be achieved and how to finance the closures. The board recently suggested in its report to the Commission an increase in production limits by 10 percent and an end to the quota system by 1989.

A second option offered was the gradual elimination of quotas until the end of 1990 if the steel industry agreed to close 75 percent of the 20 million tons of overcapacity in hot-rolled coils, heavy plate, and heavy sections.

A third option was to end quotas in January 1988 if the industry failed to guarantee adequate closures. The report also suggested that the Commission continue to insist on its near total ban on state subsidies to steel companies. 3/

The Commission removed wire rod and merchant bars from the quota system at the end of 1987 and extended quotas for hot and cold-rolled coil, plate, and heavy sections until the end of June, 1988. Most industry sources indicate that the quota system will probably continue until the end of 1990 for hot and cold-rolled coil because of widespread forecasts for a weak market. 4/ In return, the EC expects significant closing of capacity.

Quotas on heavy plate and sections will also probably be continued if closures are effected. The industry has already volunteered to close over half the 9.6 million tons of overcapacity. 5/

1/ Metal Bulletin, Mar. 24, 1987.
2/ Metal Bulletin, Sept. 24, 1987.
3/ Financial Times, Nov. 19, 1987.
4/ See, for example, Financial Times, Jan. 13, 1988.
5/ Ibid.

Additional ECSC activities.--The Commission also put emphasis on grants and reduced interest conversion loans to member states to encourage the creation of new activities in areas where employment in the coal and steel industries was declining (fig. 4-2). The Commission gave some of these funds to the ECSC out of it general budget, thereby negating the necessity of raising the levy on steel enterprises.

The extent of these low interest loans, totaling more than $3 billion, reflects the Commission emphasis on assisting discharged workers. Almost 200,000 jobs were created using these funds.

Nonrepayable redeployment aid further assists workers and steel producers. The grants are used to encourage early retirement, temporary tide-over assistance, resettlement allowances, and vocational retraining, and are as shown in the following tabulation:

Country	Millions of dollars
Belgium	54.6
Denmark	1.7
West Germany	160.3
France	228.8
Ireland	1.1
Italy	64.3
Luxembourg	23.6
Netherlands	6.4
United Kingdom	511.4
Total	1,052.2

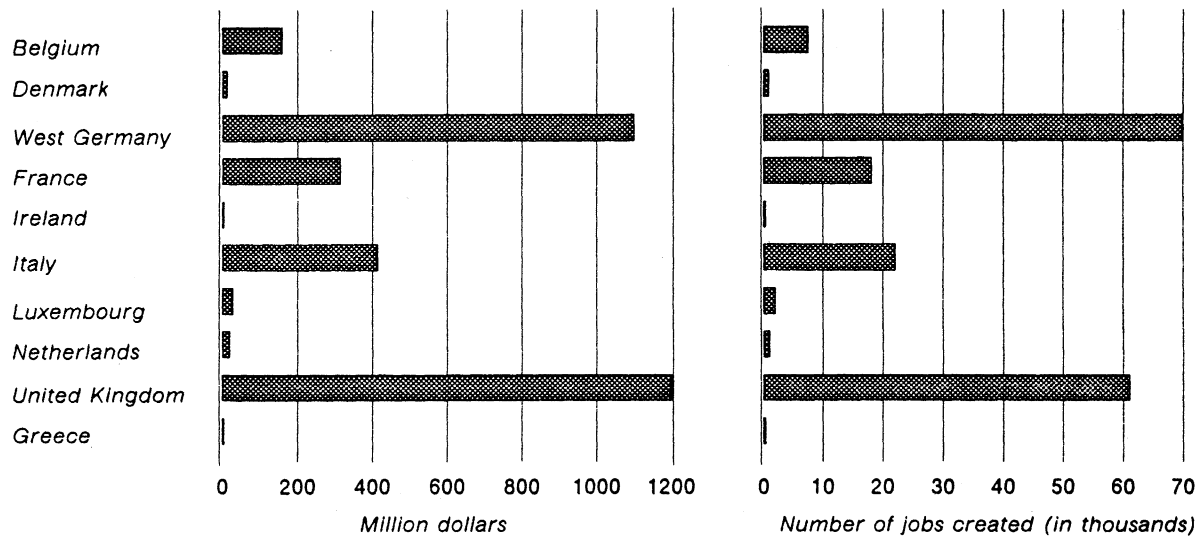
Source: Eleventh through Twentieth General Report on the Activities of the European Communities.

ECSC loans for subsidized housing for steel workers were granted, part at a 1 percent per annum interest rate, and the rest at market rates. In 1986, for example, $127 million in loans were granted, $38 million at a 1 percent interest rate and $99 million at market rates. 1/

The EC funds R&D projects in the form of grants of up to 60 percent of project costs. During 1979-86, the ECSC granted $167 million to fund almost 600 R&D projects. Steel enterprises, research centers, and universities also used $255 million granted from state governments. 2/ The projects must be for improvements in the production and use of steel. The results become the property of the EC and are made available to all members. Most research is done by producers and universities, and focuses on production rather than market or product features where competition is more intense. 3/

1/ Bulletin of the European Communities, No. 5, 1986, p. 41.
2/ Louis Schorsch, p. 32; figure reflects funds granted from 1980 to 1985.
3/ Information developed through interviews with steel industry officials.

Figure 4-2
Value of ECSC conversion loans and number of jobs created, by countries, 1975-86 period



Source: *Twentieth General Report on the Activities of the European Communities*, 1986, p. 216.

Although recognizing the significance of process-oriented research and the need to improve manufacturing facilities through innovation, the Commission in its statement of General Objectives for Steel by 1990 calls for a major shift in emphasis to ensure that R&D becomes more market driven with particular emphasis being placed on the major consuming sectors such as motor vehicles, construction, and machinery. The Commission notes that it is vital that product-oriented research is effective in defending traditional markets as well as in extending the areas of application and uses for steel. Issues of major concern will include materials substitution, achieving improved properties, more consistent quality, increasingly stringent consumer specifications, and the role of research as a stimulus in establishing new and updating existing codes and standards by the appropriate bodies. 1/

1/ General Objectives, Steel 1990, Brussels 1985, p. IV/2.

CHAPTER 5. THE BRAZILIAN INDUSTRY

Background

The Brazilian steel industry has been a focus of government economic planning since 1948 when president Guilio Vargas declared, "The most basic problem of our economy is that of steel." This sentiment was given greater emphasis in 1973 with the establishment of Siderugia Brasileria SA (Siderbras), a state holding company for the nation's major steel producers. Brazil's three major sheet and strip producers are Siderbras companies and for purposes of this report, data referring to Brazilian competitiveness in these products refer to Siderbras companies unless otherwise noted.

The President of Siderbras recently declared that "Brazil has the destiny of becoming a steel power," 1/ and consistent with this philosophy, the steel industry of Brazil has developed within a framework of government incentives and restrictions. Within the framework of a series of national plans for development of the steel industry, there has been a steady increase in the production of raw steel. As table 5-1 illustrates, Brazil's raw steel production rose by almost 300 percent between 1970 and 1986, bringing that nation's steel industry from 18th to 7th place in world production.

Table 5-1
Brazilian steel industry: Raw steel production for world and Brazil, 1970 and 1982-86

Raw steel production (million tons)	1970	1982	1983	1984	1985	1986
World...million metric tons..	586.8	645.4	663.7	710.2	719.1	714.2
Brazil.................do....	5.4	13.0	14.7	18.4	20.5	21.2
Percentage of world production........percent..	0.9	2.0	2.2	2.6	2.9	3.0
Relative position of Brazil among steel producing countries..................	18	12	11	8	7	7

Source: 1987 IBS Statistical Yearbook.

Although government direction under the development plans did increase production, there were accompanying distortions in investment patterns that resulted in erratic industry development and financial burdens. 2/ Brazilian industry officials have suggested that government policies that followed adoption of the the steel development plan of 1975 are directly responsible for constraints on the competitiveness of Brazil's steel industry today.

The 1975 expansion plan was intended to meet the needs of Brazil's domestic market, which had the fastest growing rate of consumption in the world in the late 1960's and early 1970's. Domestic consumption of all steel

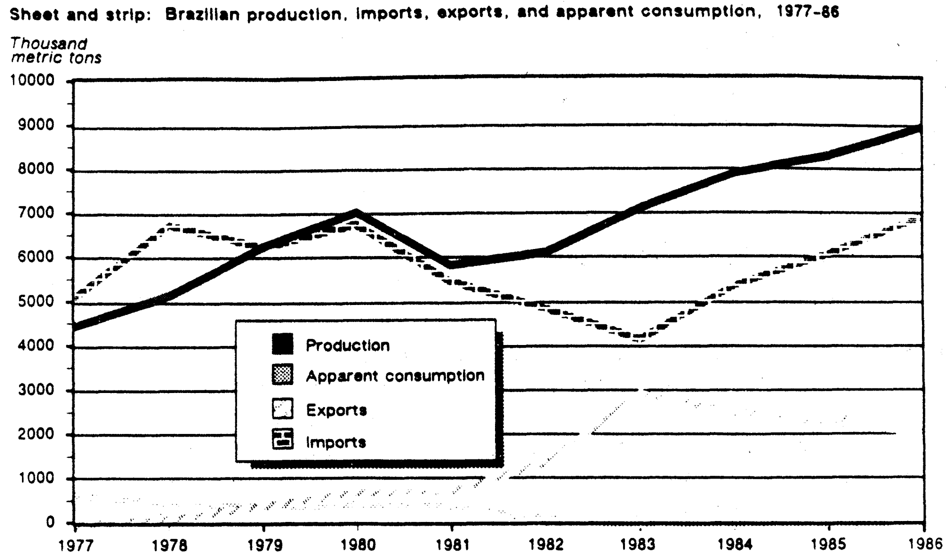
1/ Siderbras president Amato S. Lanari, Jr., American Metal Market, Oct. 3, 1986.
2/ Werner Baer, The Brazilian Economy: It's Growth and Development.

products had been rising at an annual rate of 18.4 percent between 1967 and 1974 and consumption of flat products outpaced that with increases of 23 percent each year in the period 1967-74, and 25.6 percent from 1970 to 1974. 1/

Under the 1975 plan, the Government of Brazil was to provide funds for a third stage of the progressive expansion programs underway at five Siderbras companies. The goal of the third stage was to add an additional 50 percent in capacity in each company. However, with the inauguration of the Figuereido administration 4 years after approval of the plan, other projects were given priority over steel, and capital funds were diverted. These delays in implementation of the outlined rationalization goals reportedly resulted in $8 billion of lost revenue and added approximately $3.9 million to Siderbras' debt. 2/

Simultaneously, the industry's difficulties were exacerbated by the global decrease in demand for steel and the general economic downturn in Brazil, both of which began in 1980. Between 1980 and 1983, a combination of import restrictions, a decrease in foreign credits, high interest rates, and relatively high domestic inflation combined to discourage domestic demand. Flat product apparent consumption declined by 20 percent between 1980 and 1981 and 37 percent between the high of 1980 and the end of 1983. It was during this same time that exports of Brazilian steel products increased significantly. Figure 5-1 illustrates the inverse relationship between exports and domestic consumption during this period and in subsequent years. Past response of the industry to fluctuations in domestic demand suggests that export levels of all types of steel products could increase if future domestic demand drops below anticipated levels. Recent statements by Siderbras' officials support this scenario. 3/

Figure 5-1
Sheet and strip: Brazilian production, imports, exports, and apparent consumption, 1977-86



Source: *Consider Yearbook*, 1983 and 1987.

1/ Information developed from interviews with Brazilian industry officials.
2/ Metal Bulletin, Jan. 27, 1987.
3/ American Metal Market, Nov. 19, 1987.

Structure of the Industry

The Brazilian sheet and strip industry is dominated by three state-owned steel companies that operate under the control and coordination of the Siderbras group (Siderugia Brasileria S.A.). Siderbras was established by legislative decree in 1973 to "promote and manage Federal interests in the steel sector and related activities." The organization currently serves as a holding company, supervising a total of nine steel companies in which the federal government is a major shareholder with voting rights. In addition, Siderbras is a minority shareholder in Siderugica Mendes Junior S.A. and also oversees the operation of an engineering firm, Companhia Brasileria De Projetos Industriais (Cobrapi). Two new steelworks have been built since 1973 under the direction of Siderbras. They are Aco Minas Gerais SA (Acominas) and Companhia Siderurgica de Tubarao (CST).

Of the 10 steel companies associated with Siderbras, three are integrated producers of flat-rolled products, Cia. Siderurgica Paulista (Cosipa), Cia. Siderurgica Nacional (CSN), and Usinas Siderurgica de Minas Gerais S.A. (Usiminas). Their combined sheet and strip production (approximately 8.9 million tons in 1986) accounts for approximately 64.8 percent of Brazil's total sheet and strip production. The remaining 35.2 percent is accounted for by several private firms and Cia Acos Especiais Itabira (Acesita), a state-owned company jointly controlled by the Bank of Brazil and the government of the State of Minas Gerais. Company output for flat-rolled products of the four nonprivate companies are shown in table 5-2.

Table 5-2
Brazilian steel industry: Flat-rolled products production by companies, 1982-86

Company	1982	1983	1984	1985	1986
	1,000 metric tons				
CSN	1,526.7	2,053.4	2,227.4	2,450.5	3,125.0
Cosipa	2,010.5	2,414.5	2,430.6	2,431.7	2,513.7
Usiminas	2,365.9	2,402.4	2,933.1	3,096.4	2,982.7
Acesita	247.9	281.5	333.4	350.6	358.7
Total	6,151.0	7,151.8	7,924.5	8,329.2	8,980.1

Source: Consider Yearbook, 1987.

Although it is the oldest of the three companies (founded in 1946), CSN is Brazil's most automated plant, producing the widest range of products. These include coils, rails, and structural shapes as well as hot-rolled products, plate, and coated sheet. Increased production figures are indicative of completion of a major expansion program that included installation of a hot strip mill (No. 2), an additional cold-rolling mill (No. 3), two continuous galvanizing lines, and a fifth electrolytic tinning facility. With completion of the program, raw steel production capacity at CSN has doubled from its 1982 level to 3.1 million tons per year of flat rolled products in 1986.

In spite of its modern facilities, CSN faces administrative and personnel costs that are higher than other Siderbras companies. These are a reflection of the company's historical function as a provider of patronage positions during the years immediately following its startup in 1946. The current workforce at CSN has been characterised by industry officials as somewhat militant. The workforce has gone on strike several times in the last 2 years, demanding higher wages. Costs of these labor actions are estimated at $3 million per day. 1/

Cosipa of Sao Paulo has been the most recent of the Siderbras producers to modernize. A $250 million expansion program currently underway includes the rebuilding of one of two high-temperature furnaces and the installation of three continuous casters. These improvements will increase plant output from 2.5 million metric tons to 3.9 million metric tons by the beginning of 1988. Seventy-four percent of current output is devoted to flat-rolled products. Cosipa has an additional advantage of being one of two major Brazilian steel companies with its own port.

It is Usiminas, however, that has the best reputation for production efficiency (80 percent of flat-rolled products are continuously cast) and research. 2/ Most major expansion was completed prior to 1980, before the Brazilian Government began to curtail investment budgets of Siderbras steel plants. However, current industry expansion plans include revamping of the existing hot strip mill to facilitate an 800,000-metric-ton increase in flat-rolled capacity. Current total capacity is 3.4 million metric tons.

In conjunction with a 5 percent minority ownership interest, operations at Usiminas were initially directed by a Japanese management group. At this time, however, Japanese participation has been reduced to one seat on the board of directors and all acting managerial positions are held by Brazilians. 3/

Both Usiminas and CSN have continued to fund research facilities that concentrate on product specific research. Since 1969, Usiminas has spent an estimated 0.5 percent of revenues on research and development (R&D) and has obtained 85 patents. Twenty-two percent of all products sold by Usiminas in 1985 had been developed by the company in the 5 years prior to that time. 4/ However, future research expenditures and joint efforts will be coordinated by Siderbras rather than by individual companies. Other investment outlays are targeted for employee training programs and for pollution control equipment.

In addition to the three Siderbras sheet and strip producers, there are at least three non-Siderbras companies that emphasize specialty sheet and strip products. Their relationship with sheet and strip producers of the Siderbras group is complementary rather than competitive.

The largest of the three is Acos Especiais Itabira (Acesita), located in Minas Gerais. The major company shareholder is the Bank of Brazil, which

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1/ American Metal Market, Apr. 28, 1987.
2/ Information developed in interviews with Brazilian industry officials.
3/ Ibid.
4/ Brazil, September 1986.

financed a plan in the late 1970's to expand the operations of the company beyond foundry and semifinished products. As a result, Acesita's facilities are relatively modern. They include two electric furnaces and two continuous casting machines. The company has an estimated cold-rolling capacity of 50,000 tons per year for stainless sheet and 100,000 tons per year for silicon sheet. Production of special flat-rolled products in 1986 was 435,636 tons. Expansion plans are currently being implemented for a new facility to process stainless steel plates. A joint venture of Acesita and Amorim e Feital, Plaminox, in Minas Gerais, is currently scheduled to begin production in December 1987 and reach its production target of 200 tons per month by March 1988.

Company structure of Acesita includes a reforestation subsidiary as well as steelworks since the operation uses charcoal rather than coking coal for steel reduction. In terms of heating value, charcoal is slightly superior to metallurgical coke and the low sulphur content of charcoal reduces steel contamination. As a replacement for coking coal, eucalyptus-derived charcoal can be cost effective for Brazilian companies located in areas conducive to short rotations and high growth rates. Although none of the integrated Siderbras steelworks use charcoal at this time, a third of Brazil's steel sector (especially private producers of nonflat products and ferroalloys), uses it as a reductant in ironmaking. 1/

Two private producers of sheet and strip also have state-of-the-art facilities and produce specialty sheet and strip products. Armco do Brasil SA Industria e Comercio located in Sao Paulo, has a universal electrolytic line with 2,000 tons per year capacity. The other producer, Mangels Industrial SA, is an even larger operation that has three subsidiaries devoted to sheet and strip products. One of the three, Maxitec SA, is responsible for engineering, construction, and installation of strip rolling plants. Production of various specifications of carbon strip is handled by two other subsidiaries with combined capacity of over 110,000 tons per year.

These three non-Siderbras facilities supply the specialty sheet and strip domestic market and both Mangels and Acesita export their products as well. Mangels ships high-, medium-, and low-carbon strip to the United States and recently concluded a 3-year agreement with Sandvik of Sweden for similar products. U.S. consumers of Mangels' products have commented favorably on the high quality of imported high-carbon strip. 2/

In addition to these six sheet and strip producers, two other Siderbras companies, CST and Acominas are important because of their potential for carbon sheet and strip production. Although both facilities currently concentrate on slabs (see 2-5), CST and Acominas have expansion plans that include moving into the sheet and strip markets. Acominas is scheduled to bring a new hot strip mill on line in the mid-1990's.

Present plans for CST call for expansion of present product lines from 3.4 million metric tons in 1986 to 6.5 million metric tons by 1995. At that

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1/ Metal Bulletin, Aug. 17, 1987.
2/ Comments made by certain U.S. purchasers.

time, about one-half of all slab production will be rolled into higher value hot strip at a new rolling facility scheduled for completion in 1992.

CST's current focus is clearly export-oriented with Asia and the Middle East accounting for over 40 percent of all exports. In 1986, China surpassed the United States as Brazil's largest single customer for steel, and countertrade arrangements exchanging Chinese coal for CST slabs have been discussed. In the United States, CST has a 15-year supply arrangement with California Steel Industries at Fontana, CA to provide 450,000 tons per year of semifinished steel (approximately 45 percent of the plant's requirement). 1/ The first shipments began in 1984. It is estimated that over 90 percent of all CST exports go to California Steel although other U.S. firms that have purchased CST slabs include Lukens, Sharon, Gulf State Steel, Rouge Steel, LTV, and Lone Star. CST's competitors in the slab export market include Hoogovens (which is located in the Netherlands), Iscor (South Africa), Solmer (France), BSC (United Kingdom), Thyssen (West Germany), and SSAB (Sweden).

The location of CST's steelworks near the deepwater port of Victoria is an advantage in maintaining low production costs. Because of unique, state-of-the-art loading facilities, the port is a principal outlet for Carajas iron ore and iron ore pellets and also serves as the port of import for coal. This easy access to materials reportedly reduces internal transportation costs significantly. For overseas transport, CST is effectively closer to Japan than to Sao Paulo with respective freight rates of $10 and $12 per ton. 2/

The equipment at CST is also state of the art and has been provided by joint-venture partners Finsider of Italy (24.5 percent) and Kawasaki of Japan (24.5 percent). The centerpiece of operations is the 3.3 million metric-ton-per-year blast furnace, one of the 10 largest in the world. A second furnace and additional coke batteries are planned to supplement hot-strip rolling facilities. With installation of a continuous caster that is due to come on line prior to 1992, approximately 65 percent of production will be continuously cast. The upgrading is anticipated to cut production costs (estimated at $135 to $140 per tonne) by 7 to 8 percent. 3/

Domestic Demand

The overriding goal of the steel sector has continued to be expansion of steel capacity, and specifically, expanded production of higher value products. Industry capacity goals for the year 2000 include 25.7 million metric tons of flat-rolled products, 10.8 million metric tons of nonflat products, and 5.4 million metric tons of special steels. Total investment costs of this expansion are estimated to be $22.5 million. The rationale for such expansion is the previously untapped demand of domestic markets. Per capita consumption of steel currently stands at 120 kilograms (kg) for Brazil, in contrast to 340 kg for the United States. Brazilian company officials predict a per capita consumption rate of 200 kg by the end of this century. With a current

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1/ American Metal Market, Nov. 4, 1986.
2/ Metal Bulletin Monthly, January 1986.
3/ Metal Bulletin, Oct. 14, 1986.

industry operating rate of 95 percent, this will require a substantial increase in capacity.

Past apparent consumption figures show erratic growth for the flat-rolled steel sector (table 5-3, following page), with a decrease of 38.4 percent between 1980 and 1983 countered by a subsequent increase of 65.5 percent by 1986. In the years between 1977 and 1986, apparent consumption of all flat-rolled products increased by 44.9 percent, with imports declining steadily for most of that period. Exports of flat-rolled products rose significantly each year until 1983, with 43.1 percent of production exported in that year (compared with 23.8 percent in 1986).

The largest domestic markets for sheet and strip products in recent years have been the transportation, packaging, and appliance industries, which respectively accounted for 16.2 percent, 5.6 percent, and 5.4 percent of apparent consumption in 1986. The evolution of domestic consumption patterns by sector for uncoated flat-rolled products (table 5-4) reflects a trend that is predicted to continue as the automotive sector doubles its output by the end of the decade.

Table 5-4
Sectoral distribution of uncoated flat product sales in Brazil, 1981-86

(In thousand of metric tons)

Sector	1981	1982	1983	1984	1985	1986
Transportation material.....	543.3	619.1	642.7	677.6	763.6	908.6
Components and parts........	2.2	.7	2.0	4.6	4.3	5.3
Agricultural and highway machinery.................	52.3	51.8	43.8	64.3	65.5	96.9
Industrial machinery and equipment................	29.1	16.9	21.5	28.4	36.2	34.6
Electric and electronic machinery and equipment...	86.9	80.3	77.5	105.4	123.3	161.3
Household and commercial appliances................	262.1	234.9	226.1	186.4	226.6	306.6
Cutlery, weapons, tools, and toys.................	3.2	3.3	2.8	3.0	3.1	2.8
Packages and containers.....	260.6	336.9	350.9	292.3	252.6	316.9
Construction...............	49.5	50.8	39.9	47.8	62.3	78.0
Distribution and semi-manufacturing............	1,291.5	1,303.8	1,317.1	1,639.5	1,554.8	2,044.4
Total sheet and coil....	4,109.5	3,805.7	3,573.5	4,401.9	4,855.7	5,656.5

Source: 1987 IBS Statistical Yearbook, p. 2-8.

1/ Chase Econometrics, Crisis and Competition: The World Steel Industry, 1986-2000, Vol. II.

Table 5-3
Flat-rolled steel: Brazil's production, exports, imports, and apparent consumption, 1982-86

(In metric tons, except as noted)

Item	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Production:										
Ordinary flat-rolled....	4,429,154	5,108,328	6,215,063	6,938,177	5,678,215	5,902,239	6,870,305	7,590,954	7,978,545	8,621,312
Specialty flat-rolled...	70,259	90,316	93,251	141,810	192,087	247,923	281,455	333,361	350,601	358,724
Total..............	4,499,413	5,198,644	6,308,314	7,079,987	5,870,302	6,150,162	7,151,760	7,924,315	8,329,146	8,980,036
Imports:										
Ordinary flat-rolled....	173,639	128,783	132,884	177,077	148,524	50,371	18,375	15,659	21,667	25,693
Specialty flat-rolled...	133,989	111,512	131,775	123,121	82,176	60,332	16,184	16,203	25,777	19,170
Total..............	307,628	240,295	264,659	300,198	230,700	110,703	34,559	31,862	47,444	44,863
Exports:										
Ordinary flat-rolled....	15,456	148,818	436,396	730,517	759,480	1,388,690	2,958,691	2,520,436	2,245,622	2,054,281
Specialty flat-rolled...	35	104	8,202	13,408	14,623	17,537	32,767	39,159	27,824	29,400
Total..............	15,491	148,922	444,598	743,925	774,103	1,406,227	2,991,458	2,559,595	2,273,446	2,083,681
Apparent consumption:										
Ordinary flat-rolled....	4,587,337	5,088,293	5,911,551	6,384,737	5,067,259	4,563,920	3,929,989	5,086,177	5,754,590	6,592,724
Specialty flat-rolled...	204,213	201,724	216,824	251,523	259,640	290,718	264,872	310,405	348,554	348,494
Total..............	4,791,550	5,290,017	6,128,375	6,636,260	5,326,899	4,854,638	4,194,861	5,396,582	6,103,144	6,941,218
Percentage change in apparent consumption over that of previous year:										
Ordinary flat-rolled....		10.9	16.2	8.0	(20.6)	(9.9)	(13.9)	29.4	13.1	14.6
Specialty flat-rolled...		[1.2]	7.5	16.0	3.2	12.0	(8.9)	17.2	12.3	(.02)
Total..............		10.4	15.8	8.3	(19.7)	(8.9)	(13.6)	28.6	13.1	13.7
Ratio of imports to apparent consumption (percent):										
Ordinary flat-rolled....	3.8	2.5	2.2	2.7	2.9	1.1	.5	.3	.4	.4
Specialty flat-rolled...	65.6	55.3	60.8	49.0	31.6	20.8	6.1	5.2	7.4	5.5
Total..............	6.4	4.5	4.3	4.5	4.3	2.3	.8	.5	.8	.6

Source: Consider Yearbook, 1987.

Recent estimates anticipate a 69-percent rise in Brazil's apparent consumption of steel products by 1996. 1/ This 5.3 percent average annual rate of growth is slightly below industry and government planning assumptions that set the figure for average annual gross national product (GNP) growth at 6 to 7 percent through the year 2000.

Conditions in the Brazilian Sheet and Strip Industry

Input Costs

Brazilian steel producers often cite a comparative advantage in input costs as the basis for their competitive position in the world market. An examination of both raw materials and wage rates confirms that, for iron ore, electric power, and labor, Brazilian producers do enjoy significantly lower costs than most other steel producers worldwide (table 5-5).

Table 5-5
Comparative operating costs for cold-rolled coil operations of certain integrated producers, 1985

Item	United States	West Germany	Japan	South Korea	Brazil
		Dollars per ton of finished product			
Operating costs......	403.00	324.00	286.00	270.00	274.00
Labor................	129.00	70.00	63.00	25.00	26.00
Iron ore.............	67.00	47.00	44.00	48.00	24.00
Scrap................	18.00	11.00	-	-	-
Coal or coke.........	50.00	48.00	52.00	55.00	68.00
Other energy.........	24.00	22.00	15.00	24.00	27.00
Miscellaneous........	115.00	126.00	112.00	118.00	129.00

Source: Up From The Ashes, Barnett and Crandall.

World Steel Dynamics estimates that materials and energy costs account for 54 percent of pretax production costs, labor for 8 percent.

Brazil is now the world's second largest iron ore producer and largest iron ore exporter, with exports of approximately 96 million metric tons in 1987. Brazil's CVRD company is responsible for the majority of production, with an estimated output of 80 million metric tons of ore this year. Of this production, 69 percent will come from the country's southern reserves, which are close to the steelmaking plants of CST, Usiminas, and Acominas, with the remainder mined at Carajas in the north. Although the quality of ore at Carajas is of superior grade (66 percent Fe), internal transportation costs require that the domestic producers utilize southern ores to maintain the lowest

1/ Chase Econometrics, Crisis and Competition: The World Steel Industry, 1986-2000. Volume II.

operating costs. The following tabulation gives estimates of mining and beneficiation costs, which suggest that Brazilian ore is among the least expensive in the world.

Brazilian steel industry: Ore grade and operating costs for iron ore, by specified producers

Producers	Ore grade	Operating costs: Mine	Operating costs: Beneficiation
	Percent	------Dollars/lt ore 1/------	
Australian Producers..............	57-65	1.60-2.60	0.30-1.60
Brazilian Producers...............	65-67	.70-2.00	.50-1.70
Canadian Producers................	66	2.00-2.50	3.00-3.50
U.S. Lake Superior 2/.............	63-66	2.00-4.50	3.25-5.00

1/ Bureau of Mines estimates, 1984.
2/ Lake Superior producers include mines in the Mesabi and Marquette ranges.

Source: U.S. Bureau of Mines, Minerals Availability Appraisal IC 9128.

In terms of energy, the last decade has brought a substantial improvement in energy efficiency of the Brazilian steel industry. Energy consumption of 5.83 Gigacalories (Gcal) per ton of crude steel production in 1977 shrank dramatically to 4.96 Gcal per ton in 1986. 1/ There has also been a shift in the mix of energy sources used in steel production as illustrated in the following tabulation:

Energy source	1980	1986
	--(Percent of use)--	
Coal..............	53.4	60.8
Charcoal..........	20.4	16.2
Fuel oil..........	13.4	4.8
Electric power....	9.7	9.5
Natural gas.......	1.4	8.1
LPG and other.....	1.7	.6
Total.........	100.0	100.0

Costs for electricity vary between states within Brazil, with industry officials estimating that steel producers pay an average of 18 mills per kilowatthour (kWh). This compares with 50 mills per kWh for U.S. producers.

Although Brazil is almost entirely dependent on foreign sources for supplies of coking coal (90 percent of requirements are imported, 50 percent of that from the United States), charcoal use has declined. At this time, none of the integrated Siderbras sheet and strip producers utilize charcoal in their operations. However, Acesita, one of the specialty producers, does.

1/ World Bank Report, Energy Efficiency in the Steel Industry with Emphasis On Developing Countries.

Labor

A fundamental contributor to low operating costs of Brazilian sheet and strip producers is the low wage rate of $3.50 per hour, inclusive of benefits. Although such rates are substantially below most other producers in the world, they are above Brazilian industry norms because of the high percentage of skilled workers among the 79,196 employees in the sheet and strip segment of the Brazilian steel industry. Even though productivity rates are lower in Brazil (a phenomenon that is not uncommon in developing countries), labor costs are a relatively low $23 per ton in Brazil; this contrasts with $85 per ton for U.S. producers and $20 per ton for Korea. 1/

Industry officials have indicated that labor costs are expected to rise sharply for Brazilian sheet and strip producers in the years ahead. In response to the recent democratization of the government, union representation is growing as a political movement. Although most members of the Metallurgical Labor Union (Sindicato dos Metalurgicos) are viewed by industry management as realistic in demands and bargaining strategies, there are pockets of militancy that reportedly may have a disruptive effect on selected sheet and strip operations in the future. In 1985 and 1986, for example, labor strikes at CSN resulted in production losses of $3 million per day. It has been suggested, however, that future escalations in wage rates will probably be offset to some extent by company policies regarding manning 2/; a reduction in manning levels, would raise labor productivity.

The contribution of low cost inputs to the comparative advantage of Brazilian sheet and strip producers is clear. When coupled with technologically advanced rolling and finishing mills, and a high degree of continuous casting, the competitive position of Brazil's industry appears strong. However, there are serious impediments to implementation of Brazil's expansion plans and fulfillment of the industry's potential. These impediments are financial in nature.

Financial Aspects of Competitiveness

Debt/equity ratios for the three Siderbras companies are somewhat difficult to assess because of the frequent indexation of assets and liabilities in response to domestic inflationary pressures. However, figures provided by Brazilian industry officials and confirmed by the World Bank estimate a ratio of 9:1 for the group. Over one-half of all sales revenues are used for debt service. Several studies suggest that Siderbras sheet and strip producers would be financially viable companies if the heavy debt burden could be reduced or eliminated. Rate of return on operational assets, such as equipment, has been estimated at 10 percent. Profit per ton estimates are not meaningful since domestic prices are controlled.

There are two primary considerations when accessing the impact of financial policies on the competitive position of Brazilian sheet and strip products during the next decade: the effects of government pricing and investment policies and the cost and availability of investment capital.

1/ World Steel Dynamics, Steel Strategist #13, Mar. 30, 1987.
2/ Information developed from interviews with Brazilian industry officials.

A transitory problem, but one which is apparently severely impeding the competitive position of the Brazilian industry, is the control of steel prices by the government as an anti-inflationary device. With the announcement of the cruzado plan on February 28, 1986, prices of steel products were held at levels 25 percent below the cost of production. 1/ It was not until early in February 1987, that producers of flat-rolled products were granted a 30 percent increase. Although approximating the inflation rate during the year of price controls, this amount did not allow for return on investment. Price controls of this type have been imposed sporadically since 1979 and have resulted in an estimated $7.5 billion in additional Siderbras debt. 2/

Recent discussion between government planning entities and steel industry officials has recognized the implications of price control policies. If prices continue to be artifically mandated, capital expenditures by firms for maintenance, upgrading, and expansion will be seriously curtailed. There has been official agreement as to future actions. In an effort to avoid the undercapitalization of the past, prices will be allowed to rise based on an established reference point for costs of production at the most efficient plant (Usiminas) plus 10 percent return on operational assets. 3/

Price controls have also exacerbated the second, more structural, barrier to long-term competitiveness, that of substantial debt. At the end of 1986, Siderbras debt was $17.2 billion. Because of the restrictions that such an enormous debt places on expansionary possibilities, top priority has been given to implementation of a "restructuring plan." The plan, signed in January 1987, has several components: debt for equity transfer, capital infusion for expansion, and implementation of measures that will ensure capability for internal, self-sustaining generation of funds.

In the first stage of restructuring, approximately $11 billion of company debt would be transferred to Siderbras. This would then be capitalized by the government in a debt-for-equity swap, with the remaining $1.8 billion to be refinanced by the state development bank (BNDES).

The second component of restructuring is continued infusion of capital for expansion and development. Investments of $9 billion for capacity expansion of 13 million tons per year and additional expenditures of $1.8 billion for blast furnace maintenance have been planned. It is anticipated that one-third of the required capital will come from company profits, one-third from capital subscriptions, and one-third from supplier credits. Additional capital may be generated by privatization of four of the smaller Siderbras steel companies.

The proposed privatization would have several effects other than providing a source for capital infusion. In addition to allowing Siderbras to concentrate on production of flat-rolled products, remaining company debt would be assumed by the purchasers. It may be, however, that this additional burden is responsible for the lack of interest shown by the private sector. To date, only steel distributor Irmaos Galeazzi has been involved in

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1/ Metal Bulletin, Aug. 6, 1987.
2/ Ibid., Jan. 27, 1987.
3/ Information developed from interviews with Brazilian industry officials.

purchasing discussions. The focus of these discussions has been Cia. Siderurgica de Mogi das Cruzes (Cosim), a producer of semifinished and nonflat-rolled products.

Although industry officials anticipate there will be additional government infusions, the specific amounts are uncertain. On July 25, 1986, the Brazilian president pledged one lump-sum grant of $9.26 billion to Siderbras to assist with debt retirement. This amount was to be supplemented by an additional $1.7 billion by 1992 and would be in addition to Siderbras' yearly budget ($557 million in 1986). To date, the government has directly paid $3.7 billion in Siderbras loans and an additional $2 billion has come from a newly formed agency, the Fondo Nacional de Desenvolvimento (NFD). 1/ In light of recent announcements that the government will reduce its investment in steel expansion and is reevaluating plans to build greenfield capacity in northern Brazil, the total financial infusions that will actually be invested in the industry remain in doubt.

The final financial barrier to Brazilian sheet and strip competitiveness is the availability and cost of investment capital in both the domestic and foreign markets. The Siderbras group has a variety of sources of financing including long-term local currency loans from BNDES; short-term loans under Central Bank Resolution 63, which are hard currency loans through local banks; and long-term foreign currency loans. As of December 31, 1986, the outstanding BNDES loans bear interest charges of between 5 and 11 percent annually, plus full indexation based on the Government Treasury Bond (ORTN) index. The other categories of loans, which are dollar denominated, bear interest charges of .875 to 2.25 above Libor or the relevant prime rate. Outstanding yen loans have interest rates of between 8.3 and 8.9 percent per annum, plus correction based on devaluation.

Expansion programs currently underway and those planned for completion within the next decade will probably have to rely primarily on domestic sources of capitalization within Brazil because of the recent suspension of interest payments on foreign debts by that country. However, given the unstable economic climate, domestic investors are wary of long-term projects. 2/

Competitive Assessment

From a global perspective, the position of the Brazilian sheet and strip industry is a strong one. The relative advantages in input costs of raw materials, power, and labor are complemented by modern and efficient facilities that are currently in place and that will be expanded significantly within the next 10 to 12 years. Although domestic consumption will continue to be the industry's primary focus, if home market demand slackens, producers would be forced to increase exports from the current levels of 20 percent of sheet and strip production. Even if domestic demand meets anticipated levels and the anticipated percent of production designated for export did not increase, the expansionary plans of Brazilian producers to increase capacity to 50 million tons by the end of the century, suggests a minimum increase of 16 million tons of flat-rolled products in the world market by the end of the century.

1/ American Metal Market, Oct. 3, 1986.
2/ Information developed in interviews with Brazilian industry officials.

With an eye toward long-term marketing arrangements and in response to increasing trade restrictions in certain countries, Brazilian producers have been shifting their export focus (table 5-6, following page). In 1983, Pacific Rim and Asian countries accounted for about 27.5 percent of Brazilian flat-rolled steel exports, the United States for 35.5 percent. In 1986, over 40.7 percent of all exported sheet and strip went to the East and 18.9 percent to the United States.

This geographic shift in export markets is, in large part, a reflection of the 1984 voluntary restraint agreement (VRA) negotiations that have set penetration limits and import quotas in certain flat-rolled products. 1/ Brazilian producers have targeted sheet and strip products as one priority area for renegotiation of increased allowances in 1989 in response to a decreased import market share since the implementation of Brazil's VRA in 1984 (table 5-7). 2/

Table 5-7
U.S. market share of certain sheet and strip imports from selected countries, 1981-86

(Percent)

Countries	1981	1982	1983	1984	1985	1986
Hot-rolled:						
EC.............	5.69	6.04	6.16	5.70	8.02	7.11
Canada.........	1.00	.97	1.35	2.59	2.46	2.99
Korea..........	.36	1.04	1.45	1.39	1.19	1.46
Japan..........	2.82	3.21	2.58	2.85	2.16	2.09
Brazil.........	.02	.41	1.94	1.56	.93	1.07
All imports....	10.64	12.70	16.15	18.49	17.45	16.38
Cold-rolled:						
EC.............	5.16	7.28	4.03	5.25	6.20	6.84
Canada.........	.70	.56	.55	.88	.93	1.12
Korea..........	.61	.51	1.15	2.15	1.57	1.80
Japan..........	2.40	2.40	3.50	4.93	4.08	3.63
Brazil.........	.11	.33	2.00	1.60	.86	.93
All imports....	9.86	12.96	14.60	20.55	17.09	16.95

Source: Calculated from AISI Annual Reports, 1984-1986.

Brazilian import sources for sheet and strip products have also shifted since 1983 (table 5-8, following). The largest increases have been in coated flat-rolled products from the United States (1,894 metric tons in 1986, up 23.3 percent) and from other Latin American countries (14,354 metric tons, accounting for 26.6 percent of total sheet and strip imports). Brazilian imports of steel products are subject to licensing requirements and import duties, both of which are subject to discretionary governmental review. However, duties may be lowered from the current levels of 20-45 percent ad

1/ Brazil also has an annually-negotiated quota arrangementt with the EC. See Chapter 4.
2/ Information developed from interviews with Brazilian industry officials.

Table 5-6
Brazilian exports of steel sheet and strip products

(In metric tons)

Market	Hot rolled sheet and coil		Cold-rolled sheet and coil		Galvanized and other coated		Stainless sheet		High carbon sheet and other specialty		Total flat-rolled exports		Percent of total flat-rolled exports	
	1983	1986	1983	1986	1983	1986	1983	1986	1983	1986	1983	1986	1983	1986
United States....	353,899	118,462	353,335	135,577	28,453	14,297	-	226	1,745	5,046	737,432	273,600	35.5	18.9
Japan............	133,716	166,026	2,572	15,137	-	1,347	-	-	-	-	136,288	182,510	6.6	12.6
China............	34,034	48,462	89,726	77,003	3,382	21,331	-	-	5,807	-	132,949	147,863	6.4	10.2
South Korea......	97,625	96,924	-	-	-	-	-	-	-	-	97,625	96,924	4.7	6.7
Other Asia.......	156,933	110,385	18,689	17,112	24,109	30,861	200	189	3,441	3,436	203,372	161,983	9.8	11.2
United Kingdom and Europe.....	90,530	55,642	-	22,377	10,368	23,658	-	-	499	900	101,397	102,577	4.9	7.1
South and Latin America........	66,781	75,383	27,048	30,275	9,889	38,865	2,879	463	17,506	17,301	124,103	162,287	6.0	11.2
Canada...........	-	-	-	-	-	151,788	-	454	-	1,067	-	17,309	-	1.2
Australia........	-	-	8,252	-	1,462	19,927	-	-	-	-	9,714	19,927	.4	1.4
Middle East......	468,680	160,641	-	11,188	1,100	2,984	-	-	-	-	469,780	174,813	22.6	12.1
All other........	36,871	65,515	19,280	20,402	5,279	18,529	74	-	866	105	62,370	104,551	3.0	7.2

Source: Consider 1983 and 1987.

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Table 5-8
Brazilian imports of steel sheet and strip products

(In metric tons)

Source	Hot rolled sheet and coil		Cold-rolled sheet and coil		Galvanized and other coated		Stainless sheet		High carbon sheet and other specialty		Total flat-rolled imports		Percent of total flat rolled imports	
	1983	1986	1983	1986	1983	1986	1983	1986	1983	1986	1983	1986	1983	1986
United States....	1	60	–	–	441	1,894	129	124	88	78	659	2,156	1.9	3.9
Japan............	–	–	489	956	3,980	3,081	530	412	1,288	1,657	6,287	6,106	18.4	11.3
United Kingdom and Europe.....	58	155	1,967	8,531	14,052	12,507	3,681	4,611	6,628	2,180	26,386	27,984	77.3	52.0
South Africa.....	–	–	–	–	–	–	780	986	–	–	780	986	2.3	1.8
South and Latin America........	–	–	–	980	–	14,354	–	–	–	–	–	15,334	–	28.4
All other........	–	1	15	121	–	924	–	263	–	39	15	1,348	0.4	2.5

Source: Consider 1983 and 1987.

valorem for sheet and strip products in the case of importers that qualify for industrial incentive programs, and import licenses may be denied under the "Law of Similars" if domestic producers claim they can supply the product.

Industry Outlook

The 1986-1989 National Plan for Development (PSN), cites a production target for the year 2000 of approximately 50 million metric tons per year, more than double the 21 million metric tons of crude steel produced in 1986. Of the projected 50 million metric tons, slightly more than 50 percent (25.7 million tonnes) will be flat rolled products. Such expansion would echo the growth of the last 5 years in which raw steel production has almost quadrupled and flat- rolled products have increased 25.5 percent (table 5-9).

Table 5-9
Brazilian production of flat products, 1983-86

(In Thousands of metric tons)

Products	1983	1984	1985	1986
Uncoated sheets and coils......	6,527.1	7,245.1	7,526.1	8,052.9
Plates and coils............	1,575.2	2,198.5	2,659.3	2,321.1
Hot-rolled coils............	2,559.2	2,435.7	2,212.5	2,586.1
Hot-rolled sheets...........	215.3	258.5	324.3	254.6
Cold-rolled coils...........	1,502.5	1,531.5	1,516.0	2,941.1
Cold-rolled sheets..........	377.7	421.3	421.5	472.1
Hot-rolled sheets coils......	3.3	4.5	2.7	11.2
Cold rolled high-carbon sheets and coils.........	-	-	-	-
Stainless steel sheets.......	54.0	63.4	72.8	81.2
Silicon sheets..............	49.3	50.9	59.0	70.0
Other alloy steel sheets and coils.....................	90.4	120.2	111.1	122.5
Black plates................	100.2	160.6	146.9	193.0
Coated sheets.................	626.8	669.2	794.0	930.1
Tin plates..................	368.8	349.2	335.7	401.9
Galvanized sheets...........	167.4	194.1	322.8	366.1
Terne plates................	3.1	3.1	4.9	-
Chrome-plated sheets.........	59.0	88.6	103.3	127.5
Other coated sheets.........	27.9	34.2	27.3	34.6
Total.....................	7,153.9	7,914.3	8,320.1	8,983.0

Source: <u>1987 IBS Statistical Yearbook</u>, pp. 1-13.

The most recent announcements detailing the Second National Steel Plan suggest that such expansion be accomplished by completing stage III of the planned expansion of existing plants. Greenfield construction in Maranhao state, as a foreign-controlled venture, has also recently been discussed.

Complementing recent capacity expansion at CSN and Cosipa, additional hot strip production will be installed at Usiminas (an additional 800,000-ton increase by the mid 1990's) and at Acominas and CST. Costs of completing these expansion programs is estimated at $820 per metric ton of capacity, in contrast to $1500 per $2000 per metric ton for greenfield construction. 1/

Additional objectives of the plan include "restarting of technical modernization programs" such as computerization and energy and materials conservation and a decrease in the ratio of exports/domestic production from 35 percent to 25 percent.

Although not detailed in the plan, it is most likely that Brazilian producers will continue the market diversification of the past 2 years in response to increased trade restrictions in certain traditional markets. The overview of marketing strategy described by industry officials is one of concentration on meeting the projected increases in domestic demand while retaining control of present export markets. Presently, some 25 to 30 percent of all sheet and strip production is exported. The goal of Brazilian producers is to develop long-term, stable agreements for end-users of high-value steel products. The United States represents such a market and will continue to be a focus of marketing efforts.

1/ Metal Bulletin, July 9, 1987.

CHAPTER 6. THE CANADIAN INDUSTRY

Introduction

The Canadian steel industry has grown from producing three to four million annual metric tons of raw steel in the early 1950's to 14 million metric tons in 1986. Raw steel production peaked in 1979 at 16 million metric tons, and averaged 2 percent of world production for 1984-1986. 1/ This growth has been attributed to cooperation between the industry and the government, who for many years formed a consensus on the desired structure of the industry. 2/ Liberal interpretation of the country's anticombine (antitrust) laws allowed product specialization by firm, allowing the industry to take advantage of economies of scale and maintain high operating rates in a small home market. Governmental trade and tax policies proved favorable to industry. 3/

In the 1960's and early 1970's, operating rates in the 90 percent range were common in the industry. During periods of high demand, imports were relied upon to supply the additional demand. As demand abated, the domestic producers drove imports out of the market to maintain high production levels. Capacity increases were generally well justified by domestic demand levels.

During the 1970's, the Canadian steel industry's expansion accompanied a corresponding expansion of markets served; this expansion included northern U.S. industrial markets. With this growth, the companies abandoned their historical restraint with respect to capacity additions and increased capacity substantially (the additions included an integrated greenfield plant, the last one built in North America). In 1976, Canada reversed its historical status as a net importer of steel and established itself as a net exporter. Since then, Canada has been a net importer in only 1 year (1981), when a strike shut down the largest producer for 4 months.

As conditions in world steel markets have not improved markedly since 1982, the Canadian steel industry, like many of its competitors, has had to reconsider its capacity and manning levels. Although the overcapacity problems of the Canadian industry were less severe than in the United States, early retirement programs, layoffs and shutdowns of certain production facilities have been necessary. However, most of these reductions have come in raw steelmaking (open hearth and ingot casting) facilities or nonsheet and strip production facilities. Emphasis on sheet production has actually increased in the 1980's, compensating, in part, for the depressed conditions in other product lines that utilize common production facilities or inputs (such as plate, pipe, and tube, etc.). 4/

1/ AISI Annual Statictical Reports, Various Years. The Canadian industry's share of world sheet and strip production averaged 3 percent for 1983-1985.
2/ D. Barnett, and L. Schorsch, Steel: Upheaval in a Basic Industry, 1983.
3/ Ibid.
4/ Information developed through interviews with Canadian industry officials.

Structure

The Canadian sheet and strip industry consists of seven firms, four of which are integrated (Stelco, Dofasco, Algoma, and Sidbec-Dosco), one of which is a specialty steel producer (Atlas Stainless), one of which is a scrap-based carbon and alloy producer (IPSCO), and one of which is a cold roller (Cold Metal Products, Ltd.). The sector is highly concentrated, with the top three companies (Stelco, Dofasco, and Algoma) accounting for about 90 percent of the carbon steel hot-rolling capacity. Atlas, as the only stainless sheet and strip producer, accounts for 100 percent of Canadian production capacity for these products. Table 6-1 indicates which sheet and strip products are produced by each of these companies.

Table 6-1
Market participation: Products of Canadian sheet and strip producers

Sheet and strip product	Algoma	Atlas	C.M.P. 1/	Dofasco	Ipsco	Sidbec-Dosco	Stelco
Hot-Rolled....	X			X	X	X	X
Cold-Rolled...	X		X	X		X	X
Galvanized....				X			X
Tin Plate.....				X			X
Electrical....				X			
Stainless.....		X					

1/ Cold Metal Products Co., Ltd.

Source: 33 Metal Producing, June 1984, interviews with industry officials.

The industry is concentrated in the manufacturing center of southern Ontario. The two largest firms, Dofasco and Stelco, maintain three works in the region that account for over 60 percent of Canada's flat rolled capacity. The third largest producer, Algoma, is located in northern Ontario at the convergence of Lake Huron and Lake Superior. These four steel works place the bulk of Canadian sheet and strip production close to the major Canadian and U.S. markets.

Corporate structures and patterns of ownership vary among firms in this industry. The three largest producers are publicly traded corporations with generally wide bases of ownership. Two producers, IPSCO and Sidbec-Dosco, have participation by Provincial governments. Atlas and Cold Metal Products are wholly owned by foreign corporations. Brief synopses of each company's ownership, organization, and major product groups are presented below.

Algoma Steel is the third largest steel company in Canada, with a single steelmaking works located in Sault Saint Marie, Ontario. Algoma is a fully integrated steel company competing in five principle product lines; sheet and strip, plate, seamless tubulars, structural shapes, and rails. Through its subsidiaries, Algoma also sells coal on the open market.

Algoma is a publicly traded company, with over 99 percent of its shares held in Canada. The principal shareholder is Canadian Pacific Limited, a diversified conglomerate based in Montreal, Quebec. Canadian Pacific Limited holds approximately 54 percent of Algoma's common stock. 1/

Atlas Stainless Steels Division, along with Atlas Specialty Steels Division comprise the steel production unit of Rio Algom Ltd., a subsidiary of RTZ Corp. Atlas, the lone stainless sheet producer in Canada, has two steel production facilities; in Welland, Ontario, and Tracy, Quebec. In July 1985, all of the firm's flat-rolled steel production was concentrated at the Tracy facility. New financial and marketing operations were formed at Tracy in order to serve the flat-rolled markets. 2/

Cold Metal Products, Ltd. (CMPL), is a subsidiary of the United States' largest cold-rolling firm. Until August 1987, the facility was a part of another U.S. firm, The Stanley Works. At that time, Cold Metal Products, Inc. (CMPI) purchased all three cold-rolling mills and the strapping division of Stanley. Two of these mills are located in the United States, with the third, formerly Stanley Precision, in Hamilton, Ontario. The Hamilton facility and the Canadian strapping operations are now a wholly owned subsidiary of CMPI. CMPL is the only stand alone cold-rolling facility in Canada, and serves internal and external markets with precision tolerance strip.

Dofasco is the second largest steel company in Canada, shipping 25 percent of the country's steel production out of its single mill site in Hamilton, Ontario. Dofasco concentrates on flat-rolled products, and is Canada's largest producer of sheet and strip. The company has been the most consistently profitable integrated steel mill in the world in recent years. According to company officials, it was the only integrated producer to make a profit in 1982. Dofasco is a publicly traded company, with 98 percent of its shares held by domestic investors. 3/

IPSCO, an electric furnace based steelmaker headquartered in Regina, Saskachewan, operates various pipemaking facilities throughout western Canada. IPSCO manufactures a diverse range of steel and steel products, including hot-rolled coil, sheet and plate; hollow structural sections; standard pipe; line pipe; oil country tubular goods; and large diameter pipe. The company has production facilities in Saskatchewan, Alberta, and British Columbia and markets its products throughout North America.

IPSCO has maintained a long record of profitability, posting its first loss in 1986 after 25 years of positive earnings. Depressed markets and revenues for pipe products overwhelmed efforts which had reduced raw steel production costs by 10 percent and nonfactory overhead costs by 15 percent over 1985 cost levels. 4/

IPSCO is owned by a combination of parties. Individual shareholders across Canada hold approximately 60 percent of the company's equity. The

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1/ Algoma annual report, 1986.
2/ Interviews with Atlas officials.
3/ Dofasco Annual Report, 1986.
4/ IPSCO Annual Report, 1986.

remaining 40 percent is split between two owners, each holding roughly 20 percent of IPSCO's stock. These organizations are the Province of Saskatchewan and Steel Alberta (owned 50 percent each by Alberta Energy Co. LTD. and Alberta Gas Trunk Line), a corporation linked to the Provincial government in Alberta. 1/

Sidbec-Dosco (Sidbec) is a relatively small producer of hot- and cold-rolled sheet, bars and rods, and pipe. Sidbec has four facilities in Quebec, however, sheet production takes place only at their Contrecoeur works. Sidbec is unique in Canada because of its production and use of direct reduced iron (DRI) for its iron units. The DRI is mixed with scrap to feed into the company's electric arc furnaces.

Sidbec has been owned by the Provincial government of Quebec since late 1968, when the facilities were bought from the British-based Dosco Ltd. An ill-fated investment in an iron ore mining subsidiary (Sidbec-Normines) resulted in a drain on company revenues until it was permanently closed in 1984. The Province has subsidized the company's operating budget since 1974, covering losses every year through 1985. During the years from 1974 to 1985, the company accumulated a deficit in the area of Can$800 million (US$600 million). In 1986, Sidbec posted a modest Can$6.5 million (US$4.9 million) profit on sales of Can$518 million (US$389 million). 2/ The Government of Quebec has disclosed that the company's return to profitability will mean that it must no longer rely on government financing. Although rumors of privatization circulate periodically, the Government steadfastly maintains that such a move is not currently planned. However, Sidbec's directors are looking at a number of joint-venture possibilities, especially in the areas of production and marketing. 3/

Stelco is Canada's largest steel producer, manufacturing a wider range of products than most Canadian steelmakers. Stelco accounts for approximately one-third of the country's steel production, and is the second largest sheet producer. Stelco has two integrated facilities located in Hamilton and Nanticoke, Ontario, and two minimill facilities in Contrecoeur, Quebec, and Edmonton, Alberta. In addition to sheet products, Stelco also produces steel in plate, bar, rod, pipe and tube, and wire and wire product forms.

Stelco Inc. is a holding company which oversees two operating groups; Stelco Steel and Stelco Enterprises. Stelco Steel has responsibility for the company's core steelmaking units. Stelco Enterprises oversees the operations involved in manufacturing fasteners, forgings, pipes and tubes, wire products, drawn steel, and communications and advertising. Stelco stock is publicly traded, with approximately 97 percent held in Canada. 4/

1/ Ibid.
2/ Information provided upon request by Sidbec-Dosco.
3/ Metal Bulletin, Apr. 10, 1987.
4/ Stelco Annual Report, 1986.

Integration

The three integrated firms, Algoma, Dofasco, and Stelco, each have holdings in raw material companies, purchasing their requirements from a variety of U.S. and Canadian mines.

Coal

Stelco and Algoma are the only Canadian sheet and strip producers with equity participation in coal mining. Dofasco owns no coal mines, and purchases all of its coal on the open market. Algoma owns several coal mines in West Virginia under the auspices of its Cannelton Industries subsidiary. These mines supply about 90 percent of Algoma's coking coal needs. Stelco has two subsidiaries and three joint ventures for the mining of coal. These holdings allow Stelco to supply roughly two thirds of their coking coal requirements. The company owns outright the Chisholm Mine in Kentucky and the Madison Mine in West Virginia. In addition to these holdings, Stelco has ownership in the following coal mining companies:

Company	Location	Ownership (Percent)
Mathies Coal Co.........	Pennsylvania	13.3
Beckley Coal Mining Co....................	West Virginia	12.5
Olga Coal Co...........	West Virginia	10.0

Iron ore

All three of the integrated producers are involved in iron ore mines with U.S. partners who have filed for bankruptcy. Algoma and Stelco are partners in the Tilden Iron Ore Partnership (annual capacity of 8.1 million metric tons), located in Tilden Township, Michigan. Three bankrupt U.S. companies (LTV, Sharon, and Wheeling-Pittsburgh) hold 21 percent of the equity in the mine. 1/ Algoma holds a 30 percent share and Stelco holds a 10 percent share of the partnership.

Tilden, a relatively new mine, has high fixed costs. Although improvements have been made, delivered iron ore costs are higher than other readily available sources. 2/ Algoma recently bought $78.8 million worth of debt associated with the Tilden Mine. The managing partner of the mine, Cleveland-Cliffs Iron Co. (39 percent ownership), purchased 126 million dollars' worth of the mine's debt in late summer of 1987. Cliffs is reportedly considering reducing capacity at Tilden by 50 percent. 3/

Dofasco (16.4 percent) and Stelco (34.5 percent) both are part owners of the Wabush Mines joint venture (annual capacity of 6.1 million metric tons),

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1/ World Steel Dynamics, Core Report Z, April 1987.

2/ Ibid.

3/ American Metal Market, Aug. 20, 1987.

which includes LTV and Wheeling-Pittsburgh as partners, with a combined 25.8 percent share. 1/ Stelco realizes that there are potential problems associated with both the Tilden and Wabush joint ventures, however, maintains that the "ultimate effect on Stelco of these bankruptcy filings is indeterminate." 2/

These companies also have participation in iron ore mines that are currently free of bankrupt partners. Algoma's wholly owned mine, the Algoma Ore Division in Wawa, Ontario, produces prefluxed pellets that allow lower cost operation of blast furnaces.

Dofasco holds a 90 percent share of the Sherman Mine (annual capacity of 1.1 million metric tons), wholly owns the Adams Mine (annual capacity of 1.1 million metric tons), and has invested in the Iron Ore Co. of Canada (6.07 percent). 3/ All of these mines are located in Canada, allowing Dofasco to purchase its iron ore with little concern for the U.S./Canadian exchange rate.

Stelco is involved in two other iron ore joint ventures, the Eveleth Mine and Hibbing Taconite, both of which are located in Minnesota. Hibbing has the lowest variable and full costs and also lowest delivered cost of any mine in the United States. Eveleth, expanded in 1977, has lost money every year since despite high operating rates. Eveleth is probably Stelco's highest cost source of pellets, since the April 1986 closure of their wholly owned Griffith mine. 4/ Closing Griffith cost Stelco Can$53 million (US$40 million). 5/

Downstream integration

The Canadian sheet and strip industry has been involved in downstream processing for some time. Several companies, including Algoma, IPSCO, Stelco, and Sidbec, participate in pipemaking activities through captive operations, subsidiaries, or joint ventures.

In the mid-1960's, Dofasco and Stelco formed Baycoat Ltd., a coil coating operation in the Hamilton, Ontario, area. Dofasco and Stelco each own 50 percent of Baycoat. 6/ In the late 1960's, Algoma formed their unfinished parts operation. This operation is aimed at the automobile manufacturers and other high volume manufacturers, and offers first stage blanking services. 7/ The operation has proved to be very successful, and is a move now being emulated by some other steel producers.

The Canadian industry is increasing their participation in value-added products. In December 1986, Dofasco acquired, for cash, the assets and operations of a long term customer; the U.S.-based cold roller, Wittar Steel

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1/ World Steel Dynamics, op. cit.
2/ Stelco Annual Report, 1986.
3/ World Steel Dynamics, Core Report Z, April 1987.
4/ Ibid.
5/ Interviews with Stelco officials.
6/ Interviews with Canadian industry officials.
7/ First stage blanking is the initial manufacturing step in processing sheet into stamped parts.

Strip. The acquisition of Wittar cost Dofasco Can$45.5 million (US$34.1 million). 1/ Stelco recently entered into an agreement with Jannock Ltd., creating a partnership that will run several steel fabricating operations formerly wholly owned by Jannock. Stelco reportedly is paying Can$81.3 million (US$62.3 million) for a half interest in the venture. 2/

Stelco and Dofasco have recently joined with General Motors and A.G. Simpson, a major Canadian auto parts manufacturer, in a joint venture to provide blanks to General Motors' new Canadian stamping facility. This is a significant move for the Canadian steelmakers, as it represents a major move into the exposed exterior panels market. Previously, most Canadian sheet consumed by the U.S. automakers was for unexposed applications. 3/

Capacity and Production

The Canadian sheet and strip industry is relatively small, with two sources estimating approximately 10 million metric tons of hot strip mill capacity (table 6-2).

Table 6-2
Canadian steel industry: Estimations of hot strip mill capacity, by sources

Firm	Number of hot strip mills	Energy, Mines and Resources Can	World Steel Dynamics
		Million metric tons	
Algoma..................	1	2.0	1.2
Atlas...................	1	.08	1/
Dofasco.................	2	4.1	4.4
IPSCO...................	1	.68	.68
Sidbec-Dosco............	1	.50	.45
Stelco..................	2	3.6	3.6
Subtotal...............	8	10.96	10.33
Minus cut-to-length plate 2/..............		.96	.96
Total................	8	10.0	9.37

1/ No estimate given.
2/ Estimate by industry officials.

Capacity utilization among the sheet producers in the Canadian steel industry has been relatively high in recent years. Table 6-3 shows total steel production and estimated finished product capability for six producers. The high rates of utilization experienced by some of these producers allows them to post low fixed costs per ton. It should be noted that the utilization rates generally increase in tandem with the importance of sheet products in a

1/ Dofasco Annual Report, 1986
2/ "Stelco and Jannock in Partnership," American Metal Market, Oct. 5, 1987.
3/ Metal Bulletin, Aug. 5, 1986.

Table 6-3
All steel products: Capacity utilization of primary sheet producers, 1981-85

Firm	Production of finished products 1981	1982	1983	1984	1985	Finished product capability 1/	1985 capacity utilization
	---------1,000 metric tons--------						Percent
Algoma....	2,285	1,335	1,594	1,770	1,872	2,313	80.9
Atlas.....	192	121	131	171	162	340	47.7
Dofasco...	2,924	2,433	2,593	3,011	2,956	3,040	97.3
IPSCO.....	406	297	287	384	403	544	74.0
Sidbec....	1,133	782	841	942	997	1,334	74.8
Stelco....	3,451	3,243	3,264	3,632	3,650	4,445	82.1

1/ Current capability. Algoma and Stelco have both significantly reduced their capability during the time period and had lower capacity utilization levels than indicated here in some years.

Source: Laciak, Stephen, "A Competitive Analysis of the Canadian Steel Industry," Wood Gundy, Inc., January 1987, p. 30.

company's product mix, and that sheet production facilities have generally run at higher levels than most other nonsheet facilities.

In an effort to increase capacity utilization, some firms are cutting capacity levels. Algoma is in the midst of significantly reducing raw steelmaking capacity from 3.2 million metric tons to 2.3 million metric tons. Although Algoma's annual raw steel production levels were in the 2.7 to 3.2 million metric ton range from 1977 to 1981, since the 1.7 million metric ton production mark posted in 1982, annual raw steel production has fluctuated from 2.1 to 2.4 million metric tons. 1/ With the downsizing, Algoma expects to be able to continuously cast 100 percent of its output by the end of 1987, up from 70 to 75 percent in recent years. 2/ Annual flat-rolled production, including plate, is in the vicinity of 725,000 metric tons of hot-rolled products and 160,000 metric tons of cold-rolled products. 3/

Atlas's plant in Tracy is a relatively small operation, currently capable of producing in the area of 45,000 to 54,000 metric tons per year. 4/ Production in recent years has been near capacity levels. Atlas officials characterize their operation as a labor-efficient, equipment-driven mill.

Dofasco's facilities are somewhat unbalanced after investment in capacity increases in various stages of processing during the late 1970's and early 1980's. Current investment is aimed at balancing various process capacities and improving quality. Estimates of nominal rolling capacity on their two hot

1/ Algoma Annual Report, 1986.
2/ Information developed in interviews with Algoma officials.
3/ Information developed in interviews with industry officials.
4/ Information developed in interviews with Atlas officials.

strip mills are in the vicinity of 4.3 million metric tpy (table 6-2). Dofasco has a cold reduction mill rated at 1.9 million metric tons per year (mtpy), while temper mill capacity is only 1.3 million mtpy. 1/ Finished flat-rolled capability, constrained by the demands of their foundry for raw iron and steel, has been estimated at 3.0 million metric tons per year (table 6-3). Dofasco also has four hot-dip galvanizing lines and two electrolytic tin lines.

In 1986, Dofasco shipped about 3.0 million metric tons of flat-rolled products, approximately 2.8 million tons of which was sheet. 2/ The breakdown of sheet shipments by product categories is further estimated to be 860,000 tons of hot rolled, 770,000 tons of cold rolled (including electrical steels), 450,000 tons of tinplate, and 725,000 tons of galvanized. 3/

IPSCO's steel manufacturing and coil production facilities in Regina, Saskatchewan, have a total melting capacity of 725,000 annual metric tons. 4/ Sheet production facilities include a reversing high lift slab and plate mill, a four-high roughing mill, a reversing hot-finishing mill and other auxiliary equipment. IPSCO does not produce cold-rolled sheet. The annual capacity of the hot-rolling equipment has recently been increased to about 680,000 metric tons from 590,000 metric tons. 5/ Production of sheet and skelp in recent years has been about 540,000 metric tons, although 1986 production levels were well below this figure. 6/ Typically, one-half of IPSCO's production is used as skelp in their pipe manufacturing operations and one-half is sold as hot-rolled sheet.

At its Contrecoeur plant, Sidbec has approximately 1,200,000 annual metric tons of raw steel capacity. Sidbec's Montreal works also has approximately 180,000 metric tons of melting capacity, however this production is cast into billets and not used to produce sheet products. 7/ Sidbec's hot strip mill has an annual capacity of about 500,000 metric tons (table 6-2), which is not quite matched by the 450,000 ton per year capacity of the company's slab caster. 8/ Recent sheet production levels are estimated at 270,000 tons per annum, with 135,000 tons shipped as hot rolled and 135,000 tons shipped as cold rolled. 9/ Sidbec has a Sendzimer cold-rolling mill, rated at about 250,000 mtpy. 10/ The Sendzimer allows Sidbec to maintain close dimensional tolerences on their cold-rolled material.

Because of the size of The Stanley Works, and the fact that CMPI is a privately held firm, detailed information on the CMPL operation is unavailable. The Hamilton plant, although lacking melting facilities, does

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1/ Energy, Mines, and Resources Canada, Publication MR 214, 1987.
2/ Interviews with industry officials.
3/ Ibid.
4/ IPSCO company publications.
5/ American Metal Market, Feb. 21, 1985.
6/ Interviews with industry officials, IPSCO 1986 annual report.
7/ Energy, Mines and Resources Canada, Publication MR 214, 1987.
8/ Interviews with industry officials.
9/ Ibid.
10/ Energy, Mines and Resources Canada, Publication MR 214, 1987.

have a wide range of rolling and processing equipment, and annual cold-rolling capacity is estimated to be in the vicinity of 80,000 metric tons per year. 1/

Stelco has a raw steelmaking capacity of 4.7 million annual metric tons, down from a peak of 6.8 million tons in 1982. 2/ Currrent capacity matches well with recent total steel production levels at the company, which have ranged from 4.1 to 4.6 million metric tons through out the 1980's; total steel production in 1986 was 4.4 million metric tons. 3/ Most of the reduction in raw steel capacity came about through the closure of Stelco's open hearth furnace shops. Stelco officials feel that the current size of the company is well suited for it's current markets, and do not anticipate any further major reductions in capacity.

Stelco has a hot flat-rolled capacity of around 3.6 million metric tons per year (table 6-2). Cold-rolled reduction capacity of about 1.4 million metric tons per year is augmented by cold-rolled skin and temper facilities of about 1.5 million metric tons per year. 4/ Current improvements being undertaken on one hot- strip mill aimed at quality improvement should increase capacity slightly. Stelco also maintains three galvanizing and three electrolytic tinning lines for the production of coated sheet products. Sheet shipments for 1986 are estimated to be around 2.1 million metric tons, 815,000 tons of which was hot-rolled product, 410,000 tons was cold rolled, 450,000 tons was tin plate and 450,000 tons was galvanized. 5/

Investment and Modernization

All of the steel producers in the Canadian sheet and strip industry have recently, or are currently, involved in investments to upgrade their sheet facilities. Continuous slab casting and ladle treatment facilities have accounted for most of the investment, however, several rolling mills have benefited from improvement programs as well. All these investments are aimed at improving product quality, but will have generally beneficial effects on productivity and operating costs as well.

Algoma has just completed investment in their 106 inch hot strip mill, costing an estimated Can$9 million (US$6.8 million). This mill was moved and computerized in 1974, and new automatic gauge control is currently being installed. This system includes x-ray thickness gauges, new electrical hardware on electromechanical screwdowns, hydraulic controls on the final three stands, and an updated computer. 6/

Algoma is also proceeding with engineering work on several other projects within their "Program of Action." Implemented in April 1986, the program includes reducing raw steel capability to equal continuous caster capability, construction of a vacuum ladle metallurgy facility, and two major projects not

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1/ Ibid.
2/ Iron Age, July 1987.
3/ Stelco Annual Reports.
4/ Energy, Mines, and Resources Canada, Publication MR-214.
5/ Interviews with industry officials.
6/ "Algoma Sheet Products Update," 1986.

related to sheet production. Upon completion, Algoma expects to produce 100 percent of their steel through the continuous casting process. 1/

Atlas is concentrating investment in the hot end of their works. New controls were recently added to their continuous caster, and engineering work is in progress to install an Argon Oxygen Decarburization station. This will lower the cycle time on their single electric furnace, effectively boosting their capacity to the vicinity of 64,000 to 68,000 mtpy. Atlas must also invest in water treatment facilities as Provincial enviromental regulations and enforcement are increasing. 2/

Two capital investment programs, one running from the mid-1970's to the mid-1980's and one currently ongoing, will cost Dofasco in the vicinity of C$2.5 billion (US$1.9 billion). Equipment installed in the earlier program includes the following:

Year	Equipment
1976......	No. 2 five-stand cold-rolling mill
1978......	No. 2 melt shop and No. 6 coke oven
1980......	Improvements to No. 4 blast furnace (bell-less top)
1981......	No. 4 galvanizing line
1983......	No. 2 hot strip mill, improvements to No. 3 BOF
1984......	Batch annealing facilities, convert galvanizing line to Galvalume
1985......	No. 4 continuous pickling line

This program was aimed at increasing Dofasco's capacity. Original plans to double capacity from 2.7 million mtpy to 5.4 million mtpy were reduced, and capacity was increased by about 1.4 million mtpy. 3/

The current construction program includes a slab caster, slab reheat furnaces, ladle metallurgy station, additional finishing stands on one of their hot strip mills, and modification of another BOF. This program will allow Dofasco, a pioneer in the direct rolling of ingots, to directly roll slabs into hot-rolled sheet. This (Can$700 million, US$525 million) program is not aimed at increasing capacity, but rather improving quality, productivity, and costs. 4/ However, because of yield improvements, Dofasco's maximum shipping capability will be increased. Upon completion of these modifications to the hot end of the mill, Dofasco is planning a Can$500 million (US$375 million) cold-rolling complex. This will include a tandem mill, a continuous annealing line, a temper mill, and yet another pickling line. 5/ The construction of additional pickling capacity is expected to reduce the large quantities (about 270,000 metric tons in 1985) of Canadian hot-rolled sheet that is pickled on a tolling basis in the United States.

1/ Information pamphlets provided by Algoma officials.
2/ Interviews with Atlas officials.
3/ Iron and Steel Engineer, September 1984.
4/ Iron Age, Mar. 7, 1986.
5/ Ibid.

IPSCO has recently invested in a moderization of their Regina works, involving the installation of a high-speed slitting facility (425,000 metric tons per year), a ladle furnace, a continuous slab caster, a slab reheat furnace, and related rolling mill modifications. 1/ The program, costing over Can$65 million (US$50 million), is designed to allow direct rolling of hot slabs into coil, resulting in cost, time, and energy savings. 2/ These facilities were completed in early 1987 and will allow IPSCO to improve production yields and quality.

Sidbec has been investing throughout the late 1970's and early 1980's in their facilities, including a 45-percent increase in cold-rolling facilities in 1985. 3/ Current plans call for expenditures of Can$30 million (US$23 million) a year over the next 3 years to upgrade various sheet and nonsheet facilities. Most of 1987's expenditures were earmarked for the sheet facilities and melt shop at Contrecoeur. The melt shop is being converted from four furnaces to two furnaces, however, the move will actually increase raw steel capacity as efficiency will be greatly increased. The planned investments will be aimed at increasing productivity and placing more emphasis on cold-rolled sheet production and sales, at the expense of their participation in the hot-rolled market.

One investment being considered for sheet products is the installation of a tension leveler. Currently, the company is slitting bad edges off their sheet in order to ship acceptable coils. The installation of a tension leveler will allow those coils to be brought up to marketable specifications without the slitting operation. This will allow shipment of wider coils and improve Sidbec's overall yield. 4/

Stelco has committed substantial sums of money to their production facilities since the late 1970's, including investment in the most recent integrated facility in North America, the Lake Erie Works (LEW) in Nanticoke. The project, at a cost of over Can$1.1 billion (US$825 million), added 1.4 million metric tons of raw steel capacity and about 1.2 million tons of hot-rolled coil capacity. 5/ This installation gave Stelco its first continuous slab caster, and LEW's high-quality product made Stelco realize the shortcommings in the steel produced at their Hilton Works, leading to the current modernization program at that facility. 6/

Stelco is currently spending Can$400 million (US$300 million) for the purpose of upgrading Hilton works, in order to improve productivity and quality. 7/ The program is focused on the installation of two continuous casting machines, one exclusively for slabs and another that can cast blooms or slabs. The slab/bloom caster was brought on line on August 25, 1987, and the slab caster started up in November, 1987. 8/ The new casters, equipped

1/ Information provided by IPSCO.
2/ IPSCO Annual Reports, 1985 and 1986.
3/ The Gazette, Mar. 14, 1987.
4/ Discussions during plant tour with Sidbec-Dosco personnel.
5/ Royal Bank of Canada, Industrial Report on the Iron and Steel Industry, May 1986.
6/ Interviews with Stelco officials.
7/ 33 Metal Producing, September 1987.
8/ American Metal Market, Nov. 2, 1987.

with advanced process control and quality monitoring processes, will allow Stelco to continuously cast over 80 percent of their total steel output. 1/ The casters were contracted for through Mitsui and Co. (Canada), a subsidiary of a Japanese trading house that provided favorable financing for Can$315 million (US$236 million). 2/

The project also includes an upgrade of the continuous cold mill and modifications to the BOF shop, including provisions for ladle processing. The cold mill modifications generally involve control equipment; hydraulic guage control, tension, and speed controls, and improved x-ray thickness gauges. Upon completion of the program, Stelco will be able to produce the tight tolerance material that is increasingly being demanded by the major customers of high-value sheet steel. 3/

Stelco is also investing in improvements to their 1983 vintage hot strip mill at their Lake Erie Works. Improvements encompassing new guage controls, repowering of the existing stands, and the addition of another complete rolling stand are aimed at allowing the mill to roll wider and thinner coils at closer tolerances and higher surface quality levels. An added bonus is that yield will increase, slightly increasing the mill's capacity. 4/

Research and Development

Research and development (R&D) work in the industry is accomplished through a combination of internal and external resources. Several firms have internal R&D departments pursuing both process and product technology.

Multilateral projects are examined by the Canadian Steel Industry Research Association, (CSIRA), a joint government/industry forum for R&D efforts. The industry is involved in cooperative research at several universities across Canada, including McGill University in Montreal, where CSIRA funds half a chair for research. Membership in CSIRA affords firms favorable terms when contracting work at McGill. 5/

Stelco funds two chairs of metallurgy, one at McMaster University in Hamilton and one at the University of British Columbia in Vancouver. Additional university funding and research is accomplished through three graduate research fellowships. 6/

Committment to R&D

Committment to funding R&D varys among the Canadian sheet and strip industry. Dofasco, for example, is increasing their financial commitment to R&D, although staffing in the R&D department has been steady over the past

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1/ 33 Metal Producing, September 1987.
2/ Interviews with Stelco officials.
3/ Interviews with Stelco officials.
4/ Ibid.
5/ Interviews with Canadian Government officials.
6/ Stelco Annual Reports.

5 years. Productivity of their research personnel is reported to be high, thanks to continued investment in sophisticated equipment. 1/ Company officials characterized R&D spending levels as three times the "healthy" level for a company of their size, and 10 times the historical (pre-1982) level for the company.

IPSCO, on the other hand, has recently restrained its R&D efforts, refraining from implementing any new long-term projects. However, both long and short-term projects are under way, with the short-term projects aimed at rapid returns to improve the company's profitability. 2/

Current emphasis

Current product research in the industry is aimed at improving the existing products. Various companies are pursuing new steel chemistries and coated sheet applications. Efforts are underway to either improve existing coatings or develop new coatings for sheet products destined for the automotive, container, and prefinished steel markets. 3/

Recent R&D efforts in the processing area have concentrated on cost reduction, quality improvement, and increasing productivity and steelmaking yields.

Employment Issues

Average total employment in the Canadian sheet and strip industry has been declining in recent years. Most producers in the industry, with the exception of Dofasco and Atlas, have recently made labor force reductions to bring staffing in line with current capacity and production levels (table 6-4). Much of this attrition has been accomplished through early retirement programs, although layoffs have contributed in certain cases. Early retirement plans in the Canadian industry pose few problems, as Provincial laws require fully funded pensions. Pension trusts are set up separately from the company, usually with company officials as trustees. However, the corporation cannot access those funds for purposes other than pension payments.

1/ Interviews with Dofasco officials.
2/ IPSCO Annual Report, 1986.
3/ Interviews with industry officials.

Table 6-4
All operations: Total average annual employment in certain years for Canadian sheet and strip producers, 1981-86

Firm	Total employees 1981	1984	1985	1986	Percentage reduction
Algoma..................	1/	9,500	1/	8,000	15.8
IPSCO..................	1/	1,657	1,535	977	41.6
Stelco 2/..............	26,263	1/	1/	17,768	32.2
Sidbec-Dosco...........	4,190	3,480	3,260	3/ 3,130	25.3

1/ Not available.
2/ Figures are for core steelmaking operations only.
3/ Sidbec plans an additional workforce reduction of 250 for 1987-88. Metal Bulletin, Apr. 10, 1987.

Source: Algoma, IPSCO, Sidbec-Dosco, and Stelco Annual Reports, various years.

As ingot casting operations are retired in 1987, further workforce reductions at Algoma are expected. Algoma's reductions are being accomplished largely through retirement incentives. 1/ IPSCO'S staffing reductions, mandated by a 1985 management decision, have included permanent reductions in nonhourly positions, accomplished through transfers, early retirements, and terminations. Throughout 1986, 141 salaried jobs were eliminated throughout the company's facilities, a reduction of 24 percent. 2/

At Stelco, productivity has increased with the decline in employment, from an average of 170 annual tons per employee in 1981 to 275 annual tons per employee in 1986. Much of the attrition was accomplished by early retirement plans, involving the reduction of the actuarial penalty in order to make retirement more attractive. Two plans were implemented, the Voluntary Early Retirement Plan and, later, the Compulsory Early Retirement Plan. 3/

Productivity

As a whole, labor productivity in the Canadian industry is believed to be close to productivity levels in the U.S. industry. Wide disparities between facilities exist, with industry estimates of Stelco's Lake Erie Works as low as 2.2 man-hours per metric ton (mhpmt) for hot-rolled coil. The industry average is believed to be about 3.9 mhpmt. 3/ Average productivity in the production of cold-rolled coil is estimated by various sources to be between 5.5 to 6.1 mhpmt. 4/ The Canadian industry is currently installing considerable continuous slab casting capability, a move that will generally improve productivity. Upon completion of several caster construction projects in 1987, an estimated 75 percent of Canadian slab production will be via this process.

1/ Algoma annual reports.
2/ IPSCO Annual Report, 1986.
3/ Interviews with Stelco officials.
4/ Ibid.

Strike activity

Strikes in the Canadian sheet and strip industry have been infrequent in recent years. Stelco has experienced a long history of strikes, partly because of its position as the largest company in the industry. Negotiations and settlements at Stelco set the standard for agreements throughout the rest of the industry. The United Steel Workers (USW) affiliated union has called for several strikes, the most recent in 1981 when sheet production at Hilton works in Hamilton was interrupted for 125 days and production at Nanticoke was interrupted for 1 month. 1/ IPSCO's workforce last went on strike in 1979, for 10 weeks. Sidbec's production workers struck for 9 days in November 1987. Dofasco has maintained a strike-free record throughout its history.

Compensation

Through the 1950's and 1960's, wage rates in the Canadian steel industry were affected by Government price and wage controls, many of which were in effect at contract negotiation times. 2/ Over the years, wage rates in the Canadian industry fell behind U.S. pay scales. The Canadian dollar's fall from parity with the U.S. dollar further bolstered the Canadians' labor cost advantage. Recently, the trend has reversed, as U.S. wage and benefit packages have been frozen or scaled back, whereas Canadian compensation has generally continued to increase in value. Currently, the average Canadian wage and benefit package is worth about Can$23.00 (US$17.50), and the average U.S. wage and benefit package is worth about $22.50. The savings in wages paid gained by the industry through workforce reductions have been somewhat offset by the general trend of increasingly lucrative wage and benefit packages. This trend is an item of concern to management officials, as labor costs in steel production typically account for about 40 percent of total input costs. 3/ Some contracts have gained management flexibility in scheduling and staffing through reductions in job classifications.

Recent contracts

In 1986, Algoma introduced wage and benefit reductions for salaried personnel ranging from 8 to 18 percent, with the higher reductions comming at the top end of the salary scale. 4/ Similar reductions were rebuffed by the union workforce. Company financial records were then made available to the Union in order to convince them of the company's position. In early June 1987, Algoma's unions accepted a new 1-year contract 2 months before the end of their existing contract. The contract froze wage and benefit remuneration at the same level as under the previous contract. 5/

A new 3-year contract was recently ratified at IPSCO's sheet production facilities. This contract continues cost of living allowance increases, which

1/ Interviews with industry officials.
2/ Barnett and Schorsch, op. cit.
3/ Interviews with industry officials
4/ Algoma Annual Reports.
5/ Interviews with Algoma officials.

union officials estimate will add Can$1.18 (US$0.89) per hour to base pay by the end of the contract. Pension benefits for retiring employees increased by Can$10.00 (US$7.50) per month for each year of service. Benefits for already retired employees were increased by Can$40.00 (US$30.00) per month. Long-term disability and accident and sickness benefits were also significantly increased. Basic hourly wages range from Can$14.90 (US$11.18) to Can$19.83 (US$14.87), averaging Can$16.63 (US$12.47). 1/

In Stelco's two contract negotiations since 1981 (1984 and 1987), the union has been successful in increasing the total benefit package, including both cost of living adjustments and pension/health care improvements. Estimates by the USW indicate that the labor package agreed to in 1984 increased benefits by Can$3.14 (US$2.36), whereas the 1987 contract contains measures worth an estimated Can$3.80 (US$2.85) per hour over the life of the contract, including a 64-percent increase in pension payments. Although not unionized, Dofasco generally matches or betters the contracts agreed to between Stelco and the USW.

The recent 3-year contract agreed to at Sidbec provided for two wage increases (Can$0.25 (US$0.19) per hour effective December 1, 1987 and Can$0.30 (US$0.23) per hour effective January 31, 1991) and introduced profit sharing. Sidbec officials estimate that the contract will cost the company Can$12.5 million (US$ 9.4 million) per year over the life of the contract. 2/

Labor policies

Algoma has recently begun efforts to improve communications between labor and management, in order to create a mutual understanding of the current problems Algoma and its employees face as a result of the reduction in size of the firm. One vehicle for improving communications are the joint management/ labor force Employee Involvement Groups (EIG's) that have introduced programs aimed at improving the quality of product, the cost structure of various processes, and the level of understanding between management and labor.

From the company's founding in 1912, Dofasco's labor practices have fostered a productive environment. The company's single site makes for short channels of communication, and a nonhierarchal organization allows employee grievancies and suggestions to travel easily up the line. 3/ Although some rudimentary work rules do exist, Dofasco officials claims greater labor flexibility than its competitors.

In 1937, Dofasco introduced profit sharing for all employees. The profit sharing mechanism has evolved over the years into a twofold, tax-deferred program; the "Employees Savings and Profit Sharing Fund" (Fund) and the "Employees Deferred Profit Sharing Plan" (Plan). The company contributes 11 percent of pretax profits to the profit sharing programs, distributed equally to all employees.

1/ American Metal Market, Sept. 9, 1987.
2/ Metal Bulletin, Nov. 26, 1987.
3/ Interviews with Dofasco officials.

The Fund is the primary pension vehicle to which the employee contributes Can$200 (US$150) per year. The company, from the profit sharing, contributes three times the amount contributed by the employees (currently Can$600, US$450). All of the money in the Fund must stay there until resignation, retirement, or dismissal of the employee. A sliding scale determines payments upon separation, ranging from 50 percent to 100 percent, based on the length of service with the company. The remainder of the 11 percent goes into the Plan. Money in the Plan can be removed at any time. 1/

In a unique approach to reducing payroll obligations during business lulls, IPSCO has developed a voluntary leave program for nonunion employees. This program allows supervisors to grant leave at two-thirds normal pay when it is mutually beneficial to the company and worker. Through this program IPSCO hopes to be able to maintain trained and experienced personnel for normal and high demand levels, while reducing payroll expenses during lean times.

Conditions in the Canadian Industry

The Domestic Market

The industry groups that are the major customers of the Canadian sheet steel industry are similar to those of the U.S. industry, with automotive and service center markets accounting for almost one-half of domestic sheet shipments (table 6-5). It is the estimation of industry personnel that approximately one-half of the service center sales end up in the automotive sector. Canadian steel service centers (SSC's) are more concentrated that those in the United States, and one SSC's (Russel Steel) sales will exceed Algoma's in 1987. 2/

1/ Information provided by Dofasco.
2/ Interviews with Algoma officials.

Table 6-5
Sheet and strip products: Domestic shipments of Canadian steel sheet and strip to industry sectors, 1982-86

Industry sector	1983	1984	1985	1986	1987	5-year average percent of domestic shipments
	----------1,000 metric tons--------					
Service centers, etc.....	549	832	940	1,049	1,141	20.1
Motor vehicles and parts..................	777	1,167	1,405	1,510	1,421	28.0
Railway, operating.......	3	2	1	1	1	0
RR cars and locomotives..	10	10	16	10	9	.3
Shipbuilding............	0	1/	1/	1/	1/	0
Steel fabricating........	59	57	63	75	71	1.5
Metal building systems...	33	34	26	26	26	.6
Contractors products.....	319	373	376	398	419	8.4
Stamping, pressing, and coating................	278	335	373	391	396	7.9
Natural resources and mining.................	14	4	7	6	5	.2
Agricultural equipment...	47	45	47	27	32	.9
Nonelectrical machinery..............	43	46	47	42	35	1.0
Electrical machinery.....	83	94	112	106	105	2.2
Industrial packaging.....	99	130	126	131	133	2.8
Pipes and tubes..........	471	617	805	761	695	14.9
Wire and wire products...	9	7	11	18	14	0.3
Containers and closures..	404	410	385	386	351	8.6
Appliances and utensils..	92	119	93	106	109	2.3
Miscellaneous...........	1	1	1	1	1/	0
Total domestic shipments 2/.......	3,292	4,282	4,834	5,044	4,962	

1/ Less than 500 tons.
2/ Columns may not sum to total because of rounding.

Source: Statistics Canada, "Primary Iron and Steel," Catalogue 41-001, December issues, 1982-86.

Since 1982, six industry sectors have accounted for an average 87.9 percent of total domestic shipments. Percentage breakdowns of domestic sales for the top six industry sectors for four major product groups are presented in table 6-6.

Table 6-6
Sheet and strip: Domestic mill shipments to industry sectors, 1982-86

(In percent)

Industry	All sheet and strip	Hot rolled sheet and strip	Cold rolled sheet and strip and other coated	Tin plate/ tin free steel	Galvanized sheet
Motor vehicles and parts.......	28.0	38.5	24.3	1.0	20.8
Service centers and distributors....	20.1	23.6	20.4	3.9	19.1
Pipes and tubes...	14.9	26.3	9.8	0	1.9
Containers and closures........	8.6	1/	.5	93.6	1/
Contractors products........	8.4	2.5	4.8	1/	31.3
Stamping, pressing, and coating.........	7.9	2.0	13.0	0.4	18.5
Total.........	87.9	92.9	72.8	98.9	91.6

1/ Less than 0.1 percent.

Source: Statistics Canada, Catalogue 41-001 "Primary Iron and Steel," December issues, 1982-86.

The primary markets of individual firms within the industry may vary widely from the industry aggregate. Each company approaches the market with a different orientation because of different product mixes, geographic location, downstream operations, etc.

Poor market conditions for Algoma's long products have led to an increasing empahsis on sheet and plate in recent years. According to their annual reports, finished steel product shipments for recent years were distributed as follows:

Product group	Percent of sales 1984	1985	1986
Plate and sheet...............	64	64	69
Structurals..................	14	17	16
Seamless tubulars and skelp...	15	14	11
Rails and Fastenings..........	7	5	4

Algoma's sheet sales are aligned by industry sector. Algoma has the ability to roll sheet up to 96 inches wide, and was the only North American producer able to do so until the startup of Tuscaloosa Steel in the United States. Although Algoma's sales are concentrated in the 42- to 72-inch range, the 96-inch material is in heavy demand in certain consuming sectors: tank fabricators, coil to plate conversion, and unexposed blanking operations.

Atlas's natural market is the Great Lakes region. Atlas considers their market niche to be the Canadian market, of which they have 50 percent. The Canadian stainless sheet market is heavily weighted towards service centers, followed by appliance and auto applications. Specialty pipe and tube manufacturers, making product for caustic and corrosive fluids handling, are another substantial market. Because of Atlas's small size, they are very flexible and like noncommodity, offbeat analysis orders. 1/ This position insulates them somewhat from import competition, which is usually in the more common commodity grades. Company officials consider it an advantage for their product mix to be highly market driven. Atlas produces a wide range of stainless chemistries, but has concentrated on the austenitic grades, which are used primarily for the manufacture of producer durables.

Dofasco, as the largest sheet producer in Canada, offers the widest range of sheet products. The company looks to a fairly regional market, making most of their sales in the North American Midwest. Dofasco has developed a high-quality reputation despite the lack of slab-casting capability. The company has some longstanding customers for tin mill products in Latin America and the South Pacific, and also sells off prime material to Asian countries. Most of their sales are shipped by truck (80+ percent) with the remainder going out by both rail and boat. Most sales are within a 400- to 500-mile radius. 2/

Sheet market niches in which IPSCO seems to have particular strengths are the alloy and high-strength steels. The major end-use markets for IPSCO's sheet products are the manufacturing, agricultural equipment, oil field equipment and transportation equipment industries. IPSCO's natural shipping market includes Western Canada and the Northwestern United States and is increasing its participation in the flat-rolled markets in Western Canada. These efforts increased 1986 flat-rolled sales (including plate) by 12 percent over those in 1985. 3/ U.S. sales are important to the company, generating 11 percent of the company's revenues in 1985.

Sidbec's cold-rolled sheet enjoys a high quality reputation in Canada, a result of their slab cast product. Sidbec has historically enjoyed an advantage over much of the Canadian industry in those applications that require a slab cast material; this advantage will dissapate as Stelco, Dofasco, and IPSCO brought new casters on line in 1987. Sidbec sells most of its cold-rolled material to the automotive and appliance industries of Canada. Working with the sales staff is a sales engineering department charged with aiding customers in their material selection and application.

Stelco is currently the only steelmaker in Canada able to produce drawn and ironed (D&I) tinplate, a steel that demands exceptionally tight tolerences. The D&I steel is required for the fabrication of two-piece food and beverage containers, a recent breakthrough in steel can production.

1/ Interviews with Atlas officials.
2/ Interviews with Dofasco officials.
3/ IPSCO Annual Report, 1986.

Trade and Consumption

Until the mid-1970's, development of the Canadian steel industry generally lagged behind the development of the domestic market: the country was a net importer through 1975. Since 1976, with the exception of 1981 when the Stelco was on strike for 4 months, Canada has been a net exporter. Although Canada trades sheet and strip with a wide variety of nations, both import and export trade is concentrated with a few nations, with the United States as the predominant partner (table 6-7 and 6-8).

Table 6-7
Sheet and strip: Canadian imports, by specified sources and by products, 1986

Source	Galvanized	Tinplate	Stainless	Other	Total 1/
	1,000 metric tons				
United States	34.4	4.4	9.7	226.8	275.1
United Kingdom	21.3	0	1.3	47.2	70.4
West Germany	4.2	0	7.5	48.2	59.9
France	13.0	0	5.7	46.9	65.7
Japan	12.7	0	4.6	18.9	36.2
Italy	3.0	0	1.9	29.3	34.2
Belgium-Luxembourg	1.7	0	3.1	10.5	15.4
All other	86.7	.1	8.8	67.4	163.0
Total 1/	176.7	4.5	43.4	495.2	719.8

1/ Rows and columns may not sum to totals due to rounding.
Source: Compiled from Statistics Canada data.

Table 6-8
Sheet and strip: Canadian exports, by specified destinations and by products, 1986

Destination	Galvanized	Tinplate	Stainless	Other	Total
	1,000 metric tons				
United States	225.6	1/	1/	749.6	975.2
Taiwan	1.2	1/	1/	117.6	118.8
Italy	3.7	1/	1/	31.7	35.4
Mexico	.2	1/	1/	26.2	26.4
Tailand	0	1/	1/	17.4	17.4
Philippines	0	1/	1/	17.1	17.1
United Kingdom	3.1	1/	1/	11.2	14.3
All other	11.7	1/	1/	60.1	71.8
Total	245.5	1/	1/	1,030.9	1,276.4

1/ Not available; included in "other".

Source: Compiled from Statistics Canada data.

Discussions with Canadian sheet and strip producers revealed that the U.S. market is considered differently than other export markets. Because of the geographic proximity and the high level of cross-border integration in their primary market (automotive), the Canadian producers consider the U.S. market as part of their "home" market. While understanding that political reality requires discretion in the total magnitude of exports to the United States, the need to maintain flexibility in order to fully serve the varying needs of longstanding U.S. customers renders any restraint on exports to the United States as unsatisfactory to the producers. Although the Canadian producers do have some longstanding trade partners in other foreign markets, the non-U.S. export market is primarily a swing market, entered when the North American demand lags.

Canada, like many other industrialized nations, is experiencing increased pressure from imported steel. While domestic market growth has allowed an 10.8 percent annual implicit growth rate (1982-86) for domestic shipments, imports for consumption have grown at a rate more than double domestic shipments (table 6-9). This increase has taken place despite tariffs on steel sheet that are among the highest for industralized countries.

Imports as a share of apparent consumption have been growing steadily (table 6-9). Much of the import growth is taking place in the western coast of Canada. In this market, which is far from the sheet manufacturing centers, ocean freight levels from Pacific Rim producers are less than overland rates from central Canada. 1/

Table 6-9
Sheet and strip: Imports for consumption, exports, domestic shipments, apparent consumption and imports as a share of apparent consumption, 1982-86

Item	1982	1983	1984	1985	1986	Average annual growth rate, 1982-86
			1,000 of metric tons			percent
Domestic shipments.....	3,292	4,282	4,834	5,044	4,962	10.8
Imports for consumption 1/.......	276	349	483	542	660	24.4
Apparent consumption...	3,568	4,631	5,316	5,586	5,623	12.0
Exports................	1,449	721	1,088	1,302	1,276	-3.1
Imports as a share of apparent consumption..........	7.7	7.5	9.1	9.7	11.4	10.3

1/ Imports for consumption differ from total imports by the amount of steel exported by steel firms for toll processing and re-imported by the same firm. This steel is counted in total imports but not in imports for consumption.

Source: Canadian Steel Industry Statistical Committee, Statistics Canada.

1/ Information developed from interviews with industry officials.

Detailed Canadian apparent consumption data for sheet and strip are contained in table 6-10. Cold-rolled sheet, including non-tin-mill coated products and galvanized products, have shown the most consistent growth, largely because of the increased demand from the automotive industry. Hot-rolled sheet consumption peaked in 1984-85 and declined in 1986; developments in energy markets are key to this product, as significant tonnages are used to produce pipe. Consumption of tin mill products (tinplate and tin-free steel) have followed an erratic course.

Table 6-10
Sheet and strip: Apparent consumption by product groups, 1982-86

In metric tons

Product	1982	1983	1984	1985	1986	Average annual growth rate, 1982-1986
Hot rolled sheet and strip......	1,423	1,973	2,489	2,500	2,414	14.1
Cold rolled sheet and strip, and other coated..............	1,037	1,374	1,517	1,568	1,621	11.8
Tinplate and tin-free steel.....	416	427	407	409	387	-1.7
Galvanized......................	691	853	903	1,109	1,200	14.8
Total 1/....................	3,568	4,631	5,316	5,586	5,623	12.0

1/ Columns may not sum to total because of rounding.

Source: Canadian Steel Industry Statistical Committee.

Consumption of sheet products is relatively concentrated in Canada. In the mid-1970's Stelco stated that 60 percent of its sales of hot-rolled product were shipped to 15 customers. Canadian steel analysts indicate that current levels of concentration throughout the sheet industry are similar. 1/

Customers in the Canadian market are said to value the products produced in Canada highly, and most do not percieve wide quality differences in the product of the various producers. 2/ Since 1982, demand for sheet products has been strong in Canada. Between January 1983 and August 1986, sheet prices increased 10 to 15 percent. 3/ Purchase decisions are based primarily on quality differentials and historic delivery performance. The exception is for customers of sheet who require extremely tight tolerances, especially sheet for deep drawing applications. These customers prefer continuously cast product because of its superior performance in drawing applications and are often willing to pay a premium for such a product. 4/ This situation may change as continuous slab cast material becomes more available in Canada.

1/ Laciak, Stephen, "A Competitive Analysis of the Canadian Steel Industry," Wood Gundy, Inc., January 1987.
2/ Ibid.
3/ Ibid.
4/ Ibid.

Financial Concerns

Production costs

A recent report suggests that, at current exchange rates, Canadian mills, on average, have lower sheet production costs than average U.S. and European mills (table 6-11). Other estimates place total Canadian costs slightly lower, at around Can$612 (US$459) per metric ton. 1/ Canada's largest advantage over the U.S. and European industries falls in the area of labor costs. This advantage, however, may be diminishing.

Table 6-11
Cold-rolled sheet: Unit production costs in specified areas

Item	Canada	United States	Europe	Japan	Brazil
	Can$ per finished metric ton				
Labor	229	291	246	172	55
Raw materials			183	154	148
Iron ore	88	106			
Metallurgical coal	54	46			
Other fuel	33	39			
Indirects and interest			226	226	336
Indirects, supplies, and services	171	171			
Interest charges	22	33			
Total production cost	597	686	655	552	539
Tariff and transportation	22	80	101	116	101
Total landed cost	619	766	756	668	640
Canadian advantage in domestic market	-	147	137	49	21

Source: Based on Laciak, Stephen, "The Canadian Steel Industry," Wood Gundy, Inc., April 1987, pp. 4, 7.

Canadian firms generally have a competitive cost advantage over U.S. competitors in the area of non-coal energy costs. The biggest component of these savings come from favorable electricity rates. 2/ Officials at one producer estimated their electricity rates to be approximately one-third of the average U.S. rates. 3/ Canada has recently deregulated natural gas, which has brought Canadian gas prices in line with U.S. prices.

With respect to material costs, coal costs for the integrated producers are directly affected by exchange rate fluctuations between the U.S. dollar and the Canadian dollar, as the Canadian producers import virtually all of their coal from U.S. mines. Costs for iron ore and scrap are less affected by

1/ World Steel Dynamics, Steel Strategist #13.
2/ Interviews with Canadian industry officials.
3/ Ibid.

exchange rate movements, as large percentages of both are purchased in Canada. Vigorous competition in the iron ore market is expected to result in improved operations at the mines and lower iron ore prices to the steel companies. Raw material costs for additives, such as nickel, chromium, manganese, and stainless scrap, are largely denominated in U.S. dollars, regardless of the source, introducing exchange-rate fluctuations to costs for those products.

Financial performance

Producers of sheet in the Canadian steel industry have generally been more profitable than participants in the U.S. sheet industry over the past few years (table 6-12). Losses by Stelco and Algoma in 1982 and 1983 initiated their downsizing initiatives; Stelco returned to profitability in 1985, and Algoma is expected to produce its first profit after 5 years of losses in 1987. IPSCO posted its first loss in 1986, but completion of their modernization program and reviving energy markets should reverse the setback. In 1986, Sidbec posted its first profit since 1974.

Table 6-12
All operations: Net income 1/ of five major sheet and strip producers, 1982-86

Company	1982	1983	1984	1984	1986
	Millions of Can$				
Algoma....................	(40.4)	(126.6)	(45.7)	(3.0)	(134.8)
Dofasco....................	63.8	120.5	180.6	170.1	135.9
IPSCO......................	10.7	9.4	15.6	5.5	(6.9)
Sidbec.....................	(66.9)	(27.0)	(34.8)	(51.7)	6.5
Stelco.....................	(40.8)	(14.2)	(3.3)	77.6	57.6
Total....................	(73.6)	(37.9)	112.4	198.5	72.1

1/ Including extraordinary items.

Source: Company Annual Reports.

Table 6-13 contains sales revenues, operating income, and operating margins for six Canadian sheet producers. Information at this level of detail was not available for Cold Metal Products (Stanley Precison).

Table 6-13
All operations: Sales, operating income and operating margins of certain firms, 1982-86

(Figures in Can$ millions unless specified)

Item	1982	1983	1984	1985	1986
Sales Revenues:					
Algoma 1/	866.5	833.7	1,043.2	1,121.5	996.4
Atlas 2/	3/	3/	249.2	209.3	339.4
Dofasco	1,485.5	1,605.7	1,926.2	1,993.6	1,934.6
IPSCO	251.0	206.7	291.4	304.5	214.2
Sidbec 4/	326.1	370.5	463.2	494.8	519.6
Stelco	2,020.3	2,033.2	2,401.2	2,434.6	2,400.3
Total	4,955.4	5,049.8	6,373.4	6,558.3	6,403.5
Operating Income: 4/					
Algoma 1/	(62.2)	(120.6)	1.2	28.0	19.7
Atlas 2/	3/	3/	11.8	(11.5)	7.2
Dofasco	111.2	221.6	295.5	264.3	234.4
IPSCO	28.5	20.8	31.1	14.3	(4.5)
Sidbec 4/	(48.2)	(4.5)	(2.9)	9.2	25.7
Stelco	(40.4)	(8.8)	80.3	143.7	106.7
Total	11.1	108.5	417.0	448.0	389.2
Operating margin:					
Algoma 1/ (percent)	(7.2)	(14.5)	0.1	2.5	2.0
Atlas 2/ (percent)	3/	3/	4.7	(5.5)	2.1
Dofasco (percent)	7.5	13.8	15.3	13.3	12.1
IPSCO (percent)	11.3	10.1	10.7	4.7	(2.1)
Sidbec 4/ (percent)	(14.8)	(1.2)	(0.6)	1.9	4.9
Stelco (percent)	(2.0)	(.4)	3.3	5.9	4.4
Total (percent)	0.2	2.1	6.5	6.8	6.1

1/ Algoma's coal operations in the United States have been excluded.
2/ Includes Altas Specialty Steels in addition to Atlas Stainless Steel.
3/ Not available.
4/ Includes only Sidbec's non-mining operations for 1982 and 1983. Includes only continuing operations for 1984 and 1985.
5/ (Total income before taxes)-(equity income)+(interest on long-term debt)

Source: Laciak, Stephen, "The Canadian Steel Industry," Wood Gundy, Inc., April 1987, company annual reports, 1981-1986.

The Canadian producers debt situation is fairly good (table 6-14). Although most debt-to-equity ratios have increased in recent years, this is mostly attributable to the moderization and capital investment programs in which virtually all producers have been engaged. Only one producer, Algoma, has a ratio exceeding one; Dofasco is in the midst of spending a billion dollars (Canadian) with apparently no impact on their debt-to-equity ratio.

Table 6-14
All operations: Ratio of long-term debt to total shareholders equity for the 4 largest Canadian sheet producers

Company	1982	1983	1984	1985	1986
Algoma..........................	0.6	0.8	1.0	1.1	1.1
Dofasco.........................	.4	.4	.3	.3	.3
IPSCO...........................	.3	.4	.3	.5	.5
Stelco..........................	.3	.3	.3	.4	.4

Source: Algoma, Dofasco, IPSCO, and Stelco Annual Reports, 1981-1986.

IPSCO has recently completed a deal to reduce its long-term debt substantially. In mid-1987, the company entered into a sale and leaseback arrangement with Xerox Canada Finance, Inc. Under this arrangement, the recently completed slab caster and reheat furnace at IPSCO's Regina works were sold to Xerox and leased back for 20 years. This action allowed the company to retire all first mortgage bonds, leaving them with no outstanding equipment mortgages. 1/

The financial information makes it obvious that, in a financial sense, Dofasco is the strongest sheet producer, consistently posting positive results. Algoma has ongoing financial problems that it hopes to rectify through its downsizing and other initiatives. IPSCO, which has a history of good performance, is currently having trouble because of the depressed demand in the pipe and tube markets, upon which the company heavily depends for sales revenue. Sidbec has returned to profitability only after years of subsidy by the Provincial Goverment of Quebec. Stelco was affected by the recession in 1982 and 1983, but has returned to profitability after shutting down considerable forming and fabricating capacity and open hearth refining capacity.

Government Policies

Tax policy

Tax policy in Canada has historically been more favorable to steel firms than tax policy in the United States. For many years equipment such as that used in the steel industry could be fully depreciated in a little over 2 years. In contrast, U.S. firms typically had to depreciate equipment over 15 years for tax purposes. A shorter depreciation period for capital equipment increases cash-flow in the initial years of an investment, and it increases the real value of the writeoff by minimizing the time it is subject to a reduction in value because of inflation. Canadian tax law also had provisions for investment tax credits and a 3-percent annual writeoff for inventory depreciation. The Conference Board of Canada, studying tax systems around the world, determined that the Canadian system was more beneficial to

1/ American Metal Market, Sept. 16, 1987.

industry than those of the United States and European countries, however, was less beneficial than South Korea's system.

Recent changes have been instituted in the Canadian tax system. The writeoff for inventories has been eliminated and the investment tax credit provision is being phased out. Also, the depreciation periods for capital equipment has been lengthened. Despite these changes, the Canadian tax system remains, for basic industry, more favorable than the U.S. system. Industry experts have indicated that the eventual effect of the changes in the tax law will result in less cash-flow and higher profits in the short run, and lower cash-flow and lower profits in the longer run.

Trade policy

Canadian tariffs for MFN countries on steel are slightly higher than U.S. tariff rates. Canada also has General Preferential Tariffs (GPT), which apply lower tariffs to imports from developing countries. On February 19, 1987, Canada raised its GPT rates on 65 steel products in response to concerns about worldwide overcapacity. The duties were increased from 2.5 to 7.5 percent, affecting an average 98.3 million dollars' worth (Canadian dollars) of imports. These duties are now equivalent to those paid by industrialized countries. 1/

The Canadian Government addresses unfair trade in a manner similar to the United States and other developed countries. Dumping actions are brought before the Canadian Trade Tribunal, an organization similar to the U.S. International Trade Commission. Recently, the Government has instituted an import-monitoring system for steel that is designed to produce more timely data on imports than has been available in the past. This system provides information on prices, types, and country of origin at the time of the steel's entry, allowing quicker identification of suspected dumping activity.

Since the implementation of the import monitoring program, the Canadian Government has instituted a tracking program in conjunction with the import program in order to determine the amount of foreign steel transshipped through Canada to the United States. This system was initiated in an effort to provide data to support the industry's efforts to avoid unilateral protectionist actions by the United States.

Regulatory policy

Most Canadian regulatory policies that impact the steel industry (environmental and health and safety) are under the control of the Provincial governments. The exception to this are water pollution regulations covering the Great Lakes, Federal properties, and ports. Although the laws are generally comparable to U.S. laws, the Canadian regulations allow more widespread use of the "bubble" approach. 2/ This allows control costs to be lower than the strict point emission standards widely used in the United

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1/ American Metal Market, Feb. 20, 1987.
2/ Interviews with industry officials.

States. Conversations with Canadian steel industry personnel indicate that, in the past, enforcement of the regulations has been spotty in some Provinces. However, movement seems to be underway to improve the enforcement activities in those Provinces that were perceived to be lax.

As is true in any country, environmental regulations add to the cost of steelmaking. The largest costs of pollution abatement for the steel firms in Canada involve air pollution regulations. Estimates provided by Canadian Government sources indicate that the increase in capital expenditures caused by environmental regulations range from about 15 percent of total investment for new facilities to 25 to 30 percent of total investment in facilities that must be retrofited. Operating costs in both newly built and modified plants are increased by about 10 percent.

Competitiveness of the Canadian Sheet and Strip Industry

Discussions with industry officials on the measures of competitiveness revealed two major themes; long-term profitability and capacity utilization. The approaches to achieving high levels of capacity utilization and profitability are varied, but a consensus emerged that the importance of customer satisfaction is increasing. One producer offered the opinion that the best way to be "competitive" was to make products that make your customers competitive; if manufacturing activities continue to move offshore, markets for raw materials, such as sheet, will follow. The Canadian sheet industry is generally strong in the areas of competitiveness that participants cited as important, and is well positioned on a technical level after industrywide modernization programs.

The industry recognizes the importance of exchange rates, especially the US$/Can$ alignment. The importance of the U.S. market to the Canadian industry cannot be understated, and movement back to parity could significantly impact the status of the Canadian producers in the U.S. market.

Canadian sheet industry production costs are lower than most industrialized countries, with Japan as the noteable exception. Canadian production costs are higher than many of the developing nations, and the industry's competitiveness in distant markets is limited to certain niches. However, in the Canadian market Canadian sheet has the lowest delivered cost and in the U.S. market Canadian sheet's delivered cost is also relatively low.

Although import penetration in the Canadian sheet market has grown, this trend does not necessarily imply declining competitiveness on the part of the Canadian industry. An expanding Canadian market has allowed concurrent growth in domestic shipments and most producers are running near their sheet production capabilities. Despite the growth in imports, Canada's sheet export levels are almost double sheet import levels, attesting to the competitiveness of the Canadian industry in international markets.

The individual companies intend to pursue various paths in order to maintain their competitive posture. Algoma expects increased participation in the auto parts markets while straight automotive sales drop. The growth in service center sales is coming at the expense of other markets, including the automotive market. Algoma is also increasing their market share in the skelp market. Because of these improving market conditions, Algoma expects hot-rolled sales to continue to figure prominently in their overall picture, especially wide coils and high-strength low-alloy (HSLA) products. 1/

Atlas sees growth in the ferritic grades (400 series), used mostly in the auto and consumer durable industries, and intends to seek greater participation in those markets. Atlas forsees a 2- to 3-percent annual growth in the 400 series products as a whole, and perhaps higher growth in certain grades.

IPSCO is striving to be the predominant supplier of hot-rolled carbon steel in its geographic market area. IPSCO also desires to be a major supplier of certain specialty (alloy) steels throughout all North American markets.

Stelco, expecting shipment levels to remain static, is pursuing higher profits by altering their product mix towards further processed and higher quality steels. With their modern Lake Erie Works complex, Stelco will remain committed to the hot-rolled markets. Their participation in cold-rolled markets will be limited to certain product niches in which the company holds a good competitive posture, such as tin plate. 2/

Stelco and Dofasco have entered a joint venture with a major Canadian auto parts producer to produce blanks from cold-rolled and coated sheet in order to supply General Motors' (GM's) stamping plant in Oshawa, Ontario. The blanks supplied to GM will be for exposed body panels. This signifies a new and lucrative Canadian market, as previously all stamping, as well as all steel purchasing, for exposed panels for the U.S. car manufacturers was U.S.-based.

Outlook

In considering the outlook for the Canadian sheet industry vis-a-vis the U.S. sheet industry, several major factors must be reviewed. On the downside, the Canadian producers basically operate in the same North American market as the U.S. producers. This market has shown declining consumption of steel products, as steel-containing items are increasingly produced offshore. Canadian labor costs are continuing to rise, even as U.S. and other producers are taking actions to reduce their labor costs. Although exchange rates currently give the Canadians an advantage over U.S. producers, a strenghtening Canadian dollar could remove this advantage well before parity is reached. Successful implementation of the U.S.-Canada Free Trade Agreement, granting Canada preferential access to the U.S. market, should cause the Canadian dollar to strengthen, although the extent of that movement cannot be determined.

The Canadians still have not installed any electrogalvanizing facilities, a move that could be seen in either a favorable or unfavorable light. Discussions on a joint venture have been conducted, however, the significant increase in electrogalvanizing facilities in the United States delayed plans to construct any such facility. Although this means that the Canadians do not have the ability to produce many of the new products being increasingly demanded, the very real possibility of overcapacity in North America already

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1/ Interviews with Algoma personnel.
2/ Interviews with Stelco personnel.

exists. If the Canadians are able to fulfill their needs for electroplated product through tolling arrangements with the U.S. facilities, the lack of such facilities is not a major problem. Although tolling arrangements are currently in effect, such an arrangement results in some loss of control by the party contracting for services. As such, it is a less desirable situation than captive capacity in a strong market, as the companies owning the facilities will tend to give their own material higher priority than toll processed material. If demand for electroplated products increases rapidly, the Canadians could be precluded from those markets until new facilities are constructed. For this reason, knowledgeable observers of the Canadian steel industry are predicting a commitment to an electrogalvanizing facility within the next 2 to 3 years.

Positive factors for the Canadian steel sheet industry include the fact that their downsizing initiatives are mostly behind them and the industry has adjusted its size to the markets it serves. Because of differences in pension laws and funding in Canada, the capacity and personnel reductions involved did not produce the problems currently being experienced by, and predicted for, the U.S. industry. The Canadian firms are generally in better financial shape than the U.S. firms, and will probably remain so as the U.S. industry continues to contract.

On the technical side, the Canadian industry is in the midst of installing significant continuous slab casting and ladle processing capacity. When this round of investment is finished, the industry will have a higher continuous slab casting average than the United States and will have, on average, newer machines. This advantage is most likely to be short term, as several U.S. casters are nearing replacement and several new casters, at locations currently without such facilities, are either planned or in the works.

Overall, the Canadian steel sheet and strip industry is highly competitive with the U.S. industry and its other rivals in its chosen markets. Customer satisfaction with the Canadian product is good, and there is no hesitation on the part of U.S. consumers to go north of the border when domestic supplies are tight, as was the case during the recent USX strike. Consumers in the major sheet market, the automotive industry, have confidence in the quality of the Canadian product; increased sales of high quality and high value material seem likely. Some producers, based on available equipment and expectations of future market conditions, are emphasizing the high-quality, hot-rolled market, a move that could be favorable as most other major sheet producers seem to be aiming for high-quality, cold-rolled niches.

CHAPTER 7. THE WEST GERMAN INDUSTRY

Structure of the West German Sheet and Strip Industry

West Germany is the world's fourth largest producer of crude steel, accounting for 5 percent of world production during 1984-86. The country is also a major trader; its exports are second only to Japan while imports are exceeded only by the United States and China. Sheet and strip is the industry's single most important product; its share of finished steel production has risen from 32 percent in 1975 to 43 percent in 1985. 1/

The West German steel industry consists of five major producers of steel and several smaller producers which collectively operate six hot strip mills. The five major producers, all of which produce sheet products, have annually accounted for over 70 percent of West German crude steel production in the 1980's.

The largest of these producers is Thyssen Stahl, which accounted for almost one-third of total West German crude steel production in 1986 (table 7-1). Each of the remaining four sheet and strip producers are considerably smaller than Thyssen, with each accounting for less than one-half of Thyssen's annual steel production total.

Table 7-1
West German steel production, by companies, 1986

Company	Steel production 1/ in 1986	Share of total steel production
	Million tons	Percent
Thyssen	11.1	30
Klockner-Werke	4.2	11
Krupp Stahl	4.1	11
Hoesch Stahl	3.7	10
Peine-Salzgitter	3.5	9

1/ Metal Bulletin Monthly, April 1987, p. 119.

Most German steel producers concentrate on manufacturing higher value products, although Thyssen manufactures a complete line of steel products. All are, however, self sufficient in crude steel production. Several of the producers have foreign subsidiaries that provide iron ore. All purchase most of their coal requirements from a jointly owned German producer.

1/ U.K. Iron and Steel Statistics Bureau, Federal Republic of Germany-1985. Sheet and strip includes hot-rolled wide coil under 3 mm for direct use, plates 3 to 4.75 mm, sheets under 3mm (hot and cold-rolled) and hot and cold-rolled strip.

The German steel companies are among the most diversified in the world, and they are continuing to become more so. Most of the integrated steel works have diversified into specialty steel and higher valued products that have generally not been the subject of as much intense competition and cost cutting by other foreign producers. In their diversification, the steel branches have stressed development of new qualities and product forms. Considerable emphasis is being placed on specialization in sheet, coil, and coated products, including hot-dip galvanized, electrogalvanized, and plastic coatings. 1/

Diversification has also occurred outside of the steel branches of companies, such as in the processing of plastics, automated factory production and computer technology. 2/ For most companies the share of steel in their annual turnover has distinctly decreased. 3/

For raw materials, West Germany depends on imports for iron ore and domestic production for coal. The iron ore found in West Germany is in isolated areas and is generally of low quality. The country therefore imports most of its iron ore from Sweden, Brazil, France, and Liberia. Several German steel producers jointly own and operate overseas ore mines that are equipped with ore dressing and pelletizing installations. 4/

With respect to coal, West German Federal and State governments heavily subsidize domestic production as well as coal transportation and export. In the 1950's and 1960's, most German steel producers were truly integrated--they owned and operated substantial coal mines in the Ruhr that produced fuel for their power plants and coking coal, a key raw material for steel production. By the late 1960's however, the cost of coal produced from German mines became prohibitively high. It reportedly increased the cost of finished steel products and jeopardized the competitiveness of the German steel industry. To avoid immediate and substantial losses as well as the fluctuations of the international coal market, a system was established whereby a government-supported corporation, Ruhrkohle, would own and operate all the Ruhr coal mines. The principal shareholders of Ruhrkohle are the Federal Government of West Germany and the major West German steel producers including Hoesch, Thyssen, Krupp, Klockner and Peine-Salzgitter. The steel companies transferred their mining interests to Ruhrkohle as their capital contribution to the new company. In conjunction with the transfer, an arrangement was also concluded which obligated Ruhrkohle to supply the quantities of coal required by the steel producers. Under the arrangement, the steel producers were obligated to purchase most of their coal requirements from Ruhrkohle. 5/

1/ Information developed through interviews with West German steel industry officials.
2/ The Economist, Mar. 7, 1987.
3/ For example, in 1975 the steel share at Thyssen as a percentage of parent company revenue was 42 percent--this dropped to 36 percent by 1986. International Iron and Steel Institute; Dr. Vondran, Panel Discussion: Industrial Relations in Today's Steel Industry, Oct. 4-7, 1987.
4/ Thyseen Stahl, Metallurgical Plant and Technology (MPT), No. 5/86, p. 1.
5/ Information developed through interviews with West German steel industry officials and petition, Certain Steel Products from West Germany, Investigation No. 701-TA-101 and 701-TA-109, U.S. Steel Corp., p. 70.

The Federal Government pays the difference between Ruhrkohle's published prices for coal and the world market price, which has reportedly cost the government $13 billion since 1980. 1/ Ruhrkohle is required to pass this payment on to the steel producers in the form of reduced prices. Discussions with German steel producers indicate that the payment does not completely equalize the Ruhrkohle price of coal with world market prices. German steel producers, therefore, must pay higher prices than their foreign competitors for one of the basic raw materials needed to make steel. The premiums they pay vary yearly. In 1985, it is estimated to have cost almost $50 million for the industry as a whole. 2/

Additionally, there are import duties on coal from outside the EC, quantitative limitation of imports from outside the EC, and a fuel oil tax. Industry officials indicate that this government protection stems from the large number of jobs the coal industry provides, especially in areas suffering from high unemployment. National security is also put forth by industry officials as further reason for protection of coal. 3/ Other sources claim the aid is to protect heavy investment by German steel firms in domestic coal facilities as well as to shield them from potential fluctuations in the price and supply of coal from the international market. 4/

Conditions in the West German Steel Sheet and Strip Industry

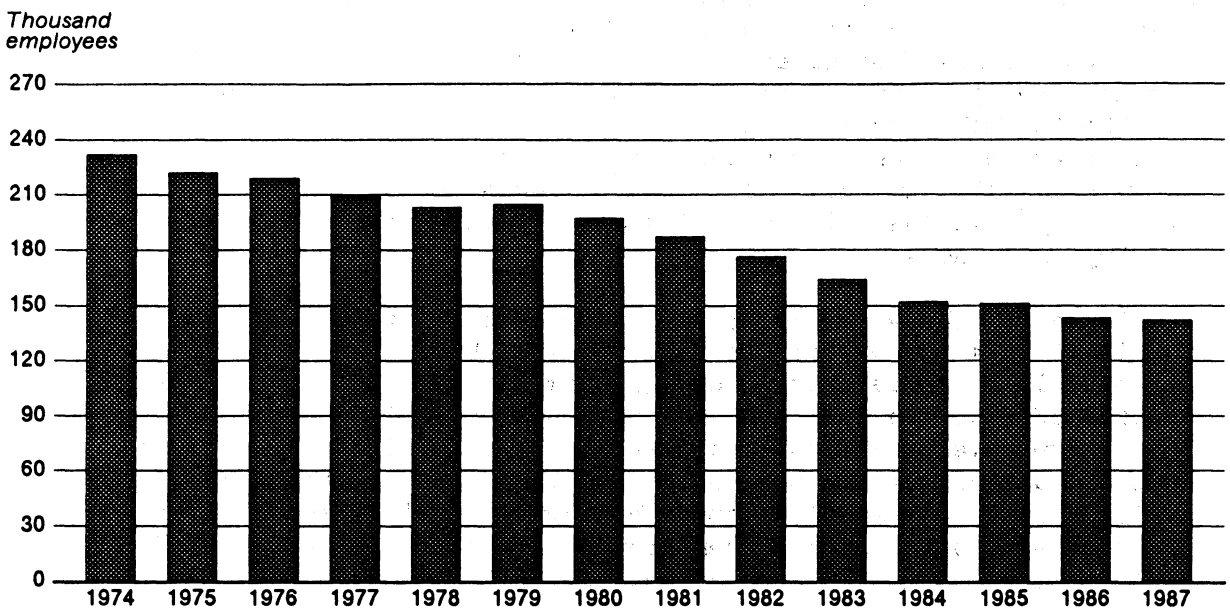
Employment

Trends

Steel production cutbacks have resulted in significant manpower reductions. From 1974 to 1987, West German steelmakers reduced their labor force by 40 percent, from 232,000 to 142,000 employees, as shown in figure 7-1.

1/ Financial Times, Jan. 12, 1988.
2/ Metal Bulletin Monthly, June 1986, p. 23.
3/ Information developed through interviews with West German steel industry officials.
4/ See, e.g., petition, Certain Steel Products from West Germany, Investigation No. 701-TA-101 and 701-TA-109, U.S. Steel Corp., p. 67.

Figure 7-1
Employees in the West German steel industry, 1974-87



Source: Statistical Office of the European Communities, Dusseldorf, 1987.

These manpower reductions, however were less (on a percentage basis) than those of its EC competitors: employment in France, for example, declined by 54.4 percent; Belgium, by 48.8 percent; and the UK, by 69.8 percent. Further reductions, estimated at 25,000 to 35,000, are predicted by West German industry officials over the next several years. 1/

The German steel industry has reduced its labor force largely through retirements and curbing new hiring. Retirements in 1986 are up 150 percent since 1974 and new hiring is down 75 percent. 2/ As in the United States,

1/ Information developed through interviews with West German steel industry officials.
2/ OECD, Employment Handbook, 1987.

employment adjustment is hampered by the fact that steel labor is relatively immobile and workers are reluctant to relocate to continue work with the same firm or to find new employment. 1/

Average compensation and productivity

The average compensation for steel workers is generally comparable with that of other developed Western steel producers. In 1986, the German steelworker's average yearly wage was $26,500. 2/ Average gross hourly earnings of manual steelworkers at $8.70 was higher than the $7.90 average for all German industry. 3/ Employment cost per hour is also comparable with that of other Western producers. The average German steel worker received $15.90 per hour (wages and benefits). 4/

In recent years, German manhours per ton shipped have declined, as shown in the following tabulation; the rates are generally lower than other western producers (indicating higher productivity), but higher than those in Japan and South Korea: 5/

Year	Manhours per ton
1978	10.4
1979	9.2
1980	9.4
1981	9.2
1982	9.8
1983	8.7
1984	7.6
1985	7.3
1986	7.0

Source: World Steel Dynamics, Steel Strategist, #13, March 1987, table 6.

Unlike the United States and Japan, West German producers have not contracted out work on a large scale. 6/

Benefits

German steelworkers enjoy a broad range of benefits. Germany has comprehensive Social Security legislation, providing for health insurance, old-age pensions, and unemployment insurance. An annual bonus in profitable

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1/ Information developed through interviews with West German steel industry officials.
2/ World Steel Dynamics, Cost Monitor No. 9, 1987.
3/ EUROSTAT.
4/ World Steel Dynamics; Steel Strategist 13, March 1987, table 6; based on actual operating rate values in 1986.
5/ Ibid.
6/ Based on discussions with industry officials.

years is not unusual. In addition, there are a full range of manpower services, such as training, retraining, and job upgrading programs. These services are administered by self-governing public corporations, which are run by an equal number of representatives from labor and management. Payroll deductions provide necessary funding. Only if unemployment rises above a specified level does the Federal Government contribute any public funds, and then only to cover additional unemployment insurance payments. 1/

Almost all the steel-producing firms maintain pension programs financed by employer contributions, and employees can contribute some of their own wages if they wish to increase future payments. Many firms create pension reserves out of profits to cover estimated liabilities for future payments under the pension plans. There is an incentive for management to set up such a reserve because it is, within certain limits, deductible when the firm computes its taxable profits. 2/

Employees enjoy various insurance coverages, including severance pay of up to one year's salary or more if the employee is at least 50 years of age with at least fifteen years' service. 3/ The various types of insurance are funded differently. Health insurance for example, is funded through equal contributions on the part of employer and employee, while accident insurance is financed entirely by employers. 4/

Unemployment insurance benefits in the German manufacturing sector usually amount to approximately 68 percent of the applicant's previous take home pay. Workers who remain unemployed for more than a year can be granted benefits amounting to 58 percent of their previous pay. The program is financed through equal contributions by the employer and employee. 5/

The share of these non-wage labor costs as a percentage of total labor costs for the German employer have increased by over 2 percent per year. In the 1980's, German non-wage labor costs were more than 40 percent of total labor costs. German non-wage labor costs have increased at a greater rate than total labor costs. 6/

Labor/management relations

Labor-management relations in the steel industry are characterized by a high degree of cooperation, particularly in times of crisis. This is largely because of worker's rights under law and the policy of "codetermination."

After World War II, German unions sought legal establishment of a system whereby employees and unions had the right to participate in the management of

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1/ Richard F. Nyrop, The Federal Republic of Germany, American University, Washington, DC, 1983, p. 235.
2/ Ibid.
3/ The following discussion relates to all German industry (i.e., is not steel specific).
4/ Richard F. Nyrop, p. 36.
5/ Ibid.
6/ OECD, Employment Handbook, 1986.

the enterprise. The system was first begun by the Ruhr steel producers. By 1947 most companies in the iron and steel industry had established supervisory boards, the German equivalent of a board of directors, based on the principle of parity--owners and employees have an equal number of representatives. The two sides select an independent chairman. 1/

In 1951, by threatening to call a general strike, the trade unions brought pressure on the Federal Parliament (Bundestag) to pass the so-called codetermination law. By this law, parity codetermination or representation in the iron and steel industry was confirmed. Industry officials indicate that such representation usually does not result in the active involvement of employees in all aspects of the business. Rather, they tend to limit their representation on the board to influence employee related issues. 2/

Additional law requires the establishment of worker's councils in each production facility to represent employees vis-a-vis employers. Reductions in hours and employment as well as vacation plans, wage scales, recruitment, job transfers and guidelines for personnel selection must be negotiated with the councils. The councils have thereby become extremely influential. The councils do not, however, have the legal authority to call a strike. 3/

Workers must be notified of dismissals months in advance and have the right to protest dismissals in court. Most employers avoid legal entanglement and difficult negotiation with the councils by using early retirement, shorter working hours and retraining schemes to adjust their work forces.

Early retirement is particularly attractive because the European Community Commission and the Federal Government pay approximately 90 percent of an early retirement program that gives steelworkers older than 55 with a decade of experience approximately 92 percent of their net pay should they decide to retire prior to the mandatory age of 65 years. The effect on the workforce has been a continual decrease in the percentage of employees over 55 years of age. 4/ Eighty-five percent of all retirements are early retirements. The alternative is for the producers and government to attempt to reduce employment through lay-offs, which cost an estimated $35-45,000 per worker due to labor laws and negotiated agreements. 5/

German steel industry officials indicate that codetermination, both through worker's councils and representation on the supervisory boards, has largely resulted in industrial peace in German industry. The representation gives the workers a raised level of interest in the well-being of the firm and industry. Additional tranquility is gained by the recognition that the development of the industry, rising real wages and improved social benefits

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1/ Richard F. Nyrop, p. 232.
2/ Information developed through interviews with West German steel industry officials.
3/ OECD, Employment Handbook, 1986.
4/ For example, in 1981, 9.8 percent of steel workers were over 55; this dropped to 6.7 percent by 1984.
5/ Information developed through interviews with West German steel industry officials.

depend on the commitment, by employee, employer, and union, to codetermination. 1/

Strikes and lockouts have been rare, and except in 1978 and 1984 when there were disputes in the steel industry, loss of working hours because of labor confrontations has been insignificant. 2/ An additional factor tempering labor demands in the 1980's is the high unemployment rates such as 15 percent in the Ruhr in 1986. 3/

Most labor related tension is over wages and the length of the work-week. German steel unions do not consider decreasing wages but prefer to shorten the average work-week, which is currently 38 hours. Wage increases have generally been moderate. 4/

Supervisory and management boards

West German companies have a two-tiered control system consisting of the supervisory board and the executive or management board. The supervisory board generally meets four or five times a year. It analyzes the annual accounts of the company and is responsible for major policy decisions, such as overall manpower planning, investment in new plants, closing old facilities, mergers and takeovers and changes of production methods. The management board is responsible for conducting the day-to-day business of the company. 5/

Production

The West German steel industry attained its peak in terms of crude steel production in 1974 when 53 million metric tons of steel were produced (table 7-2). Subsequent contractions in demand resulted in corresponding declines in production, which, during 1984-86, averaged 39 million tons per year. The contractions in production have been accompanied by reductions in capacity, though on a lagged basis. In light of the optimistic forecasts made in the early 1970's for continued growth in steel demand, investments were made in new facilities; crude steel capacity grew from 60 million tons in 1974 to a peak of 69 million tons in 1979 before closures began to narrow the difference between steel capacity and production. By 1986, restructuring had reduced effective capacity to 47 million tons.

1/ Ibid.
2/ Ibid.
3/ The Economist, May 3-9, 1986, p. 93.
4/ Information developed through interviews with West German steel industry officials.
5/ Richard F. Nyrop, p. 221.

Table 7-2
Crude steel: West German production, capacity, and capacity utilization, 1974-86

Year	Production	Capacity	Capacity utilization
1974	53	60	88
1975	40	63	64
1976	42	66	64
1977	39	68	57
1978	41	69	59
1979	46	69	67
1980	44	67	66
1981	42	68	62
1982	36	65	55
1983	36	61	59
1984	39	52	75
1985	40	49	82
1986	37	47	79

Source: ECSC Investments, Commission of the European Communities, 1972-86.

In terms of the sheet and strip market an analysis of market trends during the 1980's indicates that apparent consumption has remained constant. Imports have increased slightly as a share of apparent consumption, while exports slightly decreased as a percentage of production (see tables 7-3 and 7-4).

Table 7-3
Sheet and strip: West German production, exports, imports, apparent consumption, and import penetration ratios, 1980-86.

Item	Production	Exports	Imports	Apparent Consumption	Ratio of imports to consumption
	---------------1,000 metric tons			---------------	---Percent--
Hot-rolled sheet and strip:					
1980	5,656	2,256	1,663	5,063	0.3285
1981	5,837	2,172	1,427	5,092	0.2802
1982	5,169	2,098	1,144	4,215	0.2714
1983	5,199	1,878	1,379	4,700	0.2934
1984	6,054	2,156	1,309	5,207	0.2514
1985	6,125	2,331	1,483	5,277	0.2810
1986	5,816	2,265	1,570	5,121	0.3066
Other sheet and strip:					
1980	9,564	4,633	2,152	7,083	0.3038
1981	8,343	4,200	2,185	6,328	0.3453
1982	7,911	3,955	2,231	6,187	0.3606
1983	8,130	4,047	2,265	6,348	0.3568
1984	8,620	4,195	2,285	6,710	0.3405
1985	8,596	4,335	2,314	6,575	0.3519
1986	8,477	3,916	2,506	7,067	0.3546
Total sheet and strip:					
1980	15,220	6,889	3,815	12,146	0.3141
1981	14,180	6,372	3,612	11,420	0.3163
1982	13,080	6,053	3,375	10,402	0.3245
1983	13,329	5,925	3,644	11,048	0.3298
1984	14,674	6,351	3,594	11,917	0.3016
1985	14,721	6,666	3,797	11,852	0.3204
1986	14,293	6,181	4,076	12,188	0.3344

Source: German Iron and Steel Federation.

Table 7-4
Steel sheet: West German production, exports, imports, apparent consumption, and import penetration ratios, by selected products, 1980-86

Item	Production	Exports	Imports	Apparent Consumption	Ratio of imports to consumption
	---------------1,000 metric tons---------------				---Percent--
Tinplate					
1980	963	545	147	565	0.2602
1981	843	430	160	573	0.2792
1982	819	387	159	591	0.2690
1983	722	403	159	478	0.3326
1984	797	340	190	647	0.2937
1985	751	348	165	568	0.2905
1986	773	392	177	558	0.3172
Galvanized					
1980	1,650	637	298	1,311	0.2273
1981	1,584	636	314	1,262	0.2488
1982	1,570	642	370	1,298	0.2851
1983	1,618	652	399	1,365	0.2923
1984	1,835	641	368	1,562	0.2356
1985	1,808	687	421	1,542	0.2730
1986	1,952	697	589	1,844	0.3194
Electrical					
1980	372	100	58	330	0.1758
1981	363	107	57	313	0.1821
1982	352	116	43	279	0.1541
1983	446	107	36	375	0.0960
1984	480	142	36	374	0.0963
1985	483	140	38	381	0.0997
1986	424	108	41	357	0.1148
Other coated 1/					
1980	558	246	90	402	0.2239
1981	686	284	95	497	0.1911
1982	773	328	100	545	0.1835
1983	939	452	112	599	0.1870
1984	972	522	132	582	0.2268
1985	1,035	554	131	612	0.2141
1986	1,040	459	140	721	0.1942

1/ Including black plate, tin-free steel, terne-plate, plastic coated and other coated sheets.

Source: German Iron and Steel Federation.

Trade

An analysis of trade patterns in 1985 indicate that the top foreign suppliers of sheet products to West Germany were all European countries, led by Belgium-Luxembourg, which accounted for 33 percent of total imports (table 7-5). The United States was the top foreign market for West German exports, followed by the U.S.S.R. and a series of European countries (table 7-6). The relatively large size of the residual category (i.e., "All other") reflects the large number of small markets to which German producers export.

Technology

In West Germany, 80 percent of crude steel is produced by basic oxygen furnaces, and 20 percent is made by electric furnaces. Production in open-hearth furnaces was discontinued in 1983. 1/ As a result of closures and substantial investment in remaining facilities, most West German facilities are considered to be modern and efficient.

Approximately 90 percent of production is continuously cast. Most of the facilities are equipped with ladle metallurgy installations, particularly for their specialty steels. One producer (Hoesch) recently installed a continuous annealing line; discussions with industry officials indicate that other companies may not follow suit as they have reservations on the cost effectiveness of the equipment.

Recent trends include an increase in surface treated flat product capacity, such as electrogalvanized, hot-dip galvanized and plastic-coated sheet. Increased requirements from the automobile industry is one of the principal reasons underlying these investments. In 1978, for example, only 8 percent of sheet deliveries from Thyssen to the auto industry were coated; by 1986, this share had risen to 41 percent. 2/

Research and Development

In the late-1970's and early 1980's, research and development concentrated on process technology. In recent years more emphasis is being put on product research. 3/ German industry officials indicate that research and development efforts are important for ensuring present and future product quality. Consumer requirements are reportedly providing the impetus for continual product improvement and extension of the product range.

The primary goals of research and development projects on the process engineering side are improving production techniques and installations, and the optimization of production lines. On the materials and processing side,

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1/ OECD, The Iron and Steel Industry, 1983-86.
2/ Metal Bulletin, Oct. 26, 1987.
3/ Information developed through interviews with West German steel industry officials.

Table 7-5
Sheet and strip: West German imports, by specified sources, by product, 1985

Source	Type of product: Galvanized	Tinplate	Stainless	Other	Total
	Thousand metric tons				
Belgium-Luxembourg	161.9	43.4	18.0	1,161.1	1,384.4
France	135.3	65.9	35.3	638.7	875.2
Austria	1.2	0.0	0.7	508.9	510.8
Netherlands	2.9	41.0	0.6	358.9	403.4
Italy	15.4	2.8	19.4	222.7	260.3
United Kingdom	20.6	18.9	2.6	136.8	178.9
Sweden	7.4	0.0	13.5	100.2	121.1
Finland	0.0	0.0	8.9	76.6	85.5
All other	76.3	20.4	28.8	286.2	411.7
Total	421.0	192.4	127.8	3,490.1	4,231.3

Source: Compiled from statistics of the U.K. Iron and Steel Statistics Bureau.

Table 7-6
Sheet and strip: West German exports, by specified destination, by product, 1985

Destination	Type of product: Galvanized	Tinplate	Stainless	Other	Total
	Thousand metric tons				
United States	171.2	83.4	10.4	743.2	1,008.2
USSR	10.2	0.0	6.8	862.9	879.9
United Kingdom	60.9	39.9	129.3	479.4	709.5
Italy	21.6	39.0	36.3	519.6	616.5
France	47.6	16.8	12.1	513.8	590.3
Belgium-Luxembourg	7.3	12.6	128.1	345.0	493.0
Netherlands	39.3	52.8	12.1	362.3	466.5
Spain	19.8	18.0	63.1	375.8	476.7
India	1.2	17.0	1.6	340.3	360.1
Switzerland	15.8	6.5	19.4	235.5	277.2
Iran	53.8	27.2	4.1	173.5	258.6
Sweden	79.4	5.1	7.5	162.1	254.1
All other	159.2	179.8	136.9	1,663.3	2,139.2
Total	687.3	498.1	567.7	6,776.7	8,529.8

Source: Compiled from statistics of the U.K. Iron and Steel Statistics Bureau.

goals include developing new steel qualities that have optimum properties and a broad spectrum of applications. 1/

Because of a close relationship with customers, research is also being conducted on the working properties of steels, (such as forming, joining, and surface coating), and into service aspects (such as corrosion resistance, fatigue strength, and structural component behavior).

An example of a recent development flowing from cooperation between the steel industry and its customers is Thyssen's laser welding installation. With this installation, Thyssen is able to produce a welded galvanized product which can be stamped directly into automobile floor panels. Auto producers had previously been required to stamp and weld separate components to produce the panels, a process which complicated the production process. 2/

Also recently developed by a German producer is a thin slab caster. The caster is designed to produce strip 1,200 to 1,600 mm wide with a thickness of only 30 to 50 mm. The thin slab caster has been sold to a U.S. firm (Nucor Corp.) for its planned flat product mini-mill. 3/

Financial Aspects

As indicated in the following tabulation, the financial performance of German steel producers improved during 1982-86, as the return on sales 4/ for three major producers (Thyssen, Klockner, and Krupp) reached 1.0 percent in 1985, following losses in 1982-83.

	Return on sales (percent)
1982..............	(0.2)
1983..............	(2.0)
1984..............	0.4
1985..............	1.0
1986..............	0.8

According to industry officials, companies began experiencing losses in the final quarter of 1986 as a result of the appreciation of the mark, which had an adverse affect on export sales.

1/ Ibid.
2/ Ibid.
3/ Metal Bulletin, Jan. 20, 1987.
4/ Financial figures reflect all operations, including those not specifically steel-related.

Table 7-7 indicates in which parts of steel production the German steel producers are investing. The first section portrays investment at the steel producing or "hot end," 1/ and the second section depicts investment in sheet and strip rolling facilities.

Table 7-7
Steel: West German steel industry investment, by type of facility, 1979-87

(In millions of dollars)

Item	1979	1980	1981	1982	1983	1984	1985	1986 1/	1987 1/
Coke ovens..........	2/	2/	2/	69	176	141	59	44	8
Sinter and pellets..	111	180	44	4	3	7	22	9	3
Blast furnace.......	78	92	108	51	28	100	270	82	55
Electric............	44	43	61	60	20	15	34	21	4
Oxygen..............	127	216	141	106	65	43	90	74	43
Continuous casting..	83	147	96	55	54	77	124	58	11
Total...........	443	677	448	344	347	382	601	288	124
Hot-wide strip......	62	45	24	16	12	17	32	42	18
Narrow strip........	38	69	63	16	7	4	48	5	4
Cold-wide strip.....	2/	2/	2/	41	75	105	151	71	21
Coating.............	2/	2/	2/	11	10	12	43	63	30
Total rolling...	99	114	87	84	104	138	274	181	73

1/ Forecast.
2/ Not available.

Source: ECSC Investments, Commission of the European Communities, 1979-86.

The large capital expenditures in blast furnaces and basic oxygen furnaces reflect recent relining and modernization efforts. The high level of expenditures on continuous casting reflects efforts being made to increase the share of steel continually cast; the share has risen from 39 percent in 1979 to 85 percent in 1986. The increased investment in coated processes coincides with increased demand for such products. 2/

Investment by the West German steel industry has not been as high per ton as in other EC countries until recently, as shown in table 7-8:

1/ Investment in the "hot end" affects all product lines, including sheet and strip.
2/ Press releases and discussions with industry representatives.

Table 7-8
Actual investment expenditure in relation to crude steel production

Year	U.S. dollar per ton West Germany	ECSC total
1979	11.5	15.0
1980	16.5	18.6
1981	18.3	19.4
1982	19.9	23.1
1983	16.7	22.3
1984	18.6	18.7
1985	26.8	23.1

Source: OECD, The Iron and Steel Industry, Paris, 1987.

Historically German banks and industry have had a close relationship. Banks provide investment capital with particular banks adapting their services to particular industries. For example, the Dresdner Bank is closely allied with the German steel industry. 1/

The banks influence German industry partly through their presence on the supervisory boards of the industrial firms, often in the capacity of chairmen or vice chairmen. The banks can appoint these representatives because of the shares they hold in the industry in their own name as well as the control over the proxies of shareholders who are their depositors. Additionally, the banks can increase their power by exchanging proxies among themselves. An individual bank can thereby increase the weight of its voting power in any firm or industry in which it has an interest. 2/

Also, directors of the large industrial firms sit on the banks' supervisory boards. This is a form of mutual supervision. The industrialist keeps the banker intimately informed of all operations of his business. In return, he receives financial support for large-scale investment. 3/

Structural Changes

Rationalization

The significant reduction in capacity of the West German steel industry reflects the results of major rationalization programs. Closure of entire operational plants have resulted in most large producers having only a single integrated production facility. The facilities closed between 1975 and 1985 include 12 sintering lines and 46 blast furnaces, 92 basic Bessemer converters

1/ Richard F. Nyrop, p. 225.
2/ Ibid.
3/ Ibid., p. 227.

and open-hearth furnaces as well as 14 older oxygen converters, and 66 rolling plants. 1/

Industry sources indicate that German steel producers had to rationalize and modernize production facilities quickly and in a different environment than other European producers. This is because government funding did not begin until 1981, years after other European governments began significant subsidy programs to their steel industries. Through the 1970's, the mostly private German firms were left largely with their own resources to close facilities and modernize the ones believed viable (with the exception of those in the Saar, discussed below). 2/ The result is that the German industry required less government funding in the 1980's. Because mostly private funds were used, restructuring was accomplished on a more market-oriented basis. 3/

Mergers and acquisitions

Mergers have played a role in West Germany's restructuring. In the mid-1970's, 20 independent companies produced over 80 percent of the crude steel in West Germany; today that same percentage is produced by 7 company groups. Federal and State governments assisted the mergers by providing aid for discharged workers and other social costs resulting from closures, loans and loan guarantees for the emerging companies, and other assistance.

An example of the government assistance in rationalization is that provided in the Saar region of Germany in the late 1970's. By 1977, relatively large employee discharges were announced, and bankruptcy threatened the two major producers in the Saar because of the difficulties associated with production in the region. These included late integration into Germany after World War II, which exacerbated an already deficient infrastructure; high unemployment and reliance on steel as the sole employer, concentration on wire rod and sections; too many steel producers; and lack of convenient access to major markets due to their isolated location. The Federal and State governments began negotiations towards a rationalization plan with the steel union and the Luxembourg steel firm Arbed, which already had interests in the Saar steel industry. 4/

Arbed gained control of the affected companies and of the financial aid in return for producing a rationalization program that was to have the approval of a public accountancy firm, and to meet certain structural requirements of the State government. The union received federal guarantees of financial support for a social plan that would protect a core of employment and reduce the hardship of unemployment for the others. The Federal Government provided aid of over $430 million to cover Arbed's risks and to help finance the social plan. 5/ The rationalization program involved concentration of ownership in one large firm, Arbed Saarstahl, integration of crude steel and rolled production at one site and a reduction of the workforce

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1/ Steel Times, April 1985, p. 157.
2/ J. Esser and W. Fach, "Crisis management in West Germany" in Industrial Crisis, St. Martin's Press, New York, 1983, p. 112.
3/ Information developed through interviews with West German steel industry officials.
4/ J. Esser and W. Fach, p. 113.
5/ Ibid., p. 112.

by one-third. A regional aid program was intensified in order to assist in diversifying the local economy.

According to German steel industry officials, additional mergers in the industry are unlikely, as there are few apparent benefits to be gained by companies. Discussions with other industry observers suggest that this reluctance to merge could complicate needed capacity reductions in the sheet and strip sector. The complication lies in the fact that with the exception of Thyssen, which operates two hot strip mills, all other sheet producer's operate only one mill. Closures of a mill would therefore lead to an effective withdrawal of all but Thyssen from the market.

West German Government Assistance

Most West German Government aid approved by the EC and recorded as disbursed to the steel industry from 1980 to 1985 was in the form of grants for investment purposes or operating aid, including interest relief. 1/ Reduced interest rate loans as well as guarantees for market rate loans were also provided. Total investment aid during this period, including the value of reduced interest rates and guarantees, was $1.1 billion. Total aid for continued operation by steel producers was $1.13 billion. Closure aid totaled $291 million and covered 50 percent of the book value of closed plants plus associated labor severance costs. 2/ A portion of the investment aid must be repaid, according to West German law, if the producers become profitable. Some of this aid has reportedly been repaid. 3/

The Federal Ministry of Research and Technology's Technological Development Program was established in 1978 to allay government and industry fears that because of the difficulties the steel industry was experiencing research and development in the steel sector was being neglected. It was believed that such neglect might eventually lead to a loss of international competitiveness. 4/

The program's most common assistance was in the form of grants of 50 percent of the research expenses, that were paid following the conclusion of the research project. Emphasis of the assistance was on the area of process technology (e.g., energy-saving processes), material properties (e.g., development of steel grades which conserve scarce alloy elements without the loss of their essential properties) as well as applications technology (e.g., application of steel in marine and nuclear technology). 5/

Under the most common form of grants there is no repayment obligation. The recipient must, however, grant a license to third parties for patents

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1/ Sixteenth Report on Competition Policy, Brussels, 1987.
2/ Ibid.
3/ Information developed through interviews with West German steel industry officials.
4/ Presentation by Dr. Gerhard Ollig, German Ministry of Economic Affairs, Sept. 1980.
5/ West German Federal Ministry of Research (BMFT), Subsidy Primer, (5th Revised Ed.), p. 88.

resulting from such research if the grant was more than 75 percent of the research cost. If the income from a license exceeds $500,000, the recipient may have to pay the government 20 percent of the license income. 1/

The Federal Ministry of Research and Technology publishes a yearly catalogue of all projects in which it grants funds. A review of this catalogue indicates that in addition to the research goals mentioned above, substantial funds received by the steelworks were often used to purchase or construct plant and equipment based on already existing technology. 2/

From 1978-1985, federal government research assistance under this program totaled approximately $350 million. 3/ Among the recipients of grants were universities, research institutes, metal-working companies as well as all the major West German steel producers. The granting of federal funds was often contingent on matching state funds, which greatly increased the aid available to the firms.

This program was operated in conjunction with the Investments Premium Law, which provided Federal grants for investments in tangible fixed assets, provided they were used for research and development purposes for at least 3 years. The amount of the grant is 20 percent of the purchase and production costs if they do not exceed approximately $365,000 and 7.8 percent of the costs that exceed this amount. In the event that the tangible fixed assets are not used exclusively for research and development purposes, the grant is available on a pro rata basis. The capital investment allowance is also granted for the purchase of new depreciable intangible assets, for example patents, if the purchase costs do not exceed $365,000. 4/

As indicated in the discussion of ECSC activities (see Chapter 4), the EC provides certain aid to member countries' steel industries. In the case of West Germany, EC redeployment aid (i.e., aid for steelworkers) for the steel industry and iron ore mining totaled $112 million during 1980-86. The total amount of workers receiving aid during this period was approximately 64,000. In 1986 alone, redeployment aid was $26 million for 9,000 workers. 5/ This aid is important because of West German reliance on early retirements to reduce the size of the workforce.

The EC also puts considerable emphasis on "conversion loans." These funds are widely available low interest loans given to steel works to assist with costs of restructuring. Additionally, conversion loans are used to encourage the creation of new business activities in areas where employment in the coal and steel industries is declining. Total conversion loans granted to West Germany during 1975-86 were over $1.1 billion and resulted in the addition of 69,000 jobs. 6/

1/ Ibid.
2/ BMFT, Subsidy Catalogue.
3/ Information developed through interviews with West German steel industry officials.
4/ BMFT, Subsidy Primer, p. 100
5/ Fourteenth through Twentieth General Report on the Activities of the European Communities.
6/ Twentieth General Report on the Activities of European Communities, p. 216.

Another source of funds was the European Regional Development Fund which assists areas adversely affected by restructuring. These grants encourage new job creating activities and concentrate on the improvement of public infrastructures. During 1975-86 grants from this fund received by West Germany totaled $725 million. 1/

Competitiveness of the West German Steel Sheet and Strip Industry

Industry sources indicate that an important factor that accounts for the relatively successful position of the German industry today is the complete reconstruction of much of the German steel industry after World War II. 2/ Factories completely destroyed were rebuilt with more modern equipment than most of their European competitors. Moreover, demand for consumer goods and consumer durables kept the steel industry producing at high utilization rates. 3/

Industry officials also believe that because the German steel industry has had to adapt to oversupply and low prices without the significant government aid and protectionist measures that other countries received, they are much more adept at quickly adjusting production and marketing methods to maintain profitability in changing market conditions. Most German steel sources claim that government aid in other EC countries, particularly France and Italy, has allowed those industries to modernize and reduce costs to the same extent as achieved by the German industry. However, according to these sources, acquired marketing, service and production skills provide the Germans with a significant advantage over these competitors. 4/

An important indication of German competitiveness is its relative costs. A review of comparative costs in recent years indicates that the West German industry has consistently been one of the lower cost producers, though its position has been affected by fluctuations in the value of the mark. Sources indicate that West Germany has become a high cost producer due to the recent appreciation of the mark. 5/ With regard to specific cost components, German material costs are higher than for many other producers. One reason is that they pay more for their coal requirements. Another reason is that Germany has no deep water ports. Most of the steel production is on the Rhine River, which necessitates the use of barges for transporting imports of raw materials and exports of finished steel products, which raises handling costs. 6/ Landlocked steel producers must use railroad shipping, which is more expensive. These companies are, however, closer to local steel consumers. Labor costs, at $124 per metric ton shipped at the actual 1986 operating

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1/ Ninth through Twentieth General Report on the Activities of the European Communities.
2/ Information developed through interviews with West German steel industry officials.
3/ The Economist, May 3-9, 1986, p. 92.
4/ Information developed through interviews with West German steel industry officials.
5/ World Steel Dynamics, Cost Monitor #10, Nov. 1987.
6/ Information developed through interviews with West German steel industry officials.

rate, were below most other western producers such as the United States at $169; Japan at $133; France at $184; and the United Kingdom at $111. 1/

Problems Confronting the West German Steel Industry

One of the difficulties confronting the West German steel industry is the requirement that they buy their coal from Ruhrkohle. The fact that the coal is sold at a higher price than world market rates effectively raises their material costs. The Germans must also rely on imported iron ore that is more expensive to transport because of the lack of deep-water ports.

Government regulations also appear to put producers at a disadvantage in certain areas. The West German steel producers reportedly pay a premium of approximately $70 million annually, for example, due to state regulated higher freight costs within Germany (as compared with other EC transportation systems). 2/ Moreover, West German environmental controls are more strict than other European producers. Environmental protection measures add approximately $46 per ton of steel; other EC countries on the average pay only $12 per ton. 3/

German steelmakers claim that more serious difficulties lie in the magnitude of aid given to other European producers. Foreign firms are able to invest at a greater rate per ton of steel. Moreover, profitable West German firms must repay a portion of the restructuring aid received by them from the German government. No other countries in the EC have such a requirement. 4/

Industry officials indicate that a related problem is that the EC has removed some products from the production quota system, which in effect allows the heavily subsidized firms in other EC countries to sell steel at reduced prices, with no quantity restriction. The potential is therefore high for these countries to gain business from the German industry.

Industry Outlook

Future success in global markets depends to a large extent on the value of the German mark. If it continues to be high in relation to the dollar, German firms anticipate they will experience difficulties. Success also depends on the extent to which excess supply in the EC is addressed. One German industry analyst with whom the staff had discussions indicated that overcapacity in the EC would continue to be a chronic problem, as economic growth would not be sufficient to maintain consumption levels. His analysis indicated that in the case of West Germany, steel consumption would grow only

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1/ World Steel Dynamics, Steel Strategist #13, March 1987, Table 6.
2/ Metal Bulletin Monthly, June 1986, p. 22.
3/ Ibid., p. 23.
4/ Ibid.

when gross domestic product (GDP) grew at a rate exceeding 3 percent per year. Most forecasts indicate growth of approximately 2 percent per year. 1/

Because a high percentage of production is exported, German steel producers are particularly susceptible to changes in foreign markets, as evidenced by recent performance. However, because of the quality requirements of many industries, such as the automobile industry, German products are able to make sales, even though a higher price may be charged. 2/

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1/ Information developed through interviews with West German steel industry officials.
2/ Ibid.

CHAPTER 8. THE FRENCH INDUSTRY

Structure of the French Steel Sheet and Strip Industry

The French Government has historically played a large role in the steel industry in terms of providing financing, directing restructuring and rationalization, funding research and development, and ownership. At the end of World War II the French steel industry required extensive modernization, to which the Government responded with a system of coordinated planning involving the major economic decision makers, including industry representatives, trade unions, government departments, and a special planning commission.

The First plan (1946-51), known as the Monnet Plan, directed public and private capital to key industries that had been damaged during the war, which included the coal and steel industries. Most of the rebuilding and modernization of the French steel industry occurred in the flat product area.

Under the Monnet Plan, the French Government encouraged many firms to merge; during 1948-56, six major industrial groupings, accounting for about 75 percent of French steel capacity, reorganized. One of the primary Government objectives was to increase steel capacity and production. To this end, a hot strip mill was constructed at Denain in 1951; it was financed partly from money provided by the Marshall Plan, as was a second hot strip mill built in Seremange in 1953. Other facilities built during the 1950's included a cold-rolling mill and a galvanizing line, both of which were constructed in Montataire in 1950. In addition to guiding investment decisions and providing aid to the industry, the Government imposed price controls on steel and was instrumental in the formation of the European Coal and Steel Community (ECSC) in 1951. Restructuring of the French steel industry after World War II resulted in a concentration of operations in two companies: Usinor and Sacilor.

During the 1960's, the French Government became actively involved in implementing a series of modified 4-year plans designed to increase the international competitiveness of the French steel industry which reportedly lagged behind their foreign competitors both in productivity and optimal plant size. The Fifth (1966-70), Sixth (1971-75), and Seventh (1976-80) Plans were particularly important in the development of the French steel sheet and strip industry as many of the problems facing the industry today evolved as a result of the policies implemented during these years.

The steel sheet and strip complex built at Dunkirk in 1963 was well situated with respect to its major markets and the availability of a deep water port. However, its construction would have not been possible without the financial support and restructuring assistance of the French Government and investors such as loan consortiums. At that time, expanded production rather than profitability was emphasized, and quantitative goals for steel sheet and strip production were to continue until 1986.

In September 1966 the French Government announced its intentions to assist the steel industry under the Fifth Plan. Financial aid was to be provided in part through subsidized loans for new investments and to increase capacity.

The 1970's proved to be difficult years for the French steel industry. Despite an emerging overcapacity problem and deepening financial losses by the steel companies, the French Government increased its aid to the industry during the Sixth Plan. In response to optimistic projections for growth in world steel demand, expansion plans were implemented that resulted in significant capacity being brought on line by the mid-1970's.

The most significant expansion was the building of the integrated steel mill complex at Fos-sur-Mer, jointly owned by Sacilor and Usinor through their joint venture, Solmer. French Government officials acknowledged that the fixed assets at Fos were financed with assistance of investments "directly subsidized" by the French Government as part of a national program to stimulate selected economically depressed regions. 1/ The fact that the location of the Fos facility was based on a desire for regional development rather than market considerations would later lead to competitive problems. Fos is located in the south of France, far away from the major steel sheet and strip markets (i.e., the French and German automakers) in the north. In addition to Fos-sur-Mer, a cold-rolling facility was built at Mardyck in 1973.

The anticipated growth in steel demand did not occur, however, and capacity utilization declined continuously from its peak in 1975. This decline was also partially attributable to French political considerations, which prevented the closings of older plants that had been designated for replacement by these newer facilities.

The resulting depression caused by overcapacity and falling demand had a profound effect on the financial health of the steel industries of France and other European countries. In 1977, steel industry restructuring efforts were begun by the ECSC, with France playing a significant role in the development of the ECSC efforts, called the Davingnon Plan. Further assistance was provided under the Government's 1978 Plan Acier, which was designed to restructure and revitalize the French steel industry.

There were several major points to the Plan Acier, the first of which was a special labor agreement between the producers association and the labor unions to facilitate a reduction of the work force. The second major point concerned rationalization and modernization of both the physical and financial structures of the industry. The second point entailed closures of some plants, primarily in the Lorraine region, while others were being modernized in the south (Fos) and north (Dunkirk). Financial restructuring under the Plan Acier amounted to the Government and banks taking effective control of the industry by creating new holding companies and by converting approximately $8 billion of long-term debt held by Usinor and Sacilor into equity. The third major point of the Plan Acier was to increase Government loans for modernization.

Several years later, in 1981, a number of industries, including the steel industry, were nationalized. The nationalization was followed by a new program that called for closing obsolete facilities and making additional investments to modernize existing competitive plants with the intention of meeting the EC goal of ending government steel subsidies by 1986. The

1/ Department of State telegram, Paris, March 1977.

program's objectives were to maintain production levels between 16 million and 19 million tons, depending on the level of economic growth in the countries that purchased French steel, and to close permanently 915,000 tons of rolling-mill capacity. The new program also called for further reductions in employment and the continuation of Government financial assistance, which totaled $8.8 billion during February 1980-December 1985.

The Government also implemented a social program aimed at limiting the impact of layoffs on steelworkers and their communities and accelerating the timing of the layoffs that were scheduled to take place. To help communities adversely affected by plant closures, the French Government provided special tax benefits for the creation of small businesses and supplemental subsidies for companies establishing plants in designated areas. The Convention Generale de Protection Sociale helped in retraining and other measures to alleviate unemployment among steel workers; the program was to end in 1987.

Despite the efforts of the EC and the French Government, the French steel industry continued to experience financial losses, which totaled $1.4 billion in 1983 and $1.8 billion in 1984, contributing to the reorganization of the French stainless steel sheet and strip industry in 1985. This reorganization involved both Usinor and Sacilor. Usinor merged its Chatillon facility with its Usinor Inox division, creating a new company called Usinor Chatillon, and Sacilor created a holding company for its stainless steel interests. Sacilor's new holding company, called Ugine SA, was wholly owned by Sacilor and held the group's 53.2-percent interest in the flat rolled stainless steel producer Ugine-Gueugnon, the second largest producer of stainless steel flat products in the world.

After the reorganization of the French flat-rolled stainless steel industry there was a reorganization of the entire steel sheet and strip industry. Sacilor reorganized its flat products division within a new wholly owned subsidiary and holding company, Solmetal, to serve as a base for cooperation with Usinor. The French Government had been urging greater coordination between Usinor and Sacilor since 1982 in an effort to eliminate the possibility of duplication of efforts and excessive competition between the two companies. Usinor became a holding company on January 1, 1986, turning all of its operating divisions into separate subsidiaries. The most important of these, Usinor Aciers, took over the flat product and stainless steel works thus becoming the fourth largest flat-rolled steel producer in Europe.

A shift in political power in 1986 was accompanied by a reexamination of conditions in the French steel industry. An industry evaluation prepared at the request of the Government concluded that the industry had to continue to reduce production capacity towards 18 million tons from the existing level of 23 million tons, and employment of production workers to 50,000 from the existing level of 73,000, and improve coordination between Usinor and Sacilor to avoid duplication of investments and to concentrate processing facilities.

In September 1986, the Government appointed Francois Mer as the chairman of both Usinor and Sacilor. 1/ Mer, adhering to the outlines of the evaluation's recommendations, was to do the following: (1) "restore the8-3

1/ "France Sees New Scope for Restructuring," Metal Bulletin, Feb. 3, 1987, p. 25.

competitiveness and profitability of the steel industry as rapidly as possible with a view to its eventual privatisation," 1/ and (2) help moderate the politically damaging labor conflicts that had historically accompanied plant closures and employment reductions. The Government also announced it would further reduce the two companies' debt-carrying costs by converting debt to equity.

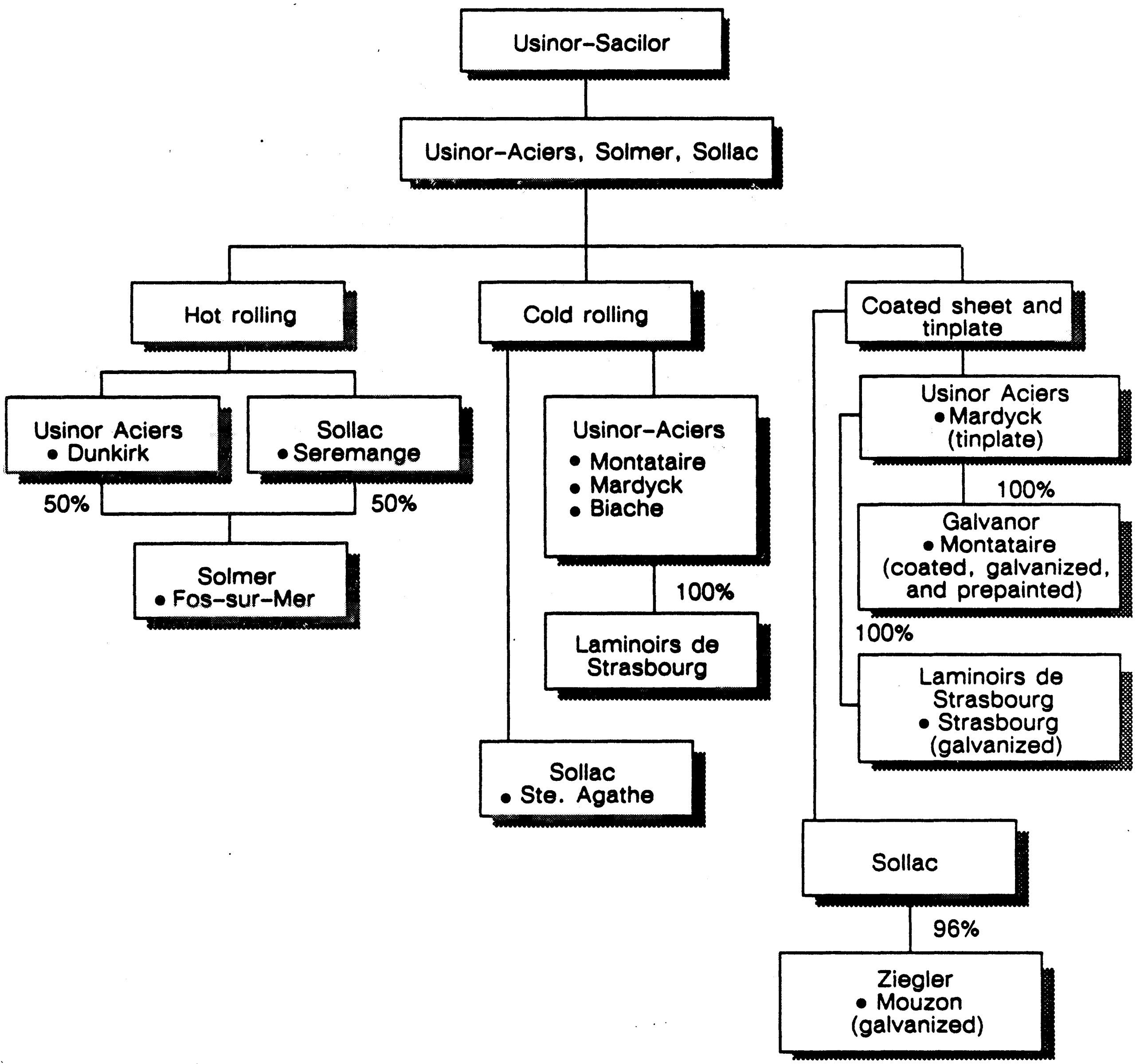
Despite having a joint chairman for Usinor and Sacilor the two steel groups were not formally merged in 1986 because of the employment cuts that rationalization would have entailed, and because of pressure from the French car-manufacturing industry to maintain competition among its suppliers. Merger plans, however, were initiated with the combination of the flat products divisions of Usinor and Sacilor in early 1987. Plans were also announced to bring the stainless steel activities of the two groups together, to bring production and marketing closer to the customer's needs, and to continue to reduce production costs so that eventually the groups will be able to break even. 2/

In May 1987 it was formally announced that Usinor and Sacilor were to be merged to form a single holding company called Usinor-Sacilor. When the merger was announced, the two companies were already in the process of merging their sales divisions. The merger of Usinor and Sacilor came at a time when the two companies posted an aggregate net loss of 12.5 billion French francs ($1.8 billion) in 1986 on sales of 75.9 billion French francs ($11 billion), a 30-percent increase over 1985's loss of 8.7 billion French francs ($968 million). In 1986 the total work force of Usinor and Sacilor was cut by 12,000 to 88,900, and it was indicated that a further 16,000 jobs would have to be cut by mid-1988. 3/ In July 1987 Usinor-Sacilor approved the merger of Ugine-Gueugnon and Usinor Chatillon, their respective specialty steel subsidiaries. The new group is called Ugine Aciers de Chatillon et Gueugnon S.A. (Ugine) and is the world's largest flat-rolled stainless producer, as well as an important electrical sheet producer.

Usinor-Sacilor is now a holding company with various subsidiaries that account for the production of the different sheet and strip products. The carbon steel flat products group is organized in five product divisions: (1) plate and pipes; (2) hot-rolled products; (3) cold-rolled products; (4) coated products; and (5) tinplate. Figure 8-1 shows the present organization of the carbon steel flat product sector, excluding plate and pipes, within the French steel industry.

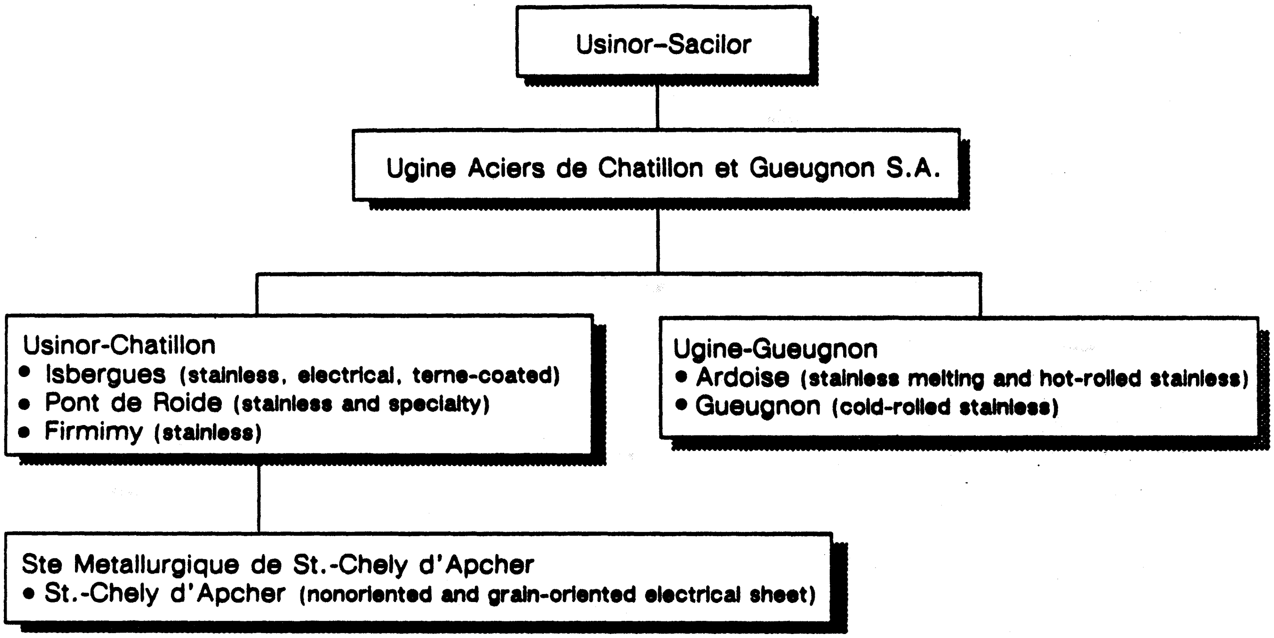
1/ "Uphill Battle to Hold Its Own in Europe: French Steel Industry," Financial Times, Oct. 13, 1986, p. 17.
2/ "Mer Merges Flat Product Groups," Metal Bulletin, Feb. 6, 1987, p. 19.
3/ "Big 1986 Loss Prompts Usinor-Sacilor Merger," Metal Bulletin, May 8, 1987, p. 23.

Figure 8-1
Carbon steel sheet and strip: Organization of the French industry, 1987



Source: Industry publications.

Figure 8-2
Stainless and specialty steel sheet and strip: Organization of the French industry, 1987



Source: Industry publications.

Figure 8-2 shows the organization of the flat rolled stainless and speciality steel sector, Ugine Aciers de Chatillon et Gueugnon SA, within Usinor-Sacilor.

The French steel industry exhibits less downstream vertical integration than the U.S. steel industry. The French steel industry does, however, exhibit more upstream vertical integration than most of the other ECSC steel producers, who import almost 100 percent of their iron ore and a majority of their coal, with the exceptions of Great Britain and West Germany. In 1985 France produced 14.6 million metric tons of iron ore, which was 92 percent of the total ECSC iron ore production. The extraction potential for French iron ore, however, is declining. In 1983 the French iron ore extraction potential was 22.3 million tons; by 1986, this had declined by 22 percent to 17.5 million tons. 1/

Iron ore is mined in the eastern part of France at Lorraine near Sollac's Seremange facility. Steel produced in Lorraine from locally produced ore accounted for about 30 percent (5.5 million metric tons) of French steel output in 1985. The Dunkirk and Fos-sur-Mer plants operate entirely on imported iron ore. The imported ore is usually secured through long-term contracts at prices that are comparable to the cost of extraction of the Lorraine ore. Fos, unlike Dunkirk, is not tied into long term contracts for iron ore and purchases its ore requirements on the open market at spot prices. The Dunkirk plant secures its imported ore through long-term contracts and the price of the ore is usually subject to negotiation over the life of the contract.

Coal production in France is limited and none of the mines are owned by steel companies. In 1985, 15.1 million tons of hard coal were produced in France, mostly from the Lorraine region. The French steel industry gets the majority of its coal requirements from West Germany, primarily through long-term contracts. About 41 percent of French coke production is accounted for by mine-owned coking plants, most of which are in the Lorraine region. The remaining coke production in France is accounted for by steel-owned coking plants. The Dunkirk, Seremange, and Fos-sur-Mer steel plants all have their own coke ovens. Just as with iron ore, the Fos-sur-Mer steel plant purchases its coal requirements at spot prices on the spot market.

There is little diversification into nonsteel areas by the French steel sheet and strip industry, in sharp contrast to its counterpart in West Germany. Steel production, metallurgy, processing, and trading make up over 80 percent of Usinor-Sacilor's activities.

With regard to licensing agreements, an area in which limited information was available, Usinor developed a product in 1983 called Monogal, which is a hot dipped galvanized steel brushed on one side leaving a very thin coat of iron-zinc alloy on the surface. A license to produce Monogal has been purchased by Thyssen Stahl, a large West German steelmaker, and others have subsequently expressed interest.

1/ European Coal and Steel Community, Investment in the Community Coalmining and Iron and Steel Industries, 1986.

Conditions in the French Steel Sheet and Strip Industry

Employment, Production Costs, and Profitability

During 1974-86 crude steel production in France declined 34 percent to 17.9 million tons, and employment of production workers declined 54 percent to 73,000 workers. These declines were primarily attributable to the adverse effects of the 1973 and 1979 oil crises on steel demand and the implementation in October 1980 of Article 58 of the ECSC Treaty to limit production from the various EC steel producers through a quota system (table 8-1). The other

Table 8-1
Steel: Production workers, crude steel production, and man-hours per metric ton of steel shipped in France, 1973-86

Year	Production workers	Annual change	Crude steel production	Annual change	Man-hours per ton 1/	Annual change
	1,000 workers	Percent	Million metric tons	Percent	Hours	Percent
1973	151.7	-	25.3	-	17.23	-
1974	157.8	4.0	27.0	6.7	15.73	-9
1975	2/	2/	21.5	-20.4	17.66	12
1976	2/	2/	23.2	7.9	16.06	-9
1977	143.0	2/	22.1	-4.7	14.82	-8
1978	131.6	-8.0	22.8	3.2	13.17	-11
1979	120.6	-8.4	23.4	2.6	11.82	-10
1980	104.9	-13.0	23.2	-0.9	10.61	-10
1981	97.3	-7.2	21.3	-8.2	10.86	2
1982	95.2	-2.2	18.4	-13.6	11.52	6
1983	90.7	-4.7	17.6	-4.3	11.00	-5
1984	85.1	-6.2	19.0	8.0	9.47	-14
1985	76.1	-10.6	18.8	-1.1	9.33	-1
1986	73.0	-4.1	3/ 17.9	-4.8	8.88	-5

1/ Calculated based on actual operating rate.
2/ Not available.
3/ Preliminary.

Source: Commission of the European Communities, World Steel Dynamics, and the American Iron and Steel Institute.

factors contributing to employment reductions were rationalization and modernization allied with the automation of production (accelerated by high steelworker wages) as well as the increasing share of production accounted for by continuous casting. These factors also explain why there has been a greater reduction in labor than there has been in raw steel production.

Continuous cast steel as a percent of crude steel production increased from 12.8 percent in 1975 to 89.6 percent in 1986, making France one of the leading European users of the continuous casting process. In some product areas, specifically sheet and strip, the share of finished product produced from continuous cast steel is close to 100 percent.

Modernization and the use of continuous casting has helped to increase productivity. Man-hours per metric ton shipped declined by 50 percent during 1975-86, from 16.17 to 8.07, at a standard operating rate of 90 percent. At the actual operating rates in the respective years, man-hours per ton shipped exhibited the same trend, declining from 17.66 in 1975 to 8.88 in 1986. The actual operation rates were 74.3 percent in 1975 and 72.6 percent in 1986. 1/

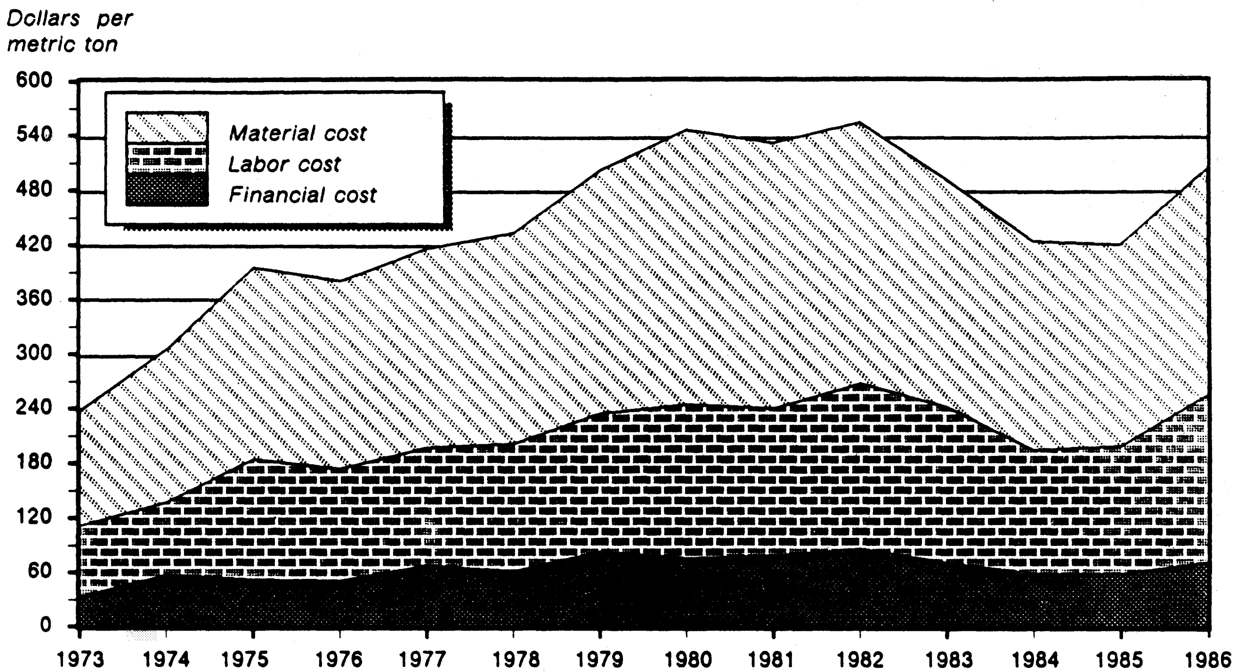
Although no precise data are available, French industry sources have indicated that job losses in the sheet and strip sector, particularly at the hot-rolling stage, have been severe because ECSC mandated restructuring efforts as well as independent efforts by individual companies have been focused on hot-rolling mills. In addition, employment reductions have occurred disproportionally on older workers because of early retirement incentives, resulting in a relatively young work force. The decreasing numbers of workers eligible for early retirement mean that future job losses will occur for younger workers (who cannot receive the generous early retirement benefits), which could have negative implications for future labor/government relations.

Historically, French steelworkers have received much higher wage rates than their counterparts in other EC countries. In fact the growth in wage rates has exceeded improvements in productivity, resulting in higher overall labor costs. A large part of the growth in steelworker wage rates can be attributed to the strength of the French steelworkers union.

Figure 8-3 shows French steel industry pretax cost per ton shipped (based on the World Steel Dynamics cost model) during 1973-86 broken down by the three major components of cost: labor, material, and financial. The total labor cost per ton was about $183.60 in 1986, which was 37 percent of total pretax production cost. Wage rates, including benefits, in France rose (in dollar terms) from $4.54 in 1973 to $20.64 in 1986, an increase of 355 percent. About two-thirds of unit labor costs are direct wages and about one-third are benefits. Unlike steelworkers in the United States, French steelworkers have not agreed to wage cuts in recent years but only to a reduction in wage rate growth. In recent years wage rates have increased less than the cost of living (in franc terms). The gap between steelworker wages and manufacturing wages in general is not as great in France as it is in the United States, according to French industry sources. Currently, there is an effort in France to move away from standard yearly automatic pay increases and have pay raises based more on merit. There is very little outside contracting in the French steel industry as the wage differential between the industry and contractors is fairly small.

1/ World Steel Dynamics, Steel Strategist #13, Mar. 30, 1987.

Figure 8-3
Steel mill products: French steel industry costs (at actual operating rate) per ton shipped, 1973-86



Source: World Steel Dynamics.

Raw material costs make up a greater percentage of the pretax cost. The raw material cost per ton shipped increased by 97 percent during the period, from $126.10 in 1973 to $247.90 in 1986. The annual changes in raw material costs during this period were not as great as the changes in labor costs. Energy costs, which are included in material costs, have been consistently below those in the United States, Japan, and West Germany since 1984 and amounted to $34 per metric ton in 1986. 1/ This is due primarily to low electricity costs in France resulting from the extensive use of nuclear power. Raw materials, most of which are priced in U.S. dollars, currently account for about 53 percent of the total pretax production costs for steel mill products in France.

Financial costs consist of State and local taxes, depreciation expense, and interest expense. Interest expense for the French steel industry accounts for the largest portion of the financial cost, representing 60 percent of the total. These costs reflect the relatively large debt levels that have historically been undertaken by the French steel industry. Even though much of the debt is secured at below market rates, debt service remains a competitive disadvantage for the French steel producers, running at about 5 percent of sales. 2/ Analysis of the debt situation is complicated by the fact that the French Government, as the principal owner of the steel

1/ World Steel Dynamics, Cost Monitor #9, Jan. 19, 1987.
2/ "Partnership Pays Off in France," American Metal Market, Oct. 6, 1987, p. 16.

companies, has often undertaken transfers of capital to the companies to reduce their debt service burden. In 1986 the financial cost per metric ton of steel mill products shipped was $71.20. Because of large capital infusions and debt-to-equity swaps by the French Government, the financial cost per ton shipped has declined recently.

After taking into account all of the components of cost and comparing these costs to total revenue per ton shipped over time, the French steel industry has not made a pretax profit on sales of steel mill products since 1974. As can be seen in figure 8-4, the largest loss was experienced in 1982 when French steelmakers lost, on average, $115.10 per ton of product shipped. More recently in 1985, the last year for which World Steel Dynamics provides profit data, French steelmakers lost $19.80 per ton shipped.

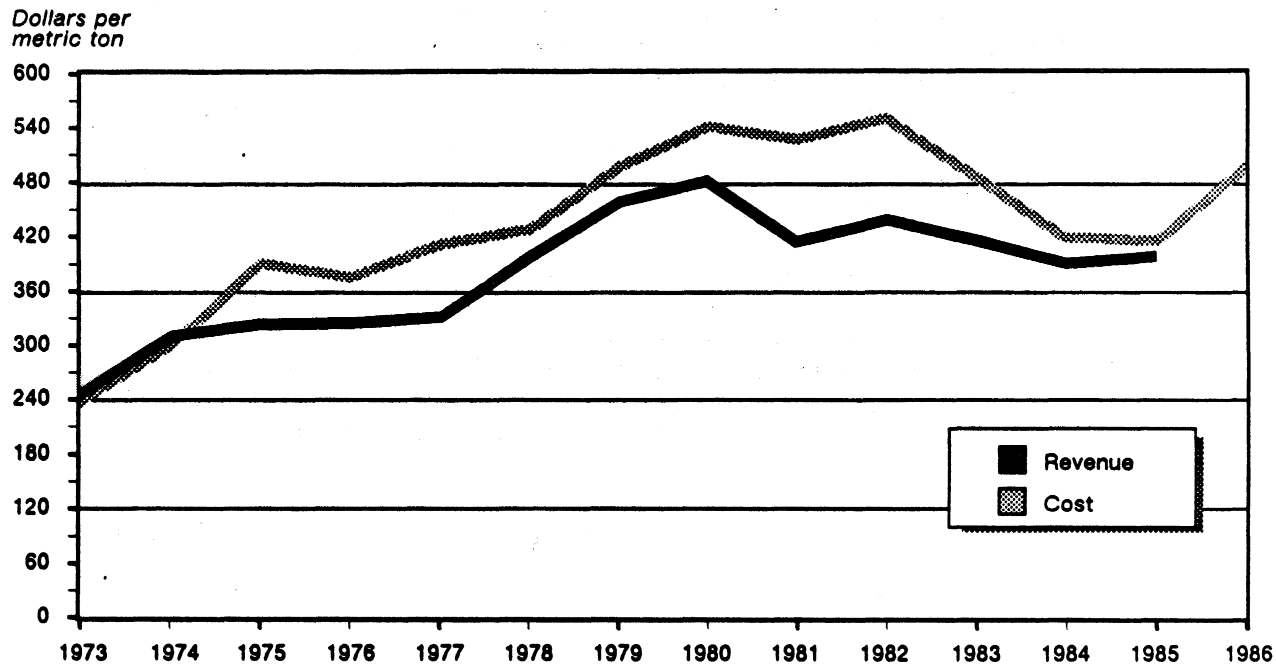
Based on their general cost model, World Steel Dynamics has estimated the French production cost for hot-rolled product (mostly sheet and plate) in early 1987. The following tabulation, which is based on a composite of the average integrated producer producing steel via the BOF and open-hearth methods, shows the costs for hot-rolled product production in France in both dollars and francs as well as the man-hours per ton and operating rate used to derive the costs:

	French francs	U.S. dollars
Operating rate (percent).........	75	75
Labor:		
Manhours/metric ton............	5.0	5.0
Employment cost/man-hour.......	140	22.76
Employment cost/metric ton.....	700	114
Materials:		
Major 1/......................	724	118
Other.........................	494	80
Material cost/metric ton.......	1,218	198
Financial:		
State and local taxes..........	48	8
Depreciation expense...........	106	17
Interest expense...............	234	38
Financial cost/metric ton......	388	63
Total pretax cost................	2,306	375

1/ Major materials include iron ore, coking coal, scrap, and energy.

Source: World Steel Dynamics, Steel Strategist #13, Mar. 30, 1987.

Figure 8-4
Steel mill products: French steel industry pretax cost (at actual operating rate) and revenue per ton shipped, 1973-86



Source: World Steel Dynamics.

Consumption

French apparent consumption of hot-rolled sheet and strip declined from about 3.1 million tons in 1980 to about 2.4 million tons in 1986 as shown in table 8-2. Import penetration for these products has remained at a significantly high level throughout the 1980's ranging from a low of 50 percent in 1980 to a high of 67.9 percent in 1986. Import penetration for other sheet and strip is much lower (table 8-2), averaging about 33.5 percent during the same time period. Apparent consumption of total sheet and strip declined from 8.1 million tons in 1980 to about 6.6 million tons in 1986, a decrease of 18 percent.

Higher value coated sheet products exhibit much lower import penetration in France than sheet and strip products in general as shown in table 8-3. Of the high value coated products, electrical sheet showed the highest import penetration (34.7 percent) in 1986. Import penetration was the lowest for galvanized sheet and strip (17 percent), the consumption of which increased significantly between 1980 and 1985.

Table 8-2
Sheet and strip: French production, exports, imports, and apparent consumption, 1980-86

Item	Production	Exports	Imports	Apparent consumption	Ratio of imports to consumption
	---------------1,000 metric tons			-----------	-----Percent-----
Hot-rolled sheet and strip:					
1980	3,754	2,225	1,527	3,056	50.0
1981	3,557	2,367	1,535	2,725	56.3
1982	3,224	1,952	1,466	2,738	53.5
1983	3,136	2,018	1,315	2,433	54.0
1984	3,296	2,097	1,775	2,974	59.7
1985	2,828	2,002	1,717	2,543	67.5
1986	2,930	2,169	1,611	2,373	67.9
Other sheet and strip:					
1980	6,373	2,929	1,644	5,088	32.3
1981	5,831	2,755	1,477	4,553	32.4
1982	5,455	2,257	1,671	4,869	34.3
1983	5,340	2,487	1,520	4,373	34.8
1984	5,655	2,833	1,476	4,298	34.3
1985	5,915	3,106	1,373	4,182	32.8
1986	5,913	3,058	1,417	4,272	33.2
Total sheet and strip:					
1980	10,127	5,154	3,171	8,144	38.9
1981	9,388	5,122	3,012	7,278	41.4
1982	8,678	4,209	3,137	7,606	41.2
1983	8,476	4,505	2,835	6,806	41.7
1984	8,950	4,930	3,251	7,271	44.7
1985	8,743	5,108	3,090	6,725	45.9
1986	8,843	5,227	3,028	6,644	45.4

Source: Chambre Syndicale de la Siderurgie.

Table 8-3
Steel sheet: French production, exports, imports, and apparent consumption, by selected products, 1980-86

Item	Production	Exports	Imports	Apparent consumption	Ratio of imports to consumption
	--------------	--1,000 metric tons	-----------		-----Percent-----
Tinplate: 1/					
1980	1,043	564	101	580	17.4
1981	894	467	116	543	21.4
1982	988	491	112	609	18.4
1983	921	480	103	544	18.9
1984	914	466	113	561	20.1
1985	936	459	116	593	19.6
1986	966	550	120	536	22.4
Galvanized:					
1980	1,014	413	217	818	26.5
1981	1,039	400	202	841	24.0
1982	1,042	324	228	946	24.1
1983	1,015	387	214	842	25.4
1984	1,136	480	204	860	23.7
1985	1,189	447	135	877	15.4
1986	1,195	499	143	839	17.0
Electrical:					
1980	178	84	48	142	33.8
1981	167	79	44	132	33.3
1982	160	73	41	128	32.0
1983	184	102	37	119	31.1
1984	171	90	30	111	27.0
1985	170	85	36	121	29.8
1986	152	86	35	101	34.7
Other coated:					
1980	263	123	42	182	23.1
1981	278	151	45	172	26.2
1982	288	154	52	186	28.0
1983	342	166	67	243	27.6
1984	423	193	74	304	24.3
1985	664	360	168	472	35.6
1986	1,079	340	187	926	20.2

1/ Includes tin-free steel.

Source: Chambre Syndicale de la Siderurgie.

Table 8-4
Average annual growth rates of French sheet and strip production, exports, imports, and apparent consumption, 1980-1986
(In percent)

	Production	Exports	Imports	Apparent consumption
Sheet and strip products:				
Hot-rolled.............	-4.0	-0.4	0.9	-4.1
Other..................	-1.2	0.7	-2.5	-2.9
Total................	-2.2	0.2	-0.8	-3.3
Tinplate 1/...........	-1.3	-0.4	2.9	-1.3
Galvanized.............	2.8	3.2	-6.7	0.4
Electrical.............	-2.6	0.4	-5.1	-5.5
All other coated.......	26.5	18.5	28.3	31.1

1/ Includes tin-free steel.

Source: Compiled from data submitted by Chambre Syndicale de la Siderurgie.

As shown in table 8-4, during 1980-1986 production of all sheet and strip products in France declined at an average annual rate of 2.2 percent. Despite the decline in production, total exports actually increased slightly. The average annual increase in total sheet and strip exports (0.2 percent) is due to greater exports of higher value products such as galvanized and other coated sheet and strip, exports of which are included in the other sheet and strip products category and are broken out separately in table 8-4. Exports of hot-rolled sheet and strip, a comparatively low value product, declined at an average annual rate of 0.4 percent. On the other hand, imports of hot-rolled sheet and strip exhibited a slight average annual increase while imports of other sheet and strip products declined.

Although consumption of sheet and strip products has declined somewhat during the 1980's, consumption of long products declined even more. In 1980 the apparent consumption of hot-rolled long products in France was about 6.1 million metric tons. By 1985, this figure had fallen to 4.2 million metric tons, an average annual decline of 7.2 percent. 1/ Consumption of plates (i.e., flat-rolled products over 4.75 mm in thickness) in France exhibited a similar drop in consumption, declining from about 2 million metric tons in 1980 to 1.4 million tons in 1985, 2/ an average annual decline of 6.7 percent.

Trade

Although France is a strong exporter of flat-rolled products, most of its sales went to other EC countries. During 1985 Spain was the biggest export market for French stainless sheet and strip exports while West Germany was the largest customer for French galvanized sheet and tinplate exports (table 8-5).

1/ Iron and Steel Statistics Bureau (United Kingdom).
2/ Ibid.

Italy took the largest share of French sheet and strip exports in 1985, accounting for 18.5 percent of the total. The United States was also a large export market for France in 1985 accounting for 9.2 percent of galvanized exports, 6.2 percent of tinplate exports, 6.6 percent of stainless exports and 11.8 percent of all other sheet and strip exports.

In 1985, France received most of its overall sheet and strip imports from Belgium-Luxembourg (59.2 percent), West Germany (18.3 percent), and Italy (9.5 percent) (table 8-6). The major exporters to France were slightly different for high value sheet and strip products. The United Kingdom accounted for 6.5 percent of French galvanized imports, 14.7 percent of tinplate imports, and 5.5 percent of stainless imports (table 8-6). The Netherlands was the second largest exporter of tinplate to France in 1985 accounting for 17.5 percent of total French tinplate imports.

Table 8-5
Sheet and strip: French exports, by specified destination, by product, 1985

(Thousand metric tons)

Destination	Type of product Gavanized	Tinplate	Stainless	Other	Total
Italy	58.1	35.2	73.5	897.4	1,064.2
West Germany	138.5	68.0	34.8	630.8	872.1
United States	56.7	28.3	25.3	505.9	616.2
Spain	9.9	27.0	114.7	243.9	395.5
Belgium-Luxembourg	25.4	13.7	5.5	244.6	289.2
United Kingdom	55.3	27.9	31.1	115.0	229.3
India	1.3	14.5	0.0	184.5	200.3
Greece	1.7	34.5	3.6	141.8	181.6
China	5.0	0.0	0.5	173.4	178.9
All other	263.1	210.0	96.0	1,164.3	1,733.4
Total	615.0	459.1	385.0	4,301.6	5,760.7

Source: Compiled from statistics of the United Kingdom Iron and Steel Statistics Bureau.

Table 8-6
Sheet and strip: French imports, specified sources, by product, 1985

(Thousand metric tons)

Source	Type of product Gavanized	Tinplate	Stainless	Other	Total
Belgium-Luxembourg...	119.5	46.6	81.1	1,831.3	2,078.5
West Germany.........	65.2	18.0	12.1	545.8	641.1
Italy................	19.8	10.8	5.6	298.0	334.2
Spain................	1.6	1.4	4.8	96.5	104.3
United Kingdom.......	15.2	17.0	6.5	46.0	84.7
Netherlands..........	1.4	20.3	0.0	58.5	80.2
Austria.............	2.4	0.0	0.4	51.2	54.0
Sweden..............	2.4	0.0	2.2	16.5	21.1
Czechoslovakia......	0.0	0.0	0.0	19.9	19.9
All other...........	6.6	1.9	4.6	78.5	91.6
Total..........	234.1	116.0	117.3	3,042.2	3,509.6

Source: Compiled from statistics of the United Kingdom Iron and Steel Statistics Bureau.

Capital Expenditures

Large capital expenditures took place in the French industry in 1984 and 1985, particularly in the areas of continuous casting, hot wide strip mills, and cold wide strip mills (table 8-7). Expenditures in these areas accounted for 51 percent of the total capital expenditures on all raw steel and sheet and strip facilities in 1985, the latest year for which official ECSC data are available. The forecast declines in capital expenditures in 1986 and 1987 probably reflect the official cessation at the end of 1985 of State subsidies to EC steel producers.

Usinor made significant investments in the steelmaking and rolling facilities at Dunkirk in 1985. At the steelmaking end of Dunkirk, a new vacuum degassing facility 1/ was installed. At the hot rolling end of Dunkirk a walking beam reheating furnace was installed to be used for reheating silicon steel slabs and low carbon steel slabs.

In 1985, Usinor also added a fifth 6-high stand to the tandem mill of the No. 2 cold rolling line at Montataire. This addition was a complement to the existing linkage of the pickling and rolling installations. (In 1982 Usinor installed the world's first system linking pickling and cold rolling operations at Montataire.) In the beginning of 1986 Usinor started up a continuous annealing line at Montataire. 2/ In 1985, Galvanor, a subsidiary

1/ This facility consists of a Deep Injection Process installation and a Ruhrstahl Heraeus Oxygen Blowing (RHOB) installation.
2/ The continuous annealing line at Montataire is under license from the Japanese steel company N.K.K., and has a capacity of 600,000 metric tons per year.

of Usinor, finished the construction of a third galvanizing line at Montataire. The line, which includes a continuous annealing system, was designed to produce Monogal and other coated sheet specifically for the auto industry.

Sollac completely revamped its hot strip mill facility at Seremange in 1984. 1/ In January 1985 Sollac started up a new hydrochloric acid pickling line at Ste. Agathe, which was eventually linked to a new tandem mill in 1986. This cold-rolling line has an annual capacity of 1.6 million metric tons and will soon be complemented by a continuous annealing line, scheduled for startup in July 1988. The pickling-tandem cold strip mill line now rolls 100 percent of the cold rolled sheet orders of Sollac. In conjunction with the start up of this line, the old pickling and rolling installations of Sollac's Ebange works were shut down.

The most significant capital expenditure at Solmer's Fos-sur-Mer facility in 1985 was associated with the start up of a second continuous caster. This two strand caster incorporates quick change molds, high cycle oscillation, electromagnetic stirring, and automatic slab marking, all considered state-of-the-art features. The total cost of the caster was 750 million francs and it has a highly developed computer control system. With the startup of the second continuous caster at Fos, all slab production via ingot at the facility was stopped.

Expected continued increased use of zinc coated sheet by French and West German auto makers prompted Usinor and Sollac to seek EC Commission approval to build electrogalvanizing facilities. Because of the general overcapacity problem, the EC Commission insisted that any new projects would have to be matched by shutdowns of older capacity. Initially, projects proposed by Usinor and Sollac were turned down because insufficient capacity cuts were offered. Only after the two companies proposed more capacity closures did the EC Commission approve in March 1985 the galvanizing projects. An added attraction to building electrogalvanizing lines is the fact that galvanized and coated sheet are no longer subject to EC production quotas.

In the stainless area significant investments were made in Ugine-Gueugnon's Ardoise works. Although stainless steel sheet production at Ardoise began in 1958, significant investments for modernization took place in the early and mid 1980's. An Argon Oxygen Decarburization (AOD) furnace was installed in 1980, replacing the existing electric arc furnaces, and a continuous slab caster was installed in 1981. A single strand caster started up in 1983 and by late 1984 all ingot casting at Ardoise ceased. The entire output of the plant now passes via the AOD-continuous casting route; as a result of the modernization, employment at the facility has declined from 1,700 workers in 1980 to 800 workers in 1986.

1/ A new Stein Heurtey 54m long slab heating furnace and a new SMS reversing roughing stand were installed as part of the revamping.

Table 8-7
French steel industry capital expenditures on raw steel and sheet and strip facilities, 1983-85 (actual), 1986-87 (forecast)

	Actual			Forecast	
	1983	1984	1985	1986	1987
	Value (million francs)				
Coke ovens	16.3	30.2	69.4	310.8	318.3
Sinter and pellets	27.8	25.4	25.2	8.8	3.5
Continuous casting	483.4	700.7	671.8	250.2	77.2
Blast furnaces	232.2	184.1	252.3	183.6	175.7
Electric arc steel	161.1	389.5	570.5	248.2	43.4
Oxygen steel	302.6	428.0	131.9	93.8	104.0
Total steel	1,223.4	1,757.9	1,721.1	1,095.4	722.1
Hot wide strip mills	270.1	559.9	328.4	287.6	64.1
Narrow strip mills	0.7	0.7	-	-	-
Cold wide strip mills	266.1	673.3	614.0	83.0	198.4
Coating plants	276.9	188.9	213.5	151.6	330.7
Other mill expenditure	160.5	362.7	309.4	12.2	569.8
Total sheet and strip	974.3	1,785.5	1,465.3	534.4	1,163.0
Grand total	2,197.7	3,543.4	3,186.4	1,629.8	1,885.1
	Value (million dollars)				
Coke ovens	2.1	3.5	7.7	44.9	51.9
Sinter and pellets	3.7	2.9	2.8	1.3	0.6
Continuous casting	63.4	80.2	74.7	36.1	12.6
Blast furnaces	30.5	21.1	28.1	26.5	28.7
Electric arc steel	21.1	44.6	63.5	35.8	7.1
Oxygen steel	39.7	49.0	14.7	13.5	17.0
Total steel	160.5	201.3	191.5	158.1	117.9
Hot wide strip mills	35.5	64.1	36.5	41.5	10.5
Narrow strip mills	0.1	0.1	-	-	-
Cold wide strip mills	34.9	77.0	68.3	21.0	32.4
Coating plants	36.3	21.6	23.8	21.9	54.0
Other mill expenditure	21.1	41.5	34.4	1.8	93.0
Total sheet and strip	127.9	204.3	163.0	86.2	189.9
Grand total	288.4	405.6	354.5	244.3	307.8

Source: Commission of the European Communities.

Capacity

During 1984-85, modernization plans took effect simultaneously with closures in other areas. As shown in figure 8-5, which shows the annual hot strip mill capacity in France by plant during 1977-86, 1985 marked the elimination of the Denain facility and a significant reduction in capacity at Seremange. By the spring of 1985 Usinor's hot strip mill facilities at Denain were completely closed, eliminating 1.7 million metric tons of annual hot strip mill capacity in France. After the Denain closure, France had a total of 12 million tons of hot strip mill capacity, with Dunkirk accounting for 4.8 million metric tons, Seremange 2.8 million, and Fos-sur-Mer 4.4 million. The 12 million metric tons of annual capacity in 1985 reflects a 15-percent decrease from the peak in 1984.

By comparison, far more capacity was modernized than shut down. A finishing center at Denain, the site of hot wide strip mill capacity reduction, went on stream in 1984 and became fully operational in 1985. With an annual capacity of 240,000 metric tons, the Denain finishing center took over the former activities of Usinor's Rehon strip mill which was closed in 1984.

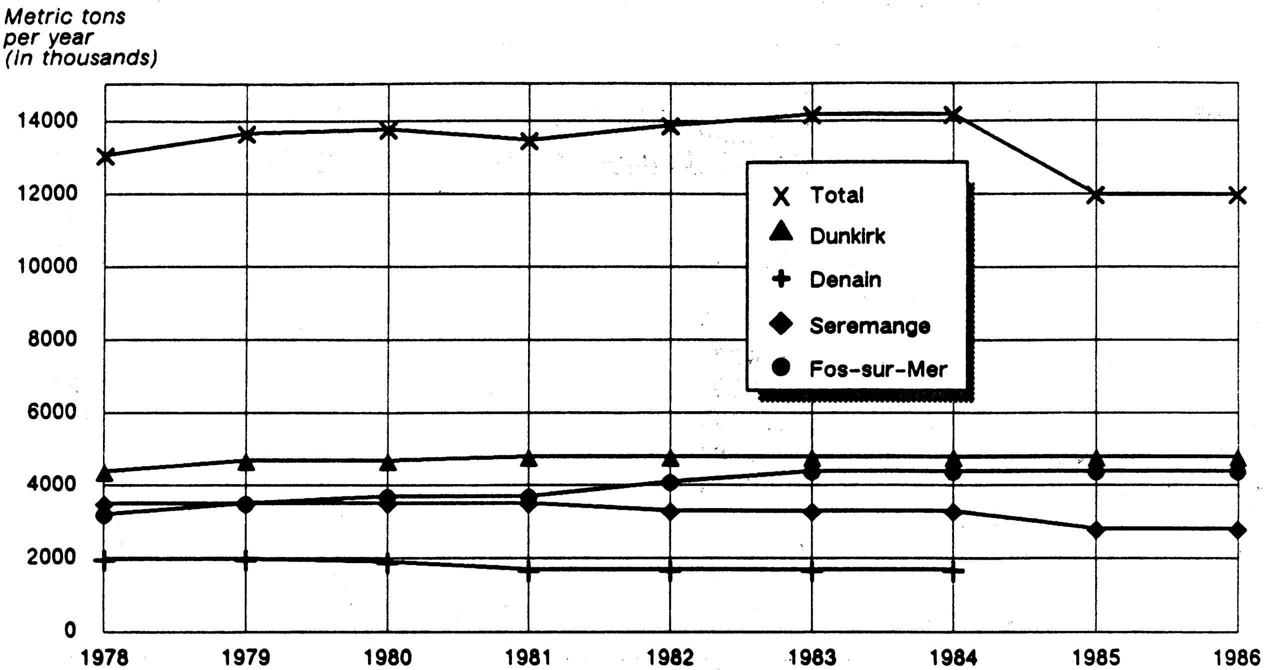
According to official EC Commission statistics presented in table 8-8, production capacity of medium and narrow strip in France declined by 38 percent during 1984-85 to 0.8 million metric tons. It is predicted to remain at that level through 1989. France experienced no reduction in annual cold-reduced sheet production capacity during 1983-85, which was at a level of 9.3 million tons. The EC Commission forecast that cold reduced sheet production capacity in France would drop to 8.8 million metric tons in 1986 and remain at that level through 1989.

Financial Structure

A closer examination of the profit data for Usinor and Sacilor is more revealing in terms of identifying the products that account for the greatest profits and losses. Table 8-9 shows net profit (loss) experienced by Usinor and Sacilor on all operations, 80 percent of which were steel related, during 1974-86. As shown in the table, both companies experienced losses during most of the period covered. More recently, Sacilor had bigger losses than Usinor, reflecting Sacilor's greater reliance on long products, the consumption of which has fallen significantly in France. The losses of recent years are attributed to the following: lower prices because of the weak dollar; reduced sales volume because of a decision to withdraw from low-price export markets; 1/ and the decline in French domestic steel demand. Table 8-10 shows aggregate sales and profit figures for the different product lines of Usinor and Sacilor in 1986. Despite the overall financial losses, flat products, excluding plate and pipe, were slightly profitable.

1/ "Big 1986 Loss Prompts Usinor-Sacilor Merger," Metal Bulletin, May 8, 1987, p. 23.

Figure 8-5
Hot-strip mills: French capacity by plants, and total, 1978-86



Source: World Steel Dynamics.

Table 8-8
Hot rolled wide strip, medium and narrow strip, and cold reduced sheet: French production, capacity, and capacity utilization, 1983-1986

Year	Production	Capacity	Capacity utilization
	----Million metric tons----		Percent
Hot rolled wide strip:			
1983	8.8	14.2	62.0
1984	9.2	14.2	64.8
1985	9.5	12.4	76.6
1986	1/	2/ 12.0	1/
Medium and narrow strip:			
1983	0.7	1.7	41.2
1984	0.6	1.3	46.2
1985	0.4	0.8	50.0
1986	1/	2/ 0.8	1/
Cold reduced sheet:			
1983	5.4	9.3	58.1
1984	5.7	9.3	61.3
1985	5.9	9.3	63.4
1986	1/	2/ 8.8	1/

1/ Not available.
2/ Estimate.

Source: Commission of the European Communities.

Table 8-9
Net profit or (loss) on all operations of Usinor and Sacilor, 1974-1986

Year	Usinor		Sacilor	
	Million French francs	Million dollars	Million French francs	Million dollars
1974	163	34	57	12
1975	(1,223)	(285)	(86)	(20)
1976	1,245	260	(187)	(39)
1977	(2,058)	(419)	(501)	(102)
1978	2,492	552	(581)	(129)
1979	(933)	(219)	(308)	(72)
1980	(1,229)	(291)	(1,214)	(287)
1981	(3,918)	(721)	(2,131)	(392)
1982	(4,987)	(759)	(1,358)	(207)
1983	(5,333)	(700)	(2,005)	(263)
1984	(7,591)	(869)	(1,594)	(182)
1985	(3,479)	(378)	(950)	(590)
1986	(5,000)	(722)	(7,500)	(1,083)

Source: Company annual reports, L'Usine Nouvelle.

Table 8-10
Aggregate sales and profit or (loss) by product line of Usinor and Sacilor, 1986

	Sales	Sales	Profit	Profit
	1,000 French francs	1,000 dollars	1,000 French francs	1,000 dollars
Long products (carbon)	10,941	1,580	(1,462)	(211)
Long products (special)	4,386	633	(561)	(81)
Long products (stainless)	1,334	193	(147)	(21)
Flat products	30,572	4,414	171	25
Plates and pipes	5,220	754	(715)	(103)
Stainless and special flat products	5,318	768	(94)	(14)
Raw steel	5,124	740	-	-
Further processing:				
Flat products	2,449	354	(132)	(19)
Long products	3,946	570	(287)	(41)
Trading	11,599	1,675	(81)	(12)

Source: *Metal Bulletin*.

Research and Development

Research and development (R&D) efforts in the French steel industry are conducted by two separate groups, the individual companies and the Institut de Recherches de la Siderurgie Francaise (IRSID), a nonprofit entity established by the French steel companies to conduct joint technical research. On the company side most of the R&D is carried out in three research centers. The Unieux research center, part of the Usinor Group, has a work force of about 200 employees. One of the largest industrial research units in France, it is dedicated to the study of the utilization properties of products and acts as a link between the engineer and the metallurgist. The Montataire Research and Development Center has a pilot workshop, a physical metallurgy laboratory, and a surface treatment laboratory. Its main function is working on improving the quality of steel sheets. The Isbergues laboratory is equipped with a metallurgical research facility and a pilot laboratory. The Isbergues laboratory takes part in the monitoring of manufactured steel products and in customer service relating to technical questions. In addition to these three research facilities, most of the steel plants have Progress, Research and Development Teams whose function is to assist the manufacturing units in advancing product quality and in operating equipment associated with new processes.

The R&D efforts of the French steel companies are concerned primarily with the following two objectives: (1) controlling the consumption of energy and raw materials, and (2) improving productivity and the quality of steel sheet products, especially coated sheet products. The first objective is to be achieved through the maximum use of scrap, developing alternative forms of energy, or by recovering gasses from the blast furnaces, coking and steel plants. The second objective is to be achieved by standardizing continuous procedures and developing automation and instrumentation.

The steel industry has been intensifying its R&D efforts. Usinor's R&D budget increased from 50 million francs in 1979 to almost 400 million francs in 1985, which was 1.1 percent of the company's total sales. According to French industry officials, the individual company research efforts are now more coordinated since the merger of Usinor and Sacilor and have become much more focused on product research. The companies are seeking to develop new grades of steel for customers who demand specific properties within a narrow range of specifications. Recently developed steels include Monogal, a steel sheet for the auto industry which is galvanized on one side and paint compatible on the other for the auto industry, and DWI 12 OZ, a highly ductile tin plate that can be drawn in one step to produce seamless cans.

Research of a more general nature is carried out by the IRSID, which has two research facilities, one at Saint-Germain-en-Laye and another at Maizieres-les-Metz. The IRSID employs about 600 people and is funded partly from dues paid by the iron and steel producers and partly from the ECSC. The ECSC is authorized to impose a levy on the production of coal and steel by EC countries, a portion of which is used to fund R&D grants paid to the various EC steel producers. According to Article 55 of the Treaty of Paris, "The results of the research financed...shall be placed at the disposal of all the interested parties in the Community." Thus, if the ECSC underwrites all or part of the R&D expense for a project by one company, the resulting technology must be made available to all other producers in the EC. In general most of the R&D grants given to the IRSID by the ECSC have gone for research in the primary stages of steelmaking (i.e. blast furnaces and crude steelmaking facilities). Companies have preferred to conduct research on specific sheet and strip products themselves because this is an area where they consider new developments to be much more proprietary in nature.

Blast furnace projects that have been developed through IRSID and steel company R&D include a hot metal sampling device (used at Solmer), the injection of pulverized coal through nozzles and tests of the injection of iron ore through nozzles to reduce the share of agglomeration. The main objective of research at the blast furnace stage is to lower the cost of producing pig iron delivered to the steel mill. 1/

Competitiveness of the French Steel Sheet and Strip Industry

According to French steel industry officials and independent analysts, the carbon steel sheet and strip sector is the strongest aspect of the French steel industry in terms of cost competitiveness and profitability. For production of hot-rolled coils, the Fos-sur-Mer plant is viewed as the lowest cost producer in France, followed by Dunkirk and Seremange.

France's Competitive Strengths and Weaknesses

The French carbon steel sheet and strip industry is characterized by large plants that must maintain a high output (and thus utilize economies of scale) to be competitive. While large plants and particularly large blast furnaces can be a competitive advantage in a strong market, they can be a disadvantage in a volatile one because of reduced production flexibility. According to industry sources, automation, modernization, and employment reductions have increased the breakeven point for French carbon steel flat product production to the range of 70 to 75 percent of capacity.

Solmer's plant at Fos-sur-Mer is considered by industry sources, both in and out of France, to be one of the most modern and competitive flat-rolled carbon steel mills in Europe. Solmer, a very low cost producer of hot metal and hot rolled coils, does not produce any finished products. The low production costs at Fos are a function of both state-of-the-art technology and raw material purchases on the spot market. At least one steel industry analyst has estimated that the cost of hot metal production at Solmer is approximately 650 French francs per metric ton ($107.79 per ton at the April 1987 franc/dollar rate of 6.03). The only other estimate of hot metal cost in France available to the Commission is made by World Steel Dynamics, which estimates that the overall production cost of hot metal for the first 9 months of 1986 was $146.00 per ton. 2/

1/ Speech given at the Journees Siderurgiques ATS 1986 by B. Trentini, Director General of the Association Technique de la Siderurgie (Technical Associaton of the [French] Iron and Steel Industry).
2/ World Steel Dynamics, Cost Monitor No. 9, Jan. 19, 1987.

Despite the technological strengths of Solmer and its production cost advantages, there are weaknesses. The most significant competitive weakness of Solmer is its location. As mentioned previously, the decision on a site for Solmer's plant was reached on the basis of a desire on the part of the French Government to stimulate regional development in the southern part of France, rather than locating near major end markets for steel sheet (i.e., French and German automakers). According to some analysts in France, two faulty assumptions were made during the time Solmer was built. The first was that steel was a growth industry, and the second was that steel plants would stimulate further economic development. As a result of its geographical location, Solmer faces high rail costs transporting its hot-rolled coils from the Fos-sur-Mer plant to Usinor and Sollac in the north and northeast of France. Of Solmer's sales to sources other than Usinor and Sollac, the majority go to Spain and Italy.

Another perceived weakness of Solmer's Fos-sur-Mer plant is that it does not produce a finished product. Field discussions suggest that a lack of integration of facilities and organization is a competitive weakness of the French steel sheet and strip industry, especially for Solmer. The hot metal and hot rolling stages at Fos-sur-Mer are technologically state-of-the-art combining basic oxygen furnaces, vacuum degassing, continuous casting, and a hot rolling mill capable of rolling large slabs from the caster. Much of the cost advantage is lost, however, when the hot-rolled coils must be transported long distances before going through finishing operations. It is considered more economical to transport a higher value product.

The second most competitive plant in the French carbon steel sheet and strip industry is viewed as Dunkirk. While its costs are estimated to exceed those at Solmer by about 15 percent, the facility is nonetheless relatively low cost compared with other European steel producers. A number of factors combine to give Dunkirk its cost competitiveness. The first is that, with complete modernization in 1973 and the installation of a vacuum degassing unit in 1985, Dunkirk is strong technologically. Other factors in Dunkirk's favor are a deep water port for both receiving raw materials and exporting steel, and proximity to the major markets for sheet and strip in the north of France. Even though Dunkirk is more integrated than Fos, field discussions indicate that it is not effectively organized, which leads to costly transportation of intermediate products such as hot metal, slabs, hot-rolled coil, and cold-rolled sheet between production stages.

What is considered by industry sources to be the least competitive plant in the French steel sheet and strip industry is Sollac's facility at Seremange. This plant, which has a little more than one-half the annual hot strip mill capacity of Dunkirk, has a hot metal production cost that is 35 to 40 percent higher than Solmer's cost, according to industry estimates. One of the reasons for Sollac's cost disadvantage is that the facility relies on iron ore produced in the Lorraine region for about one-third of its requirements. This locally produced ore, used primarily in sintering plants, is low grade and has a high phosphorous content and, as such, must be blended with imported ore, mostly that from Brazil. The proximity of the ore to Seremange and the high productivity level of the mining companies partially offset the low quality of the ore.

Even though Seremange has good blast furnaces that were modernized in 1984, hot metal production costs are seen as the weak point of the facility. Lack of integration in production processes is viewed as particularly acute at Seremange, the oldest operating hot strip mill in France. The competitive strengths of Seremange include its cold rolling and coated sheet facilities, and its proximity to the major steel sheet and strip consumers in France and West Germany.

Recently, as part of a plan to rationalize pig iron production in Lorraine and cut costs, Usinor-Sacilor closed an iron ore mine at Hayange and a benefication plant at Suzange. The resulting reduction in pig iron capacity is about 1 million metric tons. Usinor-Sacilor's three remaining iron ore mines at Minette are considered sufficient for the company's local blast furnace iron ore requirements. 1/

One particular technological strength of the French steel sheet and strip industry is in the area of pickling line/tandem (cold-rolling) mill linkage. In recent years pickling lines have been viewed by steel producers as a means of increasing efficiency and product quality as finishing moves from a batch operation to a continuous system. 2/ France is considered by many industry sources to be one of the most proficient steel producers in the use of "endless rolling," a term used to describe a system where steel sheet flows directly from the pickler through the tandem mill. As described in the capital expenditures section of this chapter, pickling and cold rolling operations have been linked at Usinor's Montataire plant and Sollac's Ste. Agathe plant. "Endless rolling" has allowed Usinor and Sollac to achieve significant gains in improving thickness and flatness tolerances. In addition, the continuous system has reduced downtime for roll changes (in the mill) and malfunctions. The main drawback to "endless rolling" is that large tonnages of steel must be run through the system in order to achieve increased productivity and cost reductions causing reduced flexibility when small quantities of specialized products must be produced. A separate system is usually required to roll non-standard sheets.

French steel industry sources claim that metallurgical expertise and a very close relationship with automakers are significant competitive strengths of the French steel sheet and strip industry. In addition, the steel companies have been willing to spend relatively high amounts of money on R&D, despite their financial difficulties. These two factors have fostered the metallurgical expertise necessary to carry out Usinor-Sacilor's objective of developing higher value specialized products.

Industry sources felt that the relationship between French steel companies and automakers gives the French steel industry a competitive advantage over their counterparts in other countries. Technicians from the French steel sheet and strip industry work very closely with major French automakers. This exchange reportedly has helped the steelmakers develop a keen appreciation of their customers' specific needs and has significantly contributed to the creation of steels designed for automakers' needs.

1/ "Usinor-Sacilor Reorganizes Operations," Metal Bulletin, Aug. 6, 1987, p. 19.

2/ "Efficiency Push Reaches the Pickling Line," Iron Age, October 1987, p. 22.

The stainless and specialty steel sheet and strip industry in France is considered to be very competitive by French industry sources, especially since Ugine-Gueugnon and Usinor Chatillon were merged. With sales of almost 6 billion French francs since the merger, this new company claims to be the world's largest producer of stainless and special flat products. About 94 million French francs in losses were reported in 1986, but industry officials claim that prices have improved steadily from the beginning of 1987 and that costs and financial charges have been lowered. Additionally the merger reportedly eliminated redundant R&D and investments and a certain amount of competition. During the first half of 1987, sales for Ugine increased by more than 8 percent to 3 billion French francs compared with the same period in 1986; profits equaled 150 million French francs in the first half of 1987. 1/

The primary reasons for Ugine's profitability in 1987 were increased demand from carmakers and the domestic appliance industries, and falling raw material prices. With respect to raw material costs, many of which are denominated in dollars, the costs of scrap, nickel, and chromium fell (in dollar terms) by as much as 40 to 50 percent during the first half of 1987. Specialized products developed by Ugine, notably a product called Uginox Fk, a ferritic stainless steel with high oxidation and thermal stress resistance used in new car exhaust systems, also have contributed to profits. In the high value specialized product areas in which exports account for two-thirds of total sales, Ugine competes effectively. For example, substantially all of Ugine's exports of stainless steel sheet to the United States were of a high quality ferritic stainless steel, which Ugine claims was imported to meet the specific needs of U.S. consuming industries, many of whose companies buy exclusively from France. Ugine's established specialties include ferritic grades, thin and extra thin gauges, and custom made grades for specific applications.

Another competitive strength of Ugine, which was made possible by the merger that created the company, is integration and specialization of production facilities. Company officials have indicated that since the merger there is neither duplication of major items of equipment, nor any imbalance in facilities. Specialization, which is expected to yield a savings of from 60 to 80 million French francs in 1987, is to be achieved by extending facilities' production lines thus reducing the need for transporting material between works. 2/

The French steel sheet and strip industry is also strong in the production of tinplate. Although the world market for this product continues to decline, packaging preferences in individual countries are distinct. In the EC, where most of France's tinplate sales occur, aluminum cans have not replaced the tinplate beverage cans to such a degree as in the United States. Apparent consumption of tinplate in France increased 11 percent from 377,000 metric tons in 1983 to 418,000 tons in 1984 and remained at that level through 1985. In 1986, Usinor Aciers, the French tinplate producer, increased output by 15 percent to 230,000 tons. 3/ French tinplate producers are also benefiting from the availability of continuously cast steel, which offers greater purity and improved shape and surface qualities after rolling.

1/ "The New Ugine: Rationalizing French Stainless," Metal Bulletin Monthly, August 1987, pp. 25-28.

2/ Ibid.

3/ "Tinplate - Learning to Live in a Complex Market," Metal Bulletin Monthly, February 1987, p. 29.

Industry Outlook

The outlook for the French steel sheet and strip industry is dependent on its own internal actions as well as actions taken by the EC Commission. With respect to its own actions, French industry sources, like many of its competitors, see a need to reduce labor costs, increase overall productivity, and develop specialized products to acquire a market niche. At the EC level, France may be subject to restructuring efforts to eliminate 30 million tons of excess capacity throughout Europe.

Employment reductions and productivity gains have not been enough to halt rising production costs in the French steel industry because of increasing labor costs. Given the reluctance on the part of French steelworkers to accept wage reductions, many industry sources feel that the steel industry must utilize labor inputs more efficiently. This has been done to a certain extent as shown by the dramatic decline in man-hours per ton shipped brought about mainly by increased use of continuous casting and more efficient technology. However, the French steel industry's productivity is still less than that of most of the other industrialized country steel producers. Recent modernization of French sheet and strip facilities is expected to help improve productivity. In addition, a new round of employment reductions is planned by Usinor-Sacilor. Between the beginning of 1987 and March 1988, Usinor-Sacilor is to reduce employment by 17,000 workers. 1/

The accelerated layoff program has reportedly begun to show results. During the first half of 1987, Usinor-Sacilor experienced a 50-percent reduction in operating losses compared with that in the same period of 1986. 2/ It was also reported that 75 percent of Usinor-Sacilor's production showed profits or improved results, attributed to the more "monopolistic" market condition in France as well as the employment reductions. 3/ Since it is unlikely that this industry situation will change in the near future, any benefits derived by the monopoly will likely continue.

The organizational structure of Usinor-Sacilor, however, will most likely continue to change. The President of La Chambre Syndicale de la Siderurgie Francaise has indicated that any necessary future restructuring of the French steel industry will be carried out progressively on a sector by sector basis rather than within the context of an overall new plan. 4/ Evidence of this was seen in September 1987 with the announcement that Usinor-Sacilor's special steel business would be regrouped, uniting the stainless flat product and the stainless long product businesses. The new group, which will be called Aciers Inoxydables & Produits Plats Speciaux, will merge Ugine Chatillon-Gueugnon with Ugine-Savoie, a stainless bar and rod producer, and Imphy, an alloy and

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1/ "Partnership Pays Off in France," American Metal Market, Oct. 6, 1987, p. 16.
2/ "French Steel Halves Losses in Jan.-June," Metal Bulletin, Sept. 10, 1987, p. 23.
3/ "Partnership Pays Off in France," American Metal Market, Oct. 6, 1987, p. 16.
4/ "Future for French Steel is in the Hands of the Industry," Steel Times, April 1987, p. 162.

superalloy steel strip, bar, wire, powder, and forgings producer. Further evidence that sector by sector restructuring will take place is the recent announcement that the carbon steel flat product business of Usinor-Sacilor (excluding plate) will be formed into a new group linking it to Dillinger Huettenwerke in West Germany's Saar region. This new company, which is to be formed by the end of 1987, will be 10 percent owned by Dillinger. 1/

With respect to the steel sheet and strip market, Usinor-Sacilor has switched from a strategy of quantitative production goals to partnership and flexibility in customer relations. Many industry officials have indicated that over time the sheer volume of French steel sheet and strip production will decrease as the market for lower value commodity grades of steel is taken over by producers from such countries as Brazil and Korea, but the French industry, like many of its developed country competitors, plans to compensate by switching to higher value specialized products.

Usinor-Sacilor plans to develop even closer relationships with automotive market customers. This strategy of working closely with the auto industry to develop the domestic sheet market was underscored at the most recent meeting of the International Iron and Steel Institute (IISI). 2/ During a panel discussion at the IISI meeting concerning the new partnership between the steel and automobile industries, the Director of Flat Products at Usinor-Sacilor outlined some of the important works being done at Usinor-Sacilor in connection with the auto industry. Two of the more significant projects mentioned were the development of a new process for stamping auto body panels called elasto-forming and a new type of sheet with honeycombed structures.

The elasto-forming process, currently being developed by Usinor-Sacilor, is designed to benefit the auto industry in the areas of drawing, sheet steel and die casts, subsequent processing, and vehicle performance. Usinor-Sacilor has developed a pilot stamping operation to test the elasto-forming process, which, according to company sources, has been shown to be successful in reducing the variability in steel sheet wall-thickness reduction after stamping.

Research on honeycomb type structures in sheet steel is being conducted by Usinor-Sacilor in conjunction with the major automakers in France. The purpose of honeycomb structures in steel sheet used by automakers is to provide greater strength and rigidity, thus allowing lighter weight steel to be used for applications that would normally require much heavier steel. Honeycombed structures in steel sheet, according to company sources, facilitate welding and reduce a car's noise level.

Any analysis of the outlook for the French steel sheet and strip industry must take into consideration the actions of the EC Commission with respect to upcoming capacity cuts made necessary because of falling steel demand. The dilemma currently facing the EC Commission is that during the first round of EC capacity cuts, which took place under the Davingnon Plan, the capacity not

1/ "French Steel Halves Losses in Jan.-June," Metal Bulletin, Sept. 10, 1987, p. 23.
2/ Twenty-first Annual Meeting and Conference, International Iron and Steel Institute, Washington, DC, Oct. 4-7, 1987.

cut was modernized to world class standards. This is certainly true of the hot strip mills in France. The current problem, unlike the situation during the capacity cuts under the Davingnon Plan, is determining which plants will be earmarked for closure when only a slight gap exists between the most technologically efficient plants and the least efficient ones. (The actions of the EC Commission with respect to the necessary capacity cuts is discussed in more detail in the section of this report entitled The European Coal and Steel Community.)

The competitiveness of the French sheet and strip industry will be affected by any capacity cuts in the EC because, according to industry officials, with less capacity steel prices should improve and the utilization rate for remaining capacity should increase, thus reducing production costs. The biggest question remaining is which countries will have to cut capacity. It is widely believed in France that any capacity cuts in France would be accompanied by social unrest, although it is not clear if France will have to make any capacity cuts in the sheet and strip area.

CHAPTER 9. THE JAPANESE INDUSTRY

The Structure of the Japanese Steel Industry

From the 1960's onward, Japan has generally been considered one of the lowest cost and most efficient steel producers in the world. To meet growing post World War II domestic and global demand for steel, Japanese producers followed a strategy of building some of the largest plants in the world to capture economies of scale. Combining the resulting lower costs with a goal of providing consistently high-quality products, Japan's steel industry was able to acquire and retain large segments of global steel export markets, despite their lack of raw materials for steelmaking. At the same time, Japan was able to provide its growing domestic automobile and consumer goods industries with high quality steel. Cooperation between Government, labor, and business coupled with high capital investment and considerable research and development (R&D) allowed Japan to keep pace with increasing world demand for steel through the early 1970's.

The current imbalance between world steel consumption and capacity and the recent appreciation of the yen against the dollar have had an adverse effect on the Japanese steel industry. Indeed, the Japanese steel industry appears to be experiencing problems similar to those suffered by steel producers in the United States and the European Community (EC) in the late 1960's and early 1970's. Rising imports, excess capacity, and eroding market share followed by market entry of lower cost foreign steel producers such as Korea, are all factors affecting the steel industry in Japan today. To remain competitive, and to lessen the impact of adjusting to these factors, Japanese steel companies have initiated rationalization plans. These plans focus on cost and capacity reduction. The Japanese view these rationalization plans as capable of reestablishing Japan's competitive posture in the global steel industry. At present, however, it is uncertain how successful these plans will be if the yen appreciates beyond the present value (i.e., 133 yen per dollar) and the global supply/demand imbalance in steel remains intact.

The Japanese steel industry, the largest in the noncommunist world, is composed of nine integrated steel producers, (one firm, Yabagi makes only pig iron), 61 steel firms with only electric furnaces (minimills), nine specialty and alloy tool producers and 103 other steel-related firms including rerollers and processing firms--a total of 182 firms. Japan's steel sheet and strip facilities include 21 hot strip mills, 70 cold strip mills, 51 galvanizing lines, and 14 tin mill lines. The top six firms are Nippon Steel Corporation, Nippon Kokan K.K., Kawasaki Steel Corporation, Sumitomo Metal Industries, LTD., Nisshin Steel Co; Ltd., and Kobe Steel Ltd. Of these six firms, five are primarily carbon steel producers and produce relatively small amounts of specialty steel. The fifth firm, Nisshin Steel, is a specialty steel producer of stainless sheet and strip. 1/

1/ Interview with Japanese Iron and Steel Federation, June 15, 1987.

Japan's 61 minimills are generally smaller plants using electric furnaces that transform scrap metal into finished products such as wire, light structural shapes, and pipes and tubes. Seven Japanese minimills produce sheet and strip. 1/ These seven include Nakayama Steel Products, Taiyo Steel, Daido Steel Sheet, Toyo Kokan, Yodogawa Steel Works, Igeta Steel Sheet and Maruichi Steel Tube.

The Japanese steel industry is relatively concentrated. The top six in 1986 firms account for approximately 72 percent of total crude steel production, 74 percent finished steel mill products, and 91 percent (cold-rolled base) of sheet and strip production. 2/ The share of raw steel produced by the top five steel companies has declined 13 percent since 1970, from 79 percent to 65 percent. However, each company within the top five has retained a consistent share of the market.

Most of Japan's steel industry is located in a heavily industrialized area located between Tokyo and Kyushu in an east-west direction. Unlike the United States, many of the steelworks are located on or close to deep water ports; this facilitates cost-effective receipt of imported materials used to manufacture steel and export the finished product. The coastal locations yield significant advantages in shipping and reductions in transportation costs. Other producers such as Korea and Taiwan have also located their facilities at deep water ports.

Japanese steelmakers must import the vast majority of their raw materials, mainly iron ore (99 percent) and coking coal (95 percent). 3/ In 1986, the rate of change in the yen led to a 50 percent decline in the already low volume of domestic coal purchased by Japanese steel producers. To obtain secure and reliable access to raw materials, some Japanese steel companies have participated in the development of foreign mines to supply them with iron ore and coking coal. The principal supplying countries of iron ore are Australia, 48 percent; Brazil, 22 percent; and India, 17 percent. The principal suppliers of coking coal are Australia, 43 percent; Canada, 25 percent; and the United States, 19 percent.

Long-term contracts between Japanese steel companies and raw materials suppliers used to be common. According to Japanese steelmakers, the recent volatility of foreign-exchange rates and worldwide overcapacity of iron ore and coal has led to a change in purchasing practices. Most contracts are now much shorter in duration and stipulate a fixed base price (usually in U.S. dollars). New mining ventures are the exception to this practice because Japanese steelmakers help to develop and finance the raw materials source. The Japanese producers said that these new ventures will ensure them of a stable supply of raw materials, and as a result, purchases from the Japanese-sponsored mining ventures will be subject to longer contracts of 5 to 7 years.

1/ These minimills are believed to purchase semi-finished coiled products for cold-rolling and/or coating.
2/ Interview with Japanese Iron and Steel Federation, June 15, 1987.
3/ Japan Iron and Steel Industry, 1986, p. 39.

Japanese steel companies market their products almost exclusively through trading companies. Trading companies in Japan are large, diversified companies. Japan has more than 6,000 trading companies, referred to as sogo shosha, which handle approximately 80 percent of exports and 70 percent of imports. The largest trading companies are Mitsui, Mitsubishi, Marubeni, and Sumitomo. The largest, Mitsui, averages 11-12 trillion yen in business a year (approximately $83 billion at current exchange rates). Of these trading companies, Sumitomo is especially active in steel. The nine largest trading companies handle almost 50 percent of Japan's international and domestic trade. Trading companies perform a number of different functions for a steel company which include guaranteeing a stable supply of raw materials (trading companies also play a role in mine financing); providing information on customers; transmitting research, development and economic information; arranging financing, and handling for almost all exports and most domestic sales. Most trading companies specialize in certain markets and services. Therefore, it is not unusual for a steel company to engage several different trading companies at the same time, each handling a different aspect or product for the steel company.

Steelmakers in Japan told Commission staff they could not exist without trading companies. Trading companies handle all export sales for Japanese steel producers. They obtain orders from foreign customers on a quarterly basis. At the time the order is placed, the trading company gives the steel company a downpayment worth up to 80 percent of the order's value. The remaining 20 percent is paid to the steel company once the order leaves the factory and the trading company then owns the product. In large foreign markets, steel company employees work with trading company personnel to help obtain orders and service customers. In addition, general trading companies handle most domestic sales of all products including steel. The major exception to this practice is specialized trading companies who handle only large, customized, technical steel product purchases that comply with rigid standards, such as products for auto producers.

Large Japanese steel companies traditionally produce a wide variety of steel products. These firms have invested mainly in steel related businesses, placing most of their interests in the heavy-engineering, shipbuilding, and construction sectors. Japanese steel firms are both privately or publicly held companies. The six integrated producers are publicly owned. There is no Government ownership of any of the large steel producers. Many Japanese steel companies have planned or executed joint ventures in the steel area. In addition, Japanese steel companies have entered into a number of joint ventures with both foreign and Japanese firms in nonsteel-related areas.

Japanese steel companies have entered into a number of joint ventures in the United States, both in steel and nonsteel areas. The following list illustrates many of the largest U.S. steel facilities the Japanese have invested in: 1/

1/ Foreign Investment in the United States Steel Industry, Metal Bulletin Monthly, May 1986.

California Steel.--Owned by Kawasaki Steel and CVRD (a government-owned Brazilian iron ore company) as a 50-50 joint venture. The plant processes imported steel slab into flat-rolled products. Kawasaki originally owned 25 percent of California Steel, this percentage was increased to 50 percent in 1987.

Inland Steel--Nippon Steel and Inland Steel finalized a joint venture during March 1987. The companies plan to construct a continuous cold-rolling tandem mill beginning in July 1987. Inland will hold a 60 percent share and Nippon Steel will hold a 40 percent share. Both companies are rumored to be considering constructing an electrogalvanizing line in conjunction with the cold-roll mill.

LTV Steel.--Sumitomo Metal Industries and LTV have a joint-venture electrogalvanizing line in Alliance, OH. LTV Steel holds 60 percent and Sumitomo Metals owns 40 percent, respectively.

National Steel.--Ownership is split 50-50 between Nippon Kokan K.K. and National Intergroup. National is an integrated steel producer and a major U.S. producer of flat-rolled products.

Wheeling-Pittsburgh.--Wheeling Pittsburgh and Nisshin Steel have a joint venture galvanizing line in Follesby, WV. Nisshin owns approximately 70 percent of the joint venture, and Wheeling-Pittsburgh owns 30 percent.

It should be noted that many of the U.S.-Japanese joint ventures in steel operations were formed within the period of the implementation of VRA's between Japan and the United States. Japanese steel producers claim that MITI allocates the amount of steel manufacturers are allowed to export under the VRA's. MITI's decision is based on the export performance of each manufacturer in historical production trends for the period 1980-85. A small amount of the allocation is retained to allow new producers to enter into different product areas. Limitations exist on product mix as the VRA's have category and subcategory quotas. However, to maximize productivity, each manufacturer tries to concentrate as much as possible on higher value products so that they may export products with the highest margin. In this regard, the VRA's pose a problem for Japanese producers as they all want to shift most of their production into these higher value products. 1/

Japanese steel executives interviewed by Commission staff during fieldwork said that neither the extension nor the abolition of VRA's with the United States would drastically alter their export policies. The Japanese said that if the VRA's ended steel producers probably would not significantly change their export behavior. However, the executives acknowledged that some changes might take place. As steel producers adjust, they may be more selective when choosing customers, shift some exports into higher margin

1/ Interview with Japanese steel producers in Japan, June 18, 1987.

products and slightly increase the level of exports to the United States. Because the present VRA's establish quotas on certain products, the Japanese stressed any change in product mix that occurred would be due to market forces, mainly a change in demand for certain products. 1/

Conditions in the Japanese Steel Sheet and Strip Industry

Labor

The Japanese are proud of their good labor/management relations. They attribute positive labor relations to programs such as quality circles and other participatory management techniques. As a result, the Japanese say that blue collar workers have a strong sense of loyalty to the company. This loyalty fosters a spirit of cooperation between management and labor and reportedly results in high labor productivity rates and low man-hour per ton ratios. A component of the cost of labor per ton produced is labor productivity, or the number of hours worked per ton of finished steel. As shown in table 9-1, Japan's labor productivity rate shows a steady increase of 73 percent whereas man-hours per ton fell 9 percent over the past 5 years, and unit labor costs in yen declined 2 percent despite the 14 percent increase in cash payments per hour.

Table 9-1
Japan's labor productivity and costs, 1982-86

Item	1982	1983	1984	1985	1986
Man hour/ton	5.7	5.2	5.0	5.1	5.2
Labor Productivity 1/	7.0	9.6	1.0	2.0	1.9
Cash Payments/hour	2,119.9	2,251.6	2,372.2	2,374.6	2,420.0
Unit Labor Cost	12,834.0	12,335.0	11,617.0	12,110.0	12,584.0

1/ Increasing rate by man-hour/ton figures.

Source: Japan Ministry of Labor, fieldwork.

The salary of a Japanese steelworker compared with that of steelworkers from other countries has risen, however, with the increase in the value of the yen. In particular, the wage gap between the United States and Japan has narrowed as U.S. steel workers earn $22 to 23 an hour and Japanese steelworkers earn about $18 to 20 an hour, including benefits and bonuses. The increase in labor costs is an incentive for Japanese steelmakers to accelerate their actions to reduce the number of employees as a method of cost reduction. For a fuller discussion of employment levels, see the section titled "Employment Reductions Under Rationalization Plans." The following

1/ Interview with trading companies in Japan, June 17, 1987.

tabulation shows the average monthly labor costs in yen for the steel industry in Japan:

Year	Production	Administrative and clerical	Average	Percent change
1982........	354,744	445,993	382,322	1/
1983........	357,209	448,387	384,527	+0.006
1984........	370,290	451,043	394,957	+0.03
1985........	386,472	469,169	411,286	+0.04
1986........	387,232	469,303	412,843	+0.004

1/ Not applicable.

Consumption

Japanese domestic demand for crude steel peaked in 1980 at 79 million metric tons in terms of apparent consumption. By 1986, domestic demand for all steel products fell to 70 million metric tons. Japanese industry analysts expect further reductions in Japanese domestic steel demand and steel exports to cause declining steel production for the remainder of the decade. Japanese steel analysts gave an example of declining production. This example assumed an exchange rate of 120 yen to 130 yen per dollar. At this rate, the consumption of crude steel in Japan would fall 2 percent, direct exports would fall 36 percent and internal indirect exports (crude steel purchased by manufacturers for use in exported products) would fall 14 percent between 1986-95. 1/

Despite the overall decline in crude steel apparent consumption, apparent consumption of sheet and strip shows an increase over the past 5 years. Apparent consumption of all sheet and strip products, as illustrated in table 9-2, rose 10 percent.

To help offset the decline in domestic consumption of ordinary steel, the Japanese Government has initiated several proposals for domestic demand expansion. Many of these proposals include the implementation of public works projects which will be financed partially by private capital.

Such projects include building a roadway across Tokyo Bay, an expressway loop around Tokyo, a large bridge across the Akashi Straits and a new airport in the Kansai district. These projects are financed by private capital to avoid increased public spending while still expanding domestic construction volume. However, Japanese steel industry analysts told the Commission staff that the stimulus to steel demand from these projects will not necessarily be as large as popularly believed. For example, although total investment required by the roadway across Tokyo Bay will amount to Y4 billion ($30 million at current exchange rates), total steel required is estimated at 470,000 tons and marginal profit to the steel industry at Y60 million ($450,000 at current exchange rates). 2/

1/ Interview with Japanese Securities Trading firm, June 17, 1987.
2/ Toru Hiranuma, "Current Situation and Outlook of the Blast Furnace Steel Industry of the Pacific Rim", Nomura Research Institute. Sept. 1, 1985. (The original article in Japanese was obtained during fieldwork and translated by CACI in August, 1987).

Table 9-2
Sheet and strip: Japan's production, exports, imports, and apparent consumption, 1982-86

(In thousands of metric tons)

Item	Shipments	Exports	Imports	Apparent consumption	Ratio (percent) of imports to consumption
Hot-and cold-rolled sheet and strip: 1/					
1982.......	19,479	7,404	1,047	13,122	7.98
1983.......	20,118	9,151	1,431	12,398	11.54
1984.......	20,820	8,972	2,097	13,945	15.04
1985.......	20,321	8,261	1,551	13,611	11.40
1986.......	19,197	8,650	1,657	12,204	13.58
Other sheet and strip:					
1982.......	9,998	3,164	2	6,836	0.03
1983.......	11,105	4,080	17	7,042	0.24
1984.......	12,441	4,005	8	8,444	0.09
1985.......	12,818	3,646	12	9,184	0.13
1986.......	13,354	3,580	20	9,794	0.20
Total sheet and strip:					
1982.......	29,477	10,568	1,049	19,958	5.26
1983.......	31,223	13,231	1,448	19,440	7.45
1984.......	33,261	12,977	2,105	22,389	9.40
1985.......	33,139	11,907	1,563	22,795	6.86
1986.......	32,551	12,230	1,677	21,998	7.62

1/ Excluding sheets greater than 3mm in thickness.

Source: JISEA data obtained during fieldwork, and monthly report of the Iron and Steel Statistics, JISF, March 1987.

Table 9-3 illustrates the shifts in demand which occurred from 1982 to 1986 within categories of finished steel (all products including sheet and strip) between the construction and manufacturing sectors. During 1986, steel demand in Japan's domestic market exhibited shifts between the construction and manufacturing sectors. In construction, demand surpassed the previous year's level with orders booked rising 8 percent. This was due to three major factors: first, the domestic demand-expansion measures introduced in October 1985; second, a comprehensive economic package put into effect in September 1986; and third, the activities of several steel firms in both residential and nonresidential building construction. In contrast, the manufacturing industries demand for steel fell an average of 17 percent as production in those segments of the economy dropped off. The decline in manufacturing

Table 9-3
Ordinary Finished steel products: Japanese orders booked of ordinary finished steel products by uses, 1982-86

Item	1982	1983	1984	1985	1986	Percent change 1985-86	Annual average change 1982 over 1986
							In Percent
Construction.......	12,834	11,647	11,341	11,211	12,096	+8	-1.47
Manufacturing:							
Industrial Machinery......	1,862	1,441	1,630	1,653	1,375	-17	-7.30
Electrical Machinery......	2,279	2,254	2,598	2,544	2,245	-12	-0.38
Home & Office Appliance......	785	652	685	698	606	-13	-6.27
Shipbuilding and marine equipment......	3,218	2,929	3,501	3,249	2,049	-37	-10.67
Auto..............	8,491	8,575	9,252	10,026	9,211	-8	+2.06
Rolling stocks...	85	58	56	39	35	-10	-19.90
Containers.......	1,832	1,826	1,993	2,004	1,899	-5	+0.90
Others...........	295	313	322	300	247	-18	-4.34
For further steel processing.......	3,046	2,828	3,066	3,028	2,839	-6.0	-1.74
Dealers............	13,823	13,605	15,337	16,064	16,279	+0.01	+4.17
Domestic consumer Total..........	48,550	46,128	49,781	50,816	48,881	-3.81	+0.17
Export...........	22,292	25,154	24,758	22,119	20,650	-6.64	-1.90
Grand total....	70,842	71,282	74,539	72,935	69,531	-4.67	-0.47

Source: Data obtained during trip to Japan, Ministry of Finance, Tokyo and monthly report of the Iron and Steel Statistics JISF, March 1987.

production levels reflected both the yen's rapid appreciation and the movement by Japanese manufacturers to shift production abroad or procure parts and components overseas.

Production

Despite declines in crude steel consumption and production, production of sheet and strip rose during 1982-86. As seen in table 9-4, production of sheet and strip rose 10 percent between 1982-1986, and had an average annual growth rate of 2.5 percent. Three types of steel were primarily produced

Table 9-4
Flat-rolled steel: Japanese shipments, by specified products, 1982-86

Product	1982	1983	1984	1985	1986	Average annual change 1982 over 1986	1986 share of total flat-rolled products
	1,000 metric tons					Percent	
Hot-rolled sheets......	8,531	8,614	9,131	8,761	8,117	-1.24	25
Cold rolled:							
Sheets......	10,948	11,504	11,689	11,560	11,080	+0.30	34
Cold electrical sheets and strip.......	1,014	1,182	1,293	1,261	1,303	+6.47	4
Tin Plate.....	1,620	1,611	1,620	1,575	1,531	-1.40	5
Galvanized sheets......	6,184	6,820	7,708	8,102	8,663	+8.79	27
Other metallic coated sheets......	1,180	1,492	1,820	1,880	1,857	+12.00	6
Total....	29,477	31,223	33,261	33,139	32,551	+2.51	

Source: JISF March 1987 Monthly Steel Report

during this 5-year period: hot-rolled, cold-rolled, and galvanized sheets. These products are used primarily for construction, auto production, and appliances. In percentage terms, the overall share represented by these three types of steel remained fairly constant, fluctuating between 87 and 86 percent of total sheet and strip production. 1/

Within the category of sheet and strip, the share held by galvanized sheets increased from 21 to 27 percent; the shares held by hot-rolled sheet declined from 29 to 25 percent; and the shares held by cold-rolled sheet fell only from 37 to 34 percent during 1982-86. Whereas the change in percentage shares is not dramatic, these shifts do reflect the decision by Japanese steelmakers to shift the direction of their industry away from commercial-grade steel products towards higher value added and more specialized higher grade products such as galvanized sheet products. This shift is intended to address the more precise needs of end-users such as automotive manufacturers. 2/

1/ Japanese share of world steel production was 14 percent in 1984-1986.
2/ Interview with major Japanese steel producer, June 18, 1987.

Exports

Japan is the world's largest exporter of steel. It is estimated that about 60 percent of Japan's steel output is destined for export as steel products or in consumer goods containing steel. 1/ Japan's role as a major global steel supplier began as early as the 1950's. The Japanese said that at that time they began exporting to generate revenue to support the cost of imported raw materials to pay for the import of steel products not made in Japan and to earn foreign exchange. 2/ Capitalizing on the U.S. steel industry's strike in the early 1950's, Japan gained a foothold in the U.S. market and began to establish themselves as a major exporter.

China and the United States are Japan's primary export markets for steel products. As illustrated in table 9-5, China displaced the United States as Japan's largest market in 1983. Interestingly, whereas China is Japan's largest export market, Japanese industry analysis told Commission staff that they were losing money on sales to China. They estimated that the export price to mainland China is only two-thirds the average export price in other markets. Whereas exports to China consist mostly of lower value steel products, Japanese industry analysts all agreed that the product mix of exports to China does not account for the total price differential; the price break was characterized by some as necessary to retain market share. 3/

Table 9-5
Japanese exports of iron and steel by country of destination, 1982-86
(In thousands of metric tons)

Year	China	United States	U.S.S.R.	Korea	Taiwan	Total world
1982.......	2,930	4,152	2,393	1,081	1,110	29,474
1983.......	7,249	4,602	2,028	1,883	1,124	32,012
1984.......	8,613	6,418	2,083	2,256	1,227	32,841
1985.......	10,934	5,245	2,132	1,936	1,104	33,342
1986.......	9,244	3,952	2,480	2,367	1,883	30,323

Source: JISF March 1987 Monthly Steel Report.

As illustrated in table 9-5, China received 9.2 million metric tons of steel products from Japan in 1986, a 15 percent decline from their 1985 purchases of 10.9 million metric tons of all steel products. This decline is viewed by Japanese industry analysis as temporary and is partly due to China's problem with foreign exchange reserves. 4/ Table 9-6 shows exports of sheet and strip by product to export markets. As in the previous case, the United States and China are the major markets.

In general, as shown in tables 9-7 through 9-10 Japan's exports to the U.S. market have focused on higher valued sheet and strip products, (i.e., galvanized sheets, tinplate, other coated sheets and cold- rolled coil). In contrast, China has become Japan's primary market for the lesser valued flat rolled steel products such as hot-rolled sheets and coil.

1/ "Steel: An Example of Shifting International Comparative Advantage," Japan Economic Institute, July 18, 1986.
2/ Interview with major Japanese steel producer, June 18, 1987.
3/ Interview with Japanese securities trading firm June 17, 1987.
4/ The Steel Industry of Japan, 1987 JISF.

Table 9-6
Japanese exports of sheet and strip, by specified destinations, by product, 1985

(In thousands of metric tons)

Destination	Type of product: Galvanized	Tinplate	Stainless	Other	Total
China............	292.8	161.0	30.9	2,690.6	3,175.3
United States....	927.2	223.8	31.5	1,269.3	2,451.8
South Korea......	58.8	0.2	142.7	805.6	1,007.3
Iran.............	71.3	32.2	22.8	684.7	811.0
Taiwan...........	64.4	73.4	58.9	555.3	752.0
Thailand.........	39.0	51.8	15.6	484.4	590.8
Indonesia........	6.0	32.6	6.4	489.3	534.3
Saudi Arabia.....	120.7	27.5	1.0	267.2	416.4
Malaysia.........	63.1	4.3	3.9	329.3	400.6
All other........	691.8	205.9	133.5	2,381.6	3,412.8
Total........	2,335.1	812.7	447.2	9,957.3	13,552.3

Source: Compiled from statistics of U.S. Iron and Steel Statistics Bureau.

Table 9-7
Steel exports: Japanese exports of sheet and strip to the United States

Item	1982	1983	1984	1985	1986	Average annual change 1982 over 1986
	Metric tons					Percent
Hot Rolled Sheet......	3,513	2,932	3,677	1,575	1,203	-23.50
Hot Strip (+500mm)...	245,652	322,710	312,356	241,649	236,620	-0.93
Hot Strip (-500mm)...	21,450	36,060	28,857	23,633	17,083	-5.53
Cold Rolled Sheet......	43,088	63,750	67,674	45,348	36,308	-4.19
Cold Strip..	9,778	642,299	742,225	573,624	491,928	+166.33
Cold Rolled Hoop.......	8,494	11,199	16,317	15,852	11,663	+8.25
Silicon Sheets.....	9,986	24,792	49,440	54,664	30,075	+31.74
Tin Plate...	111,007	157,649	210,688	219,238	153,227	+8.39
Galvanized sheets.....	557,763	931,597	1,385,148	985,615	942,346	+14.01
Other Coated.....	89,927	156,696	215,391	196,361	229,194	+26.35
Total....	1,400,658	2,349,684	3,031,773	2,357,559	2,149,647	+11.30

Source: Official Japanese export data obtained during fieldwork, June 17, 1987.

Table 9-8
Percentage mix of sheet and strip exported by Japan to the United States, by specified products, 1982-86

(In percent)

Item	1982	1983	1984	1985	1986
Hot-rolled sheet........	0.3	0.1	0.1	0.1	0.1
Hot strip(+500mm).......	17.5	13.7	10.3	10.2	11.0
Hot strip(-500mm).......	1.5	1.5	1.0	1.0	0.8
Cold-rolled sheet.......	3.1	2.7	2.2	1.9	1.7
Cold strip..............	22.1	27.3	24.5	24.3	22.9
Cold-rolled hoop........	0.6	0.5	0.5	0.7	0.5
Silicon sheets..........	0.7	1.1	1.6	2.3	1.4
Tin plate...............	7.9	6.7	6.9	9.3	7.1
Galvanized sheets.......	39.8	39.6	45.7	41.8	43.8
Other coated............	6.4	6.7	7.1	8.3	10.7
Total...............	100.0	100.0	100.0	100.0	100.0

Source: Official Japanese export data obtained during fieldwork, June 17, 1987.

Table 9-9
Japanese exports of all steel products to the United States, by products, 1982-86

Product	1982	1983	1984	1985	1986	Average annual change 1982 over 1986
	Metric tons					Percent
Pig iron.........	11,999	11,119	8,236	13,650	7,659	-10.62
Ingots...........	4,058	2,524	8,863	110,232	45,477	+82.97
Rails............	93,380	97,872	193,037	171,170	64,647	-8.78
Structural shapes........	343,914	492,501	749,796	525,875	419,005	+5.06
Bars and rods....	26,755	32,961	32,126	23,397	18,810	-8.43
Wire rod in coil..........	131,801	205,717	268,522	204,044	185,960	+8.99
Plates...........	28,721	7,354	17,623	11,944	10,364	-22.49
Sheet and strip..	1,400,658	2,349,684	3,031,773	2,357,559	2,149,647	+11.30
Pipe and tube....	1,494,345	673,262	1,160,629	1,044,345	404,702	-27.86
Alloy steel......	225,708	218,241	334,708	299,636	255,507	+3.15
Other products...	390,307	510,782	612,168	483,119	390,493	+0.01
Total........	4,151,646	4,602,017	6,418,481	5,244,971	3,952,271	-1.22

Source: Official Japanese export data obtained during fieldwork, June 17, 1987.

Table 9-10
Percentage mix of all steel products exported by Japan to the United States, by products, 1982-86

(In percent)

	1982	1983	1984	1985	1986
Pig iron..............	0.3	0.2	0.1	0.3	0.2
Ingots................	0.1	0.1	0.1	2.1	1.2
Rails.................	2.2	3.0	3.3	1.6	
Structural shapes......	8.3	10.7	11.7	10.0	10.6
Bars and rods..........	0.6	0.7	0.5	0.4	0.5
Wire rod in coil.......	3.2	4.5	4.2	3.9	4.7
Plates................	0.7	0.2	0.3	0.2	0.3
Sheet and strip........	33.7	51.1	47.2	44.9	54.4
Pipe and tube..........	36.0	14.6	18.1	19.9	10.2
Alloy steel............	5.4	4.7	5.2	5.7	6.5
Other products.........	9.4	11.1	9.5	9.2	9.9
Total..............	100.0	100.0	100.0	100.0	100.0

Source: Official Japanese Export Data obtained during fieldwork, June 17, 1987.

The United States imported 2.4 million metric tons of flat-rolled (sheet and strip) Japanese steel during 1985, a decline from the 1984 level of 3.0 million metric tons. The decline in steel exports to the United States from Japan was largely attributed to the VRA's, which limited the amount of steel shipped to the United States. This decline continued in 1986 as Japan exported only 2.1 million metric tons of sheet and strip to the U.S., a 0.2-million-metric-ton reduction.

In summary, Japanese steel export levels have remained stable with the exception of pipe and tube. Sheet and strip exports have changed nominally with no more than a 3-percent annual increase or decrease during the period 1982-86. Most changes in the level of sheet and strip products has been in the range of 1 percent or less. The product mix of Japanese steel exports to the United States has shifted as shown in table 9-9. This table shows that pipe and tube exports have declined approximately 28 percent and sheet and strip export levels have risen almost 11 percent. These changes occurred with an overall increase in exports of steel products to the United States in the vicinity of 1 percent. In terms of all steel products exported to the world, sheet and strip's share rose almost 35 percent whereas the level of steel products exported to the world fell 5 percent. The increase in the share held by sheet and strip steel reflects the relative strength of demand for sheet products.

Imports

Japanese steel executives say their duties of 3.9 percent on most steel products make their market open to imports from all major supplying countries. The Japanese steel industry expressed concerned over the level of steel imports, in their market. The overall import penetration for all steel products is low, 3 to 4 percent, especially when compared with that of the United States. Table 9-2 shows import to consumption ratios of 13 percent in 1986 for hot- and cold-rolled sheet and strip and 0.2 percent for all other sheet and strip products. Japanese steel executives point out that the imports are concentrated in two product sectors, pipe and tube and plate, where new, lower cost producers such as Korea have acquired a substantial share of the market. The Japanese steel executives noted that imports from Korea are especially high and that they are now facing the same situation with Korea and Taiwan that the United States faced with Japan 10 or 20 years ago. Steel producers in Japan told Commission staff that they estimate Japan's world export share will drop from 30 percent to 20 percent due to Korea and Taiwan's increased activity in export markets. Still, despite the concern expressed by the Japanese executives over steel imports, the level of sheet and strip imports is still relatively low. Table 9-11 illustrates sheet and strip imports to Japan by product. Table 9-12 illustrates Japan's sheet and strip imports by country and product. Furthermore, despite increasing import volume, the ratio of imports to consumption as illustrated in Table 9-2 is less than 8 percent.

Table 9-11
Japanese imports of sheet and strip, by products, 1982-86

Item	1982	1983	1984	1985	1986	Average annual rate of growth
	1,000 metric tons					Percent
Hot rolled sheet and strip..........	1,045	1,272	1,871	1,363	1,283	+5.26
Cold-rolled sheet and strip..........	2	159	226	188	374	+269.79
Other sheet and strip..........	2	17	8	12	20	+77.83
Total............	1,049	1,448	2,105	1,563	1,677	+12.44

Source: Official Japanese export data obtained during fieldwork, June 17, 1987

Table 9-12
Japanese imports of sheet and strip, by specified sources, by product, 1985

(In thousands of metric tons)

Source	Type of product: Galvanized	Tinplate	Stainless	Other	Total
South Korea........	6.5	0.3	2.3	881.0	890.1
Taiwan.............	0.1	0.0	3.3	283.3	286.7
Brazil.............	0.0	0.0	0.0	186.2	186.2
All other..........	0.3	0.3	4.9	262.9	268.4
Total...........	6.9	0.6	10.5	1,613.4	1,631.4

Source: Compiled from statistics of the U.K. Iron and Steel Statistics Bureau.

Japanese industry analysts said that small independent companies handle imports of steel into the Japanese market. These companies are based primarily in Osaka. Japanese steel producers claim that steel companies do not import steel products nor are they affiliated with importing companies. The producers did express concern over rumors that large trading companies may be trying to import steel.

Japan's primary imports are heavy plate, hot-rolled coils, and consumer grade products. In 1985, the influx of carbon plate became so heavy that it accounted for about 50 percent of plate sales made through service centers. The Japanese producers attribute the majority of the increased plate supply to Korea. Importers have also penetrated about 25 percent of the Japanese hot coil market. One of the leading suppliers is Korea's POSCO, which in 1983 shipped some 56 percent of Japan's total 1.2 million metric tons of hot coil and sheet imports. As a result of significantly lower priced imports in hot coil, Japanese producer prices have been dragged down. This concern also has been expressed by many U.S. producers in recent years relative to the price suppression associated with low-cost exports to the United States.

Technology

Integrated plants with large blast furnaces to capture economies of scale are characteristic of Japan's steel industry. However, it is only in the last 30 years that the Japanese have moved into their present position as technology leaders. The industry expanded in the 1950's and 1960's, and at that time steel producers adopted the most innovative processes used for steelmaking. Subsequently, rapid adoption of continuous casting techniques placed the Japanese among the technological leaders in steel. The new plants built during this time gave the Japanese an advantage over the older foreign industries who focused on retrofitting technical innovations to existing plants. This added-on technology could not capture the full advantages of the Japanese plants that were specially designed to take advantage of the post-World War II innovations in steel production.

Japan has traditionally focused attention on research and development in the steel industry. In comparison with the United States, Japan has spent and continues to spend more than twice the U.S. amount on research in terms of the ratio of research and development expenditures to sales in the area of steel. Furthermore, Japan devotes valuable human resources to further research and development. For example, the Japanese report the ratio of researchers to total employment in the steel industry is almost 4 percent, compared with the United States whose ratio is less than 1 percent. 1/

The need to reduce energy costs was brought to a head during the global oil crisis of the early 1970's. At that time, rising oil prices drove up the price of other forms of energy such as coal and sent much of the global economy into a recession. In response, the Japanese steel producers focused their efforts on the reduction of energy consumption and rationalization

1/ Japanese Steel Management Challenges, videotape presentation by Japan Iron and Steel Federation, June 1987.

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investments. 1/ These actions reduced the amount of high cost raw materials, mainly oil, in some cases by as much as 40 to 50 percent; reduced the amount of raw steel required for the same amount of finished product by 15 to 20 percent; and reduced the amount of labor required, by 10 to 15 percent. Between 1973 and 1983, the percentage of steel which was continuously cast rose from 21.2 percent to 86.3 percent; oil has been replaced by coal and the yield of finished steel product per unit of input increased from 84.3 percent to 91.6 percent.

Further improvements have subsequently been achieved. In 1986, the continuous casting ratio was 92.7 percent and the yield of steel was 93 percent. In 1986, 70 percent of BOF steel was processed by secondary refining, as was more than 50 percent of steel produced by the electric furnace process.

In addition to technology, Japan's large scale plants have other advantages including high productivity resulting from high production levels, improved labor utilization in terms of productivity, and more efficient use of centralized, administrative components. At the same time, these plants pose certain disadvantages. In periods of low operating rates, large-scale plants are less flexible, making capacity adjustments difficult.

Financial structure

Japanese industry analysts reported that the big five firms had losses of Y467.9 billion (approximately $3 billion) in fiscal year 1986. This figure includes interest costs but excludes gains from selling marketable securities. 2/ Indeed, many analysts downplay the size of reported losses and see them as merely cosmetic because the industry sold y 343.2 billion in shares and marketable securities to cover these losses. 3/ Japanese steel analysts told Commission staff that the losses can primarily be seen in three areas: seamless pipe, 28 percent; shipbuilding and engineering, 35 percent; and exports to China, 37 percent. This trend is expected to continue as estimates place losses for the top five steel firms at Y400 billion ($2.7 billion) for the first quarter of 1987. This figure compares with $308.4 million in earnings reported by the U.S. industry during the same period. Despite these losses, the Japanese steel executives say their domestic sales are still profitable. Industry analysts interviewed by Commission staff in Japan said the target price of domestic sales is 7 to 15 percent higher than exports but in actuality, the average domestic sales price is about 30 percent higher.

Japanese steel producers' capital formation and financing systems traditionally differ from those of other industrial nations in two ways. The first difference is the strong initial Government involvement in the operation of the steel industry. During the post-World War II period of rebuilding, the steel industry in Japan was considered one of four target industries. The

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1/ These programs included: the adoption of continuous casting equipment; energy-recycling, such as turbine generation by furnace-top pressure recovery; coke dry-quenching systems; increased energy recycling of the by-product gas of blast furnaces and basic oxygen furnaces; and decreasing oil usage at the blast furnace.
2/ Interview with Japanese securities trading firm, June 17, 1987.
3/ The Japan Law Letter, vol. VI, Issue 2, April/July 1987.

close cooperation between business and Government to revive and expand the Japanese economy gave steel and other key industries in Japan a distinct advantage. For example, between 1951 and 1962, 75 percent of the investment funds of the Japan Development Bank went to only four industries, coal, electricity, shipping and steel. 1/

After these target loans were made to the steel industry, Government and producers worked together to maintain high operating rates in steel and to protect the steel industry's highly leveraged financial position. In addition, the second difference is the source of funds for operations and capital improvements for production facilities. Steel firms in countries like the United States have historically relied on retained earnings to supplement other internal sources of investment funds. Japanese companies are able to look to external sources for needed capital. Perhaps even more important, commercial banks represent the major source of external funds in Japan--as opposed to equity investors (stockholders) and bondholders in the United States. These commercial banks in turn look to the central Government bank--the Bank of Japan--as their primary credit base, thus vertically integrating the financial credit system. 2/

This relationship placed Japanese steel producers in a unique position to readily obtain low-cost investment funds to establish and develop their industry. The availability of these funds and the cooperation among businesses, banks, and the Government in Japan was a key factor in the industry's past and current financial resiliency. 3/

The rapid appreciation of the yen during 1986 and 1987 has also had a significant effect on Japanese steel producers. The Japanese steel producers say that the yen's rate of appreciation diminishes their international price competitiveness and ultimately their profits. 4/ Furthermore, the yen's rapid and unanticipated high level creates an environment of economic uncertainty that not only limits the industry's ability to plan future investments but also constrains their ability to implement existing rationalization plans which are based on the yen remaining at a level close to 150 yen per dollar. The yen's rise cut into not only the steel industry's exports but also the exports of the major domestic steel consumers--primarily the automotive and shipbuilding industries. However, the effect of the yen on steel-producer losses is mitigated because steelmakers rely on imported raw materials such as iron ore and coking coal which are priced in dollars and therefore become relatively cheaper to buy (in terms of yen); moreover domestic sales have remained profitable.

Whereas the Japanese steel producers remain committed to research and development expenditures for technology, investments by the steel industry in construction projects has fallen in yen terms by an average of 25 percent

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1/ Economics of International Steel trade, prepared for AISI by, Putnam, Hayes & Bartlett, Inc., May 1977.
2/ Ibid.
3/ Ibid.
4/ Toru Hiranuma, "Current Situation and Outlook of the Blast Furnace Steel Industry of the Pacific Rim," Nomura Research Institute. Sept. 1, 1985. (The original article in Japanese was obtained during fieldwork yarn translated by CACI in August, 1987).

since 1986. Most new investments are made to improve processing techniques develop new materials, and diversify into nonsteel activities. In 1987, the Japan Iron and Steel Federation (JISF) reported that funds procured for plant and equipment investment dropped below depreciation levels, reflecting a shrinkage in investment scale. As a result, debt repayments exceeded new borrowings. Financial information for the six major Japanese steel companies is summarized in table 9-13.

Table 9-13
1986 capital, operational profit of top six steel companies

(In million yen)

Company	Capital	Operational profit	Ordinary profit	Sales
Nippon Steel........	331,835	20,003	12,610	2,178,537
Nippon Kokan K.K....	159,326	15,354	7,823	1,091,671
Kawasaki Steel......	146,664	1,378	7,292	927,822
Sumitomo Metal......	133,777	7,652	13,728	902,682
Kobe Steel..........	127,302	8,053	14,049	988,842
Nisshin Steel.......	42,845	23,786	6,635	352,665
Total...............	941,749	76,226	62,137	6,442,219

Source: Field notes, "Kaisha Shikikho" by Tokokenzai Shinpposha, taken from each company's annual reports, and compiled for USITC visitors.

Rationalization Plans for Japanese Steel Producers

Japanese steel producers and industry analysts state that rationalization plans will be the key stimulus for structural change in the Japanese steel industry from 1986 well into the 1990's. These plans were implemented to cope with changes in world steel markets which have led to losses and falling production levels. Most Japanese companies have used a plan with the following three goals: cost reduction, capacity reduction, and increased financial stability. Firms have both modernized and reduced employment levels to reduce costs. Firms have begun to close less efficient facilities to reduce capacity. Finally, firms have diversified their operations to include a number of nonsteel ventures to increase financial stability.

Should the assumed exchange rate of 150 yen per dollar vary appreciably or other substantive economic changes occur, Japanese producers can be expected to adjust their plans accordingly. 1/

Employment reduction under rationalization plans

As shown in table 9-14, over past five years, employment in the steel industry has been falling. In 1986, the industry employed 251,266 workers, including production, administrative, clerical and technical workers. This figure represents a decline of 17,229 persons or 6 percent since 1982.

1/ Interview with Japanese Securities Trading firm June 17, 1987.

Table 9-14
Number of workers employed by the Japanese steel industry, 1982-86

Year	Production	Administrative and clerical	Total
1982....................	187,308	81,187	268,495
1983....................	189,265	81,078	270,343
1984....................	183,855	80,969	264,824
1985....................	181,592	77,818	259,410
1986....................	172,748	78,519	251,267

Source: JISf 1987 labor data.

The Japanese steel producers told Commission staff that the six major integrated steel companies have announced a number of measures to reduce the employment levels of both white- and blue-collar employees as part of their rationalization plans. At selected works, employees were asked to take several unpaid "holidays" a month, during which they were paid between 60 and 70 percent of their full pay. Four of the big six (Nippon Steel, Nippon Kokan K.K., Sumitomo Metals, and Kawasaki Steel) announced such measures.

The latest figures for employment reduction for the five major steel producers are outlined below. The Japanese steel analysts that provided the information stressed that the reduction plans were constructed under the assumption of an exchange rate of approximately 150 yen per dollar and a Japanese crude steel production level of 90 million metric tons for Japan fiscal years 1988-90.

<u>Nippon Steel</u>.--The total present workforce numbers 64,000 workers of which 6,000 are iron and steel employees. The firm will reduce employment levels as follows: 9,000 by retirement, 6,000 through transfers to new business, and 4,000 by a reduction/layoff plan, for a total reduction of 19,000 employees by 1990.

<u>Nippon Kokan K.K</u>.--The total present workforce numbers 28,000 workers of which 19,400 are iron and steel employees. The firm will reduce the number of iron and steel workers by 6,200 and reduce other workers by 1,800; some 2,500 will retire; and the rest will be transferred to new businesses or affiliated companies, for a total reduction of 8,000 by 1991.

<u>Kawasaki</u>.--The total present workforce numbers 24,500 of which 5,500 will be reduced through transfers to new businesses and expanded nonsteel businesses and through an enlarged layoff program by 1989.

<u>Sumitomo</u>.--The total present workforce numbers 25,200 which will be reduced by 6,000 to 19,200 by detailing surplus employees to steel related and nonrelated companies by 1988.

<u>Kobe</u>.--The total present workforce numbers 27,900 which will be reduced by 5,900 by the end of 1989.

Historically, major Japanese industries have guaranteed the full-time permanent segment of their workforce employment for life. At present, the steel producers in Japan say they remain firm in their commitment to provide employment for all of their displaced workers. This situation may change if the steel producers incur more substantial economic setbacks. At present, the Japanese are focusing their employment reduction efforts on transfers and/or retirement rather than layoffs and firings. Temporary measures have been taken to relocate workers among the existing steelworks; this is especially the case for single male workers who can be transferred without the upheaval associated with moving an entire family.

Transfers often affect blue-collar workers first. They are dispatched for periods of 6 months to a year to the mill's principal end-user companies. The steel companies continue to pay the workers' salary and in return the receiving company reimburses the steel company with an agreed amount. In the past, workers were often sent to major steel consumers such as automobile manufacturers. This practice has become increasingly less common as steel consumers in Japan are also adversely affected by the appreciation of the yen. For example, with market conditions for the auto industry less favorable, the auto companies have announced they will no longer take borrowed employees.

The Japanese industry group interviewed by Commission staff in Japan discussed the issue of subcontracting and how that segment of the steel industry would fare under these rationalization plans. Steel producers in Japan subcontract out for many low-level, labor-intensive services such as loading and unloading materials, processing scrap and slag and general equipment repair and maintenance. Special technical or transport companies offer these services to the steel producers. The use of these services by steel companies is extensive and it is estimated that about one-half of the employees working for the big six steel producers are contractual employees rather than permanent hires of the steel companies.

Because the steel producers purchase a contract for a specified service rather than a set number of workers, Japanese steel producers and industry analysts could not estimate the number of contract employees affected by service cancellation under rationalization plans. The Japanese industry analysts did say that reducing subcontracted services would not result in any additional costs to a steel firm. Furthermore, steel firms said they would like to substitute permanent hires for contract employees to perform these services as a method for absorbing surplus workers. Steel firms that proposed this alternative were subject to strong public criticism. This criticism was directed at the negative impact service cancellation would have on local economies since many subcontractors are concentrated in small regional areas where steel is the major industry. As a result, many steel firms are examining the possibility of transferring surplus permanent hires to subcontracting firms.

In addition to these temporary measures, the industry also announced more permanent changes in employment. One change is the nonreplacement of retirees. Another measure proposed is to transfer steel employees, known as "haken", from the steel operations to subsidiaries, both steel and nonsteel.[20] Many of the new companies acquired by Japanese steel producers, especially in the nonsteel area, are expected to bear most of the employee reduction effort.

In addition, these firms began granting additional leave to employees in December 1986. Employees on this extended leave plan, receive 80 percent of their normal pay and the Government reimburses the firm 66 percent of the payment. Many firms have chosen to grant employees additional leave. The major steel firms estimate that up to 5,000 employees have been involved in this particular segment of rationalization. In addition, two minimills and three specialty steel firms have also instituted this policy. 1/

Diversification under rationalization plans

Another element of rationalization is diversification. In recent years, Japanese steel companies have been venturing into new fields, investing in companies that produce new materials and high-technology products. Steel producers are focusing on the fields of finance, communications, consumer goods, real estate, and electronics as potential areas for diversification. A second and more recent reason for diversification springs from the need of the Japanese steel company to have a firm to which excess employees can be transferred rather than laid off. (For a fuller discussion of this issue see the preceding section on employment). The Japanese view these diversification plans as a large component of the steel producer's ability to restructure and regain profitability. However, most firms are entering industry sectors with well-established products and markets and will probably face stiff competition and at least initially, only a few leading firms will make a significant profit.

Japanese steel companies pursued two objectives in diversification. The first was to reduce steel's share of their overall revenues. The second was to vertically integrate their company for efficiency and cost purposes. The percentage share accounted for by steel income among the big six steel companies varies: for example, Kobe Steel derives 42 percent of its returns from its steel division whereas Nippon Steel's share from its steel division averages about 80 percent. 2/

Diversification strategies of the Japanese steel companies differ widely between inhouse solutions and outside solutions. Nippon Kokan K.K., for example, set up a new unit to develop new businesses within the company. They screened proposals from employees and invested in several. One of the most successful has been a food company that raises pigs. Another approach is that of Sumitomo Metals, which in 1986 established seven new companies ranging from a travel agency to a consulting company for those seeking foreign venture partnerships. In 1986, Kawasaki Steel formed a joint venture with LSI Logic Corp. of the United States to process silicon wafers in Japan, and Nippon Steel and Philips have agreed to produce jointly ceramic electronic components. Nippon Steel, the Western world's largest steel company at present, derives 80 percent of its sales from steel. Nippon's rationalization calls for a diversification plan through 1995, in which steel will account for less than 50 percent of total sales. Nippon expects that its electronics

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1/ Interview with Japanese Iron and Steel Federation, June 18, 1987.
2/ Interview with Japanese securities trading firm, June 17, 1987.

division along with its information/communications division will account for 20 percent of sales. The remaining 20 percent will be composed of engineering, urban development, and infrastructure projects. 1/

Capacity reduction under rationalization plans

The steel industry like almost all capital-intensive industries has difficulty matching demand and capacity. For example, in general, Japanese steel industries have an advance planning stage of 10 to 15 years. As of March 1987, MITI estimated Japan's crude steel capacity at 150.6 million metric tons and the industry's capacity utilization at 65.3 percent. This percentage is thought to be somewhat understated because it includes plants that have been permanently shut down. Plans exist to further reduce capacity. Closures have occurred since 1982 and future plans for many firms include further reductions in capacity.

The following tabulation outlines the facilities each firm has targeted for reduction or shutdown:

Rationalization Plans announced by Major Japanese Steelmakers
Production Units

Nippon Steel (1987-90)
- Blast furnaces--Muroran, Kamaishi, Hirohata, Sakai, Tobata
- Sintering, coke-making, steelmaking, and CC facilities, related to suspended BF, will also be suspended
- Rolling equipment--Muroran (hot and cold strip), Yawata (plate, stainless steel only; seamless, shift reduction), Nagoya (plate, heavy gage and special steel only), Hikari (wire rod, stainless and titanium steel only)

Nippon Kokan K.K.(1987-89)
- Blast furnace--Keihin
- Seamed pipe fitting--Keihin
- Slabbing--Fukuyama

Kawasaki Steel (1987-88)
- Chiba facilities--Sintering, Coke ovens (2), Slabbing, Steelmaking, Plate and hot strip

Sumitomo Metal (1986-88)
- Wakayama facilities--Blast furnace, coke oven, plate mill
- Seamless facilities--Amagasaki, Kainan
- OCTG processing lines-reduced from 6 to 3 lines

Kobe Steel (1987-88)
- Radical reformation of foundry pig iron, welding rod, and medium and small size casting

Nisshin Steel (1987-88)
- None

1/ News Release, Telepress Associates Inc., March 12, 1987, obtained during fieldwork in Japan, July 1987.

Government Policies

According to Japanese steelmakers, the Japanese Government is presently involved with the steel industry in two ways: first, through the Ministry of International Trade and Industry (MITI) regarding export issues; and second, through legislative programs that affect employment and transfers for all industries. MITI historically played several roles including that of encouraging steel companies to purchase domestic coal (often at a higher price), aiding companies with VRA restrictions and shipments, and a variety of other export promotion assistance.

The Japanese legislature regulates employment procedures. The Smooth Adjustment Act, an employment regulatory bill currently in debate, which addresses aid to industries harmed by the rapid appreciation of the yen and other economic factors that cause employment reduction and capacity shutdown. The Government also administers subsidy programs such as the low-interest yen impact loan. These mandates are available to all affected industries and not just steel producers.

Whereas the Smooth Adjustment Act, introduced in 1986, is receiving attention in the current legislative debate, the Japanese steel producers explained that certain unemployment laws have existed for quite some time. The unemployment insurance law for example, has existed for several decades and was revised in 1977. At present, the unemployment insurance program requires an employer to contribute 35 percent of the total benefit paid to a worker into a fund. Prior to 1977, the Government reimbursed large firms 50 percent and small firms 66 percent for wages paid to surplus workers. In 1977, the Government increased the reimbursement levels to 66 percent and 75 percent respectively. Since 1978, the five major steel firms have participated in the Government's program.

Competitiveness of the Japanese Steel Sheet and Strip Industry

Aspects of Competitiveness

Quality is a key aspect of competitiveness according to Japanese steel executives and industry analysts. They see the high quality of their product as a result of many different factors. First, the Japanese feel the advanced technology of their mills produces a consistently high-quality product. Second, the relative newness of Japanese facilities enables them to produce a higher caliber product. Third, the Japanese labor force is highly trained and dedicated to producing a quality product. Finally, Japanese steel producers maintain close, communication networks with their end-use customers. This practice enables producers and consumers to collaborate to develop improved steel products.

Service is considered an equal if not more important aspect of competitiveness for the Japanese steel executives. They claim that when quality and price competition are close, service then emerges as the most important consideration. Three factors contribute to the high level of service in Japan. First, they emphasize their ability to monitor supply and demand needs closely so that precise delivery dates can be met. Large steel customers in Japan demand that steel is delivered within short notice and almost to the hour specified. Second, Japanese steel producers are able to provide their customers with highly specialized technical services and on-site problem solving. Finally, trading companies as channels of distribution play an important role in the Japanese ability to provide responsive service. Because nearly all of the product is sold through trading companies, they have significant, indepth knowledge of the market, producers, and customers; and they are able to help establish superior service relationships.

The Japanese firmly believe in their philosophy of providing high quality products and responsive service. They see enhanced communication with end users as key to retaining and expanding market share, especially in export sales. Through trading companies, foreign direct investment and joint technology programs, the Japanese will continue to foster communication with their export customers. The Japanese say that this type of contact plus the close domestic industry relationships between customer and supplier will help them prosper in the future.

Japan's Competitive Strengths and Weaknesses

In addition to the above aspects of competitiveness, the Japanese industry analysts and steel producers also feel that their ability to contain costs with comparatively new, larger plants and stable raw material supply channels contribute to their competitive advantage. First, the Japanese steel analysts claim that their modern plants, high productivity rate through almost exclusive use of continuous casting and the ability to achieve economies of scale and thus contain costs. Second, Japanese steel producers assert that they face lower raw material costs because of the secure, cost-efficient distribution channels they have developed and invested in with foreign suppliers of raw materials and, plant locations on the coastline that reduce shipping charges for raw materials. Third, labor-management relations are strong; the Japanese producers have not experienced a strike in over 20 years and the workforce reportedly remains dedicated and productive. Fourth, the Japanese steel producers and industry analysts readily admit that Japan is an export-dependent nation that must continue to cultivate close Government and industry relations. 1/ Finally, their ability to sell at domestic prices well above export prices permits the Japanese greater export competitiveness. This ability is reflected in their willingness to take losses on sales to China to retain market share. 2/

Despite Japan's strong market position, the steel industry does have some disadvantages in the world steel market. The Japanese steel producers see the rapid rate of change in the yen as the most pressing disadvantage. The yen's value has changed so quickly that it has been very difficult for the Japanese steel producers to adjust their production and investment plans and operations. In addition, the developing countries are providing increased competition within lower grades of steel.

The Japanese steel producers view Korea, Brazil, Canada, and Europe as their major competitors. They are most concerned with Korea because of its geographic proximity and the comparative advantages Korea has over Japan. According to industry analysts in Japan, several factors contribute to Korea's advantage over Japan in certain segments of the market. For example, Korea has developed modern steel facilities comparable to Japan's; the facilities

1/ Interview with Japanese Iron and Steel Federation, June 15, 1987.
2/ Ibid.

are highly efficient and are operating at nearly 100 percent capacity. In addition, the Korean economy is currently experiencing a period of high growth, which enables these facilities to achieve economies of scale. However, the two most important Korean advantages are a foreign-exchange rate that has until recently remained closely aligned with the U.S. dollar (which has depreciated against the yen), and their low labor costs. Since the 1970's, the exchange rate has moved in Korea's favor, creating a favorable export environment. Secondly, Korea has low wage rates, estimated by the Japanese steelmakers at 17 percent of Japan's labor cost. 1/

Outlook for the Japanese Steel Sheet and Strip Industry

Overall, the Japanese steel producers and industry analysts feel the outlook for their steel sheet and strip industry is positive in the long run. Whereas officials cited concern over the yen's appreciation, import penetration, and excess capacity, they did not view these as insurmountable problems. Rather, they stressed that they are carefully planning for the future with rationalization plans to reduce costs and increased research and development investment to maintain their reputation of high quality, responsive service and technological innovation.

In addition to efforts by the Japanese steel producers, many factors will contribute to the future of Japan's steel industry. Both global economic factors and domestic performance factors will shape the steel industry in Japan. The primary global factors will be the foreign-exchange market, the changes in steel demand, and the market entry of new producers. Also important will be the ability of Japan's steel producers to implement successfully the strategies they have designed. The positive long-term outlook the Japanese producers and analysts profess depends on the success of current rationalization plans in cost and capacity reductions; their ability to either meet low-priced foreign products from competitors, such as Taiwan and Korea, or shift away from these products; competent management of nonsteel firms acquired through diversification; and their ability to adjust plans to accommodate a yen rate lower than 150 yen per dollar if necessary.

In addition to these efforts to adjust to current economic conditions, Japanese steel producers have additional resources in the form of vastly undervalued land assets that other countries such as the United States lack. The major Japanese steel producers have substantially undervalued the land in their portfolios. Given the extraordinary land prices in Japan, especially on the coast where the majority of steel producers are located, these land assets give steel producers an additional financial resource to fall back on. Whereas none of the Japanese firms the Commission spoke to had any plans to sell their land, this additional resource gives Japanese producers a competitive edge over other industrial nations in the current industry environment.

The Japanese steel producers and industry analysts seem confident they will emerge successful from this period of sluggish demand and fluctuating exchange rates. They refer to their industry's ability to ride out the turbulent years of the energy crisis and retain profitability as proof of their resiliency. If the exchange rate remains relatively stable and

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1/ Interview with Japanese Iron and Steel Federation, June 15, 1987.

rationalization plans are successful, the Japanese steel producers say they will regain their profitability. They also feel they will emerge from this period with an even stronger steel industry. Especially important, they claim, will be the steel industry's increased ability to meet customer demands for specialized steel and to expand non-steel diversification.

CHAPTER 10. THE KOREAN INDUSTRY

Structure of the Korean Steel Sheet and Strip Industry

The Korean steel industry was established during the Japanese occupation (1910-45) to meet demand caused by Japan's military preparation and to complement existing Japanese facilities. By 1940, there were approximately 12 iron and steel companies in Korea, with the majority of production being pig iron and the remainder consisting of steel products. The Korean steel industry operated much like a subcontractor to the Japanese industry, and most of the products were exported to Japan. Domestic capital formation, training of Korean engineers or managers, and transfer of know-how were prohibited. 1/

After Korea became independent in 1945, it was divided into North Korea and South Korea. The South Korean 2/ steel industry was destroyed by the Korean War (1950-53), after which the country began a project to restore damaged facilities. Reconstruction was slow because of a lack of capital and technology, but by 1961 there were 27 firms in operation with a total capacity of 346,000 tons per year. Growth in the Korean steel industry followed the rapid growth of the Korean economy based on a series of Five-Year Economic Development Plans. During the first Five-Year Plan (period 1962-66), basic industries were established in Korea and the infrastructure was expanded, resulting in high demand for steel products. 3/ During the second five-year plan (period 1967-71), a base of heavy industries, including steel, was formed, and a number of electric furnace steelmaking facilities and small rolling mills were established. Also during this period, a plan to construct an integrated steel mill emerged to improve Korea's self-sufficiency in steel products in the 1970's. During 1971-81, there was significant growth in Korea's steel industry; in 1973, the first integrated steel mill, Pohang Iron and Steel Co. (Posco) was completed. There have been additional expansions of Posco since then, and as a result certain structural imbalances among ironmaking, steelmaking, and rolling capacities have been greatly reduced. Posco, the largest steel producer in Korea, is the only steel company in Korea to operate fully integrated mills (i.e., those having ironmaking blast furnaces in addition to steelmaking furnaces and rolling and finishing operations). The remaining seven raw steel producers operate electric furnaces; one of these companies produces stainless steel, and the rest make carbon and other alloy steel. Current raw steelmaking capacity in Korea is approximately 17.5 million metric tons per year, and production in 1986 totaled 14.6 million metric tons. Approximately 70 percent of Korean steel output is continuously cast. 4/

There are 12 producers of sheet and strip in Korea. 5/ The industry operates three hot-strip mills, six cold-strip mills, seven galvanizing lines,

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1/ Jeongheum Kim, The Korean Steel Industry, Pennsylvania State University Graduate School, Department of Mineral Economics, May 1986.
2/ Hereafter, Korea refers to South Korea (the Republic of Korea).
3/ Kim, Op. cit., The Korean Steel Industry.
4/ Korea Iron and Steel Association.
5/ These producers, listed in descending order based on level of production, are Pohang Iron & Steel Co. (Posco), Union Steel Mfg. Co., Dong Bu Steel Co., Dong Kuk Steel Mill Co., Dong Yang Tinplate Ind. Co., Sammi Steel Co., Korea Iron & Steel Co., Shin Hwa Sil Up Co., Dai Yang Metal Co., Sam Yang Metal Co., Tong Yang Mool San Co., and Poong San Special Metal Co. Commission staff met with officials of Posco, Union, and Dong Bu in Korea.

and three tin mill lines. Posco is the largest producer of sheet and strip. The other firms purchase hot-rolled coils (from both Posco and foreign suppliers), which they cold roll and finish. The following examines the structure of Posco, then discusses the operations of the two largest nonintegrated sheet and strip producers, Union Steel Mfg. Co. and Dong Bu Steel Co.

The history of Posco is brief but eventful. During the Second Five Year Plan (1966-71), emphasis was placed on developing a base of certain heavy industries, including steel. Eventually, most of the funding for the establishment of Posco's first stage of operations came from Japan in the form of war reparations and funds from Japan's Export/Import Bank. Posco was incorporated under the South Korean Commercial Code on April 1, 1968, for the purpose of ironmaking, steelmaking, and conducting all incidental business directly or indirectly related thereto. 1/ Posco's corporate organization is both quasi-governmental and private. Currently, Posco's government ownership is held at 33.4 percent by the Ministry of Finance, 38 percent by the Government's Korea Development Bank, and 2.5 percent by the State-controlled Korea Tungsten. Of the private sector shares, the Korea First Bank holds 7 percent; the Bank of Seoul, 6.6 percent; the Cho-Hung Bank, another 6.6 percent; and the Hanil Bank, 5.9 percent. On March 25, 1987, South Korea's Minister of Finance authorized the four commercial banks to sell their combined 26.1 percent shareholding in Posco by the end of 1987. The banks' share will be offered to the public in several installments through the country's new over-the-counter stock market. 2/ In addition, a team of university professors and securities specialists has been selected to conduct a study of the feasibility of a public listing for the Government-owned shares of Posco.

Posco is involved in some joint ventures related to steel production and the acquisition of raw materials. The most significant of these is the joint venture in Pittsburg, CA, between Posco and the USS Division of USX Corp., known as USS-Posco Industries (UPI). Posco agreed to pay to USX $90 million for a 50-percent share of the plant, which produces high-quality sheet and tin plate products. The agreement, which was the result of more than 3 years of effort by USX Corp. to attract foreign investment in its steel operations, provides Korea with an entry into the western U.S. market for sheet products. Posco hopes to supply the Pittsburg works with hot-rolled coils produced in Korea when, and if, the voluntary restraint agreements (VRA's) limiting Korea's exports to the United States expire (the current expiration date is in September 1989). Posco representatives have indicated that the success of this venture is heavily dependent on such a supply arrangement. 3/ UPI is spending $350 million on a modernization program for the plant that includes the construction of a replacement pickle line and tandem cold mill, as well as a continuous annealing line to replace the plant's batch annealing facilities. The modernization is scheduled for completion in early 1989. Posco also has a joint-venture interest in a small steel processing and

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1/ "Posco: Korea's Emerging Steel Giant," World Steel Dynamics, October 1985.
2/ Metal Bulletin Monthly, May 1987, and Metal Bulletin, July 20, 1987.
3/ Information developed through interviews with Korean steel industry officials. Counsel for Posco submitted additional information supporting its claim that the supply of hot bands by Posco's facilities in Korea is crucial to UPI's success. This information is contained in app. J.

service center operation in the United States. 1/ Joint venture participation in coal mines is discussed later in this section.

Construction of Posco at the Pohang location occurred in several phases. The first stage, with 1.03 million metric tons of annual capacity, was completed in June 1973 at a cost of $292 per metric ton of capacity. The second stage of expansion was completed in May 1976 and raised total capacity to 2.6 million metric tons per year at a cost of $347 per ton of incremental capacity. Construction of the third stage designed to increase capacity to 5.5 million metric tons was begun in August 1976 and completed in December 1978 at a cost of $466 per metric ton of incremental capacity. During this period, technical expertise was acquired in the fields of ironmaking, steelmaking, and steel rolling by sending employees to Japan, Austria, West Germany, the United States, and France for training. The fourth stage of expansion was completed in May 1983 and boosted capacity to 9.1 million metric tons at a cost of $386 per metric ton of incremental capacity. 2/

Despite a four-stage expansion of the Pohang facility, it became apparent to the Korean Government in the late 1970's that the Pohang works (in combination with South Korea's electric furnace works) would not be able to meet the country's expected steel consumption, and plans for Posco's second integrated steelworks were activated. Kwangyang Bay was formally selected as the site for the new works in November 1981 because it provided a deep port for delivery of raw materials and export of finished products, and because there was an existing infrastructure encompassing highways, railroads, and power sources. The plant layout was designed for maximum efficiency by locating all major plant components (from stockyard to blast furnace to mills) in a straight line. Raw materials are unloaded at the port on one side of the plant, and the finished products are loaded onto ships at the port on the other side of the plant. The first phase of Kwangyang's construction was completed 6 months ahead of schedule in May 1987 and added 2.7 million metric tons of capacity to Posco's operations, raising total capacity to 11.8 million metric tons. This makes Posco the fifth largest steel company in the Western World and South Korea the world's ninth largest steel producing country. The cost of constructing the Kwangyang Bay works was kept to a minimum by completing the works early, by using low-cost, experienced Korean international construction companies, and by taking advantage of highly competitive bidding by equipment suppliers from various countries. 3/ The majority (71 percent) of the total investment in Kwangyang was financed through Posco, without direct government assistance, and the remainder (foreign loans) was financed through long-term, low-interest suppliers' credits. Posco estimates that construction costs (including the cost of the site and land reclamation work) amounted to $637 per metric ton of annual raw steel capacity, compared with a world figure close to $1,500 per metric ton of new construction. 4/ Posco is planning a second phase of expansion at

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1/ Metal Bulletin, Dec. 9, 1986; 33 Metal Producing, February 1987; and Iron Age, Sept. 5, 1986.

2/ "Posco: Korea's Emerging Steel Giant," World Steel Dynamics.

3/ Information developed through interviews with Korean steel industry officials.

4/ Pohang Iron & Steel Co., Ltd., Press Release: Dedication of Kwangyang Steel Works, May 1987, and "Korean Steel Left to Fend for Its Own," American Metal Market, Oct. 7, 1983.

Kwangyang designed to add 2.7 million metric tons of capacity by December 1988. It expects the construction cost (per metric ton of annual capacity) of this phase to be only $370, making a two-phase average cost of $504 per metric ton. The company compares this with the per ton construction cost of Brazil's Tubarao works of about $700, and China Steel's (Taiwan) second phase expansion cost of $857. 1/ As Kwangyang Bay is more efficient than the Pohang works in terms of energy, labor, and production costs (Kwangyang continuously casts 100 percent of its slab output compared with 80 percent at Pohang), management has decided to concentrate low-end semi-finished steel production at its new works and the Pohang facility continues to move into higher valued, further processed products. 2/ There are tentative plans for further expansion at the Kwangyang Bay facility, which would raise Posco's raw steel production capacity to 19.9 million metric tons per year by the early 1990's.

Additional expansions planned by Posco include the construction of a 250,000 metric ton stainless steel hot-strip plant at the Pohang works to be completed by July 1989. One purpose of this plant is to supply Korean producers of cold-rolled and finished stainless steel, such as Sammi Steel, with hot-rolled stainless bands. A cold-rolling mill to be completed by mid-1989 is also planned for the Kwangyang Bay works. 3/

Posco's rolling capacity includes 5.7 million metric tons of hot-strip capacity and 1.8 million metric tons of cold-rolling capacity at the Pohang facility, and 2.64 million metric tons at Kwangyang, which produces hot-rolled strip exclusively. The hot-strip mills produce hot-rolled sheet in coil, checkered plates, and skelps in thicknesses ranging from 1.2 mm to 22.0 mm. The hot-rolled products are either supplied as intermediate materials for cold-rolled products and silicon steel or used as plates for bridges, structures, or pipes and tubes. Posco uses the hot-charge rolling technique in which the hot slabs transported from the continuous caster are heated temporarily in the reheating furnace, thus reducing energy use and increasing productivity. The two cold-rolling mills produce products ranging from 0.15 mm to 2.0 mm in thickness, and the new mill can produce sheets up to 60 inches in width. This is considerably wider than the standard 48-inch width produced in other Korean steel mills. Products made by these mills consist principally of cold-rolled coils, galvanized coils and cut-to-length sheets, and black plate in coils.

Posco currently employs about 18,700 workers, which includes both regular employees and contract employees. The contract employees perform service tasks such as furnace relining, cleaning, packing, preparing ingot molds, and treating slabs. Company officials claim that a significant percentage of these employees have at least the equivalent of a high school education. The company has one of the lowest employment costs per ton shipped of any integrated steel producer in the world. According to World Steel Dynamics, Posco's employment cost for hot-rolled products in early 1987 was $20 per ton. This figure is lower than that for all major producing countries except Brazil, which also had employment costs of $20 per ton. Wages are paid on the basis of grade and job difficulty. Workers who perform those jobs requiring

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1/ Ibid.
2/ Metal Bulletin, Apr. 7, 1987.
3/ Metal Bulletin, Jan. 6, 1987, and Feb. 20, 1987.

the highest skill levels receive the highest wages. Wage increases are based in part on the number of years of service.

Posco's employees are not unionized. Their concerns are taken before a labor/management coordination committee, which comprises some 25 worker representatives and 17 management officials that meet once a month to discuss labor issues. This system resulted in the announcement by company officials that employees will receive two wage increases: the first in October 1987 and the second in 1988. Posco officials claim that the increase will bring average salaries, excluding bonuses, to about $820 per month (at the present exchange rate of about 808 won per dollar). This wage level represents about one-third of the equivalent salaries for Japanese steelworkers. 1/

Management at Posco has also attempted to improve the technical expertise of its employees through various formal training programs including computer applications, steelmaking, and language instruction. The company also has technical compensation agreements with steelmakers in other countries (such as Taiwan, Austria, and Australia) whereby engineers are exchanged each year. To further improve working conditions, Posco has built recreational, educational, and medical facilities for its workers and provides college scholarships for children of its employees. Housing is provided at low cost to families and unmarried workers. 2/

Posco relies heavily on imports of metallurgical coal and iron ore (the primary raw materials used in steelmaking) to meet its needs. In 1986, the Korean steel industry as a whole imported most of its iron ore and 100 percent of its coking coal. The major suppliers of iron ore to Posco that year were Australia (38 percent), Brazil (24 percent), India (22 percent), Peru (14 percent), and Canada (2 percent). The principal coal suppliers were Australia (41 percent), Canada (26 percent), the United States (25 percent), the Soviet Union (6 percent), and China (2 percent). Recently, South Korea announced the discovery of its largest reserve of iron ore found to date, but the new mine is unlikely to alter significantly the country's dependence on imports. 3/

Raw materials represent the largest share of production costs. For example, in early 1987, the cost of raw materials (e.g., coal, iron ore, and steel scrap) represented 61 percent of Posco's pretax cost of $252 per metric ton of hot-rolled product. 4/ Because transportation costs represent a significant portion of raw material costs, Posco has located both of its plants on the South Korean coast, with the Kwangyang Bay facility benefiting from a natural harbor with a large capacity for handling raw materials. During its early years, Posco had acquired most of its raw materials from overseas on a long-term contract basis. However, the oil crises, rising prices, and the resource nationalization policies of the supplying nations caused raw material supplies to dwindle. As a result, Posco has proceeded with an overseas resource development plan since the mid-1970's to secure a guaranteed steady supply of materials. 5/

1/ Metal Bulletin, Sept. 24, 1987.

2/ Information developed through interviews with Korean steel industry officials.

3/ Metal Bulletin, July 9, 1987.

4/ World Steel Dynamics, Steel Strategist #13, Mar. 30, 1987.

5/ Information published by Pohang Iron & Steel Co.

In the United States, Posco acquired 100 percent of the Tanoma Coal Mine in Pennsylvania, and has been importing 600,000 tons of coal each year since 1982. 1/ Posco also developed Mt. Thorley Coal Mine in Australia and Greenhills Coal Mine in Canada in 1982 under a joint-venture contract. Posco has a 20 percent capital participation in each of these mines. The company plans to continue to develop overseas resources to meet the increased demand of the Kwangyang Works and to further guarantee raw material supplies in the future.

A number of the major world steel producers are diversifying into non-steel areas in an effort to improve profitability. Posco Chairman Tae Joon Park stated that Posco has no intention of decentralizing and decreasing its productivity through excessive diversification, but instead will concentrate on upgrading a limited number of products including higher value-added products such as lighter and thinner gauge materials with higher strengths for use in automobile panels and appliances. 2/ However, Posco's research and development (R&D) efforts have been directed toward new materials, computers, and telecommunications, as well as steelmaking technology.

The two largest non-integrated sheet and strip producers, Union Steel Mfg. Co. and Dongbu Steel Co., are both privately owned steel rollers which purchase hot-rolled coils (principally from Posco) and further process them into cold-rolled sheets, galvanized sheets, other coated sheets, and pipes and tubes. 3/ Union Steel, the largest of the non-integrated companies, was established in December 1962. Soon after, work began on reclaiming land for the site for what is now Korea's largest port, Pusan. This location was chosen because the port provided easy access for raw material deliveries and product shipments. Union Steel rolled its first steel in September 1967. The company was started with assistance from Japan's Yawata Steel, prior to the latter company's merger with Fuji Steel in 1970 to form Nippon Steel. The Pusan works had an initial capacity of 100,000 tons per year. Additional expansions throughout the 1970's and 1980's have raised Union's cold-rolling capacity to 850,000 tons per year. The majority of Union Steel's output supplies the automotive, electronics, and appliance industries. According to the trade press, the company is planning a major modernization program and an expansion that could double cold-rolling capacity by 1990. 4/ Officially, the company is saying nothing about the expansion; in fact, it claims that it is uncertain about the strength of internal demand after the 1988 Olympic-stimulated building boom runs its course and, therefore, has no plans to expand. 5/

1/ Posco officials stated that the lack of deepwater ports on the United States' east coast limits Posco to loading only 100,000 tons of coal onto their 200,000-ton-capacity ships, which they top off with coal in Brazil. The cost of U.S. coal remains competitive because of the enormous size of the coal vessels which keeps the freight rates low, and because of the combined loading of coal from the United States and Brazil.

2/ Metal Bulletin, Apr. 29, 1986.

3/ Officials of these companies stated that the use of multiple suppliers of hot coil, such as producers in Japan and Taiwan, was incentive for Posco to keep its coil prices at reasonable levels.

4/ Metal Bulletin Monthly, The Rise and Rise of Union Steel, May 1987.

5/ Information developed through interviews with Korean steel industry officials.

In 1977, Union Steel was absorbed by the Kukje Group whose interests include such industries as footwear manufacture and construction. Kukje acquired about 57 percent of Union (a controlling share). Union Steel prospered under Kukje until the conglomerate collapsed in February 1985. Under a rescue plan designed for the group by its creditor banks and the Korean Government, control of Union Steel was to go to Dongkuk Steel, an electric furnace steelmaker. However, reportedly severe dissatisfaction on the part of Union employees 1/ with Dongkuk's personnel actions and stock manipulations caused Union Steel's labor union to insist that the South Korean Government either place Union Steel under a "respectable and sound" company management, or let the employees run Union Steel themselves. 2/ The Government chose the first alternative. 3/ Union's current president, vice president, and six other senior staff members are from Posco. Dongkuk continues to hold a direct 17-percent share in Union, together with another 16-percent through affiliates.

Union's managers state that it is not currently involved in any joint ventures related to the production of steel or the acquisition of raw materials; however, company officials identify raw material supplies (i.e., hot coil requirements) as a significant concern. 4/ Union Steel currently purchases 60 to 70 percent of its annual hot coil requirements from Posco and imports the remainder from South Africa, Brazil, Spain, and Japan. 5/

Dongbu Steel Co. 6/ is South Korea's third largest steel roller and has undergone several changes in ownership over the past few years. The company is a publicly owned corporation whose stock is traded on the Korea Stock Exchange. The company's facilities include two sheet-producing plants equipped with cold-rolling mills, galvanizing mills, and tin plate mills. Dongbu's major domestic market is the automotive industry. 7/ The company produces a variety of products including a 60-inch wide, cold-rolled coil for automobile production. This is a relatively new product for Korean steel producers and it supplies a market previously served only by the Japanese until the entry of Dongbu. The oldest facility operated by Dongbu was established approximately 20 years ago. According to the firm's leaders, it has no official plans to expand its operations, choosing instead to modernize existing facilities in an effort to improve product quality and productivity.

1/ Union employs a total of 2,100 employees and does not use subcontractors.
2/ Metal Bulletin Monthly, May 1987.
3/ Ibid.
4/ Information developed through interviews with Korean steel industry officials.
5/ Ibid.
6/ Dongbu is the former Illsin Steel Co. which went bankrupt in May 1982. Illsin had purchased approximately 700,000 metric tons of hot-rolled coil per year from Posco. In order to maintain the fabricator as a viable entity, Posco decided to purchase Illsin. As a result, Illsin became a wholly owned subsidiary of Posco and its name was changed to Dongin Steel Co. Posco sold Dongin, which was consistently profitable, in 1984 and the company became known as Dongbu. (Posco, World Steel Dynamics).
7/ Information developed through interviews with Korean steel industry officials.

Improvements are financed principally by Dongbu, with additional funds obtained from commercial banks. 1/

Dongbu is not a partner in any joint ventures in the production of steel or the acquisition of raw materials. The company's principal raw material requirements are hot-rolled sheets for further processing. These sheets are supplied principally by Posco, with additional quantities imported from Brazil, South Africa, Australia, Japan, and Taiwan. 2/

No subcontractors are employed at Dongbu. The company is unionized, and officials characterize labor/management relations as friendly and cooperative.

Conditions in the Korean Steel Sheet and Strip Industry

Employment 3/

Total employment in the steel industry in Korea rose by 8.3 percent, from 60,000 employees in 1982 to 65,000 employees in 1986. Production workers accounted for approximately 80 percent of total employment during the period. 4/ Although labor costs in Korea are among the lowest in any steel-producing country, both wages per hour and labor costs per metric ton of finished steel rose between 1981 and 1985, as shown in the following tabulation:

Year	Wages per hour 1/ (in U.S. currency)	Labor cost per metric ton of finished steel 1/ (in U.S. currency)
1981..............	$2.44	$21.45
1982..............	2.53	20.97
1983..............	2.67	21.90
1984..............	2.88	22.33
1985..............	2.94	22.25

1/ Data provided by Korea Iron & Steel Association.

Korea's steel industry was affected by the labor disputes in mid-1987 as some 18 steel companies reportedly experienced labor unrest. Most disputes were settled through peaceful negotiation between union and management. 5/ It is likely that increased labor costs will result from the talks, as appears to be the case with Posco (see previous section).

Despite increasing labor costs, Korean steel producers have realized employment cost savings as a result of steady improvements in productivity.

1/ Ibid.
2/ Ibid.
3/ Employment data are for all steel products combined, as specific data for sheet and strip products are not available.
4/ Data provided by the Korea Iron & Steel Association.
5/ Metal Bulletin, Sept. 24, 1987.

The following tabulation shows that annual output per employee rose and man-hours per ton declined during 1981-85:

Year	Annual output per employee 1/ (metric tons)	Man-hours per metric ton of finished steel (all products) 1/
1981..............	320	8.80
1982..............	334	8.31
1983..............	336	8.19
1984..............	356	7.74
1985..............	359	7.57

1/ Data provided by Korea Iron & Steel Association.

Consumption

Despite the expansion of Posco and the additional capacity provided by the Kwangyang Bay facility, growth in South Korea's domestic steel consumption is expected to outpace the increase in the country's output over the next few years, according to the Korean Iron and Steel Association. The association estimates that South Korean domestic consumption will reach 18.87 million metric tons by 1991, up from 11.04 million metric tons in 1985. The second stage expansion at Posco's Kwangyang facility should raise overall South Korean steel capacity to 14.5 million metric tons per year by 1988. Posco's third and fourth stages of expansion at the Kwangyang works (still in the planning stages) could each add 2.7 million metric tons of annual capacity, but even this higher capacity level would be insufficient to meet projected domestic consumption in the early 1990's once export demand (which currently averages between 25 percent and 30 percent of annual production) has been satisfied. 1/

Major sources of demand for steel in South Korea include the infrastructure projects spawned by Korea's urbanization plans and the large-scale construction program resulting from the country's plans to host the 1988 Olympics. 2/ In addition, domestic production of automobiles, electronic products, heavy electrical equipment, and general machinery products are all export-oriented industries, which have shown high rates of growth that are expected to continue. 3/ Much of this growth in demand will be reflected in increased consumption of sheet and strip products, which is a primary reason for Posco's consideration of a third and fourth stage of expansion at Kwangyang Bay. Industry sources have indicated that even with additional expansion, Korea's steel industry may not be able to meet demand and that imports may have to supplement domestic production. As shown in

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1/ Metal Bulletin Monthly, May 1987.
2/ However, industry representatives expressed concern that many of the structures (hotels, etc.) being built for the Olympics may be largely unused after the Games.
3/ Korea Iron and Steel Association.

table 10-1 apparent consumption of sheet and strip products overall in Korea increased by 159.3 percent from 1.4 million metric tons in 1982 to 3.7 million metric tons in 1986. These figures do not include Posco's internal consumption of hot-rolled products for the production of cold-rolled products, thereby understating apparent consumption of hot-rolled sheet and strip. Apparent consumption of cold-rolled sheet and strip rose steadily from 711,000 metric tons in 1982 to 1.8 million metric tons in 1986, representing an increase of 152.9 percent. The growth resulted principally from increased demand from the automotive and appliance industries.

Along with growth in apparent consumption, Korea's production of sheet and strip increased steadily by 18.0 percent, from 3.4 million metric tons in 1982 to 4.0 million metric tons in 1986. There was concurrent growth in production of cold-rolled sheet and strip. Exports, which were at their highest 5-year level in 1982, fluctuated during the period, as did imports, which peaked in 1986.

Trade

As shown in table 10-2, Korea's overall exports of sheet and strip products declined by 16.9 percent, from 2.4 million metric tons in 1982 to 2.0 million metric tons in 1986. Declines occurred in exports of hot-rolled and cold-rolled products, whereas exports of other sheet and strip rose. As a share of Korea's total sheet and strip exports, Japan was the major market during 1982-86, accounting for approximately 42 percent of total exports during the period. However, on a product category basis, the United States was the principal market for Korea's exports of cold-rolled and other sheet and strip, and Japan was the primary market for exports of hot-rolled products.

Posco officials indicated that they receive the highest export prices on their shipments to Japan. They first began to export to that country in 1978, shipping commercial grade products. Their goal is to further penetrate the Japanese market by supplying that country with higher quality, value-added products. 1/

Table 10-3 shows that there was fairly steady growth in imports in all product categories during 1982-86. Specifically, imports of hot-rolled sheet and strip increased by 278 percent from 1982 to 1986; imports of cold-rolled sheet and strip rose by 367 percent and imports of other sheet and strip rose by 194 percent. Japan was the principal supplier of all categories of sheet and strip imports during the period, supplying from 67 percent (in 1985) to 95 percent (in 1982) of total imports.

Certain Korean imports are restricted and must receive an import license before they can enter the country. Of steel products, only stainless steel strip remains restricted, and this restriction is expected to be lifted in

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1/ Information developed through interviews with Korean steel industry officials.

Table 10-1
Sheet and strip: Korea's production, exports, imports, and apparent consumption, 1982-86

Item	Production	Exports	Imports	Apparent consumption	Ratio of imports to consumption
	Thousand metric tons				Percent
Hot-rolled sheet and strip: 1/					
1982	1,968	1,704	345	609	56.7
1983	1,594	1,350	1,026	1,270	80.8
1984	1,499	1,240	1,455	1,714	84.9
1985	1,516	1,255	1,270	1,531	83.0
1986	1,664	1,305	1,303	1,662	78.4
Cold-rolled sheet and strip: 2/					
1982	1,322	689	78	711	11.0
1983	1,669	768	94	995	9.4
1984	1,905	935	147	1,117	13.2
1985	1,900	792	177	1,285	13.8
1986	2,096	662	364	1,798	20.2
Other sheet and strip: 3/					
1982	123	17	18	124	14.5
1983	169	22	33	180	18.3
1984	195	28	49	216	22.7
1985	183	32	49	200	24.5
1986	268	36	53	285	18.6
Total sheet and strip:					
1982	3,413	2,410	441	1,444	30.5
1983	3,432	2,140	1,153	2,445	47.2
1984	3,599	2,203	1,651	3,047	54.2
1985	3,599	2,079	1,496	3,016	49.6
1986	4,028	2,003	1,720	3,745	45.9

1/ Includes only hot-rolled products for outside sales, which understates apparent consumption and overstates the ratio of imports to consumption.
2/ Includes cold-rolled sheet and strip, tin plate, galvanized sheet and strip, and other coated or plated sheet and strip.
3/ Includes stainless sheet and strip, and electrical sheet and strip.

Source: Korea Iron and Steel Association.

Table 10-2
Sheet and strip: Korean exports, by products and by country markets, 1982-86

Item and destination	1982	1983	1984	1985	1986	Average annual change, 1986 from 1982
	1,000 metric tons					
Hot-rolled sheet and strip exports to--						
Japan	876	789	755	779	721	-4.8
United States	155	190	221	185	202	6.8
EC	125	13	-	32	20	-36.8
Other countries	548	358	264	259	362	-9.8
Total	1,704	1,350	1,240	1,255	1,305	-6.5
Cold-rolled sheet and strip exports to-- 1/						
Japan	143	107	143	125	115	-5.3
United States	119	388	529	364	376	33.3
EC	-	-	-	-	2	2/
Other countries	427	273	263	303	169	-20.7
Total	689	768	935	792	662	-1.0
Other sheet and strip exports to-- 3/						
Japan	-	4	5	8	9	2/
United States	2	8	11	13	10	49.5
EC	2	1	-	2	2	0
Other countries	13	9	12	9	15	3.6
Total	17	22	28	32	36	20.6
Total sheet and strip exports to--						
Japan	1,019	900	903	912	845	-4.6
United States	276	586	761	562	588	20.8
EC	127	14	-	34	24	-34.1
Other countries	988	640	539	571	546	-13.8
Total	2,410	2,140	2,203	2,079	2,003	-4.5

1/ Includes cold-rolled sheet, cold-rolled strip, tin plate, galvanized sheet and strip, and other coated or plated sheet and strip.
2/ Not applicable.
3/ Includes stainless sheet and strip and electrical sheet and strip.

Source: Korea Iron and Steel Association.

Table 10-3
Sheet and strip: Korean imports, by product and by supplying countries, 1982-86

Item and source	1982	1983	1984	1985	1986	Average annual change, 1986 from 1982
	1,000 metric tons					
Hot-rolled sheet and strip imports from--						
Japan	326	870	1,001	883	1,030	33.3
United States	-	-	-	-	4	1/
EC	5	1	50	73	10	18.9
Other countries	14	155	404	314	259	107.4
Total	345	1,026	1,455	1,270	1,303	39.4
Cold-rolled sheet and strip imports from-- 2/						
Japan	75	92	146	95	360	48.0
United States	-	-	-	-	1	1/
EC	-	-	1	2	2	1/
Other countries	3	2	-	80	1	-24.0
Total	78	94	147	177	364	47.0
Other sheet and strip imports from-- 3/						
Japan	17	27	33	31	44	26.8
United States	-	-	-	-	-	1/
EC	1	5	10	9	7	62.7
Other countries	-	1	6	9	2	1/
Total	18	33	49	49	53	31.0
Total sheet and strip imports from--						
Japan	418	989	1,180	1,009	1,434	36.1
United States	-	-	-	-	5	1/
EC	6	6	61	84	19	33.4
Other countries	17	158	410	403	262	98.1
Total	441	1,153	1,651	1,496	1,720	40.5

1/ Not applicable.
2/ Includes cold-rolled sheet, cold-rolled strip, tin plate, galvanized sheet and strip, and other coated or plated sheet and strip.
3/ Includes stainless sheet and strip and electrical sheet and strip.

Source: Korea Iron and Steel Association.

1987 or 1988. 1/ Potential importers of stainless steel strip must obtain permission from the Korea Iron and Steel Association to import the product. Upon approval they must then request an import permit from the Government of Korea. Non-restricted items automatically receive an import permit. The average tariffs on Korean imports of steel products are as follows: 2/

Item	Tariff (percent ad valorem)
Scrap	2% + 2.5% defense tax
Iron ore	1% + 2.5% defense tax
Semi-finished products	10% + 2.5% defense tax
Hot-rolled coil	10% + 2.5% defense tax
Other further processed steel products	20-25% + 2.5% defense tax

For certain steel products considered especially important to the industry, there is a quota system that allows limited imports of these items at a reduced duty rate of 2 percent ad valorem, as follows: 3/

Item	Quota level
Cold-rolled sheet	120,000 metric tons per 6 months
Galvanized sheet	20,000 metric tons per 6 months
Heavy plate	48,000 metric tons per 6 months

Importers of raw materials in Korea (e.g., hot coils used to produce cold-rolled coils) are eligible for duty drawback on their imports of products which are further processed, then exported. According to industry officials, this program was designed to apply uniformly to all product categories. Its goal is to ensure that the competitiveness of Korean producers will not be adversely affected in world markets by the payment of duties on raw materials, which results in higher costs and consequently higher export prices for end products. Therefore, the effective rate of import duties may be much lower than the actual rate of duty, depending on the extent of duty drawback.

Technology

During the early years of the South Korean steel industry, developed-country steel producers (e.g., Japan) willingly fostered the expansion of Korea's steel industry by providing technology, technical assistance, equipment, and funding. Now, the Korean steel industry sees itself as being in a position to transfer to other countries its knowledge and expertise regarding the construction of efficient, low-cost steel mills such

1/ Information developed through interviews with officials of the Ministry of Trade and Industry.
2/ Ibid.
3/ Ibid.

as Posco's Kwangyang Bay facility (completed in May 1987). 1/ Because the Korean steel industry is relatively new, Korean steel executives claim its facilities employ the most modern production technology, particularly the Kwangyang Bay operation. For example, Kwangyang continuously casts 100 percent of its slabs, compared with a ratio of 80 percent for the Pohang facility. Another feature enhancing the new works' efficiency is the hot charging of slabs, a process by which the hot slab is conveyed directly to the hot-strip mill by a heat-shielded roller table to reduce heat loss and energy costs. Kwangyang also benefits from fully automated processes and a computerized management system covering all lines of management of the steel works. Posco managers state that nearly all of the software used to control and operate the automated systems has been developed by the firm's own staff. The equipment for the Kwangyang facilities was supplied by a consortium of 15 Korean companies and 17 companies from other countries. The Korean companies, including Korea Heavy Industries and Construction, Hyundai Heavy Industries, Samsung Heavy Industries, and several others, formed partnerships with their foreign counterparts: Davy McKee of Great Britain, Voest-Alpine of Austria, Mannesman Demag of West Germany, and Mitsubishi of Japan. 2/

According to Korean steel executives, despite the number of foreign suppliers of equipment and technology, many of the developed country steel producers are currently reluctant to provide such expertise. 3/ For example, much of the technology to construct the Kwangyang facility was supplied by the Japanese, despite the policy conflict between the Japanese steel industry, which sought protection of its technology, and Japanese equipment manufacturers seeking sales. Finally, the Government of Japan announced that the country would sell advanced technology to Posco. This followed intense lobbying by Japanese machinery manufacturers determined not to lose sales, which incorporated technology that could readily be acquired elsewhere (such as in Western Europe). 4/ Consequently, Korea's modern facilities have made it a strong rival for the Japanese steel industry.

Although the Korean steel producers have technical exchanges with certain foreign producers (e.g., with the French steel industry for electrogalvanizing lines and blast furnace technology), the alleged growing unwillingness of major foreign steel producers to supply equipment and technology to Korea has caused the country's steel industry to attempt to become self-sufficient in the development and implementation of new technology. All three sheet and strip producers have emphasized the importance of improving their technological competitiveness. They plan to accomplish this in part by studying improved manufacturing technologies in developed countries such as Japan and West Germany. In accordance with this goal, Posco opened the research-oriented Pohang Institute of Science and Technology (POSTECH) in December 1986 which will work closely with Posco's Research Institute of Industrial Science and Technology (RIST) (founded as the Technical Research

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1/ Information developed through interviews with Korean steel industry officials.
2/ Pohang Iron and Steel Co., Ltd., Press Release: Dedication of Kwangyang Steel Works, May 1987.
3/ Information developed through interviews with Korean steel industry officials.
4/ U.S. Department of State telegram, American Embassy in Seoul.

Laboratories of Posco in 1977). At POSTECH the Koreans hope to develop a school of higher learning that will eventually obtain the stature of the California Institute of Technology or MIT. 1/ POSTECH actively recruits Korean students that score highest on nationally administered science and mathematics tests. Most of the faculty members of both POSTECH and RIST were recruited from Korean Ph.D.'s living and teaching at universities or research laboratories located in developed countries. Together the two facilities, POSTECH and RIST, will conduct research in the fields of materials science, mechatronics (robotics and automation), information science, fine chemicals, bio-mechanics, as well as basic science and management science.

In addition to process research and development, Korea's sheet and strip producers are exploring new product technology, with most of their efforts concentrated on the development of better quality products (more "clean" steel) and high-value-added products such as stronger, lighter weight, coated sheet products for the automotive industry. Research is also being conducted on new materials such as new ceramics and carbon fiber, and on the development of thin slab casting and direct strip casting operations. 2/

Financial Structure

South Korea's three sheet and strip producers have posted profits on their operations for the past few years. Posco, the integrated producer, generated sufficient funds to finance about 70 percent of the cost of the Kwangyang Bay facility and to finance the continued modernization of the Pohang facility. 3/ As of early 1987, Posco was capitalized at 423,700 million won (about $497.3 million) and had total assets of about 4,479,500 million won (about $5.3 billion). During its January-December 1986 business period the company had sales of 2,241,600 million won ($2.5 billion) on which it earned a net profit of 2.8 percent. This represented an 8.7 percent increase over sales in 1985 and a 0.5 percent rise in net profit. 4/ Posco's operating profit per ton shipped in 1984 amounted to $50.52 per ton. 5/ Posco reportedly has never paid a cash dividend to the entities that own it. 6/ Their shares of profits have been paid by stock dividends.

The two nonintegrated sheet and strip producers, Union Steel and Dongbu Steel, have also experienced several years of profitability. In 1986, Union Steel made profits estimated at 3.1 percent on sales. This represented a sixfold improvement over its 1985 performance. Dongbu Steel earned profits of 96,000 million won ($109 million) in 1986. 7/

1/ Information developed through interviews with Korean steel industry officials.
2/ Ibid.
3/ Ibid.
4/ Metal Bulletin Monthly, May 1987.
5/ Op. cit., World Steel Dynamics, "Posco: Korea's Emerging Steel Giant," October 1985.
6/ Information developed through interviews with Korean steel industry officials.
7/ Metal Bulletin Monthly, May 1987.

Although all three sheet and strip producers experienced increased profits in 1986, only two of them (Posco and Dongbu) increased their investments in steel manufacturing that year. Posco's investments rose from 542,000 million won ($623 million) in 1985 to an estimated 1,356,000 million won ($1.5 billion) in 1986, representing an increase of 150 percent. The expenditures are directed principally at meeting the continued expansion in domestic demand. The funds were spent on various projects including the construction of the new mill at Kwangyang, and the installation of a two-strand slab caster and a six-strand billet caster at Pohang. Expenditures by Dongbu rose by 100 percent from 200 million won ($230,000) in 1985 to an estimated 400 million won ($454,000) in 1986. The investments were on various modernization projects. Unlike Posco and Dongbu, Union Steel reduced its investments in 1986 to "regulate excessive business expansion." Its expenditures fell from 23,700 million won ($27 million) in 1985 to 9,900 million won ($11.2 million) in 1986, representing a decline of 58 percent. 1/

Government Policies

The South Korean Government has a number of policies that affect international trade in many products, including steel. In April 1987, the U.S. Secretary of Commerce visited Korea to discuss a wide range of trade issues and to urge the Korean Government to accelerate removal of nontariff barriers and reduction of tariffs. The emphasis of the discussions was on the assurance of free and fair trade between Korea and the United States. This theme was pursued in all discussions including those on market access and on the removal of Korean local-content restrictions that result in favored treatment for domestically produced goods compared with imports. The Korean Government announced that it will accelerate market-opening measures by relaxing import-restrictive special laws. 2/ Korean Government officials dealing with steel observed that merely reducing tariffs will not necessarily enhance the U.S. share of Korean imports. 3/ They claimed that Korean experience in many product areas indicates that Japan derives the majority of benefits when Korean tariffs are lowered. Other topics included the development of an information exchange for joint ventures in third countries between U.S. and Korean firms, U.S. interest in shipping coal and natural gas to Korea, and Korea's import diversification program aimed at reducing its trade surplus with the United States ($7 billion in 1986) by increasing imports from this country. 4/ There have also been press reports indicating U.S. Government requests that Korea permit the won to appreciate somewhat against the dollar in light of Korea's large trade surplus with the United States.

Although the South Korean Government directly owns a 33-percent share of Posco, the company operates basically as a private enterprise and, in addition to allowing the banks to sell their Posco shares, there is a plan under consideration to publicly list and sell the government-owned shares. In 1987,

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1/ Metal Bulletin, June 20, 1986.
2/ Business America, May 11, 1987.
3/ Information developed through interviews with Korean steel industry officials.
4/ Business America, May 11, 1987.

Korea's Fair Trade Commission (FTC) added Posco to its list of companies designated as "market dominating businesses," which are those companies that have annual domestic sales approaching 30,000 million won (about $37 million at the August 1987 exchange rate) and that are responsible for more than 50 percent of total local sales of a product, or when the combined sales of three companies represents more than 70 percent of the local market share. Posco was named for slab steel. The company had previously been entered, along with Union Steel and Dongbu Steel, for cold-rolled sheets and galvanized sheets. The FTC closely watches the pricing policies of these companies for these products. Market dominating companies convicted of violating the Antitrust and Fair Trading Act can be fined a maximum of 70 million won (about $87,000), and those responsible sentenced to a maximum of 1 year in jail. 1/

Other policies implemented by the South Korean Government that affect the steel industry include environmental protection measures regulating the levels of air, water, and noise pollution at the mills. The cost of these regulations is significantly higher for the integrated sheet and strip producers (e.g., Posco) than for the rolling mills (Union and Dongbu) which do not operate blast furnaces or produce raw steel, two procedures that create substantial pollution. 2/ According to Posco representatives, approximately 10 percent of the company's capital spending is for pollution control measures. Violation of these measures could result in penalties and/or jail sentences. Industry officials indicated that Korea's pollution control requirements were comparable in terms of cost and coverage with those in other major steel-producing developed countries. 3/

The South Korean steel industry is also affected by the policies of other governments. As a developing country, South Korea can receive favorable financial terms from governmental agencies in the industrialized world. Financing provided by the mill suppliers is usually channeled through the governments of their respective countries. Consequently, interest rates are low on items purchased. 4/

Competitiveness of the Korean Steel Sheet and Strip Industry

Measures of Competitiveness

Korea's three largest producers of sheet and strip have indicated that there are many elements which determine a steel industry's competitiveness. These elements fall into two broad categories: the level of costs and the level of technological development. The category of costs includes production costs (raw material costs, energy costs); labor costs (including worker productivity); and construction/modernization costs (including the length of the construction period, the age of the facilities, and the level of investment in plant modernization). Technological development includes the degree to which new product/process technology is adopted and the level of the

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1/ Metal Bulletin Monthly, May 1987.

2/ Information developed through interviews with Korean steel industry officials.

3/ Ibid.

4/ Iron and Steel Engineer, April 1985.

associated capital expenditures and expenditures on R&D. The Korean sheet and strip producers have indicated that achieving strength in these competitive factors will lead to a favorable competitive position for the country's sheet and strip industry. 1/

Korea's Competitive Strengths and Weaknesses

With the appreciation of the value of the Japanese yen relative to the U.S. dollar and the Korean won, Korean steel producers see themselves as currently the world's lowest-cost and most competitive steel manufacturer. 2/ They hold this position despite the need to import virtually all the raw materials and energy required to produce the steel. Both the integrated (Posco) and nonintegrated (Union and Dongbu) sheet and strip producers agreed that the industry's current global competitive strengths include their relatively modern production facilities that contribute to efficient operations and high levels of productivity, 3/ and their low production costs that are principally the result of low labor costs and low construction and associated capital costs. 4/ Japanese steelmakers attribute Korea's current competitive edge to the same general factors. 5/

The Korean steel producers view Posco's Kwangyang Bay facility as a prime example of a modern, efficient, low-cost integrated steel mill that greatly enhances Korea's competitive position in the world. The plant is the least costly steelworks to be constructed in the world in recent history. (Discussion of Kwangyang plant construction is contained in section on industry structure).

Korea's sheet and strip industry also holds a competitive edge over other major sheet- and strip-producing countries in the area of labor costs. For example, the average U.S. steelworker earned $22 per hour in 1986 and the average Japanese steelworker, $16, while his Korean counterpart earned $2.30. 6/ For hot-rolled products, Korea's employment cost per ton in early 1987 was $20, compared with $85 per ton in the United States and $72 per ton in Japan. 7/

Another competitive advantage that the Korean steel industry enjoys compared with other major producing countries is its ability to operate at

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1/ Information developed through interviews with Korean steel industry officials.
2/ Ibid.
3/ Ibid. Officials in the planning department of the Korean Iron & Steel Institute indicated that Korea's major steel facilities are on average less than 6 years old, compared with 10-year-old plants in Japan, 20-year-old plants in Europe, and 30-year-old plants in the United States. (American Metal Market - International Steel, Oct. 6, 1987).
4/ In turn, part of this latter advantage is due to the efficiency of Korea's construction industry.
5/ Information developed through interviews with Japanese steel industry officials.
6/ U.S. Department of Labor, Bureau of Labor Statistics.
7/ "Steel Strategist #13," World Steel Dynamics, Mar. 30, 1987.

close to 100 percent of capacity. The Korean producers can maintain full operating capacity even if domestic demand falls because their products are competitive in overseas markets. Korean producers also realize cost advantages by operating fairly simple product lines and producing a limited number of products in large volume (e.g., Posco's hot coils). Consequently, certain indirect costs (inspection and product handling) are relatively low. Korea gains a further cost advantage (vis-a-vis Japan) by pegging the won closely to the U.S. dollar; as a result the strength of the Japanese yen raises the price of Japanese products relative to those from other countries while Korea keeps its dollar prices steady. 1/

The Korean sheet and strip producers acknowledge that there are certain competitive weaknesses that they must address as part of their strategy to improve their international competitiveness. 2/ Their principal concern is their dependence on foreign sources of supply for necessary raw materials such as iron ore and coking coal. This is a problem of particular importance to Posco, the integrated steel producer. To improve this situation, the company has invested in overseas coal mines in an effort to secure stable sources of coal supply. The nonintegrated sheet and strip producers rely on both Posco and foreign producers to supply their raw material needs (i.e., hot-rolled coils for further processing). They do not wish to depend exclusively on the sole Korean producer of hot-rolled bands (Posco), and therefore seek additional supplies from foreign sources.

A second aspect of sheet and strip production that the Koreans view as an area requiring strengthening is their lack of high technology in certain areas of operation. This factor could slow their plans to upgrade the quality of their products which they plan to accomplish by producing more technically sophisticated, high-valued products. This is also one of the reasons underlying the founding of POSTECH and RIST.

Nature of Principal Issues/Problems Confronting the Korean Sheet and Strip Industry

The Korean sheet and strip producers regard their dependence on imports of more sophisticated, higher valued products (particularly those from Japan) as a structural problem for which they must develop long-term solutions. Such imports over a period of many years resulted in a significant trade deficit with Japan, which the Korean Government would like to have reduced. This situation is not one that will improve over time, but rather requires Korean sheet and strip producers to become self-sufficient in the area of high-quality steel production. They are attempting this by constructing modern, new mills (for example, Posco has begun construction of a 250,000 ton-per-year stainless steelworks to produce hot-rolled stainless coils for further processing by Korean cold-rollers) and by intensifying efforts to acquire and develop the latest in product and process technology. 3/ They are also placing more emphasis on developing their own technology advances.

1/ Mr. Toru Hiranuma, Current Situation and Outlook of the Blast Furnace Steel Industry of the Pacific Rim, Nomura Research Institute.
2/ Information developed through interviews with Korean steel industry officials.
3/ U.S. Department of State telegram, January 1984, and Metal Bulletin, Apr. 3, 1987.

The role of exchange rates, although not necessarily a problem for Korean sheet and strip producers, is influential in the Korean steelmakers' marketing strategies. Over the past 2 years the Korean Government has allowed the won to appreciate modestly against the U.S. dollar (3.2 percent during 1986, ending at 861.40 won to the dollar) in response to its large and growing trade surplus with the United States. From January 2, 1987, to June 30, 1987, it rose by an additional 6.1 percent to 808.9 won to the dollar. 1/ Korean steelmakers worry that their Government might act more quickly under increasing U.S. Government pressure for greater won appreciation. The rise in the U.S. dollar value of South Korean steel exports means that producers are receiving less money for their exports in terms of local currency. On the positive side, the rising value of the won has resulted in lower prices for imported raw materials. However, producers worry that many of their fastest growing domestic markets (e.g., autos) are export oriented, and would be significantly affected by changes in exchange rates.

Competitive Strategies of the Korean Sheet and Strip Industry 2/

The general strategies of the Korean sheet and strip producers enhancing their international competitiveness include the following: (1) adherence to a steel import substitution policy that includes the upgrading of product technology to replace high-valued Japanese steel exports (e.g., automobile panels) to Korea, as well as to export increasingly higher valued steel products to Japan, a country with which Korea has a significant trade deficit; (2) the improvement of production efficiency, especially in terms of productivity and capacity utilization; (3) the improvement of customer services, with special efforts to better meet customer requirements from the automotive (galvanized and coated sheet and strip) and electrical equipment markets; and (4) the development of proprietary technology as discussed previously in the section on technology.

To achieve these goals the sheet and strip producers have developed extensive plans designed to facilitate their competitive strategies. Posco's fundamental strategy is to remain as the primary supplier of steel in the range of products where it can be competitive and can supply quality goods, according to the company's executive vice president. This means that Posco may have to surrender some of its low-end, low-priced steel markets to producers in other developing countries (Brazil and Taiwan) and shift production emphasis to markets for higher valued products. Posco is already shifting production in this way within the framework of its existing plants. As Kwangyang Bay is more efficient than Pohang in terms of energy costs, labor costs, and productivity, management has decided that the Kwangyang facility will be primarily a large-scale producer of basic products such as semi-finished steel and the Pohang facility will be the mainstay of production of higher valued products as well as technological advancement. 3/

1/ Metal Bulletin, Aug. 6, 1987.
2/ The information in this section was developed through interviews with officials of the Korean steel industry and supplemented with information from trade press as noted.
3/ Metal Bulletin, Apr. 7, 1987.

Another important goal of Posco's strategy is to increase productivity by continuously modernizing facilities and reducing the labor content of its products. The reductions in labor content would result from the installation of automated equipment, the computerization of management systems, and the institution of training programs to develop multi-skilled workers.

With regard to its strategies concerning foreign trade, Posco does not view exports as a profit center, as do Japanese producers. The company indicates that there has been no change in its longstanding policy to export as much steel as is required to earn enough foreign exchange to pay for imports of raw materials such as coal and iron ore. This currently takes about 25 to 30 percent of Posco's production, a figure that could decline with a drop in raw materials prices or in response to strengthening domestic demand. 1/ Korean Government authorities indicate a desire to have exports produce sufficient foreign exchange to cover imports of steel products not yet made in Korea. Export markets also provide a means of assuring high-capacity utilization in periods of reduced domestic demand.

The strategies of the two major nonintegrated sheet and strip producers are similar to those of Posco. The companies plan to focus production efforts on supplying domestic demand, arguing that the export market looks relatively unpromising because of potential competition from countries such as Brazil, Taiwan, Indonesia, and Pakistan. The two producers are making efforts to improve production by upgrading and modernizing their facilities and by emphasizing quality control in their production operations. They also intend to improve services to customers, especially by expanding their ability to fill smaller volume, specialized orders more efficiently. However, they appear to be much more cautious than Posco regarding the expansion of steelmaking capacity. They express greater uncertainty about continued strong growth in both domestic steel consumption and their customers' export markets.

Industry Outlook

Discussions in Korea with officials of the three major sheet and strip producing companies indicate that the short-term outlook for the industry is good, reflecting growth in domestic demand from the largest consumers of sheet and strip (the automotive and home appliance industries), the development of the country's infrastructure, and anticipated growth in the country's exports. As mentioned above, this view is expressed most confidently by Posco. Producers are optimistic about their ability to enhance their international competitiveness by improving productivity and capacity utilization and expanding into the production of higher value products.

The sheet and strip industry, particularly Posco, is likely to continue to expand over the next several years. Because expansion plans are based on projected growth in domestic consumption, the increase in capacity is expected

1/ Ibid.

to be fully utilized. 1/ Consumers, principally the automobile and appliance manufacturers and the sheet and strip cold rollers, will benefit from the increased capacity. The automobile and appliance producers will have access to a more abundant supply of higher valued, higher quality sheet products and will be able to reduce their reliance on imported flat-rolled products. The cold-rollers, including the stainless steel rollers, will have a greater supply of hot-rolled band for their operations, possibly at a lower price. Japan, the major foreign supplier of hot-rolled coil to Korean cold-rolled sheet producers, raised its prices for such steel and limited its supply in the second and third quarters of 1987. According to the trade press, the Japanese are capitalizing on rising world prices and soaring Korean demand. 2/

In the area of trade, industry officials expect their export prospects to grow. They intend to continue to export as much steel as is required to earn the foreign exchange necessary to cover raw material import costs. However, the Korea Institute for Economics and Technology has projected that although exports of finished steel will grow at an average rate of 4.7 percent between 1985 and 1990, surging home demand will reduce this to 1.1 percent between 1991 and 2000. 3/

The joint venture between USX and Posco Industries (UPI) to process hot-rolled bands in Pittsburg, CA, is another area of optimism for Posco officials in that it will help Posco maintain its share in the U.S. market, while providing USX with capital and technology for plant modernization. Officials caution, however, that the success of the venture is dependent on a guaranteed, steady supply of hot bands from Posco's plants in Korea. Such a supply is restricted under the VRA between the United States and Korea, which is scheduled to expire in September 1989.

Some Korean officials argue that the VRA's favor the less efficient foreign producers by guaranteeing them a share of the U.S. market, and that Korea would have a larger market share if increased tariffs rather than VRA's were implemented. However, there is a positive side to the VRA's for the Korean industry that enhances their outlook with respect to trade with the United States. According to Korean industry officials, the VRA's have given Korean steelmakers a "windfall" of about $60 million annually that is being used to make their mills more competitive. The additional profits to Korea resulted from the increased level (of about $40 per ton) in U.S. steel market prices as a result of the VRA's. The Korean officials observed that continued controls on exports of steel to the United States will only lead to further processing of steel products in Korea prior to their shipment to the United States. 4/

1/ While Korea's sheet and strip industry expects most of its capacity expansion to be absorbed by increased domestic demand, much of that growth is for export of automobiles and appliances, so that indirectly the export market will absorb much of the steel industry's growth as well. In turn, the steel industry contributes considerably to sustaining the competitiveness of Korea's exports by supplying among the lowest cost steel available worldwide to the country's automobile and appliance producers.
2/ Metal Bulletin, July 27, 1987.
3/ Metal Bulletin, Apr. 7, 1987.
4/ American Metal Market, Mar. 16, 1987.

The generally positive outlook for the Korean sheet and strip producers has been clouded by the country's labor unrest, which may have a significant effect on the industry's competitiveness. The worker dissatisfaction has resulted in large part from the failure by leading manufacturing corporations to use a portion of rising profits for pay raises for workers. For that reason Korea has some margin for increasing wages proportional to increases in worker productivity, without adversely affecting unit labor costs or prices. However, labor pressures could cause wage increases to exceed productivity gains, thereby raising unit labor costs.

One of the industries most affected by the strikes is the auto industry, a major consumer of sheet and strip products. Should rising unit labor costs adversely affect the global competitiveness of its products and cause exports to fall, then the sheet and strip producers may be faced with excess production capacity. This is likely because the industry's expansion efforts are reportedly designed to meet anticipated growth in demand from the domestic auto industry, an export-oriented market. 1/

1/ Metal Bulletin, Aug. 13, 1987.

CHAPTER 11. THE U.S. INDUSTRY

Industry Structure

It is difficult to discuss the U.S. steel sheet and strip "industry" as a whole because of the wide diversity of firms, products, technologies, and markets that exist within the industry. Companies that are considered steel sheet and strip producers can range from a small cold-finishing operation, which employs fewer than 100 workers, to a large integrated mill, which employs thousands of workers. In addition to the tremendous variation in size among sheet and strip producers, there can be great differences in the products produced (see chapter 1). Presently there are 41 firms in the United States that produce some type of steel sheet and/or strip. Some of these firms produce a full range of sheet and strip products and others are highly specialized and produce one or two. For the purposes of this study the steel sheet and strip industry is divided into two broad categories, integrated producers and nonintegrated producers. The distinguishing feature between the two types of producers is that integrated producers start with molten steel to produce their sheet and strip products, while nonintegrated producers start with either a hot-rolled product produced by integrated steel producers, or with a partially cold-rolled product, and perform the final finishing operations on it.

Within the integrated producer category, there are two major subdivisions, carbon steel sheet and strip producers and specialty steel producers. The majority of the specialty steel producers' production is represented by stainless and alloy tool steel although they are frequently capable of producing other specialty steel products, such as silicon electric steels, magnetic materials, and high-temperature and high-strength alloy steels. Nonintegrated producers consist primarily of rolling mills. Whereas it is very easy to distinguish between the integrated and nonintegrated producers, there can be some ambiguity as to which subcategories the integrated producers fall into. For example, Armco, a large integrated producer, is a leading stainless steel producer, but because most of the company's overall sales are accounted for by carbon steel products, Armco would be classified as an integrated carbon steel sheet and strip producer. In general, specialty steel would have to account for more than 50 percent of a company's sales for that company to be classified as a specialty steel producer.

An important subcategory that can exist for all types of sheet and strip producers is referred to as "reconstituted" mills. These are mills that have been restructured either because of bankruptcies and/or bankruptcy threats or have been sold to individual operators. Through the restructuring, sometimes under Chapter 11 of the bankruptcy code, the reconstituted mills have reduced labor and material costs and often have lower interest expenses than in their former state. A more detailed discussion of these cost reductions is presented in this chapter in the section on sheet and strip production costs.

It is important to note that so-called "minimills" do not at this time produce sheet and strip products. Minimills generally produce long products (i.e., rods, bars, and light structurals) from billets and blooms. These mills use scrap metal as the basic raw material and melt it down in an electric furnace to produce molten steel. The majority of minimills use continuous casting for all of their output. Before Nucor Steel announced that it was going to build a flat-rolled steel plant (scheduled to be operational in the first half of 1989), no minimills have been in the sheet and strip business because of the high cost of the hot strip mills necessary for rolling slab into sheet and strip. These high speed mills may cost $600 million or more and must roll about 3 million tons of slabs annually for efficient operation. 1/ This is not consistent with minimill operations. The advent of a new technology known as thin slab casting has allowed Nucor to enter the flat-rolled steel business. This development is discussed further in the industry outlook section of this chapter.

Degree of Concentration

Data gathered through Commission questionnaires (39 steel companies were surveyed) on shipments of domestically produced steel sheet and strip indicate that the domestic sheet and strip industry is significantly concentrated at the four-firm level at 56 percent compared with the 40-percent average for all manufacturing industries in the United States (based on data of the U.S. Department of Commerce, Bureau of the Census). Table 11-1 indicates that the top four carbon and stainless steel producers accounted for over one-half of 1986 industry shipments; the stainless sector, considerably smaller in terms of the volume of shipments, is by far the more concentrated, with four firms accounting for 81.9 percent of 1986 shipments.

Table 11-1
Steel sheet and strip: Concentration of industry shipments, by types, 1985 and 1986

(In percent)

Item	In 1985		1986	
	4-firm	8-firm	4-firm	8-firm
Total sheet and strip................	60.8	87.4	55.7	86.3
Carbon and certain alloy steel sheet and strip..............	62.0	88.7	57.0	85.6
Stainless steel sheet and strip............................	71.1	95.9	81.9	99.7

Source: USITC producers' questionnaire.

1/ Robert W. Crandall, The U.S. Steel Industry in Recurrent Crisis, 1981.

The concentration ratios, which are calculated using only domestic data can be misleading, as the omission of foreign competition tends to overstate market concentration. The inclusion of imports of total sheet and strip products would reduce the 4-firm concentration ratio to 45.7 percent, a drop of 10 percent. Moreover, the ratios may be misleading in another respect. In a country with a large geographic area, concentration ratios derived for the country as a whole will frequently understate concentration in particular regional markets. It is often argued for example, that the Western United States constitutes a separate market and that the major steel producers are concentrated in the Great Lakes area.

Type of Ownership; Corporate Organization

There are about five different categories of ownership that the domestic steel sheet and strip companies fall into: publicly traded, privately owned, 100-percent foreign owned, partially foreign owned, and employee owned. The distinction between categories is often not clear cut; for example, a company's ownership may reflect a combination of employee and private ownership. The following tabulation lists companies according to the ownership category that best describes the largest percentage of their ownership; the following letters in parenthesis indicate the type of company and its production: I-C = Integrated carbon; I-S = Integrated specialty; N-C = Nonintegrated carbon; N-S = Nonintegrated specialty:

Publicly traded	Privately owned
Acme Steel (I-C)	Allegheny-Ludlum (I-S)
Armco Inc. (I-C)	Blair Strip Steel Co. (N-C)
Athenia Steel Co. (N-C)	Cold Metal Products Co., Inc. (N-C)
Bethlehem Steel (I-C)	Eastmet Steel 1/
Carpenter Technology Corp. (I-C)	Geneva Steel (I-C)
Coshocton Stainless Division (N-S)	Gibraltor Steel (N-C)
Empire-Detroit Division (N-C)	Greer Steel Company (N-C)
Inland Steel Company (I-C)	Gulf States Steel, Inc. (I-C)
Lone Star Steel (I-C)	Haynes International Inc. (N-S)
LTV Steel Company (I-C)	J & L Specialty Products (N-S)
National Steel Corp. (I-C)	Marwais Steel Company (N-C)
Rouge Steel (I-C)	Metal Tech Industries (N-C)
Sharon Steel (I-C)	Pennsylvania Rolling Mills (N-C)
United States Steel (I-C)	Rome Strip Steel Co., Inc. (N-C)
Washington Steel (I-S)	The Stanley Works (N-C)
Worthington Industries (N-C)	Thompson Steel Company (N-C)
Wheeling-Pittsburgh (I-C)	Tuscaloosa Steel Corp. (N-C)

1/ Discontinued sheet and strip production in December 1985

100 percent foreign ownership

Company	Country and company of ownership
California Steel Industries (N-C)	Brazil: Rio Doce Ltd. - 50% Japan: Kawasaki Steel Corp. - 50%
Theis Precision Steel Corp. (N-C)	FRG: Friedr Gustov Theis Kaltwatzwerke GMbH
Thomas Steel Strip Corp. (N-C)	FRG: Hille and Mueller GMbH
Whittar Steel Strip (N-C)	Canada: Defasco

Partial foreign ownership

Company	Country of ownership
USS Posco (N-C)	South Korea: Pohang Steel Company - 50% U.S.: USX - 50%
National Steel Corp. (I-C)	U.S.: National Intergroup - 50% Japan: Nippon Kokan K.K. - 50%

Employee owned

Calstrip Steel Corp. (N-C)	Profit sharing - 58%
Wierton Steel Corp. (I-C)	ESOP - 100%
McLouth Steel Products (I-C)	ESOP - 80% - 10% Cyrus Tang

The tabulation shows that the major, large integrated steel companies such as United States Steel, Inland Steel, and LTV, are publicly traded companies. In fact, 85 percent of 1986 shipments of steel sheet and strip are from publicly traded companies. A majority of the small privately owned steel companies are either nonintegrated steel mills or producers of specialty steels. Fifty-three percent of specialty steel production is produced by privately held steel companies.

Domestic Joint Ventures

Several domestic steel companies have initiated joint ventures with other U.S. firms. The primary reasons for such participation have been identified as diversification of product lines, and as a means of obtaining capital infusions and marketing and technical assistance.

United States Steel Corp. (USS) has committed itself to two domestic joint ventures, one of which is a 540,000 metric ton processing facility in Jackson, MI, to process wide sheets from USS for customers in the automotive, appliance, furniture, and metal-door industries. Worthington Steel, the partner in this venture, will provide 50 percent of startup capital and will be responsible for management of the operation. USS has also entered a joint venture with Rouge Steel, a subsidiary of Ford, to cooperate on a two-sided electrogalvanizing line near Detroit. Also involved in a new joint venture electrogalvanizing project are the companies of Inland Steel, Bethlehem and Pre-Finish Metals, Inc. Shipments from their 360,000 metric ton line in Waldbridge, OH began in mid-1986.

Degree of Vertical Integration

Most of the major integrated carbon steel sheet and strip producers have equity positions in iron ore mining operations in the United States and Canada. Since neither the stainless steel nor the nonintegrated sheet and strip producers use iron ore or coal, they do not have equity positions in raw material operations. Bethlehem Steel, National Steel Corp., and USX Corp. are the only sheet and strip producers that currently own and operate coal mines.

During the 1890's U.S. carbon steel companies began investing in the iron ore reserves and operating mines in the United States and Canada. This investment activity peaked in the late 1960's and again in the late 1970's to the point where investment in iron ore and pellet plants accounted for over 30 percent of investment in steel operations in those years, as shown in table 11-2.

Table 11-2
U.S. steel industry: Total investment and investment in iron ore and pellet plants, 1965-82

Year	Investment Steel industry	Iron ore and pellet plants	Investment in iron ore as a percent of investment in steel
	------------Billion 1972 dollars------------		
1965	1.95	0.40	20.5
1966	2.19	0.24	11.0
1967	2.38	0.22	9.2
1968	2.34	0.78	33.3
1969	1.95	0.70	35.9
1970	1.58	0.23	14.6
1971	1.15	0.41	35.7
1972	1.06	0.14	13.2
1973	1.22	0.21	17.2
1974	1.63	0.25	15.3
1975	1.71	0.29	17.0
1976	1.66	0.32	19.3
1977	1.59	0.41	25.8
1978	1.50	0.46	30.7
1979	1.45	0.48	33.1
1980	1.51	0.42	27.8
1981	1.51	1/	1/
1982	1.14	1/	1/
Annual rate of growth (percent):			
1970-80	-.45	6.02	6.2

1/ Not available.

Source: Up from the Ashes, by Robert Crandall and Donald Barnett

By the early 1980's over expansion led to the collapse of raw material prices and the price of iron ore from Brazil and Australia delivered to the Chicago area was lower than the production costs of most domestic ore. However, integrated carbon steel producers continued to invest in domestic and Canadian iron ore operations because of a belief on the part of steel producers that there would be future steel shortages resulting in much higher prices for Brazillian and Australian iron ore. U.S. steel producers felt that a guaranteed access to iron ore reserves was a hedge against any iron ore price increases in the future. At least two steel analysts feel that with the recent decline in world steel consumption the vast iron ore mining operations in the United States and Canada owned by U.S. integrated carbon steel producers "will never be worth more than a fraction of their original cost." 1/

1/ Donald F. Barnett and Robert W. Crandall, Up From the Ashes, 1986.

Currently, U.S. steel companies control, through equity ownership, more than 80 percent of the iron ore produced in the United States and Canada. The top carbon steel sheet and strip producers are more than self-sufficient in producing their own iron ore (table 11-3). The companies with excess iron ore self-sufficiency, National, USX, Wheeling-Pittsburgh, LTV, and Bethlehem, accounted for almost 50 percent of all steel sheet and strip shipments in 1986.

Table 11-3
U.S. steel sheet and strip industry: Iron ore self-sufficiency ratios, by company, 1985 1/

Company	Iron ore self-sufficiency ratio 2/
National Steel	181
USX Corp	176
Wheeling-Pittsburgh	125
LTV	123
Bethlehem	123
Inland Steel Co	88
McLouth Steel Products	54
Acme Steel	44
Rouge	42
Sharon	39
Armco	29
Gulf State Steel	0
Lone Star	0
Weirton	0

1/ The ratios shown understate the self-sufficiency of iron ore supply by the amount of sinter ore each company may have consumed.
2/ Iron ore equity ownership divided by 1985 finished steel shipments.

Source: World Steel Dynamics, The Threatened North American Iron Ore Industry, Core Report 2, April 1987.

Iron ore mines in the United States, which are concentrated in Minnesota, Michigan, and Wisconsin, operated at an average of 61 percent of capacity in 1986, down from a peak of 85 percent in 1979, compared with Canadian iron ore mines that continually operated at an average of 85 percent of capacity during the same period, reflecting the fact that Canadian mines have higher ore grades and lower production costs. 1/ The number of producing North American mines has declined from 25 in 1981 to 16 in 1986. As equity participants in iron ore mines, integrated steel sheet and strip producers are vulnerable to the iron ore oversupply problem. Table 11-4 shows the ownership of major North American iron ore mines in 1986.

1/ World Steel Dynamics, The Threatened North American Iron Ore Industry, April 1987.

Table 11-4
U.S. and Canadian iron ore operations: Equity participation, by firms, 1986

Firm	Owners	Percentage equity
Hibbing Taconite, MN........	Bethlehem.................	60.3
	Cleveland Cliffs..........	15.0
	Stelco, Canada............	14.7
	Total.................	100.0
Erie Mining Co., MN.........	LTV.......................	100.0
	Cleveland-Cliffs..........	0
	Total.................	100.0
Minntac, MN.................	USX Corp..................	100.0
Reserve Mining Co. 1/......	Armco.....................	50.0
	LTV.......................	50.0
	Total.................	100.0
Butler Taconite, MN 2/......	Wheeling-Pittsburgh.......	38.0
	Inland Steel..............	38.0
	M.A. Hanna................	24.0
	Total.................	100.0
National Steel Pellet Plant, MN.......................	National Steel............	100.0
Minorca, MN.................	Inland Steel..............	100.0
Eveleth Mines, MN...........	Armco.....................	35.0
	Rouge.....................	31.7
	Oglebay-Norton............	18.5
	Stelco, Canada............	14.8
	Total.................	100.0
Empire, MI..................	Inland Steel..............	40.0
	LTV.......................	35.0
	Wheeling-Pittsburgh.......	10.0
	Cleveland-Cliffs..........	15.0
	Total.................	100.0
Tilden, MI.................	Cleveland-Cliffs..........	39.0
	Algoma, Canada............	30.0
	LTV.......................	12.0
	Stelco, Canada............	10.0
	Wheeling-Pittsburgh.......	4.0
	Sharon Steel..............	5.0
	Total.................	100.0
Quebec-Cartier Mining, Canada..................	USX Corp..................	100.0

See footnotes at end of table.

Table 11-4--Continued
U.S. and Canadian iron ore operations: Equity participation, by firms, 1986

Firm	Owners	Percentage equity
Quebec-Cartier Pellets and Sidbec Normines	USX Corp.	100.0
Sidbec-Normines, 2/ Canada	Sidbec, Canada............	50.1
	British Steel.............	41.7
	USX Corp..................	8.2
	Total.................	100.0
Iron Ore Company of Canada..	M. A. Hanna...............	26.8
	Bethlehem.................	32.8
	National Steel............	19.0
	Dofasco, Canada...........	6.1
	Wheeling-Pittsburgh.......	4.9
	Hollinger.................	7.2
	Labrador Mines............	3.2
	Total.................	100.0
Wabush, Canada..............	Stelco, Canada............	25.6
	Dofasco, Canada...........	16.4
	LTV.......................	15.6
	Wheeling-Pittsburgh.......	10.2
	Acme Steel................	10.2
	Inland Steel..............	10.2
	Finsider, Italy...........	6.6
	Cleveland-Cliffs..........	5.2
	Total.................	100.0

1/ Closed in 1986.
2/ Closed in 1985.

Source: World Steel Dynamics.

Most U.S. mines are high cost relative to mines in other countries, especially Brazil and Australia, whereas Canadian mines compare more favorably. Table 11-5 shows the 1986 production and delivered costs for U.S. and Canadian mines at their actual 1986 operating rate as well as the f.o.b. port costs for Brazilian iron ore. With low production costs Brazil, is able to offer iron ore on the world market for prices significantly below the production costs for U.S. mines and slightly below Canadian costs. 1/

1/ According to World Steel Dynamics the average world price for Brazilian iron ore was $23.78 per long ton in 1986.

Table 11-5
Iron ore: Actual operating rate and f.o.b. mine full costs, by specified countries and firms, 1986

Firm	Actual operating rate	F.o.b. mine full costs 1/
	Percent	
United States:		
Hibbing Tac.................	59	$ 31.19
Erie.......................	75	27.36
Minntac....................	44	40.82
Reserve Mining.............	60	55.30
Butler Tac.................	0	
National...................	87	35.70
Minorca....................	90	36.49
Eveleth Mines..............	100	40.45
Empire.....................	90	29.09
Tilden.....................	43	51.54
Canada:		
Quebec-Cartier (Pellet)....	100	24.73
Iron Ore Comp. of Canada...	100	23.81
Wabush.....................	83	25.66
Brazil (f.o.b. port; Tubarao):		
CVRD - Pellet cost.........		16.93

1/ Dollars per long ton of pellets.

Source: World Steel Dynamics, The Threatened North American Iron Ore Industry, April 1987.

As previously mentioned there are three U.S. integrated steel sheet and strip producers that currently own and operate coal mines: USX Corp.; National Steel Corp., and Bethlehem Steel. USX owns or leases domestic coal properties, through its U.S. Steel Mining Co., Inc., subsidiary, with demonstrated reserves in 1986 totaling approximately 1.5 billion metric tons of bituminious coal and 117 million metric tons of lignite. About 75 percent of USX's domestic bituminous coal reserves are owned and 25 percent are under long-term lease. One-half of the bituminous coal reserves are considered metallurgical quality and the rest are considered steam quality. 1/ Over 70 percent of USX Corp.'s domestic coal reserves are located in Alabama, Virginia, West Virginia, and Pennsylvania.

Bethlehem Steel Co. owns and operates a number of coal mines through its Beth Energy Mines subsidiary. Beth Energy is composed of coke ovens at Lackawana and 13 coal mines in Pennsylvania, West Virginia, and Kentucky. During 1986 Bethlehem's coal operations produced 10.0 million metric tons of coal of which 56 percent were shipped to the company's operations and the rest were sold to third parties or placed in inventory. Bethlehem obtains most of

1/ USX Corp., 10 K report, 1986.

the coal requirements for its coke ovens from its own mines. In 1986 about 92 percent of Bethlehem's total coal consumption was provided by its mining operations. 1/

National Steel Corp. is involved in coal production through mines owned directly by its National Mines division and Mathias Coal Company, a joint venture of National Steel, Consolidation Coal Co., and Stelco of Canada that is managed by National Mines. During 1986, National Mines produced and sold 3.0 million metric tons of coal of which 33 percent went to National's Steel plants.

Extent of Diversification

Generally the large integrated carbon steel sheet and strip producers are the most diversified of the U.S. sheet and strip industry, followed by the specialty producers, and the nonintegrated producers. It is important to make the distinction between a steel sheet and strip producer that is diversified into other business and one that is a part of a larger, diversified parent company. Historically, when the steel industry was more profitable and had excess cash, many large integrated firms bought other businesses, which were often in nonsteel areas. Over time as some of these nonsteel businesses became more profitable and the steel companies became less profitable, cash from the nonsteel operations was used for steel operations. In an attempt to prevent the masking of unprofitable operations by profitable ones, some diversified steel companies reorganized in such a way that the principle business segments act either as distinct operating units responsible for generating their own capital requirements or as stand alone subsidiaries controlled by a single publicly owned holding company. Examples of these types of firms include USX Corp., National Steel Corp., Lone Star Steel, and Inland Steel.

The U.S. sheet and strip producers that are now part of a larger parent company are shown in the following tabulation:

Parent company	Steel subsidiary (or division)	Percent of parent company sales, 1986
USX Corp	U.S. Steel (USS)	21
LTV Corp	LTV Steel Co., Inc.	6
NKK/National Intergroup	National Steel Co.	1/
Lone Star Technologies, Inc.	Lone Star Steel Co.	1/
Inland Steel Ind., Inc.	Inland Steel Co.	64
Worthington Industries	Worthington Steel	2/ 52
Blount Inc	Washington Steel	16
Ford Motor Co	Rouge Steel	1/
Tang Industries Inc	McLouth Steel Products	1/
Tippins	Tuscaloosa Steel	1/
National Standard	Athenia Steel Co.	1/

1/ Not available.
2/ 5-year average.

1/ Bethlehem Steel Corp., 10-K report 1986.

The businesses that the above-listed parent companies are involved in other than steel are diverse. USX Corp. is primarily involved in the exploration and production of oil and gas; LTV Corp., in aircraft and energy products as well as missiles and electronics; and Lone Star Technologies, in pollution control systems and operation of a common carrier that transports a variety of commodities. Worthington's other subsidiaries produce custom pipe fittings, pressure cylinders, and coated glass. Blount Inc.'s nonsteel businesses include machinery and equipment as well as construction and engineering. National Intergroup, Inc., is a diversified company with interests in the distribution and service businesses. Nippon Kokan, K. K. (NKK), the second largest steel producer in Japan, is heavily involved in the production of silicon for semi-conductors and other high-technology products. Ford Motor Co. is the second largest domestic car manufacturer. Tang Industries (a U.S. company), the parent company of McLouth Steel, is a highly diversified group of companies involved in steel processing, warehousing and distribution, and aluminum production.

Bethlehem Steel Corp., Armco Inc., and Acme Steel Co., all of which are integrated carbon steel sheet and strip producers are primarily steel companies with few nonsteel interests. Prior to 1986, Bethlehem and Armco were involved in nonsteel activities and Acme was part of a larger diversified company. During 1986, Bethlehem Steel sold or discontinued all of its diversified (nonsteel) operations including the following subsidiaries: Husan Inc.; J. M. Tull Industries Inc.; and Bethlehem International Engineering Corp. During 1985, Armco Inc., discontinued its insurance operations (Armco Financial Services Group) and sold its aerospace and strategic materials segment, becoming primarily a steel producer. In addition to its steel operations, Armco also produces oilfield equipment. In 1986, Acme Steel, a producer of steel and steel strapping products, was spun off from Interlake Inc., a diversified company with interests in special materials handling and packaging products, and investment castings. At the time of the spinoff Acme accounted for 25 percent of Interlake's sales.

Some integrated carbon steel sheet and strip producers have never been extensively diversified and are not divisions or subsidiaries of larger diversified companies. These companies include Gulf States Steel, Weirton Steel Corp., Sharon Steel, and Wheeling-Pittsburgh Steel Corp. Gulf States and Weirton were formed as stand alone companies when certain facilities were spun off from larger integrated firms.

With the exception of Worthington Steel, Athenia Steel Co., and Tuscaloosa Steel, the majority of nonintegrated steel sheet and strip producers are privately held, stand alone companies with very little, if any, diversification into nonsteel areas. In general, stainless steel sheet and strip producers are not diversified in nonsteel businesses.

Foreign Participation

In recent years more domestic steelmakers have entered into partnerships with foreign investors. This is partly a reflection of the need for capital, a strategy for expansion or diversification, and, on the part of the foreign company, a way of having a U.S. market presence that is not vulnerable to import restrictions by being a domestic producer.

As mentioned previously, there are four steel sheet and strip companies that are wholly owned by foreign companies; California Steel Industries, Theis Precision Steel Corp., Thomas Steel Strip Corp., and Whittar Steel Strip. These were originally operated by domestic companies and sold to foreign companies. California Steel Industries is a joint venture between a Japanese and a Brazilian company. Theis and Thomas are wholly owned by a West German company, and Whittar is wholly owned by a Canadian company.

Two companies, USX and National Steel, are involved in 50:50 joint ventures with foreign companies. The USS-Posco operation in Pittsburgh, CA, is a joint venture between USX and Pohang Iron and Steel Co. of South Korea. National Steel Co. is owned by National Intergroup and Nippon Kokan K.K. of Japan.

On a smaller scale, many domestic steelmakers have gone into joint ventures with a foreign company on particular projects. Wheeling-Pittsburgh has entered into a joint venture with Nisshin Steel Co., Ltd., of Japan to build a steel coating line. Inland Steel and Nippon Steel Corp. of Japan are joining together to build a cold-rolled strip mill near South Bend, IN. By joining with Nippon, Inland is acquiring state-of-the-art steel processing technology (i.e., Nippon's continuous annealing and processing line.), and Nippon is developing a manufacturing base in the United States. Finally LTV and Sumitomo Metals have joined together on an electrogalvanizing line. This is not an all encompassing list, but it illustrates the growing importance of foreign participation in the U.S. steel industry.

In response to Commission questionnaires, U.S. producers indicated that the reasons for entering into joint ventures with foreign companies were three-fold: the need for capital; a way to expand and diversify product lines; and as a means of acquiring engineering and technical assistance. It would appear that foreign companies have often participated in joint ventures in order to gain greater and more secure access to the U.S. market. In the case of Nippon Steel, for example, Nippon officials indicated that they hope to regain some of the tonnage they lost in their domestic market as a result of Japanese auto and appliance makers establishing their own manufacturing bases in the United States. 1/

Another point to note is that most of the joint ventures are between domestic producers and Japanese companies. The Japanese are concerned about the U.S. market becoming increasingly protected by the U.S. Government and also about the currency fluctuations. As a result they are anxious to enter the U.S. market as a domestic producer instead of merely as an exporter. 2/

1/ "Inland, NSC sign CR Mill Joint Venture," July 30, 1987, Metal Bulletin.
2/ "Foreign Involvement in the U.S. Steel Industry," Metal Bulletin Monthly, May 1986.

Conditions in the U.S. Industry

Domestic Consumption 1/

Overall Trends

Apparent U.S. consumption of steel sheet and strip during 1984-86 was a relatively stable 45 million metric tons per year, up sharply from a low (during the past two decades) of 33.1 million metric tons in 1982. The 45 million metric tons, however, was significantly below the 51 to 52 million metric tons of consumption experienced as recently as 1977-79.

As figure 11-1 shows, domestic shipments fluctuated with apparent consumption from 1969 to 1986. The absolute size of fluctuations in imports was much smaller than those in domestic production. However, in terms of percentage, imports showed even more marked percentage change from year to year, exceeding 50-percent and 40-percent increases in 1983 and 1984, respectively; the largest domestic shipment changes were in the 15 to 25 percent range. As the minority and residual source of supply, imports would be expected to show the greater volatility.

Figure 11-2 shows the import penetration of steel sheet and strip products from 1969 through August of 1987. Between 1969 and 1981, import penetration fluctuated between 10 and 15 percent of consumption, only rising above 15 percent in 1971, 1977, and 1978. After 1981 import penetration level began to increase. It peaked in 1984 at around 21 percent of consumption. Since 1984 both the absolute level and penetration ratio of imports have fallen. This coincides with the establishment of the import quotas agreed to in conjunction with the voluntary restraint arrangements (VRA's).

From 1969 to 1973 apparent consumption increased at an average annual rate of 6.4 percent. After the first oil crisis of 1972-73, when a downturn in the economy began, apparent consumption fell sharply to a low in 1975 of 37.0 million metric tons. During the 1976 to 1979 economic recovery, consumption grew to a peak just over 51 million metric tons in 1978, but this was still below the 1973 high. In the 1980's it again began to decline as stagflation became a characteristic of the recession experienced in the early 1980's. With the second oil crisis in 1982 consumption reached a low of 33.1 million metric tons. In recent years consumption has remained relatively steady, around 45 million metric tons.

Previously it was felt that steel consumption was so basic to the economy that it would closely follow the ups and downs of the economy. However,

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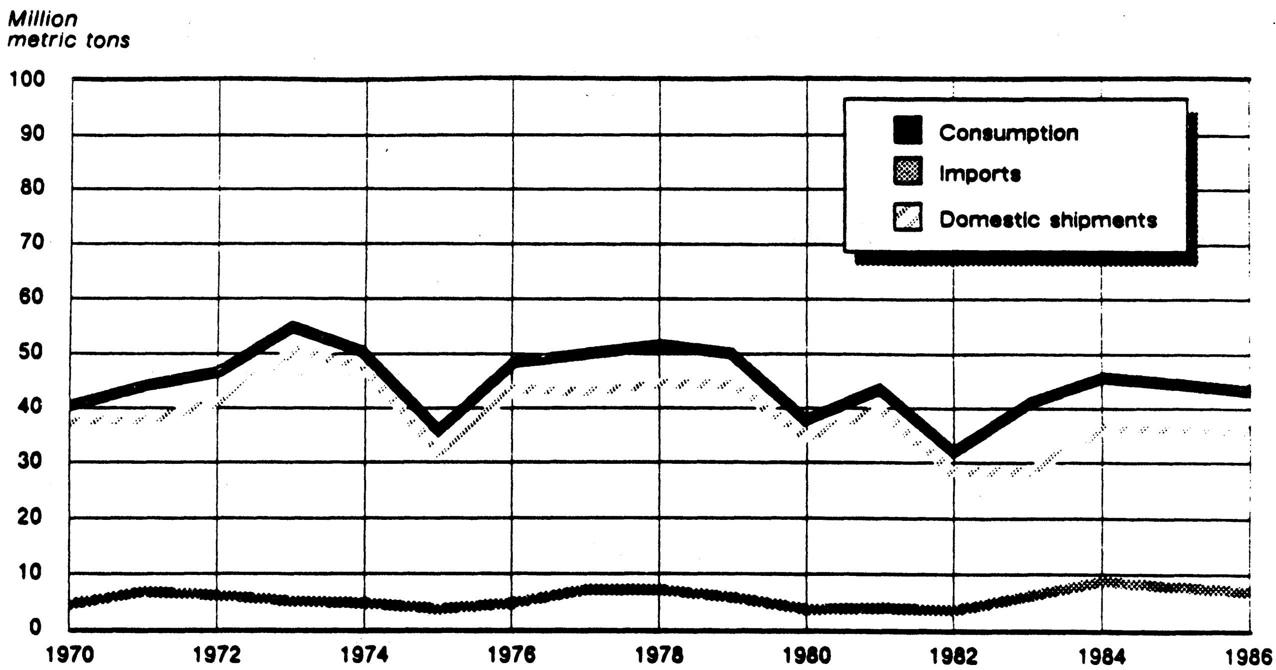
1/ A description of how sheet and strip products are traded, including pricing and terms of sale, types of sales, and channels of distribution is contained in appendix K.

Figure 11-1

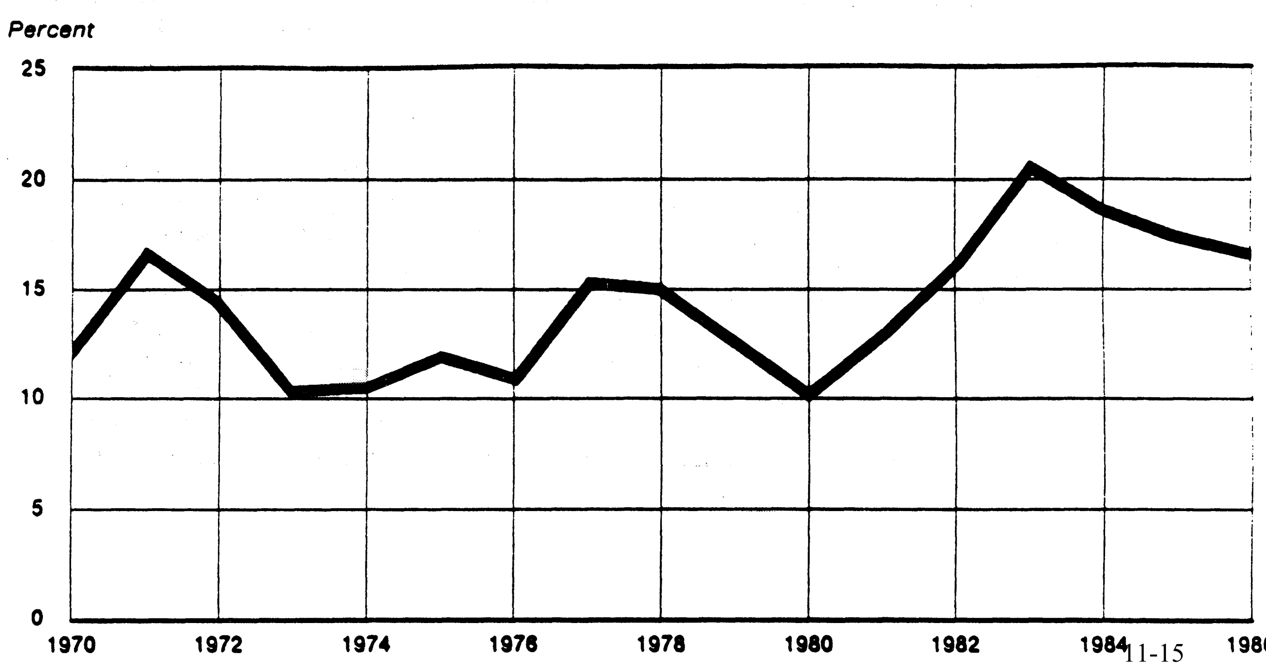
Steel sheet and strip products: Apparent U.S. consumption, imports, and domestic shipments, alternate years 1970 to 1986



Source: Compiled from data published by the American Iron & Steel Institute.

Figure 11-2

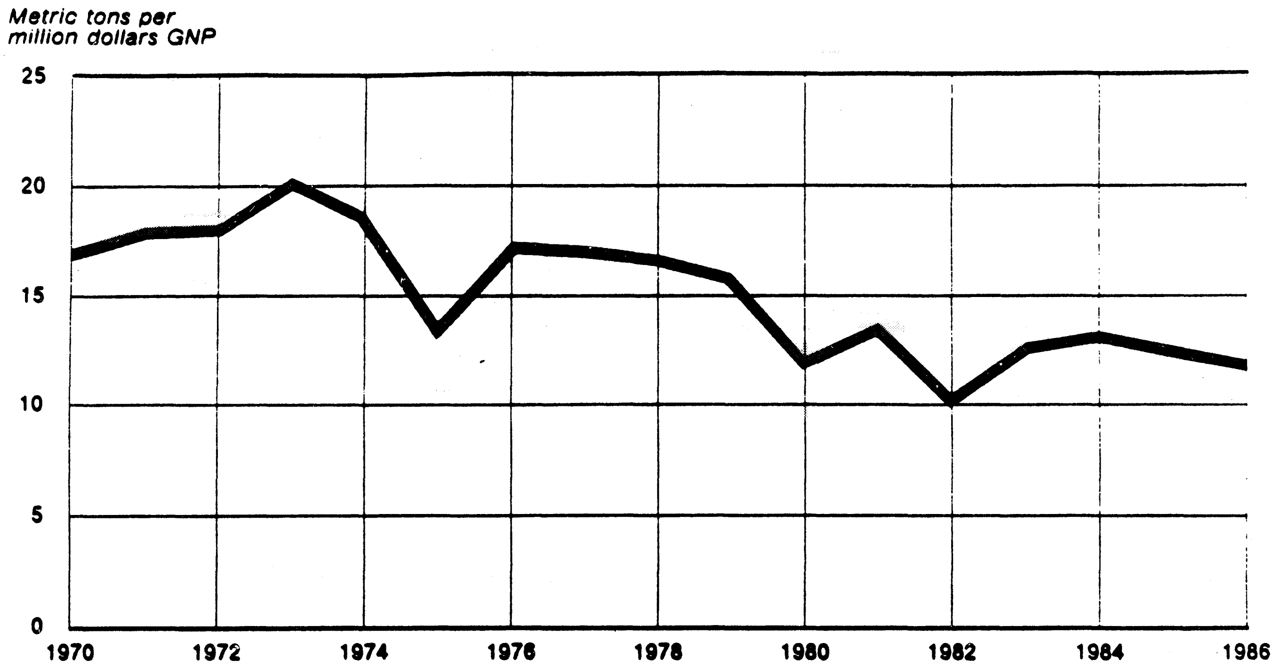
Steel sheet and strip products: U.S. import penetration, alternate years 1970 to 1986



Source: Compiled from data published by the American Iron & Steel Institute.

figure 11-3 shows the market trend of the decline in apparent steel sheet and strip consumption in metric tons as a share of Gross National Product (GNP) in millions of 1982 dollars. GNP is one measure of changes in economic activity. If consumption of sheet and strip fluctuates closely with fluctuations in the economy, then the ratio of consumption to GNP should remain relatively constant. In this case, in figure 11-3, the ratio fluctuates and follows a generally downward trend, especially after 1973.

Figure 11-3
Steel sheet and strip: Apparent consumption in metric tons per million dollars of the 1982 Gross National Product, alternate years 1970 to 1986

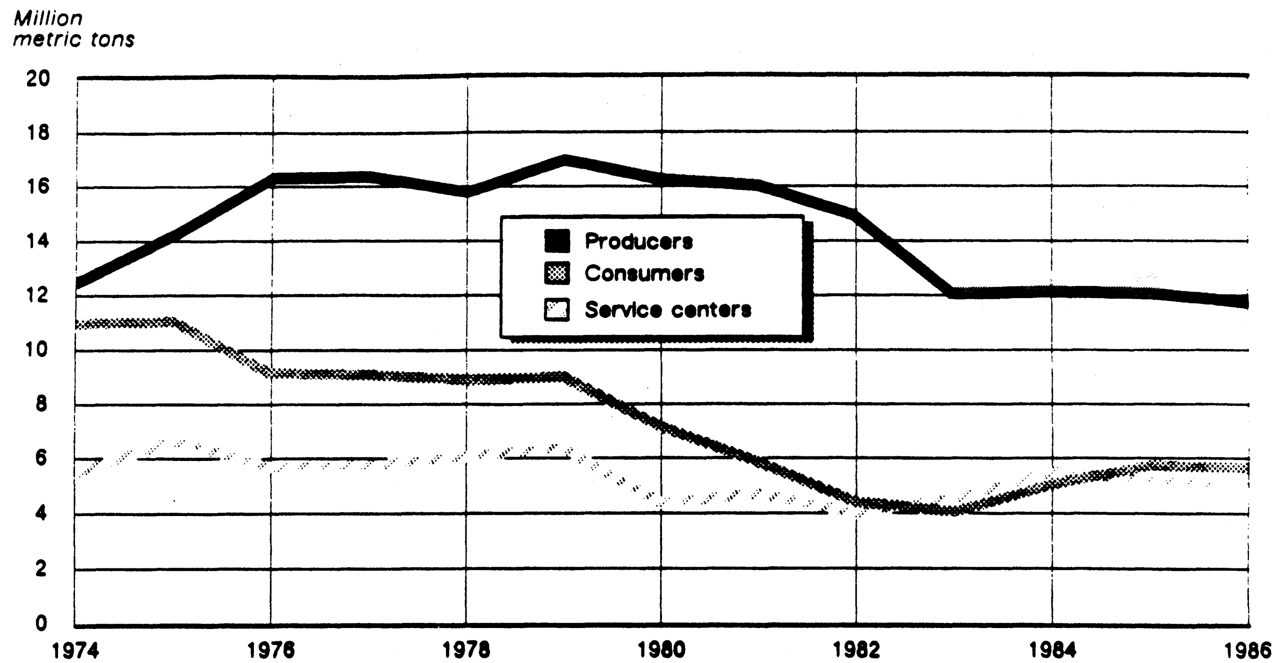


Source: Compiled from data collected by the American Iron & Steel Institute and the U.S. Census Bureau.

In summary, apparent consumption has followed a downward trend punctuated by various peaks and low points. A trend decline of 0.5 percentage point annually is indicated when examining the data from 1969 to the present. The consumption trends do not appear to be driven by changes in the general economy, but rather by changes in the demand for sheet and strip, which appears to be declining relative to overall demand in the economy. Adding to this declining trend is the fact that there has been a movement toward reducing inventories held by the steel mills as well as those held by consumers and service centers (fig. 11-4). In all three cases after 1979 inventories began to decline, reaching a new, lower level by 1983, a level which has remained relatively constant in recent years.

Figure 11-4

All steel mill products: Changes in inventories of U.S. producers, consumers, and service centers, alternate years 1974 to 1986



Source: World Steel Dynamics, Steel Strategist # 13.

Product trends

Steel sheet and strip can be divided into four product categories; hot-rolled, cold-rolled, coated, and stainless. For the time period 1980-86, hot-rolled products have accounted for 31 percent of apparent consumption; cold-rolled products, 36 percent; coated products 31 percent; and stainless products, 2 percent (table 11-6 and fig. 11-5). From 1980 to August 1987 shifts have occurred within the top three products. Initially cold-rolled sheet and strip accounted for the largest share of consumption, 38 percent in 1980, and coated products accounted for 28 percent. During January-August 1987, coated products were consumed in slightly larger volumes than cold-rolled, both representing around 31 percent of consumption. This shift could largely reflect the increased demand in the auto industry for coated products that have greater corrosion resistance, a point discussed further on in this study.

The four types of steel are further distinguished by a quality designation (table 11-7). Commercial quality is the basic and most commonly

Table 11-6
Sheet and strip: U.S. shipments, exports, imports, and apparent consumption, 1980-86

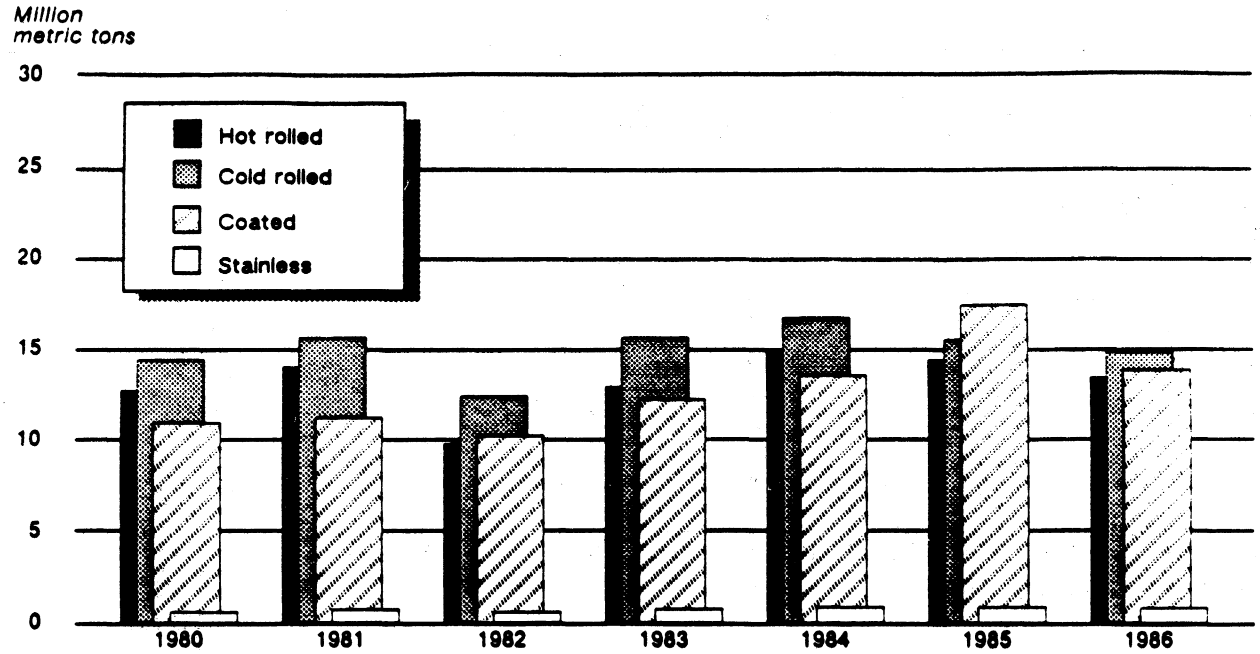
Item	Shipments	Exports	Imports	Apparent consumption	Ratio of imports to consumption
	----------------	1,000 metric tons	----------------		Percent
Hot-rolled carbon and alloy sheet and strip:					
1980............	11,588	181	1,359	12,766	10.6
1981............	12,782	198	1,490	14,074	10.6
1982............	8,649	75	1,241	9,815	12.6
1983............	11,096	48	1,863	12,911	14.4
1984............	12,477	52	2,503	14,929	16.8
1985............	12,254	53	2,254	14,456	15.6
1986............	11,566	62	1,936	13,440	14.4
Jan.-Aug. 1987..	8,005	35	1,312	9,285	14.1
Cold-rolled carbon and alloy sheet and strip:					
1980............	13,320	308	1,421	14,433	9.8
1981............	14,294	184	1,559	15,669	10.0
1982............	10,938	118	1,635	12,455	13.1
1983............	13,386	109	2,361	15,637	15.1
1984............	13,301	93	3,520	16,729	21.0
1985............	12,958	81	2,721	15,598	17.3
1986............	12,402	110	2,597	14,890	17.3
Jan.-Aug. 1987..	8,558	83	1,421	9,896	14.4
Coated carbon and alloy sheet and strip:					
1980............	10,134	785	1,582	10,932	14.5
1981............	10,219	451	1,496	11,265	13.3
1982............	9.131	272	1,366	10,225	13.4
1983............	10,284	236	2,248	12,296	18.3
1984............	10,562	187	3,128	13,504	23.2
1985............	14,684	179	2,941	17,446	16.9
1986............	11,304	253	2,750	13,801	19.9
Jan.-Aug. 1987..	8,216	152	1,924	9,988	19.3
Stainless steel sheet and strip:					
1980............	635	75	34	594	5.8
1981............	688	40	65	713	9.2
1982............	528	23	79	584	13.5
1983............	709	22	76	764	10.0
1984............	744	18	125	851	14.7
1985............	755	24	123	855	14.4
1986............	725	27	138	836	16.5
Jan.-Aug. 1987..	565	40	81	606	13.3

Table 11-6--Continued
Sheet and strip: U.S. shipments, exports, imports, and apparent consumption, 1980-86

Item	Shipments	Exports	Imports	Apparent consumption	Ratio of imports to consumption
	---------------1,000 metric tons---------------				Percent
Total sheet and strip:					
1980............	35,678	1,349	4,396	38,725	11.4
1981............	37,983	874	4,610	41,720	11.1
1982............	29,246	490	4,321	33,077	13.1
1983............	35,475	414	6,548	41,608	15.7
1984............	37,085	349	9,251	46,012	20.1
1985............	40,651	335	8,010	48,326	16.7
1986............	35,997	452	7,395	42,966	17.2
Jan.-Aug. 1987..	25,345	308	4,736	29,775	15.9

Source: Compiled from official statistics of the U.S. Department of Commerce and the American Iron and Steel Institute.

Figure 11-5
Steel sheet and strip products: Apparent U.S. consumption, by types, 1980-86



Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 11-7
Sheet and strip: U.S. producers shipments by quality, 1986 1/

Sheet and strip products	Quality measures: Commercial	Drawing quality 2/	Drawing quality special killed	Structual quality	Drawn and redrawn	Drawn and iron	Other
	Percent						
Hot-rolled......	51	10	17	14	0	0	8
Cold-rolled.....	49	11	30	6	0	0	4
Coated:							
Hot-dipped galvanized..	39	7	28	16	0	0	10
Electro-galvanized..	26	2	67	0	0	0	5
Tinfree.......	0	0	0	0	1	16	83
Tinplate......	0	0	0	0	2	10	88
Zinc-alum.....	0	0	4	96	0	0	0
Other.........	35	10	46	6	0	0	3
Stainless.......	64	1	3	0	0	0	32

1/ Data were also collected for 1985, but results were not significantly different from 1986.
2/ Includes deep draw quality.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

purchased grade of sheet and strip. This steel has the widest variations in metallurgical and chemical properties and has limited deformation capabilities (i.e., it is not suitable for many stamping applications). Drawing quality is more uniform throughout the coil and can be subjected to greater stresses during the forming process. Drawing quality special killed is used for the fabrication of parts that require more severe deformation than can be achieved with the previous two qualities of steel. High strength steel, made to specific mechanical specification is generally termed as structural quality. The last two quality factors, drawn and dedrawn, and drawn and ironed, are actually processes used to form the two-piece steel can. Steel used in these processes must be thin and able to withstand high stresses created when the can is formed.

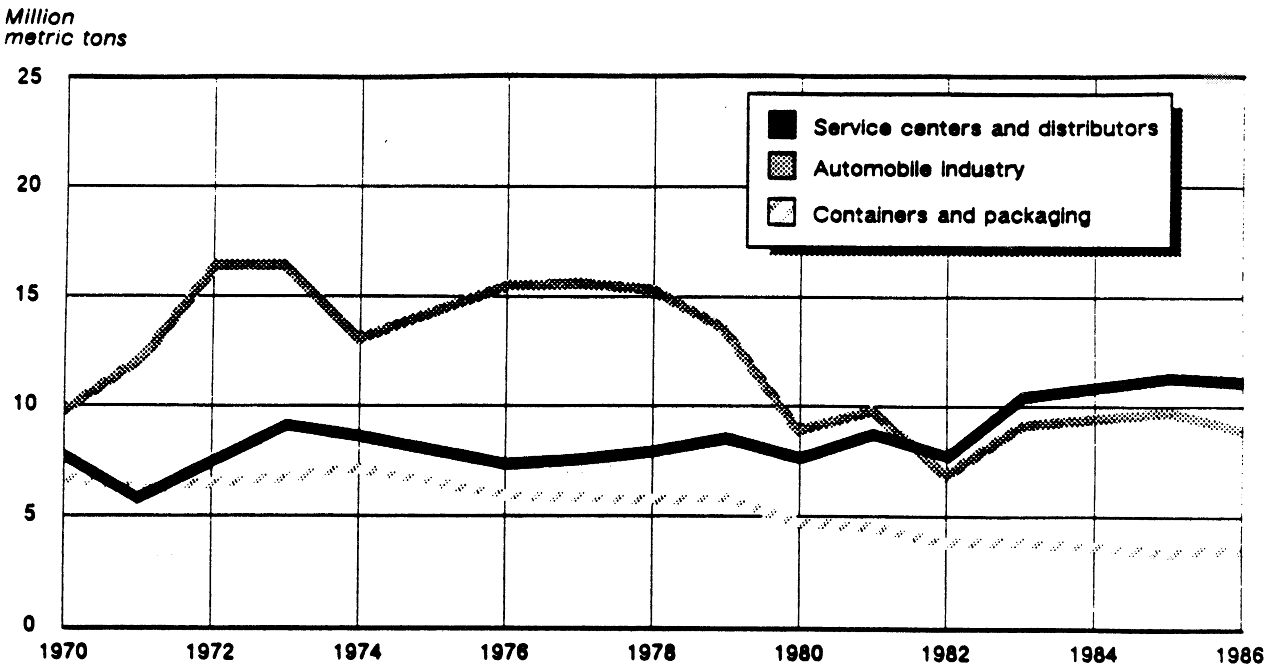
In both hot-rolled and stainless the majority of shipments are commercial. Cold-rolled, hot-dipped galvanized, and other coated products were divided between commercial quality and drawing quality, while electrogalvanized was primarily of drawing quality.

End market trends

The three major purchasers of steel sheet and strip in the United States, steel service centers and distributors, the automotive industry, and the container and packaging industry, account for over 60 percent of domestic shipments. Figure 11-6 indicates that shipments to the automotive and container/packaging markets have declined. In 1982, service centers and distributors became the largest purchasers of sheet and strip shipments, exceeding the automotive sector for the first time. Currently, as figure 11-7 shows, the largest volume of shipments, around 30 percent, go to service centers and distributors, around 25 percent of shipments go to the automotive industry, and 10 percent goes to manufacturers of containers and packaging. It is believed that these figures also reflect overall apparent consumption; data on imports to specific market groups are not available.

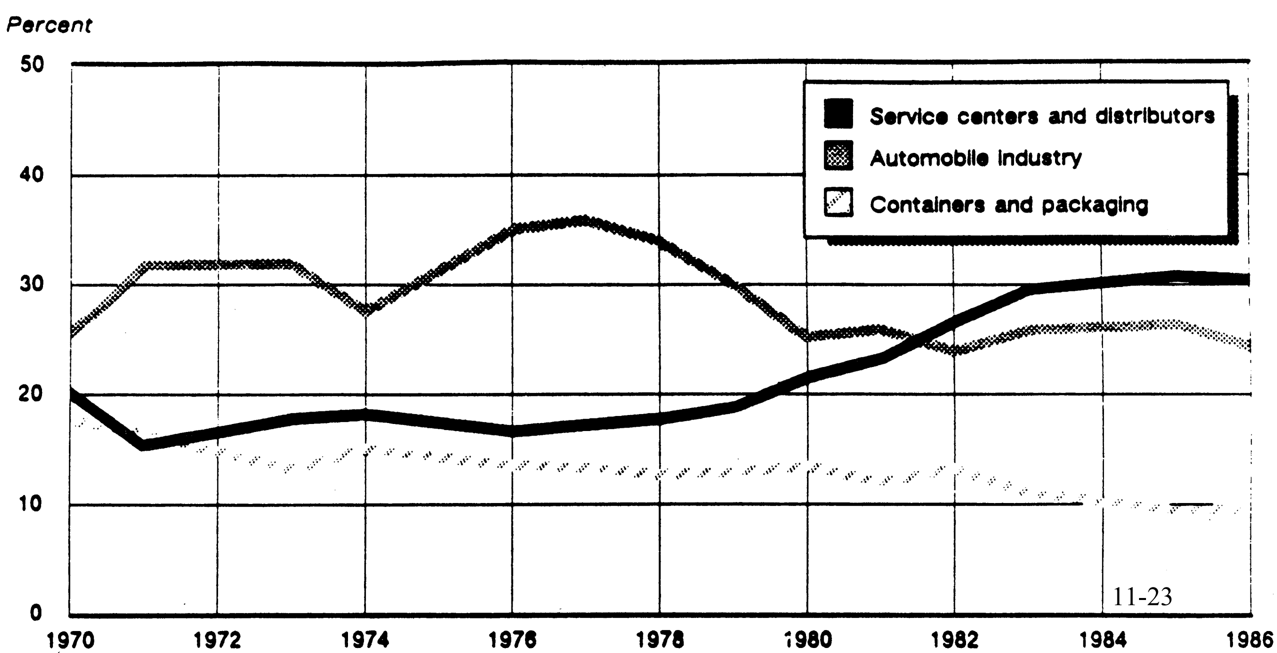
Although service centers and distributors purchase the largest quantity of sheet and strip, they are not consumers but instead act as intermediaries. Service centers and distributors purchase sheet and strip for later resale to the industries that use it; data on the destination of their subsequent shipments are not available.

Figure 11-6
Steel sheet and strip products: U.S. domestic shipments to each of the 3 major markets, alternate years 1970 to 1986



Source: Compiled from data published by the American Iron & Steel Institute.

Figure 11-7
Steel sheet and strip products: Share of total shipments to each of the 3 major markets, alternate years 1970 to 1986



Source: Compiled from data published by the American Iron & Steel Institute.

The service centers offer value-added services such as blanking, coating, slitting, and, in some cases, making component parts. As seen in figures 11-6 and 11-7, service centers are increasing their purchases of sheet and strip at an average yearly rate of about 2.2 percent. One explanation for the increase may be that steel end users are attempting to lower the high cost of inventories. There is a current trend toward smaller inventories and use of just-in-time (JIT) deliveries. This results in greater reliance on service centers and distributors to supply steel products on a timely basis. This plus the trend toward value-added services is one explanation for the increase in shipments to this market.

The single largest end-use consumer of steel sheet and strip is the automotive industry. According to the American Iron & Steel Institute (AISI) this industry purchased 9.2 million metric tons of steel sheet and strip in 1986. This compares with purchases of 15.7 million metric tons in 1976, or a decline of 41.6 percent over purchases in the last decade. The reduction in the number of automobiles produced domestically and a reduction in the amount of steel used per automobile are the major causes of this decline. The reduction of the amount of steel used per automobile is the result of automakers manufacturing smaller cars and also substituting other materials for sheet and strip in some areas of the car. Table 11-8 shows what has occurred between 1976 and 1986 for these two factors affecting steel sheet and strip demand.

Table 11-8
U.S. steel sheet and strip industry: Number of domestically produced passenger cars and amount of steel used per passenger car, 1976 and 1986

Item	1976	1986	Percentage change
Number of domestically produced passenger cars (million units)........	8.5	7.8	-8.2
Amount of steel used per average passenger car (kg)............	1,034	808	-21.9
Theoretical amount of steel used per year in cars (million kg) 1/......	8.8	6.3	-28.4

1/ Theoretical weight is equal to the number of passenger cars produced in a certain year multiplied by the weight of the average amount of steel used per car produced.

Source: Wards Automotive Yearbook and "The Internationalization of the Automotive Industry and its Effects on the U.S. Automobile Industry," USITC Publication 1712, June, 1985.

The analysis indicates that the combination of these two reductions have resulted in a 28 percent decline in steel consumed. Discussions with Ford Motor Co. personnel indicate that approximately 60 percent, by weight, of the steel in the automobile is sheet and strip. It was also indicated that there are many areas where other materials have replaced sheet and strip, such as dashboards and bumpers. Although in the past the movement toward downsizing of automobiles has contributed to the decline in steel consumption, automakers in Europe, Japan, and the United States believe that this trend has stopped and steel usage per automobile has stabilized.

Another factor contributing to the decline in sheet and strip purchases in the last decade could be the changes that have occurred in the amount of end-user inventories kept. According to an automotive industry executive, the attitude of the automotive industry ten years ago was to stock as much sheet and strip as possible so as to avoid the possibility of interrupted production as a result of strikes or other intermediate material shortages. It was common to have 10 to 15 days supply, or more, in inventory at that time. Currently, for Ford, inventory consists of a 5 to 6 day supply, or 8 to 10 days when production rates are high. The process of reducing inventories results in an extended period of reduced purchases while inventories are being depleted. This probably occurred for the automakers from 1979 to around 1984 or 1985. The movement toward smaller inventories has come about for a couple of reasons. First, inventories cost money and tie up capital. The second reason they can keep inventories smaller is that steel companies have reportedly become more reliable in terms of product consistency and delivery. Also there has been no major industry-wide steel strike since 1959.

A further factor that may have affected purchases of domestically produced steel sheet and strip by the automakers, is increased purchases of imported steel sheet and strip. In the past, many of the large automakers, such as Ford and GM, have had policies to buy only domestically produced steel. In recent years both of these companies have relaxed these policies. The Japanese steel sheet and strip industry produces a high-quality product largely because of the demands for quality of the Japanese automakers. For the U.S. automakers to compete with Japanese automobiles they must also use high-quality steel sheet and strip products. If it cannot be produced domestically the automakers are willing to import. Currently, domestic automakers indicate that they import less than 10 percent of their total purchases of steel sheet and strip. 1/ In the future imports could increase their share of the domestic automotive market if after the VRA's expire, domestically produced steel is unable to compete in terms of quality and price. 2/

Automaker purchasing patterns have also changed. Both U.S.-owned and U.S.-based Japanese automakers have begun to minimize the number of steel companies that supply the automakers with steel sheet and strip based on competitive and closely negotiated efforts to improve the consistency and reduce the high rejection rates of domestic steel supplied to the automotive industry. Consistency includes such factors as constant thickness or gauge, width, and chemistry throughout the coil. Automakers feel that by reducing the number of suppliers they will also reduce the volume of rejects and downtime in the stamping operation that results from inconsistent steel. Attempts to process a bad coil are both time consuming and costly. A part that does not form correctly may cause the stamping presses to be down for a half hour or more. By relying on two or three suppliers to deliver steel sheet and strip that is consistent in gauge and chemistry, the auto producers

1/ Responses to ITC questionnaires.
2/ From discussions with automotive industry executives.

hope to increase productivity as well as to maintain production of high-quality automobiles. With fewer suppliers, it is also easier to increase interindustry cooperation. The respective engineers and designers can work together to produce a higher quality product. The steelmakers can focus on a major client's needs and arrange longer, lower cost production runs, and the automakers can increase their productivity. Major domestic auto and steel companies already have joined together to focus on the improvement of uniformity in materials and standardization of tooling and test. A program called the Auto/Steel Partnership was initiated in the summer of 1987 to improve the worldwide competitiveness of both U.S. steelmakers and automakers.

The second largest end user of steel sheet and strip is the container and packaging industry. As in the auto industry, shipments have fallen over time. From 1969 to 1986, shipments declined at an average annual rate of 4 percent. There are two major reasons for this decline, the most important of which is the substitution of other materials. Of lesser importance is a contraction in one area of the container and packaging industry.

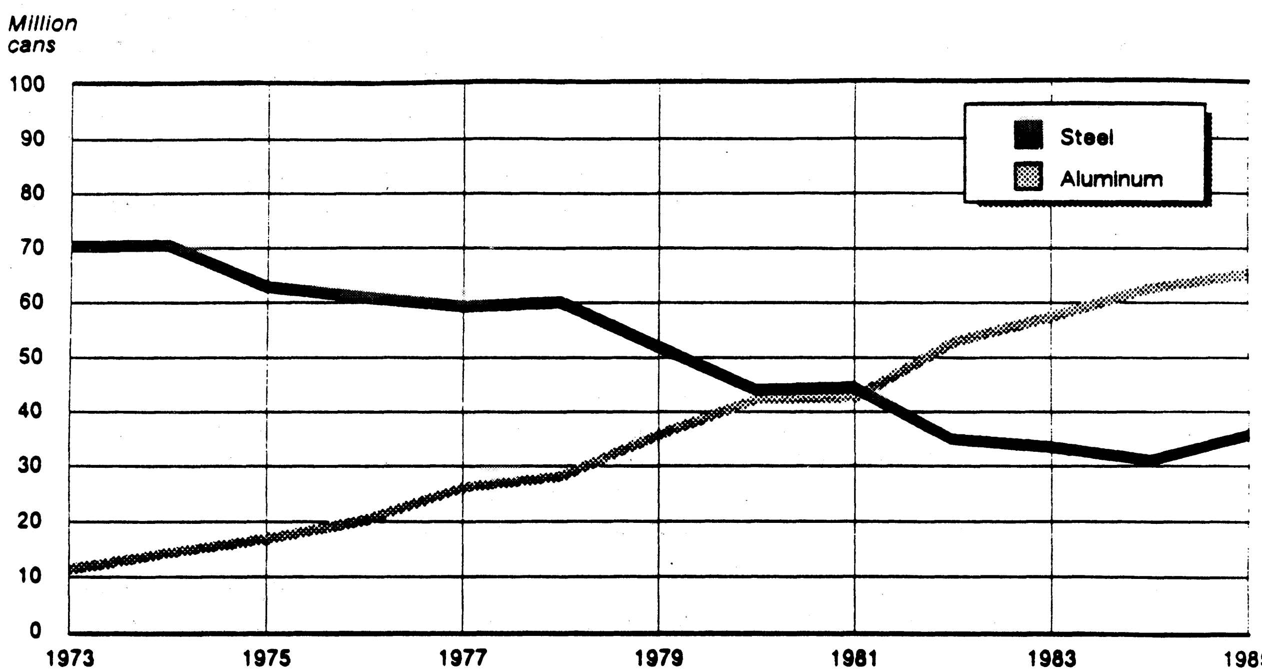
Figure 11-8 shows that the substitution of aluminum for steel in the beverage can market has had a large impact on steel consumption in that market. In 1972, steel cans accounted for 87 percent of the total metal can market, and aluminum accounted for 13 percent. By 1985, steel accounted for a little over 30 percent of the metal can market, and aluminum's share had grown to 66 percent. The decrease in the use of steel beverage cans started when there was concern over the possible harmful affects resulting from the ingestion of lead used in the side-seam soldering of three-piece cans. In addition, new technology permitting use of aluminum to make a two-piece can began to influence the market. By the time steel manufacturers introduced a two-piece can, steel's share of the beverage can market had already been greatly erroded. 1/

Steel still dominates in the food can portion of the container market. However, the use of all cans in food packaging has also declined since 1975 (fig. 11-9). The decline, according to the Department of Commerce, was a result of reduced preparation of food at home, owing to the continued trend toward smaller families and working mothers. Greater use of frozen convenience foods, in combination with the trend toward eating away from home, also eroded the market for food cans.

According to AISI data on shipments, each of the other major consuming industries account for less than 10 percent of total shipments. In summary, the decline in consumption of steel sheet and strip to date seems to have been largely a result of downsizing of automobiles, substitution of other materials in numerous uses, and changes in inventory levels.

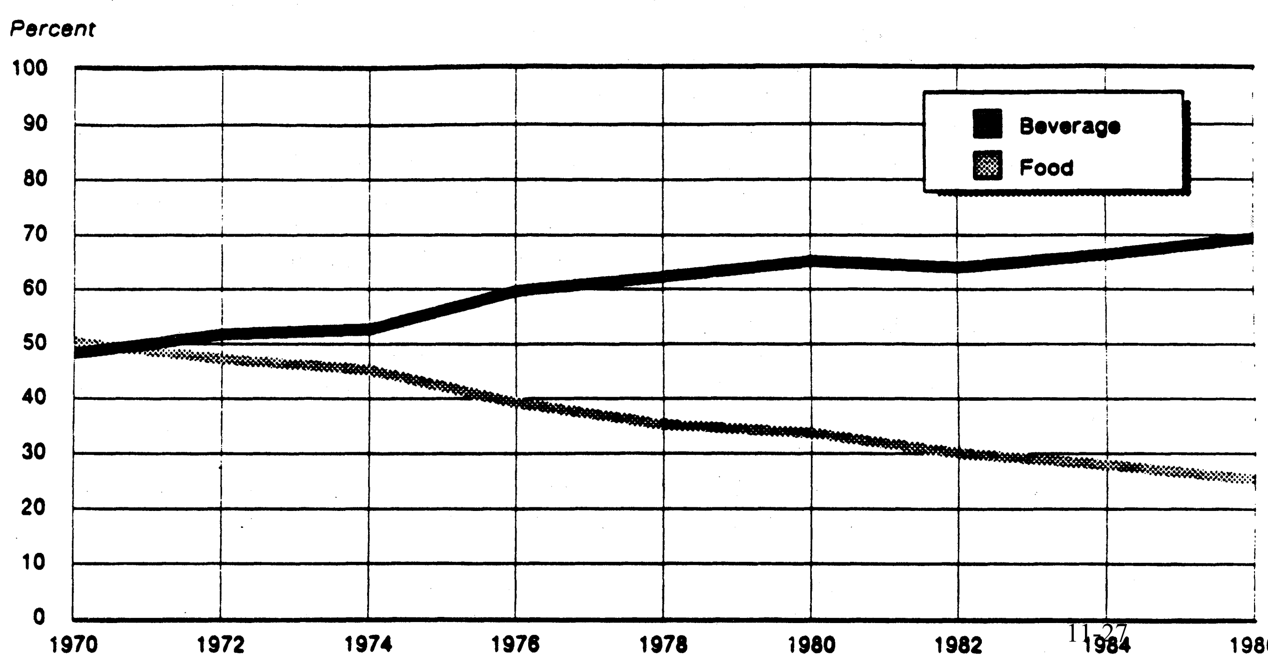
1/ Nappi, C., "Metals Demand and the American Container and Packaging Industry: 1970-1990." Materials and Society. vol. 10, No 3, 1986 pp. 455-490.

Figure 11-8
Metal cans: Production, by types, alternate years 1973 to 1985



Source: C. Nappi, "Metals Demand and the American Container and Packaging Industry: 1970-1990," *Materials and Society*, vol. 10, No. 3, 1986, pp. 455-490.

Figure 11-9
Percentage distribution of food and beverage can production, alternate years 1970 to 1986



Source: C. Nappi, "Metals Demand and the American Container and Packaging Industry: 1970-1990," *Materials and Society*, vol. 10, No. 3, 1986, pp. 455-490.

Technical Trends Affecting Consumption

Technological forces are contributing to declining consumption of sheet products and the changing composition of sheet consumption. These forces include improvements in both the steel products themselves as well as alternative materials. The competition between various materials is causing advances in the performance of all materials involved. Further decreases in steel's share of the materials market can be expected to continue as alternative materials and lighter, stronger steels replace conventional steel products.

Automobiles

In sheet steel's most important market, the automobile industry, the main competition comes from high-performance plastics. This category includes both thermoplastics and thermosetting composites. While manufacturers of thermoplastics have had continued success in increasing the amount of plastics in automotive construction, thermosetting composites have had more limited success, due to their more recent emergence and relatively high cost. The growth of plastics in automotive use is tending to level off, and further growth is generally precluded until greater acceptance of plastic body panels occurs.

The use of plastics in the outer body panels has generally been limited to low-volume production and custom cars. Application in higher volume production cars has been limited to certain body parts, such as fenders in certain pickup trucks, nose cowlings, and grill openings. General Motors plans increased use of plastics in similar applications on 1989 models, but the industry generally agrees that steel will remain the material of choice for body skins well into the 1990's. 1/

In view of their typical applications, cold-rolled steel will face increased competition from plastics at an earlier stage than hot-rolled steel. Cold-rolled steel is generally used in the body skin applications that plastics are targeting, applications that have low temperature and stress levels. Hot-rolled sheet is generally used in framing and other structural applications, posing more difficult problems for the plastics to overcome, especially in the area of fastening. Although plastics have made some inroads in structural applications, consumer perception of plastics as inferior to steel in such applications may be the largest barrier faced by plastics. 2/

Two characteristics of plastics are driving their increased use in automobiles: corrosion resistance and weight. Automotive consumers are demanding more durable cars and the automakers are responding by increasing the use of corrosion resistant materials. Whereas in many cases this has resulted in increased use of coated steels, plastics also are an alternative. The consideration of weight is based on the desire of consumers, and the regulations of the Federal Government for increased fuel efficiency.

1/ R. Balazik, and B. Klein, "The Impact of Advanced Materials on Conventional Nonfuel Mineral Markets: Selected Forecasts for 1990-2000," U.S. Bureau of Mines Information Circular 9150.
2/ Ibid.

Raw material costs, on a per kilogram basis, currently favor steel. A study conducted by the U.S. Bureau of Mines indicate that galvanized sheet for body panel applications costs in the vicinity of 97 cents per kilogram, and the price of composites for such applications runs in the $2.65 to $3.31 per kilogram range. The same study indicates that a conservative ratio of steel-to-plastic weight for body applications is in the range of 1.6. 1/ Applying this ratio to the per kilogram costs yields a unit raw material cost of $1.55 for galvanized sheet, approximately one-half of the current plastic cost.

Design costs also figure into the substitution equation. Automotive engineers are familiar with steel performance and are accustomed to designing parts in steel. Plastics companies are moving aggressively to educate the auto engineers, with many firms, such as Du Pont, G.E. Plastics, Celanese, etc., establishing Detroit-based development centers. Like the steel companies, they are providing advice, expertise, and personnel to the automakers in an effort to increase the auto companies' familiarity with the abilities and advantages of plastics.

Aside from raw material costs, there are other production cost factors involved in the decision to choose steel or plastic for a certain application. Production rates for steel and plastic parts vary, with steel holding a distinct advantage over composite plastics. Typical production rates of 500 steel parts per hour compares with 30 composite parts per hour. 2/

If the steel part and the plastic part are directly comparable, steel holds a formidable advantage. However, designing in plastic often allows a consolidation of parts, compared with designing in steel. Steel designs are limited by the ability of the steel to be drawn as well as the width of the sheet from which the part is made. Since composite parts are constructed from resins and material matrices over a form, they are not constrained by such limitations. This allows larger and more complex parts to be produced, diminishing the amount of assembly time required in downstream operations. The ability to consolidate parts may be plastic's greatest strength in its competition with steel. In spite of the higher material and production costs associated with composite manufacture, the assembly cost savings they provide in subsequent operations could make them more economical if production rates are doubled. 3/ At current production rates, parts consolidation ratio of 10 to 1 is considered necessary to make composites competitive with steel. 4/

Another consideration influencing the decision to use plastics or steel is the fact that tooling costs for the production of steel parts are considerably higher than for plastic parts. Since the cost of tooling must be amortized over the life of the production run, longer runs are required for steel tooling than for plastic tooling if fixed costs per unit are to be equalized. Steel tooling costs vary greatly within the global auto industry, with U.S. costs historically among the highest. Recently, the U.S. auto firms

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1/ Balazik and Klein, op. cit.
2/ Ibid.
3/ Balazik and Klein, op. cit.
4/ American Metal Market, Mar. 4, 1987.

have been exploring the tooling practices of the Japanese auto industry, which has relatively low tooling costs. 1/

General Motors recently adopted the Japanese tooling methods for production of a low-volume model. Production of this model with plastic body panels reportedly would have been more economical had the company used standard U.S. tooling methods. However, the cost savings afforded through the use of Japanese designed and produced stamping dies favored the use of steel panels. As the U.S. automakers gravitate to shorter production runs, tooling design will become an important factor in steel's ability to compete with plastic. Major U.S. tooling suppliers, concerned by the overseas buying in this case, are investing in modernization programs that should serve to reduce the size and cost of domestically produced tooling. 2/

These varying cost factors form an equation that determines the competitiveness of steel and plastic for auto part production, yielding a "breakeven point" at which the low cost production status shifts from one material to the other. Above this level steel parts are favored, but below this level, plastic is favored. As the breakeven point lowers, the outlook for steel improves. Depending on the part, the type of tooling, the type of steel or plastic to be used, the opportunities for part consoldation, and other factors, this breakeven point can vary greatly.

Many studies have been conducted by auto, steel, plastic, and consulting companies, and each seems to yield a different breakeven point. Some estimates have ranged as high as one-half million units, based on historical U.S. tooling costs. Average estimates, for the U.S. industry, seem to range from 120,000 to 200,000 cars per year. However, the chief engineer for a leading Japanese auto producer has been quoted as saying that the breakeven point for their company is as low as 6,000 cars per year. 3/

Plastics are currently hindered by several shortcomings in their performance under severe conditions. Most plastics encounter problems in high-temperature applications, and many plastics, as well as the pigments used to color them, degrade when exposed to ultraviolet light. Since many composites compare favorably with steel in terms of strength and durability under high stress conditions, thermoplastics have a less successful record. Plastics companies are devoting significant research and development work in the thermoplastics field, as the low production rates for composites may preclude their widespread use.

Containers

In the U.S. containers market, the experience of steel and alternative materials differs greatly between the two industry segments; beverage containers and food containers. In the beverage segment, steel has to a great extent already been replaced by aluminum, plastics, and glass. In the food segment, steel has maintained its position more effectively, but it is being

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1/ American Metal Market, Nov. 25, 1985.
2/ American Metal Market, Nov. 25, 1985.
3/ "A Steely Decision," Automotive Industries, February 1986, p. 7.

challenged by the same materials that contend for the beverage market, (in particular, aluminum and plastic). Development of new steels that have the ability to be deep drawn, such as in the drawn-and-ironed (D&I) and draw-and-redraw (DRD) production operations, enhance steel's chances of competing with these alternative materials. These steels and production processes, D&I and DRD, allow the production of two-piece seamless steel cans, reducing production costs and increasing consumer acceptance vis-a-vis the standard three-piece steel can. Currently, while winning back the beverage market seems unlikely, the new steel should allow retention of much of the food can market.

New technology developed by Weirton Steel Corp. is expected to strengthen steel's position in the food can market. The company's technology center (Wiertec) has developed an easy-open steel can top. Utilizing a pull ring, this can top eliminates the need for a can opener and directly competes with the aluminum easy-open can top.

Construction

In the construction market, the use of sheet steel is actually growing, because of increased acceptance of steel studs for framing purposes, steel roofing applications, and prefabricated steel sheathed buildings. Acceptance of steel studs in the commercial sector is almost complete, and acceptance in the residential sector is slowly growing. In this application, steel is displacing wood as a structural material. This substitution is being driven by new fastening technologies, the lighter weight of comparable units, and reduced construction times.

In the roofing and prefabricated building industry, improved coatings that tolerate greater forming requirements and offer superior corrosion resistance have aided in the growth of sheet steel consumption.

Recycling considerations

All metals fare well when considering their ability to be recycled. However, the issue of recycling poses a major problem for plastics, especially composites. Recycling of plastics often involves a downgrading in the level of use, if recycling is possible at all. In high-volume applications, such as auto body panels, the ability to be recycled is expected to become more important as the opportunities for landfill disposal are decreasing rapidly. Steel's ability to be easily recycled is a competitive strength when considering nonmetalic substitutes. However, trends toward coated steel use are making recycling more difficult as impurity levels in scrap steel are increasing.

Inter-steel substitution

Research and development efforts have brought about new steel sheet products that are replacing traditional sheet products in a number of markets. Most of the changes in the types of sheet consumed are taking place in the automotive industry, traditionally the market in which many steel sheet developments have been made. The sheet products experiencing increased demands can be grouped into two major categories; coated steels and higher strength steel. Examination of industry shipment data for a 10 year period (1977-86) reveals that, with the exception of two categories, shipments in all sheet product categories declined. The two exceptions were the "galvanized" and "all other metallic coated" categories.

In some cases, carbon and alloy steels are being replaced by high-value stainless steel products. The coated and stainless steel substitution is being driven by demand for corrosion resistant materials, and the use of high-strength steel stems from efforts to reduce the weight of finished products.

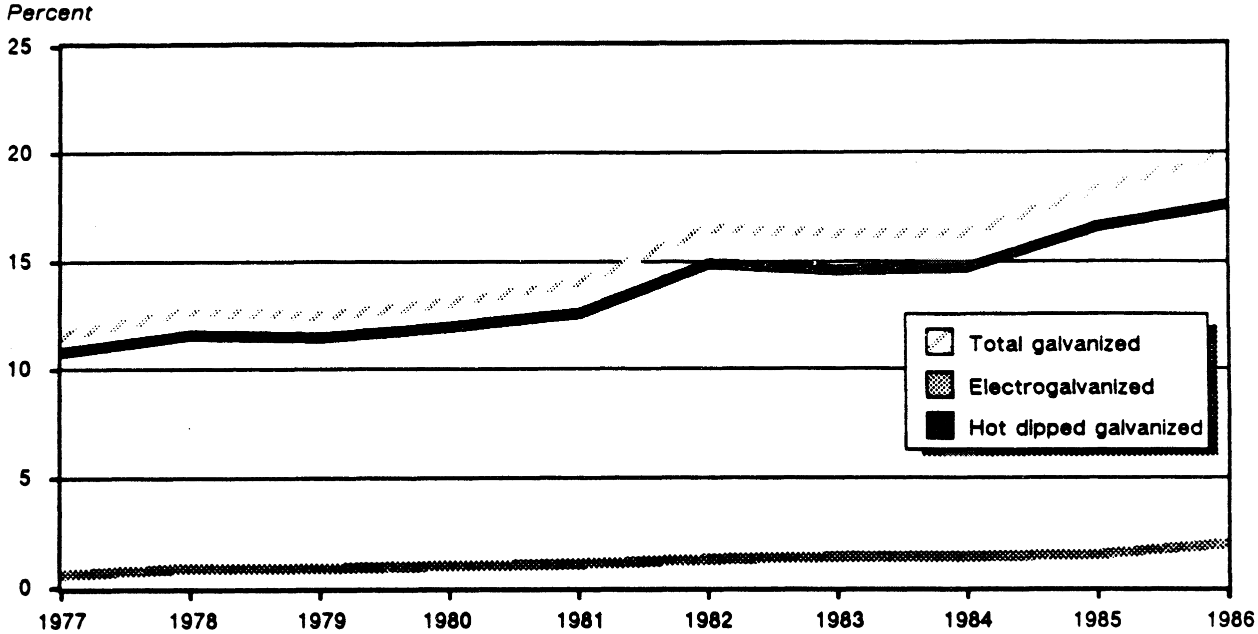
Changing specifications for sheet in the auto industry reflect an increased desire for corrosion protection. The increasing consumption of electrogalvanized sheet in that industry comes to a great extent at the expense of a two layer coated material known as Zincrometal. For the past 10 years, Zincrometal has been the material which automakers have chosen to reduce car body corrosion.

The market for Zincrometal has recently been about 900,000 metric tons annually. However, shipment levels in the late 1980's are expected to fall off sharply, as automakers substitute electrogalvanized sheet. Early estimates of 1987 shipments are in the 450,000 metric ton range, with shipments of 270,000 metric tons forecast for 1989. 1/ However, estimates later in the year projected shipments of only 140,000 metric tons for 1987. 2/

Electrogalvanized steel is also serving to replace hot-dipped galvanized steel in some applications. However, both types of galvanized steel, in addition to other zinc-based coated products, are replacing uncoated sheets in a number of applications. The increasing importance of galvanized products in the sheet market is depicted in figure 11-10. Hot-dipped and electro-coated galvanized sheet have increased their share of sheet shipments by 43.6 percent over the last 10 years. The percentage of total galvanized shipments accounted for by electro-coated material has also exhibited steady growth, accounting for 6.4 percent of galvanized shipments in 1977 and 11.1 percent in 1986. Galvanized sheet is expected to continue its growth. Forecasts by Chase Econometrics project market growth of 27 percent over current levels by 1995. 3/ This growth is expected to come largely at the expense of uncoated cold-rolled sheet.

1/ T. Balacerek, "Electro-galvanized Steel Crimps Coil Coaters' Zincrometal Sales," American Metal Market, May 1, 1987, p. 1.
2/ H. Howard, "A Renaissance in Sheet Demand," American Metal Market, Sept. 12, 1987, p. 6.
3/ Skillings Mining Review, Aug. 30, 1986, p. 11.

Figure 11-10
Galvanized sheet: U.S. shipments, 1977-86



Source: American Iron & Steel Institute, 1987 Annual Statistical Report.

Two zinc-based coated products, Galvalume and Galfan, are gaining increased acceptance in the marketplace. Both Galvalume and Galfan are grouped in the "all other metallic coated" category by the industry for statistical purposes. This category also includes aluminum, copper, and terne (lead-tin) coated sheet. Shipments in this category have increased by 27.5 percent, from 837,300 metric tons in 1977 to 1,067,800 metric tons in 1986. Much of this growth can be attributed to Galvalume sales. Galfan production in the United States began only recently.

Galvalume, the older of the two, was developed by Bethlehem Steel Corp. during the 1960's. It is an alloy coating, composed of 43.5 percent zinc, 55 percent aluminum, and 1.5 percent silicon. Galvalume is applied by the hot-dip process. Its main attribute is increased corrosion protection; it can resist corrosion for up to three to four times longer than traditional galvanized products. 1/ In unpainted applications, Galvalume is the most corrosion resistant zinc-based coating available. Its major use is for commercial roofing and siding.

Galfan was developed under the auspices of the International Lead and Zinc Research Organization during the late 1970's and early 1980's. Adoption has been slow, and U.S. production has been limited. Also a zinc-based alloy coating, Galfan includes 5 percent aluminum and a trace of mischmetal (lanthanum and cerium). Galfan is also highly resistant to corrosion, lasting two to three times longer in harsh conditions than conventional galvanized

1/ A. King, "New Processes Enhance Steel, Cut Costs," American Metal Market, Sept. 15, 1987, p. 12.

products. 1/ However, its most outstanding attribute is its ability to resist damage when undergoing forming operations. Most coatings crack and/or flake from the steel substrate when subjected to forming operations, especially those requiring deep drawing or severe forming. Galfan is highly ductile and bonds so tightly to the substrate that its forming capabilities are claimed to be limited by the substrate, not the coating. Galfan also exhibits superior paintability and corrosion protection at cut edges. Although developed as a competitor to Galvalume, the two coatings are now expected to compete directly in only a few applications. Galfan is expected to develop niches in the construction, automotive, and appliance industries as additional firms begin production of the product and customer acceptance increases.

Stainless steel sheet, representing the ultimate in corrosion resistance for steel products, is replacing other corrosion resistant steels in some applications. The most prominent application experiencing this shift is a movement by automotive producers to replace aluminum coated steel in exhaust systems with stainless steel. Several U.S. model lines have been switched to stainless systems, and increased substitution is expected. Both nickel and chromium based stainless steels are expected to benefit from the automakers' shift.

Research and development by the steelmakers has resulted in improved steel products, some of which actually serve to decrease steel consumption, measured in tonnage terms. These products, the high-strength steels, allow the substitution of thinner lighter sheet in many applications. Substitution of high-strength steels for mild steels typically result in a reduction of over 10 percent in the required thickness of the sheet for comparable applications. 2/

High-strength steels fall into four main categories: the high-strength low alloy (HSLA) steels, the rephosphorized steels, the bake hardenable steels, and the dual phase steels. Acceptance of high-strength steel in sheet products has been somewhat mixed. When first introduced in the 1970's, production problems on the part of both the steelmakers and the auto companies led to their eventual rejection, except for some specialized applications, after attempts at adoption for body panels failed. Because of the low ductility of the materials available at that time, it behaved differently in stamping operations and resulted in high rejection rates. Since then, improvements in the steel itself and a better understanding of necessary adjustments to the stamping and assembly operations have renewed interest in the high-strength material among the automakers. Though acceptance is far from widespread, design trends moving towards more aerodynamic shapes should lead to increased use of high-strength steel. Such designs have fewer creases, which serve to strengthen a panel.

U.S. Trade Analysis

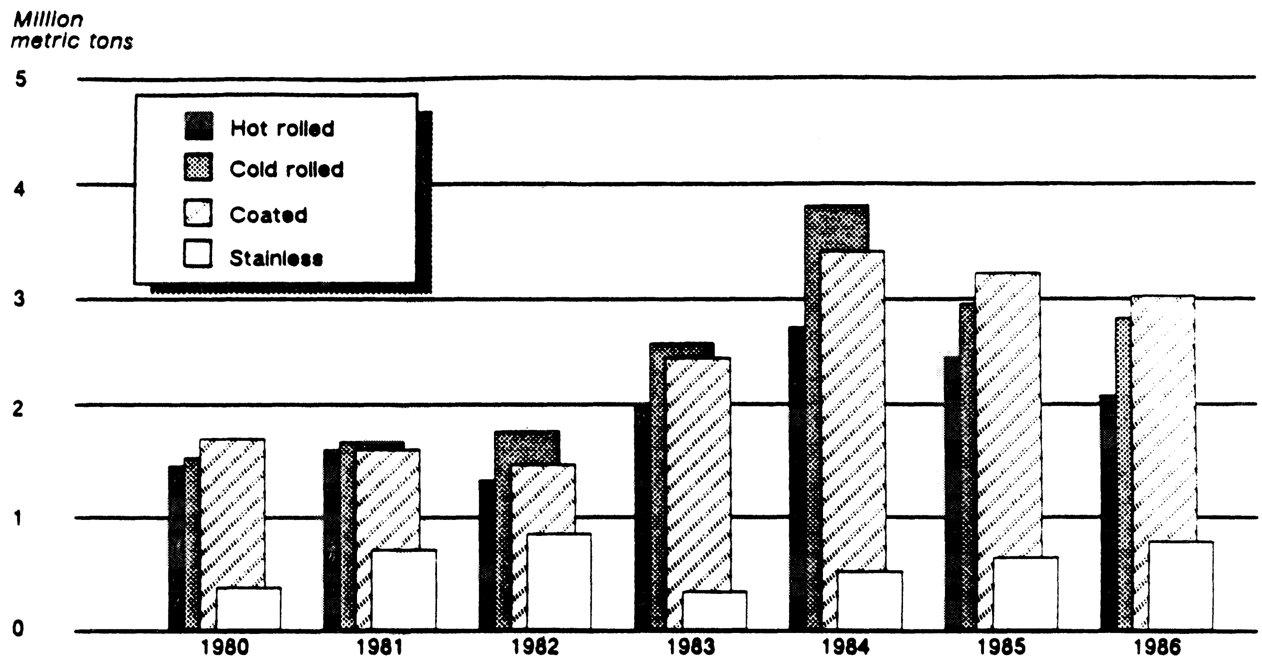
Imports

Overall, the U.S. imports of sheet and strip have increased from 4.4 million metric tons in 1980 to 7.4 million metric tons in 1986, this

1/ Ibid.
2/ "Review of High Strength Steels Available", Iron and Steel International, April, 1984, pg. 47.

represents an increase of 68 percent. Figure 11-11 shows how this increase in imports was distributed across the four product categories. Imports of each of the four product categories showed increases during this time period and all imports, except stainless sheet and strip, peaked in 1984.

Figure 11-11
Steel sheet and strip products:, U.S. imports, by types, 1980-86



Source: Compiled from official statistics of the U.S. Department of Commerce.

Imports as a percent of consumption is the key factor in establishing quota levels within VRA's. Imports as a percent of apparent steel sheet and strip consumption was 11.4 percent in 1980; by 1984 this level had increased to 20.1 percent. With the help of the VRA's this level has declined to 15.9 percent for the January-August 1987 period. On a product basis cold-rolled sheet and strip products has showed the greatest change in import penetration. In 1980, imports of cold rolled products as a percent of consumption was 9.8 percent, increasing to 21.0 percent in 1984, before declining to 14.4 percent during January-August 1987. Coated products currently have the highest level of import penetration at 19.3 percent for the same months of 1987.

Imports of hot- and cold-rolled sheet and strip grew since 1980. The growth is largely accounted for by increased imports from Canada, South Korea, West Germany, and especially by "other countries". (table 11-9). For coated and stainless sheet and strip products, imports increased from all sources. The most dramatic increases have been in the "other countries" categories. For all products, imports from this category increased 210

Table 11-9
Imports of sheet and strip products by country of origin 1/

	1980	1981	1982	1983	1984	1985	1986	January-August-- 1986	1987
	Thousand metric tons								
Hot rolled:									
Canada........	132	141	95	162	364	331	339	218	317
Japan.........	478	395	314	328	407	296	271	181	172
France........	265	318	149	239	274	374	273	171	154
West Germany..	187	200	243	206	239	302	288	195	159
South Korea...	23	51	103	164	190	154	181	129	122
Other countries...	275	386	337	764	1,028	797	582	374	387
Total.......	1,360	1,491	1,241	1,863	2,502	2,254	1,934	1,268	1,311
Cold Rolled:									
Canada........	85	113	67	90	131	126	148	93	132
Japan.........	600	429	370	654	937	730	651	458	370
France........	114	145	132	130	117	148	126	92	77
West Germany..	249	367	383	308	391	375	400	244	204
South Korea...	94	92	60	172	340	236	261	188	147
Other countries...	279	414	622	1,007	1,579	1,076	985	660	491
Total.......	1,421	1,560	1,634	2,361	3,495	2,691	2,571	1,735	1,421
Coated:									
Canada........	172	172	133	203	305	285	279	171	248
Japan.........	1,010	885	768	1,134	1,715	1,572	1,268	868	899
France........	72	93	78	86	94	122	108	72	82
West Germany..	148	152	181	216	252	298	298	184	171
South Korea...	8	37	37	151	171	152	158	113	114
Other countries...	172	157	168	458	591	513	640	418	411
Total.......	1,582	1,496	1,365	2,248	3,128	2,942	2,751	1,826	1,925
Stainless:									
France........	5	13	20	18	32	24	24	18	15
Japan.........	15	14	13	21	29	25	20	14	16
West Germany..	0	14	18	3	10	9	14	11	4
Sweden........	4	3	4	4	7	6	7	5	4
Other countries...	10	23	24	31	47	59	73	57	41
Total.......	34	67	77	77	125	123	138	105	82
Total:									
Japan.........	2,101	1,724	1,465	2,137	3,087	2,625	2,211	1,521	1,458
West Germany..	584	731	826	731	894	934	1,000	634	537
Canada........	396	432	300	459	804	745	769	484	698
South Korea...	125	182	202	494	714	552	611	437	389
France........	456	568	379	473	519	668	533	353	327
Other countries...	734	973	1,149	2,254	3,233	2,438	2,272	1,503	1,327
Total.......	4,396	4,610	4,321	6,548	9.251	8,011	7,396	4,932	4,736

1/ Only the top import sources are listed, see appendix L for complete list of import sources.

Source: Compiled from official statistics of the U.S. Department of Commerce.

percent. This indicates that the VRA's are restricting growth from some traditional suppliers and that unrestricted countries are finding the U.S. market available and are widening their U.S. import base. (See tables in app. L for further country breakdowns.)

As a result of the VRA's, imports of all sheet products from Japan have declined since 1984. Imports from West Germany which have been subject to import restraints since 1982 under the U.S-EC steel arrangement have increased since 1984, while imports from France, also restrained since 1982 have remained at about the same level.

Some domestic sheet and strip producers import various products from foreign sources (table 11-10). These imports increased until 1984, fell between 1984 and 1985, then increased in 1986. In the Commission questionnaire the producers that import were asked why they imported slabs, and hot-rolled and cold-rolled sheet and strip. The producers indicated that the exclusive foreign availability of a certain product, the quality of a particular product, and the lower price of a product were the most important factors in their purchase decisions. Not important to producers purchase decisions were delivery time; historical supplier relationships; the reliability of the supplier; ownership in the supplier, barter or countertrade; or transportation costs.

Producers were also asked what factors had the greatest influence on their import purchase decisions (table 11-11). Just under one-half responded. Of those who did, the most important factors identified were related to the product characteristics of the imports and price, as shown in the following tabulation (in percent of respondents):

	Important factors	
	Primary/Very	Prim./Very/Impt
Metallurgical specifications......	74	100
Specific product availability.....	78	89
Surface finish...................	56	89
Physical tolerances..............	44	88
Lower purchase price.............	59	65
Drawing characteristics..........	38	69

Identified as least important were barter/countertrade considerations, the corporate relationship with supply sources, opportunity for complimenting existing product mix with imports, shorter delivery times, and lower transportation costs.

Table 11-10
Domestic steel sheet and strip producers' imports of sheet and strip

(Values in metric tons)

Item	1982 Volume	1982 Percent 1/	1983 Volume	1983 Percent 1/	1984 Volume	1984 Percent 1/	1985 Volume	1985 Percent 1/	1986 volume
Hot-rolled sheet and strip.......	53,706	144.3	131,187	127.3	298,142	-25.7	221,599	22.3	270,928
Cold-rolled sheet and strip.......	2/	2/	109,087	36.8	149,272	-40.6	88,719	49.3	132,479
Coated sheet and strip...........	2/	2/	2/	2/	2/	2/	2/	2/	6,757
Stainless sheet and strip.......	0	0	0	2/	2/	2/	2/	2/	0

1/ Percentage change in imports from one year to the next.
2/ Data are confidential.

Source: Compiled from data submitted in response to questionnaires of the USITC.

Table 11-11
U.S. producers' perceptions of the factors that are most important in influencing their import purchase decisions for steel sheet and strip. Percent of respondents choosing each level of importance and the percent of total questionnaire respondents who commented on each particular factor are given

(In percent)

Decision Factor	Primary Importance	Very Important	Important	Marginally Important	Not Important	Percent Response
Lower purchase price.....	18	41	6	35	0	44
Shorter delivery time....	0	0	24	18	53	44
Availability of a specific product.......	61	17	11	6	6	46
Product characteristics:						
Metallurgical specs....	53	21	26	0	0	49
Physical tolerances....	22	22	44	6	6	46
Coating quality........	22	0	33	0	44	23
Surface finish.........	28	28	33	0	11	46
Drawing characteristics........	25	13	31	0	31	41
Terms of sale............	0	14	14	29	43	36
Engineering/technical assistance.............	0	0	25	38	38	41
Historical supplier relationship/reliability of supplier...............	6	6	44	13	31	41
Subsidiary/owner of supplier...............	0	0	0	18	82	28
Barter or countertrade...	9	0	0	0	91	28
Lower transportation.....	7	0	14	21	57	36
Complement existing lines..................	8	0	15	0	77	33

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Producers were asked to rate countries they imported steel products from according to how these compared with the United States and other countries on a variety of factors (table 11-12). The overwhelming perception was that these countries were average. The few notable exceptions were--

Item	Rate	Country
Lower purchase price	Much better	Brazil
	Better	France, Korea
Metallurgical specs	Much better	Japan
	Better	West Germany
Surface finish	Much better	Japan
Product availability	Better	Japan, West Germany
Shorter delivery time	Better	Canada
Drawing characteristics	Better	West Germany
Supplier relationship/ reliability	Better	Japan

Exports

Domestic exports of steel sheet and strip products have declined from 1.3 million metric tons in 1980 to 452,000 metric tons in 1986, a decline of 66.5 percent (table 11-13 and fig. 11-12). The major declines have been in exports of all products to "other countries." Although the U.S. import base is widening the export base appears to be narrowing. The declines in exports do not appear to be a result of one particular product, as all four product categories declined by about 65 percent between 1980 and 1986. The largest declines of exports of all sheet and strip products have been to Mexico. In 1980, 293,000 metric tons of sheet and strip were exported; this declined to a level of 68,000 metric tons in 1986, representing a decline of 77 percent. However, since 1984 exports of hot- and cold-rolled sheet and strip to Japan and Mexico have increased. Exports to all other countries declined from 904,000 metric tons to 233,000 tons, or by 74 percent. Some of these extreme declines could be tied to the serious debt problems faced by developing countries.

Table 11-12
U.S. producers' perception of the quality of steel sheet and strip from a specific country when compared with other producing countries (most popular response)

Decision factor	Brazil	Canada	France	Japan	Korea	West Germany
Lower purchase price	1	3	2	3	2	3
Shorter delivery time	4	2	3	4	4	3
Availability of a specific product	4	3	3	2	3	2
Product characteristics:						
Metallurgical specs	3	3	3	1	3	2
Physical tolerances	3	3	3	2	3	3
Coating quality	-	3	-	-	-	-
Surface finish	3	3	3	1	3	3
Drawing characteristics	3	3	-	3	-	2
Terms of sale	4	3	3	3	3	3
Engineering/technical assistance	3	3	4	3	3	3
Historical supplier relationship reliability of supplier	4	3	-	2	4	3
Subsidiary/owner of supplier	-	5	-	-	4	-
Barter or countertrade	-	4	-	5	-	3
Lower transportation	4	4	3	3	3	3
Complement existing lines	4	3	-	3	-	3
Percent of producers responding to each country category	21	21	15	38	18	33

1 - Much better
2 - Better
3 - Average
4 - Below average
5 - Much below average

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

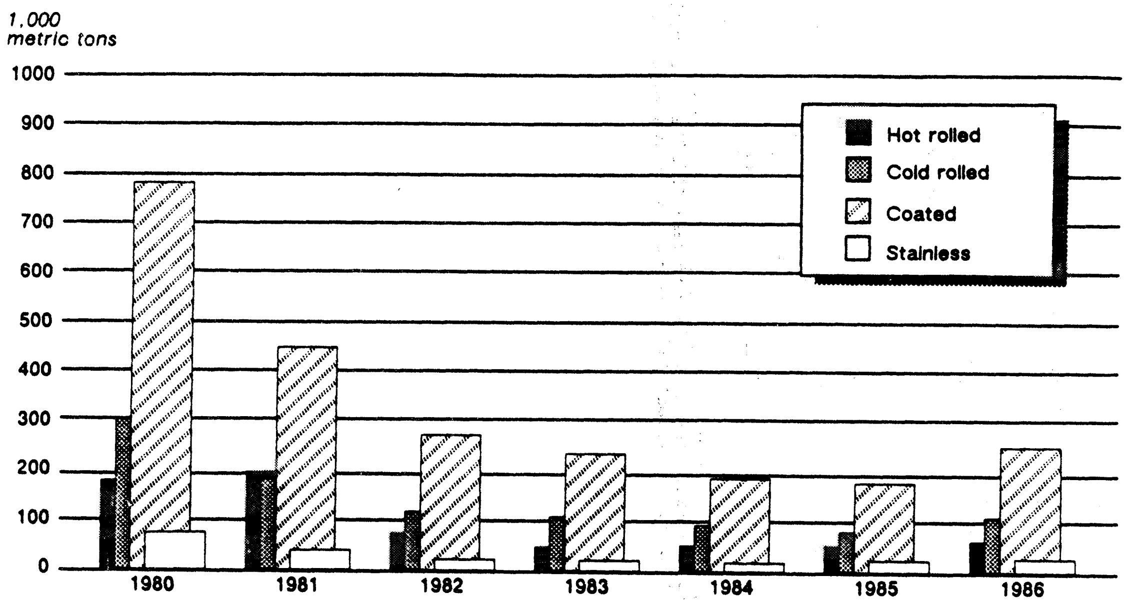
Table 11-13.
Exports of sheet and strip products by country destination 1/

Item	1980	1981	1982	1983	1984	1985	1986	January-August-- 1986	January-August-- 1987
	Thousand metric tons								
Hot rolled:									
Mexico........	64	32	7	7	9	13	15	11	13
Japan.........	0	0	1	0	1	1	15	2	1
Canada........	16	103	31	33	32	25	11	8	11
United Kingdom	1	1	0	0	0	0	7	6	1
Other countries...	99	62	36	8	10	14	14	8	6
Total.......	180	198	75	48	52	53	62	35	32
Cold Rolled:									
Canada........	29	46	24	27	29	25	23	14	24
Mexico........	39	20	6	6	12	13	37	18	32
India.........	45	31	22	9	15	14	11	10	6
Japan.........	4	4	1	2	2	2	4	3	3
Other countries...	191	83	64	64	35	27	34	25	18
Total.......	308	184	117	108	93	81	109	69	83
Coated:									
Canada........	34	52	36	47	45	40	40	28	39
Hong Kong.....	4	6	5	5	47	4	38	23	23
Egypt.........	44	31	4	16	2	27	16	8	17
Italy.........	140	21	20	21	15	13	27	22	28
Other countries...	562	341	208	147	77	94	132	98	55
Total.......	784	451	273	235	186	178	253	179	152
Stainless:									
Mexico........	40	9	4	1	3	5	11	3	24
Canada........	15	16	11	12	6	9	4	2	3
Taiwan........	3	3	3	2	2	0	7	0	7
West Germany..	1	1	0	1	0	1	1	0	0
Other countries...	16	11	5	6	7	8	4	4	5
Total.......	75	40	23	22	18	23	27	9	39
Total:									
Canada........	94	219	102	119	112	100	76	52	77
Mexico........	293	182	71	35	51	43	68	35	74
Taiwan........	47	27	23	30	15	10	32	19	22
Hong Kong.....	10	8	7	11	4	4	43	25	24
Other countries...	904	437	288	219	166	178	233	161	110
Total.......	1,348	873	491	414	348	335	452	292	307

1/ Only the top export destinations are given for each product, see appendix L for completed list of export destinations.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Figure 11-12
Steel sheet and strip products: U.S. exports, by types, 1980-86



Source: Compiled from official statistics of the U.S. Department of Commerce.

Employment, Unit Hourly Labor Cost, and Productivity

Overall employment of production and related workers in the steel sheet and strip industry declined 36 percent to 58,667 in 1986-87, from 91,208 in 1984-85 (table 11-14). Although substantial reductions in employment took place in all carbon steel sheet and strip products, the largest decline, 51 percent, took place in hot-rolled products during the 3-year period shown in table 11-14. The decline in employment reflected production cutbacks and restructuring, which entailed the elimination of older production facilities, the modernization of other facilities, or the building of modern plants. The relatively small decline of employment in stainless steel production was the result of a fairly stable market and slightly increasing production between 1984-85 and 1986-87.

Unit hourly labor cost increased between 1 percent and 7 percent during 1984-85 and 1986-87 in the various segments of the steel sheet and strip industry, with the exception of hot-rolled products where labor cost declined 1 percent during the same period. The increases represent the relatively small incremental annual increases in the negotiated labor contracts, including principally insurance, health, and pension benefits.

Labor productivity increased substantially in all carbon steel sheet and strip sectors of the industry. The largest productivity increase was 56 percent between 1984-85 and 1986-87 in the galvanized sector followed by a 48-percent increase in the hot-rolled sector of the industry. These increases are attributable to the closure of inefficient facilities and modernization and automation of production equipment, as well as organizational restructuring, which has achieved man-hour per ton levels not previously attained. 1/

1/ See ch. 12, "Labor," Competitive analysis of U.S. and principal foreign competitors.

Table 11-14
Average number of production and related workers in U.S. establishments producing carbon and certain alloy steel sheets and strip products and unit hourly labor cost, and productivity of such employees, July 1, 1984-June 30, 1985, July 1, 1985-June 30, 1986, and July 1, 1986-June 30, 1987

Product	Average number employed				Unit hourly labor cost				Productivity			
	1984-85	1985-86	1986-87	Percentage change 1984-85 to 1986-87	1984-85	1985-86	1986-87	Percentage change 1984-85 to 1986-87	1984-85	1985-86	1986-87	Percentage change 1984-85 to 1986-87
					(dollars)				(hours per ton)			
Carbon and certain alloy steel:												
Hot rolled	38,472	23,697	18,841	-51	15.75	15.99	15.59	-1.0	1.98	1.27	1.04	+48
Cold rolled	24,795	19,705	19,583	-21	15.62	15.81	16.42	+5.0	2.37	1.81	1.94	+18
Galvanized	9,613	6,250	6,226	-35	15.28	16.18	16.34	+7.0	4.22	2.09	1.84	+56
Other	13,340	10,784	9,414	-29	15.38	16.09	16.36	+6	4.21	3.85	3.60	+15
Stainless steel	4,988	4,670	4,603	-8	17.51	15.28	17.71	+1	11.95	13.62	11.30	+5
Total	91,208	65,106	58,667	-36	-	-	-	-	-	-	-	-

Source: 1/ U.S. International Trade Commission, Annual Survey Concerning Competitive Conditions in the Steel Industry and Industry Efforts to Adjust and Modernize. Report to the President on Investigation No. 332-209 under section 332 of the Tariff Act of 1930. August 1985; August 1986; and August 1987.

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Strike activity was minimal in the domestic sheet and strip industry during 1986 and 1987, particularly when compared with the last industry-wide strike in 1959, which lasted 116 days. There were nine strikes during 1986 and 1987 among domestic sheet and strip producers.

Of these, only three strikes were by more than 1,000 employees, and only the strike of the USX Corp. was a significant one, as it involved 22,000 employees and lasted for 184 days. The effect of the USX strike was industrywide, in the sense in which it temporarily rearranged the market, as other steel companies picked up the product lines that USX could not provide during, and for a short period after, the strike. The other strikes were short in duration, limited usually to one facility and arose as a result of disputes on issues which each company was negotiating separately with the USWA (see the following discussion on recent contract negotiations).

The recent (1986 and 1987) contract negotiations between the United Steelworkers of America (USWA) and the major integrated steel producers 1/ greatly enhanced the competitiveness of the steel industry since they involved efforts to tailor the agreements to the need of each company, and they included labor cost concessions aimed at preserving jobs by enhancing U.S. steel competitiveness. Previously (for the past 30 years) the USWA negotiated as a unit with the entire steel industry. As a result of the individual contract negotiations, the steelworkers announced that they would consider concessions with companies that exhibited financial distress, in order to improve their competitiveness, conditioned on a free and open examination of the company's financial records and an agreement that other interested parties (i.e., the banks and the company) would also share in the sacrifice of reducing wages and benefits. 2/

Prior to the 1986 and 1987 negotiations, wage levels were set uniformly throughout the industry, and similar levels of fringe benefits were granted for all companies. Because of the varied numbers of retired workers and other differences, the total hourly employment cost among the major steel companies varied widely prior to the 1986 and 1987 negotiations.

During 1986/87, differences in the total hourly employment cost (THEC) among the major producers significantly narrowed. This was the result of the "level playing field" concept advanced by the USWA, which reflected the union's desire to take labor costs out of competition (i.e., not to give a competitive edge in wages to any one company). The equalizing of THEC was generally achieved for the major producers that were not operating under Chapter 11 of U.S. Bankruptcy Law.

The major issues that dominated the contract negotiations and were included in all contracts were incentive pay, overtime, wage and benefit rollbacks, and the contracting out of work. These issues directly impacted labor cost and affected a company's competitive position.

1/ The major companies with whom the USW negotiated include Armco, Inc., Bethlehem Steel Corp., Inland Steel Co., LTV Steel Co., National Steel Corp., USX Corp. and Wheeling-Pittsburgh Steel Corp.; these companies account for approximately 57 percent of all raw steel production in the United States.
2/ United Steelworkers of America.

Incentive pay is linked to improving production standards in a company in order to increase productivity. They are based on a Cooperative Wage Study developed by the union and the steel companies, which establishes the following: (1) jobs that qualify for incentive pay; (2) the criteria on which the level of incentive pay should be established; and (3) the criteria under which incentive production levels are established. 1/ In 1986-87 the straight time incentive earnings were $1.58 per man-hour worked, which represented 14 percent of the base straight time earnings and 7 percent of the THEC. 2/

In each contract the union sought to reduce overtime. The USWA claims that overtime enables companies to control the size of the labor force and reduce labor costs; hence laid-off workers would not be recalled to work. According to the Bureau of Labor Statistics data, the use of overtime hours increased from 1.5 hours per worker per week in 1982 to 3.8 hours per worker per week in 1986. 3/ A report prepared by Locker/Abrecht Associates estimates that the elimination of all overtime hours in 1985 would have provided 13,900 jobs, increasing steelworker employment by approximately 9.2 percent. 4/

With respect to wage and benefit rollbacks, compensation reductions have generally taken the form of reductions in hourly wages paid as well as reductions in holidays and Sunday premium bonuses. Some reductions in insurance costs have also been achieved. 5/ Following is a summary of the wage and benefit reductions to which the USWA and steel/companies agreed. Total wage and benefit reductions for the major firms are shown in table 11-15.

1/ United Steelworkers of America.
2/ Ibid.
3/ As reported by 64 steel companies to the American Iron & Steel Institute.
4/ Locker/Abrecht Associates, Inc. Confronting the Crisis: The Challange for Labor, Reportto United Steelworkers of America, AFL-CIO-CCC. Dec. 16, 1985.
5/ United Steelworkers of America.

Table 11-15
U.S. steel industry: Wage and benefit reductions and effective date of agreement, by companies, August 1985-December 1986

Company	Effective date of agreement	THEC New	THEC Expiring	Reduction Per hour
Wheeling-Pittsburgh 1/.....	8/85	2/ $18.00	3/	3/
LTV 1/....................	4/1/86	4/ 18.09	$25.19	$3.60
National..................	4/28/86	22.21	23.72	1.51
Bethlehem.................	7/1/86	22.50	24.84	2.34
Inland....................	8/1/86	3/	3/	3/
USX.......................	2/1/87	22.50	24.84	2.34
Armco:				
Ashland..................	12/1/86	3/	3/	3/
Baltimore................	12/1/86	3/	3/	3/
Kansas City..............	12/1/86	3/	3/	3/

1/ In Chapter 11 bankruptcy proceeding.
2/ 1985 settlement agreement.
3/ Not available.
4/ Includes a $3.50 per hour reduction as a result of the Pension Benefit Guaranty Corp.'s assumption of pension liabilities (as estimated by World Steel Dynamics).

Contracting out or subcontracting attempts to achieve improved competitiveness by lowering labor costs through the transfer of work from union employees to outside companies with nonunion employees. The principal forms of subcontracting which occur in sheet and strip operations include maintenance work, and buying semifinished products from lower cost producers. According to industry sources, the more common areas for subcontracting include shearing, slitting, pickling, finishing, side trimming, and stamping, which all have a relatively high man-hour content that can be performed by independent processors with lower operating costs.

Another advantage associated with subcontracting is that it provides flexibility to the steel companies. Steel labor becomes less expensive if the size of the labor force can be varied according to need; this is reportedly easier to achieve with subcontracting. Some major producers estimate that a 15- to 30-percent increase in labor productivity can be attained by using subcontractors.

Another dimension of subcontracting occurs in instances where a steel company purchases semifinished products from another manufacturer, domestic or foreign, thereby saving on employment or, possibly, investment cost.

Subcontracting was the single most important issue in the 1986/87 labor negotiations. It is estimated that the equivalent of 8 percent of the steel labor force of approximately 147,000 wage earners, or 12,000 full-time steelworkers' jobs were contracted out in 1986. 1/ This translates into approximately 24 million hours of labor. The amount of contracting out varies significantly among the larger integrated steel companies. Although some companies contract out only 1 to 2 percent of their total labor hours, others reportedly subcontract as much as 25 percent, or more. In view of the importance of subcontracting, all contracts that were negotiated by the major producers acknowledged the principle that "work capable of being performed by bargaining unit employees shall be performed by such employees."

Much union/management collaboration as a result of restructuring has taken place in the steel industry and has resulted in significant changes in traditional labor management relationships, with an increased emphasis on developing cooperative solutions to problems. The objective is to make union work rules flexible, reduce redundancy in jobs, and give greater decisionmaking to workers. These types of actions contribute to cost reductions in labor, material and overhead, and to greater labor productivity.

Most steel companies have adopted some form of an employee involvement, union/management collaboration, which makes them more cost-competitive. These kinds of relations are new to most firms of the U.S. industry, and go considerably beyond the individual incentive plans. The cost savings can be substantial. In the case of one company, for example, as much as a 12 percent total cost saving was achieved, even as the average annual bonus per employee rose from $315 to $3,293 between 1981 and 1984 according to the U.S. Department of Labor.

However, one of the more prominent examples can be found at LTV Steel Co.'s recently constructed state-of-the-art, 72-inch wide electrogalvanizing line, which is capable of producing 360,000 metric tons per year of rust-resistant steel to be pressed into automobile body parts. The line is operated by the L-S Electrogalvanizing Co. (L-SE), a joint venture of LTV and Sumitomo Metal Industries, Ltd. (SMI).

The major innovation at L-SE is the separate labor agreement that was concluded between the company and the USWA. In lieu of rigid job classes, only three skill levels were established. Bonuses are paid twice a year to all 60 employees. If laid off, all employees are paid 100 percent of their salary when combined with unemployment compensation (for a maximum of 26 consecutive weeks). When unemployment runs out, LTV pay 60 percent of the salary for another 26 weeks. If disabled, employees are entitled to 100 percent of their salaries for 3 months and thereafter to 60 percent of base salary for life or until retirement. Moreover, workers have a voice in major decisions, including hiring and firing.

USWA members and managers have been cross-trained in various skills. Managers assist in nonsupervisory activities related to plant operations, and actively solicit suggestions and ideas from junior members of the team. The plant is viewed by both the union and the company as an important experiment, which could serve as a model for changes in other plants.

The L-SE plant is claimed to be the most productive facility of this type in the United States, requiring 0.3 to 0.4 man-hour per ton of steel for all

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1/ World Steel Dynamics.

finishing operations including galvanizing. This compares favorably to the 0.5 man-hour per ton for a similar facility in Japan. U.S. plants reportedly average approximately 1 man-hour per ton in galvanizing operations.

Retraining of workers

Retraining of the active workforce became a necessity in recent years because of the technological changes taking place in the steel industry. Modernization requires the updating of skills, learning new skills, and cross-training of workers in different skills. For example, it includes training in supervision, metal mixing, mold preparation, maintenance, computer operations, and electronics. Other training includes classroom and on-the-job training for upgrading machine equipment operators, training to improve product quality and productivity and retraining programs for the displaced workers. Training thus obtained cuts cost and makes job performance more efficient, resulting in greater labor productivity. According to industry and union sources, over 90 percent of retraining consists of on-the-job training programs that involves active and laid-off workers.

From October 1, 1986, to June 30, 1987, expenditures by the 10 major steel companies 1/ for the retraining of workers totaled $35.3 million, compared with an estimated $28.4 million for the 9 month period during October 1, 1984, and June 30, 1985. 2/ Most training and retraining involves a joint effort between labor, as represented by the union, and the management of the particular company.

Changes in management organization

In recent years major structural changes took place in the management organization of U.S. steel companies to improve operational efficiency and competitiveness. The following three examples illustrate the different organizational methods chosen.

The profit center responsibility type of management was adopted at Inland Steel. The advantage of this method is the total participation of small groups achieving a high degree of efficiency, inventiveness, and peer pressure for performance. Its disadvantage is the lack of centralized management, allowing for possible inefficiencies in corporate decisionmaking.

At Inland Steel, a restructuring plan created Inland Steel Industries as the corporate parent for various profit centers. Each profit center was accountable for the direction taken in steelmaking decisions, which has forced the steelmaker to measure the impact of its steelmaking decisions on profits,

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1/ "Major company" is defined in the Trade and Tariff Act as an enterprise whose raw steel production in the United States during 1983 exceeded 1,500,000 short tons (or 1.4 million metric tons).
2/ U.S. International Trade Commission, Annual Survey Concerning Competitive Conditions in the Steel Industry and Industry Efforts to Adjust and Modernize, Report to the President on Investigation No. 332-209 under section 332 of the Tariff Act of 1930, August 1987.

investment financing, and other critical business issues results. The center had to develop a 3-year plan with the objective of breaking even in the low part of the business cycle. The plan had a basic philosophy--keep customers in business, cut costs, and provide more value to the customer. This objective required the improvement of labor productivity by simplifying work rules. In addition, supporting services (including the machine shop, electric shop, ingot mold foundry, and coking plant) were critically evaluated. The viable operations continued to receive support, while exit strategy (such as selling, ceasing investment, and closing facilities) was developed for the nonviable operations.

The joint-venture type of management is exemplified when National Steel Corp. chose partnership with a Japanese steelmaker for reasons of bringing new capital into the company. On August 22, 1984, National Intergroup signed an agreement under which Nippon Kokan K.K. purchased a 50-percent equity interest in National Steel Corp. NKK reportedly sought a joint venture in the United States or Canada in response to stagnation of the Japanese market and U.S. protectionism.

The two companies are working together as a joint venture to transform National Steel Corp. into a world-class producer. The company was headed up initially by an American Chairman and President and a Japanese Vice Chairman. Recently, however, the American President stepped aside and was succeeded by a Japanese executive with extensive metallurgical and engineering experience.

The press has reported that management's goals for National are to achieve the following by the year 1990:

(1) A 40 percent improvement in productivity;
(2) A 10 percent improvement in yield (from about 78 percent currently to 90 percent);
(3) A 20 percent improvement in prime product production; and
(4) A 50 percent reduction in downtime.

An employee-owned type of corporation is built on employee involvement, new ideas, communication, and group interaction. For example, Weirton Steel Corp., formerly part of National Steel, became a wholly employee-owned company when it commenced business on January 11, 1984. Special circumstances have made the Employee Stock Ownership Plan (ESOP) work for Weirton. Groups of 10 to 12 employee-owners from common work areas are organized into Employee Participation Groups (EPG) after completion of classroom training in problem solving. They meet weekly in work areas and address such problems as cost reduction, productivity, and safety. Such an approach also helps to improve management/worker relations and attitudes. Over 2,000 trained employee-owners make up 125 EPG teams that are the vanguard of other ongoing employee involvement programs.

Other factors that assisted Weirton as an employee-owned and employee-managed company was an independent union (The Independent Steelworkers Union), the commitment of the entire town to save the plant, and its relatively stable financial state at the time of purchase. In addition, Weirton facilities were bought at a greatly depreciated purchase price, affording an immediate advantage to the new employee-owners.

Currently, a management consulting study is being undertaken with the purpose of reorganizing the firm's structure. The new structure would assist line managers when considering the impact of their decisions on company profits, investment, and other business criteria.

The matter of unfunded pension liabilities in the steel industry is one that has received increased attention during recent years. As restructuring in the industry has occurred, pension obligations have proved to be increasingly burdensome to certain companies. For example, in the case of LTV Corp., one of the three largest raw steel producers in the United States, it was considered the single most important element in the company's filing for protection from creditors under Chapter 11 in 1986. At that time, LTV had three times as many retirees (71,000) as employees (25,000), and was making annual pension payments of $380 million, as well as $90 million in annual health and life insurance premiums for retirees. Under Chapter 11, such obligations can be assigned or transferred to the Pension Benefit Guaranty Corp. (PBGC), gaining a significant labor cost advantage over the company's competitors. 1/ For example, LTV Steel by transferring pension liabilities to the PBGC reduced its hourly labor cost by $3.50 and Wheeling-Pittsburgh Corp. (also in Ch. 11 bankruptcy) by $3.00. As a result, both companies decreased their total employment cost to approximately $18 per hour, or approximately 22 percent below the steel industry average of little over $23 per hour.

As of March 1987, 81 percent of all PBGC claims were by steel companies (the other 19 percent of the annual claims represented all other U.S. industries) and amounted to approximately $535 million for the year. The 182 plans terminated by steel companies represented about 14 percent of the 1,345 plans terminated. Net claims or underfunding for the 182 steel plans amount to $3.1 billion as opposed to $3.9 billion for all 1,345 plans.

Underfunding of the pension plans has occurred as companies experiencing operational problems encountered difficulties setting aside resources to fund their pension plans. As of May 1987, the PBGC was responsible for providing benefits to 151,900 workers in the steel industry, 76,875 of which were already retired.

The PBGC estimates that as of May 1987, the total pension underfunding for five other major steel companies, which are not included in the 182 terminated plans (i.e., Bethlehem, Armco, National, USX, and Inland) was between $4 to $6 billion. The underfunding includes 420,000 participants in the pension plans of those five companies, of whom 220,000 are already retired.

The pension obligations assumed by the PBGC from steel companies have created financial problems at that agency. Only one-half of the PBGC's current annual benefit payments are currently collected from dues paid by the participants in the program. The remainder has to be covered from the income gained from approximately $2 billion of PBGC assets, turned over by bankrupt companies to PBGC. Under the current financing method PBGC's liabilities

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1/ The PBGC, an independent agency of the U.S. Federal Government, was established under Title IV of the Employee Retirement Income Security Act of 1974. Currently PBGC pays estimated total monthly pension benefits or claims of about $660 million per year. (PBGC News Release, Jan. 13, 1987.)

amount to $4 billion and the threat of further obligations from steel companies adds to the magnitude of the potential financial problems.

The PBGC made two major moves in 1987 to lessen its liabilities. Proposals were submitted to Congress by the Administration as well as by the PBGC to increase the minimum funding for all its program participants and to change its current equal premium payments by all participants to a risk-related premium system. Also PBGC made an unprecedented move in September 1987 and returned $2 billion in unfunded pension liabilities to LTV Corp. The PBGC argued that in view of LTV's $252 million operating profits during the first 6 months of 1987 and a recently concluded full pension benefit plan with the USWA, LTV was able to fund its own pension plan. The issue is currently being argued in court.

Capacity

Location

The majority of sheet and strip operations, especially fully integrated operations, are located in the Great Lakes area, which accounts for 71 percent of the U.S. steel sheet and strip operations (tables 11-16 through 11-17). Only 7 percent of U.S. steel sheet and strip operations are located in the Western United States, as shown in figure 11-13. Most steelmaking operations are near major waterways, mainly because of the need for water in steelmaking activities and as a low cost means of transporting products. Of the 86 steel sheet and strip operations, there are 38 hot-strip mills. The following tabulation highlights the number of operations per state:

State	Number of operations
Ohio	21
Pennsylvania	16
Michigan	11
Indiana	7
Illinois	6
California	4
Connecticut	4
New York	4
Alabama	3
Kentucky	2
Maryland	2
New Jersey	1
Rhode Island	1
South Carolina	1
Texas	1
Utah	1
West Virginia	1
Total	86

Table 11-16
Carbon steel and certain alloy steel: Location and nature of steelmaking operations by state, carbon and certain alloy steel

State	Company-town	Slab via ingot	Continuous cast slab	Hot-rolling	Cold-rolling	Hot-dipped galvanized	Electro-galvanized	Tin plate	Zinc-aluminum	Other coating
AL	USX-Birmingham	X		X	X	X		X		
AL	Gulf states-Gadsen	X		X	X	X				
AL	Tuscaloosa-Tuscaloosa			X						
CA	USS-Posco-Pittsburgh				X	X		X		
CA	Marwais-Richmond					X				X
CA	Calstrip-Los Angeles				X					
CA	California Steel-Fontana			X	X	X				
CT	Stanley-Works-New Britain					X				X
CT	Allegheny-Ludlum-Wallingford				X					
CT	Theis-Bristol				X					
CT	Carpenter-Bridgeport	X								
IL	Thomas-Franklin Park				X					
IL	Acme-Riverdale	X		X	X		X			
IL	Worthington-Chicago				X					
IL	LTV-East Chicago		X	X	X	X		X	X	
IL	LTV-Hennepin				X	X				
IL	National-Granite City									
IN	USX-Gary	X	X	X	X	X	X	X		
IN	Bethlehem-Burns Harbor	X	X	X	X	X	X			
IN	Cold Metal Pro. Indianapolis				X					
IN	Inland-East Chicago	X	X	X	X	X				X
IN	National-Portage				X	X		X	X	X
KY	Worthington-Louisville				X					
KY	Armco-Ashland	X		X	X	X				
MD	Bethelem-Sparrows Point	X	X	X	X			X	X	
MD	Worthington-Baltimore				X					
MI	USX-Dearborn						X			
MI	Rouge-Dearborn	X	X	X	X		X			
MI	McLouth-Trenton		X	X						
MI	McLouth-Gibraltor				X					
MI	Whttor-Detroit				X					
MI	Sharon-Dearborn				X					
MI	National-Ecorse	X	X	X	X		X			
MI	J & L Specialty-Detroit				X					
MI	Greer-Ferndale				X					
NJ	Athenia-Clifton				X					

Table 11-16
Carbon steel and certain alloy steel: Location and nature of steelmaking operations by state, carbon and certain alloy steel--Con.

State	Company-town	Slab via ingot	Continuous cast slab	Hot-rolling	Cold-rolling	Hot-dipped galvanized	Electro-galvanized	Tin plate	Zinc-aluminum	Other coating
NY	Bethlehem-Lackawana					X				
NY	Allegheny-Ludlum-Locksport				X					
NY	Gibraltor-Buffalo				X					
NY	Rome-Rome				X					
OH	Bethlehem-Wallbridge						X			
OH	Thomas-Warren				X		X			X
OH	Greer-Dover				X					
OH	Worthington-Columbus				X					
OH	Armco-Middleton	X	X	X	X	X	X			X
OH	Cold Metal Prod.-Youngstown				X		X			
OH	Inland-Walbridge						X			
OH	Empire-Det-Mansfield	X		X	X					
OH	Empire-Dot-Dover					X				
OH	Sharon-Warren						X			
OH	Wheeling-Pitts-Yorksville				X			X		X
OH	Wheeling-Pitt-Martin's Ferry					X				
OH	Wheeling-Pitt Canfield						X			
OH	LTV-Cleveland	X	X	X	X		X			
OH	J & L-Louisville				X					
PA	USX-Drauosburg	X		X	X	X			X	X
PA	USX-Fairless Hills	X		X	X	X		X		
PA	Worthington-Malvern				X		X			
PA	Allegheny-Ludlum-Brackenridge	X	X	X	X					
PA	Allegheny-Ludlum-W. Leechburg				X					
PA	Allegheny-Ludlum-Bagdad				X					
PA	Rolling Mills-New Castle				X					
PA	Sharon-Farrell	X		X	X	X				
PA	Wheeling-Allenport				X					
PA	Carpenter-Reading	X	X	X	X					
PA	LTV-Aliquippa							X		
PA	Blair-New Castle				X					
RI	Worthington-Pawtucket				X					
SC	Worthington-Harmony				X					
TX	Lonestar-Lonestar	X			X					
UT	Geneva Steel-Geneva	X	X							
WV	Wierton-Wierton	X	X	X	X	X	X	X		

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

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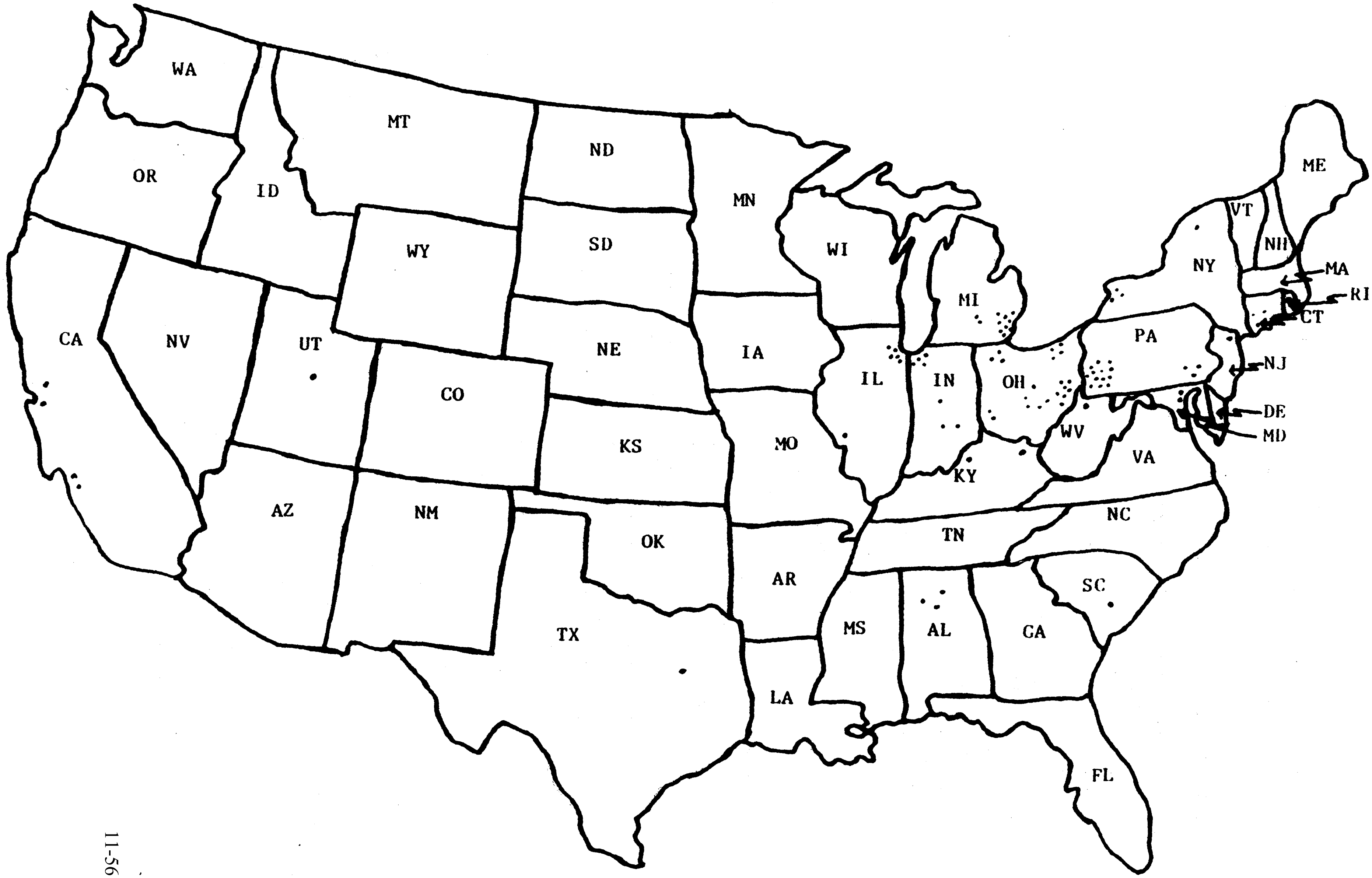
Table 11-17
Stainless steel: Location and nature of steelmaking operations, by states

State	Company-town	Slab via ingot	Continuous cast slab	Sheet and strip
CT	Allegheny-Ludlum-Wallingford.....	X		X
CT	Carpenter-Bridgeport	X		
IN	Haynes Int'l-Kokoma..............	X		X
IN	Allegheny-Ludlum-New Castle......			X
MI	J & L-Detroit....................			X
NY	Allegheny-Ludlum-Lockport........	X		
OH	Empire-Det-Mansfield.............	X		X
OH	Coshocton-Coshocton..............			X
OH	LTV-Canton.......................	X		
OH	J & L-Louisville.................			X
OH	Armco-Zanesville.................			X
OH	Cold Metal Prod.-Youngstown......			X
OH	LTV-Cleveland....................	X		
PA	Washington-Washington............			X
PA	Washinton-Houston................		X	X
PA	Armco-Bulter.....................		X	X
PA	Allegheny-Ludlum-Brackenbridge...	X	X	X
PA	Allegheny-Ludlum-W. Leechburg....			X
PA	Carpenter-Reading................	X	X	X
PA	J & L-Midland....................	X	X	X

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Note.--"X" indicates production of the product listed above.

Figure 11-13
Location of Domestic Steel Sheet and Strip Operations



Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

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Steel producers were asked what changes they anticipated would occur in their steelmaking capacity before 1990. Overall, net capacity decreases were indicated in three areas: coke ovens, steelmaking furnaces, and ingot teeming for carbon and alloy steel facilities (table 11-18). All other facilities showed net increases. The most common increases in capacity will occur through the restructuring of existing facilities, and the most common means of reducing capacity will be through permanent closures of facilities. However, new capacity is planned in a variety of stainless steel processes and in cold rolling, continuous annealing, pickling, and temper rolling. 1/

Utilization

To calculate capacity utilization rates the study used annual capacity estimates and actual annual production for 1986 (table 11-19). Since capacity changes on a yearly basis, calculations for 1986 were the only utilization rates that could be estimated from the data gathered through Commission questionnaires. Capacity is a function of many variables; for example, if a particular hot-dip galvanizing line happened to fill a lot of orders for heavier galvanized coatings in a certain year, the production capacity would be much lower because of the fact that it takes longer to apply a thick coat to a coil of steel than to apply a thin coat, hence less steel would have been coated, but the process could have been fully utilized.

A significant factor impacting capacity utilization rates in 1986 was a strike by employees of USX, the largest producer of steel sheet and strip, that lasted 184 days and involved 22,000 employees. There were also several other strikes, but on a much smaller scale. The combination of the strikes caused total production of steel sheet and strip to be lower than it would have been in 1986.

The lowest capacity utilization was in the electrogalvanizing facilities, where much of the capacity came on line in 1986. During initial startup of the lines, many problems resulting from equipment breakdown and breaking in the new equipment occurred. Operators of many electrogalvanizing lines have indicated that they are currently running at or above 90 percent of capacity. 2/

1/ For the time period 1984-86 the United States accounted for approximately 11 percent of world crude steel production and 15 percent of world sheet and strip production.

2/ "The New Galvanizing Lines are Running." Iron Age, March 1987.

Table 11-18
Anticipated changes in domestic sheet and strip steelmaking capacity by the end of 1990

Facilities	Net effect on domestic capacity	Expansion: Construct new facility	Reactivate mothballed facility	Add to existing facility	Restructure existing facility	Other	Reduction: Close facility	Dismantle facility	Sell facility	Other	Temporary closure
Carbon and certain alloy steel:											
Coke ovens	Decrease						X				X
Blast furnaces	Increase				X		X				X
Steelmaking furnaces	Decrease			X	X						X
Ingot teeming	Decrease						X	X			
Slabbing mills	Increase						X	X			
Continuous slab casting	Increase				X		X				
Hot-rolling mills	Increase				X					X	
Cold-rolling mills	Increase	X		X	X						
Batch annealing	Increase			X							
Continuous annealing	Increase	X									
Temper rolling	Increase	X									
Hot-dipped galvanized	Increase				X		X				
Pickling lines	Increase	X			X						
Stainless steel:											
Steelmaking furnaces	Increase				X	X					
Continuous slab casting	Increase				X	X					
Hot-rolling mills	Increase				X						
Pickling lines	Increase	X			X						
Cold-rolling mills	Increase	X			X	X					
Continuous annealing	Increase	X	X								

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

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Table 11-19
Utilization rates for selected processes in carbon, certain alloy steel, and stainless steel production, 1986

Item	Utilization rates
	Percent
Carbon and certain alloy tool steel:	
Slab via ingot	48.5
Continuous cast slab	66.6
Hot-rolled	56.0
Cold-rolled	62.5
Hot-dipped galvanized	86.4
Electrogalvanized	35.1
Stainless steel:	
Slab via ingot	10.8
Continuous cast slab	79.8

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Capacity utilization rates for January-June 1987 were estimated in a paper presented at a recent steel conference. As shown in table 11-20, utilization rates are higher than the utilization rates seen in 1986.

Table 11-20
Capacity utilization in various areas of steel sheet and strip production, January-June 1987 1/

Item	Class I	Class II	Class III	Total
Steelmaking: Flat product	81.0	74.0	60.0	75.0
Finished rolling:				
Hot-strip mills	81.0	73.0	66.0	73.0
Cold-reduction mills	82.0	78.0	61.0	71.0
Galvanizing lines	83.0	74.0	67.0	78.0
Tinplate lines	70.0	67.0	44.0	57.0

1/ Usable industry capacity, allocated by Donald Barnett (based on his own and other experts evaluations) into 3 categories. Ranking on Class I through Class III. Class I indicates, on a comparative basis, facilities capable of greater efficiency, lower cost and higher quality product, but does not necessarily imply first class facilities.

Source: Donald F. Barnett, "Battle for the U.S. Market: The Search for Value and Quality." June 24, 1987, a paper presented at Steel Survival Strategies II.

Imbalances of major steel plants

Imbalances at major steel plants arise when a modern piece of equipment is installed within a steel producing flow line that consists of older, less technically modern steelmaking equipment. An example is Bethlehem Steel's Sparrows Point plant that has a new continuous caster; because of an older hot-strip mill, Sparrows Point is unable to fully utilize the capabilities of the caster. Over time, such additions result in a facility that integrates equipment of varying ages and conditions. Although the U.S. steel sheet and strip industry's dependence on marginally competitive capacity has been greatly reduced, the remaining marginal facilities often support adjacent, viable facilities. This can preclude selectively eliminating outmoded facilities without first securing alternative operating support and reducing operational capacity. It also means that entire integrated plants cannot be closed without the loss of costly, viable facilities.

To become more competitive in U.S. and world markets, the U.S. steel sheet and strip industry will need to adjust these imbalances. However, the current economic conditions of the steel industry negates the possibility of building new, highly competitive "greenfield" plants that would allow the industry to produce high-quality, low-cost steel. Instead, the domestic industry will most likely continue making investments in piece-by-piece renewal of existing plants, which means the imbalances in major steel plants are likely to become a continuously shifting, but chronic problem.

Assessment of technology

A majority of the carbon and alloy steel sheet and strip producers responding to the Commission questionnaire felt that their continuously cast slabs, hot-dipped galvanized, and electrogalvanized coating facilities were highly competitive (table 11-21). They felt that coating lines, other than galvanizing, required modernization. On all other carbon and alloy facilities, producers took a moderate approach, indicating they felt the facilities were competitive. The producers of stainless steel sheet and strip felt that their steelmaking furnaces, continuous slab casters, pickling lines, and annealing facilities were all highly competitive and that all other facilities were competitive. The types of facilities judged most competitive were stainless continuous cast slab, stainless steelmaking furnaces, and carbon and alloy electrogalvanizing lines; the two least competitive were certain carbon and alloy coating lines and carbon and alloy batch annealing facilities.

In his paper presented to Steel Strategies II, Dr. Barnett discussed the current competitive status of the domestic steelmaking capacity. He estimated that the supportable capacity of the U.S industry is 82 million metric tons, which is an estimated 18 million metric tons below current capacity. He further noted that the naive assumption of many people is that if we simply reduce capacity by 18 million metric tons the long-term profitability of the U.S. steel industry will be restored. Barnett believes this is not necessarily true as not all U.S. capacity is competitive. In fact, he

Table 11-21
Domestic steel sheet and strip steelmaking capacity and competitive assessment of that capacity 1/

(In thousands of metric tons)

Type of facility	Highly competitive 2/	Competitive	Requires modernization 2/	Total Tonnage
Carbon and alloy:				
Coke ovens............	2	7	2	20,336
Blast furnaces........	2	7	2	49,540
Steelmaking...........	1	9	2	52,417
Ingot teeming.........	1	8	3	20,766
Slabbing mills........	1	10	1	36,287
Continuous cast slab..	6	4	1	30,954
Hot-rolling mills.....	2	7	3	55,906
Pickling lines........	3	6	3	43,307
Cold-rolling mills....	3	5	3	32,717
Batch annealing.......	2	6	4	25,163
Continuous annealing..	3	6	2	6,342
Temper rolling........	3	7	2	32,891
Galvanized steel:				
Hot-dip.............	5	5	2	7,176
Electrogalvanizing..	7	4	1	2,460
Electrotinning........	2	9	1	3,705
Tin-free steel........	4	7	1	1,503
Other coating.........	2	4	6	1,086
Stainless steel:				
Steelmaking furnaces..	9	2	1	741
Ingot teeming.........	2	9	1	571
Slabbing mills........	3/	3/	3/	3/
Continuous cast slab..	10	1	1	1,033
Hot-rolling mills.....	4	7	1	1,584
Pickling lines.......	6	4	1	930
Cold-rolling mills....	4	6	1	1,097
Annealing.............	7	4	1	1,570
Temper rolling........	1	10	1	590

1/ Table key is as follows showing percent respondants indicating this amount.

1 = 0-10%	2 = 11-20%
3 = 21-30%	4 = 31-40%
5 = 41-50%	6 = 51-60%
7 = 61-70%	8 = 71-80%
9 = 81-90%	10 =91-100%

2/ Highly competitive capacity includes modern, state-of-the-art facilities. Capacity that requires modernization includes facilities which are in need of substantial modernization to become fully competitive in the near term.
3/ Data are confidential.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

believes that only 30 percent is of a high quality. Table 11-22 illustrates how Barnett breaks down capacity. Capacity in Class I generally reflects facilities that use the newest steelmaking technology, such as continuous casters. 1/

Table 11-22
Capacity assessment of U.S. industry: 1987 1/
(In millions of metric tons)

Item	Class I	Class II	Class III	Total
Capacity: Flat product				
(carbon)....................	24.5	22.7	19.1	66.3
Finished rolling capacity:				
Hot-strip mills.............	19.1	16.8	24.0	59.9
Cold-reduction mills........	9.8	11.3	14.1	35.2
Galvanizing lines...........	6.4	3.2	1.4	11.0
Tinplate lines..............	0.9	2.7	2.7	6.3

1/ Usable industry capacity, allocated by Donald Barnett (based on his own and other experts evaluations) into 3 categories. Ranking on Class I through Class III. Class I indicated, on a comparative basis, facilities capable of greater efficiency, lower cost and higher quality product, but does not necessarily imply first class facilities.

Source: Donald F. Barnett, "Battle for the U.S. Market: The Search for Value and Quality." June 24, 1987, paper presented at Steel Survival Strategies II.

Profitability

The vast majority of U.S. carbon steel sheet and strip shipments are accounted for by the publicly owned integrated producers. An analysis of their profitability gives a good indication of the overall state of the profitability of the industry. In general the stainless steel sector, whose financial data were collected in a recent Commission report, 2/ is far more profitable than the integrated carbon steel sector. It is difficult to make generalizations about the nonintegrated carbon steel sector because of the lack of publicly available financial data. However, Worthington Industries, a nonintegrated producer, has consistently been the most profitable company in the U.S. steel sheet and strip industry based on information in the company's 1986 annual report.

1/ Currently approximately 55 percent of U.S. raw steelmaking capacity is continuously cast.
2/ Stainless Steel and Alloy Tool Steel, Investigation No. TA-203-16, USITC Publication 1975, May 1987.

Production costs

Production costs in the U.S. steel sheet and strip industry vary widely depending on the type of product (e.g., carbon steel sheet, stainless steel sheet) and the product mix within a particular category (e.g., tin-plate, galvanized sheet). Complicating the cost situation is the fact that some firms produce a wide range of sheet and strip products, some of which may have significantly different costs than others. Any attempt to generalize about production costs for the U.S. steel sheet and strip industry will not in any way indicate the actual costs for a particular company producing a particular product.

The most detailed analyses of production costs in the U.S. steel sheet and strip industry have been done by World Steel Dynamics 1/ and by Robert Crandall and Donald Barnett. 2/ An analysis done by Barnett and Crandall shows the cost of producing cold-rolled coil at a representative integrated steel mill operating at 90 percent of capacity in 1985 (table 11-23). This analysis, calculated by the authors based on short tons, is detailed in its coverage of the different cost components involved in the integrated process from the conversion of raw materials into steel through cold rolling.

A significant point to note about the cold-rolled sheet production cost analysis done by Barnett and Crandall is that labor and energy account for a much higher percentage of cost at the early stages of cold-rolled sheet production than they do at the finishing stages. For example, at the coke oven stage labor and energy account for about 40 percent of total coke production cost and at the cold-rolling stage labor and energy account for only 14 percent of the finished product cost. As seen in table 11-23, this is apparent because the actual amount of labor and energy used at each production stage is changing less than the increase in value added to the product. A company can therefore offset high labor and energy costs by eliminating facilities at the primary end of sheet production and concentrating its efforts on the higher value (i.e., finishing) end of production.

Factors other than high labor and energy costs have created an incentive to eliminate facilities at the primary end of steelmaking. For example, many steel mills that previously owned coke ovens have shut them down because they could not be profitably run in the light of strict environmental laws. As a result, many steel producers now purchase coke on the spot market or through long-term contracts from producers who maintained modern coke making facilities, thereby avoiding the maintenance and pollution control costs associated with coke ovens. The production costs for these producers would tend to be less than those suggested by the Barnett and Crandall analysis (to the extent that these costs exceed market prices for purchased material).

World Steel Dynamics has predicted that few integrated steel plants will be viable in the early 1990's unless they produce a flat-rolled steel product via continuous casting, which is estimated to save between $30 and $50 per metric ton on production costs. In 1986, U.S. steel sheet and strip producers

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1/ World Steel Dynamics, Steel Strategist No. 13, Mar. 30, 1987.
2/ Donald F. Barnett and Robert W. Crandall, Up From the Ashes: The Rise of the Steel Minimill in the United States, 1986.

Table 11-23
U.S. steel sheet and strip industry: Input per ton of output and operating cost to produce cold-rolled coil (at a capacity utilization rate of 90 percent), 1985

Item	Input per ton of output	Operating cost Per ton
Coke oven:		
Coal..................	1.56 tons @ $55.00	$85.80
Labor.................	0.85 man-hour @ $22.50	19.15
Electricity..........	30 kilowatt hours @ $0.045	1.35
Other energy.........	4.10 million Btus @ $4.50	18.45
Byproduct credit.....	9.00 million Btus @ $4.50	-40.50
Miscellaneous........	1/	12.15
Total coke cost....		96.40
Blast furnace:		
Iron ore.............	1.53 tons @ $40.00	61.20
Coke..................	0.53 ton @ $96.40	51.10
Labor.................	0.80 man-hour @ $22.50	18.05
Electricity..........	35 kilowatt hours @ $0.045	1.60
Other energy.........	2.6 million Btus @ $4.50	11.70
By-product credit....	4.0 million Btus @ $4.50	-18.00
Reserve, for re-lining............	1/	4.75
Miscellaneous 2/.....	1/	9.05
Total hot-metal cost............	1/	139.40
Basic oxygen furnace:		
Hot metal............	0.82 ton @ $139.40	114.30
Scrap................	0.29 ton @ $80.00	23.20
Labor.................	0.45 man-hour @ $22.50	10.15
Electricity..........	60 kilowatt hours @$0.045	2.70
Fluxes and additives..........	1/	11.75
Other additives......	1/	5.00
Supplies.............	1/	7.00
Miscellaneous........	1/	2.55
Total liquid steel cost.......	. . .	176.65

See footnotes at end of table.

Table 11-23--Continued
U.S. steel sheet and strip industry: Input per ton of output and operating cost to produce cold-rolled coil (at a capacity utilization rate of 90 percent), 1985

Item	Input per ton of output	Operating cost Per ton
Slab caster:		
Yield loss, from raw steel.............	0.025 ton @ $176.65	$4.40
Scrap credit.........	0.018 ton @ $80.00	-1.45
Labor................	0.45 man-hour @ $22.50	10.15
Electricity..........	30 kilowatt hours @ $0.045	1.35
Refractories.........	1/	5.00
Miscellaneous........	1/	6.00
Total slab caster cost............	1/	25.45
Ingot caster:		
Yield loss, from raw steel.............	0.030 ton @ $176.65	5.30
Scrap credit.........	0.021 ton @ $80.00	-1.70
Labor................	0.20 man-hour @ $22.50	4.50
Miscellaneous........	1/	7.50
Total ingot caster cost............	1/	15.60
Slab mill:		
Yield loss, from ingots............	0.15 ton @ $192.25	28.85
Scrap credit.........	0.105 ton @ $80.00	-8.40
Labor................	0.45 man-hour @ $22.50	10.15
Electricity..........	25 kilowatt hours @ $0.045	1.15
Other energy.........	1.10 million Btus @ $4.50	4.95
Miscellaneous........	1/	5.65
Total slab mill cost............	1/	42.35
Total average slab slab cost 3/.....	1/	223.25
Hot strip mill:		
Yield loss, from slab..............	0.050 ton @ $223.25	11.15
Scrap credit.........	0.035 ton @ $80.00	-2.80
Labor................	0.65 man-hour @ $22.50	14.65
Electricity..........	110 kilowatt hours @ $0.045	4.95
Other energy.........	2.15 thousand cubic feet @ $4.50	9.70
Miscellaneous........	1/	12.80
Subtotal...........	1/	50.50
Total hot-rolled coil cost........	1/	273.75

See footnotes at end of table.

Table 11-23--Continued
U.S. steel sheet and strip industry: Input per ton of output and operating cost to produce cold-rolled coil (at a capacity utilization rate of 90 percent), 1985

Item	Input per ton of output	Operating cost Per ton
Cold-finishing process:	4/	
Yield loss, from hot band	0.120 ton @ $273.75	$32.85
Scrap credit	0.084 ton @ $80.00	-6.70
Labor	1.63 man-hour @ $22.50	36.70
Electricity	170 kilowatt hours @ $0.045	7.65
Other energy	1.80 thousand cubic feet @ $4.50	8.10
Miscellaneous	1/	22.00
Subtotal	1/	100.60
Total cold-rolled coil cost	1/	374.35
Sales and overhead:		
Labor, shipping	0.30 man-hour @ $22.50	6.75
Labor, administration	0.45 man-hour @ $22.50	10.15
Miscellaneous	1/	11.00
Total sales and overhead	1/	27.90
Financial costs:		
Depreciation	1/	24.00
Interest	1/	12.00
Taxes	1/	7.20
Total financial cost	1/	43.20
Total cost of finished steel	1/	445.45
Addendum 5/	Man-hours per ton	5.75

1/ Not applicable.
2/ Includes sintering costs; assumes 25 percent of iron ore is sintered.
3/ Assumes 35 percent slab casting and 65 percent rolled ingots at a total average slab cost of $223.75.
4/ Picking, tempering, annealing, and cold rolling.
5/ Includes all labor, operating and administrative.

Source: Donald Barnett and Robert Crandall, Up From The Ashes.

produced a total of 38.2 million metric tons of carbon steel slabs of which 54 percent were continuously cast. 1/ Over 90 percent of the slabs produced by stainless steel sheet and strip producers during the same period were continuously cast. Continuous casting improves productivity by speeding up

1/ Based on data submitted in response to questionnaires of the U.S. International Trade Commission.

the overall sheet and strip production process and reducing the amount of labor required. In addition, continuous casting uses far less energy than the traditional ingot route to slab production and results in a higher quality steel that is preferred by many customers. As the percent of slabs produced by the continuous casting process increases, overall production costs in the sheet and strip industry will decrease. Table 11-24 shows additions to continuous slab casting capacity in the United States for the period 1983-88.

Table 11-24
U.S. steel sheet and strip industry: Continuous slab casting capacity additions, by company and plant, 1983-88

Year	Company	Plant	Capacity Million metric tons
1989	Armco	Ashland	0.6
1986	Bethlehem	Burns Harbor	2.0
1986		Sparrows Point	2.6
1986	Rouge	Dearborn	1.6
1986	Inland	Indiana Harbor	1.3
1983	LTV	Cleveland-East	1.6
1983		Indiana Harbor	2.8
1987	National	Great Lakes	1.8
1988	USS	Fairfield	1.8
1986		Gary	2.8
1984	Wheeling-Pittsburgh	Steubenville	1.8
Total			20.7

Source: World Steel Dynamics.

Some integrated steel producers have recently been purchasing slabs in lieu of melting their own steel due to a number of reasons. In some cases (e.g. Weirton Steel, National Steel) slab purchases are done on a temporary basis to keep a company's hot strip mill(s) in operation while blast furnaces are being relined or to meet increasingly strict quality requirements while more advanced technology (e.g. continuous casters, vacuum degassing facilities), necessary to produce the high quality steel, is being installed. In other cases, slab purchases are on a permanant basis due to the closure of primary steelmaking facilities (e.g. California Steel, Lone Star Steel). In situations where primary steelmaking facilities are permanantly closed, producers can achieve cost savings to the extent that they can avoid costly maintainence. 1/

Probably the most significant cost savings achieved by steel sheet and strip producers since 1985, when the Barnett and Crandall cost analysis was

1/ LTV Steel, according to the company's 1986 form 10-k report, estimated the cost of relining a blast furnace at its Indiana Harbor works to be approximately $114.5 million.

done, have been in the area of labor; the nature of these savings is discussed more fully in the employment section of this chapter.

An important issue with respect to production costs not covered in the Barnett and Crandall analysis is the recent emergence of reconstituted mills. The reconstituted producers are comprised of companies (or parts of companies) which have been sold or restructured through Chapter 11 bankruptcy proceedings. Between 1979 and March 1987 there were nine carbon steel producer companies in this category accounting for an estimated 16.1 million metric tons (or 25 percent) of total industry shipments of carbon steel in 1986. Of these nine companies, five are integrated steel sheet and strip producers and one, California Steel, is a nonintegrated sheet and strip producer. The six sheet and strip producers "reconstituted" since 1979 are listed in table 11-25. In addition, Sharon Steel Corp., the twelfth largest U.S. steel producer and a significant carbon steel sheet and strip producer, filed for Chapter 11 bankruptcy in April 1987.

Table 11-25
U.S. sheet and strip industry: Reconstituted companies, shipments, share of industry shipments, and current status, 1986

Company	Shipments	Percent of industry shipments 1/	Status
	Millions metric tons		
LTV Steel Co.	8.6	13.6	In Chapter 11.
Weirton Steel	2.2	3.4	Formerly part of National Steel.
Wheeling-Pittsburgh	2.0	3.1	In Chapter 11.
California Steel Co.	0.9	1.4	Formerly Kaiser Steel.
McLouth Steel Products	0.9	1.4	Formerly part of McLouth Steel Corp.
Gulf States Steel	0.6	1.0	Formerly part of LTV.
Total	15.2	23.9	

1/ All carbon steel products.

Source: World Steel Dynamics, Steel Strategist No. 13, Mar. 30, 1987, and Commission staff.

With respect to the cost savings that can be realized by reconstituted companies, World Steel Dynamics estimates that such a company could, while in Chapter 11, reduce average pre-tax costs by 25 percent to about $373 per metric ton, or approximately $123 per ton below that of other major competitors. 1/ Of the $123 reduction, about 50 percent would result from decreased employment costs; 2/ the balance of cost reductions would occur in

1/ World Steel Dynamics, Steel Strategist No. 13, Mar. 30, 1987, p. 16.
2/ This assumes the reduction of man-hours per metric ton shipped from 7.0 to 5.8 and a reduction in the THEC from $22.50 to $16.50.

materials and energy costs, and decreased financial costs (i.e., depreciation, state and local taxes, and interest expenses). The reductions would be achieved through the release of contractual obligations; renegotiation of electricity and natural gas rates; the negating of interest obligations through Chapter 11 procedures; and the reduction of non-cash charges such as depreciation expenses. By far the most significant of the reconstituted companies is LTV Steel, whose specific production costs, and savings achieved while in Chapter 11 are discussed in more detail under the section of this chapter entitled "Employment, unit hourly labor costs, and productivity."

Table 11-26 shows the maximum cost variation between an established and reconstituted mill that has been through Chapter 11 bankruptcy. Although the data are generalized for all steel products it does provide a good sense of where the cost savings occur and the relative magnitude of those savings.

The competitive position, in terms of cost, of U.S. steel sheet and strip producers changed significantly when LTV Steel, the second largest producer in the United States, declared Chapter 11 bankruptcy in July of 1986. Through cost savings achieved as a result of being in Chapter 11, LTV Steel went from being a relatively high-cost producer, to being a low-cost producer. The tabulation below compares the production costs in dollars per metric ton for class I cold-rolled steel (and all of the intermediate products) for a typical integrated producer, for LTV Steel both before and after the Chapter 11 filing, and for a typical reconstituted mill:

	Typical U.S. Major	LTV Before	LTV After	Reconstituted U.S. Mill
Iron Ore..........	40	42	34	43
Met Coal..........	55	61	50	45
Hot Metal.........	154	163	136	154
Liquid Steel......	198	207	181	190
Slab..............	237	243	206	220
H.R. Coil.........	314	324	280	298
C.R. Coil.........	402	416	360	380
S.G.&A............	35	35	26	24
Financial.........	51	62	32	31
Total Pretax Cost for cold-rolled coil.....	488	508	419	435
Before Financial..	438	446	387	405

Source: World Steel Dynamics, Steel Strategist #13, March 30, 1987.

The above data assume that a typical reconstituted mill is located in the Pittsburgh region, where coal costs are relatively low. Being located in the Great Lakes area, LTV would face relatively higher coal costs but would benefit from lower iron ore costs.

Table 11-26
U.S. steel industry: Maximum cost variation between an established and a reconstituted plant

	Established major plant	Reconstituted plant out of bankruptcy	Savings per ton/ shipped	Comment
Operating rate (percent)..	75	80	1/	1/
Wage per hour (all benefits)....	$22.5	$16.5	$-6	About 25 percent lower.
Man-hours per metric ton shipped.......	7.0	5.8	-1.2	Improved work rules.
Employment cost/per metric ton shipped...........	$157	$96	-61	The major savings.
Iron ore: price/ per metric ton....	$48.0	$38.0	1/	1/
usage/metric ton..	1.60	1.60		
cost/metric ton shipped...........	$77	$61	$-16	Buys in the spot market.
Metallurgical coal..	$52	$47	$-5	Purchases in "spot" market.
Steel scrap.........	$11	$11	-	
Energy.............	$63	$58	$-5	Can renegotiate electricity and natural gas contracts.
Fluxes, alloys, additions.........	21	21	-	1/
Refractories and rolls............	15	15	-	1/
Miscellaneous materials and SG&A expense......	$49	$45	$-4	Somewhat lower SG&A expense.
State and local taxes............	$8	$4	$-4	Municipalities collect lower taxes.
Depreciation expense...........	$29	$10	$-19	A non-cash charge.
Interest expense....	$14	$5	$-9	Creditors lose.
Pretax cost.........	$496	$373	-123	Lower cost inputs are the key, despite older equipment.
Operating cost (excluding, deprec. & misc. taxes)......	$445	$354	$-87	Lower by 20 percent.
Fixed costs 2/......	$97	$69	$-47	Down 29 percent.

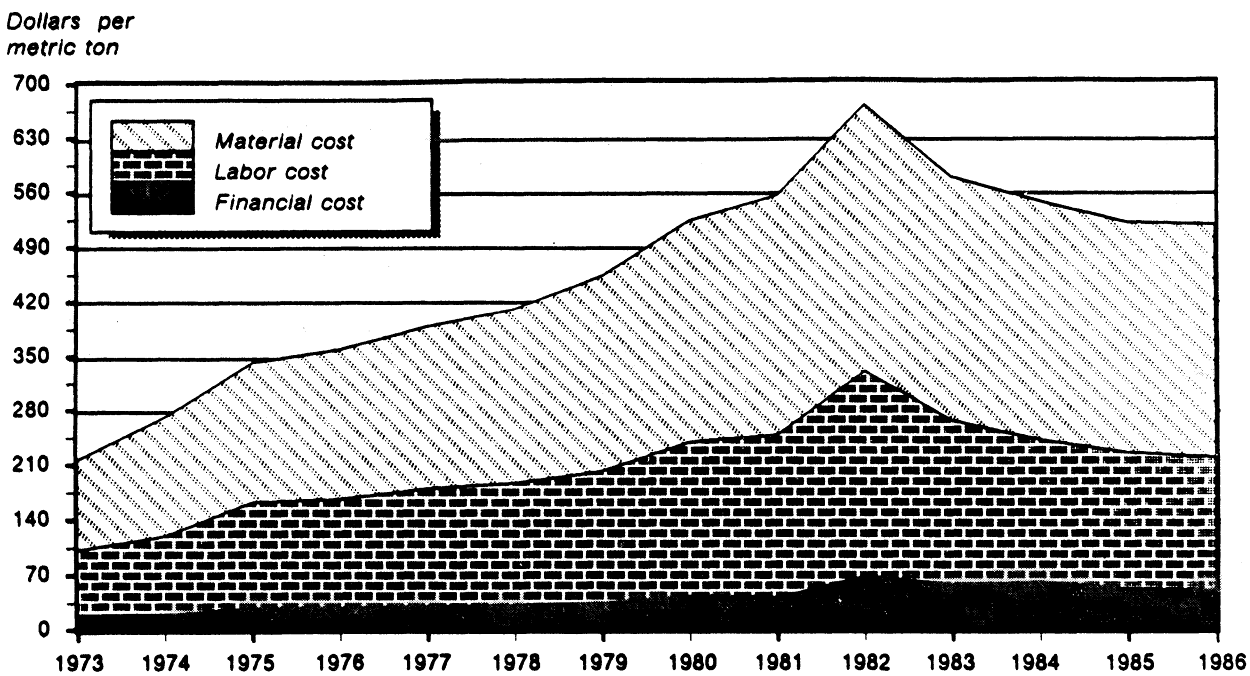
1/ Not applicable.
2/ Fixed costs are considered to be 33 percent of employment costs, 7 percent of material costs and 100 percent of financial costs (including State and local taxes).

Source: World Steel Dynamics.

For use in international cost comparisons, World Steel Dynamics has a model that estimates the U.S. steel industry's production costs broken down by material cost, labor cost, and financial cost, over time. The cost estimates derived by this model pertain to 16 different steel mill products, including flat rolled products, long products (e.g. wire rod and structurals) and pipes and tubes. The model is based on a composite of the average integrated firm producing steel via the BOF and open-hearth methods and provides a good indication of the relative changes in production costs over time.

Figure 11-14, which is based on data from the World Steel Dynamics cost model, plots the total annual U.S. production costs per metric ton of steel product shipped during 1973-86 at actual operating rate, and the various components of that cost (i.e., material, labor and financial costs). As shown in figure 11-14, the production cost per metric ton shipped by the U.S. steel industry peaked in 1982 after increasing steadily since 1973. Production costs have fallen since 1982, but, as shown in the figure, labor costs have declined even more relative to material costs while financial costs have leveled off at around their 1982 level.

Figure 11-14
Steel mill products: U.S. steel industry costs (at actual operating rate) per ton shipped, 1973-86



Source: World Steel Dynamics.

World Steel Dyanmics has converted its cost estimates for all steel mill products into estimates based on only hot-rolled products like sheet and plate. In general, the cost estimates based on all steel products are higher than those for hot-rolled products. The tabulation below shows the World Steel Dynamics cost model estimates for U.S. hot rolled products production costs (i.e., plates, sheets, and strip) per metric ton shipped during early 1987.

	U.S. dollars per metric ton shipped (except where noted)	Percent of total pretax costs
Labor:		
Man-hours (per ton).......	3.7	1/
Emp. cost (per man-hour)..	23.0	1/
Emp. cost (per ton).......	85	25.4
Materials:		
Major.....................	149	44.6
Other.....................	61	18.3
Material cost (per ton)...	210	62.9
Financial:		
State & local taxes.......	7	2.1
Depreciation expense......	21	6.3
Interest expense..........	11	3.3
Financial cost/ton........	39	11.7
Total pretax costs..........	334	100.0

1/ Not applicable.

Source: World Steel Dynamics.

The above calculation by World Steel Dynamics assumes an operating rate of 60 percent. 1/ The major materials, which make up 45 percent of total pretax costs, include iron ore, coking coal, scrap, and energy.

The World Steel Dynamics cost estimates for the steel sheet and strip industry do not include stainless steel sheet and strip, but the annual surveys concerning competitive conditions in the steel industry done by the Commission in connection with the President's National Policy for the steel industry do provide some insight. Data from the past three periods covered in the Commission surveys indicates that production costs for stainless steel are higher than for any carbon steel sheet and strip products (table 11-27).

1/ The actual operating rates in 1987 for U.S. sheet and strip producers are not available but questionnaire data submitted to the Commission indicates that the utilization rate for hot-rolled sheet and strip in the United States was 56 percent in 1986.

Table 11-27
U.S. steel sheet and strip industry: Production costs, by product line, for the period July 1-June 30 of 1984-85, 1985-86, and 1986-87

Sheet and strip products	July 1, 1984-June 30, 1985	July 1, 1985-June 30, 1986	July 1, 1986-June 30, 1987
	Per metric ton		
Hot-rolled	$ 417	$ 391	$ 414
Cold-rolled	540	498	547
Galvanized	646	549	532
Other 1/	662	626	691
Stainless	1,797	1,881	1,617

1/ Primarily tinplate and aluminized steel.

Source: Numbers derived from data presented in various editions of Annual Survey Concerning Competitive Conditions in the Steel Industry and Industry Attempts to Adjust and Modernize, USITC Investigation No. 332-209.

The higher costs of stainless steel sheet and strip production are primarily a function of the alloying elements necessary to produce stainless steel (i.e., nickel, molybdenum, chromium, and manganese) and the more stringent performance requirements for the steel itself. Historically, the two key alloying elements necessary for stainless steel production, nickel and chromium, and stainless steel scrap, have experienced significant price declines. More recently, though, scrap nickel and chromium prices have been increasing.

Per ton profitability

Although stainless steel has the highest cost per ton of the major sheet and strip products, it also generates the largest amount of revenue and profits. Since July 1, 1984, stainless steel sheet and strip production for the U.S. industry has been consistently more profitable than hot-rolled, cold-rolled, galvanized, and other types of sheet and strip products (mostly tin plate and other coated steel plated with zinc-aluminum coating). Of the period covered by the Commissions annual survey July 1, 1986 through June 30, 1987 were by far the most profitable for stainless steel sheet and strip producers (table 11-28).

Table 11-28
U.S. steel sheet and strip industry: Revenue generated, by product line, for the periods July 1-June 30 for 1984-85, 1985-86, and 1986-87

Sheet and strip products	July 1, 1984-June 30, 1985	July 1, 1985-June 30, 1986	July 1, 1986-June 30, 1987
	Per metric ton		
Hot-rolled	$ 392	$ 346	$ 349
Cold-rolled	537	489	494
Galvanized	675	584	610
Other 1/	681	655	654
Stainless	1,920	1,955	1,857

1/ Primarily tinplate and other coated steel.

Source: Numbers derived from data presented in various editions of Annual Survey Concerning Competitive Conditions in the Steel Industry and Industry Attempts to Adjust and Modernize, USITC Investigation No. 332-209.

As shown by the above table the revenue generated per ton shipped declined for every sheet and strip product between the 1984 and 1985 period and the 1986 and 1987 period. The largest decline occurred in the hot-rolled sheet and strip area.

The profit situation is significantly different for the various sheet and strip products. Based on the profit-and-loss data collected by the Commission for sheet and strip products, hot rolled carbon sheet and strip have consistently been the unprofitable and stainless has been the most profitable (table 11-29).

Table 11-29
U.S. steel sheet and strip industry: Profit or (loss), by product line, for the period July 1-June 30 of 1984-85, 1985-86, and 1986-87

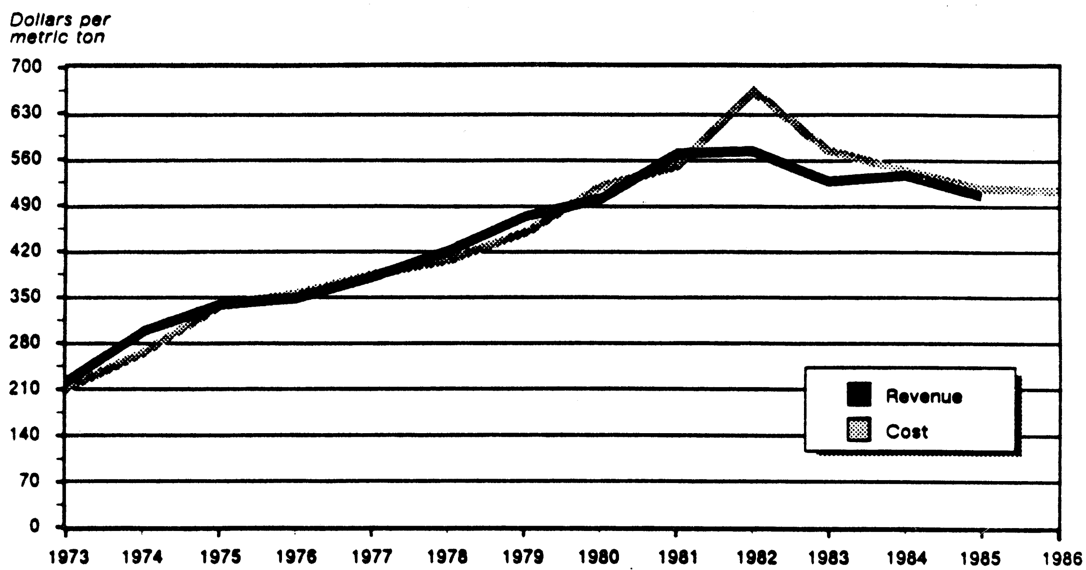
Sheet and strip products	July 1, 1984-June 30, 1985	July 1, 1985-June 30, 1986	July 1, 1986-June 30, 1987
	Per metric ton		
Hot-rolled	$-25	$-45	$-65
Cold-rolled	-3	-9	-53
Galvanized	29	35	78
Other 1/	19	29	-37
Stainless	123	74	240

1/ Primarily tinplate and other coated steel.

Source: Numbers derived from data presented in various editions of Annual Survey Concerning Competitive Conditions in the Steel Industry and Industry Attempts to Adjust and Modernize, USITC Investigation No. 332-209.

The lack of profitability for hot-rolled sheet and strip shown by Commission data is consistent with revenue and cost data for hot-rolled product generated by World Steel Dynamics. As shown in figure 11-15, which is constructed from the World Steel Dynamics cost model discussed previously, revenues from shipments (a weighted average of all products) in the United States have not exceeded costs since 1981.

Figure 11-15
Steel mill products: U.S. steel industry pretax cost (at actual operating rate) and revenue per ton shipped, 1973-86



Source: World Steel Dynamics.

There are a number of reasons why stainless steel sheet and strip production is more profitable than other carbon steel products. First stainless steel producers do not face the enormous capital costs associated with blast furnaces and coke ovens since their steel is melted in electric furnaces. Second, producers of flat-rolled stainless steel currently continuously cast more than 90 percent of their products, a much higher percentage than flat-rolled carbon steel producers. Third, wage rates in the stainless steel sector, which are similar to the wages received in the carbon steel industry, account for a much smaller share of total production cost than they do for carbon steel production.

Financial analysis

The majority of carbon steel sheet and strip shipments are accounted for by the large integrated producers, all of whom publish financial data in the form of annual reports and form 10-K's. World Steel Dynamics has assembled this information and has derived profitability figures on steel operations as well as other nonsteel activities the companies may be involved in. This data, shown in table 11-30, is for all steel products not just sheet and strip. The percent of total 1986 steel shipments from each company accounted for by sheet and strip was: 63 percent for Weirton, 78 percent for Armco, 71 percent for Inland, 79 percent for LTV, 100 percent for National, and 72

Table 11-30
Integrated carbon steel sheet and strip producers: Selected financial data, by company, 1/, 1984-March 1987

Company	Total steel operations: Steel shipments	Market share	Operating profit	Total operating profit	Non-steel operating profit	Other income	Nonrecurring items	Profit before interest and tax	Interest expense	Pretax profit	Taxes 2/	Net income
	Million short tons	Percent	Per short ton	Million dollars								
USX (U.S. Steel)												
1984	12.12	16.4	0	3	1,383	480	212	2,078	1,019	1,059	566	493
1985	12.52	17.1	-3	-32	1,669	275	202	2,114	903	1,711	614	597
1986	8.53	12.2	-67	-571	-232	115	-931	-1,619	830	-2,449	-616	-1,833
January-March 1987	0.50	2.9	-479	-238	154	9	57	-18	170	-188	-91	-97
Bethlehem												
1984	8.90	12.1	-17	-151	25	84	67	25	112	-87	26	-113
1985	8.82	12.1	-15	-128	34	25	14	-54	106	-161	35	-196
1986	8.47	12.1	-13	-107	-45	23	115	-14	126	-140	13	-153
January-March 1987	2.34	13.8	19	45	-29	10	37	62	34	28	3	26
Armco												
1984	4.60	6.2	3	16	-150	89	-71	-116	179	-295	0	-295
1985	4.37	6.0	20	88	14	38	30	170	117	52	7	45
1986	4.20	6.0	14	57	-8	7	-445	-389	79	-468	5	-472
January-March 1987	1.19	7.0	23	27	-1	1	47	75	21	54	2	53
Inland												
1984	5.00	6.8	5	23	33	0	-29	27	62	-35	6	-41
1985	4.70	6.4	-9	-44	45	0	-114	-114	65	-179	0	-178
1986	4.88	7.0	2	11	13	0	69	93	72	21	2	19
January-March 1987	1.24	7.3	11	14	16	0	50	80	17	63	0	63
LTV												
1984	8.30	11.3	-27	-224	105	43	-78	-154	251	-405	-27	-378
1985	10.68	14.6	-24	-253	126	49	-324	-403	319	-772	2	-724
1986	9.23	13.2	7	65	-455	33	-2,699	-3,056	205	-3,261	-9	-3,252
January-March 1987	2.54	14.9	39	99	37	10	52	198	10	3/	3/	130
Nat. Inter-group (National Steel)												
1984	4.50	6.1	2	10	65	36	-17	89	72	17	3	14
1985	4.41	6.0	-13	-59	-24	37	71	39	54	-15	1	-15
1986	4.49	6.4	-8	-35	21	-19	-20	-10	76	-86	2	-88
January-March 1987	1.19	7.0	-13	-15	9	4	0	11	26	-15	0	-15

1/ These 6 companies accounted for 74 percent of total hot-rolled, cold-rolled, and galvanized steel sheet and strip shipments in 1986.
2/ A negative tax figure indicates a credit.
3/ Not available.

Source: World Steel Dynamics, Steel Profit Outlook, May 21, 1987.

percent for USX. 1/ Sheets, strip, and tin mill products accounted for 48.8 percent of Bethlehem's sales in 1986. 2/

There is no distinct pattern in profitability for the six firms shown in table 11-30 between 1984 and 1986. Some companies were profitable in one year then became unprofitable in the following year (e.g., USX, Armco, and National Steel are in this category). Others such as LTV and Bethlehem have shown consistently negative earnings during the period 1984-86. LTV Steel lost $3.3 billion in 1986 (during which the company filed for Chapter 11), which was the largest single loss of any company during the period covered. As a result of a strike by the United Steelworkers against U.S. Steel, USX lost $1.8 billion in 1986. The strike at USX, the largest domestic steel producer, lasted into the first quarter of 1987. The company produced no steel in January, accounting for a decrease in USX's market share and profitability and partly accounting for the increased market share and profitability of Bethlehem, Armco, Inland, 3/ and LTV. National Steel increased its market share in the first quarter of 1987 but remained unprofitable.

Beginning in the first quarter of 1987 all of the companies shown in table 11-30 showed positive earnings. A factor that weighted heavily in the increased profitability was the Tax Reform Act of 1986. According to the new tax law large integrated steel producers are entitled to receive 50 percent of investment tax credit carryforwards as a one time cash payment from the Federal Government to compensate the companies for the repeal of the investment tax credit. The payments are to be received in January 1988 but many companies chose to record some portion of their estimated refund in each quarter of 1987. The amount of nonrecurring items that was directly accounted for by the tax refund was $50 million for Inland, $42 million for Armco, $32 million for Bethlehem, and $18 million for National. 4/ LTV showed profitability during January-March 1987 primarily because of cost savings achieved under Chapter 11, especially in the area of pension liabilities and interest expense.

The large integrated steel sheet and strip producers continued to be profitable in the second quarter of 1987. Table 11-31 shows steel shipments, sales and earnings for various integrated steel sheet and strip producers for the second quarter of 1986 and 1987.

1/ Company annual reports.
2/ Ibid.
3/ During the public hearing held on Feb. 24, 1987, Mr. T. Andrew Ellwein of Inland Steel Co. stated: "The strike at USX had some effect on improved realizing prices in the fourth quarter (of 1987). As far as volume, Inland Steel Company in the sheet area was operating at near capacity operations, so that we really didn't get any benefit from volume." Transcript at p. 331.
4/ "First Quarter Earnings: Steel Gets a Tax Check," Iron Age, June 1987, p. 29.

Table 11-31
U.S. steel sheet and strip industry: Steel shipments, sales, and earnings or (loss) for specified companies, April 1-June 30 1986 and April 1-June 30, 1987

Company	Steel shipments 1/		Sales 2/		Earnings (loss) 2/	
	April 1, 1986- June 30, 1986	April 1, 1987- June 30, 1987	April 1, 1986- June 30, 1986	April 1, 1987- June 30, 1987	April 1, 1986- June 30, 1986	April 1, 1987- June 30, 1987
USX 3/........	2.69	1.95	1,300	875	-59	37
LTV...........	2.18	2.26	1,167	1,219	-1.2	85.6
Bethlehem.....	1.97	2.06	1,109	1,128	-23.8	46.8
Inland........	1.14	0.998	559	525	31.3	4.7
Armco.........	0.980	1.12	658	720	-384.7	36.2
National......	0.990	1.11	531	616	-4.6	18.4
Weirton.......	0.515	0.597	278	322	10.0	35.7
Wheeling-Pittsburgh..	0.558	0.533	245	259	-60.3	39.3
Acme..........	4/	4/	57	85	0.95	4.7

1/ In millions of metric tons.
2/ In millions of dollars.
3/ Numbers are for U.S.S. division and related resources of USX Corp.
4/ Not available.

Source: "Largest Integrated Steel Producers Report Profitable Second Quarter," American Metal Market, Aug. 13, 1987, p. 1, and company quarterly reports.

Financial ratios are often useful for analyzing the financial position of companies. Table 11-32 shows cost of goods sold, operating profit, and net income as a percent of net sales for the top seven integrated carbon steel sheet and strip producers during the period 1984-86.

Weirton Steel, an employee-owned producer whose main product lines are tin-mill products, has consistently been the most profitable integrated sheet and strip producer. LTV Steel was consistently the least profitable, based on its operating profit margin and earnings as a percent of sales. The lowest profit margin for any of the producers during the period covered was for LTV, which had a net profit margin of a negative 40 percent in 1986.

A company's financial performance can also be measured by its return on total assets and return on equity. The following tabulation, derived from the Company Annual Reports, shows the return on total assets (ROA), and the return on equity (ROE) for seven integrated producers. ROA is defined as net income as a percent of total asset value. ROE is net income as a percent of

Table 11-32
U.S. steel sheet and strip industry: Cost of goods sold, operating profit, and net income as a percent of net sales, by specified companies, 1984-86

Company and year	Cost of goods sold	Operating profit	Net income
	percent		
Armco:			
1984	90	-1	-7
1985	90	3	1
1986	90	-11	-18
Bethlehem:			
1984	90	-1	-2
1985	90	0.1	-4
1986	90	-0.1	-4
Inland:			
1984	90	4	-1
1985	90	-2	-10
1986	90	3	1
LTV:			
1984	90	-5	-5
1985	90	-9	-9
1986	90	-40	-40
National:			
1984	90	2	1
1985	90	-3	-4
1986	90	-1	-3
USX:			
1984	70	8	3
1985	70	8	2
1986	70	-10	-12
Weirton:			
1984	90	8	6
1985	90	7	5
1986	90	6	4
Wheeling-Pittsburgh:			
1984	92	-6	-6
1985	107	-24	-45
1986	82	-27	-27
Acme Steel Company:			
1984	89	5	3
1985	95	-1	-0.5
1986	94	-9	-9
Worthington Industries:			
1984	83	10	5
1985	82	11	6
1986	82	11	6

Source: Company annual reports.

shareholder's equity minus the value of preferred stock, as shown in the following tabulation:

Company and year	ROA	ROE
Armco:		
1984	-8.2	-31.3
1985	1.5	5.3
1986	-18.7	-111.4
Bethlehem:		
1984	-2.6	-12.1
1985	-4.1	-24.9
1986	-3.3	-24.5
Inland:		
1984	-1.6	-3.9
1985	-6.8	-20.2
1986	0.8	1.8
LTV:		
1984	-5.5	-27.9
1985	-11.5	-113.0
1986	-59.1	1/
National:		
1984	1.2	3.1
1985	-5.1	-15.0
1986	-3.6	-11.3
USX:		
1984	2.6	10.1
1985	2.8	8.8
1986	-8.4	-38.7
Weirton:		
1984	12.6	100.00
1985	11.9	60.2
1986	8.2	34.3
Wheeling-Pittsburgh:		
1984	-5	-19
1985	-29	-6
1986	-28	2/
Acme Steel Co.:		
1984	37	3/
1985	-1	-1
1986	-12	-19
Worthington Ind.:		
1984	4/ 9	5/ 19
1985	4/ 10	5/ 20
1986	4/ 10	5/ 19

1/ In 1986, LTV had a retained earnings figure of -$4,132.9 million making the company's equity a negative number.
2/ Not relevant because both net income and shareholders equity were negative.
3/ During 1984 Acme Steel was a division of Interlake, Inc., and no figures for shareholders equity are available.
4/ Return on average total assets.
5/ Return on average shareholders equity.

The profitability of stainless steel sheet and strip producers as a whole was examined in a recent Commission report. 1/ The financial data on stainless steel sheet and strip producers obtained in this report is shown in table 11-33.

Income-and-loss data were received from 10 U.S. producers on their stainless sheet and strip operations. The reporting producers together accounted for 100 percent of U.S. producers' shipments in 1986. Total net sales of stainless steel sheet and strip increased by 15 percent from $1.2 billion in 1983 to $1.4 billion in 1984 and then declined steadily to $1.3 billion in 1985 and $1.2 billion in 1986, a drop of 14 percent from the 1984 level of sales.

U.S. producers' operations on stainless steel sheet and strip were profitable throughout the period of investigation. Aggregate operating income increased by 72 percent, from $104 million in 1983 to $179 million in 1984, and then declined by 50 percent to $89 million in 1985. In 1986, such income rose to $155 million despite decreasing sales. The ratio of operating income to net sales rose from 8.4 percent in 1983 to 12.6 percent in 1984, dropped to 6.6 percent in 1985, and then increased to 12.7 percent in 1986. The pretax net income margin followed a trend similar to that of the operating income margin.

Cash-flow from operations increased from $109 million in 1983 to $180 million in 1984 and then declined to $88 million in 1985. Such cash-flow rose to $154 million in 1986. Two of the 10 reporting firms sustained operating losses in 1983 and 1985, whereas only 1 firm reported such losses in 1984 and 1986.

1/ Stainless Steel and Alloy Tool Steel, Investigation No. TA-203-16, USITC Publication 1975, May 1987.

Table 11-33
Stainless steel sheet and strip: Income-and-loss data of 10 U.S. producers on their operations, 1/ 1983-86

Item	1983	1984	1985	1986
Net sales:				
Trade (million dollars)	1,224	1,403	1,328	1,204
Intra-Intercompany transfers (million dollars)	10	13	19	13
Total net sales (million dollars)	1,234	1,416	1,347	1,217
Cost of goods sold (million dollars)	1,088	1,190	1,201	1,017
Gross profit or (loss) (million dollars)	146	226	146	200
General, selling, and administrative expenses (million dollars)	42	47	57	45
Operating income or (loss) (million dollars)	104	179	89	155
Interest expense (million dollars)	16	15	16	15
Other income or (expense), net (million dollars)	[illegible]	(5)	(9)	(8)
Net income or (loss) before income taxes (million dollars)	88	159	64	132
Depreciation and amortization expense included above (million dollars)	21	21	24	22
Cash flow or (deficit) from operations 2/ (million dollars)	109	180	88	154
As a share of net sales:				
Gross profit or (loss) (percent)	11.8	16.0	10.8	16.4
Operating income or (loss) (percent)	8.4	12.6	6.6	12.7
Net income or (loss) before income taxes (percent)	7.1	11.2	4.8	10.8
Cost of goods sold (percent)	88.2	84.0	89.2	83.6
General, selling, and administrative expenses (percent)	3.4	3.3	4.2	3.7
Number of firms reporting:				
Operating losses	2	1	2	1
Net losses	3	1	2	0

1/ Reporting firms accounted for 100 percent of U.S. shipments in 1986.
2/ Defined as pretax net income or (loss) plus depreciation and amortization expense.

11-82

Source: Stainless Steel and Alloy Tool Steel, Investigation No. TA-203-16, USITC Publication 1975, May 1987.

Table 11-34, which lists the 5-year average and 1986 return on equity (ROE) and the net profit margin (i.e., net income as a percent of sales) for various industries, is provided to help put the profitability of the U.S. sheet and strip industry into perspective.

Table 11-34
U.S. steel sheet and strip industry: 5-year average and 1986 return on equity (ROE) and net profit margin

(In percent)

Item	ROE 5-year average	ROE 1986 1/	Net profit margin 1/
Aerospace and defense..........	14.9	12.3	3.9
Banks..........................	15.0	15.5	7.8
Beverages and tobacco..........	21.9	18.2	6.5
Chemicals......................	11.8	10.9	4.3
Media..........................	19.1	20.9	7.3
Consumer products..............	12.7	13.6	4.5
Electric utilities.............	14.3	14.5	13.1
Food distributors..............	17.0	13.0	1.2
Drugs and health care..........	19.3	15.6	8.3
Natural gas....................	14.0	11.3	4.8
Automobiles and trucks.........	6.0	6.8	2.7
Heavy equipment................	5.7	6.7	2.2
Metals (steel).................	2/	-2.5	2/
All industry...................	12.6	13.0	3.9

1/ Industry medians.
2/ Listed in Forbes as a deficit, but no actual number given.

Source: Forbes, Jan. 12, 1987.

As can be seen in table 11-34 during 1986, the steel industry ranked far below any other major U.S. industry in terms of ROE and net profit margin. The number listed for 1986 steel industry ROE is actually higher than for the integrated sheet and strip producers because it includes some relatively profitable minimills that do not produce sheet and strip. The average ROE for the top integrated U.S. sheet and strip producers, not including LTV and Wheeling-Pittsburgh, 1/ in 1986 was -25.0 percent, and the average net profit margin for these companies (including LTV and Wheeling-Pittsburgh) was -12.4 percent. Stainless steel sheet and strip producers fared much better.

1/ Armco, Bethlehem, Inland, National, USX, and Weirton.

Capital Expenditures

Since the twelve month period beginning July 1, 1984, capital expenditures in most areas of steelmaking have declined. Total capital expenditures in the 3-year period shown in table 11-35 have declined at an average annual rate of 36 percent. Only in the area of sheet and strip was there an increase between the 1984-85 and the 1985-86 time periods.

During the past 3 years, over 50 percent of all capital expenditures have been in the primary steelmaking area. This is largely due to the installation of new continuous casting capacity and ladle metallurgy systems. In 1986, 11 continuous casters and 13 ladle metallurgy systems were installed. These two types of facilities have the ability to produce higher quality semifinished steel products more economically. 1/

The increased expenditures in the sheet and strip operations in the 1985-86 time period is partially a reflection of the increased demand for electrogalvanized sheet and strip. In this time period, five electrogalvanizing lines were installed. 2/

Although capital expenditures declined significantly in the last 3 years, sales of steel products have only declined at an average annual rate of 3.1 percent (table 11-35). In the past year sales of steel products increased in all areas except in carbon and certain alloy products, which showed a slight decline.

The ratio of capital expenditures in a certain product area to sales in that area, were as follows:

Item	1984-85	1985-86	1986-87
Sheet and strip..................	1.6	3.0	1.3
All other products...............	6.7	3.3	1.8
Total products 1/................	8.5	6.6	4.4

1/ Including expenditures in primary steelmaking facilities.

The largest revenue source, sheet and strip products, had a smaller ratio of capital expenditures to sales than all other products. As mentioned previously, however capital expenditures on primary steelmaking has consistently been relatively high, which explains why the overall ratio of expenditures to product sales exceeds the product specific expenditures by a significant margin.

Most domestic steel sheet and strip capacity was installed over 30 years ago when the steel industry was more profitable. Steel producers could afford to install state-of-the-art equipment newly introduced to the industry.

1/ "Operation Bootstrap: Steel Spending . . . Despite Hard Times," Iron Age, Sept. 5, 1986.
2/ Ibid.

Table 11-35
Capital expenditures and net sales for steel sheet and strip, July 1, 1984-June 30, 1987

	July 1, June 30, 1984-86		July 1-June 30, 1985-86		July 1-June 30, 1986-87		Percentage change	
	Value	Percent of total	Value	Percent of total	1985-86 Value	Percent of total	1984-85 to 1985-86	1985-86 to 1986-87
	1,000 dollars		1,000 dollars		1,000 dollars			
Capital expenditures:								
Carbon and certain alloy steel:								
Primary steel-making.......	1,378,840	54.5	1,010,007	53.1	790,049	64.2	-26.7	-21.8
Sheet and strip.......	231,255	9.1	496,422	26.1	196,285	16.0	114.7	-60.5
All other products 1/..	788,058	31.1	315,229	16.6	186,759	15.2	-60.0	-40.8
Stainless steel:								
Primary steel-making.......	51,567	2.0	27,985	1.5	23,107	1.9	-45.7	-17.4
Sheet and strip.........	36,048	1.4	25,220	1.3	24,336	2.0	-30.0	-3.5
All other products 1/..	44,392	1.8	27,202	1.4	33,605	2.7	-38.7	23.5
Total primary making.........	1,430,407	56.5	1,037,992	54.6	813,156	66.1	-27.4	-21.7
Total sheet and strip..........	267,303	10.6	521,642	27.4	220,621	17.9	95.2	-57.8
Total other products 1/....	832,450	32.9	342,431	18.0	220,364	17.9	-58.7	-35.6
Total, of all expenditures.....	2,530,160	100.0	1,902,065	100.0	1,229,814	100.0	-24.8	-35.3
Net sales:								
Carbon and certain alloy steel:								
Semifinished products 1/..	287,905	1.0	426,757	1.5	561,619	2.0	48.2	31.6
Sheet and strip........	15,813,586	53.4	16,748,727	58.5	16,242,019	58.2	5.9	-3.0
All other products 1/..	11,440,898	38.6	10,050,632	35.1	8,999,584	32.3	-12.2	-10.5
Stainless steel:								
Semifinished products.....	188,345	0.6	160,115	0.6	231,708	0.8	-15.0	33.5
Sheet and strip........	1,379,279	4.7	846,418	3.0	1,364,038	4.9	-38.6	61.2
All other products 1/..	516,203	1.7	401,555	1.4	466,801	1.7	-22.2	16.2
Total semi-finished.....	476,250	1.6	586,872	2.0	775,327	2.8	23.2	32.1
Total sheet and strip..........	17,192,865	58.0	17,595,145	61.4	17,606,057	63.2	2.3	0.1
Total other products 1/....	11,957,101	40.4	10,452,187	36.5	9,460,385	34.0	-12.6	9.5
Total, of all sales...........	29,626,195	100.0	28,634,204	100.0	27,847,769	100.0	-2.1	-2.7

1/ Includes plates, bars, wire rod, wire, wire products, structural shapes and units, nails and related products, and pipes and tubes.

Source: U.S. International Trade Commission Publications 2019 and 1881. "Annual Survey Concerning Competitive Conditions in the Steel Industry and Industry Efforts to Adjust and Modernize."

11-85

In light of the financial problems confronting the industry, the installation of new technology is currently often in the form of a joint venture with a foreign company. The foreign company is looking for greater access to the U.S. market, whereas the domestic firm is in need of financial resources and technological expertise. USS Division of USX Corp. has joined with Pohang Iron and Steel Co. in a $300 million cold-finishing complex on the West Coast. The complex is capable of continuously feeding pickled sheets into a new tandem cold mill. A continuous annealing line will then feed the coils directly into a temper mill. The cold-rolling line is reportedly the world's most advanced cold-finishing complex. 1/

Inland Steel Industries, Inc., and Nippon Steel Corp. are building a $400 million cold-rolling plant in the Midwest. This is a 1 million short ton tandem facility capable of producing the quality sheet, according to an Inland executive. 2/ Heidtman Steel Products, Inc., is building a new hot strip mill that uses shape and profile sensors for its hot mills. This will be the first company in the United States to use the shape system developed by Hoesch of West Germany. Although there is an excess of hot-rolling capacity in the United States, Heidtman feels that because of the high quality of their product, they will have no trouble selling the coils.

There is a market for quality products, and companies are exploring new avenues to promote quality. Inland and USS are designing new systems for nonstop pickling and cold rolling. They feel this will help smooth the reduction operation and give more precise control.

There are currently efforts among steel producers to upgrade their facilities to improve quality standards, and achieve a greater proportion of top quality capacity, which certain industry analysts believe represents less than 30 percent of domestic capacity.

In past years, most companies concentrated on converting to continuous casting. Since the beginning of 1986, Bethlehem Steel has brought on stream a 2.0 million metric ton slab caster at Burns Harbor and a 2.6 million metric ton slab caster at Sparrows Point. Inland Steel Co. has just completed the installation of two slab casters and is in the process of rebuilding a third. LTV Steel Co. is expanding the capacity of its Cleveland slab caster and is providing a new ladle metallurgy system to go with the caster at Indiana Harbor. National Steel plans to bring a caster onstream at the end of 1987 at the Great Lakes plant; USS is installing a slab caster at Fairfield, AL; and Wierton Steel Corp. has equipped its slab caster for fully continuous operations.

Empire-Detroit Division of Cyclops Corp. purchased a 170-ton electric furnace from Armco's Houston Works to be installed at its operation in Mansfield, OH. Inland Steel Co. plans a $55 million improvement to Indiana Harbor, which will almost eliminate handling related surface defects on products from its 80-inch hot-strip mill. USS Division of USX Corp. has converted a galvanizing line built in 1946 to a Galvalume line in 1982. Shape

1/ Iron Age, "The Revolutionary Changes in Cold Rolling," Dec. 5, 1986.
2/ Ibid.

control systems on cold mills are being installed at the [illegible] Works of LTV, the Irvin Works of USS and Nationals Great Lakes plant. These systems help to improve the width and gauge of the sheets. There are many other smaller additions and upgrades, but the above-mentioned ones show the variety of forms that the improvements can take. 1/ In addition, table II-35 lists a variety of steel sheet and strip modernization and expansion projects.

Purchasers of sheet and strip products indicated that they feel the quality and performance of domestic steelmakers has improved. Automakers are demanding higher quality steel, and they indicate that they have received it from the domestic steelmakers. 2/

Research and Development

The focus of research and development (R&D) in the U.S. steel industry has shifted over the years. In the immediate post-World War II era, the U.S. industry was the world leader in basic steel research, concentrating on new grades of steel and improved iron and steelmaking processes. Starting in the late 1950's, the focus shifted towards process optimization, as production costs were addressed in the face of escalating labor, raw material, and energy costs. Although process-oriented R&D continues, many major innovations have been commercialized in the 1960's and 1970's (includes continuous casting, continuous annealing, and computer control systems) and R&D emphasis is changing. It should also be noted that major developments in process technology in the steel industry have historically been the domain of the equipment suppliers and engineering firms, as opposed to the steel companies themselves. Steel company contributions to process technology are typically incremental operating improvements or minor retrofits that when summed have led to large improvements in productivity and efficiency.

U.S. steel companies are again shifting their R&D emphasis, increasing efforts in product optimization; placing the customers' needs first and attempting to fulfill their requirements. In the sheet and strip field, the most active product R&D programs involve research on coatings, corrosion resistance, high-strength steels, and production process controls. Similar trends are reported in foreign industries. 3/ Often the line between process and product R&D is blurred, as satisfying customers' requirements often involves investment and improvements in process technology. While the mechanical equipment for high-quality sheet and strip production is relatively proven and readily available, the electronic (digital) and hydraulic control of such equipment is an area in which much R&D is being pursued. Digital control requires an integrated Statistical Process Control (SPC) system throughout the production process. Most domestic steelmakers have already implemented SPC programs.

The sheet industry's R&D is becoming more market oriented. In the past, products were often developed with the intention of finding or developing a

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1/ Iron Age, "Steel's Upgrading Push for Higher Quality Products," September, 1987.
2/ Responses to U.S. International Trade Commission questionnaires.
3/ Information submitted in response to USITC questionnaires and interviews.

Table 11-36
Steel sheet and strip mills: Assessment of current expansion and selected modernization programs

Company/location	Type of mill	Year of modernization 1/	Special features	Equipment supplier/(country)	Remarks
Nucor Corp. Crawfordsville, IN	Hot strip/cold rolling (minimill)	To be completed in late 1988 or 1989	a) Thin slab continuous caster AG (FRG) b) Four finishing stands	SMS Schloemann Siemag	Will employ new technology rather than scaled-up technology. Labor cost will be reduced substantially.
Inland Steel Co. Indiana Harbor Works East Chicago, IN	Hot strip Cold strip	1985 1987	a) Single-strand slab caster b) Advanced continuous annealing and galvanizing lines	Mannesmann DeMag Sack (FRG) Hitachi-Zosen/Mitsubishi (JPN)	Will allow company to reduce labor cost and raise productivity.
LTV Steel Indiana Harbor, IN	Hot strip Cold strip	1983 1985	a) Twin slab caster (FRG) b) Galvanizing lines	SMS Schloeman Siemag AG Sumitomo Heavy Industries (JPN)	New technology will allow company to meet quality demands and reduce operating cost.
National Steel Great Lakes Steel Div. Ecorse, MI	Hot strip Cold rolling	1985 1986 1983	a) Two-strand slab caster b) Electrogalvanizing lines c) Computer control systems	SMS Schloemann Siemag, AG Nippon Kokan (JPN) General Electric (U.S.)	Major operating cost reductions and productivity improvements are expected.
Bethlehem Steel Burns Harbor, IN	Cold rolling	1985 1985 1986 1983	a) Thin slab caster b) Shape control sensors c) Hydraulic rolls d) Continous annealing/pickling lines	Hazelett Strip Casting (U.S.) Davy McKee Corp.(U.K.) Davy McKee Corp. (U.K.) Blaw Knox Co. (U.S.)	An estimated $300 million modernization program will allow for major improvements in quality control and production.
Heidtman Steel Products Toledo, OH	Hot strip	To be completed in 1988	a) Computer processed control system b) Stelco coil box c) Shape control sensors d) Gage controls	General Electric (U.S.) Davy McKee Corp. (U.K.) " " " " " "	Will provide latest technology at every point in production.
Rouge Steel Co. Dearborn, MI Joint-Venture U.S. Steel Corp.	Hot strip	1986 1987	a) Two-strand slab caster b) Electrogalvanizing lines	Hitachi/Zosen (JPN) Comstock Engineering Co. (U.S.)	Will allow company to meet automotive demands for higher quality sheet and strip products.
Weirton Steel Weirton, WV	Hot strip Cold rolling	1986 1988 1988	a) Continuous slab caster b) Automatic gage control c) CVC rolls to allow for schedule free rolling d) Shape control	SMS Schloemann Siemag, AG (FRG) " " Morgan/SMS AG (FRG) Davy McKee Corp. (U.K.)	Will allow company to reduce operating cost and improve quality control at all levels.
USS, USX Corp. Joint-Venture (USS-Posco Industries) Pittsburg, CA	Cold rolling	To be completed in 1988	a) Computer process control system and drives b) Continuous annealing line c) Continuous pickling line d) Shape control	General Electric (U.S.) Mitsubishi Heavy Industries (JPN) Mannesman DeMag Sack AG (FRG) Davy McKee Corp. (U.K.)	When completed, will be most advanced cold-finishing facility, using latest technology.
USS, USX Corp. Fairfield, AL	Hot strip	To be completed in 1988	a) Continuous slab caster b) Reversing rougher stands c) Gage controls d) Computer controls	Tippins (U.S.) " " " " General Electric (U.S.)	Will allow firm to reduce operating cost and improve quality control.

1/ Dates refer to expected date of completion or year of completion.

Source: World Steel Industry Data Handbook/U.S.-1987; Association of Iron and Steel Engineers, Pittsburgh, PA.

market once technical success had been attained. Virtually all of the firms now follow the market, developing products in response to developments in market demand. In conjunction with this development, domestic steelmakers appear to be increasing their expectations of an R&D department's contribution to the bottom line, while more narrowly focusing their work. Several long-time participants confirmed that while possessing large R&D departments has always been something of a status symbol, early application of innovations has not been an historic characteristic of the U.S. integrated industry. In the 1950's, 1960's, and 1970's, risk-averse executives preferred installing proven technology over adopting innovations. Developments proven in the lab had trouble receiving management approval for implementation. Money was being made and the impetus for adoption of potentially risky technology was not great. Some U.S.-developed procedures and equipment, such as a consumable basic oxygen furnace (BOF) temperature lance, were first installed in production settings by steel companies in other countries. U.S. companies have now reversed themselves in this respect, and are embracing R&D and new technologies as necessary ingredients in the survival or strengthening of both the industry and individual firms.

Difficult financial circumstances have limited expenditures on R&D in recent years. As table 11-37 shows, R&D expenditures as a percent of sales, both total and sheet and strip, have trended downward throughout the period. Sheet and strip R&D post slightly higher numbers than total R&D, indicating that the U.S. industry is emphasizing, to a slight degree, R&D expenditures in the sheet and strip area. R&D on raw materials is being reduced, as suppliers are being held more responsible for R&D in their product areas. 1/

Similar data on R&D in the stainless sheet and strip industry are confidential for the first two periods. However, for the July 1986-June 1987 period, expenditures for both stainless sheet and strip R&D and total R&D was reported as 0.72 percent of sales, more than double the rate in the carbon sector (table 11-37). Expenditures over the 3-year period trended downward, but to a lesser degree than in the carbon steel segment.

One development in the industry clouding this issue is that R&D within steel companies is less concentrated in R&D departments than in the past. According to interviews with R&D directors, staffing levels in formal R&D departments have fallen significantly faster than the numbers of personnel doing R&D type work. Most of the steel companies have moved some of their R&D personnel into other departments, such as marketing or production, reflecting a shift in R&D towards more efforts in applications and less efforts on basic research. These employees are now more involved with development work,

1/ Information developed in interviews with industry officials.

Table 11-37
Steel: Research and development (R&D) expenditures, sales, and R&D as a percent of sales, by specified time period 1/

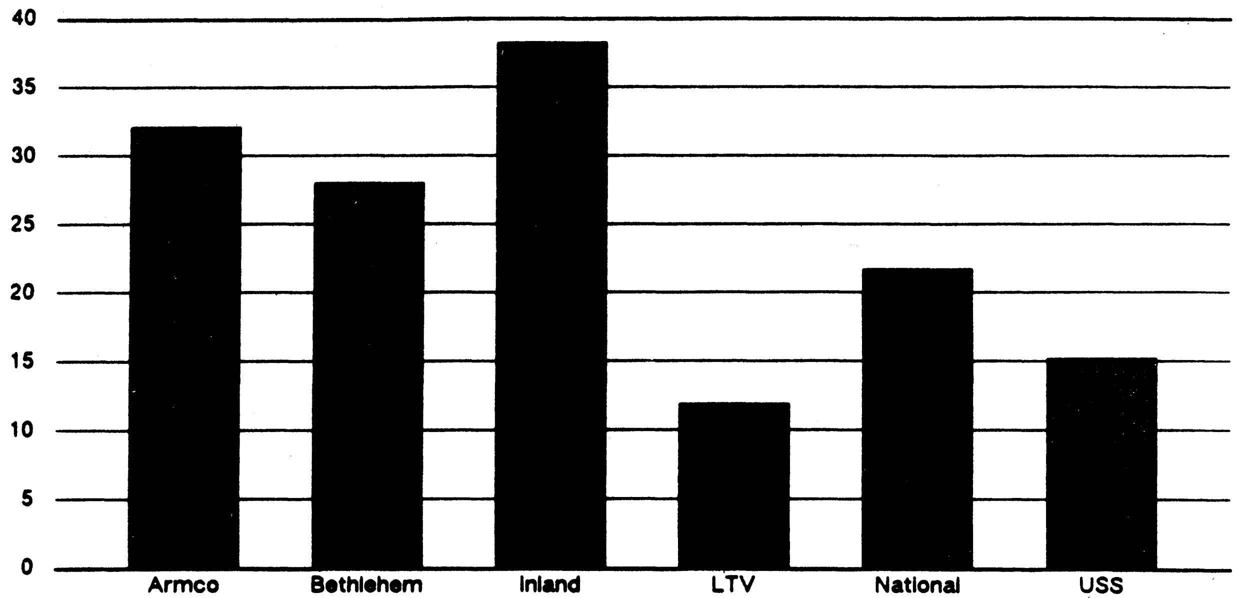
Item	Carbon steel July 1, 1984-June 30, 1985	Carbon steel July 1, 1985-June 30, 1986	Carbon steel July 1, 1986-June 30, 1987	Stainless steel July 1, 1986-June 30, 1987
R&D expenditures:				
Primary ironmaking and steelmaking (1,000 dollars)..	36,060	37,336	32,736	12,183
Allocated to sheet and strip 2/ 1,000 dollars)...	20,704	22,968	20,606	4,707
Sheet and strip (1,000 dollars)....	51,033	38,520	33,936	5,128
Other (1,000 dollars)...........	26,779	18,555	14,699	9,644
Total (1,000 dollars).......	113,872	94,411	81,371	14,772
Sales:				
Sheet and strip (1,000 dollars)....	15,813,586	16,748,727	16,242,019	1,364,038
Other products (1,000 dollars)...........	11,728,803	10,477,389	9,561,203	680,509
Total (1,000 dollars).......	27,542,389	27,226,116	25,803,222	2,044,547
R&D as a percent of sales: 3/				
Sheet and strip (percent)..........	0.45	0.37	0.34	0.72
Other (percent)......	0.36	0.31	0.28	0.73
Average (percent)......	0.41	0.35	0.32	0.72

1/ For comparison, Standard and Poor's Compustat Services reports the following percentages for other industries: automobiles, 3.7; chemicals, 4.1; fuels, 0.8; and miscellaneous manufacturing, 2.8.
2/ Allocated on the basis of sales.
3/ R&D includes sums allocated from primary ironmaking and steelmaking.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

including process optimization and product application. Figure 11-16 shows recent R&D staffing levels at major U.S. sheet producers in relation to shipments for all carbon steel products.

Figure 11-16
Carbon steel: R&D personnel per million tons shipped, as of June 1986



Source: Provided by industry sources.

According to industry sources, the movement in R&D activities by the U.S. steel industry away from basic research towards applications research in recent years has been driven by the difficult financial conditions that have created pressure to contribute quickly to the bottom line. Some companies are limiting large portions of their research to short-term projects of 2 years or less. Although this may yield short-term benefits, some in the industry are concerned about the future effects of neglecting long-term research. Some of the U.S. industry's competitors, most notably the Japanese, are reported to consider R&D spending as an investment in future cost reduction as opposed to a short term cost. 1/

One of the trends in the R&D arena is an increase in cooperative research, both among the steel companies and in conjunction with customers. One major example of this cooperative approach is an increase in the size and number of "Product Application Groups (PAG's)" that involve close working relationships between engineers of the steel companies and the engineering and production departments of the major customers of the steel firms, especially the automotive companies. This approach usually involves placing steel company engineers at the customer's design and production facilities in order to be involved in the planning stages of product design. Commonly known as a systems engineering approach, whole subsystems of a vehicle are designed through interindustry cooperation, resulting in lower cost development, a higher quality product, and shorter development cycles. The cooperation between steel and auto engineers in early product development is enhancing steel's ability to fend off the advances of other materials and promote the use of steel. Japanese steel firms, along with their trading companies, were the leading developers of this practice of having technical personnel at a large customer's worksite in both domestic and foreign markets.

Exchanges of customers' and steelmakers' engineers for short terms is also part of the program; the purpose of the exchange is to familiarize both sides with the perceptions and problems of the other and to foster closer contact and communication. PAG programs are also considered a valuable marketing tool, as the steel company that aids a customer in the development of a part or product stands a good chance of winning the business when that part goes into production.

Most of the large sheet producers in the United States have PAG programs in place with the major automotive companies. These programs provide a conduit for the transfer of technical knowledge and support considered to be crucial to the large volume and high-quality customer. Most foreign competitors apparently have difficulties in implementing such PAG programs with U.S. customers, although programs with manufacturers in their home countries are more common. The exception to this rule are the Canadian producers, that, because of their proximity to the U.S. customers and the large amount of production in Canada by U.S. automakers, have successfully pursued such initiatives with U.S. manufacturers. As mentioned earlier, the Japanese producers are also pursuing such opportunities, particularly through their U.S.-based auto and parts plants.

1/ Information developed in interviews with industry officials.

Financial pressures facing the U.S. steel companies have served to increase cooperation within the industry, as the resources required for certain basic and multidisciplinary research can no longer be supported by any single company. Until recently, the companies were cautious in this area, fearing possible antitrust repercussions. However, recent legislation has improved the environment for intraindustry research. The National Co-operative Research Act of 1984 (Public Law 462) encourages collaborative R&D by introducing a "rule of reason" in judging such activities and removing the provision for treble damages in third-party suits. Protection under this statute is available to any consortium that files with the Department of Justice and the Federal Trade Commission. Of the 66 groups that had filed by late 1987, 2 included steel firms both of which were working on casting thinner steel forms. 1/

The U.S. steel industry has also initiated cooperative projects with organizations outside the industry. Several companies have established relationships with major universities as a cost-effective method for addressing certain R&D questions. Projects carrying a wide degree of interest have been, and continue to be, coordinated by an industry association, the American Iron and Steel Institute (AISI). Recent AISI collaborative research has concentrated on process control sensors because of a lack of readily available sensors capable of performing in the extreme conditions encountered in steelmaking. Although most of the sensor work has been for raw steelmaking and casting processes, a project for the detection of defects on sheet surfaces has had some recent successes. This project was undertaken by the AISI after determining that none of the laboratories at the steel companies could handle the multidisciplinary research required to successfully address the problem. AISI's members defined the needed research, and groups of companies and research facilities were invited to bid on the job. A consortium, including Westinghouse Electric and Eastman Kodak, have been developing the sheet defect detection system and are nearing the project's goals.

The role of the U.S Government in funding steel research was discussed with the domestic producers. Although opinions varied somewhat, there was general agreement on several topics. The first was that Government's focus in research should be process oriented. Many steel company executives claim that process development is inherently a more costly endeavor than product development and would also be more likely to interest and aid a broader spectrum of companies. The involvement of multiple participants makes process development a more logical choice for Government research funds, as benefits are more equally distributed throughout the industry. Process development is also more likely to be transferable from the one industry to other industries, utilizing the Government's funds more effectively.

Another topic raised by several companies was the level of funding provided by the Government for steel research. Funding for such research is disbursed by several Government organizations, primarily the National Science Foundation, the Department of Energy (DOE), the Department of Interior (Bureau of Mines), and the Department of Commerce (National Bureau of Standards).

1/ Information provided by the Office of Productivity, Technology, and Innovation, U.S. Department of Commerce.

According to figures supplied by industry sources, Government funding for steel industry research averages about $26 million per year. This represents 0.04 percent of steel industry sales, compared with the Government's average spending of 1.2 percent of industry sales for all of manufacturing. The steel companies would like the funding in their area to be closer to the average levels. There is also a feeling that the Government should concentrate more on basic research. Such research funded by the steel companies has effectively disappeared because of the uncertain returns. Current Government funding for R&D related to sheet and strip production is concentrated in two DOE programs. In conjunction with Westinghouse Electric and Armco, DOE is providing $26 million in an effort to develop thin-strip continuous casting technology. 1/ DOE is also providing $1 million for a 4-year project on sensor technology. 2/ A third DOE project, involving the USS Division of USX and Bethlehem Steel, was recently terminated after spending over $17 million (of a planned $28.8 million) on thin-slab casting technology. Commercialization of a West German design convinced participants to redirect their research money and efforts to other projects. 3/ Government funds are also supporting research on "levitation" casting at Argonne National Laboratories. Levitation casting involves the replacement of water-cooled molds with electromagnetic forces in the solidification section of a continuous caster. 4/

From the steel industry point of view, one attraction of involving the Government in a research project is that it tends to reduce the potential antitrust problems of joint ventures between steel companies for the purpose of research. Although this approach has the added benefit of bringing in additional funds into the project, it also has a some major drawbacks. These problems have caused several steel companies to question whether Government involvement in R&D, as it is now structured, is beneficial to their interests. Although the industry would rather not have to rely on Government funds, current conditions preclude complete rejection of this source of funds.

The major problem with Government support of R&D is that R&D done with government funds, unless licensed under the Federal Technology Transfer Act of 1980 (Public Law 99-502), becomes subject to the Freedom of Information Act (FOIA). This means that the findings of the research are freely available to any interested party, including foreign competitors. Research that is paid for by the U.S. steel companies and the U.S. taxpayer therefore could serve to benefit foreign firms and industries. The Federal Technology Transfer Act of 1986 is an amendment to the Stevenson-Wydler Technology Innovation Act of 1980 (Public Law 96-480). The key provisions of the amendment authorizes Government laboratories to license technology on an exclusive or nonexclusive basis, allowing the laboratories and their employees to share in the stream of royalties and thus providing incentives to license, and allowing Federal labs to enter into collaborative, shared, funding arrangements with private sector

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1/ American Metal Market, Mar. 11, 1987.
2/ "How Federal Policies Affect the Steel Industry," Congressional Budget Office, February 1987.
3/ American Metal Market, Mar. 11, 1987.
4/ Ibid., Sept. 22, 1986.

organizations. 1/ These provisions should serve to encourage greater cooperation between industry and government researchers.

Yet another problem with Government funding is the conditions under which most funding is offered. DOE regulations, for example, require that research funded by them take place in national laboratories. 2/ The steel industry would much prefer the research to take place in a steel plant. The industry feels that the transfer of a certain technology throughout the industry, once it is developed, would occur more quickly if the technology were developed in a plant or steel company laboratory. Industry participants indicated that the viability of a new technology is more readily accepted if developed at an industry site as opposed to a government laboratory. There also seems to be strong feelings that the involvement of the national laboratories and the oversight procedures instituted by some agencies lead to increased costs. One company involved in recent research in conjunction with a Government agency claimed that the regulations and proceedures dictated by that agency increased project costs by 10 to 15 percent. Other producers also indicated that considerable amounts of government research funds are wasted because of poor management of projects by the contracting agencies.

Debt

The large integrated carbon steel sheet and strip producers have traditionally taken on large amounts of debt to finance capital expenditure programs. As was shown in the profitability section, operating profits for the integrated producers were often negative. Even with nonsteel operating profit and other income taken into account, many of these firms still could not generate positive earnings. As indicated in the tabulation below, which shows the debt as a percent of equity 3/ for the top seven U.S. sheet and strip producers, only two large firms had more equity than debt in 1986 (in percent):

Company	1984	1985	1986
Armco	70	60	130
Bethlehem	110	160	180
Inland	70	100	70
LTV	160	330	1/
National	60	70	70
USX	110	80	100
Weirton	250	150	120

1/ In 1986, LTV had a retained earnings figure of $-4,132.9 million, making equity negative.

1/ Information provided by the Office of Productivity, Technology, and Innovation, U.S. Department of Commerce.
2/ Information developed in interviews with industry officials.
3/ In calculating the percents, long-term debt plus the value of leases was used.

Liquidity ratios, which measure a firm's ability to meet financial obligations as they become current, are often used by creditors to analyze a company before making any loans. In a highly capital-intensive industry like steel, the ability to receive short-term credit is absolutely essential for the daily operation of mills. The current ratio, defined as current assets divided by current liabilities, considers current assets as being readily available and convertible into cash. The current ratios for seven of the top integrated producers for 1984-86 are shown in table 11-38.

Table 11-38
U.S. sheet and strip producers: The ratios of current asset to current liabilities, 1984-86

Company	1984	1985	1986
Armco	1.3	1.4	1.4
Bethlehem	1.1	1.1	1.3
Inland	1.8	1.5	1.9
LTV	1.3	1.3	3.1
National	1.4	1.1	1.1
USX	1.1	1.1	1.0
Weirton	1.7	1.9	1.9

Source: Company annual reports.

The liquidity of the major integrated steel producers, as measured by the current ratio, seems for the most part, to be in line with the liquidity of all durable manufacturing industries during 1986. The average current ratio of seven of the top integrated producers was 1.7 for 1986, slightly above the current ratio of 1.6 for all durable manufacturing. 1/ Excluding LTV's current ratio, which increased in 1986 because of reduced current liabilities resulting from Chapter 11 bankruptcy proceedings, the average current ratio for the integrated producers in 1986 was 1.4, slightly less than the durable industry average. Weirton and Inland Steel were significantly above the durable industry average in 1986, whereas National, USX, and Bethlehem were significantly below it.

Because inventories can be hard to dispose of at their book value on short notice, and are often sold for just above production cost when a company is forced to sell them quickly, the quick ratio may be a more useful measure of liquidity. 2/ The quick ratios in table 11-39 show that LTV and Inland exceeded the quick ratio for all durable manufacturing industries, which was 0.9 in 1986.

1/ Based on data from Quarterly Financial Report, published by the U.S. Department of Commerce.
2/ The quick ratio is defined as current assets minus the value of inventories divided by current liabilities.

Table 11-39
U.S. sheet and strip producers: Quick ratios of 7 steel companies, 1984-86

Company	1984	1985	1986
Armco	0.8	1.0	0.9
Bethlehem	0.5	0.6	0.9
Inland	0.9	0.8	1.2
LTV	0.5	0.4	1.8
National	0.9	0.7	0.7
USX	0.6	0.6	0.8
Weirton	0.5	0.5	0.6

Source: Company annual reports.

A small difference between a firm's current ratio and its quick ratio is regarded favorably because it indicates that the firm is not holding large inventories. For 1986, the difference between each integrated producer's current ratio and quick ratio was between 30 percent and 40 percent, with the notable exception of Weirton, whose quick ratio was about 68 percent less than its current ratio. 1/

The high debt levels and low and inconsistent profits have resulted in poor bond rating for the integrated producers. This increases the cost of raising capital since companies with lower bond ratings must pay higher interest rates on new bonds that they issue in order to attract bond purchases. Table 11-40 lists Moody's bond ratings for the top six U.S. steel producers. The Moody's rating indicate a deterioration in almost all companies' standings since 1983. As of June 1987, all these companies' bonds were rated as falling below the level of medium-grade obligations, a rating that only two of them held in 1986 (table 11-40). A less than medium-grade rating indicates that the obligations are speculative in nature. The Chapter 11 filing of LTV Corp. severely depressed the rating of its bonds, as they are currently considered to be highly speculative. The bonds of the companies absorbed by LTV in 1984, Republic and J&L, were also downgraded to the point where the principle or interest may be considered to be in danger.

1/ In 1986, Weirton's inventory was $288.5 million, which was 68 percent of the total current assets (company 1986 annual report).

Table 11-40
Moody's bond ratings 1/ of selected U.S. steel producers, 2/ 1980-87

Firm	Feb. 1980	As of January-- 1981	1982	1983	1984	1985	1986	1987	June 1987
Armco......	A	A	A	A2	Baa2	Baa3	Ba2	B2	B2
Bethlehem..	A	A	A	Baa2	Baa2	Bal	Bal	B2	B2
Inland.....	Aa	A	A	Baa2	Baa2	Baa2	Baa2	Ba3	Ba3
J & L 4/...	Ba	Ba	Ba	Bal	Bal	Bal	B3	Baa	Caa
National...	Aa	A	A	Baa3	Bal	Bal	B3	Ba3	Ba3
Republic 4/.......	A	A	A	Baa3	Bal	Bal	B3	Caa	Caa
U.S.S. 5/..	Aa	A	A	A3	Baa2	Baa2	Baa2	Baa3	Bal
LTV 4/	6/	6/	6/	6/	6/	B1	B1	Ca	Ca

1/ Moody's bond ratings are as follows:
- Asa: Best quality and carry smallest degree of risk.
- Aa: High quality and together with Aaa, are known as high-grade bonds.
- A: Possess many favorable investment attributes and are considered upper medium-grade obligations.
- Baa: Medium-grade obligations that are neither highly protected nor poorly secured.
- Ba: Obligations that have speculative elements; future cannot be considered well assured.
- B: Generally lack characteristics of desirable investment.
- Caa: In poor standing; may be in default or may present elements of danger with respect to principal or interest.
- Ca: Speculative in a high degree.
- C: Lowest rated bonds.

2/ Bond ratings of subordinated debentures are not shown. These ratings have historically been one rating below the ratings shown here.
3/ In 1983, Moody's modified its ratings. The numbers place the bond's rating within the alphabetic (A and B) ratings. 1 is preferable to 2, which is preferable to 3.
4/ During 1984, Jones and Laughlin (J&L) and Republic were merged with LTV Corp.'s Youngstown Sheet and Tube division to form LTV Steel Co.
5/ On July 9, 1986, USS changed its corporate name to USX to reflect the diversification of the company into nonsteel lines of business.
6/ Not applicable.

Source: Moody's Bond Record, Moody's Investors Service, Inc., various Editions.

Structural Changes

Throughout the 1980's, significant structural changes have occurred in the U.S. sheet and strip industry. These changes have resulted from mergers and acquisitions, company downsizing, and facility sales and closures. Mergers and acquisitions have acted to increase concentration in the industry as well as to increase foreign ownership. However, the effect on industry concentration has been offset to some extent by firms that have sold parts of their operations to former management teams, individual investors, or the employees. The downsizing of firms and facility closures have resulted in a change in the geographic distribution of hot metal operations (particularly through the closure of facilities in the northeast and West Coast) and a trend away from full integration. In the area of stainless steel sheet and strip, structural changes have resulted in a more concentrated, specialized, privately owned industry.

Carbon steel sheet and strip sector

One of the most significant series of mergers and acquisitions in the U.S. integrated carbon steel sheet and strip industry, in terms of increasing concentration, led to the formation of LTV Steel, the second largest U.S. carbon steel sheet and strip producer. In 1968, the LTV Corp., a conglomerate involved in aerospace, defense, and energy products, entered the steel business by purchasing Jones and Laughlin Steel. In 1978, these steel operations were merged with Youngstown Sheet and Tube, and in 1984, LTV purchased Republic Steel, whose operations, along with those of J&L and Youngstown Sheet and Tube, became what is now known as LTV Steel Co., Inc., a wholly owned subsidiary of the LTV Corp.

The nonintegrated sector of the sheet and strip industry has also recently become more concentrated as a result of merger and acquisition activity. In July 1987, Cold Metal Products, a nonintegrated cold-rolled strip producer, acquired three units of the Stanley Works, another cold rolled strip producer, making Cold Metal Products the largest U.S precision cold rolled strip producer; these two companies accounted for 16 percent (8 percent each) of the U.S. market for cold-rolled strip. 1/ Included in the acquisition were Stanley's cold-rolled strip plants in New Britain, CT; Ottawa, OH; and Hamilton, Ontario, Canada. Stanley's Canadian operations, known as Stanley Precision, Canada's only specialty cold-rolled strip producer, has a strapping operation and two service centers in Ontario and Quebec. Previous to the acquisition, Cold Metal Products did not produce strapping. Stanley's former strapping division will become Stanley Uniform Packaging Systems, a division of Cold Metal Products, and will have its headquarters in New Britain. The New Britain plant and the Ottawa plant will operate as part of Cold Metal Products, whereas Stanley's Canadian operations will become Cold Metal Products Co., Ltd., a wholly owned subsidiary of Cold Metal Products Inc.

In addition to increasing industry concentration, merger and acquisition activity has led to increased foreign ownership. In March 1984, the Justice Department halted a planned merger between U.S. Steel (now a division of USX Corp.) and National Steel because their antitrust guidelines showed that an unacceptable level of market concentration would have resulted from the merger. On August 22, 1984, National Intergroup, the parent company of National Steel, signed a definitive agreement under which Nippon Kokan K.K. (NKK), a Japanese steel producer, purchased a 50 percent equity interest in

1/ "Cold Metal No. 1 Precision Strip Maker," American Metal Market, Aug. 6, 1987, p. 1.

National Steel Corp for $292 million. The company, National Steel, now operates as joint venture between NKK and National Intergroup.

The two important acquisitions in the nonintegrated sector involved foreign firms. In late 1986, the Board of Directors of Dofasco, an integrated Canadian steel sheet and strip producer, approved a $45 million acquisition of Whittar Steel Strip, which was previously owned by Whittar Industries, Ltd. and managed by Whittaker Corp. Secondly, on October 1, 1986, Friederick Gustav Theis Kaltwalzwerke GmbH, one of the largest steel strip producers in West Germany, acquired Wallace Barnes, a privately owned nonintegrated cold-rolled strip producer, which is now known as Theis Precision Steel Corp.

Although merger and acquisition activity has acted to concentrate the U.S. carbon steel sheet and strip industry, buyouts have decreased concentration because many plants that were formerly part of one large company are now operated as separate companies. In addition, some firms have attempted to downsize by selling either entire plants or portions of plants. In at least one case, downsizing has also led to foreign ownership. Factors contributing to the actions by large companies to sell off plants or portions of plants include compliance with Justice Department decisions regarding anti-trust issues, the need of financially weakened companies to raise cash, and technological obsolescence.

One example of a facility buyout prompted by antitrust considerations is the case of Gulf States Steel. When LTV and Republic agreed to merge in 1984, a condition of the merger, stipulated by the Justice Department, was that two of their plants had to be sold. Republic's Gadsden, AL, mill, a fully integrated sheet and strip facility, was specified to be sold and, on December 17, 1985, was bought by the Brenlin Group, which formed a new company called Gulf States Steel to operate the facility.

Entire facilities are not always sold as a whole. It is often the case that a large facility will contain some components that are technologically obsolete and some that are modern. In this situation, a firm may decide to close the obsolete portions and sell only the modern parts. The selloff of portions of a larger facility can lead to greater specialization among sheet and strip producers.

The formation of Metaltech., Inc., is an example of a specialized company formed to operate portions of a large plant formerly owned by another producer. A galvanizing line for sheet steel, formerly owned and operated by LTV at the company's Pittsburgh, PA, works, a fully integrated facility, was acquired in 1984 by a partnership headed by a former executive from National Steel and a former LTV executive. This facility eventually became known as Metaltech Inc, a nonintegrated cold-rolling and galvanizing operation. The rest of LTV's Pittsburgh works were dismantled.

Another example where portions of a facility were sold by a financially weak company is the formation of California Steel Industries; in this instance, the sale of the facility also resulted in increased foreign ownership in the industry. At the end of 1983, Kaiser Steel sold portions of its fully integrated Fontana Works, located in Fontana, CA, to a group consisting of Michael Wilkinson, a British investor; Kawasaki Steel Corp., a

Japanese steel producer; and Rio Doce LTD, a subsidiary of CVRD, a Brazilian mining company. The purchase price of $110 million included the hot-rolling, cold-rolling, and hot-dip galvanizing facilities. Kaiser had dismantled the hot metal end of the plant, which included obsolete blast furnaces and open-hearth steelmaking furnaces. The new company formed after the purchase was called California Steel Industries, and its original ownership was as follows: Michael Wilkinson held 50 percent of the equity and acted as chief executive; Rio Roce LTD held 25 percent of the equity in exchange for providing some of the capital for the purchase; and Kawasaki received 25 percent of the equity in exchange for its technical and engineering expertise. Subsequent to the formation of California Steel Industries, Mr. Wilkinson sold his holding to Rio Roce Ltd and Kawasaki, each of whom currently hold 50 percent of the equity. California Steel now purchases semifinished steel slabs from both foreign and domestic sources, and rolls them into finished products.

In the early 1980's, National Steel Corp. was incurring huge financial losses, especially at its integrated steel sheet works in Weirton, WV. In an effort to cut costs, National decided to close down part of its Weirton facility. Fearing the loss of jobs that would have resulted from the closure, the employees of the Weirton Steel Division offered to purchase the plant. On November 23, 1982, Weirton Steel Corp., was incorporated in order to acquire the assets of the former Weirton Steel Division of National Steel Corp. The assets were acquired by the employees of the division on January 11, 1984. As of this date, Weirton became wholly owned by its employees under a qualified Employee Stock Ownership Plan (ESOP).

Technological considerations and a work stoppage were factors contributing to a decision by USX Corp. to close a plant in Utah. USX Corp.'s Geneva Works, located in Provo, UT, were closed in mid-1986 during a companywide work stoppage and did not open when the matters were settled. This plant, the only remaining integrated basic steelmaking facility in the Western United States, was considered by many industry sources 1/ to be obsolete because of old open-hearth furnaces, the lack of continuous casting capability, and poor finishing facilities. To save the plant from total closure, a group consisting of community and civic leaders known as the General Advisory Board conducted studies on the future viability of the works and what would be needed to operate the plant successfully. On August 31, 1987, Basic Manufacturing and Technology, Inc., of Salt Lake City, UT, purchased the Geneva Works and by early September 1987, operations at the plant resumed under a new name, Geneva Steel of Utah. The improved cost savings, which initially made the plant viable, were in large part due to a labor contract signed in late June 1987 lowering the cost of benefits and implementing a profit-sharing plan.

Since 1971, there have been many facility closures in the U.S. steel sheet and strip industry. As shown in appendix M, most of the facility closures have involved primary facilities, such as blast furnaces, steelmaking furnaces, and coke ovens. The decline in the number of these type of facilities reflect the extreme capital costs associated with maintenance, the

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1/ One analysis in particular, Up From the Ashes by Donald Barnett and Robert Crandall, had indicated that the Geneva Works was unlikely to survive.

cost of complying with environmental laws, and technological obsolescence. The closures have resulted in the elimination of hot metal facilities supporting sheet and strip production on the West Coast and a decline in the importance of the northeast in hot-metal production.

After the dismantling of the hot-metal operations of Kaiser Steel's former Fontana Works, the closest fully integrated operation to the West Coast is the recently resumed Geneva Works in Provo, UT. West Coast sheet and strip producers, which include California Steel Industries, the USS/Pohang joint venture in Pittsburgh, CA, and Marwais Steel Co., currently purchase semifinished steel in the form of slabs or hot- or cold-rolled coils and roll them into a finished product.

In addition to the West Coast, the Northeast 1/ has experienced a sharp decline in the number of hot-metal facilities as shown in appendix I and illustrated by the fact that raw steel production in the Northeast as a percent of total U.S. raw steel production declined from 36.3 percent in 1960 to 14.2 percent in 1985. 2/

The West Coast situation and the decline in raw steel production in the northeast are part of a larger trend in the U.S. sheet and strip industry, away from full integration. This trend is highlighted by newly built facilities like Tuscaloosa Steel Corp., which brought on line in late 1985 a combination roughing-finishing mill to roll purchased slab, most of which will come from USX Corp.'s Fairfield, AL, plant and British Steel Corp., into sheet and plate. Another example of a nonintegrated company that purchases semifinished steel for rolling into finished products is USS-POSCO Industries, a joint venture between USX Corp and Pohang Iron and Steel Co. of South Korea that became effective April 1, 1986. The venture, a nonintegrated cold-rolling operation, owns and operates the former Pittsburgh, CA, plant of U.S. Steel on the west coast. Semifinished steel, in the form of hot-rolled coils, for this venture had been sourced from USX Corp.'s Geneva Works before it shut down in mid-1986. Much of the hot-rolled coil now comes from POSCO's Korean operations.

Heidtman Steel Products, Inc., provides further evidence of a continuing trend towards more nonintegrated operations, which purchase semifinished steel. Heidtman, a steel service center chain based in Toledo, OH, with plants in six different locations, has recently decided to construct a 1.1 million metric ton per year hot-strip mill, which when completed in 1989 will be the first greenfield hot-strip mill built in the United States in nearly 17 years. Slabs for the hot-strip mill will be sourced from either U.S. or foreign-integrated steel producers. 3/

One result of the sheet and strip industry's move away from full integration is a reduced need for raw materials like coal and iron ore. This reduced need in conjunction with the current availability of relatively low cost raw materials on the "spot" market has led many integrated sheet and

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1/ Includes all of the Middle Atlantic States--New York, New Jersey, and Pennsylvania, the New England States, and Maryland.
2/ Based on statistics from the American Iron & Steel Institute.
3/ "Heidtman Writes Itself a Very Tall Order," 33 Metal Producing, September 1987, p. 26.

strip producers to divest or close captive mining operations. Appendix N shows raw material operations, either coal or iron ore, owned by sheet and strip producers, that have been shut down since 1971. This list indicates a recently accelerated exit from raw material operations; in addition to the reasons mentioned above, deteriorating competitive position with respect to cost has also influenced the closures (see the section of this chapter entitled "vertical integration"). In many instances, there are high exit costs associated with exiting from mining operations (see the section of this chapter entitled "Competitiveness").

<u>Specialty steel sheet and strip sector</u>

In recent years, a number of efforts to restructure the domestic specialty steel sheet and strip industry have been implemented. These efforts have included company divestitures, management buyouts, and curtailed operations. Certain companies (i.e., USX and Bethlehem Steel) have left the specialty steel business to concentrate on carbon and other alloy steel products. As a result of restructuring, the specialty steel industry is increasingly privately held. Significant changes that have occurred in the structure of the specialty steel industry relating to sheet and strip since 1983 are as follows:

- Jones and Laughlin Steel Corp. and Republic Steel Corp. merged in December 1984 and formed LTV Steel. A condition for the merger, imposed by the U.S. Department of Justice, required LTV to dispose of Republic's Massillon, OH, stainless steel flat-rolled division, which was sold to a private investor and became Enduro Stainless.

- Enduro Stainless ceased its stainless re-rolling operations at the end of 1985 as a result of a dispute with its former owner over supplies of stainless hot band for the works. The company entered into bankruptcy proceedings in February 1986 and was subsequently sold to Mercury Stainless, a Wheeling, IL, stainless processor and distributor, which resumed re-rolling operations in 1987.

- In April 1986, LTV Steel sold its specialty steel operation, known as LTV Specialty Steel, to a management group led by the division president. The operations were renamed J&L Specialty Products Corp., which is currently the second largest U.S. stainless steel sheet and strip producer.

- Al Tech Specialty Steel Corp. was sold in mid-1986 by its parent company, GATX Corp., to Rio Algom, Ltd., a Toronto, Canada-based company with interests in mining, and specialty steel production.

- Allegheny Ludlum Steel Corp. acquired the melting facilities of specialty producer Guterl Steel in 1984. In March 1987, Allegheny Ludlum announced its decision to become a publicly held company by offering to sell initially almost 6.3 million shares of common stock. The company's filing with the Securities and Exchange Commission stated the planned stock offering is to be mainly for U.S. investors, but 1.1 million shares would be offered outside the United States. 1/

1/ <u>American Metal Market</u>, Mar. 30, 1987.

- o Universal Cyclops Specialty Steel Division of Cyclops Corp. was reorganized into two divisions effective September 1, 1984: the Coshocton Stainless Division, which produces and markets stainless steel sheets and strip; and the Cytemp Specialty Steel Division, which produces and markets Cyclops' other specialty steels, principally in bar and billet forms.

- o In early 1987, the Dixons Group, a British firm, purchased Cyclops Corp., which at the time was involved in steel, construction, and retailing. An agreement was reached between the Dixons Group and Allegheny Corp., a company involved primarily in financial services, in connection with the Cyclops acquisition. Under the agreement a subsidiary of Allegheny is to purchase the steel and construction businesses of Cyclops, leaving Dixons with the retail operations. MSL Industries, a subsidiary of Allegheny involved in steel fabricating, was created as a public company and renamed Cyclops Industries in June 1987. This company then acquired the steel and construction businesses of Cyclops Corp. to form the new Cyclops.

- o In December 1985, Eastmet Corp. decided to suspend production of stainless steel sheet and strip at the company's Eastern Stainless Steel Division to concentrate on stainless plate. On January 6, 1986, Eastmet, along with Eastern Stainless, filed for protection from creditors under Chapter 11 of the U.S. bankruptcy code.

- o USX Corp. (formerly U.S. Steel Corp.) left the specialty steel business in 1984. The company had been marketing stainless plate, sheet and strip.

- o Bethlehem Steel Corp. left the specialty steel business, specifically alloy tool steel, in 1984.

Domestic Policies

Legislation and regulations not specifically trade related, 1/ which may nonetheless have some impact on the competitiveness of U.S. steel sheet and strip producers, include safety and pollution standards promulgated by the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA), the Buy American Act of 1933, and tax and other fiscal policy such as the Tax Reform Act of 1986.

Although the most common methodologies for assessing the impact of such legislation is quantification of expenditures for compliance, or the effect on net revenues for the steel industry as a whole, actual expenditures for pollution control and safety requirements are site-specific and widely divergent between operations. Variations in costs are true for Federal fiscal policies as well since companies use different accounting practices, have different amounts of residual tax credits, and have personalized loan

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1/ Measures affecting foreign trade are addressed separately under, "Assessment of Steel Import Restraint Measures."

arrangements with commercial lenders. Because of these variations within the U.S. steel industry, the figures for expenditures that follow under individual sections do not precisely reflect true costs and benefits to specific steel sheet and strip producers. They are, however, useful indicators of the effects of Government policies on industry competitiveness.

In addition to financial measures, the timing of expenditures for compliance with legislated regulations is an important consideration. The United States has been in the forefront of environmental and safety legislation. Consequently, initial expenditures took place during a period of time when foreign producers were investing in other aspects of steel operations. As a corollary, the pollution control and safety investments of foreign producers were often integrated as part of modern equipment and facilities, in contrast to U.S. operations that required retrofitting.

A central consideration, and one that is impossible to assess, is whether or not the expenditure figures cited here would have been used in alternative ways by U.S. sheet and strip producers at that time. It is unclear whether or not equipment, training, or other measures would have been purchased in lieu of mandated expenditures. For this reason, expenditure figures may overstate the impact of such legislation. Nevertheless, it is clear that there has been some retardant effect on the total revenues available for investment by U.S. sheet and strip producers.

Buy American Act

The 1933 Buy American legislation and subsequent executive orders apply to direct purchases by Federal agencies. With respect to Federal agency sheet and strip purchases, shipbuilding contracts by the Department of Defense (DOD) account for the majority of Federal agency procurements. For this reason, DOD purchasing decisions provide one of the best indicators of the effect of Buy American policies on steel sheet and strip producers. Since most of these purchases are not direct but are a result of shipbuilding commissions to private companies, the agency does not directly evaluate the competitiveness of sheet and strip suppliers. However, the agency does evaluate contracts submitted by shipbuilders. Within this context, the comment of DOD officials has been that most shipbuilders do buy foreign steel if it is of good quality and is competitively priced. In addition, it is the opinion of DOD officials that these purchases do not violate Buy American policies, since sheet and strip costs represent less than the required 50 percent of total construction costs.

This reasoning refers to the evolution of Buy American legislation, which originally specified that domestically produced materials must be used by Federal agencies unless one of the following three provisions applied: (1) the required materials were unavailable domestically, (2) the purchase would not be in the public interest, or (3) the cost was prohibitive. The price differential to be applied in comparing foreign and domestic products was not spelled out. Subsequently, the DOD set a standard of 25 percent of the landed, tariff-inclusive price, a standard generally followed by all agencies until 1954. In that year, an executive order lowered the minimum differential to 6 percent and also clarified the definition of an imported good by stipulating that products should be considered to be of foreign origin if 50 percent or more of the total materials cost of the product originated outside the United States.

On January 1, 1981, the General Agreement on Tariffs and Trade (GATT) Government Procurement Code was implemented, with the intention of restricting discrimination by signatory governments against foreign suppliers and ensuring transparency in the procurement process. The effect of the agreement on steel sheet and strip purchases regulated by the Buy American Act was minimal, since the largest procurer, DOD, was exempted from the code provisions for reasons of national security.

Although there have been efforts by the U.S. steel industry to increase Government steel purchases under the provisions of the Act, it appears that procurements of sheet and strip steel products are not significantly influenced by Buy American legislation.

In addition to the Buy American Act, preferential treatment is also given to the purchase of domestically produced merchandise under the Surface Transportation Act of 1978. Although steel is specifically covered by the act, most of the material benefitting from the measure would be heavier flat-rolled products (i.e., plates), structural shapes, and wire cable.

At the state level, many states have individually implemented laws giving preferential treatment to purchases of domestically produced merchandise. Their effect on steel sheet and strip sales are unknown, but believed to be relatively small.

Environmental and safety legislation

The impact of OSHA and EPA regulations on the competitiveness of U.S. sheet and strip producers is not easily quantified. Estimates of costs for compliance are generally given for the U.S. steel industry as a whole and ignore nonquantifiable compensatory benefits. In addition, abatement costs vary between companies. Integrated producers with iron and coal mines have substantially higher capital expenditure requirements for compliance than producers without such facilities.

A second area of concern is the lack of quantitative data for pollution-abatement expenditures of foreign producers. Although sheet and strip producers abroad must also meet certain legislated environmental and safety requirements, the levels of strictness and expenditures and, more importantly, the timing of implementation cannot be precisely determined.

Original environmental legislation concentrated on air and water pollutants with the promulgation of the Clean Air Act of 1970 and the National Water Quality Control Act of 1972. For a decade following enactment, industry expenditures focused on abatement in these two categories and as a result, capital expenditures increased sharply (table 11-41).

Table 11-41
Steel industry capital expenditures for pollution control, 1951-86

Year	Water	Air	Solid waste	Total
	Millions of dollars			
1951-65	$209.6	$238.8	$1/	$448.4
1966-70	315.9	256.9	1/	572.8
1971-75	439.3	790.6	1/	1,229.9
1976	158.7	330.5	1/	489.2
1977	205.7	329.1	1/	534.8
1978	180.8	277.2	1/	458.0
1979	201.2	449.6	1/	650.8
1980	168.2	342.3	7.5	518.0
1981	119.4	369.8	6.6	495.8
1982	104.6	157.3	2.6	264.5
1983	55.6	84.6	2.7	142.9
1984	53.3	79.6	4.8	137.7
1985	66.4	53.8	16.0	136.2
1986	31.5	39.3	1.6	72.4

1/ Data not available prior to 1980.

Source: AISI annual reports. Figures will understate total industry costs since not all companies reported financial data.

From 1966 to 1970, expenditures for pollution measures averaged $1.09 per ton of raw steel produced; between 1971 and 1986, the cost rose to an average of $14.51 per ton. As a percentage of capital expenditures, however, investments for pollution abatement have decreased over time from a high of 26.4 percent in 1979 to 7.3 percent in 1985. Industry analysts have suggested that this may be due to the fact that a majority of large outlays for abatement equipment were completed prior to 1980:

Year	Percentage of total capital expenditures allocated to pollution abatement
1966-70	5.6
1971-75	13.2
1976	15.0
1977	18.7
1978	18.7
1979	26.4
1980	19.5
1981	20.9
1982	11.7
1983	7.7
1984	11.4
1985	7.3
1986	8.2

In addition to these capital investment costs there are also annual expenses. Maintenance costs for pollution abatement equipment for large integrated producers required additional expenses of approximately $50 million per year, and administrative expenses for both OSHA and EPA programs contributed an estimated $100 million more to annual industry compliance expenditures. 1/

Further, it is most likely that the steel industry will be required to implement additional procedures to meet legislated requirements as other substances are regulated in the future. For this reason, the recent downward trend in expenditures for abatement control (fig. 11-17) may level off or reverse. Steel company officials claim that the uncertainty associated with continuing revision of pollution legislation impedes effective long-range planning by their respective companies. The number of pollution control legislation currently under consideration by Congress serves to illustrate the uncertainty facing industry. There are presently 11 legislative bills dealing with acid rain, 81 addressing other types of air pollution, 33 concerning hazardous, toxic, or solid waste, 66 which focus on radiation abatement, approximately 45 related to water quality, and 2 OSHA-related proposals. 2/

In general, air and water pollution abatement are regulated in one of two ways: either by end-of-line methods or by changes-in-process methods. Of total pollution-abatement expenditures during the 1976-86 decade, end-of-line equipment purchases comprised an average of 88 percent of all monies spent. 3/

Process methods are intended to reduce "fugitive" emissions generated during the production process. In the steel industry, such controls focus on coke oven sources or coke byproduct recovery operations. Officials at one U.S. steel company reported that these requirements have resulted in the closure of a coking facility because of costs of compliance attainment, and as a result of this closure, coke is now purchased from European sources. At least 19 other steel company-owned coking facilities have closed because of environmental requirements. 4/ The high costs of building new coking facilities (estimated by industry officials at a minimum of $330 per metric ton) have also been an impetus to develop alternative technologies such as the KR process, which would bypass the need for coke or metallurgical coal in the ironmaking process.

Currently, the steel industry's principal air pollutant is particulate matter total suspended particulates (TSP), with permitted emissions related to particle size. Recent promulgation of the PM 10 (particulate matter 10) standard has decreased the allowable diameter of particulates to 10 micrometers. The financial effect on the steel industry of these new, downward-adjusted limits, is an estimated $500 million in increased capital

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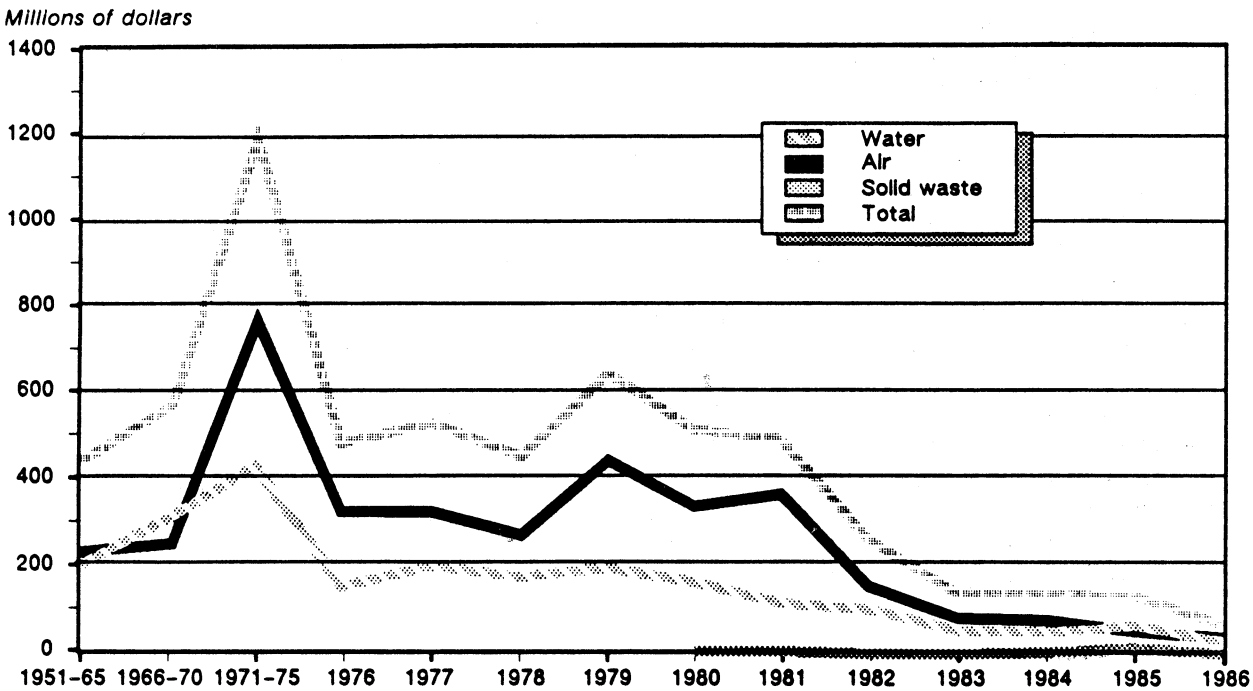
1/ Interviews with U.S. steel officials, AISI Annual Reports.
2/ Office of Congressional Liaison, EPA.
3/ Bureau of Economic Analysis, Congressional Budget Office, Survey of Current Business.
4/ Energy Information Administration, Coking Coal.

Figure 11-17
Steel industry capital expenditures for pollution control for the periods 1951-65, 1966-70, and 1971-75 and annually, 1976-86



Source: *AISI Annual Yearbooks.*

expenditures for air pollution control equipment. 1/ This will be in addition to the $3.3 billion spent on air pollution control measures since passage of the Clean Air Act in 1970. The American Iron and Steel Institute has recently filed a court petition seeking review of the PM 10 controls.

According to domestic industry sources, another area of uncertainty with respect to expanded air pollution abatement requirements is that of proposed acid rain legislation. It is most likely that some type of abatement legislation that would reduce the permissible limits of sulpher dioxide and nitrogen oxide emissions will be enacted. Although the steel industry

1/ Barnett and Crandall, Up From The Ashes.

produces only a relatively small amount of sulpher dioxide and nitrogen oxide emissions, the industry estimates required compliance capital expenditures to be approximately $100 million. More importantly, from the perspective of long-range competitiveness, electrical power rates for steel producers would increase if coal-fired powerplants pass on their cost of abatement expenditures for pollution control. Although electricity accounts for only 4.4 percent of production costs per ton of steel, using estimates of possible increases in electricity rates' the indication is that costs could go as high as $200 million annually for the industry. 1/

Water pollution regulations are similar to those for air in that they address both conventional pollutants (such as TSP) and toxins. In response to industry legal challenges, there have been a series of modifications to the original 1972 regulations that apply to existing sources of iron and steel manufacturing. Current effluent limitations for the steel industry are based on a 1984, court-supervised agreement negotiated between EPA and industry officials and probably will not be modified significantly. 2/

Company representatives claim that it is the area of hazardous waste regulations that poses the highest future costs for steel producers. Since promulgation of the Resource Conservation and Recovery Act (RCRA) in 1980, industry capital investment for solid waste abatement has accounted for only 2.4 percent of total pollution abatement expenditures. However, environmental regulation analysts suggest potential future economic liabilities are significant.

For example, one of the largest financial question marks for all industries is posed by long-term liabilities for hazardous waste disposal mandated by the 1980 Comprehensive Emergency Response, Compensation, and Liability Act (Superfund) legislation. It is this measure that steel producers claim can substantially increase the cost of retiring old facilities and reducing capacity. The regulations specify that industry must pay the costs of responsible waste disposal whether or not the company continues to operate at the site. Although to date only four steel disposal-related sites have been designated at the Federal level as subject to Superfund stipulations, 3/ at least twice that many have been identified at the State level and are currently under discussion between steel companies and local authorities. Total required expenditures for corrective actions have been estimated at $1 billion per year for the primary metals sector.

Hazardous waste provisions of both RCRA and Superfund apply to materials deemed to be toxic, flammable, corrosive, or reactive. At this time, there are four steel process-specific wastes that have been identified by the EPA as potentially hazardous because of toxicity. They are coal tar wastes, spent pickle liquor, slag, and electric arc furnace dust. The classification of both slag and electric arc furnace dust as hazardous has been challenged by some steel companies. EPA has not handed down a final determination in these cases.

1/ Iron Age, Oct. 3, 1986.
2/ Interviews with EPA officials.
3/ Federal Register, July 22, 1987.

Another type of hazardous waste regulation that represents a large cost to companies is the necessity to correct disposal practices and handling of polychlorinated biphenyls (PCB's). These compounds are present in transformers and capacitors and, to a lesser degree, in nonelectrical applications such as adhesives and lubricants. Although costs of corrective actions vary widely between companies, several steel companies have indicated annual expenditures of more than $900,000 since 1985 to comply with regulations in this area.

At this time, it appears that there will continue to be additional legislation in the areas of both air pollution and waste disposal that will require additional expenditures by steel producers. Although it is impossible to ascertain the financial magnitude of future legislation, the impact on competitiveness with respect to foreign producers will be less pronounced than in the past. Recent studies indicate similar expenditures for pollution control by all major foreign steel producers in industrialized countries, 1/ and interviews with Korean and Brazilian industry officials confirm increasing costs of implementation there as well.

The substantial capital expenditures for pollution abatement, the ongoing maintenance costs for compliance with EPA and OSHA regulations, and the uncertainty surrounding future requirements in these areas constitute an encumbrance to the investment of capital in other projects. Whether such alternative investments would be made or would contributesubstantially to the global competitiveness of the U.S. steel industry, however, cannot be presumed.

The Tax Reform Act of 1986

The effects of the Tax Reform Act of 1986 (TRA) on the competitiveness of the U.S. manufacturing sector have been scrutinized by a multitude of interests, reflecting different bases of comparison and assumptions and reaching diverse determinations. Although narrowing the scope of examination to the steel industry focuses analysis on specific provisions of the TRA and provides more concrete figures with which to work, there are still a variety of conclusions as to the severity of TRA effects on steel producers and their largest consumers. With the addition of company-specific variables such as financial health and accounting practices, clear cut results of the TRA on steel producers are further blurred.

Despite the divergence of views as to the aggregate impact of TRA on the industry's competitive position, there are four provisions of the Act that directly affect U.S. steel producers: (1) imminent rebate and elimination of the 10 percent investment tax credit (ITC); (2) the lengthening of depreciable lives for machinery from 5 to 7 years; (3) treatment of company net operating losses (NOL's); and (4) the institution of a minimum tax level of 20 percent on adjusted corporate earnings. 2/

1/ Congressional Budget Office and OECD figures.
2/ Congressional Budget Office Study How Federal Policies Affect the Steel Industry, Feb. 1987.

Elimination of the 10 percent ITC by the TRA has been offset to some degree by the transition rule for steel companies. Under the rule, unused ITC's may be carried back for 15 years rather than for the 3 years previously allowed. In addition, the Federal Government will refund a percentage of the estimated $1.3 billion in unused ITC's.

There are, however, several limitations on the transition rule that should limit the U.S. Treasury's liability to about $500 million.

First, unused company ITC's must be directly related to steel activities. Of the $1.3 billion in steel ITC's, perhaps 10 to 20 percent are related to nonsteel activities. Moreover, only 50 percent of the remaining carrybacks are refundable. Second, companies must have produced at least 1.5 million net tons of steel in 1983 to qualify for transition provisions. The one exception to this requirement is McLouth Steel. Third, the ITC's cannot be carried back before 1962, the year in which they were introduced. Finally, the Federal refunds must be used by steel companies for reinvestment and modernization, research and development, the, retraining of workers, or other appropriate projects. In the case of LTV, which is in bankruptcy, the refunds must be used in steel production or for employee benefits, rather than for paying off creditors. 1/

One effect of the refund will be to boost profits (or decrease losses) in 1987 and 1988. Some companies are using anticipated refunds to supplement 1987 revenues. 2/ Whether such refunds will be used for investments that will aid the competitive position of the industry will depend on the investment made by each company.

In recent years the steel industry's use of NOL's to offset tax liabilities resulted in an estimated average effective tax rate of 23 percent, as comparte to a general industry tax rate was 46 percent. 3/ Under the TRA, those levels of general and average effective tax rates have been increased to 34.

In 1986, steel segments of 25 companies representing 77 percent of the industry's raw steel production, reported a total loss of $4.2 billion. This was the fifth year in a row for losses, which are cumulatively estimated at $11.7 billion. 4/ NOL's for eight major steel companies as of December 31, 1986 are shown in the tabulation below:

1/ Congressional Budget Office Study How Federal Policies Affect the Steel Industry, Feb. 1987.
2/ Of an estimated $130 million refund due to Bethlehem Steel in 1988, for example, the company recorded $32.5 million in the first quarter of 1987 as a reduction in their 1987 tax liabilities.
3/ An effective tax rate may be calculated as the difference between before-tax and after-tax rates of return on assets and represents the average rate paid by an industry on investments. Estimates cited were calculated by the Congressional Budget Office.
4/ AISI estimates.

Company	Net Operating Loss Carryforwards (Million dollars)
USX	$2,400
LTV	2,100
Bethlehem	1,214
Armco	934
Inland	642
National	480
Wheeling-Pittsburgh	450
Total	8,220

Source: Estimated by industry officials.

Prior to the TRA, the full amount of NOL's could be utilized in calculating tax liabilities. In the future, however, only 90 percent of NOL's can be applied to taxable income. Coupled with the required 20 percent minimum tax, it appears the tax burden for all steel companies will increase.

In addition to adjusting the applicable rate of NOL's allowed, several other provisions in the TRA address their use. Since the use of NOL's is not restricted to the product lines in which they were incurred, companies can use them to offset income earned in other lines of business. To discourage the economic incentive this might provide for the acquisition of steel companies by profitable enterprises or the diversification of steel companies by buying into existing firms with positive and sizeable income streams, the TRA specifies certain allowable managerial procedures. These procedures are intended to discourage any apparent advantage there would be in using the NOL's as a subsidy for investment in a company currently giving pretax rates of return below market rates. It is doubtful, however, that steel companies have discretionary capital funds for acquisition investments of this type. 1/

The net effect of the institution of a minimum tax level and changes in the use of NOL's is a decrease in the value of NOL's as offsets to tax liability. The result of these measures will be an increased tax burden. However, industry officials point out that the companies do not absorb the entire tax burden under any tax regime since they are able to channel some of the increase to consumers, depending on the pressures of competition, which would effect a companies ability to raise their product prices.

The fourth provision in the TRA that will affect the future tax liabilities of U.S. steel producers is the lengthening of depreciable lives of machinery from 5 to 7 years and of nonresidential real estate from 19 to 31.5 years. Of the two, machinery is the more significant change for the steel industry since the reduction of the dollar amount that can be claimed following the first year has been decreased. Allowable depreciation for hypothetical investment in a $300 million piece of equipment is shown in the following tabulation, under the accelerated cost recovery system (ACRS) in effect prior to the TRA, and the current 7-year system using a double declining balance (DDB).

1/ Information developed from interviews with U.S. industry officials.

	Year	1	2	3	4	5	6	7
5 years	(rate)	.15	.22	.21	.21	.21	1/	1/
ACRS	($claimed)	45	66	63	63	63	1/	1/
7 year	(rate)	.2857	.2040	.1458	.1041	.0868	.0868	.0868
DDB	($claimed)	85.71	61.22	43.73	31.24	26.04	26.03	26.03

1/ Not applicable.

According to industry officials, when analysed in conjunction with changes in the absolute tax rate, the effect of TRA revisions on steel companies is less burdensome than certain tax analysts originally suggested.

Much of the broader economic analysis of the TRA has addressed the degree and implications of a 50 to 78-percent increase in the cost of capital for new equipment, which is usually defined as including a combination of available interest rates and tax treatment of new investments. Although at least one industry official has expressed concern about the increased cost of capital to steel companies under the TRA, several other major integrated producers discount the significance of that factor in investment decisions of large industrial corporations with over $250 million in assets. This alternative view holds that overriding, company-specific investment considerations focus instead on long-term factors. These include the productivity and quality changes resulting from a given investment and the timing of major investments in order to protect or enhance a company's competitive market share position. Several steel officials have expressed their agreement with the position that "the theoretical cost of capital is much less significant than the actual after tax return on the investment - of which the cost of capital is only a minor part". 1/

This inability to generalize about the effects of the TRA, evident throughout discussions with steel industry officials, is also reflected in the attitudes of many of their largest customers. In 1986, for example, initial reactions to the TRA proposals by the "Big 3" automakers (which account for approximately 25 percent of all U.S. sheet and strip purchases) were mixed. GM supported the TRA, Ford opposed it, and Chrysler was considered neutral. 2/

The summary effect of recent tax legislation on the competitiveness of U.S. sheet and strip producers, based on available information, is too uncertain to judge.

Assessment of Steel Import Restraint Measures

For the last 20 years, U.S. trade in steel has been affected by the import restraint measures implemented by the U.S. Government. Trade policy instruments such as quotas, tariffs, and voluntary restraint agreements (VRA's) represent a form of regulation of the flow of goods and services that

1/ Comments made by industry official in internal company document.
2/ Information developed from interviews with U.S. industry officials.

otherwise would be determined by market forces. U.S. steel trade data as well as the industry performance during this period reflect the constraints imposed by trade policy measures on international trade.

The main policy measures implemented in steel trade from 1969 to present are as follows:

1969-74--VRA's with Japan and the European Community (EC)
1976-79--Specialty steel quotas
1978-82--Trigger Price Mechanism (TPM)
1982-84--U.S.-EC steel VRA's
1983-89--Specialty steel measures
1984-89--Nine-point U.S. Government policy for the steel industry

Following a chronological sequence, the effect of the trade restraint measures on the flow of imports into the United States is reviewed, taking into account product-mix changes as well as shifts in the distribution of imports between restrained and nonrestrained supplier countries. Also evaluated is the effect of the trade restrictions on the price of domestic steel, on U.S. output, employment, and profitability, and on U.S. consumption. Given the multiproduct approach of the trade restrictions and the data coverage from available sources, the analysis is conducted at the steel industry level without product differentiation, except that the analysis of the effects of the current VRA's is specifically focused on sheet and strip steel products.

The review of the U.S. experience with VRA's and TPM indicates that such trade measures have been generally acknowledged to have been effective in limiting the flow of imports of steel mill products into the United States. However, macroeconomic factors such as business cycles and fluctuations of the exchange rate appear to have exercised an even stronger influence on the flow of trade and on the domestic industry than trade policy measures. According to industry analysts, the latter have reduced foreign competition in the domestic industry and may have delayed the adjustment of the integrated producers to new market conditions without substantially improving their international competitiveness. 1/ The specialty steel industry, however, apparently took advantage of the trade restrictions to modernize and carry out significant investment and capital improvement programs. 2/

1/ Similar conclusions were reached by the Congressional Budget Office in their recent study on the steel industry (see Congress of the United States, Congressional Budget Office, How Federal Policies Affect the Steel Industry, February 1987, p. 36).
2/ G.C. Hufbauer, D.T. Berliner, K.A. Elliott, Trade Protection in the United States, 31 Case Studies, Institute for International Economics, Washington, DC, 1986, p. 196.

Voluntary Restraint Arrangements on steel mill products, 1969-74

It is generally recognized that the 1969-74 VRA's served their purpose of restricting the volume of steel imports. However, since the VRA's designated export limits by weight with no product-mix specification, they were less effective in restraining the shift to higher value imported steel. Although the VRA's may have generated some gains in domestic employment, the effects on the industry in terms of profitability and capital investment were not significant. As a result, one industry analyst concludes, domestic producers were able to postpone structural adjustments needed to restore the competitiveness of the industry. 1/

The VRA's were instituted in response to rising import penetration led by the Japanese. In addition, in 1967-68, demand for domestically produced steel dropped sharply partly because of cyclical factors, and partly because of the threat of a steelworkers strike that drove major steel consumers to foreign suppliers. In the fall of 1968, a bill was introduced in the Senate, limiting U.S. steel imports to 9.6 percent of the U.S. market. In order to forestall this initiative, Japan and the EC, whose combined exports accounted for 82 percent of total U.S. steel imports, agreed to restrict their exports to the United States.

The VRA's, which took effect in January 1969, limited exports from Japan and the EC to 5.22 million metric tons each for 1969 2/ and set a 5-percent annual growth in the quotas for 1970 and 1971. Originally scheduled to expire on December 31, 1971, the VRA's were extended for 3 more years. The export ceilings under these arrangements and actual U.S. imports are shown in table 11-42.

As table 11-42 indicates, actual imports from Japan and the EC were below the announced ceiling in 5 out of the 6 years; their market share declined from 13.4 in 1968 to 11 percent in 1969-70, before rising again to 13.3

1/ See K. Jones, Politics vs. Economics in World Steel Trade, Allen and Unwin Ltd., 1986, pp. 116-117.
2/ Actual U.S. imports of steel from Japan and the EC in 1968 were 6.6 million and 6.4 million metric tons, respectively.

Table 11-42
Export ceilings and actual U.S. imports of steel mill products, 1969-74

Item	1969	1970	1971	1972	1973	1974
Japan and EC:						
VRA ceiling (1,000 metric tons)..	10,433	10,954	11,502	13,165	13,385	13,719
Actual U.S. imports (1,000 metric tons)..	10,389	9,533	12,759	12,899	11,020	11,415
Actual imports as a percent of ceiling..	99.6	87.0	110.9	98.0	82.3	83.2
Nonrestrained supplier countries:						
Actual U.S. imports (1,000 metric tons)..	2,342	2,591	3,846	3,141	2,724	3,073
Total U.S. imports (1,000 metric tons)..	12,731	12,124	16,605	16,040	13,744	14,488
Exports from nonrestrained sources as a percent of U.S. imports.....	18.4	21.4	12.2	19.6	19.8	21.2

1/ United Kingdom excluded in 1969-71 and included in 1972-74.

Source: USITC, Economic Effects of Export Restraints, USITC Publication 1256, June 1982.

percent in 1972. 1/ It is generally believed that the VRA's were successful in limiting the volume of imports until 1972 and ceased to be binding thereafter, 2/ as exporters focused less attention on the U.S. market as a result of surging worldwide steel demand. Table 11-43 shows how the value of foreign products rose relative to domestic steel prices during the 1968-74 period.

1/ G.C. Hufbauer, D.T. Berliner, K.A. Elliott, Op. cit., p. 156.
2/ R. W. Crandall, The United States Steel Industry in Recurrent Crisis, The Brookings Institution, 1981, p. 103.

Table 11-43
Ratio of Import Prices (cost, insurance and freight) to Domestic Steel Prices in the United States, 1968-74

Item	1968	1969	1970	1971	1972	1973	1974
Hot rolled sheet.....	0.85	0.89	1.01	0.98	1.04	1.13	1.25
Cold-rolled sheet....	.90	.88	.97	.95	.97	1.10	1.25

Source: R.W. Crandall, The U.S. Industry in Recurrent Crisis, The Brookings Institution, 1981, p. 49.

The results of several econometric studies confirm the effectiveness of the VRA program in reducing the volume of imports. The USITC 1/ estimated that, during 1969-74, the VRA's reduced imports by 17.27 million metric tons (19.04 million net tons), with an annual average reduction of 2.9 million metric tons (3.2 million net tons); others 2/ have estimated that the VRA's reduced U.S. steel imports by amounts that are two to three times greater than the USITC estimates.

However, because of the absence in the agreements of explicit limitations on specific types of steel products, during 1968-71, a shift took place in the product mix of U.S. imports towards more expensive stainless and alloy tool steel products. The upgrading of the imports can be shown by comparing the volume and the value of imports in 1968 and 1970. The total quantity of steel imported from the restrained countries in 1968 was 13.05 million metric tons ($1,514 million) compared with 9.52 million metric tons ($1,510 million) in 1970. Thus, the total value of imports in 1968 and 1970 from the restrained supplier countries was about the same, despite a 27-percent decline in the volume of imports in 1970. 3/ Awareness of this potential outcome prompted the introduction of product-specific limitations in the extended VRA's in 1971 and in subsequent agreements.

The distribution of imports between restrained and nonrestrained supplier countries changed between 1969 and 1974. Imports of steel mill products from nonrestrained supplier countries increased by 31 percent during this period (see table 11-42), while the share of total U.S. imports by nonrestrained countries increased from 18 to 21 percent.

During 1968-72, U.S. import prices are believed to have increased by 6 to 8 percent 4/ as a result of the VRA's. The higher import prices encouraged

1/ USITC, Economic Effects of Export Restraints, USITC Publication 1256, June 1982, p. 8.
2/ A. Jondrow, "Effects of Trade Restrictions on Imports of Steel," in U.S. Department of Labor, The Impact of International Trade and Investment on Employment, 1978, p. 14; and W. E. Takacs, Quantitative Restrictions and U.S. Steel Industry, unpublished Ph.D. dissertation, Johns Hopkins University, May 1975.
3/ USITC, Op. cit., p. 4.
4/ R.W. Crandall, Op. cit., page 107.

steel purchasers to shift to domestic sources and, as a consequence, the price of domestic steel rose, according to some estimates, by 1 to 6 percent. 1/ With prices generally higher for both domestic and imported steel, the VRA's also may have led to a fall in steel consumption, although, in the case of intermediate products like steel sheet and strip, the higher price tends to reduce demand less than in proportion. The USITC found that, during 1969-74, the estimated reduction in the quantity of steel demanded, triggered by the VRA's, was 9.98 million metric tons (11.0 million net tons). 2/

The VRA's are believed to have had only marginal effects on domestic production. Crandall found that the increase in capacity utilization attributable to the VRA's was no more than 3 percentage points. 3/ According to the USITC, in 1973, when the domestic production increased by 21 percent from the previous year, only 1.1 percent of the increase, or 227,000 metric tons (250,000 net tons), could be attributed to the VRA's, whereas the bulk of the increase was credited to cyclically rising demand for steel. 4/ Neither the domestic price increase nor the gain in capacity utilization was "sufficiently large to raise the return on equity in the industry to a level sufficient to make new investment profitable." 5/ In fact, measured in terms of return on equity, profitability actually declined in the steel industry from 7.7 percent in 1968 to 4.3 percent in 1970, but between 1971 and 1974 it increased steadily, reaching 16.9 percent in 1974. 6/ Since the VRA's were in effect throughout the period, it appears that demand factors, such as the steel boom of 1973-74, were the major determinants of the industry's profitability. Although capital expenditures were below the 1968 level ($2.3 billion) throughout the 6-year period of voluntary restraints, 7/ wages accelerated, thus aggravating one of the major problems in the industry.

The effect of the VRA's on employment was positive. The USITC study estimated the effects of the VRA's on domestic employment, including that in the steel and related industries. Annual net benefits ranged from 1,657 man-years in 1969 to 55,223 man-years in 1971, with an average retention of 19,117 jobs per year over the 6-year period. 8/

1/ Crandall's estimates range from 1.2 to 3.5 percent; the USITC estimates range from 1.3 to 5.7 percent, with an average of 3.8 percent over the 6 years.
2/ USITC, Economic Effects of Export Restraints, USITC Publication 1256, June 1982, p. 10.
3/ R. W. Crandall, op. cit., p. 107.
4/ USITC, Economic Effects of Export Restraints, USITC Publication 1256, June 1982, p. 10.
5/ R. W. Crandall, op. cit., p. 107.
6/ Federal Trade Commission, Staff Report on The United States Steel Industry and its International Rivals, November 1977, p. 68.
7/ American Iron and Steel Institute, 1974 Annual Statistical Report.
8/ In another study, Jondrow estimated the effect of the VRA's only on the steel industry (SIC 331) employment during 1969-73; his results range from 16,495 man-years in 1968 to 109,341 in 1973, with an annual average of 57,769 man-years (see Jondrow, op. cit., p. 16).

Specialty steel quotas, 1976-80

The VRA's expired in December 1974. In 1975, as U.S. demand declined, the specialty steel industry petitioned the USITC for escape clause relief from an increased inflow of foreign stainless steel and alloy steel. After an affirmative determination of injury by the USITC, but prior to the transmittal of the USITC final report to the President, the United States negotiated an orderly marketing agreement with Japan for a 3-year period, restricting Japanese exports to the United States of the five specialty steel products where the USITC had found indication of injury to the domestic industry. In June 1976, following the USITC recommendation, the President 1/ imposed quotas on imports of stainless steel and alloy tool steel products (bars, wire rods, plates, sheet, and strip) for a 3-year period. The quotas were established on a trading area, or, in the case of the larger suppliers, on a country-by-country basis, and were to be increased by 3 percent annually. This program, which was modified in 1977 and 1978, was extended to February 13, 1980.

The VRA's were effective in restraining the flow of imports; as prices rose and domestic consumption increased, the industry improved its profit margin and was able to introduce a number of changes which resulted in enhanced competitiveness of the domestic firms with regard to imports as well as with regard to each other. 2/

As table 11-44 indicates, imports of specialty steel declined during the period of restraints, both in absolute and in relative terms. The U.S. economy expanded between 1976 and 1978, reaching a rate of growth in 1978 of over 5 percent in real terms, and decelerated in the two subsequent years, showing a 0.2 percent contraction in 1980. Between 1976 and 1979, apparent consumption increased by 26 percent (see table 11-44), yet imports declined by almost 10 percent; in 1980, when consumption contracted to the 1976 level because of a further downturn in the economy, imports totaled 118,000 metric tons, i.e., 22 percent less than the volume of specialty steel imported in 1976 at the same level of consumption. Import penetration figures also confirm that imports lost market share over this period: the import market share declined by almost 30 percent between 1976 and 1979, before recovering slightly in 1980. Taking into account the fact that the dollar depreciated in real terms between 1974 and 1980, the USITC estimated that, during 1976-79, the VRA's reduced the flow of imports by an average of 25 percent per year. 3/ Stainless sheet and strip experienced a greater import decline than specialty steel during 1976-80 in both absolute and relative terms.

1/ Presidential Proclamation No. 4445.
2/ USITC, Stainless Steel and Alloy Tool Steel, USITC Publication 968, April 1979, p. A-16; see also USITC, Stainless Steel and Alloy Tool Steel, USITC Publication 1377, May 1983, p. 7.
3/ USITC, Stainless Steel and Alloy Tool Steel, USITC Publication 968, April 1979, p. A-144.

Table 11-44
Specialty steel and stainless steel sheet and strip: U.S. imports, apparent consumption, and market share, 1974-80

Year	Imports	Apparent consumption	Market share
	-------1,000 metric tons-------		Percentage of consumption
Specialty steel:			
1974	137	1,202	11.4
1975	140	771	18.1
1976	152	999	15.2
1977	128	1,037	12.3
1978	148	1,147	12.9
1979	137	1,258	10.8
1980	118	999	11.8
1976-80 change (percent)	(22.4)	0	(22.3)
Stainless steel sheet and strip:			
1974	59	747	7.9
1975	60	435	13.8
1976	71	657	10.8
1977	64	683	9.3
1978	74	752	9.9
1979	56	802	7.0
1980	34	594	5.8
1976-80 change (percent)	(52.1)	(9.5)	(46.3)

Sources: USITC, Stainless Steel and Alloy Tool Steel, USITC Publication 968, April 1979 and USITC, Stainless Steel and Alloy Tool Steel, USITC Publication 1377, May 1983.

Under the VRA's the prices of imported steel increased, according to some estimates, by approximately 6 percent, 1/ causing a shift of demand towards domestic producers; the extent of the shift has not been estimated. For stainless steel sheet and strip, the USITC found that, in the first year (1976-77) estimated imports, in absence of the VRA's, would have been higher than actual imports by 19,050 metric tons (21,000 net tons). 2/ No estimates are given for the remaining years.

1/ Morici P. and Megna Laura L., U.S. Economic Policies Affecting Industrial Trade: A Quantitative Assessment, Report No. 200, Washington: National Planning Association, p. 22.
2/ USITC, Stainless Steel and Alloy Tool Steel, USITC Publication 968, April 1979, p. A-141.

As table 11-45 shows, U.S. specialty steel shipments, capacity utilization and profits increased during 1976-79. It is generally believed that this improvement is strongly correlated with the expanding U.S. economy and a depreciating dollar. However, it is also recognized that the industry took advantage of this set of favorable economic conditions (reduced foreign competition in the domestic market and strong U.S. demand) to improve its efficiency. The industry introduced a number of changes during the period of relief, both technological and organizational in nature, requiring substantial capital expenditures. 1/ The employment figures remained at approximately the same level during most of the restraint period in spite of sizable increases in production, reflecting increased labor productivity, especially in the stainless steel product area. 2/

Table 11-45
Shipments, capacity utilization, employment, and profits of the U.S. specialty steel industry, 1974-80

Year	Shipments	Capacity utilization	Employment	Profits 1/
	Thousand metric tons	Percent	Average number production workers	Million dollars
1974..........	1,147	81.4	23,824	259
1975..........	675	46.6	16,102	81
1976..........	902	54.4	18,624	87
1977..........	959	56.0	18,473	204
1978..........	1,045	65.5	17,437	214
1979..........	1,189	70.0	18,347	308
1980..........	982	58.2	16,744	174
1976-80 change (percent)...	9.0	7.0	(10.1)	100.0

1/ These figures represent U.S. firms accounting for approximately 90 percent of U.S. producers' shipments; these figures represent net income (losses) before taxes.

Sources: USITC, Stainless Steel and Alloy Tool Steel, USITC Publication 968, April 1979, and USITC, Stainless Steel and Alloy Tool Steel, USITC Publication 1377, May 1983.

1/ For more detail on specific measures undertaken by the industry during 1976-80, see USITC, Stainless Steel and Alloy Tool Steel, USITC Publication 1377, May 1983, p. A-48.
2/ Ibid., A-28; also USITC, Stainless Steel and alloy Tool Steel, Publication 968, April 1979, p. A-33.

Trigger Price Mechanism (TPM) 1978-1982

In 1975, a global recession resulted in lower demand for steel worldwide as well as in the United States. Consequently, the U.S. steel industry experienced a drop in output and capacity utilization. As world demand declined, import pressure increased in the U.S. market, where import penetration rose from 13 percent in 1973-74 to 17.8 percent in 1977. In response to a number of antidumping petitions against Japanese and European exporters, in 1978, the Carter administration implemented the TPM, a system based on import reference prices ("trigger prices"), allowing the immediate initiation of antidumping investigations against imports entering the United States at prices below the established floor. The trigger prices were based on Japanese production costs (Japan was acknowledged at that time as the world's low-cost producer) plus an 8-percent profit margin; the prices were subject to quarterly revisions in accordance with changes in Japanese production costs and exchange-rate fluctuations.

The purpose of the TPM program was to limit the importation of steel being sold in the United States at less-than-fair value (LTFV) (i.e., dumped). In 1978, the TPM covered 65 percent of U.S. steel mill imports; by 1979, it was extended to 85 percent of the U.S. steel mill imports and it affected approximately 70 steel products. As the system was based on Japanese production costs, it allowed other higher cost producers to continue selling at less that fair value without being subject to dumping complaints. 1/ U.S. producers supported the TPM until March 1980, at which time they filed trade suits against steel producers in seven European countries, an action which led to the immediate suspension of the TPM. In October 1980, the administration reached an agreement with the domestic industry; the suits were withdrawn and trigger prices were reimposed with some modifications, including changes in the methods for reflecting dollar/yen exchange rate movements. In addition, a surge provision was included for imports of carbon steel products, whereby significant increases in imports of a product from a country could trigger a self-initiated antidumping or countervailing duty investigation by the U.S. Government.

In 1981, as the U.S. dollar started to appreciate, steel imports rose steadily. In January 1982, domestic producers filed numerous antidumping and countervailing duty suits. In response, the administration abolished the trigger price system for virtually all products and processed the complaints. Those filed against EC producers were ultimately settled through the negotiation of a VRA.

Significant shifts in the value of the U.S. dollar and major cyclical fluctuations in U.S. and world demand appear to have dampened the effect of the TPM on steel trade and on the domestic industry. While prices increased during the period of the TPM, affording U.S. producers some additional profits, the level of capital investments made to modernize the industry was not materially increased. At the same time wage increases granted over this period tended to perpetuate the relatively high labor costs in

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1/ U.S. Government officials indicated that the filing of dumping complaints in all likelihood would lead to a suspending of the TPM in light of the resources which would be required to process the cases.

the industry. According to a leading analyst, "given the substantial role of labor costs" in the industry, "effective trade protection simply postpones part of the necessary adjustment to the loss of competitiveness. The steel industry today is paying for wage increases granted behind a protective barrier in the 1970's." 1/

Under the TPM, imports of steel mill products declined by almost 21 percent (see table 11-46). However, over the same period, consumption dropped by 35 percent. The import market share declined during 1978-79, and recovered thereafter, as the dollar began to appreciate. The two major factors in the decline of U.S. imports during 1978-80 were the downturn of the domestic economy and the depreciating dollar exchange rate. During 1978-80 the U.S. economy contracted and its rate of growth dropped from a healthy 5.3 percent (in real terms) in 1978 to -0.2 percent in 1980. 2/ At the same

Table 11-46
Steel mill products and steel sheet and strip imports, apparent consumption, and market share, 1977-82

Year	Imports	Apparent consumption	Market share
	-----------Million metric tons	----------	Percentage of consumption
Steel mill products:			
1977...........	17.5	98.4	17.8
1978...........	19.1	105.9	18.1
1979...........	15.9	104.3	15.2
1980...........	14.1	86.5	16.3
1981...........	18.1	95.6	18.9
1982...........	15.1	69.3	21.8
1978-82 change (percent)....	(20.9)	(34.6)	20.4
Steel sheet and strip:			
1977...........	7.9	43.6	18.1
1978...........	8.0	45.1	17.7
1979...........	6.5	45.2	14.5
1980...........	4.4	35.6	12.5
1981...........	4.6	38.0	12.2
1982...........	4.4	29.2	14.9
1978-82 change (percent)....	(45.0)	(35.3)	(15.8)

Sources: American Iron and Steel Institute, 1981, 1982, and 1983 Statistical Reports.

1/ R.W. Crandall, Effects of U.S. Trade Protection for Autos and Steel, Brooking Papers on Economic Activity, 1:1987, pp. 281-283.
2/ U.S. Bureau of Economic Analysis, The National Income and Product Account of the United States, 1929-82, and Survey of Current Business, July 1986 issue.

time, the exchange rate moved in a direction favorable to U.S. producers: between 1976 and 1979, the U.S. dollar depreciated vis-a-vis the major currencies (34 percent against the yen and 22 percent against the Deutsche Mark (DM)), thus forcing foreign suppliers to cut their profit margins or raise their U.S. prices. The dollar stabilized in 1979, and by 1981 it started to appreciate again. Steel sheet and strip imports declined at a greater rate than steel mill products during 1978-82, losing U.S. market share. 1/

A shift in the distribution of U.S. imports took place in 1978, at the inception of the TPM program. Japanese share of the U.S. steel market declined from 7.2 percent in 1977 to 5.6 percent in 1978, and the Japanese share of total U.S. steel imports declined from 40 to 30 percent. 2/ The major gainers were Canada, Brazil and Spain: their combined market share in the United States increased from 2.1 to 2.9 percent, and their share of total U.S. imports increased from 11.7 to 15.7 percent. During 1979-80, however, the Japanese regained market share, primarily at the expense of the EC countries. Looking at the whole TPM period (1978-82), the EC and Japan together maintained a stable share of U.S. imports (in the range of 64 to 67 percent), and Brazil increased its share of U.S. imports from 1.4 percent in 1978 to 3.6 percent in 1982.

During the TPM period, import prices are believed to have increased as a result of the trade restrictions. Taking into account the 1976-78 depreciation of the U.S. dollar, Crandall 3/ estimated that actual import prices may have increased during 1978-79 by as much as 5 percent each year, showing an increase of over 10 percent by 1979. Between 1979 and 1981, import prices further increased, according to some estimates, 4/ by almost 17 percent.

Econometric studies have indicated that the TPM did not have a significant effect on domestic producer prices. According to Crandall, the 10-percent increase in import prices in 1979 resulted in an increase of the average price of carbon steel products (including hot-rolled sheet, cold-rolled sheet, bars, structurals, and plate) in the range of 0.8 to 1.1 percent in 1979, with the greatest impact on cold-rolled sheet and hot-rolled bars. Crandall points out that although realized carbon steel prices rose by 10.6 percent in 1978, the bulk of this increase is attributed to stronger demand and accelerating inflation. 5/ In 1979, steel prices increased by another 10.5 percent, and labor and material costs increased by more than 11 percent.

1/ At the steel-mill-product level, a substantive increase in imports of pipe and tubing during the period (from 2.5 million metric tons in 1977 to 4.7 million metric tons in 1982) partially offset the declining trend in other steel-product import categories.
2/ American Iron and Steel Institute, 1982 Annual Statistical Report.
3/ R.W. Crandall, The U.S. Steel Industry in Recurrent Crisis, Brookings Institution, 1981, pp 111-115.
4/ G.C. Hufbauer, D.T. Berliner, K.A. Elliott, op. cit., p. 167.
5/ R.W. Crandall, The U.S. Steel Industry in Recurrent Crisis, Brookings Institution, 1981, pp. 111.

After 1980, U.S. producer prices for steel continued to increase with respect to world prices (see table 11-47), primarily because of the appreciation of the U.S. dollar. As the differential between U.S. and foreign prices increased, the U.S. market became more attractive to foreign producers and import penetration rose. As imports acquired additional market share, the U.S. industry faced lower operating rates and declining profit margins. It was in this climate that U.S. steel companies filed numerous unfair trade complaints, leading to the suspension of the TPM.

Table 11-47
U.S. and world steel prices, 1978-84

Year	U.S. producers' price	Antwerp spot export price	U.S. price as a share of Antwerp price
	Dollars per metric ton		Percent
1978	330	315	105
1979	365	369	99
1980	376	382	98
1981	412	357	115
1982	399	332	120
1983	376	293	128
1984	389	296	131

Sources: R. Crandall, The Effects of U.S. Protection for Autos and Steel, Brookings Papers on Economic Activity 1:1987, p. 275.

During the period of enforcement of the TPM, business cycles and exchange-rate fluctuations appear to have been stronger determinants of the level of consumption, output, and employment than the trade restrictions. Apparent consumption of steel mill products declined from 105.9 million metric tons in 1978 to 86.5 million tons in 1980, and 69.3 million tons in 1982 (table 11-46); the main factor in the decline of U.S. consumption is the downturn in the domestic economy, which experienced a 2.5-percent contraction in 1982. Domestic shipments rose in 1978-79 (by 2.4 percent), as prices increased and import pressure abated because of a decelerating economy and a declining dollar. After 1979, domestic shipments declined as the economy further weakened and import penetration increased (see tables 11-46 and 11-48). Employment followed the same trend: it increased up to 1979, to 341,931 production workers, and then rapidly declined, to 198,477 production workers in 1982, with an overall loss of 41.1 percent between 1978 and 1982 (see table 11-48).

Industry profits rose during 1978-81 (table 11-48), aided by strong demand from oil and gas producers (for pipe and related drilling equipment), higher prices, and the falling dollar. When the market weakened, the industry incurred losses, in real terms, ranging from $1.38 billion in 1982 to $0.10

Table 11-48
Shipments, capacity utilization; employment, and profits of the U.S. steel industry, 1977-82

Year	Shipments	Capacity utilization	Employment	Profits 1/
	---------Million tons--------		Average number production workers	Billion dollars
1977..........	91.2	78.4	337,396	0.01
1978..........	97.9	86.8	339,155	0.71
1979..........	100.3	87.8	341,931	0.62
1980..........	83.9	72.8	291,483	0.77
1981..........	88.5	78.3	286,219	1.16
1982..........	61.6	48.4	198,477	(1.38)
1978-82 change (percent)...	(37.1)	(44.2)	(41.1)	(139.0)

Sources: American Iron and Steel Institute, 1980, 1982, 1983 Annual Statistical Reports; profit figures represent total profits of U.S. steel companies from AISI, adjusted for nonreporting companies and deflated by the overall consumer price index, as reported by R.W. Crandall, The U.S. Industry in Recurrent Crisis, The Brookings Institution, 1981, p. 278.

billion in 1984. 1/ During 1977-81, real investment in steel maintained a relatively stable level of $1.5 billion per year. 2/ Competitive problems continued with respect to the industry's relative cost disadvantage, however, as compensation, measured as total employment cost per hour, rose by 66 percent during 1978-82, from $14.30 to $23.78. 3/.

U.S.-EC Steel VRA's 1982-85

Between 1979 and 1985, the U.S. dollar appreciated in real terms by roughly 60 percent, import penetration increased from 15.2 to 26.4 percent and the steel industry's financial performance deteriorated. In January 1982, the domestic industry filed a number of antidumping and countervailing cases covering 20 percent of the 1981 total U.S. carbon steel imports. In an attempt to settle the suits against European producers, the United States negotiated an arrangement which went into effect in November 1982. Originally set to expire in December 1985, the arrangement has since been modified and extended through September 1989. Under the arrangememt, the EC agreed to limit exports of ten carbon steel products to a fixed percentage of the projected U.S. market, ranging from 2.2 percent for tin plate to 21.5 percent for sheet piling. The ten products involved accounted for about 64 percent of total U.S. steel imports from the EC in 1982. 4/ The EC agreed to the

1/ R.W. Crandall, The Effects of U.S. Trade Protection for Autos and Steel, Brookings Papers on Economic Activity, 1:1987, p. 278.
2/ Ibid.
3/ American Iron and Steel Institute, 1982 Annual Statistical Report, p. 18.
4/ USITC, Summary of Trade and Tariff Information, Iron and Steel, January 1985, p. 9.

restraints in return for the withdrawal of steel trade cases filed against EC producers; any new proceeding with regard to the covered products constitutes grounds for terminating all or parts of the arrangement.

As table 11-49 indicates, imports from the EC declined during 1982-83 and rose again in 1984-85. Sheet and strip imports from the EC, most of which were covered under the arrangement, increased at a greater rate than all steel mill products during 1982-85, and gained U.S. market share.

Table 11-49
Steel mill products: U.S. imports from the EC, 1981-85

Year	Imports	Share of total U.S. imports	Share of apparent U.S. consumption
	Million metric tons	Percent	Percent
Steel mill products:			
1981...........	5.9	32.6	6.1
1982...........	5.1	33.6	7.3
1983...........	3.7	24.1	4.9
1984...........	5.7	24.2	6.4
1985...........	6.4	28.8	7.2
1982-85 change (percent)....	25.0	(14.3)	(0.1)
Products subject to VRA:			
1981...........	1/	1/	1/
1982...........	3.3	39.2	6.8
1983...........	2.7	26.7	4.9
1984...........	3.1	21.4	4.8
1985...........	3.9	29.0	6.1
1982-85 change (percent)....	18.2	(26.0)	(10.3)
Steel sheet and strip:			
1981...........	1.9	41.2	4.6
1982...........	1.8	41.7	5.5
1983...........	1.9	28.0	4.5
1984...........	2.3	23.4	4.9
1985...........	2.8	33.0	6.2
1982-85 change (percent)....	55.1	(20.9)	12.7

1/ Not available.

Sources: USITC, Monthly Report on Selected Steel Industry Data (Inv. 332-153), and American Iron and Steel Institute, 1981, 1982, 1983, 1984, and 1985 Annual Statistical Report.

While strongly influenced by the VRA's, the reduction in the EC share of U.S. imports reflected a growing diversification of imports from traditional sources such as the EC, Canada, and Japan. Imports of steel mill products into the United States from sources other than these three areas (principally Brazil, Spain and Korea) rose from 20-24 percent of all U.S. imports in 1978-82 to close to 40 percent in 1984. 1/ Reductions in imports resulting from the VRA were therefore more than offset by increases from other suppliers. This upsurge in imports, largely from developing countries, is indicative of the ongoing shift in global steel production capacity away from traditional regions. It also reflects the fact that, after 1980, economic conditions in the U.S. market were favorable to increased foreign competition: the dollar was appreciating and, as import penetration increased, low operating rates were pushing upwards the costs of U.S. producers vis-a-vis foreign manufacturers. 2/

Specialty steel quotas, 1983-1989

In 1982, import penetration in specialty steel reached an all time high of 19.9 percent of apparent U.S. consumption 3/ as foreign producers benefitted by the appreciation of the U.S. dollar. In July 1983, following an affirmative determination of injury by the USITC in a section 201 investigation, the President announced his decision to grant import relief to the specialty steel industry for a period of 4 years (48 Federal Register 33233). The relief included the following measures: (1) temporary duty increases on stainless steel sheet and strip and stainless steel plate, to be progressively reduced from 8 and 10 percent, respectively, to 4 percent; and (2) imposition of tonnage quotas on imports of stainless steel bar and wire rods, and on certain alloy tool steel products, each to be increased annually by 3 percent. Under the steel VRA's, subsequently implemented as part of the national policy for the steel industry introduced by the President in September 1984, most VRA countries were exempted from paying additional duties; quotas were by-and-large unaffected. In 1987, the import relief was extended to 1989.

Import penetration of specialty steel products declined from 19.9 percent in 1982 to 16.1 in 1983, before rising to 16.8 in 1984. 4/ The total volume of imports declined by almost 7 percent between 1982 and 1983 and rose by over 22 percent between 1983 and 1984. Since the share of imports in the U.S. market remained stable between 1983 and 1984, the 1984 increase in import volume is largely attributed to expanding domestic consumption. Domestic production also increased: during 1982-84, domestic shipments rose by 34 percent, to 1,039,630 metric tons, and capacity utilization increased by 67 percent, to 70 percent in 1984. 5/ U.S. production capacity decreased by 4

1/ American Iron and Steel Institute, 1982, 1985 Annual Statistical Report.
2/ G.C. Hufbauer, D.T. Berliner, K.A. Elliott, op. cit., p. 171.
3/ USITC, Stainless Steel and Alloy Tool Steel, USITC Publication 1377, May 1983, p. A-88.
4/ G.C. Hufbauer, D.T. Berliner, K.A. Elliott, op. cit., p. 198.
5/ G.C. Hufbauer, D.T. Berliner, K.A. Elliott, op. cit., p. 200.

percent between 1983 and 1984, 1/ and the industry's profits improved, from $94 million in losses in 1982 to $265 million in net profits in 1984. 2/ During this period, the industry undertook a major program of capital improvements and R&D, totaling nearly $1 billion.

According to the industry, the quotas provided a "modest" recovery in stainless steel bar and rod and alloy steel production, but were less effective in the stainless sheet and strip area. 3/

Nine-point U.S. Government policy for the steel industry, 1984-89

In January 1984, Bethlehem Steel Corp. and the United Steelworkers of America filed a section 201 complaint with the USITC, alleging that increased imports of certain carbon and alloy steel products were a substantial cause of serious injury to the industry. 4/ The Commission made an affirmative injury determination with respect to imports of five of nine product groups, including sheet and strip products. To remedy the injury, the Commission recommended a relief program comprised of a mix of increased tariffs and quantitative restrictions. The President, however, determined that import relief measures would not be in the national interest, and, on September 18, 1984, a nine-point comprehensive program was announced, affecting the U.S. steel industry. The major component of the program was the negotiation of "surge-control" arrangements, understandings, or suspension agreements with countries "whose exports to the United States had increased significantly in recent years due to an unfair surge in imports." Specifically, the program was intended to address concerns over the level of subsidies awarded by foreign governments to U.S. competitors, and over the "diversion from other importing countries who have restricted access to their market." The President indicated that the restraints on U.S. imports of steel were intended to "enable one of the United States' most basic and vital industries to return to a level playing field, one in which steel is traded on the basis of market forces, not government intervention." 5/ The surge-control arrangements, which are to remain in existence through September 30, 1989, consist of market-share restrictions and quotas, or a combination thereof, that apply to detailed product categories. As of December 1987, the United States Trade Representative had negotiated restraint agreements with 19 major steel exporting countries and the EC (excluding Portugal and Spain, which negotiated separate agreements). 6/ As a result of the restraints, import penetration was expected to decline to a level of about 18.5 percent, excluding semifinished steel, which subsequent administration statements indicated would be limited to about 1.7 million short tons (or 1.54 million metric tons) per year.

1/ USITC, Annual Survey on Certain Stainless Steel and Alloy Tool Steel, USITC Publication 1666, March 1985, p. 1.
2/ Ibid., p. A-6.
3/ G.C. Hufbauer, D.T. Berliner, K.A. Elliott, op. cit., p. 196.
4/ Stainless and alloy tool steel products, which were already subject to import relief, were not included in the investigation.
5/ 49 Federal Register 36814.
6/ There are approximately 25 countries, including Canada, exporting steel to the United States without a formal agreement.

Import penetration in steel mill products reached a record 26.9 percent in 1984 (20.3 percent in sheet and strip) (see table 11-50). Since 1984, however, when the VRA's became effective, import penetration declined by 12 percent in the steel mill product category and by almost 15 percent in the sheet and strip product category.

Table 11-50
Steel mill products and sheet and strip: U.S. imports, apparent consumption, and market share of specialty steel, 1983-87 1/

Year	Imports	Apparent consumption	Market share
	-------1,000 metric tons-------		Percentage of consumption
Steel mill products			
1983	15,855	76,003	20.9
1984	24,226	90,141	26.9
1985	22,575	87,939	25.7
1986	19,313	81,879	23.6
1987:			
Jan.-Sept	14,172	64,089	22.1
1984-86 change (percent)	(20.3)	(9.2)	(12.3)
Steet and strip			
1983	6,561	41,615	15.8
1984	9,373	46,104	20.3
1985	8,206	44,925	18.3
1986	7,511	43,388	17.3
1987:			
Jan.-Sept	5,370	33,664	16.0
1984-86 change (percent)	(19.9)	(5.9)	(14.8)

1/ Trade figures include certain fabricated sheet and strip products and are therefore slightly larger than those presented in other sections of this study.

Sources: USITC, Monthly Report on the Status of the Steel Industry, USITC Publication 2039, December 1987.

Since the implementation of the VRA's, there has been a shift in the import trade pattern between VRA and non-VRA countries. Between 1984 and 1986, imports of steel mill products from VRA countries 1/ declined from 20.0 million metric tons to 14.4 million metric tons, or by 28 percent, and imports of the same products from non-VRA countries increased from 4.3 million metric tons to 4.9 million metric tons, or by 12 percent. Among the non-VRA countries significantly increasing their imports to the United States during this period were Taiwan, Canada, Turkey, and Singapore. Imports

1/ Not including the People's Republic of China and Trinidad and Tobago, imports from which became subject to VRA's in 1987.

of sheet and strip from VRA and non-VRA supplier countries, however, declined during the same period; the decline was slightly larger for imports from VRA countries (21 percent) than for imports from non-VRA countries (15 percent).

The VRA's, although effective retroactively as of October 1, 1984, were not actually finalized with most countries until mid-1985. Since the program is now only in its second full year, an assessment of its effects is premature. However, econometric simulations developed by the Commission indicate that the impact of the VRA's in the steel sheet and strip area is relatively small. The results are based on the assumption that, absent restraints, import penetration in the United States in 1987 would be no higher than the record 20.33 percent import/consumption share experienced in 1984. 1/

Under certain circumstances (such as a stronger dollar), import penetration could, of course, be higher. In order to gain insights into the marginal benefit of the restraint under such conditions, the effects of the VRA's are assessed assuming penetration of 25 percent and 30 percent, as well as 20.33 percent.

The simulations, 2/ which provide a gauge of the likely market effect of the VRA's, estimate the price and level of imports and the domestic consumption, price, production, and employment in the sheet and strip industry at each level of import penetration. Although no specific market share restriction has been set under the VRA's for exports of steel sheet and strip to the United States, a derived market share of 17.07 percent is calculated to apply to this product category for 1987. 3/

The model relies on previous econometric work for the estimation of key parameters, such as the responsiveness of quantity demanded to price changes. For the responsiveness of the domestic supply to price changes, there is a

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1/ It is unlikely that the import share for 1987 would exceed the share of 20.33 percent experienced in 1984. In that year, conditions, such as the value of the dollar, were especially favorable to foreign producers. Since then, the dollar has experienced a significant decline in value, reducing incentives for all exporters.

2/ See app. O for a description of the methodology and results. The model is a partial-equilibrium, one-industry model: it looks at the relevant industry in isolation from the rest of the economy, assuming that price changes in the industry have insignificant effects on other industries. However, the results of the estimation have limitations with respect to considering the effects of the VRA's upon the industries producing finished goods out of steel sheet and strip.

3/ The current limits set on the exports of steel sheet and strip products from individual countries can be aggregated to obtain an estimate of the implicit market share restriction that applies to this product category. For 1987, the implicit market share restriction thus calculated is 17.07 percent. This figure is based on the implicit share limit of 14.57 for VRA countries and an assumed 2.50 share for countries not covered by the VRA's. The latter is the 1986 import share held by non-VRA countries, which is assumed to remain unchanged in 1987.

wide range of estimates depending upon the assessment of excess capacity available in the industry. For this reason, the estimated market effects are presented on the basis of two levels of excess domestic capacity--moderate excess capacity and large excess capacity. The methodology and data used to derive the estimates are described in appendix O. For estimates of 1987 consumption, shipments, and total imports, the model relies on DRI forecasts.

As table 11-51 indicates, trade restrictions under the model simulation would not have a significant impact on the domestic industry at the 20.33-percent free-trade import penetration level. According to the results of the simulation, the trade restrictions reduce the import flow and result in higher import and domestic prices. However, consumption does not decline significantly, and domestic shipments increase by only 2 to 4 percent, and sales of domestic producers increase from 2 to 5 percent. The effects on employment are positive: on the basis of an estimated workforce of 90,000, the model shows that the VRA's result in job savings of under 3 percent.

Table 11-51
Effect of the trade restraint measures under the assumption of an underlying free-trade import penetration level of 20.33 percent

	Moderate excess capacity	High excess capacity
Price of imports (percent change).......	8.97	5.25
Price of domestic product (percent change).............................	1.26	0.05
Total imports (volume) (percent change).............................	(16.26)	(17.19)
Apparent consumption (volume) (percent change).............................	(0.27)	(1.37)
Domestic shipments (volume) (percent change).............................	3.81	2.66
Sales volume (percent change)..........	5.12	2.72
Increase in employment (jobs)..........	2458	1737

Source: Data compiled on the basis of the results of the econometric model presented in app. O.

Tables 11-52 and 11-53 present the results of the effects of the current VRA's under conditions in which import penetration, in the absence of the VRA's, would rise to 25 and 30 percent. The tables show that the effects of the VRA's would reach significant levels under the assumption of moderate excess capacity and 30 percent import penetration: in this case, domestic prices would rise by 4 percent, total sales volume would increase by 19 percent, and gains in employment would represent 6 to 9 percent of the current estimated labor force.

Table 11-52
Effect of the trade restraint measures under the assumption of an underlying free-trade import penetration level of 25 percent

	Moderate excess capacity	High excess capacity
Price of imports (percent change)...........	21.26	12.16
Price of domestic product (percent change)..	2.84	0.12
Total imports (volume) (percent change).....	(32.84)	(34.50)
Apparent consumption (volume) (percent change)..................................	(4.07)	(1.64)
Domestic shipments (volume) (percent change..................................	8.76	6.08
Sales volume (percent change)...............	11.85	6.20
Increase in employment (jobs)...............	5390	3833

Source: Data compiled on the basis of the results of the econometric model presented in app. O.

Table 11-53
Effect of the trade restraint measures under the assumption of an underlying free-trade import penetration level of 30 percent

	Moderate excess capacity	High excess capacity
Price of imports (percent change)...........	34.07	19.08
Price of domestic product (percent change)..	4.35	0.18
Total imports (volume) (percent change).....	(45.43)	(47.46)
Apparent consumption (volume) (percent change)..................................	(4.09)	(7.67)
Domestic shipments (volume) (percent change)..................................	13.63	9.39
Sales volume (percent change)...............	18.57	9.59
Increase in employment (jobs)...............	8025	5743

Source: Data compiled on the basis of the results of the econometric model presented in app. O.

The results of the simulation indicate that the restrictiveness of the trade measures must reach significant levels before the trade restraints yield a relatively high level of benefits to the sheet and strip industry. However, sheet and strip is an intermediate product and price changes also affect consuming industries which use sheet and strip in the manufacture of other products. Given the price increases that could occur at significant levels of restriction in the sheet and strip product area, and the potential effects of such changes on downstream products, a total cost/benefit assessment would include a consideration of these issues.

Competitiveness of the U.S. Industry

The measures which might be used to evaluate competitiveness as well as the most significant problems facing the industry in its attempt to become more competitive vis-a-vis domestic and foreign competition were among the issues and topics discussed with steel industry officials. The industry views expressed during fieldwork and information from a number of other sources suggest that the U.S. sheet and strip industry is presently facing significant obstacles to greater competitiveness, but has made significant progress despite the difficulties.

Substantial overcapacity, perpetuated by high exit costs and the reconstitution of mills, is seen by industry officials as the most significant problem currently facing the established producers. The overcapacity has adversely affected profitability--considered by industry sources to be one of the more important measures of competitiveness--by lowering operating rates, a condition which results in increases in overall production costs. Another significant problem facing the industry is the lack of internally generated funds for investment and the high cost (and limited availability) of outside financing; financing problems have inhibited wide-scale modernization. With less capital for plant improvements, producers have been forced to be highly selective in modernizing equipment, often leading to major imbalances at sheet and strip facilities.

High exit costs have substantially contributed to overcapacity, but the industry has taken constructive action on the problems of capital availability and the need for modernization, given its weak financial position. Cooperative arrangements among sheet and strip producers, especially through joint ventures with Japanese firms, have been among the responses to these problems. In many cases, these arrangements are entered into to manufacture a specific product. Steelmakers and automakers have also recently entered a new era of cooperation that most evidence suggests will enhance the competitiveness of both industries.

Measures of Competitiveness

Most industry sources consider production costs and profitability good measures of competitiveness. With respect to production costs, the cost of capital, raw materials, labor, energy, plant location and layout, and the cost of distribution all interact to determine such costs in the sheet and strip industry. The U.S. sheet and strip industry has evolved to the point where producers are no longer as dominant in the domestic market with respect to their ability to influence prices. The increased influence of imports and weak market conditions are the principal factors underlying the shift in market conditions. 1/ The primary means of achieving profitability in such an environment is to utilize cost inputs more effective (i.e., cut costs), which is seen as a means to improve producers' efficiency and competitiveness. Companies in Chapter 11 bankruptcy and reconstituted companies have achieved significant cost savings for various reasons unrelated to their technological competitiveness and efficiency (e.g., through a reduction in labor, raw

1/ World Steel Dynamics, Steel Strategist #13, Mar. 30, 1987.

materials and capital costs) and as such have become more profitable than other companies in the industry. Their ability to do so has been an issue of concern to the companies which have not been restructured since it can have a major effect on their respective sales and profit levels. Ironically, the companies in the weakest financial position could, through Chapter 11, emerge as highly profitable, low cost producers.

Comparisons of international production cost must take into account exchange rates that are determined by macroeconomic factors beyond industry control. The greater the variability in real exchange rates, the lower the value of production costs as a variable measuring international competitiveness (except on a short term basis).

Another concern of U.S. sheet and strip producers with respect to exchange rates is that certain major steel exporting countries may artificially peg the value of their currency to the U.S. dollar, thus allowing them to maintain low dollar production costs for exports to the United States when the dollar falls in value.

Industry officials feel that profitability as a measure of competitiveness is more accurate when comparing domestic producers than when comparing producers from different countries because of different accounting practices. In addition, subsidization by foreign governments, which is alleged to be widespread, can often make an otherwise inefficient producer appear to be profitable. Comparisons of profitability are also complicated by greatly varying product mixes among manufacturers and by one time charges that can offset profits earned from efficient sheet and strip operations.

Fieldwork by the Commission staff has suggested that another way to measure competitiveness is the ability of a sheet and strip producer to deliver a high quality product that will save its consumer time and money when manufactuered into a steel product. This measurement is best accomplished, according to industry sources, by examining how U.S. sheet and strip consumers (i.e., the market) view U.S. sheet and strip producers. A submission by Bethlehem Steel to the Commission in connection with this investigation states that "Perhaps the best measure of Bethlehem's competitiveness in terms of quality comes from the market place . . ." The importance of the sheet and strip market as an indicator of competitiveness was further underscored by a company official that indicated, in a submission to the Commission, that customer perceptions of a company and its financial strength (as indicated by profitability) are important to competitiveness, as they can greatly influence purchase decisions. 1/

A frequently cited measure of competitiveness derived from the market is the steel supplier performance rating done by U.S. automakers, the largest consumers of steel sheet and strip. The steel supplier performance reports

1/ Pre-hearing submission by T. Andrew Ellwein of Inland Steel Co. on Feb. 24, 1987.

done by Ford Motor Co. rate sheet and strip producers on quality, delivery, and cost, according to the following weighting system: quality, 50 percent; delivery, 30 percent; and cost (i.e., price), 20 percent. 1/ Another system used by General Motors (GM) since 1983 rates each sheet and strip producer on the following factors: strategic direction, financial strength, quality, R&D, production efficiency, labor relations, and manufacturing capabilities. 2/ The factors used for steel supplier ratings by Ford and GM are consistent with those mentioned by sheet and strip producers as good measures of competitiveness.

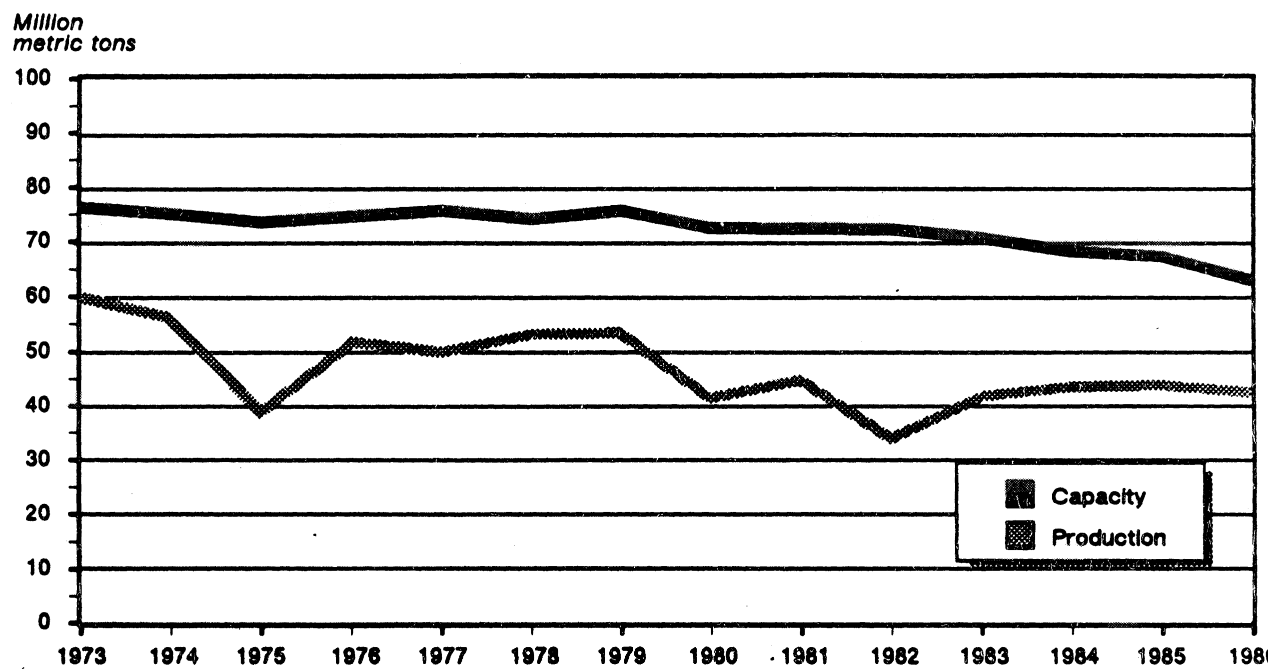
In conclusion, it is apparent from discussion with steel producers and steel users that there are numerous aspects to competitiveness. While various measures can be devised to draw comparisons, each has certain limitations.

Principal Problems Confronting the U.S. Industry

Overcapacity

According to industry sources, the single most significant problem currently facing the U.S. industry is overcapacity. Despite an overall reduction in domestic hot-strip mill capacity since 1973, production has consistently been below capacity (fig. 11-18). The overcapacity problem

Figure 11-18
Wide hot-strip mills: U.S. capacity and production, 1973-86



Source: World Steel Dynamics.

1/ "Steelmakers and Automakers Team up to Improve Quality," Iron Age, February 1987.
2/ Ibid.

gradually developed because of a number of factors, including increased imports (both direct and indirect), reduced demand, and more recently, the installation of modern technology that allows greater productivity and increased production of steel with fewer inputs of capital and labor.

Overcapacity, in turn, has led to increased operating costs, that have been a major factor in the poor financial performance of U.S. sheet and strip producers (see profitability section). At a low operating rate, the fixed costs of production for an entire company have to be allocated over fewer units of production, thereby raising the average total cost of production. Underutilizing capacity can also adversely affect average total production costs because certain variable inputs would have to be employed at a less than optimum level. For example, the operation of a blast furnace requires a fixed amount of labor and fuel that cannot be varied significantly if output varies. 1/ A recent analysis of the steel industry 2/ has suggested that shifts in operating rates have an even greater impact on costs than changes in the scale of operations. According to this analysis, a 3.6 million metric ton integrated plant producing cold-rolled sheet would achieve cost savings of 65 percent if the operating rate and output were to increase from 0.9 million to 3.6 million metric tons. It has also been estimated that if steel industry capacity utilization could be raised, given current prices, significant cost reductions would occur, bringing the industry to a position of probitability, as shown in table 11-54.

Table 11-54
Hot-rolled steel sheet: Average total cost, average price, and operating profit, at certain capacity utilization levels

	Capacity utilization		
	65 percent	80 percent	90 percent
Average total cost ($ per metric ton)	519	472	448
Average price ($ per metric ton)	485 to 513	485 to 513	485 to 513
Operating profit ($ per metric ton) 1/	-6 to -34	13 to 41	37 to 65

1/ Defined as the difference between price and average total cost. The values are before consideration of tax.

Source: Estimates developed by the Congressional Research Service, using as sources: National Academy of Engineering and the National Research Council. The Competitive Status of the U.S. Steel Industry. Washington, National Academy Press, 1985, pp. 146-158; Paine Webber, World Steel Dynamics, Steel Strategist #13, Mar. 30, 1987; Wharton Econometrics, Executive Summary Steel, vol. I, June 29, 1987, Bala Cynwyd, 1987. p. 2f; and, telephone conversations with various steel companies, July 1987.

1/ "Steel Manufacturing in the United States: Can a Smaller Industry Be Profitable?" by David Cantor, Congressional Research Service, July 31, 1987.
2/ Steel: Upheaval In a Basic Industry, by Donald Barnett and Louis Schorsch, 1983.

Exit costs

Although reducing capacity is considered by many industry sources to be the key to increasing the competitiveness of the U.S. steel sheet and strip industry, the high costs associated with closing facilities (exit costs) have prevented the necessary reductions. In general, from a business perspective the cost of closing a steel sheet and strip facility is only justified when the projected cost of continued operations, which include operating profit and loss and necessary capital investments, exceeds the net present value of the closure costs. These conditions are difficult to meet, with the result that producers often will continue to operate facilities which probably should be closed.

A closer examination of exit costs is necessary to understand why companies are so reluctant to close plants. Through discussions with industry officials, the Commission staff developed the following list of the most significant exit costs:

(1) Pension costs;
(2) Retiree insurance costs (health and life);
(3) Supplemental unemployment benefits;
(4) Severance pay;
(5) Raw material supply contract termination penalties;
(6) Environmental costs;
(7) Penalties for violating net worth requirements of certain loans;
(8) Indirect financial costs associated with a loss of political support; and
(9) Costs associated with writing down undepreciated plant assets.

Of the above mentioned costs, pension costs, retiree insurance costs, supplemental unemployment benefits, and severence pay (referred to hereafter as employment costs) are by far the most significant in terms of inhibiting capacity reductions. The employment cost problem associated with plant closure has been magnified over time as the proportion of retired workers to active workers in the sheet and strip industry has increased. The problem has been compounded by the fact that when a plant is closed, the net present value of all pension payments, which occur over a number of years, must be written off in one lump sum during the closure year. The many complex issues associated with pension costs are discussed in further detail in the employment section of this report.

U.S. producers have faced environmental costs in connection with plant and raw material operation closures. These costs, which are related to environmental laws, act to increase the costs of capacity shutdowns. Of these laws, the most important is section 107 of the Superfund Act, which makes steel companies potentially liable for cleanup costs at their abandoned treatment, storage, and disposal facilities to which waste are sent, causing companies to must spend what could amount to hundreds of millions of dollars in cleanup costs. This is but one example of the many environmental costs faced by U.S. sheet and strip producers (see Government policies section).

A significant area of environmental costs associated with capacity reduction is that of shutting down raw material operations, especially coal mines. Although these costs are not directly associated with sheet and strip facilities, they do divert funds from sheet and strip modernization programs. 1/ An important environmental cost incurred by a steel company when closing a coal mining operation is related to acid drainage. In an abandoned coal mine, ground water often reacts with sulfur and other minerals present to create a toxic substance, which the former owner is responsible for pumping out, treating, and storing. If other mines in the area have already closed, the last mine to close may experience an overflow from the other mines. In this situation, the last operator is responsible for treating all acid mine drainage. Based on environmental costs as well as black lung claim settlement costs, industry officials estimate that exit costs from a coal operation are about $21 per ton of capacity.

An integrated producer will usually incur raw material supply contract termination penalties when a plant is closed. These penalties, a direct cash cost that occurs at the time of closure, stem from the historical practice by most major integrated producers of securing iron ore and coal through equity positions in mines 2/ or through long-term contracts. Both methods of obtaining raw materials were used over time to hedge against any short-term tightening of supply. In both instances, the agreements often contain a "take or pay" clause that requires a company to pay some type of penalty for any raw material forgone. Although these costs are significant, the penalties are usually negotiable and rarely equal the value of the raw materials not purchased.

Another significant cost realized when capacity is closed involves loans that have net worth covenants. Many loans by banks to U.S. sheet and strip producers are contingent upon a certain amount of tangible net worth being maintained by each particular company. If a company decides to close down a plant, its total tangible net worth may fall below the amount required in its loans. In this case the entire unpaid amount of the loan may then become due. Industry officials have indicated that these types of net worth requirement loans can preclude shutting down capacity because many cannot afford a large lump sum payment as would be required if net worth fell below requirements.

The indirect costs associated with a loss of political support as a result of a plant closure are difficult to quantify but over the long term they can be significant to a company. Because steel mills are often the center of economic activity in many towns, providing a great deal of employment (direct and indirect) and local tax revenue, closing a mill will often put a company in political disfavor. During fieldwork, many industry officials indicated that this type of political disfavor can be harmful, sometimes precipitating local advocacy of legislation costly to the industry.

1/ Based on fieldwork.
2/ In instances where producers hold an equity interest, the steel company generally receives output from the operation in proportion to its equity position.

One of the more comprehensive attempts to quantify the exit costs for the steel industry was done by Chase Econometrics (table 11-55). The estimates closely corrolate with the experiences of a steel firm that recently closed an integrated steel plant.

Table 11-55
All steel products: Estimates of exit costs incurred when closing a steel mill

Cost category	Dollars/ employee	Dollars/ metric ton	Percent of total
Cash cost:			
Employee-related.........	$54,000	95	72
Suppliers, etc...........	13,500	24	18
Noncash cost:			
Asset writeoff...........	7,500	13	10
Total Costs................	75,000	132	100

Source: Chase Econometrics presented at steel industry conference in Washington, DC, on Mar. 5, 1987.

During the fieldwork conducted by Commission staff, most industry officials concurred with the estimated $75,000 per employee cost for plant closures. Some industry officials indicated that the $75,000 figure was good as an average but it could go as high as $100,000 per employee depending on the age of the workforce at the time of the closure. In recent years, the employment reductions that have taken place in the sheet and strip industry have fallen disproportionally on younger workers. As a result, the average age of most workers still actively employed in the sheet and strip industry is fairly high. Pension benefits to workers with more seniority are much greater than those to younger workers.

One sheet and strip producer, Armco Inc., experienced a $75,000 per employee shutdown cost at one of its plants. The chairman's letter to shareholders in Armco Inc.'s 1986 annual report states: "Armco incurred a charge of $90 million for employee benefits and pension costs when we closed the Ambridge, Pennslyvania tubular plant in 1985. As there were 1200 active employees, the cost to Armco and its shareholders was $75,000 per employee. These costs do not consider the personal and financial costs to the employee and local community." Although Armco's Ambridge plant is not a sheet and strip facility, it is fully integrated (i.e., containing blast furnaces, and BOF's) so closure costs would be similar to those for an integrated sheet and strip plant.

A situation has recently developed in the U.S. industry where companies that declare Chapter 11 bankruptcy can close capacity at a much faster rate than their nonbankrupt counterparts because in Chapter 11, a firm can be relieved of significant pension debt and raw material obligations. Industry sources feel that because pension costs, by far the most significant exit cost, can be assumed by the Federal Government for a Chapter 11 company through the Pension Benefit Guaranty Corporation, the competitive situation in the sheet and strip industry has shifted in favor of companies which had previously been considered inefficient. In fact, some of the most significant capacity reductions have been achieved by companies in Chapter 11 bankruptcy. 1/ Additionally, companies in Chapter 11 can achieve significant cost reductions as described in the profitability section of this report.

U.S. industry sources not currently in Chapter 11, have pointed out that they face an unfair situation when attempting to reduce capacity relative to their foreign competition. Many foreign producers, according to U.S. industry officials, receive Government assistance for restructuring (i.e., closing capacity). Two frequently cited examples were the European steel producers that receive subsidies for plant closures from both the European Coal and Steel Community and their national governments, and the Japanese producers that receive financing from the Bank of Japan and market protection of Government-authorized cartel arrangements to assist in restructuring.

In some cases where high exit costs preclude shutting down obsolete capacity in the United States, sheet and strip producers have opted to sell plants outright, again perpetuating overcapacity in the industry. The plants that are sold (i.e., reconstituted) are considered by some industry sources to be unfair competition because of the many concessions made by the selling company, local muncipalities, labor, and suppliers to keep the plants running. These concessions in conjunction with what are considered extremely low selling prices (table 11-56) allow older plants to be profitable, at least in the short run. In addition to the low prices and the wage concessions offered by the labor force, local governments will often grant concessions on taxes and utility rates as an inducement for investors to buy the steel plant, which, in many communities, is the center of economic activity and employment.

1/ According to its 10-K report, LTV, the largest sheet and strip producer currently in Chapter 11 bankruptcy, has been able to reduce its annual steelmaking capacity by 31 percent from 18.3 million tons to 12.6 million tons.

Table 11-56
Steel sheet and strip: Date of plant sale, buyer, and purchase prices for sheet and strip plant sales, 1984-87

Date	Plant(s)	Buyer	Purchased price Million dollars	Dollars/ metric ton
1986...........	USS-Pitt, CA	Posco	1/ 290	213
1984...........	National	Weirton	194	56
1984...........	Kaiser	California Steel Industry	110	34
1986...........	LTV-Gadsden	Brenlin Group	2/ 5	3
1987...........	USX-Geneva Works	Basic Manufactures Technology	3/ 30	4/

1/ Fifty-fifty joint venture; total cost includes $90 million sale price plus approximately $200 million in startup capital charges.
2/ Reduced from original asking price of $23 million, also dropped LTV supply purchasing requirements.
3/ Industry estimate.
4/ Not available.

Source: Chase Econometrics, American Metal Market.

Capital availability/management

A significant problem confronting the U.S. industry in its attempt to restructure and modernize is its inability to obtain capital; the problem is caused primarily by lack of profitability and resulting low bond ratings. Lack of profitability has prevented producers from internally generating the funds necessary for modernization of their facilities. Lack of profitability has also led to low financial rates of return, which in turn has caused a lowering of sheet and strip producers' bond ratings. Low bond ratings (see section on Debt) result in companies having to pay relatively high rates of interest on new public issues of debt to attract investors. Additionally, low financial rates of return have created a reluctance on the part of banks and other financial institutions to lend money to sheet and strip producers, a problem aggravated by the net worth loan practice mentioned above.

Another problem associated with the industry's restructuring is how to manage investment in new plant and equipment effectively. With the cost of major pieces of equipment in the hundreds of millions of dollars and sources of capital limited, the companies have had to be highly selective in deciding which items should be replaced or modernized. As a result, certain production locations have ended up being a mixture of old and new, where state-of-the-art capability in one phase of the operations cannot be used optimally because of the limited capability of older equipment in use in other operations at a particular plant.

Regional differences

Many industry sources feel that the west coast of the United States constitutes a completely separate market from the rest of the country and that the competitive situation for sheet and strip producers there is much different. Being far from low-cost domestic sources of iron ore and metallurgical coal and the major steel consuming areas, the only two fully integrated sheet and strip facilities in the western region, the Fontana Works of Kaiser Steel and the Geneva Works of USS (built during World War II amid national security concerns) found it uneconomical to maintain their blast furnaces and steelmaking facilities. Exacerbating the situation was a relatively high import penetration level. The Geneva Works was idled during a work stoppage at USX in 1986 but was later purchased by investors that are now operating the facility after achieving cost savings through new labor contracts and other special concessions. The hot metal end of the Fontana Works was shut down when Kaiser sold its facility in 1983. With the hot-metal capacity on the west coast currently limited to minimills, nonintegrated sheet and strip producers in the region, which include California Steel Industries, USS-POSCO Industries, and Pinole Point Steel Co., must rely on purchases of semifinished products, either slabs or hot-rolled coils, from outside sources.

In their quest for semifinished steel, west coast nonintegrated sheet and strip producers are constrained in two significant ways. On the one hand, the VRA's negotiated between the United States and both Japan and Korea place limits on how much semifinished steel can be exported to the United States. On the other hand, transportation and handling costs for semifinished steel produced in areas east of the Rocky Mountains, which range between $35 to $70 per ton, increase the west coast producer's production costs for finished sheet and strip products.

Competitive Strategies of U.S. Sheet and Strip Producers

Capital acquisition

Despite the impediments to restructuring and modernization, the U.S. sheet and strip industry has made significant progress in obtaining capital through what are considered by industry sources to be unconventional means, including off-balance-sheet financing for major capital projects and joint-venture agreements.

The types of off-balance-sheet financing used by U.S. sheet and strip producers to obtain capital have usually involved foreign companies, particularly Japanese companies, although domestic firms have been involved as well. An example of off-balance-sheet financing involving domestic firms is an arrangement known as a leverage-lease agreement, where a piece of equipment is installed at a mill but is owned by a group of banks. This type of arrangement was used by at least one major producer who raised the capital to build a facility by obtaining long-term commitments from customers to pay a set amount of money each month (whether the steel was bought or not). With the payment commitments by the customers in place, a group of banks then became willing to provide capital for the project.

Another form of off-balance-sheet financing involves specific pieces of equipment-like continuous casters. Again, a lot of these type arrangements involve bank-ownership of the equipment and leasing back to the steel company. This allows the bank to get the tax advantages of ownership, which generally are not available to loss-making companies and the steel company to obtain badly needed capital.

Currently, the most important source of external capital to the U.S. sheet and strip industry is foreign producers, particularly Japanese firms, through both off-balance-sheet financing and joint ventures. This involvement has enhanced the competitiveness of the U.S. industry in a number of ways. Not only has foreign involvement allowed U.S. firms to obtain capital for modernization, it has also allowed U.S. firms access to advanced Japanese technology. A common statement made by industry officials to Commission staff during the fieldwork was that there were no technological secrets in the steel industry. Although producers know what the best technology is, gathering the capital to obtain it is the problem. Industry sources feel that joint ventures with Japanese firms have allowed them to get both capital and state-of-the-art technology. It is interesting to note that Japanese trading companies are involved in many of the off-balance-sheet financing that involves foreign firms. For example, at USX Corp.'s Gary, IN, works, Japanese trading companies supplied funds for the construction of a continuous caster and related equipment. USX then arranged a tolling agreement with the Japanese trading companies. Japanese trading companies have also helped finance a $400 million continuous cold-rolled steel complex joint venture between Inland Steel and Nippon Steel Corp. Joint ventures between U.S. and Japanese sheet and strip producers have been especially prevalent in the area of electrogalvanizing, where a number of new facilities have recently been constructed. If the relative value of the dollar persists at current or lower rates, it will presumably encourage more such arrangements.

Competitive improvement measures

In response to competitive pressures, U.S. producers have taken a number of actions to improve their relative position. As shown in table 11-57, improving product quality was the principal measure chosen by the highest percentages of producers both as a response to domestic competition (95 percent) and as a response to foreign competition (89 percent). Concentrating on increasing market niches and improving or expanding technical assistance and support were also chosen by a high percentage of producers as responses to domestic and foreign competition.

Table 11-57
Principal steps being taken by domestic producers of steel sheet and strip to improve their competitive position in response to domestic and foreign producers 1/

Steps to improve competitive position	In response to competition from-- Domestic producers	Foreign producers
	----Percent----	
Promotion and market related:		
Improve buyer-incentive programs....	24	18
Increase advertising, market budget..........................	24	16
Concentrate increasingly on market niches where firm has competitive advantage or competition is weak..	89	74
Target specific geographic areas/end-user markets.....................	71	53
Price and finance related:		
Concentrate on maintaining price competitiveness.................	82	74
Improve financing terms of purchase.......................	3	3
Product-related:		
Improve product quality.............	95	89
Improve/expand technical assistance and support......................	84	71
Output related:		
Diversify product six to strengthen market position..................	50	39
Change product six to focus on most profitable lines..................	63	45
Increase production of higher value-added products...................	71	58
Consolidate production into fewer or newer facilities.................	18	18
Relocate production or distribution facilities to cut transportation costs...........................	5	5
Sell or close low profit operations......................	13	13

See footnotes at end of table.

Table 11-57--Continued
Principal steps being taken by domestic producers of steel sheet and strip to improve their competitive position in response to domestic and foreign producers 1/

Steps to improve competitive position	In response to competition from-- Domestic producers	Foreign producers
	Percent	
Strategy related:		
Modernize present plant and equipment	82	74
Invest in new plant and equipment	58	53
Increase research and equipment:		
To develop new products	58	47
To improve process or production efficiency	74	61
Participate in joint ventures:		
To help finance new projects	34	26
To help modernize existing facilities	24	21
Increased tolling arrangements	58	39
Diversity into nonsteel operations	8	3
Divestment of nonsteel operations	5	5
Cost related:		
Labor:		
Invest in more labor-saving equipment	61	50
Increase contracting out work	16	16
Reduce employment	45	42
Cut wages, salaries and/or benefits	21	18
Training programs for utilizationof computer-aided equipment	66	58
Increased emphasis on management techniques	71	58
Cross over or merging of individual job responsibilities	58	55
Materials:		
Increase foreign sourcing of:		
Iron ore	3	3
Coke	3	0
Slabs	13	13
Hot-rolled products	13	11
Cold-rolled products	5	3

1/ Responses are given in percent of total producers who were taking each particular step in order to improve their competitive position.

Source: Data compiled in response to questionnaires of the U.S. International Trade Commission.

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Quality improvement, development of market niches, and technical assistance are actually all related as responses to competition particularly with respect to the automotive market.

Information collected during the course of the investigation has suggested that the U.S. sheet and strip industry is moving away from the commodity-grade markets (where newly developing countries such as Brazil and Korea are becoming dominant) to markets of higher value, specialized products designed to fit specific needs, particularly in the automotive market. This move toward the automotive market has also brought about much closer cooperation between automakers and steelmakers in the form of technical assistance. Discussions with industry officials indicated that producers in countries such as Brazil and Korea, while offering low product prices, have not been able to match the quality of domestically produced goods or the technical assistance offered to automakers. U.S. producers have moved to exploit this advantage in an attempt to retain specific sectors of the sheet and strip market. In many instances, this may mean lower tonnage, but the higher value added and greater loyalty among customers is seen as adequate compensation.

Industry officials have indicated that close cooperation between steelmakers and automakers, a relatively recent phenomenon (see "Domestic Consumption" section), is one way that U.S. sheet and strip producers are strengthening their position in the automotive market. Field discussions revealed that U.S. sheet and strip producers have engineers that are stationed at major U.S. auto companies to work with auto engineers to help develop the right types of steel to fit specific needs. This type of cooperation is viewed as having helped to improve the competitiveness of both industries.

The new trend toward automaker and steelmaker cooperation is exemplified by Honda of America (HAM) and its steel suppliers. In reference to Inland Steel's efforts to become a sheet supplier to HAM's newly built plant in Marysville, OH, a company official claimed: "I am frank to say that at the beginning Inland Steel Company could not meet HAM's technical and quality requirements. However, HAM committed to work with us as a partner in an effort to solve these problems. We both were dedicated to making the relationship work. Specifically, HAM's and Inland Steel Company's engineers and production people worked closely together to determine what needed to be done to meet their requirements, including technical and other cooperation with Nippon Steel Company, HAM's major supplier in Japan. Indeed, in some cases, HAM modified their original specifications to accommodate what Inland Steel Company could produce. This experience also helped us in some of our capital investment decisionmaking." 1/ According to this official, Inland was supplying 95 percent of Honda's requirements by 1984.

By the spring of 1986, HAM had two other domestic steel sheet and strip suppliers, Armco and Bethlehem Steel. Armco was unsuccessful in its initial attempts to produce the type of steel required by HAM but through greater cooperation with HAM was able to become a supplier. As noted at the Commission hearing, "This competitiveness strategy has paid off with Honda of

1/ Prehearing brief of T. Andrew Ellwein, Inland Steel Co. for hearing on Feb. 24, 1987, at p. 4.

America. Armco, based on these intensified efforts, reapproached Honda of America and formed a close working relationship with its people, including a steady stream of personnel visiting each other's facilities to assess capabilities and needs. In fact, based on discussions with Honda of America concerning their needs and requirements, Armco developed new types of steel that it had not previously made. These new products have found acceptance with other Armco customers as well." 1/

Bethlehem Steel, the other supplier to HAM's Marysville, OH, plant, indicated it was selected to be a sheet supplier after a highly competitive 10-month program emphasizing quality and service. Fieldwork has indicated that the type of cooperation shown between Honda of America and its U.S. steel suppliers is now commonplace at other auto companies, including Ford, GM, Chrysler, and AMC.

In an attempt to produce the higher quality steel shown to be required by automakers, U.S. sheet and strip producers have been modernizing their plant and equipment. As shown in table 11-57, 82 percent of the U.S. producers responding to the questionnaire indicated that modernizing plant and equipment is a principal step being taken to improve competitiveness.

The main areas where technological modernization has enhanced U.S. sheet and strip producer's competitiveness in the automotive market are greater use of continuous casting, vacuum degassing, ladle metallurgy, and statistical process controls (SPC). Although, modernization has been less than complete, as indicated in the previous discussion on the availability of capital, the resulting quality improvement has been favorable as shown by a significant decline in Ford's steel rejection rate (see section on "Factors Influencing Purchase Decisions"). Ford has also noted a 70-percent improvement in steel cleanliness (i.e., surface carbon contaminants) since 1983. 2/ Further evidence that the quality of U.S. produced sheet and strip has improved is shown by the falling rate of GM's rejections of exposed steel (i.e. steel sheet for outside body panels on cars) from 5 to 7 percent during 1981-82 to between 2 to 3 percent currently and HAM's rejection rate for steel from its three U.S. suppliers to below 1 percent. 3/

Industry Outlook

In assessing the outlook for the U.S. sheet and strip industry, it is important to examine how the producers will respond to both market and technological developments. Although the U.S. sheet and strip industry has not historically adjusted rapidly to both types of developments, the preceding discussions of industry restructuring shows that it has recently proven to be

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1/ Submission by Armco Inc. to the USITC on Mar. 11, 1987.
2/ International Iron and Steel Institute, 21st Annual Meetings and Conference, Washington, DC, Oct. 4-7, 1987. Talk given during a panel discussion on the new partnership between steel and the automobile: "The North American Challenge: An Automakers View" by R.J. Krygier of Ford Motor Co.
3/ "Steelmakers and Automakers team up to Improve Quality," Iron Age, February 1987, p. 25.

more adaptive, which is critical in light of rapidly changing market conditions. Compounding problems further is the erosion of technological barriers that had formerly kept minimills out of the market. With their relatively strong financial condition and entrepreneural management, minimills could eventually pose a serious challenge to the traditional integrated sheet and strip producers. The financial outlook would be considerably brighter for the integrated producers if older, technologically obsolete capacity could be reduced efficiently so that the more modern production facilities, often installed in direct response to market developments, could be run at higher operating rates.

One of the more significant responses of the U.S. sheet and strip industry to the market in recent years has been the construction of five new electrogalvanizing lines and a greenfield continuous cold-rolling mill, some of which was accomplished through joint ventures with Japanese firms. The construction of the electrogalvanizing lines was undertaken in direct response to rising demand for electrogalvanized sheet, particularly by the major domestic automakers; the sheet is in high demand because of its high rust resistance, weldability, and paintability. U.S. output of electrogalvanized sheet and strip, a high value product designed to fit a specific application, should increase significantly in the future to meet anticipated strong demand.

Competitive Tactics

The construction of five new electrogalvanizing lines marks a new industry flexibility. At the onset of increased demand for electrogalvanized sheet, few U.S. producers had the financial resources necessary to construct their own facility. Joint ventures with other domestic producers and Japanese producers provided an innovative solution to U.S. producers' financial difficulties. Fieldwork has suggested that more cooperative arrangements between U.S. companies and Japanese companies are most likely to take place in the future as U.S. companies seek capital and technology infusions from Japanese producers, which, in turn, are seeking shelter from U.S. trade measures and exchange-rate volatility. It has also been indicated that U.S. producers will cooperate more among themselves in the future. Cooperative arrangements between U.S. firms and Japanese firms is seen as a means of enhancing competitiveness.

According to industry sources, cooperation among U.S. sheet and strip producers will continue in ways other than joint ventures. One frequently cited example is intercompany transfers of output. To compensate for the technological imbalances at many facilities, U.S. producers may coordinate production activities among themselves to utilize fully the best aspects of each of their plants. For example, a company with excellent hot-metal and continuous-casting facilities may ship its slabs to another company with superior hot-rolling and finishing operations in a tolling arrangement. The benefits of intercompany cooperation would be dependent largely on companies being able to dismantle obsolete capacity in a less costly manner than the current situation permits; fully utilizing some facilities will not produce significant cost savings if capacity utilization on a companywide basis is low.

Customer Requirements

At least two steel industry analysts contacted by Commission staff have indicated that stricter customer requirements with respect to sheet and strip products will lead to an increasingly fragmented market. Because highly specialized products are usually consumed in lower tonnages, reducing the economic advantage of many large integrated producers that have equipment designed for large production runs, in many instances, the final stages of production for specialized products will be done by service centers and re-rollers, whose future role in the sheet and strip market is seen as expanding.

Minimills

Another important development with respect to the outlook of the U.S. sheet and strip industry is the entrance of minimills into the market. Historically minimills have been kept out of the flat-rolled steel area for technological reasons. The amount of capital investment (about $600 million or more) required to build a hot-strip mill capacity necessary for efficient operation (about 3 million tons) was not consistent with the minimill concept. 1/ The advent of a new technology, thin slab casting, has now made it possible for minimills to produce sheet and strip because a thinner slab comming from the continuous caster eliminates the need for some of the initial reducing stands on the hot-strip mill and lowers the necessary capital expenditures and capacity. Also, careful scrap collection (to get only high quality scrap) and ladle metallurgy have helped make it possible to use scrap to produce high quality products.

The first minimill to attempt entering the sheet and strip business, Nucor Corp., will soon begin building in Indiana a hot-rolled and cold-rolled strip mill scheduled for start up in mid-1989, based on the SMS Schloemann-Siemag thin slab caster. 2/ With a combined hot-rolling and cold-rolling capacity of 800,000 tons per year, the proposed facility will be very small relative to existing sheet and strip plants. The anticipated cost savings from the new thin slab casting process are expected to be between $50 to $75 per short ton. More significantly, the president and chief executive of Nucor has indicated that if the new facility proves to be a success, Nucor would build more. 3/ Since the plant will most likely not be able to produce

1/ Up From the Ashes, Donald Barnett and Robert Crandall, 1986.
2/ "Nucor's Green Light for Flat Products Mini," Metal Bulletin, July 20, 1987, p. 19.
3/ Ibid.

the high-quality sheet demanded by the auto industry in its initial production runs, industry officials do not see Nucor as an immediate threat. 1/ If the new technology can be successfully installed and the thin slab casting process can be refined to produce high-quality automotive sheet, then the currently existing U.S. sheet and strip industry will be challenged by minimill competitors. Some industry analysts estimate that minimills will eventually account for 10 percent of the flat-rolled market.

Future Demand, Purchaser Perspective

Future demand is important to the U.S. steel sheet and strip industry. A sampling of purchasers of sheet and strip were asked, in Commission questionnaires, what their current purchases of various sheet and strip products were in 1986 and what they project their annual purchases will be by 1990 (table 11-58).

Table 11-58
Sheet and strip: 1986 purchases of sheet and strip and projected annual purchases by 1990 1/

Sheet and strip product	1986	Projected annual purchases by 1990	Average annual percentage rate change
	-----------metric tons-----------		----Percent----
Hot-rolled	2,128,260	2,407,652	13
Cold-rolled	2,496,233	2,003,776	-20
Coated:			
Hot-dipped galvanized	1,375,092	1,186,193	-14
Electrogalvanized	423,748	1,238,483	192
Tin free	122,984	116,598	-5
Tin plate	276,778	267,029	-4
Zinc-alum	113,717	155,362	37
Other	458,245	178,179	-16
Stainless	54,751	54,961	0.4
Total	7,449,808	7,608,233	2

1/ Data represents only a sample of the total purchases of sheet and strip as indicated by responses to the purchasers questionnaire.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

The largest increase is projected to be in purchases of electrogalvanized sheet and strip. This reflects the movement toward greater need for corrosion resistant steel products. The outlook for total sheet and strip demand is less encouraging as overall these purchasers expect to increase their volumes consumed by 2 percent over this four year period.

1/ Based on fieldwork.

The purchasers were asked what the factors were that influenced their projected increases and/or decreases. Increased production of end products and increase in company size and/or sales were the major reasons sited. Decreased production of end products and the development of higher performance materials which substitute for steel sheet products were the two major reasons sited for decreases projected.

With respect to the coverage of companies included in the Commission sample, the respondents accounted for the following percents of 1986 apparent consumption in the four main product catagories:

Sheet and strip product	Percent of apparent consumption
Hot-rolled	17.5
Cold-rolled	18.5
Coated	22.1
Stainless	7.2

Table 11-59 also helps to clarify the character of the purchasers responding to the Commission questionnaire. This table shows the type of steel products purchased by the respondents. Most purchases were of a commercial quality, except for electrogalvanized and other coated products, which were mainly purchased in the drawing quality special killed category. A comparison with shipment data reported by producers indicates that the consumers purchases were slightly more biased toward commercial grade steels.

Table 11-59
Sheet and strip: Profile of respondents for Commission's purchasers questionnaire according to the quality of sheet and strip they are purchasing.

	Quality Measures						
Sheet and strip product	Com-mercial	Drawing quality 1/	Drawing quality special killed	Structural quality	Drawn and redrawn	Down and iron	Other
Hot-rolled	72	8	5	15	0	0	0
Cold-rolled	56	26	15	0	0	0	3
Coated:							
Hot-dipped galvanized	30	15	40	9	0	0	6
Electrogalvanized	5	11	67	1	0	0	16
Tin free	98	0	0	0	2	0	0
Tin plate	94	0	5	0	1	0	0
Zinc-alum	11	12	14	63	0	0	0
Other	33	15	50	0	0	0	1
Staniless	44	39	11	0	0	0	5

1/ Drawing quality includes deep drawing quality.

Source: Compiled from date submitted in response to questionnaires of the U.S. International Trade Commission.

CHAPTER 12. COMPETITIVE ANALYSIS OF U.S. AND PRINCIPAL FOREIGN COMPETITORS

Domestic Industry's View of Comparative Strengths and Weaknesses

In the questionnaires sent to domestic sheet and strip producers, the respondents indicated their opinions on the strengths and weaknesses of the U.S. industry and their primary foreign competitors for various factors which affect costs and competitive ability. Their opinions were based on the following scale: 1 = principal strength; 2 = some strength; 3 = neither strong nor weak; 4 = some weakness; 5 = principal weakness. If the respondents did not have knowledge of a particular country or factor, they were asked to refrain from responding. The weighted averages of their responses are displayed in table 12-1, with lower scores indicating a stronger position. In many cases, individual responses were widely scattered, indicating a lack of consensus among the domestic industry. A possible explanation for this is that some respondents may have responded solely on the basis of their firm's position, rather than on the position of the industry as a whole. These opinions also vary widely from data presented elsewhere in this report.

Supply Factors

Raw Materials

Iron ore and energy are the two primary inputs used in the production of steel, accounting for approximately 50 to 60 percent of pretax operating costs per ton of raw steel produced. For this reason, the availability of inputs at moderate cost is a significant factor in the competitive position of a steel producer. The required form and mix of these inputs varies according to the steelmaking process employed; for example, raw steel (i.e., steel that has not been rolled into final shapes) is produced in either open-hearth furnaces which can utilize scrap and pig iron in virtually any proportion, electric furnaces, which rely almost exclusively on scrap as a metallics charge, or basic oxygen furnaces (BOF), which can use up to 30 percent scrap as a metallic charge. Although the methods of steel production in each of the countries studied vary, with BOF accounting for approximately 60 percent of all steel production in the United States, and 71 to 86 percent of steel produced by other nations, most steel used to produce sheet and strip is made in BOF's.

The sources of energy used at a steel plant can be classified into primary sources purchased from outside the plant, and secondary source byproduct gases that are generated in various parts of the steel plant and that can be recovered for reuse. Areas of concentration for improving energy

Table 12-1
Sheet and strip: U.S. producers' views of the strengths and weaknesses of U.S. industry and primary foreign competitors

Factor	United States	Brazil	Canada	France	Japan	Korea	West Germany
Raw materials costs:							
Iron ore	2.9	1.2	2.3	3.1	3.6	3.2	3.2
Coke	2.2	2.9	2.3	2.7	3.6	3.8	2.9
Limestone	2.4	2.7	2.5	3.2	3.5	3.1	3.3
Scrap	1.5	3.8	2.3	3.2	3.9	4.0	3.2
Alloying elements	3.1	2.5	2.9	2.6	3.7	3.7	3.1
Raw materials availability	2.0	2.2	2.3	3.3	4.0	4.1	3.1
Energy costs	2.0	2.7	2.0	2.9	4.1	4.0	3.4
Cost of capital	3.7	3.3	3.2	3.0	1.5	1.6	2.6
Availability of capital	3.8	3.4	2.6	2.8	1.6	1.5	2.7
Labor wage rates	4.7	1.2	3.4	3.4	3.6	1.5	3.4
Labor productivity	2.9	3.8	2.9	3.3	1.8	2.3	2.4
Labor skills	2.1	4.0	2.4	2.8	1.7	2.9	2.0
Technology used	2.6	2.8	2.7	2.7	1.4	1.6	2.0
Scale of operations	2.5	2.3	2.6	2.6	1.6	1.7	2.3
Plant layout	3.4	2.0	2.9	2.5	1.5	1.4	2.6
Plant location	2.6	2.9	2.5	2.3	2.1	2.4	3.0
Level of capital expenditures	4.8	2.3	2.6	3.3	1.5	1.4	2.5
Research and development	3.4	4.1	3.0	3.0	1.3	2.8	2.1
Transportation infrastructure	2.3	4.1	2.6	2.5	2.5	2.3	2.8
Government involvement:							
Trade protection	4.0	1.6	2.8	2.2	1.3	1.3	2.4
Subsidization	4.4	1.8	3.0	1.9	1.8	1.5	2.4
Regulation:							
Health/safety	3.6	2.9	3.2	3.0	2.1	2.4	2.9
Environmental	3.8	2.9	3.4	2.9	2.5	2.2	3.3
Antitrust	4.2	1.9	2.9	2.3	1.6	1.1	2.5

Source: Information developed from responses to U.S. International Trade Commission questionnaires.

consumption during the BOF process are shown in figure 12-1. One of the objectives of improved energy efficiency is to expand the use of secondary sources as much as possible and thereby reduce the requirements for purchased energy. U.S. producers recover a smaller percentage of energy than other producers in industrialized nations although there has been an increase in recovered energy since 1980 (table 12-2).

Table 12-2.
All steel production: Energy recovered as a percent of total energy used, 1980-85

Country	1980	1981	1982	1983	1984	1985
United States....................	13.5	13.4	14.0	13.5	13.5	15.5
Japan............................	21.0	28.5	29.1	29.8	30.9	31.8
West Germany.....................	21.9	21.3	20.9	21.6	22.4	21.5
France...........................	20.0	19.5	18.4	19.2	19.4	20.3
Canada...........................	20.8	18.1	16.9	17.5	16.9	27.0
Brazil	1/	1/	1/	1/	1/	26.5

1/ Not available.

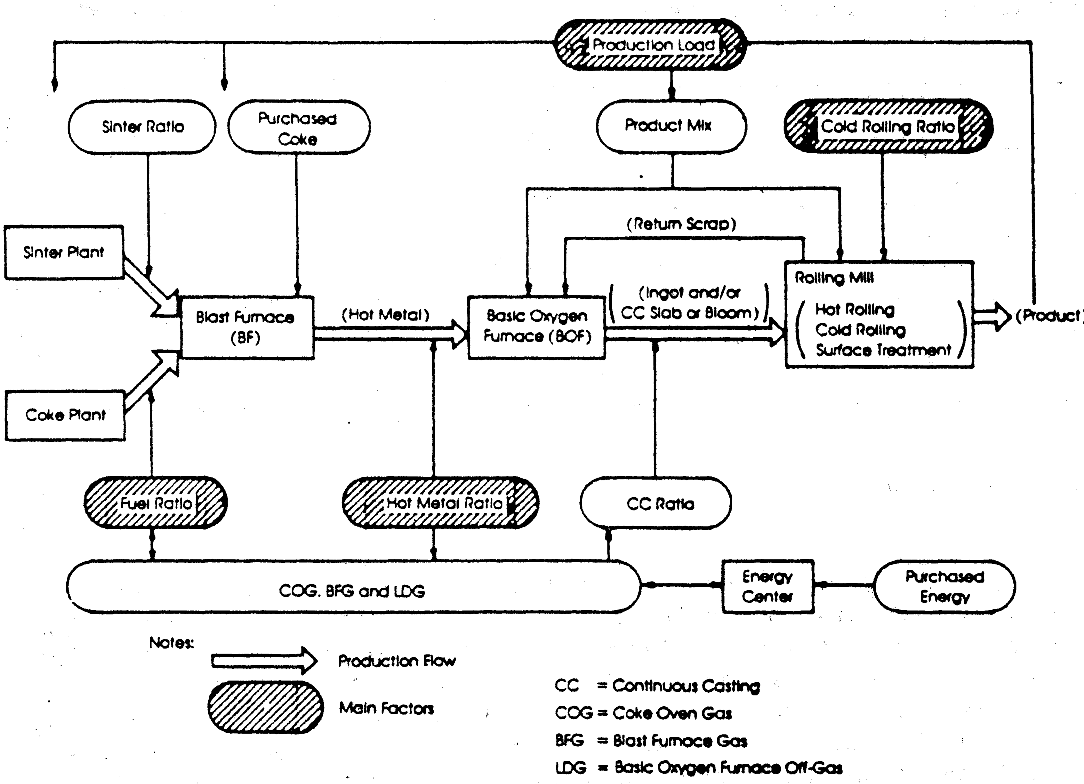
Source: OECD Energy Analysis.

The primary sources of energy for steelmaking are metallurgical or coking coal, fuel oil, electricity, and natural gas. Of these inputs, which account for 25 to 30 percent of total production costs, metallurgical coal represents the largest percentage of fuel costs. For U.S. producers, coal-related costs contribute approximately 10 percent to the total cost per ton of raw steel. This is similar to the ratio for Canadian producers, and compares favorably with costs for both Japan and France which represent 12.6 and 13.8 percent, respectively, of total cost per ton. West Germany is the highest cost industrial producer with 16.0 percent of pretax production costs associated with coal inputs, largely because of requirements for domestic purchases under the Ruhrkohle system.

Brazil has a domestic purchasing requirement of 10 percent, which increases coal-related input costs because of low-quality coal and inadequate transportation systems. Korean producers import 100 percent of their coking coal, most of it from mines in which they have joint-venture participation (Australian and Canadian properties) or complete ownership (Pennsylvania's Tanoma Coal Mine). Japan and France have only a small amount of domestic coal reserves and, as a result, import most of their coking coal requirements, the majority of which are secured by long-term contracts. In terms of coal availability, U.S. and Canadian producers enjoy an advantage over their counterparts in other countries, and, in concert with Australia, are the major suppliers for steel producers who import large quantities of raw materials.

Although other fuels (electricity, natural gas, and fuel oil) account for a smaller percent of energy inputs, the substantial increase in the cost of

Figure 12-1
Finished steel production: Main factors affecting energy consumption in a conventional integrated steel plant



Source: World Bank Study, Energy Efficiency in the Steel Industry With Emphasis on Developing Countries these materials since the early 1970's has contributed disproportionately to the rise in steel production costs worldwide. Electrical rates and natural gas prices for U.S. industrial users rose by more than 400 percent and 800 percent, respectively, during 1973-85 (table 12-3).

Table 12-3
Steel sheet and strip: U.S. prices of electricity, coking coal, and natural gas, 1973-85

Year	Industrial electricity	Coking coal	Natural gas
	Per kilowatt-hour	Per ton	Per 1,000 cubic feet
1973	$0.0125	$19.11	$0.58
1974	.0169	33.00	.69
1975	.0207	45.98	.96
1976	.0221	48.37	1.30
1977	.0250	50.17	1.83
1978	.0279	52.75	2.17
1979	.0305	54.50	2.84
1980	.0369	56.04	3.76
1981	.0429	59.34	4.00
1982	.0495	60.86	4.05
1983	.0497	51.75	4.35
1984	.0503	53.32	4.70
1985	.0517	53.07	4.60

Source: Barnett and Crandall, Up From The Ashes.

Because rolling and finishing processes use a larger amount of electricity than any sector in the production of sheet and strip (other than ironmaking), rates for industrial users are an important determinant of final product price. Estimates of current electrical rates for producers suggest costs are widely variable, ranging from a low of 18 mills per kWh for Brazil to 91 mills per kWh for Japan; U.S. producers pay approximately 50 mills per kWh. 1/

The raw material input that accounts for the largest percentage of material costs for U.S. producers (24.1 percent) is iron, which can be added in several forms: lump ore, scrap, pellet feed, or sinter. 2/ Iron ore is marketed as a number of different products, with brand names and product forms based largely on a plethora of physical and chemical specifications. The ores are priced on an iron unit basis, which refers to the metal content of the ores (one iron unit = each percentage point of contained iron in a long ton). This basis is widely used in the industry for determining prices and shipping costs.

1/ Electronic Industries Association data and information obtained from Brazilian industry representatives.
2/ World Steel Dynamics, Price/Cost Monitor Report #9.

At the present time, Australia and Brazil serve as the price leaders for iron ore because of the large volume and high quality of their exports. Current f.o.b. and quoted shipping prices do not accurately reflect all companies' costs, however, since many have captive mines or long-term contract arrangements and do not purchase ore from other sources. It is estimated that in the United States and Canada, 98 percent of all iron mines are owned by steel companies. 1/

Since the late 1960's, pellets have been the primary blast furnace feed in the United States and Canada, owing to the depletion of high-grade natural ores and construction of pellet plants at the mines. The dominant role of pellets in this region is one of the major factors that distinguishes these markets from the iron markets of Japan, West Germany, France, Korea, and Brazil (table 12-4).

Table 12-4
Ironmaking: Fe charge mix, by country, 1985

(In percent)

Country	Sinter	Pellet	Ore
United States.........	24	76	0
Canada................	13	83	4
Japan.................	73	10	17
West Germany..........	62	25	13
France................	85	5	10
Brazil................	80	6	14

Source: IISI, Statistics on Energy In The Steel Industry, 1980-85.

Of the seven producer nations analyzed in this report, only Brazil has large quantities of high-quality ore. The United States and Canada are able to utilize their lower grade ore resources through pelletizing, but the final cost is still well above the import price of fine ore or pellets at coastal ports. This price differential results in two purchasing regions within the United States. Great Lakes' pellets are purchased by Midwest producers, whereas coastal producers primarily utilize imports. Producers in the other countries studied import the majority of their iron ore requirements.

Ferrous scrap is another form of iron used in steelmaking, averaging about 27 percent of the metal charge in BOF steelmaking. It is not currently a significant factor in materials costs for most sheet and strip producers, however, since integrated operations rely primarily on "home" scrap, i.e., scrap generated within the plant.

1/ U.S. Bureau of Mines.

At current operating rates, Brazil and Korea are the producers with the lowest absolute materials costs (table 12-5). However, neither country is as self-sufficient in major inputs as Canada and the United States. In fact, Korea is almost 100-percent import dependent. In addition, the costs of materials are subject to fluctuations in foreign exchange, ocean shipping rates, and spot market prices, making constant relative input prices over time "virtually impossible" for a steel producer in a specific country to maintain. 1/

Table 12-5
Hot-rolled products: Materials cost, by country, early 1987

	United States	Canada	Japan	Korea	West Germany	France	Brazil
Operating rate (percent).....	60	80	60	100	80	75	95
Materials (dollars per metric ton):							
Major 1/	149	129	118	104	141	118	84
Other	61	56	83	49	82	80	53
Total.........	210	185	201	153	223	198	137
Total pretax costs per metric ton....	334	306	399	252	347	375	253

1/ Major materials include iron ore, coking coal, scrap, and energy.

Source: World Steel Dynamics, Steel Strategist #13.

Labor

Labor productivity, the number of labor hours required to produce a ton of finished steel, is a competitive measure of production efficiency between countries. In industrialized countries, the steel sheet and strip industries and supporting production facilities continued to react to changing consumption patterns and global excess capacity by closing inefficient facilities, modernizing production plants, and restructuring product mix. The cost-cutting methods taken in the United States and the EC improved manhour-per-ton results by 20 to 40 percent since the early 1980's. For example, by early 1986 and continuing in 1987, the United States had the highest labor productivity in hot-rolled products (table 12-6), whereas Brazil and Korea had the lowest productivity because of the larger number of labor-intensive facilities in their respective countries.

1/ World Steel Dynamics, Steel Strategist #13.

Table 12-6
Hot-rolled products: International productivity comparisons, early 1986 and early 1987

Country	Productivity Early 1986	Productivity Early 1987	Percentage increase early 1986 to early 1987
	Man-hours per short ton		
United States	3.6	3.4	6
West Germany	4.0	3.8	5
Japan	4.2	3.9	7
Canada	4.1	4.0	2
France	4.7	4.5	4
Korea	5.8	5.4	7
Brazil	5.9	5.8	2

Source: World Steel Dynamics, Steel Strategist #12 and #13.

In Japan, labor productivity improved 10 percent during 1981-86. Japan's lifetime employment system has become an impediment in its efforts to enhance labor productivity in the current environment of overcapacity and declining demand for steel. The country's current effort to cut employment by about 30 percent consists mainly of accelerating early retirements, a minimum amount of hiring, and transferring workers to nonsteel businesses.

The hourly compensation in 1986 of U.S. steelworkers was the highest ($22.24) in comparison with that of steelworkers in the countries studied. The hourly compensation of Japanese steelworkers at $16.05 in 1986 is believed to have risen to around $20 per hour in 1987 because of the rapid appreciation of the yen against the dollar. By comparison, Korean and Brazilian steelworkers in 1986 were compensated at $2.30 and $2.26 an hour, respectively, reflecting a distinct labor cost advantage compared with all other countries studied (table 12-7).

Hourly compensation for iron and steelworkers was higher in each of the countries studied than for all manufacturing (table 12-7). Industry sources attribute higher steel wages to the relatively strong bargaining position of steelworker labor unions.

Table 12-7
Hourly compensation costs for production workers in all manufacturing and in iron and steel manufacturing, by country, 1975 and 1986

Country	All manufacturing 1975	All manufacturing 1986	Growth 1975-86	Iron and steel 1/ 1975	Iron and steel 1/ 1986	Growth 1975-86
	---U.S. dollars---		Percent	--U.S. dollars--		Percent
United States......	6.35	13.09	106	10.24	22.24	117
Japan..............	3.05	9.05	197	5.26	16.05	205
Canada.............	5.86	10.96	87	7.56	15.34	103
West Germany.......	6.35	13.44	112	7.31	15.31	109
France.............	4.60	10.45	127	5.87	12.49	113
Korea..............	.37	1.55	319	.48	2.30	379
Brazil.............	.86	1.30	51	1.26	2.26	79

1/ Data on iron and steelworker wage rates from the Bureau of Labor Statistics is based on production workers only and applies to a wide range of iron and steel products.

Source: U.S. Bureau of Labor Statistics, 1986 and 1975. Includes base and overtime pay, bonuses, premiums, cost of living adjustments, vacation, etc., cost of payments in kind and social security, etc., and all other direct compensation to workers.

Adjusting compensation levels for differences in productivity narrows the unit labor cost advantages of some countries, but only to a limited degree. For example, in nominal dollar terms, hourly production worker compensation in Korea is 10 percent of that in the United States. However, when adjusted for differences in productivity, it rises to 16 percent (table 12-8).

Table 12-8
Level of compensation, productivity, and unit labor cost in iron and steel manufacturing, by countries 1/

Country	Level of compensation	Productivity	Unit labor cost
	---Percent---		
United States...............	100.0	100.0	100.0
Brazil......................	10.1	58.6	17.2
Korea.......................	10.3	63.0	16.3
France......................	56.2	77.4	76.6
West Germany................	68.8	89.5	76.9
Canada......................	69.0	85.0	81.2
Japan.......................	72.2	87.2	82.8

1/ Table is calculated based on data presented in table 12-7.

Source: U.S. Bureau of Labor Statistics.

During 1975-86 the percentage growth of hourly compensation in iron and steel and all manufacturing industries in the western industrialized countries averaged 110 percent (in dollar terms), or approximately 7 percent per year. In comparison, the growth of hourly compensation during the same period in Japan was approximately 200 percent and in Korea over 300 percent, reflecting the more rapid expansion and general productivity gains of these faster-developing economies, and in the case of Japan, an appreciation of the yen vis-a-vis the dollar. The relatively low growth rate of hourly compensation in iron and steel and all manufacturing industries in Brazil was due to the frequent devaluation of the home currency.

Despite increasing labor costs, industrialized producers have realized employment cost savings as a result of reduced employment and improvements in productivity. A comparative analysis, based on total employment and raw steel production, shows that annual output of raw steel per employee in 1986 was the highest in the United States (424 metric tons) and the lowest in France (184 metric tons) (table 12-9). In Japan, reductions in total steel employment were more moderate due primarily to lifetime employment practices. However, in 1987 all five major Japanese-integrated mills announced reductions in steel employment on the order of 30 percent during the next 4 years as part of their rationalization plans.

In contrast to industrialized countries, employment in the Korean and Brazilian steel industries increased substantially during 1974-86. As both nations made commitments to expand steel production during this period, total employment in Korea rose 97 percent and rose 44 percent in Brazil.

Among the industrialized countries, Canada and the United States had the lowest pretax cost (table 12-10). The highest pretax cost producer was Japan ($399 per metric ton) because of its high financial costs which reflected

Table 12-9
Total employment and raw steel production per employee, by country, 1975 and 1986

Country	Total employment 1975	Total employment 1986	Percentage change, 1986 from 1975	Raw steel production per employee 1975	Raw steel production per employee 1986	Percentage change, 1986 from 1975
	--Thousands--		Percent	-Metric tons-		Percent
Japan...........	317.0	244.0	23	291	403	38
United States...	457.0	174.8	62	232	424	83
West Germany....	222.0	143.0	36	181	259	43
Brazil..........	55.0	79.2	44	152	268	76
France..........	205.0	97.3	53	105	184	75
Korea...........	33.0	65.0	97	61	223	266
Canada..........	51.5	45.2	12	254	285	12

Source: European Coal and Steel Community. Amercian Iron and Steel Institute, 1986 Annual Statistical Report. IBS (Brazilian Steel Institute). Energy Mines, and Resources of Canada. Korea Iron and Steel Association. Ministry of Labor, Japan. Statistics Canada.

Table 12-10
Hourly compensation in iron and steel manufacturing, pretax cost (labor, materials, and financial) of hot rolled products, and operating rate by country, early 1987

Country	Hourly compensa-tion--iron and steel manufac-turing 1/ 2/	Cost of hot-rolled products: Labor and materials cost	Financial cost (State and total taxes, depreciation, and interest expense)	Pretax cost (labor and materials and financial)	Operating rate
	U.S. dollars per hour	-----U.S. dollars per metric ton		-----	Percent
Brazil...........	3.10	157	96	253	95
Korea............	3.37	173	79	252	100
Canada...........	17.78	264	42	306	80
United States....	23.00	295	39	334	60
West Germany.....	17.90	298	49	347	80
France...........	22.76	312	63	375	75
Japan............	16.81	273	126	399	60

1/ Includes base and overtime pay, bonuses, premiums, cost of payments in kind and Social Security, etc., and all other direct compensation to workers.
2/ The wage rates calculated by World Steel Dynamics tend to be higher than the iron and steel worker wage rates obtained from the Bureau of Labor Statistics because the wage rates derived by World Steel Dynamics are based on all employees and a narrower product range. World Steel Dynamics derived wage rates may also include certain social charges not reflected in Bureau of Labor Statistics data.

Source: World Steel Dynamics, Steel Strategist #13, p. 35.

falling operating rates, the accounting method peculiar to Japanese mills, and the strenghtening of the yen against the dollar. 1/ Among the developing countries, Brazil and Korea were the lowest pretax cost producers, because of the low input cost of materials and labor complemented by some of the world's newest and most modern facilities.

1/ World Steel Dynamics and Professor Kawahito, Middle Tennessee University, Murfreesboro, Tennessee.

Technology 1/

Technological innovations are often divided into two groups: product and process. This distinction is apt in many manufacturing industries as the two categories can usually be differentiated; new products can often be produced with existing equipment. However, in a materials industry (such as steel sheet and strip) new products often require new production equipment, blurring the distinction between the two groups. For example, a company desiring to add electrogalvanized sheet to its product line requires an electrogalvanizing facility. Meeting tighter gauge and shape specifications usually requires modification of rolling mills. Production of low impurity steels requires modifications or additions to refining equipment. Although new product and process technologies are generally available through licensing agreements, possession of product technology in itself is not meaningful if the process technology embodied in installed equipment is not at the disposal of the organization. For this reason, the technological competitiveness of any steel sheet and strip industry or firm is determined by its installed production equipment. Therefore, this section concentrates on the production technology currently in use in the domestic industry and its major foreign competitors.

Technological leadership in the integrated sheet and strip industry, in terms of both development and application, has passed to offshore competitors. Recent advances in steel sheet production technology have emerged to a great extent in Japan and Europe, reflecting high levels of research and development spending in these steel industries. Although new technology is easily available through licensing agreements, industries that purchase technology will generally be a step behind those that develop the technology.

One of the U.S.-integrated industry's greatest concerns in the area of technology is financing the purchase of new equipment. Many new developments enhance quality, but have little impact on productivity or production costs. As a result of financial difficulties, discrete investments in selected portions of the production process have yielded unbalanced facilities. Some excellent hot-end facilities are teamed with mediocre or poor rolling and finishing facilities. However, in other cases, the situation is reversed. To some extent, this has been caused by the need to retrofit existing facilities, as opposed to building complete new plants.

The U.S.-integrated sheet industry's technological position will not change rapidly, although the industry has impressed some foreign competitors with their recent investment programs, as well as the speed with which certain firms have improved their position in terms of installed equipment. However, unless their financial performance improves markedly, improvements to facilities will only occur in an incremental fashion.

1/ This section is based upon questionnaire responses of domestic producers and interviews with domestic and foreign industry officials. Opinions expressed by all parties were generally consistent in pointing up the key technologies required to be competitive (e.g., secondary refining, continuous casting, computerized monitoring and control, continuous processes) as well as the U.S. sheet and strip industry's need for more widespread application of these technologies.

Sources of Technologies

Although new technology, regardless of its source, is readily available through licensing agreements, the lack of leadership in the development of new technology is indicative of an overall lack of leadership and competitiveness in industries operating in a worldwide market. Most major steel process technologies are currently originating in foreign countries; however, some high-level sensor and control development is proceeding in the United States. Major new developments in ore reduction, steelmaking, and casting have come from Europe (especially West Germany) and Japan, and most rolling technology originates in Japan. Gauge and profile control developments have been achieved by both the Japanese and Europeans. Japan has also led the way in process coupling and continuous annealing technology.

U.S.-Integrated Producers' Technological Standing

Overall, the most significant differences in the state of technology advantage arise from the fact that foreign producers generally have newer facilities than domestic mills. As new foreign mills are built, they incorporate state-of-the-art technologies that give those mills great advantages in terms of cost and productivity. New process technologies generally have different requirements in terms of space, flow lines, and organization than those of older technologies. Placing newer technology in an existing plant can result in nonoptimal performance. Integrating a variety of newer technologies in an optimal configuration often requires construction of an entirely new (greenfield) facility. The most recent integrated U.S. greenfield facility was built during the 1960's and was substantially completed in 1969. Several foreign competitors have greenfield facilities that were completed in the 1980's, such as Stelco's Lake Erie Works (1980) and Posco's Kwangyang Works (1987). Industry sources report that modernization efforts to refurbish existing facilities can require funding levels exceeding the original costs of those facilities.

The greatest challenge facing U.S. modernization efforts in this regard is that foreign competitors have comparatively more modern equipment than the U.S. industry. From melting to finishing, the greater use of technologies, such as argon stirring, vacuum degassing, continuous casting, roll bending, and more sophisticated electronic controls, permits certain foreign competitors to produce a higher average level of steel quality and closer physical tolerances on products.

Japan sets the world standards on installed technology, although West Germany, France, Korea, and Canada do have certain facilities or operating units that utilize the most advanced equipment. The following are some of the areas where foreign technology generally exceeds that of domestic producers:

- o Modern facilities.
- o Computerization--start to finish.
- o Automation throughout.
- o Gauge, profile, and shape controls.
- o Inventory tracking systems.
- o Auxiliary and ancillary equipment to support quality and productivity refinements.

Steelmaking

In the areas of steelmaking for sheet and strip grades of steel, the best U.S. facilities provide steel quality equal to that produced by modern world competitors, with the present exception of grades requiring vacuum degassing (principally required for enhancing deep drawing and electrical properties).

In terms of control of the minor elements (sulfur, nitrogen, carbon, and phosphorous) that play a significant role in determining the quality of the most demanding requirements for sheet steel, the U.S. position is as follows:

- o Sulfur control is generally equivalent for all countries and is often achieved by hot metal desulfurization.

- o Nitrogen control by the U.S. industry is a little less competitive. A few U.S. steelmakers can meet restrictive levels (less than 50 ppm N) in liquid steel.

- o Carbon control (to less than 0.005% carbon) which is provided by vacuum degassing is routine in Japan, Korea, and the EC; Canada and the United States are presently installing facilities. Ultra-low carbon sheet steel is required to meet the demand for extra deep drawing qualities in cold-rolled and hot dip galvanized sheets.

- o Phosphorous control, which is expected to be a developing requirement in the United States over the next 5 to 10 years, may require capital expenditures. The need for equipment will not be known until degassing is fully implemented; it will depend on raw materials' phosphorous content and iron and steelmaking practices. Japan is the only competitor that presently has the capability to remove phosphorous through hot metal treatment.

In terms of modern, efficient BOF equipment (such as independent blowing, combined blowing, high blow rates, and complete process control), producers outside the United States have an advantage; this equipment shortens heat times and enhances impurity removal. Japan and Korea have the most complete array of such equipment; the United States is close to Canada and the EC.

Steelmaking operations particularly suitable for coated products involve vacuum degassing and other ladle metallurgy practices; Japan, Germany, France, and Canada have these facilities. Most major U.S. producers have some ladle metallurgy capability at their sheet production plants, but modern vacuum degassing is less widespread in the carbon steel sheet industry, reflecting constrained investment abilities.

Continuous Casting

Many U.S. producers are equipped with competitive world class continuous slab casters. However, in the area of efficiency, minor technical deficiencies do exist with the result that hot charging capability does not approach that of Japan or the EC. As a result, production cycles are lengthened and costs are increased.

Also, although most U.S. primary sheet and strip producers in the United States have some continuous slab casting capability, much sheet is still produced via the ingot method. In 1986, U.S. primary sheet producers continuously cast only 53.9 percent (20.6 million metric tons) of their slabs, with 46.1 percent (17.6 million metric tons) coming from rolled ingots. 1/ Production in 1987 should be more heavily weighted towards continuous cast slabs, as approximately 12.2 million metric tons of slab casting capacity was brought on line during 1986 and 1987. 2/ Continuous cast slab production in most other major sheet producing countries, with the exception of Canada and Brazil, generally has been higher. 3/ Current construction programs should move both Canada and Brazil ahead of the United States by 1988.

One area of continuous casting technology in which the United States is leading the world is the installation of a commercial thin slab caster. This technology allows significantly lower capital and operating costs as it eliminates the need for some downstream facilities, such as a roughing mill. This also has the effect of significantly reducing the minimum optimal scale 4/ of a sheet production facility. The first firm applying the technology, Nucor, is a newcomer to the sheet field and not one of the integrated producers. Nucor bought the technology from a West German equipment manufacturer.

Rolling Technology

Recent modernization programs have updated some domestic hot strip mills to "world class" standards, but in foreign countries, especially Japan, Korea, West Germany, and France, state-of-the-art technology (such as automatic gauge control, profile and shape control, and 6-high mill stands) is more widespread. Japan has the most "world class" hot- and cold-rolling facilities, with Korea rapidly improving its position. Additional mill stands enhance the ability of an installation to meet tight dimensional tolerances. Cold-rolling mills in foreign industries tend to have more stands than U.S. mills.

Coupling of processes is more common in foreign competitors' facilities as well. Coupling generally reduces product variability and production costs while increasing production rates. Japan and Canada have pioneered, respectively, direct slab and direct ingot rolling technology. Continuous

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1/ Information developed from responses to U.S. International Trade Commission questionnaires.

2/ World Steel Dynamics, Steel Strategist #13.

3/ According to the International Iron and Steel Institute and the American Iron and Steel Institute, the share of raw steel produced by continuous casting in 1986 was as follows: Brazil, 46 percent; Canada, 46 percent; France, 90 percent; West Germany, 85 percent; Japan, 93 percent; Korea, 71 percent, and the United States 55 percent.

4/ See F.M. Scherer, Industrial Market Structure and Economic Performance, Rand McNally Publishing Co.

pickle line/cold mill coupling has been implemented in 6 facilities worldwide, concentrated in Japan and France, with no such facilities located in the United States. However, two domestic facilities under construction will couple several processes together. Inland's planned cold rolling facility will reportedly couple all operations from pickling to finishing, the second such facility in the world. Technology for this joint venture will be supplied by Inland's Japanese partner. Nucor's thin slab caster-based flat rolled facility is planned to be continuous from melting through cold rolling.

Continuous annealing (C/A) has received mixed reviews from the domestic industry, and some companies are not convinced of its overall superiority. However, such installations greatly reduce process time (from days to minutes), and several U.S. companies either have installed, or are planning to install, C/A technology.

In coating technologies, the Japanese and French are reported to be the leaders. In-line temper rolling and better post-coating annealing are reported to make their hot-dip galvanized a superior product. U.S. firms have recently invested heavily in modern, wide electrogalvanizing facilities, giving them the ability to produce the increasingly popular zinc-based electrolytically coated products (used primarily in automobile manufacture). However, the Japanese offer a greater variety of products with alloy coatings, some of which were developed in close conjunction with paint systems, which yield superior finish after painting. The European producers also have electrogalvanizing capability, as do the Koreans.

U.S. industry superiority was repeatedly singled out in only one coating area: oxygen-free finishing for hot dip galvanized sheets. This process produces a superior finish on hot dip products, almost on a par with electrogalvanized in terms of finish smoothness and consistency. However, this product faces stiff competition from a close substitute--electrogalvanized sheet.

Cold-rolled and Specialty Industries

In contrast to the U.S.-integrated facilities, world class facilities are fairly widespread in the domestic cold-rolled and specialty sheet industries. Both industries are highly competitive on a technological level with virtually any foreign industry. The only competitive weakness cited by industry respondents for the U.S. stainless sheet industry is in light gauge products; this could be rapidly overcome with the expected commercialization of a U.S.-developed strip casting (less than 1mm) process in the next year or two. This process provides a substantial production cost advantage for certain popular grades of light-gauge stainless strip. Another technological advantage for the U.S. stainless industry is their wide range of products, which includes several grades not produced elsewhere.

Government Involvement

Government involvement can also lower costs by subsidizing capital investment and research and development. For example, the French Government provides financing, funds capital infusions, grants debt-for-equity swaps, directs restructuring and rationalization efforts, and monitors production levels for its nationalized steel industry.

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In Brazil, however, government involvement in the form of price controls on steel has resulted in lost revenues and greater industry debt. This, in turn, has reduced the availability of funds for equipment maintenance and modernization and facility expansion. In response, the Government has given top priority to a restructuring plan which includes a debt-for-equity transfer, capital infusion for expansion, and implementation of measures that will ensure capability for self-sustaining generation of funds.

Government ownership of mills is a factor in the Korean steel industry. Posco, the country's only integrated steel producer, is owned 33.4 percent by the Ministry of Finance, 38 percent by the Government's Korea Development Bank, and 2.5 percent by the State-controlled Korea Tungsten. The remaining ownership consists of private sector shares. However, Posco officials claim that the Government takes no greater an interest in Posco's activities than would any shareholder in any company. According to the company's executive vice president, "Posco's primary duty is to remain a free and independent steel producer, not dependent on government support." 1/

A country's tax structure can also influence an industry's competitiveness. Steelmakers in Canada and the United States are affected by legislative programs concerning tax policy. The effect of these policies on Canadian producers has been to increase cash-flow in the initial years of investment. However, changes instituted in the Canadian tax system in 1987 will eliminate the writeoff for inventories and phase out the investment tax credit provision in addition to lengthening depreciation periods for capital equipment. This will result in less cash flow and lower profits in the long run, which could limit funds available for modernization. In the United States, the effect on competitiveness of the institution of the Tax Reform Act of 1986 (TRA) and its associated provisions is difficult to evaluate because of the extent of the provisions and the variations in financial health and accounting practices among steel producers. 2/ The effect will be largely determined by the TRA-related accounting decisions made by individual companies.

Governments have also intervened through a variety of mechanisms designed to influence the terms under which steel could be imported into their home markets; quotas, voluntary restraint agreements, relatively high tariffs, and/or licensing requirements are among the mechanisms that have been used. These trade-related measures have been intended to enhance the competitive performance of industries in the protected countries.

Another form of government participation is through international governmental organizations including the Inter-American Development Bank (IDB), the OECD, UNIDO, and the World Bank. These organizations, which are involved in the world steel industry to varying degrees, assess of the effect of government policies on the international trade flow of steel (OECD), and the provide of technical and developmental assistance to various sectors of the steel industries in developing countries (UNIDO and World Bank).

1/ Metal Bulletin Monthly, May 1987.
2/ The provisions concern the following: investment tax credit; methods for the depreciation of equipment; treatment of net operating losses; and the institution of a minimum tax level of 20 percent on adjusted corporate earnings.

Because the role of the government in the steel industry varies widely among countries, its effect on competitiveness is difficult to quantify. However, respondents to the Commission's questionnaires did provide information on their views regarding the competitive strengths and weaknesses resulting from government involvement (table 12-1). This information shows that the U.S. industry views itself as having competitive weaknesses in each of the listed areas of government involvement. The foreign competitors, on the other hand, are believed by respondents to be at less of a competitive disadvantage, and, in fact, are believed to exhibit competitive strengths in certain areas. Korea is perceived to have the greatest competitive strengths in the area of government involvement, followed by Japan. West Germany, Brazil, France, and Canada were viewed by respondents as being neither strong nor weak in a number of the areas identified in the questionnaire.

Rankings of the effect of health/safety and environmental regulations varied the least among countries and represented neither a principal strength nor a principal weakness for any country evaluated. This finding is corroborated by information contained in the various country profiles which suggests that environmental legislation does not significantly affect the competitive position of any particular steel producing country relative to its foreign counterparts.

Financial Aspects

The companies in the countries examined in this study had varying degrees of profitability. During the period 1982-86, French companies consistently posted the lowest return on sales, and Canadian and Korean companies posted the highest return on sales. U.S. companies posted losses for this period, but recent data indicate that 1987 may signal a more profitable era. Finally, 1986 was considered a particularly bad year for Japanese steel producers because of rapid exchange-rate fluctuations. Athough most Japanese companies posted considerable losses in 1986, they continued to show a positive, but low return on sales.

Factors Affecting Profitability

Developed countries with mature steel industries had several common factors of production that contributed to their relatively poor financial performance over the last decade. Rising labor, energy, and materials costs, excess capacity, and declining demand for steel contributed to losses experienced by the United States, France, West Germany, and Japan.

The steel industry in France was the least profitable of the industries in those of all the seven countries. The two French companies were primarily affected by the following three factors: the lower price of steel due to the weak dollar, an overall reduced volume of sales because of a shift in product mix towards higher value steel in export markets, and a sizeable decline in the French domestic steel market.

In West Germany, the steel industry's financial performance was mixed. Although the industry has shown a profit in the last 3 years, West German industry officials predicted that with the fall of the dollar, their steel industry will most likely incur losses in 1987. West German steel producers also told the Commission that the factors affecting profitability of their industry include a close relationship with banks that ensures that funds are available for investment and operating capital, changes in the exchange rate that affect the value of the mark, and the ability to control production costs.

Japan consistently performed well until 1986. The recent Japanese losses are attributable to the rapid appreciation of the yen since 1985, excess capacity, falling domestic demand, considerable losses in export markets on which they have traditionally depended to boost profitability, and increased competition from new, low-cost market entrants.

Canadian companies' profitability is the exception of the countries with mature steel industries. Canadian steel producers have a cost advantage over their competitors especially in the areas of labor, energy, and iron ore costs. Furthermore, Canada has plentiful supplies of iron ore, high capacity utilization rates, and low fixed cost per ton figures.

Brazil and Korea, countries with developing steel industries, were not as strongly affected by high production costs and declining steel demand as countries with mature steel industries. Both Brazil and Korea are expanding their capacity and seek to capture segments of the export market through competitive pricing. Korean firms' profitability has been enhanced by the competitive advantages of low wage rates, the relative newness of their mills, and an increased ability to penetrate lucrative export markets such as the United States and Japan. Brazil's profitability has been constrained primarily by their relatively unstable economy. Factors specifically affecting the steel industry in Brazil include a high inflation rate that has led to a periodic reindexing of assets and liabilities, and government price controls on domestic steel prices that have held prices below the cost of production. In contrast to countries with mature steel industries, Brazil's relatively modern facilities and abundant raw materials make its steel industry potentially profitable outside of Brazil's overall unstable economy.

For most companies, capital investment levels in general have been low with emphasis on investment at the finishing end of steel production. Increased world demand for higher quality specialized steel products has caused many firms to move away from low-value steel products. In addition, the investment focus for most countries has been on increased spending on development of new steel treatment technologies, such as coating, rather than capacity expansion for increased crude steel production.

Measures of Profitability

Financial ratios, especially return on sales, are one measure for judging a firm's financial health. Sales and net income figures for specified companies appear in table 12-11 and table 12-12. Table 12-13 shows return on sales and illustrates, in general, the financial condition of the steel industry in the selected countries.

As shown in table 12-13, France's two sheet and strip producers, Sacilor and Usinor have a negative return on sales for the entire period. German sheet and strip producers exhibited a negative return on sales for 1982 and 1983. In 1984, the three German steel producers had a positive return on sales that rose steadily for the rest of the period. Usiminas, a Brazilian firm, is one of nine steel producers owned by Siderbras Group, a holding company with the Brazilian Government as majority shareholder. Usiminas had a negative return on sales for all years except 1984. Although return on sales for Japan was positive, the trend for all producers shows a significant decline. Many steel producers in Japan offset their large losses in 1986 through capacity reduction and sales of marketable securities.

Table 12-13 shows that return on sales for two major Canadian sheet and strip producers rose steadily although Stelco had a negative return on sales during 1982-84. Pohang Steel, the largest steel producer in Korea, had a positive return on sales for the period.

As shown in table 12-13, the overall losses for U.S. sheet and strip producers have been considerable and are reflected in the large proportion of negative return on sales. Furthermore, the financial performance of most of these firms has been somewhat erratic, often depending on factors other than operating results. LTV Steel was the least profitable and filed for bankruptcy in 1986, while Weirton was the most profitable. Weirton is an integrated employee-owned firm, whose relatively low labor costs account in part for its overall profitability.

Table 12-11
Sales: Selected sheet and strip producers in France, West Germany, Canada, Brazil, Korea, Japan, and the United States, 1982-86

(In dollars)

Item	1982	1983	1984	1985	1986
Usinor	4,127,855	4,262,710	4,421,588	4,047,301	4,860,076
Sacilor	4,441,968	4,285,825	4,334,440	5,406,709	6,154,075
Total, France	8,569,823	8,548,535	8,756,028	9,454,010	11,014,151
Klockner	2,316,985	2,091,070	1,603,141	1,555,725	1,938,835
Krupp	6,885,996	6,761,591	6,403,501	6,276,035	7,299,059
Thyssen	12,946,652	11,301,248	11,776,215	11,357,871	13,818,174
Total, West Germany	22,149,633	20,153,909	19,782,857	19,189,631	23,056,068
Dofasco	1,204,001	1,302,720	1,487,228	1,459,521	1,392,020
Stelco	1,637,435	1,649,534	1,863,107	1,782,433	1,727,101
Total, Canada	2,841,436	2,952,254	3,350,335	3,241,954	3,119,121
Usiminas	988,940	789,245	959,536	958,987	1/
Total, Brazil	988,940	789,245	959,536	958,987	1/
Posco	2,382,621	2,255,655	2,428,832	2,376,059	2,534,087
Total, Korea	2,382,621	2,255,655	2,428,832	2,376,059	2,534,087
Kawasaki	5,700,869	4,581,474	4,623,461	5,000,796	5,585,393
Kobe	5,360,638	4,885,412	5,472,832	5,314,869	5,583,004
Nippon Kokan K.K.	7,167,059	6,267,271	5,962,725	6,285,820	6,086,493
Nippon	14,424,901	11,605,901	11,994,569	12,534,517	13,034,715
Sumitomo	6,648,338	5,492,402	4,921,381	5,313,817	5,459,793
Total, Japan	39,301,805	32,832,460	32,974,968	34,449,819	35,749,398
Armco	4,102,000	3,042,100	3,245,500	2,936,100	2,640,500
Bethlehem	5,260,300	4,898,200	5,392,100	5,117,700	4,332,900
Inland	2,424,500	2,748,900	3,135,000	2,999,400	3,173,200
LTV	4,776,800	4,577,800	7,046,100	8,198,800	7,721,400
National	1,805,100	2,021,600	2,293,100	2,082,300	2,127,800
USX	20,764,000	19,351,000	21,092,000	20,779,000	14,938,000
Weirton	1/	1/	1,075,125	1,156,301	1,173,812
Wheeling-Pittsburgh	775,403	831,260	1,057,151	688,171	941,965
Total, United States	39,908,103	37,470,860	44,336,076	43,957,772	37,049,577
Grand total	116,142,361	105,002,918	112,588,632	113,628,232	112,522,402

1/ Not available.

Source: Fortune directory of the biggest 500 industrial companies outside the United States, August 1983, 1984, 1985, 1986, 1987. U.S. companies' annual reports.

Table 12-12
Net income: Selected sheet and strip producers in France, West Germany, Canada, Brazil, Korea, Japan, and the United states, 1982-86

(In dollars)

Item	1982	1983	1984	1985	1986
Usinor..........	(694,437)	(713,874)	(845,921)	(381,747)	(717,460)
Sacilor..........	(541,300)	(710,785)	(920,006)	(585,129)	(1,069,910)
Total, France..	(1,235,737)	(1,424,659)	(1,765,927)	(966,876)	(1,787,370)
Klockner.........	(21,179)	(56,379)	745	11,087	223
Krupp............	1/	(117,952)	25,901	28,707	36,270
Thyssen..........	(27,449)	(211,491)	59,216	146,699	150,463
Total, West Germany......	(48,628)	(395,822)	85,862	186,493	186,956
Dofasco..........	51,717	97,748	139,448	124,527	97,781
Stelco...........	(33,071)	(11,553)	(2,533)	56,848	41,441
Total, Canada..	18,646	86,195	136,915	181,375	139,222
Usiminas.........	(181,308)	(147,149)	59,338	(70,784)	1/
Total, Brazil..	(181,308)	(147,149)	59,338	(70,784)	1/
Posco............	20,930	67,093	74,488	71,634	70,101
Total, Korea...	20,930	67,093	74,488	71,634	70,101
Kawasaki.........	141,039	74,896	3,086	83,071	83,095
Kobe.............	59,900	47,369	(37,170)	42,555	29,217
Nippon Kokan K.K.	136,762	103,815	(44,505)	77,896	30,248
Nippon...........	256,698	142,467	3,619	207,080	184,174
Sumitomo.........	172,551	129,106	(41,783)	103,260	82,869
Total, Japan...	766,950	497,653	(116,753)	513,862	409,603
Armco............	(564,800)	(458,600)	(50,600)	27,200	(278,400)
Bethlehem........	(1,469,600)	(163,500)	(112,500)	(196,000)	(152,700)
Inland...........	(135,500)	(115,500)	(42,600)	(147,400)	34,800
LTV..............	(154,900)	(180,700)	(378,200)	(723,903)	(3,251,600)
National.........	(462,773)	(161,400)	20,800	(88,400)	(59,800)
USX..............	720,000	(227,000)	2,075,000	1,735,000	(1,494,000)
Weirton..........	1/	1/	60,622	61,035	45,085
Wheeling-Pittsburgh.....	(58,769)	(54,080)	(59,376)	(303,072)	(250,923)
Total, United States.....	(2,126,342)	(1,360,780)	1,513,146	364,460	(5,407,538)
Grand total..	(2,785,489)	(2,677,469)	(12,931)	280,164	(6,389,026)

1/ Not available.

Source: Fortune directory of the biggest 500 industrial companies' outside the United States, August 1983, 1984, 1985, 1986, 1987. U.S. companies annual reports.

Table 12-13
Return on sales: Selected sheet and strip producers in France, West Germany, Canada, Brazil, Korea, Japan, and the United States, 1982-86

(In percent)

Item	1982	1983	1984	1985	1986
Usinor	-16.8	-16.7	-19.1	-9.4	-14.8
Sacilor	-12.2	-16.6	-21.2	-10.8	-17.4
Total, France	-14.4	-16.7	-20.2	-10.2	-16.2
Klockner	-0.9	-2.7	1/	0.7	1/
Krupp	1/	-1.7	0.4	0.5	0.5
Thyssen	-0.2	-2.0	0.5	1.3	1.1
Total, West Germany	-0.2	-2.0	0.4	1.0	0.8
Dosfasco	4.3	7.5	9.4	8.5	7.0
Stelco	-2.0	-0.7	-0.1	3.2	2.4
Total, Canada	0.7	2.9	4.1	5.6	4.5
Usiminas	-18.3	-18.6	6.2	-7.4	2/
Total, Brazil	-18.3	-18.6	6.2	-7.4	2/
Posco	0.9	3.0	3.1	3.0	2.8
Total, Korea	0.9	3.0	3.1	3.0	2.8
Kawasaki	2.5	1.6	0.1	1.7	1.5
Kobe	1.1	1.0	-0.7	0.8	0.5
Nippon Kokan K.K	1.9	1.7	-0.7	1.2	0.5
Nippon	1.8	1.2	1/	1.7	1.4
Sumitomo	2.6	2.4	-0.8	1.9	1.5
Total, Japan	2.0	1.5	-0.4	1.5	1.1
Armco	-13.8	-15.1	-1.6	0.9	-10.5
Bethlehem	-27.9	-3.3	-2.1	-3.8	-3.5
Inland	-5.6	-4.2	-1.4	-4.9	1.1
LTV	-3.2	-3.9	-5.4	-8.8	-44.7
National	2.9	-8.0	0.9	-4.2	-2.8
USX	3.5	-1.2	9.8	8.3	-10.0
Weirton	2/	2/	5.6	5.3	3.8
Wheeling-Pittsburgh	-7.6	-6.5	-5.6	-44.0	-26.6
Total, United States	-4.0	-3.6	3.4	0.8	-14.8
Grand total	-2.0	-2.5	1/	0.2	-5.7

1/ Less than .05 percent.
2/ Not available.

Source: Fortune directory of the biggest 500 industrial companies outside the United States, August 1983, 1984, 1985, 1986, 1987. U.S. companies' annual reports.

U.S. Steel Purchasers' Views on Competitiveness

Table 12-14 shows what the respondents to the Commission's questionnaire believe are the major factors influencing purchaser's decisions on steel sheet and strip procurements. The results indicate that purchase price, delivery time, availability of a specific product, and product characteristics (quality measures) were the most important factors in purchasing decisions. The least important factors were barter or countertrade and a subsidiary/owner relationship with the supplier.

An illustration of the importance of customer service is reflected in the Ford Motor Co. experience. The company started a shared objectives program in 1983 with their steel suppliers. This was an effort to improve the lines of communication between Ford and the suppliers. Ford believed there was a need to improve steel performance. As part of this strategy, an objective measurement system was established. Ford bases its purchasing decisions 50 percent on quality, 30 percent on delivery, and 20 percent on pricing. Since Ford implemented this strategy, significant performance improvements have been made. Figures figures 12-2 and 12-3 show charts depicting the increased performance by domestic steel suppliers in the areas of quality and delivery that were noted by Ford Motor Co.

Less than 40 percent of companies questioned by the USITC indicated that they purchased foreign steel sheet and strip. Many purchased from steel service centers or distributors, however, and did not know the origin of their steel. Using the same factors shown in table 12-14, companies were surveyed on countries' performances. When examining the results of this comparison

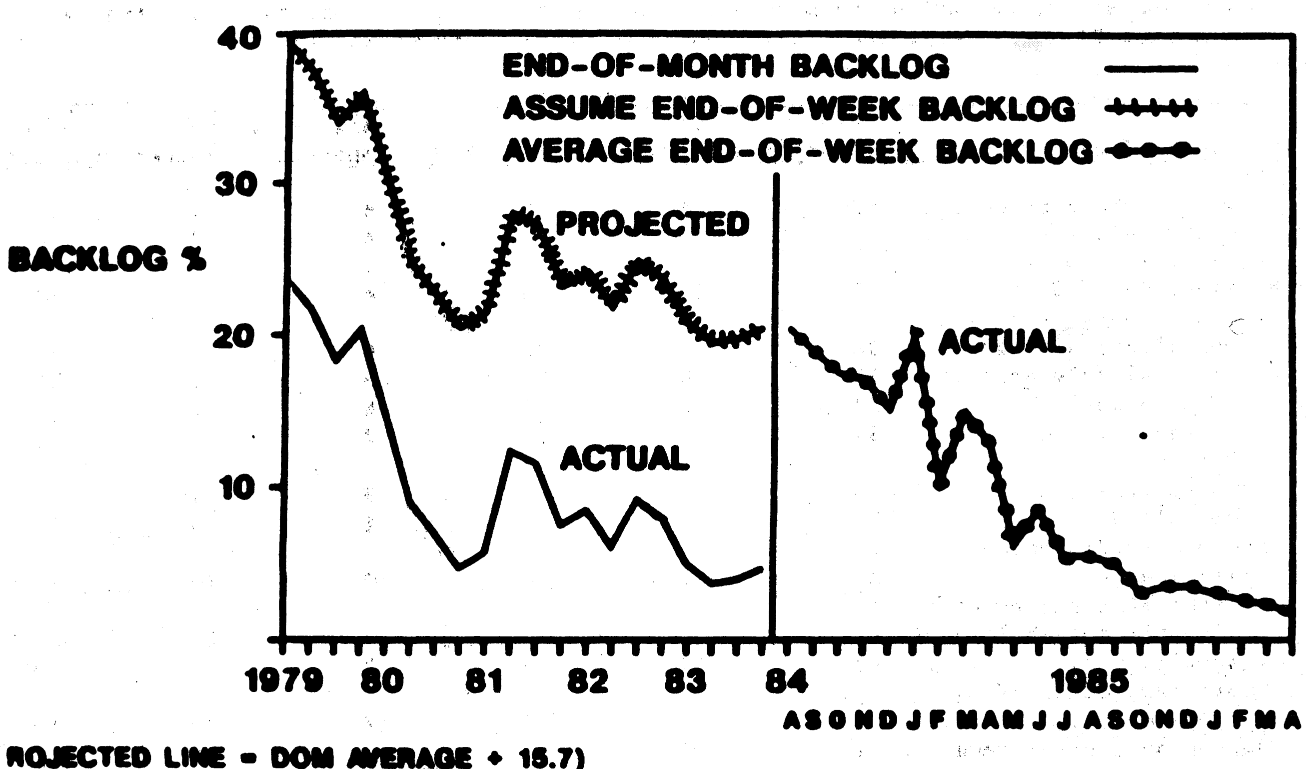
Table 12-14
U.S. purchasers' perceptions of the factors influencing their purchase decisions for steel sheet and strip, percent of respondents choosing each level of importance and the percent of total questionnaire respondents that commented on each particular factor

(In percent)

Decision factor	Primary importance	Very important	Important	Marginally important	Not important	Percent response
Lower purchase price.....	50	28	15	4	3	90
Shorter delivery time....	35	33	21	4	7	88
Availability of a specific product.......	42	37	16	4	2	89
Product characteristics:						
Metallurgical specs....	36	31	28	4	1	81
Physical tolerances....	30	38	23	5	3	81
Coating quality........	23	32	27	6	11	71
Surface finish.........	37	29	27	7	1	82
Drawing characteristics........	34	26	18	9	13	73
Terms of sale............	10	20	39	21	10	81
Engineering/technical assistance.............	12	20	38	20	10	79
Historical supplier relationship/reliability of supplier..............	28	33	24	12	3	86
Subsidiary/owner of supplier...............	3	3	8	17	70	58
Barter or countertrade...	2	3	3	13	80	60
Lower transportation.....	12	25	37	15	11	74

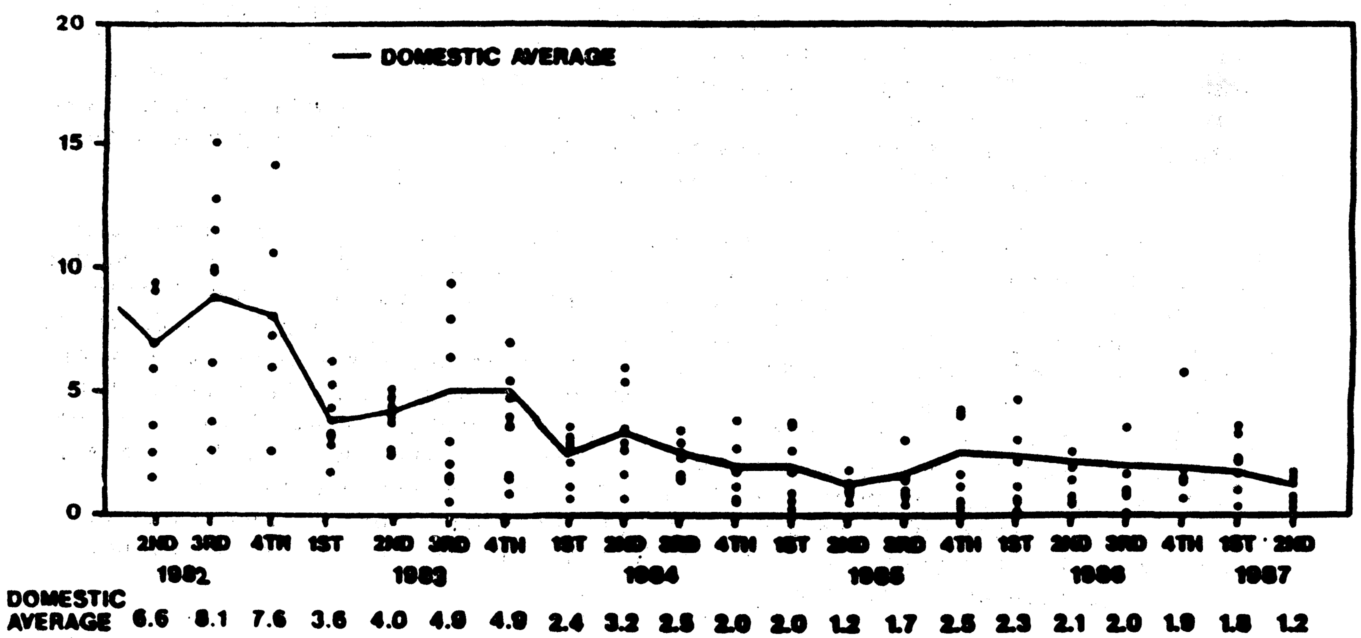
Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Figure 12-2
Delivery performance of domestic steel suppliers (1979-85 model years)



Source: Ford Motor Co. purchasing department

Figure 12-3
Quality performance of domestic steel suppliers (beginning 1st quarter 1983 - average percent rejection rate)



Source: Ford Motor Co. purchasing department (table 12-15), it must be kept in mind that the percentage of respondents who had opinions on countries other than the United States was relatively low. When looking at the three important factors influencing purchasing decisions--pricing, delivery and quality--a clear picture emerges. According to those U.S. purchasers surveyed, Brazil, Japan, and Korea offer the lowest purchase prices. For shorter delivery time, the United States and Canada are perceived to have the best performance. The quality category encompasses five product characteristics in which Japan clearly emerges as the respondents' perceived superior producer. When the United States is compared with the other six countries in this survey, it appears to have an advantage in four areas--shorter delivery time, availability of a specific product, historical or reliable supplier, and lower transportation costs. The implication is that U.S. steel sheet and strip producers need to improve their quality and lower their costs to become fully competitive on a worldwide scale.

Purchasers were asked to provide their first, second, and third choices of companies where they would purchase a certain steel sheet and strip product that consistently lived up to the factors they deemed most important (table 12-16). The only foreign company named was Nippon Steel. This is in contrast to the results of table 12-15 which showed Japan as being the best at meeting the most factors in a superior fashion. There are many possible reasons for this discrepancy. Certain steel sheet and strip purchasers may feel Japanese steel is of higher quality, but because of corporate "buy American" policies, they do not purchase Japanese steel. In addition, purchasers may have historical relationships with domestic suppliers that they are hesistant to break. Finally, the purchaser may have heard that Japanese steel is better, but had no firsthand experience.

In the Commission's purchasers questionnaire, companies were also asked to compare U.S. quality to foreign quality on a variety of products. The response indicating that the foreign quality was "unknown" was by far the most common response in all catagories. Table 12-17 shows the results for product categories where at least 15 percent of questioned companies responded.

The results indicate that the majority of those responding felt that Japan produces a superior quality product compared with that of the United States, whereas Brazil generally produces a lesser-quality product. The other four countries were found to produce the same quality product as that of U.S. producers.

Table 12-15
U.S. purchasers' perceptions of steel sheet and strip suppliers performance for key purchase decision factors, by country

Decision factor	United States	Brazil	Canada	France	Japan	Korea	West Germany
Lower purchase price	3	1	2	2	1	2	3
Shorter delivery time	1	5	2	3	3	3	3
Availability of a specific product	1	4	2	3	1	3	3
Product characteristics:							
Metallurgical specs	3	3	3	3	1	3	3
Physical tolerances	3	3	3	3	1	3	2
Coating quality	3	3	3	3	1	2	2
Surface finish	3	3	3	3	1	3	3
Drawing characteristics	3	3	3	3	1	3	2
Terms of sale	3	3	3	3	3	3	3
Engineering/technical assistance	2	4	3	3	3	3	3
Historical supplier relationship reliability of supplier	1	4	3	3	3	3	3
Subsidiary/owner of supplier	3	5	3	3	3	3	3
Barter or countertrade	5	5	3	3	3	3	4
Lower transportation	1	3	3	3	3	3	3
Percent of purchasers responding to each country category	59	11	21	13	36	12	18

1 -- Much better
2 -- Better
3 -- Average
4 -- Below average
5 -- Much below average

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

12-29

Table 12-16
Purchasers' preferred suppliers, by product, according to the factors in table 12-15

Sheet and Strip Products 1/	First	Second	Third
Hot rolled (48%)........................	LTV	National	USX
Cold rolled (58%)........................	LTV	USX	Bethlehem
Zinc alum coated (13%)..................	Inland	Armco	Bethlehem
Hot dipped galvanized (43%).............	USX	LTV	National
Electrogalvanized (17%).................	Weirton	Bethlehem	Inland
Tin plated (9%).........................	Nippon	USX	Weirton
Other coated (11%)......................	Armco	LTV	USX
Stainless (28%).........................	Allegheny Ludlum	J&L Specialty Steel	Armco

1/ Percentage in parenthesis is the percent of the 187 respondents to the questionaire that designated a company choice for the product catagory.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table 12-17
Steel sheet and strip: Comparative analysis of the perceived quality of products from various countries

Product	Brazil	Canada	France	Japan	Korea	West Germany
Carbon and certain alloy steel:						
Hot rolled sheet and strip....	D	S	F&S	F	S	S
Cold rolled sheet and strip...	D	S	S	F	S	S
Electrogalvanized.............	D	S&D	S	F&S	S	S
Hot-dipped galvanized.........	D	S	S	F	S	S

D = quality of U.S. producers' products is superior to that of the foreign producer
S = quality of U.S. producers' products is the same as the foreign products
F = quality of U.S. producers' products is inferior to that of the foreign producer

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Importance of Origin

When purchasers of steel sheet and strip were asked how often they were interested in the country of origin of their steel, 53 percent responded that they were always interested and 30 percent were occasionally interested, and 14 percent were never interested in the country of origin. Most companies indicated that they were very concerned about the quality of the steel they purchased; there was also a large number of respondents who indicated they preferred to buy domestically produced steel.

Service centers, distributors, and stampers were asked how often their customers were interested in the country of origin of the material they purchased. The majority, 52 percent, indicated that customers were occasionally interested, 33 percent said that their customers were never interested, and only 1 percent indicated their customers were always interested. The two main reasons cited were customer concern over quality and customers that had or were tied to corporate (and/or federal and state) "buy-American" policies.

Effects of the VRA's on Consumers 1/

A large number of purchasers indicated that they felt no effects from the voluntary restraint agreements (VRA's); however, purchasers from the Western United States stated that the VRA's have hurt them by restricting imports. They claim that the large steel companies have abandoned the western market. According to those companies that responded to the purchasers questionnaire, the lack of integrated producers in the West and import reductions resulting from the VRA's have hurt the competitive position of industries in the Western United States that use steel sheet and strip.

Around 40 percent of those responding to the questionnaire feel that the VRA's are directly responsible for the current tight market and high prices. Some state that the current exchange rate in addition to the USX strike in 1986 have also contributed to the current tight market.

The purchasers were asked what percent of their sheet and strip purchases in 1986 were met by imports and what percent would have been accounted for by imports if the steel VRAs were not in force. Of those who responded, 55 percent said there would be no change, 28 percent indicated that they would increase their purchase of imported steel if there were no VRA's, and 18 percent either did not know where the steel they bought was produced or had no opinion.

Overall Competitiveness

The purchasers of steel sheet and strip were asked to comment on U.S. producers' overall competitiveness and the actions that they feel the producers should take to improve their competitiveness. Many felt that the U.S. producers are improving, but some felt that they are not improving as fast as they should be with the assistance of such programs as the VRA's.

1/ A broader discussion of the effects of the VRAs on the steel industry is presented in chapter 11 of the report.

The majority of purchasers feel that the U.S. producers, in order to improve their competitive position, need to improve the quality of their products, modernize their facilities, and lower labor costs. Many purchasers also believe that steel producers need to become more customer oriented. They need to cater more to the customer rather than greeting customers with a "take-it-or-leave-it" attitude. A minority of the respondents, which also tended to purchase the largest quantities of steel, indicated that their relationship with the major steel producers had improved.

Pricing Developments

The intense pricing competition that exists in domestic and international steel markets continues to reflect the significant demand shifts, changes in the value of the dollar and other currencies, and worldwide restructuring. In addition, with developing world steel producers becoming more efficient and cost effective in steel manufacturing, the ability of these producers to influence the level of prices in international markets has become an increasingly important factor. POSCO (Korea) and China Steel (Taiwan) are examples of how the combination of relatively low-wages and the newest and most modern production facilities have advanced the competitiveness of developing world steel producers.

With respect to the prices of sheet in the United States, transaction prices for flat-rolled sheet products (which were $100-$140 per short ton, or an estimated 23-29 percent, off list prices at the end of 1985) were successfully raised about 5 percent in the first and second quarters of 1986. In a move initiated by U.S. Steel, effective January 1, 1986, published base prices of hot- and cold-rolled sheet were cut by $60 per ton, with remaining discounts reduced by 40 percent. This move resulted in an increase in transaction prices of $20-$40 per ton (or approximately 4 to 14 percent) over fourth quarter 1985 prices. With strengthened "end-user" demand, declining imports, and increased steel orders "hedging" against possible labor strikes, second quarter transaction prices increased to $10-$15 per ton off list price; in certain cases, steel products received full book price. 1/

A second price hike, initiated by U.S. Steel and intended to raise prices by about 3.7 percent effective May 5, 1986, failed to take place principally due to a decline in demand. Specific factors contributing to its failure included: (1) high inventories; (2) labor agreements with two major companies which reduced hedge buying; (3) end-user resistance to higher prices and the availability of lower priced imports; and (4) reduced steel consumption by the largest consumer, General Motors, due to reduced auto production. Given the slackening demand, third quarter prices were $10 to $15 per short ton below second quarter prices. 2/ However, the decline in domestic steel prices that began in the summer of 1986 was halted in most markets by the USX work stoppage in August of that year. Since USX accounted for about 15 percent of total U.S. sheet and strip production, its withdrawal from the U.S. market had a significant impact. In the Midwestern United States, the largest of the U.S. regional markets, demand for flat-rolled products was stagnating and

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1/ American Metal Market, January 31, 1986, February 14, 1986.
2/ American Metal Market, March 12, 1986, April 17, 1986, May 21, 1986.

showing further signs of falling when the USX work stoppage occurred. Because of USX's prominence in this market, there was a marked price reaction to its withdrawal from the market. "Spot" prices for galvanized sheet, the steel product in greatest demand in this regional market, rose by about 5 percent to $640 per ton. 1/

One leading producer, LTV Steel, announced a 20-percent reduction in the base price discount on most flat-rolled products, which became effective with shipments on or after March 29, 1987. The transaction price hike affected hot-rolled, cold-rolled, and hot-dipped galvanized sheet. Products not affected were electro-galvanized sheets and terne plate sheets, which are consumed primarily by automakers that purchase the material on year-long contracts which were negotiated in the spring of 1986. Long-term contractual agreements negotiated prior to November 5, 1986, were not affected by the announcement. 2/

During April-May 1987, hot-rolled sheet prices in the South on new mill orders reportedly increased by about $20 per short ton, which effectively eliminated a $15 per ton discount which had been in effect. The price increase also reflected full implementation of extra charges announced by southern steelmakers. 3/ Hot-rolled prices on new orders were generally in the $400 to $420 per ton range during the second quarter of 1987, according to industry sources. Like domestic hot-rolled sheet prices, prices for imported sheet were also up by about $20 per ton. However, spot prices of carbon sheet for the auto and construction markets experienced declines in the second quarter of 1987. As demand from the automotive and construction industries flattened, prices for galvanized and cold-rolled sheet (which were up $60 to $80 per ton in August 1987) began to level off as U.S. producers and importers cut supplies. 4/ In addition, hot-rolled sheet (which had previously been the most abundant flat-rolled product) also became less available in the U.S. market . In an attempt to take advantage of the increasingly tight supply of this product, USX, which resumed steel production on February 2, 1987, announced a price increase of approximately 5 percent (about $25 per ton) effective with October 1 shipments. The action taken by USX is an attempt to carry stable prices into the fourth quarter of 1987; other major steel producers are expected to follow. 5/

On the West Coast, where California Steel is the only domestic producer of hot-rolled sheet, and imports have been declining, the possibility of a $15 per short ton price hike is increasing. Currently, California Steel is quoting just over $360 per ton for hot-rolled sheet. 6/

The prices of stainless steel sheet may be rising faster on the West Coast than stainless steel price increases in other parts of the United States. This is largely due to increased purchases of higher priced domestic material and reduced availability of imports. The appreciation of the yen

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1/ World Steel Dynamics, Steel Price Trak #19-#20.
2/ American Metal Market, December 3, 1986.
3/ American Metal Market, May 20, 1987.
4/ American Metal Market, August 14, 1987.
5/ American Metal Market, July 14, 1987.
6/ American Metal Market, August 14, 1987.

relative to the dollar, coupled with import quotas, have caused foreign suppliers to cut their exports to the West Coast by 15 to 20 percent. As a result, domestic prices of some stainless steel sheet products have increased significantly from prices announced earlier during the year. For example, the price of Type 430 stainless steel bright annealed sheet, which service centers once processed mainly from coils supplied by the Japanese at a significant discount to domestic prices, has risen about 45 percent to $1.30 a pound from about $.90 per pound during early 1987. Industry sources indicate that domestic prices are likely to continue increasing as foreign supplies become less available on the West Coast.

With regard to general international price comparisons, the following tabulation indicates that, as of December 1986, U.S. prices for sheet products were generally higher than Canadian and EC prices (in their respective markets) but equal to or less than Japanese prices, as follows: 1/

Spot price comparisons, December 1986

(U.S. dollars per short ton)

Market	Hot-rolled coil	Cold-rolled coil	Galvanized sheet
United States	334	445	640
Canada	319	392	464
EC	256	377	480
Japan:			
Dealer	334	456	729
Big Buyer 2/	454	542	634

1/ For international "spot" price comparisons for sheet products, see Appendix P, Tables 1-3.
2/ "Big Buyer" prices are those quoted by contract buyers in Japan.

Source: World Steel Dynamics, "Steel Price Trak #21."

CHAPTER 13. INDUSTRY VIEWS OF MAJOR PROBLEMS THAT SHOULD BE ADDRESSED IN A NEW ROUND OF TRADE NEGOTIATIONS

The increasingly competitive nature of the global steel market, resulting from evolving world class supplier countries that are faced at home with diverse economic trends and demand swings for steel, is expected to place continued import pressure on the large U.S. market for steel. Domestic steel producers, including sheet and strip manufacturers that are taking steps to reorganize operations and adjust product lines to meet this challenge, have identified several issues that should be addressed in the new trade round. The industry believes that certain steps are necessary in order to maintain the progress they feel has been achieved in competing more effectively with imports.

Steel mill products covered by Standard Industrial Classification Codes (SIC's) 3312, 3315, 3316, and 3317, which include steel sheet and strip products, are represented by the following views expressed by the American Iron and Steel Institute.

Tariff Liberalization

The U.S. steel industry is opposed to relaxation or lifting of the current U.S. tariff rates on steel. The industry contends that its continued progress in becoming fully competitive internationally and domestically requires continued protection from low cost, unfairly subsidized foreign steel.

At the same time, the U.S. industry feels that the import tariff rates in other countries should be lowered to be more in line with U.S. tariff rates. Steel tariffs in other countries, especially some of the developing countries, are almost twice the level of U.S. tariffs. Lowering of these tariffs would help to promote fair trade in the global steel industry.

Nontariff Measure Liberalization

Alleged U.S. nontariff barriers, including measures such as voluntary restraint agreements (VRA's), quotas and "Buy American" policies, have somewhat countered certain foreign trade measures/policies and are generally considered to have helped the U.S. industry become more competitive. The predominant feeling in the steel industry is that these measures should be left intact and that the VRA's should be extended beyond the 1989 expiration date if a world steel surplus continues. This view is not as popular among steel producers in the Western United States. Many of these companies do not melt their own steel, but rather process semifinished steel slabs obtained from foreign suppliers at lower transportation costs than the cost of shipping slabs from the integrated producers of the Eastern United States. The VRA's have made it more difficult to be price competitive because they often have difficulty in obtaining a comparable price/quantity of semifinished steel from U.S. suppliers. They feel that many of the major integrated producers have abandoned the Western market and that the VRA's limit supply from foreign sources. West coast producers feel the steel industry in the 14 Western

States should be dealt with separately, and favor relaxation of import quotas on such products as steel slab.

Foreign nontariff barriers include import licensing and export subsidies. Although the U.S. steel industry exports very little, certain specialty steel companies have had trouble obtaining import licenses. Some countries refuse to grant import licenses, and their governments provide fiscal and financial incentives to companies to encourage exports of steel. Steel industry executives believe the trade negotiations should address nontariff barriers and try to identify and minimize these types of unfair trade practices.

Subsidization

Many foreign countries are believed to subsidize their steel industry through low interest loans, government payments for rationalization of overcapacity, and tax incentives, just to name a few. The U.S. industry would like the GATT Subsidies Code to be strengthened. Through methods such as low interest loans, additional steelmaking capacity is being created at a time when worldwide overcapacity is a major problem. The U.S. industry believes that if the Subsidies Code is strengthened measures could be taken to control the type of subsidization mentioned above.

Dumping

The U.S. industry believes that the current antidumping provisions do not address several issues. Specifically, they see a need to clarify the antidumping provisions so they address diversionary dumping. Industry sources believe some VRA countries may sell steel products to non-VRA countries, such as Canada, that in turn sell these goods in the U.S. market. The industry feels that this issue needs to be addressed and an agreement on how to eliminate this problem is necessary.

Export Credits

Many developed countries subsidize the financing of exports of steel plants and equipment to the developing world. One example was the competition between OECD governments to provide official export financing for the 2.7 million ton expansion of South Korea's POSCO Kwangyang Bay facility. This is an expansion that is occurring during a time of stagnant steel demand and world overcapacity. The U.S. steel industry, which is backed by the U.S. Government on this issue, wants the OECD to reach an agreement that there will be no official export financing of plant and equipment until the overcapacity problem is solved.

Other Issues

In some newly industrialized countries preferential trade treatment, such as the Generalized System of Preferences and Caribbean Basin Initiative

accords, allow these countries to export goods to the U.S. market without paying as much as other trading partners. The U.S. steel industry believes that many of these newly constructed steel plants are world class, modern facilities and as such are already competitive without the added benefit of preferential trade treatment.

Appendix A

Request Letter from the Senate Committee on Finance

United States Senate

COMMITTEE ON FINANCE
WASHINGTON, DC 20510

1278

86 FEB 13 P5:01

NUMBER 1286
Office of the Secretary
Int'l Trade Commission

February 12, 1986

The Honorable Paula Stern
Chairwoman
U.S. International Trade Commission
701 E Street, N.W.
Washington, D.C. 20436

Dear Madam Chairwoman:

The Committee on Finance requests that the United States International Trade Commission conduct a series of investigations under section 332 of the Tariff Act of 1930, on the international competitiveness of selected major United States industries.

The 99th Congress faces important decisions regarding a wide range of trade issues, including Administration efforts to launch a new round of multilateral trade negotiations aimed at reducing international barriers to trade in goods, services, and investment flows. To guide Congress in decisions about the future of the international trading system, the Committee needs to understand the competitive strengths and viability of key U.S. industries, the extent and nature of competition facing these industries in foreign and domestic markets, and the extent to which any current trade problems result from special situations such as the strong dollar, debt and interest rate problems, or from more fundamental competitive problems.

Several witnesses appearing before this Committee have stressed that U.S. competitiveness and industrial viability must be gauged in terms of performance in international as well as domestic markets. It is important for these studies to examine the viability of these industries and U.S. trade negotiation objectives from the vantage point of the global nature of competition and the internationalization of production and ownership.

For each of these industry studies the Committee requests coverage of:

The Honorable Paula Stern
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1. Measures of the current competitiveness of the U.S. industry in domestic and foreign markets;

2. Comparative strengths of U.S. and major foreign competitors in these markets;

3. Nature of the main competitive problems facing the U.S. industry;

4. Sources of main competitive problems; to what extent from:

   a. special transitory or reversible situations such as exchange and interest rate problems, as opposed to

   b. fundamental or structural problems;

5. Competitive strategies; how important are foreign and U.S. markets to future competitiveness, in terms of economies of scale, growth rates, and pre-empting of market advantages.

The Committee decided not to identify specific industries or numbers of studies, but envisages up to seven studies. The Committee has instructed its staff to work out with ITC staff the specific industry selection and production schedule, depending on availability of appropriate staff to conduct them within the requested time. However, it requests that all studies be completed within 18 months and submitted to the Committee individually as completed.

The industries to be studied should be pivotal to overall U.S. industrial and technological strength, by virtue of being (a) either pathbreaking in the development of leading edge technologies that will shape future competitiveness of other U.S. industries, or (b) supplying critical equipment or materiel used in other important industries. The selection should be diverse enough that the range of their impact should reach broadly across the entire spectrum of U.S. industrial strength, represented by the seven tariff schedules. Examples would be key industrial agricultural commodities, selected synthetic organic chemicals, and textile fabrics, along with the equipment producing industries associated with each.

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The Committee recognizes that much of the information and data desired may not be available from secondary sources and that primary data gathering may prove essential to understanding global industry competition. It requests that in meeting the objectives of these studies the Commission develop new sources of information outside the United States through both interviews and questionnaires where possible, to assure effective assessment of the strengths and weaknesses of foreign competitors, and of the terms of competition in key foreign markets.

Sincerely,

Bob Packwood

BOB PACKWOOD

United States Senate

COMMITTEE ON FINANCE
WASHINGTON, DC 20510

April 2, 1986

Dr. Paula Stern
Chairwoman
United States International
Trade Commission
701 E Street, N.W.
Washington, D.C. 20436

Dear Chairwoman Stern:

Pursuant to my February 12th letter to you requesting a series of investigations on U.S. international trade competitiveness under section 332 of the Tariff Act of 1930, this is to confirm that the following specific sector studies are requested within that general heading:

Auto parts and equipment
Optical fibers and associated technology and equipment
Steel sheet and strip and associated equipment
Textile mills and associated equipment
Building-block petrochemicals: Competitive implications for construction, cars, and other major consuming industries

The Committee still has under consideration additional requests within the overall survey, and will relay those to you shortly.

The Committee understands that the International Trade Commission cannot begin and complete all the studies simultaneously, but requests that it begin them as soon as staff resources are available so the Committee will have results available as soon as possible for its consideration of the future of the trade agreements program.

Sincerely,

Bob Packwood

BOB PACKWOOD
Chairman

Appendix B

Notice of Institution of Investigation No. 332-231 in the _Federal Register_

concerning the building-block petrochemical industry on such end-user industries as the automotive and construction industries.

Public Hearing

The Commission will hold a public hearing on this investigation as well as the four others in this series (Inv. Nos. 332-229 through 332-233) at the United States International Trade Commission Building, 701 E Street NW Washington, DC, beginning at 10:00 a.m. on February 24, 1987.

All persons shall have the right to appear in person or by counsel, to present information and to be heard. Persons wishing to appear at the public hearing should file requests to appear and should file prehearing briefs (original and 14 copies) with the Secretary, U.S. International Trade Commission, 701 E Street NW., Washington, DC 20436, not later than noon, February 2, 1987. If the Commission decides to hold one or more hearings outside of Washington, DC, it will issue a supplemental notice of hearing by January 6, 1987.

Written Submission

Interested persons are invited to submit written statements concerning the investigation. Written statements should be received by the close of business on November 21, 1986. Commercial or financial information which a submitter desires the Commission to treat as confidential must be submitted on separate sheets of paper, each clearly marked "Confidential Business Information" at the top. All submissions requesting confidential treatment must conform with the requirements of § 201.6 of the Commission's *Rules of Practice and Procedure* (19 CFR 201.6). All written submissions, except for confidential business information, will be made available for inspection by interested persons. All submissions should be addressed to the Secretary, United States International Trade Commission, 701 E Street NW., Washington, DC 20436. Hearing-impaired individuals are advised that information on this matter can be obtained by contacting our TDD terminal on (202) 724-0002.

Issued: July 22, 1986.

By order of the Commission.

Kenneth R. Mason,

Secretary.

[FR Doc. 86-17102 Filed 7-29-86; 8:45 am]

BILLING CODE 7020-02-M

[332-233]

U.S. Global Competitiveness: Optical Fibers, Technology and Equipment

AGENCY: United States International Trade Commission.

ACTION: Institution of investigation.

EFFECTIVE DATE: July 9, 1986.

FOR FURTHER INFORMATION CONTACT: Mr. Christopher Johnson or Ms. Linda Linkins, General Manufactures Division, Office of Industries, U.S. International Trade Commission, Washington, DC 20436 (telephone 202-724-1730 or 202-724-1745, respectively).

Background and Scope of Investigation

The Commission on July 9, 1986, approved the institution of investigation No. 332-233, following receipt of letters on February 13, 1986 and April 2, 1986, from the Chairman of the Committee on Finance, United States Senate, requesting that the Commission conduct a series of investigations under section 332(b) of the Tariff Act of 1930 (19 U.S.C. 1332(b)) concerning the international competitiveness of a broad range of selected major United States industries. Institution of this study is scheduled for September 10, 1986.

The Commission investigation will examine the U.S. optical fiber industry, and its major foreign competitors, to determine the impact of global competition on the industry, and to assess how the industry is responding to these dynamic forces. As requested by the Committee, the Commission's report will analyze and address: (1) Measures of the current competitiveness of the U.S. industry in domestic and foreign markets; (2) comparative strengths of U.S. and major foreign competitors in these markets; (3) the nature of major competitive problems facing the U.S. industry; (4) the sources of these problems, including the extent to which they arise from special transitory or reversible situations or are the result of more fundamental or structural problems; and (5) the importance of U.S. and foreign markets to the future competitiveness of U.S. and foreign producers, in terms of economies of scale, growth rates, and pre-empting of market advantages.

Public Hearing

The Commission will hold a public hearing on this investigation as well as the four others in this series (Inv. Nos. 332-229 through 332-233) at the United States International Trade Commission Building, 701 E Street, NW., Washington, DC, beginning at 10:00 a.m. on February 24, 1987. All persons shall have the right to appear in person or be represented by counsel, to present information and to be heard. Persons wishing to appear at the public hearing should file requests to appear and should file prehearing briefs (original and 14 copies) with the Secretary, U.S. International Trade Commission, 701 E Street, NW., Washington, DC 20436, not later than noon, February 2, 1987. If the Commission decides to hold one or more hearings outside of Washington DC, it will issue a supplemental notice of hearing by January 16, 1987.

Written Submissions

Interested persons are invited to submit written statements concerning the investigation. Written statements should be received by the close of business on March 12, 1987. Commercial or financial information which a submitter desires the Commission to treat as confidential must be submitted on separate sheets of paper, each clearly marked "Confidential Business Information" at the top. All submissions requesting confidential treatment must conform with the requirements of § 201.6 of the Commission's *Rules of Practice and Procedure)* 19 CFR 201.6). All written submissions, except for confidential business information, will be made available for inspection by interested persons. All submissions should be addressed to the Secretary, United States International Trade Commission, 701 E Street NW., Washington, DC 20436. Hearing-impaired individuals are advised that information on this matter can be obtained by contacting our TDD terminal on (202) 724-0002.

Issued: July 22, 1986.

By order of the Commission

Kenneth R. Mason,

Secretary.

[FR Doc. 86-17103 Filed 7-29-86; 8:45 am]

BILLING CODE 7020-02-M

[332-231]

U.S. Global Competitiveness: Steel Sheet and Strip Industry

AGENCY: United States International Trade Commission.

ACTION: Institution of investigation.

EFFECTIVE DATE: July 9, 1986.

FOR FURTHER INFORMATION CONTACT: Ms. Nancy Flecher, Minerals and Metals Division, Office of Industries, U.S. International Trade Commission, Washington, D.C. 20436 (telephone 202-523-0341).

Background and Scope of Investigation

The Commission on July 9, 1986, approved the institution of investigation No. 332-231, following receipt of letters on February 13, 1986, and April 2, 1986, from the Chairman of the Committee on Finance, United States Senate, requesting that the Commission conduct a series of investigations under section 332(b) of the Tariff Act of 1930 (19 U.S.C. 1332(b)) concerning the international competitiveness of a broad range of selected major United States industries. Institution of this study is scheduled for September 8, 1986.

The Commission investigation will examine the steel and strip industry and its major foreign competitors, to determine the impact of global competition on the industry, and to assess how the industry is responding to these dynamic forces. As requested by the Committee, the Commission's report will analyze and address: (1) Measures of the current competitiveness of the U.S. industry in domestic and foreign markets; (2) comparative strengths of U.S. and major foreign competitors in these markets; (3) the nature of major competitive problems facing the U.S. industry; (4) the sources of these problems, including the extent to which they arise from special transitory or reversible situations or are the result of more fundamental or structural problems; and (5) the importance of U.S. and foregin markets to the future competitiveness of U.S. and foregin producers, in terms of economies of scale, growth rates, and pre-empting of market advantages.

Public Hearing

The Commission will hold a public hearing on this investigation as well as the four others in this series (Inv. Nos. 332-229 through 332-233) at the United States International Trade Commission Building, 701 E Street, NW., Washington, DC beginning at 10:00 a.m. on February 24, 1987. All persons shall have the right to appear in person or be represented by counsel, to present information and to be heard. Persons wishing to appear at the public hearing should file requests to appear and prehearing briefs (original and 14 copies) with the Secretary, U.S. International Trade Commission, 701 E Street, NW., Washington, DC 20436, not later than noon, February 2, 1987. If the Commission decides to hold one or more hearings outside of Washington DC, it will issue a supplemental notice of hearing by January 16, 1987.

Written Submissions

Interested persons are invited to submit written statemens concerning the investigation. Written statements should be received by the close of business on March 12, 1987. Commercial or financial informaiton which a submitter desires the Commission to treat as confidential must be submitted on separate sheets of paper, each clearly marked "Confidential Business Information" at the top. All submissions requesting confidential treatment must conform with the requirements of § 201.6 of the Commission's *Rules of Practice and Procedure* 19 CFR 201.6). All written submissions, except for confidential business information, will be made available for inspection by interested persons. All submissions should be addressed to the Secretary, United States International Trade Commission, 701 E Street, NW., Washington, DC 20436. Hearing-impaired individuals are advised that information on this matter can be obtained by contacting our TDD terminal on (202) 724-0002.

Issued: July 22, 1986.

By order of the Commission.

Kenneth R. Mason,
Secretary.

[FR Doc. 86-17104 Filed 7-29-86; 8:45 am]

BILLING CODE 7020-02-M

[332-229]

U.S. Global Competitiveness: Textile Mill Industry

AGENCY: United States International Trade Commission.

ACTION: Institution of investigation.

EFFECTIVE DATE: July 9, 1986.

FOR FURTHER INFORMATION CONTACT: Reuben Schwartz (202-523-0114) or Joseph Williams (202-523-5702),Textiles, Leather Products, and Apparel Division, Office of Industries, U.S. International Trade Commission, Washington, DC 20436.

Background and Scope of Investigation

The Commission, on July 9, 1986, approved the institution of investigation No. 332-229, following receipt of letters on February 13, 1986, and April 2, 1986, from the Chairman of the Committee on Finance, United States Senate, requesting that the Commission conduct a series of investigations under section 332(b) of the Tariff Act of 1930 (19 U.S.C. 1332(b)) concerning the international competitiveness of a broad range of selected major United States industries. Institution of this study is scheduled for September 2, 1986.

The Commission investigation will examine the U.S. textile mill industry and its major foreign competitors to determine the impact of global competition on the industry, and to assess how the industry is responding to these dynamic forces. As requested by the Committee, the Commission's report will analyze and address: (1) Measures of the current competitiveness of the U.S. industry in domestic and foreign markets; (2) comparative strengths of U.S. and major foreign competitiors in these markets; (3) the nature of major competitive problems facing the U.S. industry; (4) the sources of these problems, including the extent to which they arise from special transitory or reversible situations or are the result of more fundamental or structural problems; and (5) the importance of U.S. and foreign markets to the future competitiveness of U.S. and foreign producers, in terms of economies of scale, growth rates, and pre-empting of market advantages.

Public Hearing

The Commission will hold a public hearing on this investigation as well as the four others in this series (Inv. Nos. 332-229 through 332-233) at the United States International Trade Commission Building, 701 E Street, NW., Washington, DC, beginning at 10:00 a.m. on February 24, 1987. All persons shall have the right to appear in person or be represented by counsel, to present information and to be heard. Persons wishing to appear at the public hearing should file requests to appear and prehearing briefs (original and 14 copies) with the Secretary, U.S. International Trade Commission, 701 E Street, NW., Washington, DC 20436, not later than noon, February 2, 1987. If the Commission decides to hold one or more hearings outside of Washington, DC, it will issue a supplemental notice of hearing by January 16, 1987.

Written Submissions

Interested persons are invited to submit written statements concerning the investigation. Written statements should be received by the close of business on March 12, 1987. Commercial or financial information which a submitter desires the Commission to treat as confidential must be submitted on separate sheets of paper, each clearly marked "Confidential Business Information" at the top. All submissions requesting confidential treatment must conform with the requirements of § 201.6 of the Commission's *Rules of Practice and Procedure* (19 CFR 201.6). All written submissions, except for confidential business information, will be made available for inspection by interested persons. All submissions should be addressed to the Secretary, United States International Trade

Appendix C

Definition of Certain Terms and Description of the Products Subject to the Investigation

DEFINITIONS

1. Steel.--An alloy of iron and carbon that is malleable as first cast. Steel may contain other elements, but iron must predominate, by weight, over each of the other elements.

2. Carbon steel.--Steel in which none of the elements listed below exceeds the quantity, by weight, respectively indicated:

1.65 percent of manganese, or
0.25 percent of phosphorus, or
0.35 percent of sulphur, or
0.60 percent of silicon, or
0.60 percent of copper, or
0.30 percent of aluminum, or
0.20 percent of chromium, or
0.30 percent of cobalt, or
0.35 percent of lead, or
0.50 percent of nickel, or
0.30 percent of tungsten, or
0.10 percent of any other metallic element.

3. Alloy steel.--Steel that contains any of the elements listed in definition 2 (above) in excess of its specified quantity.

4. Stainless steel.--Any alloy steel that contains, by weight, less than 1 percent of carbon and over 11.5 percent of chromium.

5. Sheets and strip.--Flat-rolled products, whether or not corrugated or crimped, in coils or cut to length. Sheet is under 0.50 inch in thickness and over 12 inches in width. Strip is under 0.50 inch in thickness and, if cold rolled, over 0.50 inch but not over 12 inches in width. Sheets and strip are included in AISI product group Nos. 28, 29, 29A, 30, 31, 32, 33A, 33B, 34, 34B, 35, 36, and 37. For the purposes of this investigation, sheets and strip are classified as follows:

SHEETS AND STRIP--HOT ROLLED are all hot-rolled products, other than galvanized and coated, less than 0.1875 inches in thickness, obtained either by rolling to width or slitting from wider material.

Includes:	Circles (blanked and sheared)	Annealed and pickled sheets
	Formed roofing and siding (black or painted)	Sketches
	Nail and tack plate	Hot-rolled sheet material slit and sold as sheet
	Enameling sheets (hot rolled)	Nonmetallic coated sheets
		Electrical

Hot-rolled carbon and alloy sheet and strip products are provided for in items 607.6700, 607.6710, 607.6730, 607.6740, 607.6900, 607.8100, 607.8342, 607.8344, 608.1920, 608.2120, and 608.2320, of the Tariff Schedules of the United States Annotated (TSUSA).

DEFINITIONS--Continued

HOT-ROLLED BANDS are mill edge coils without the additional processing after hot rolling that might be expected with hot-rolled sheet steel. Coil ends are not cut back to conform to established thickness and width tolerances. Hot-rolled bands are provided for in item 607.6720 of the TSUSA.

SHEETS AND STRIP - COLD ROLLED are all cold reduced products (other than galvanized, coated, and electrical grades) less than 0.1875 inches in thickness, obtained either by rolling to width or slitting from wider material.

Includes:
- Enameling sheets (cold rolled)
- Circles (blanked or sheared)
- Sketches
- Tack plate
- Nonmetallic coated sheets
- Porcelain enameling sheets
- Formed roofing and siding (unpainted or painted)
- Cold-rolled sheet material slit and sold as sheet
- Electrical

Excludes: Stainless clad sheets

Cold-rolled carbon and alloy sheet and strip products are provided for in items 607.6200, 607.6400, 607.8355, 607.8360, 607.8600, 607.9205, 607.9210, 607.9315, 607.9320, 608.1940, 608.2140, 608.2145, 608.2150, 608.2340, 608.3100, 608.3810, 608.3820, 608.3900, 608.4700, 608.5510, 608.5520, 608.5900, 608.6710, and 608.6720 of the TSUSA.

SHEETS AND STRIP--GALVANIZED--HOT DIPPED are produced in either coils on continuous coating units or in cut lengths on vat coating units by passing the flat-rolled material through a bath of molten zinc. Generally, coating weights of up to 2.75 ounces of zinc per square foot of material (total both sides) are applied. Zinc coating applied by the hot dip method is normally heavy enough to resist corrosion without additional protective coating.

Hot-dipped galvanized sheets are usually produced to ASTM specifications A-525 for general requirements (coated sheet), A-526 for commercial quality; A-361 for formed roofing and siding; A-444 for culvert sheets; and A-446 for physical quality in accordance with the Standard Galvanized Sheet Gauge Numbers Table.

DEFINITIONS--Continued

Includes: Flat products
Corrugated products
Formed roofing and siding (including accessories)
Culvert sheets, flat or formed

Galvannealed (heat treated after coating)
Chemically treated (bonderized for painting)

Differentially coated
Coated one side only
Wiped coated

Galvanized and painted
Galvanized and coated (asphalt, etc.)

Black plate gauges
Prime and secondary material

SHEET AND STRIP--GALVANIZED--ELECTROLYTIC are produced on continuous coil coating lines by electroplating from aqueous solutions that contain zinc compounds. This zinc-coated sheet is produced with a wide range of coating weights to provide coatings that are compatible with the service life required. Some products are made with very light coatings (up to approximately 0.08 ounce per square foot each side) for applications that usually involve subsequent painting to provide additional corrosion protection. More recently, a number of electroplating lines have been built to provide heavier coatings (up to 0.30 to 0.35 ounce per square foot each side) for applications requiring improved corrosion protection without painting. Electrolytic galvanized sheet can readily be coated on one surface only or both surfaces with equal or differential coating weights.

The light-coated product for subsequent painting is normally produced to meet ASTM A591 specification. The heavier electroplated zinc coatings are mostly used by the automotive industry, which has developed its own coating weight requirements although the coated-sheet product can be produced to meet some of the coating weight categories of ASTM A525 (G01 to G90 categories).

Includes: Flat products
Chemically treated (bonderized) for painting
Electrogalvanized and painted
Coated one side only
Black plate gauges
Prime and secondary material

Galvanized sheet and strip products are provided for in items 608.0730, 608.1300, 608.1310, 608.1320, and 608.1330 of the TSUSA.

DEFINITIONS--Continued

OTHER COATED is sheet and strip coated with metallic coatings that are not zinc- or tin-alloy based (aluminum coated, copper coated, and terne), organic coatings, inorganic coatings, or combinations of these types of coatings (e.g., zincrometal). Sheet or strip coated with temporary organic coatings only (e.g. slushing or mineral oils) are not included in this catagory. Other coated sheet and strip products are provided for in items 607.8350, 608.0100, 608.1340, 608.1440, 609.1700, and 609.1790 of the TSUSA.

STAINLESS SHEET AND STRIP is provided for in items 607.7610, 607.9010, 607.9020, 607.9029, 608.2600, 608.2900, 608.4300, 608.4309,and 608.5100 of the TSUSA.

ZINC-ALUM is a coating of primarily zinc and aluminum, e.g., Galfan, Galvalume, etc. This product is provided for in item 608.1350 of the TSUSA.

TIN PLATE--ELECTROLYTIC AND HOT DIPPED

Tin Plate - Electrolytic is cold reduced tin mill black plate (either prime or secondary material) specified in cut sizes or coils, coated with tin by electrode position.

Tin Plate/Hot dipped is black plate (either prime or secondary material) additionally processed by pickling and coating on both sides with commercially pure tin by the hot dip process. It is termed coke tin plate, charcoal tin plate, or silver tin, depending on coating weight.

Includes:	Charcoal tin plate	Common cokes
	1A Charcoal	Standard cokes
	2A Charcoal	Best cokes
	Coke tin plate	Kanners special

Tin plate is provided for in items 607.9600, 607.9700, and 607.9900 of the TSUSA.

TIN-FREE STEEL is black plate that has been electrochemically or vacuum deposit coated with chrome-chrome oxide or chrome phosphate. This excludes tin, aluminum, and zinc coatings that have been electrochemically or vacuum deposited. Tin-free steel is provided for in item 609.1710 of the TSUSA.

Appendix D

Glossary of Technical Terms

Glossary of Technical Terms

annealing	a process by which, through controlled heating and cooling, ductility is restored to work hardened steel.
argon oxygen decarburization (AOD)	a ladle metallurgy process, used primarily for stainless steel production. The process utilizes argon blowing and the formation of carbon/oxygen compounds to remove carbon from molten steel.
backup roll	a roll that serves to support, and reduce the bending in, a work roll.
basic oxygen furnace (process) BOF (BOP)	the predominant furnace (process) used in the integrated steel industry.
blowing	forcing air, oxygen, or other gases though molten metal for the purpose of refinement.
brownfield	a facility built on the site of some previously existing infrastructures, buildings, or equipment.
cluster mill	a single stand mill design that utilizes several levels of gauged backup rolls supporting small work rolls.
crown	the curved profile of a sheet's cross section, perpendicular to the direction of rolling. Crown is caused by the tendency of rolls to deflect when loaded.
electrical steel	steel, generally with high silicon levels, that has certain known electrical and magnetic properties. Grain orientation in the sheet's microstructure determines the major subsets of electrical steels: nonoriented and oriented.
electrogalvan-izing	the process of applying zinc to a steel substrate by passing an electrically charged steel product through an oppositely charged, zinc-rich electrolytic solution.
fines	very small particles of mineral raw materials.
finishing operations	the manufacturing processes that are performed after temper rolling.
finishing train	the set of rolling stands at the exit end of a rolling mill that impart small net reductions on the processed material.
galvanize	to apply a zinc coating to a steel substrate.

Galvalume	a coated steel product utilizing an aluminum/zinc/silicon (55 percent/43.5 percent/1.5 percent) alloy coating. Galvalume exhibits superior corrosion resistance than 100 percent pure zinc galvanizing, especially at higher temperatures.
Galfan	a zinc/aluminum/mischmetal (95 percent/5 percent/trace) alloy coating. Galfan is highly ductile and resists cracking and flaking when the steel substrate is formed.
gauge	a measure of material thickness.
greenfield	a facility built on an entirely new site. Contrasts with brownfield.
heat	a batch of steel melted at one time.
hot end	the melting, refining, and casting facilities of a steel mill.
hot metal	molten iron produced in a blast furnace.
induction heating	a method of heating that utilizes varying electromagnetic fluxes.
ladle metallurgy	the practice of further steel refinement, performed in a ladle after partial refining of a heat in a steelmaking furnace. The term ladle metallurgy includes a variety of processes.
mandrel	an arbor or spindle around which material is coiled.
near-net-shape casters	continuous casters that produce semifinished forms requiring only minimal physical alteration to produce finished products.
open-hearth furnace	a reverbratory, regenerative steelmaking furnace that has largely been replaced by the BOF.
pickle	to remove surface oxide deposits by immersion in acidic baths.
reversing mill	a discontinuous rolling mill that processes the material through successive forward and backward passes.
rolling mill	equipment that reduces and transforms the shape of semifinished or intermediate steel products by passing the material through a gap between rolls that is smaller than the entering material.

roll	a cylindrical body.
Ruhrstahl-Heraeus Oxygen Blowing (RH-OB)	a ladle metallurgy process, incorporating vacuum degassing, oxygen blowing, alloy addition, and heating functions capable of producing very high-quality, low-carbon steels. Low carbon enhances the properties of electrical and deep drawing sheet.
secondary steelmaking	see "ladle metallurgy."
Sendzimir mill	usually refers to a cluster mill for cold rolling designed by T. Sendzimir. Sendzimir also produces planetary mills for hot rolling operations.
shape	the form of a sheet when examined from the edge. See crown.
slab	a semifinished form of steel, rectangular in shape, with a width at least twice the thickness. Slabs can either be rolled from ingots or cast directly on a casting machine.
stand	a housing that contains one set of rolls in a rolling mill.
tandem mill	a rolling mill with two or more stands arranged for continuous (single direction) rolling.
teem	to pour molten metal.
transfer bar	the semifinished form of steel that exists between the roughing and finishing trains of a hot-strip mill.
transverse flux	a magnetic field in which the lines of magnetic force exist perpendicular to the body being acted upon.
work roll	one of a pair of rolls that touch the material being processed, causing a reduction in thickness.
zincrometal	a steel sheet product coated with a proprietary two-layer (base/primer), corrosion-resistant coating system. Zincrometal utilizes a zinc rich primer (Zincromet) over a chromium base (Dacromet).

Appendix E

State-of-the-Art Features for Rolling and Finishing Equipment

Hot strip mill

- o Hot and/or direct slab charging
- o Total computer control from slab charging to coil storage
- o Walking beam furnaces with temperature set point control
- o Large edgers with 4- to 6-inch width-reduction capacity
- o High-capacity reversing roughers
- o Automatic width control
- o Schedule-free rolling
- o Six or seven finishing stands
  - AGC--hydraulic screw positioning and loopers
  - Fast roll change
  - Use of advanced mill configurations for gauge, profile, and shape control (roll bending, 6-hi stand, paired cross roll, side-shifting rolls, or CVC (continuous variable crown process))
- o Laminar flow water cooling on runout table
- o Finishing/coiling temperature computer control system
- o High-capacity coilers (e.g., 1100+ PIW coils up to 0.75" in thickness)
- o Automated marking, banding, weighing
- o Coil transfer cars
- o Individual coil cradle storage

Pickling

- o Combination pickler/cold tandem mill
- o Automated welder
- o Flex-type or tension leveller scale breaking
- o Entry loop car
- o Automated acid control system (HCL)
- o Exit loop car
- o Quick change trimmer
- o Automatic centering trimmer
- o Electrostatic oiler
- o Delivery tension reel
- o Individual coil storage cradles
- o Overhead crane coil handling system

Tandem mills

- o Combination pickler/cold tandem mill or fully continuous cold tandem mill
- o Full computer control
- o Entry payoff reels
- o Six high mill or equivalent for shape and crown control
- o Shape/gauge control system with feedback
- o Hydraulic roll positioning
- o Variable crown backup rolls
- o Speed regulated
- o Feed forward and vernier digital AGC
- o Datalogging
- o Quick roll change
- o Coil storage on individual cradles/overhead crane handling

<u>Annealing and finishing equipment</u>

- Continuous annealing/processing lines
- Electrolytic strip cleaning
- Computer controlled box annealing
- Six high temper mill with shape/gauge control
- Electrostatic oiling
- Reinspection line
- Positive coil handling--conveyor, crane, coil cradle storage
- Rubber-sleeved coil mandrels
- Modern roll preparation (EDT)
- Automated packaging line

Appendix F

Modifications in World Sheet and Strip Capacity Since 1984

The following modifications in world sheet and strip capacity have been announced or completed since 1984. 1/

United States

Thin slab casting mill.--Nucor Corp. will build a flat products minimill with a capacity of 800,000 tons per year in the Southern United States. The facility is scheduled for startup in early 1989 and will incorporate a Schloemann-Siemag AG strip casting plant with a direct-connected hot-strip mill. A reversing cold-rolling mill is to be modernized to include continuous variable crown technology and a temper rolling stand. Production will be divided equally between hot-rolled and finished cold-rolled steel. This is significant because it represents the first entry into the sheet and strip business by one of the growing number of low overhead, high-profit minimill companies. As a step in backward integration, it contrasts with the dominant trend of existing sheet and strip producers to drop earlier stages of production.

Hot strip mills.--Heidtman Steel Products, a U.S. coil coater, plans to build a greenfield hot-strip mill in Toledo, OH. The mill will have an annual capacity of 1.4 million tons and is tentatively scheduled for startup in February 1989. The mill is to be equipped with a coil box to reduce heat loss during rolling. Inland Steel awarded a contract to supply a pair of walking-beam slab-reheating furnaces to service the 80-inch hot-strip mill at its Indiana Harbor Works. The project is said to be 1 of 13 hot-strip mill-related improvements under consideration at the plant. Weirton Steel Corp. is planning a modernization project for its hot-strip mill that will include adding computerized gauge, shape, and crown controls to its facility. Operation is scheduled for mid-1988. The firm will minimize the impact of the installation of new equipment by taking a number of brief planned outages on the hot-strip mill. USX Corp. shut down two of its hot-strip mills. The company indefinitely idled its Geneva, UT, plant, which was subsequently purchased by a separate concern interested in restarting operations there. The Fairless Hills, PA, plant is being modernized simultaneously with the construction of a continuous caster. Hot-strip mills at other USX plants were also scheduled to be modernized.

1/ Information on capacity developments gathered from various issues of Steels Alert, an abstract of articles from industry publications, and Metal Bulletin Monthly, April 1987.

Cold-rolling mills.--USS-Posco Industries (UPI), a 50-50 joint venture between USX and Posco (South Korea) to modernize the plant producing high-quality sheet and tin plate products at Pittsburg, CA, expects to have its 1.5-million-ton-per-year cold-rolling mill and continuous annealing and pickling lines onstream by October 1989. UPI's operations include two hot-dip galvanizing lines, three tinning lines, and a temper mill as well as cold-rolling and annealing capability. According to the trade press, the object of the modernization is improved product quality rather than increased output. Inland Steel Industries Inc. and Nippon Steel Corp. have entered into a cold-rolling mill joint venture (I/N Tek) that will be built near South Bend, IN. The facility is expected to be a major supplier to Japanese and domestic automakers in the United States, as well as to appliance producers and furniture manufacturers. The venture will give Inland a total of 2.5 million tons per year of cold-rolling capacity.

Electrogalvanizing (e.g.) lines.--In 1986, five new e.g. lines began operation in the United States. They are Walbridge Coating, jointly owned by Bethlehem Steel, Inland Steel, and Pre-Finish Metals, with a capacity of 400,000 tons per year; L-S Electrogalvanizing Co., a joint venture of LTV Corp. and Sumitomo Metal Industries of Japan, with a capacity of 400,000 tons per year; Double Eagle Steel Coating, a joint venture between USX and Rouge Steel, with a capacity of 700,000 tons per year; Armco's e.g. line at its works in Middletown, OH, with a capacity of 400,000 tons per year; and National Steel's e.g. line at its Ecorse, MI, works, with a capacity of 400,000 tons per year. The principal application of e.g. sheet and coil is in the manufacture of auto body panels.

Hot-dip galvanizing lines.--Heidtman Steel Products and its joint-venture partner, National Materials Corp., opened a heavy-gauge hot-dip galvanizing plant that produces 20,000 tons of heavy-gauge galvanized steel per month.

Coil processing.--National Steel Corp. and Marubeni Corp. (Japan) have announced a joint venture, Pro Coil Corp., which is a coil-processing plant to be built in the Detroit area. The plant will have an initial capacity of 120,000 tons per year of blanked product, and 100,000 tons per year of slit coil. Production will be for the automotive industry and startup is scheduled for January-March 1988.

Japan

Hot-strip mills.--Nippon Kokan KK's Fukuyama Works achieved full operation of its continuous casting-hot direct rolling process in which the caster is linked to one of the hot-strip mill lines, in mid-1985. According to industry rationalization plans announced by Japanese steelmakers, capacity reductions are anticipated in hot-strip operations at Nippon Steel and Kawasaki Steel by 1990.

Cold-rolling mills.--Kawasaki Steel Corp. started up a new cold-rolled strip mill in 1987 at its Mizushima Works, with a capacity of 90,000 tons per year. The mill is designed to roll a broad product mix, ranging from high-strength, deep-drawing automotive sheet to electrical grades. In 1986, Kobe Steel began operation of a 130,000-ton-per-month reversing cold-rolling strip mill as part of an expansion project at its Kakogawa Works. Nippon Steel announced that it would reduce cold-rolling operations by 1990 as part of its restructuring plan.

Electrogalvanizing lines.--In the past 3 years, Japanese steelmakers brought onstream at least 864,000 tons per year of new e.g. capacity. Kawasaki Steel started an e.g. line at its Mizushima Works in mid-1987. The line, which has a capacity of 30,000 tons per month, is part of the company's modernization program aimed at orienting its product mix toward automobiles, electrical equipment, and home appliances. The e.g. line built by Nisshin Steel at its Hanshin works went into operation in late 1986 with a capacity of 12,000 tons per month. Kobe Steel completed a continuous coating line at its Kakogawa Steel Works in early 1987. The line produces a product called Durasteel, which was developed to meet increased demand for e.g. automotive sheet. Nippon Steel began operation of its e.g. line in mid-1985 at its Kimitsu Works, with a monthly capacity of 22,000 tons.

Hot-dip galvanizing lines.--Yodagowa Steel Works, a sheet steel processor that makes cold-rolled, galvanized, and prepainted sheet from purchased coils, has announced plans to install a new dual-purpose, hot-dip line to produce Galvalume and conventional galvanized sheet steel. The line will have a capacity of more than 200,000 tons annually.

Continuous zinc-vapor deposition line.--A zinc-vapor deposition line has been connected to an existing Sendzimir-type hot-dip galvanizing line at Nisshin Steel's Hanshin Works. Commercial production was scheduled to begin in late 1986. The process is expected to be more economical than the hot-dip galvanizing process.

Canada

Dofasco, Inc. has reached financial agreement with Mitsui & Co. for a new slab caster and direct rolling project. This includes a 2.4-million-ton-per-year Mannesmann Demag/Hitachi Zose caster, slab heating equipment, and modification of the existing hot-strip mill for direct rolling of hot slabs. Stelco has added a fifth rolling stand to its state-of-the-art hot-strip mill at its Lake Erie Works. The company has incorporated hydraulic automatic gauge controls on the new mill stand and retrofitted two of the existing stands during the shutdown period.

European Community

Hot-strip mills.--West Germany's Thyssen Stahl is modernizing its hot-strip mill in Beekerwerth. The mill will be equipped with continuously variable crown (CVC) technology, which will improve strip flatness and crown control. The modernization was to be completed in 1987. In the United Kingdom, BSC's Port Talbot hot-strip mill has been modernized with the objectives of increasing coil weight capacity, extending the product range, and enhancing quality. The revamp included the replacement of three original reheating furnaces with a new one and the addition of a new large reversing roughing mill and a new coil box. The Hoogovens Group in the Netherlands is modernizing one of its hot-strip mills by replacing two of three existing coilers so as to increase maximum strip gauge and to enable higher weight coils to be produced. The roughing section of the mill is also being revamped. Modernization is expected to be completed by the fall of 1988. Spain's Ensidesa is also modernizing its 1.7-million-ton hot-strip mill to increase the annual production to 2.3 million tons and to improve product quality. Another Spanish company, Altos Hornos de Vizcaya (AHV), has revamped its hot-strip mill by installing a large rolling mill and raising mill finishing speeds. Capacities will be increased from 1.5 million to 2 million tons per year, with potential for further increases to 2.5 million tons per year with improved tolerance and quality control. Italian steelmaker, Terni, is reported to be nearing completion of its hot-strip mill revamp, with only the automation of the process to be completed. The modernized seven-stand finishing mill, which is used for magnetic and stainless steel strip, came on-stream in 1986. In France, Usinor's hot-strip mill facilities at Denain were completely closed by early 1985, eliminating 1.7 million metric tons of annual hot strip mill capacity. Significant capacity cuts also occurred at the Seremange facility during this period. The total reduction in hot-strip mill capacity between 1984 and 1985 amounted to approximately 2 million tons per year.

Cold-rolling mills.--Firsteel, the United Kingdom's precision cold-strip producer, is to install a new cold-rolling mill at Walsall that will produce strip with better dimensional control, tighter tolerances, and improved surface quality. Lee Steel Strip has announced plans to install a Sendzimir mill on its 18-inch Farmer Norton 4-high mill, with the goal of improving product quality and production capacity for special steel strip. Belgian stainless steel producer, ALZ, is installing a new reversing cold mill for reduction and temper rolling that is due to startup in June 1989. On completion, it will enable the company to expand its market to stainless sheet products over 2 meters in width. Cockerill-Sambre of Belgium plans to close its cold-rolling mill at Jemeppe within the next 2 years and to modernize the Liege cold-rolling mill to replace the lost capacity. Modernization at Liege is underway and is designed to transform the facility into a fully continuous production unit. The work is scheduled for completion by July 1988 and is expected to result in substantial improvements in product quality, yield, and productivity. The Netherland's Hoogovens has awarded a contract to modernize its 5-stand tandem cold-rolling mill, with completion by the end of 1987. Spain's Sidmed has signed a contract with the U.S.'s Westinghouse to improve the electronic controls on its tandem cold mill and pickling line at Sagunto. This is part of a general modernization program aimed at strengthening Sidmed's position in the Spanish and European flat product markets. The project is expected to be completed by mid-1988. In Luxembourg, Arbed SA is constructing a new cold-rolling mill at its Dudelange Works that will have continuous variable crown technology for the production of high-quality strip within a wide range of sizes. The new mill is scheduled to begin operation at the end of 1987 and will have a capacity of 350,000 tons per year.

Annealing lines.--In West Germany, Krupp Stahl has installed a new bright annealing facility at its Dusseldorf-Benrath plant to enhance its market position in specialty steel cold strip. British Steel is installing a new continuous annealing process line (CAPL) at its Trostre works. The 360,000-ton-per-year dual-purpose line will process tin mill products and cold-reduced products, principally to meet demand for higher strength steels from the automotive sector. The line is expected to startup in 1989. Other developments in annealing operations include the introduction by Spain's only flat-rolled stainless steel producer, Acerinox, of a new annealing-pickling line to handle 20,000 tons per month of specialty steel grades.

Galvanizing lines.--In 1986, Hoesch Stahl, one of West Germany's major coated sheet producers, bought a Bethlehem Galvalume license for its Dortmund works. Also, the country's new Thyssen Stahl plant for electrolytic coating of cold-rolled thin sheet is near completion. The plant can be adapted for coatings other than zinc. The United Kingdom's BSC Strip Mill Products is revamping one of the electrogalvanizing lines at the Shatton Works by installing seven Sumitomo vertical plating cells and the associated technology. This will permit production of wide double- and single-sided zinc-coated strip. The work is expected to be completed by mid-1988. Belgium's new continuous hot-dip galvanizing plant, Segal, was expected to be operating at capacity by October 1987. In 1986, Cockerill Mechanical Industries acquired a license from Bethlehem International Engineering Corp. to design and build Galvalume lines and to convert existing galvanizing lines.

Coating lines.--The United Kingdom's BSC has announced plans to increase capacity at one of its color-coat lines by 50 percent. The company has begun operations at its first dual-purpose plant for coating wide strip steel at its Shatton Works. It is designed to produce more than 200,000 tons per year each of Galvatite, traditional galvanized strip, and Zalutite, an aluminum-zinc-coated product new to BSC and developed commercially by Bethlehem Steel Corp.

Finland

Finland's Outokumpu Oy plans to begin trial runs at its new Steckel mill at the Tornio stainless steel works in late 1987. The mill will produce stainless steel plate and wide strip and is expected to reach its design capacity of 200,000 tons per year in mid-1988.

Austria

Austria's Voest-Alpine is continuing with its restructuring program, which includes the commissioning of an electrogalvanizing line and a coil coating line at the Linz works.

Turkey

Turkey's state-owned Eregli Iron and Steel Works has announced plans to expand capacity of its No. 1 hot-strip mill from 1.6 million to 3.0 million tons per year. The project will begin as soon as financing is acquired.

New Zealand

New Zealand Steel Ltd.'s second stage of expansion, which was scheduled for completion in late 1987, will give the company 550,000 tons per year of flat product rolling capacity.

Australia

Hot-strip mill.--BHP's Port Kembla Works is undergoing modernization of its hot-strip mill, which will have a capacity of 2.2 million tons per year.

Cold-rolling mill.--BHP has also announced plans to revamp the five-stand cold-rolling mill and to install a new pickling line at its Springhill Works.

Capacity Modifications in Developing Countries

Efforts undertaken in the developing countries to modify capacity include the expansion of existing lines and the addition of new electrogalvanizing lines, cold-rolling mills, and hot-strip mills. These are described below.

Brazil

Hot-strip mill.--In conjunction with its restructuring plan, Brazil's Cia Siderurgica de Tubarao (CST) is considering the installation of a 3.5-million-ton-per-year hot-strip mill.

Electrogalvanizing line.--Usiminas, in Brazil, has announced plans to install an electrogalvanizing line, the country's first. The project involves construction of a 30,000-ton-per-month line to be completed in 3 years.

South Africa

In South Africa, a new continuous annealing line is being installed at one of Iscor's works. The line will enable Iscor to produce drawing quality steels, particularly for the automotive industry. The main contractor for the design, manufacture, and supply of equipment and the installation and commissioning of the plant is Nippon Steel Corp. (Japan).

Korea

Hot-strip mill.--In September 1986, work to update and expand the No. 1 hot-strip mill at Posco's Pohang facility was completed, raising capacity by 270,000 tons per year. The work included improved slab reheating and better mill control systems. Modernization was also undertaken at Posco's No. 2 hot-strip mill to improve quality and yield. In April 1987, Posco's new Kwangyang Bay Works came on stream with a capacity of 2.7 million tons per year. The facility produces only hot-rolled flat products.

Cold-rolling mill.--Work was completed on Posco's new 1-million-ton-per-year cold-rolling mill in Pohang in early 1987. The mill will feed the works' new 300,000-ton-per-year electrogalvanizing line.

Galvanizing lines.--Union Steel started production of Galvalume in May 1986, by modifying one of its two galvanizing lines in Pusan into a dual-purpose Galvalume/galvanizing line.

Taiwan

Hot-strip mill.--Demand for hot band in Taiwan has led to the An Feng Steel Co. Ltd. project, which will have a hot-rolling production capacity of 1 million tons per year, possibly to be doubled later. Construction is scheduled for completion by mid-1989. China Steel Corp. is in the process of expanding capacity at its hot-strip mill in Kaohsuing from 1.8 million tons per year to 3.7 million tons per year.

Cold-rolling mill.--An Mau Steel, the Taiwan-Australian joint-venture company, has begun expanding production facilities. The company added to its existing 400,000-ton-per-year cold-rolling capacity when it commissioned a new 275,000-ton-per-year cold-rolling mill in mid-1987. A continuous galvanizing line is also scheduled to begin operation in early 1988. Part of this output will feed an 80,000-ton-per-year color-coating line.

Continuous annealing.--China Steel Corp. (CSC) is working with Nippon Kokan K. K. (Japan) to supply the technology for a continuous annealing line to be installed at the Kaohsuing Works' cold-rolling mill as part of an ongoing expansion program. The line will have a capacity of 400,000 tons per year and is scheduled to begin production by the spring of 1988.

Tinning lines.--Ton Yi Industrial Corp. has begun commercial production at its new 60,000-ton-per-year electrolytic tinning line.

Malaysia

Federal Iron Works has contracted with a Canadian company to install a continuous coil-coating line to process cold-rolled steel, galvanized steel, and aluminum.

Thailand

Thailand's major steel producers recently decided to postpone plans for a proposed major new integrated steelworks, but it is likely that a previously planned strip mill may be built. No decision has been reached on whether this mill would be a hot-strip or cold-rolling mill.

Indonesia

Cold-rolling mill.--Operations have begun at a cold-rolling mill with potential production capacity of 850,000 tons per year.

Tinning lines.--The country's first tinplate plant, owned by tin producer P.T. Tambang Timah, began production in September 1985. The facility is expected to reach full capacity of 130,000 tons per year in 1988.

India

Salem Steel is to install a second Sendzimir cold-rolling mill that will increase output of cold-rolled stainless steel sheet at the works from the current 32,000 tons per year to 70,000 tons per year. Nippon Denro Ispot plans to install a 120,000-ton-per-year cold-strip mill scheduled to start up in June 1988. Integrated Steels Limited is building a strip rolling complex in the Indian State of Maharashtra for the manufacture of cold-rolled carbon steel strips. The plant will have a capacity of 120,000 tons per year, with capability to expand to 200,000 tons per year. Lloyds Steel Industries has announced plans to establish a minimill in Maharashtra State for the production of 120,000 tons per year of cold-rolled sheet.

Pakistan

The Omega Tin Plate Co. will bring on stream a 60,000 ton per year tinning line by the end of 1987.

Philippines

Plans for steel capacity expansion in the Philippines (reflected in the projections for hot-strip mill capacity in the previous tabulation) have been jeopardized by the political and economic uncertainty in that country.

Capacity Modifications in Nonmarket Economy Countries

The nonmarket economy countries have undertaken modernization and expansion programs to improve their capacities. They are described below.

East Germany

Efforts to upgrade hot-strip mill capacity and expand product range are underway at the Eisenhuttenkombinat Ost Works, with completion scheduled for 1988.

China (PRC)

A cold-rolled strip mill with a capacity of 2.1 million tons per year has been completed at the Baoshan Steel Works at Shanghai, and construction of a hot-strip mill with a capacity of 4 million tons per year is underway.

Soviet Union

The Soviet Union is in the midst of a modernization and expansion program that includes construction of a new rolling mill at the Novolipetsk Iron and Steel Works. The 1986-90 Five Year Plan includes efforts to increase production of higher quality products such as cold-rolled sheet and coated sheet.

Appendix G

Exchange Rates

Nominal-exchange-rate determination

The theory of purchasing power parity (PPP) provides a partial explanation for movements in nominal exchange rates over the long run. This theory suggests that variation in nominal exchange rates tends to correspond to differences between rates of inflation across countries. A strict interpretation of PPP suggests that exchange rates will move towards equilibrium levels that equate the costs of a representative bundle of goods and services across countries. For example, if in long run equilibrium a given basket costs 200 deutsche marks in West Germany, $100 in the United States, and 17,000 yen in Japan, then PPP would imply that a dollar should be valued at 2 deutsche marks and 170 yen. A weaker version of PPP that acknowledges continuous departures from long run equilibria holds that exchange-rate movements over time will offset differences across countries in their respective rates of inflation. Therefore, nominal exchange rates move toward levels that compensate for differences in the rates of inflation among countries and have the effect of leaving international price competitiveness unchanged. Consequently, nominal exchange-rate shifts can be unreliable as a measure of the effects of exchange-rate variation on industrial competitiveness to the extent that they reflect differing rates of inflation. For example, a 50-percent nominal depreciation of the Mexican peso renders Mexican steel no more competitive in the United States if inflation in Mexico doubled the peso price of steel. Real exchange rates (nominal exchange rates adjusted for the effects of inflation at home and abroad) constitute the proper basis for analyzing the effects of exchange-rate movements on competitiveness. 1/

Real exchange-rate determination

For most developing countries and nonmarket economies with inconvertible currencies, changes in real exchange rates are administered by capital and exchange controls. For most industrialized countries, however, integration into the world financial system results in the determination of exchange rates as a byproduct of trading activity in financial assets (and to a far lesser extent, in markets for goods and services). Behavior in capital markets tends to reflect market perceptions of economic changes occurring within a country viewed in the context of a global economy. In the short run, capital flows are highly sensitive to interest rate differentials, adjusted for anticipated inflation and taxes. For example, rising real interest rates on dollar-denominated assets tend to attract foreign capital, thereby depressing the value of foreign currencies and placing upward pressure on the dollar. Monetary policy, with its capacity to ease or tighten credit, is therefore a fundamental determinant of capital flows and real exchange-rate variation in the short run. In the longer run, trends in capital flows respond to differences across countries in savings behavior, prospects for profitable investment (expectations for economic growth), technological change and factor

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1/ To the extent that Mexican steel prices rise by less than 100 percent, steel becomes relatively cheaper to U.S. consumers. In this case, however, Mexican steel gains competitiveness through a decline in the real price of steel, measured using the Producer Price Index for Mexico. The gain in competitiveness cannot be attributed to a shift in the real dollar-peso exchange rate.

productivity growth, trends in industrial regulation, fiscal policy, and political risk, among others.

From the standpoint of any single industry, real exchange-rate movements can usually be regarded as exogenous. 1/ However, general equilibrium theory suggests that industry-specific commercial policies intended to restrain imports will tend to raise the value of the local currency, compared with what it would otherwise have been. The magnitude of the effect of protection on exchange rates will vary in proportion to the the industry's share in national trade and the extent of the policy intervention. This suggests that restrictions on steel imports have resulted in real dollar appreciation. However, the magnitude of this effect is most likely to have been very small.

1/ One exception concerns countries whose traded-goods sectors are dominated by a few large industries. Shifts in demand for one of these industry's output can affect real exchange rates.

Appendix H

Modeling Exchange-Rate Changes

Partial equilibrium analysis can be used to illustrate qualitative effects on trade in steel products because of (exogenous) shifts in real exchange rates. In the analysis that follows, the world market for steel is decomposed into a U.S. market and the rest of the world (ROW). Figure H-1 is assumed to describe conditions in the world steel market in 1980, before the period of real dollar appreciation. Figure H-2 describes the effects of the dollar appreciation of 1980-85. Figure H-3 incorporates voluntary restraint agreements (VRA's) agreed upon by foreign exporters of steel to the United States. 1/ Finally, figure H-4 describes the consequences of the ongoing real dollar depreciation in the presence of VRA restrictions that remain binding. The analysis ignores, among other possible considerations, business cycle effects.

Prior to the dollar appreciation, the world price in dollars is P_{1980} and the volume of world steel trade is T_{1980}, as determined by the intersection of world excess supply and demand schedules (fig. H-1). U.S. (net) imports are M_{1980} (fig. H-1), matched by ROW net exports of X_{1980} (fig. H-1).

Beginning in 1980, the dollar appreciated in real terms against the currencies of countries exporting steel. At any given dollar price of steel, dollar appreciation results in foreign producers being more willing to increase supply to the world market, and foreign consumers respond by reducing demand (fig. H-2). Therefore, excess supply at the prevailing world price (P_{1980}) drives the price down to P_{1985}. As a result of the falling world price of steel, U.S. imports rise from M_{1980} to M_{1985}, matched by rising ROW net exports.

Introduction of binding quotas on foreign exports of steel to the United States is depicted in figure H-3. The VRA results in a reduction of U.S. imports to $M_{1985/Q}$ and an increase in the domestic price of steel imports from P_{1985} to $P_{1985/Q}$. 2/ The decline in U.S. imports at the prevailing world price results in a further decline of the world dollar price of steel (fig. H-3). This decline results in reduced exports by ROW producers, and/or increased demand by ROW consumers (fig. H-3) sufficient to offset the decline in U.S. imports.

Subsequent to the imposition of the VRA's, the dollar depreciates in real terms. This leads to leftward shifts in foreign excess supply and/or outward shifts in excess demand (fig. H-4). This increases the equilibrium world price of steel (in dollars) from $P_{1985/Q}$ to $P_{1987/Q}$. The figures depict the case where dollar depreciation is not sufficient to restore equality between the domestic and world prices for steel. In this case, dollar depreciation has no effect on the level of U.S. imports or domestic price. Consequently, so long as the quotas continue to be effective (binding), dollar depreciation is not a factor in any observed contraction in U.S. imports.

1/ The VRA's, it should be noted, encompassed 95 percent of the foreign suppliers of steel to the United States, not including Canada. Consequently, the model does not explicitly allow for the possible substitution of steel from non-VRA producers in U.S. import demand.
2/ Schorsch notes that "U.S. trade restraints have tended to keep U.S. prices well above world levels," Challenge, July-August 1987, p. 40.

Figure H-1
World steel market, 1980

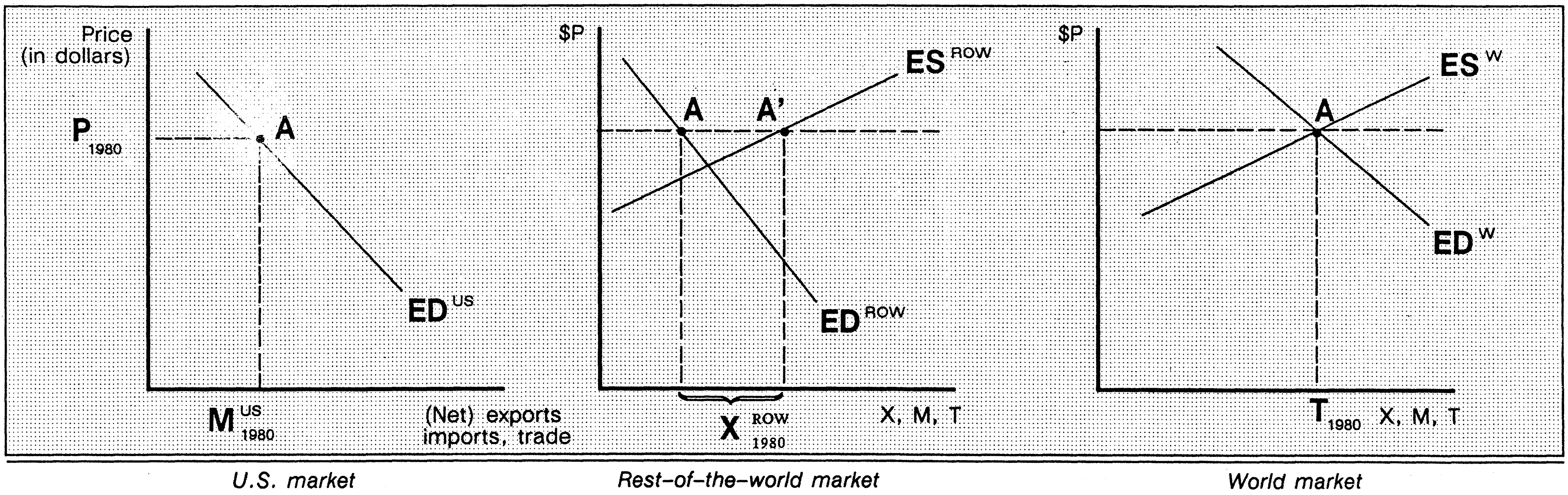


Figure H-2
Real dollar appreciation, 1980-85

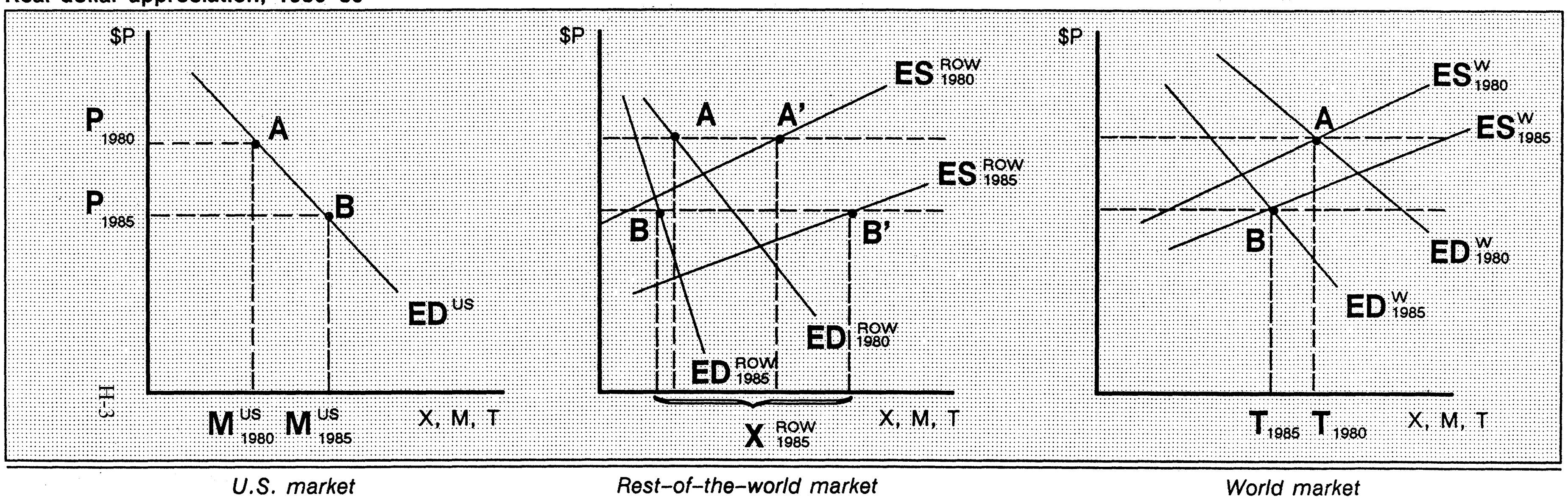


Figure H-3
Voluntary restraint agreements, 1985

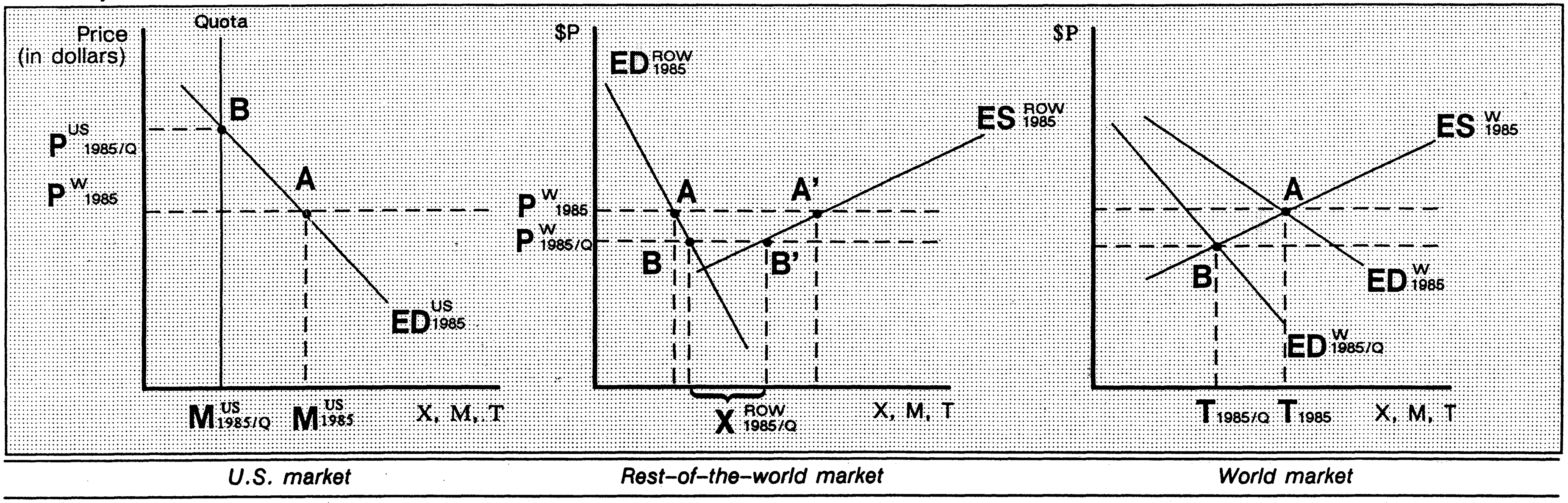
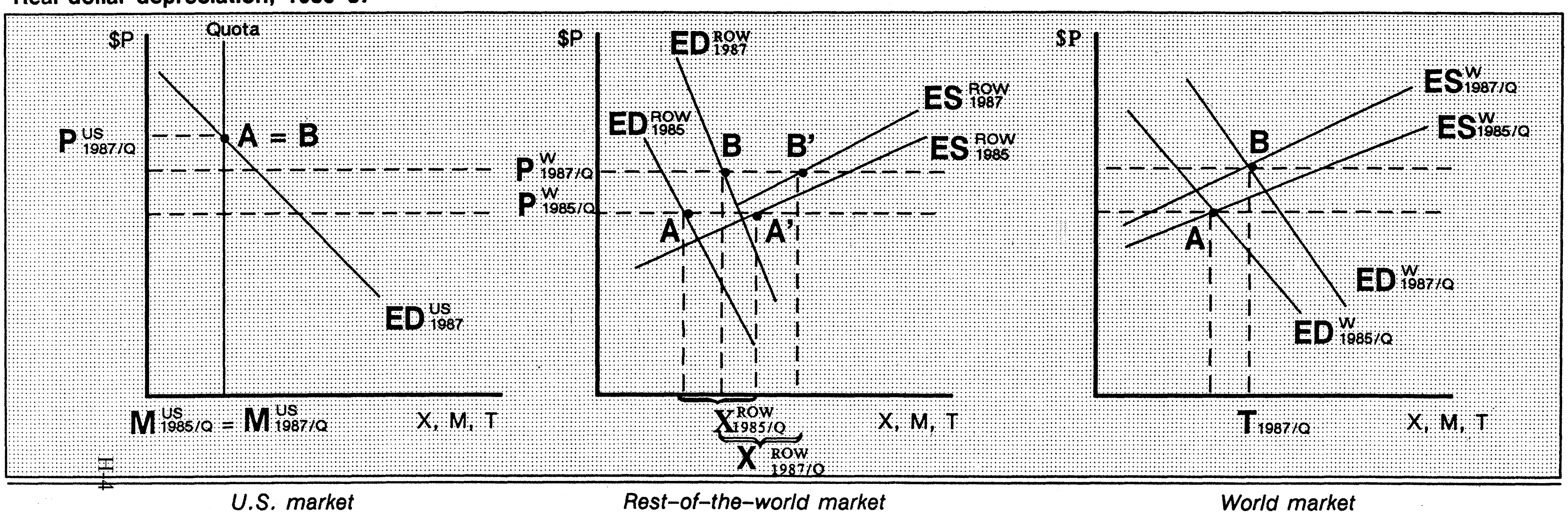


Figure H-4
Real dollar depreciation, 1985-87



Not until dollar depreciation is sufficient to render existing quota allocations ineffective (unbinding) would such depreciation begin to contribute to a decline in U.S. imports of steel. Dollar depreciation would first have to raise the world price of steel to the domestic (U.S.) price level consistent with the restricted level of imports. Only then would further depreciation of the dollar drive the world price of steel (in dollar terms) higher still, and thereby induce a reduction in U.S. steel imports to levels below those stipulated by the VRA's.

Appendix I

Investigations Under U.S. Antidumping and Countervailing Duty Laws
During January 1, 1980-October 1, 1987

Table I-1
Steel sheet and strip: Products and countries subject to investigation under the antidumping statutes during Jan. 1, 1980-Oct. 1, 1987, and U.S. imports of such products, 1986

Product	Country	1986 imports: From subject countries	1986 imports: From all countries
		-----Metric tons-----	
Carbon steel sheet:			
Hot-rolled	Austria, Belgium, Brazil, Finland, France, Hungary, Italy, Luxembourg, Netherlands, Romania, South Africa, United Kingdom, Venezuela, West Germany	1,269,814	2,162,904
Cold-rolled	Argentina, Belgium, Brazil, France, Italy, Luxembourg, Netherlands, South Africa, Spain, United Kingdom, West Germany	1,141,112	2,272,090
Galvanized	Australia, Austria, Belgium, East Germany, France, Italy, Luxembourg, Netherlands, Romania, South Africa, Spain, United Kingdom, Venezuela, West Germany	627,119	2,105,674
Carbon steel strip:			
Hot-rolled	Belgium, France, Italy, Luxembourg, Netherlands, United Kingdom, West Germany	1,641	39,514
Cold-rolled	Belgium, France, Italy, Luxembourg, Netherlands, United Kingdom, West Germany	26,804	111,929
Stainless steel sheet:			
Hot-rolled	France, West Germany	168	3,878
Cold-rolled	France, West Germany	37,094	123,776
Stainless steel strip:			
Hot-rolled	France, West Germany	0	0
Cold-rolled	France, West Germany	1,139	9,848
Total	Argentina, Australia, Austria, Belgium, Brazil, East Germany, Finland, France, Hungary, Italy, Luxembourg, Netherlands, Romania, South Africa, Spain, United Kingdom, Venezuela, West Germany	3,104,891	6,829,613

Source: Products and countries compiled from data of the U.S. International Trade Commission; imports compiled from data of the American Iron & Steel Institute.

Table I-2
Steel sheet and strip: Products and countries subject to investigation under the countervailing duty statutes during Jan. 1, 1980-Oct. 1, 1987, and U.S. imports of such products, 1986

Product	Country	1986 imports: From subject countries	1986 imports: From all countries
		-----Metric tons-----	
Carbon steel sheet:			
Hot-rolled	Austria, Belgium, Brazil, France, Italy, Luxembourg, Mexico, Netherlands, Republic of Korea, South Africa, Spain, Sweden, United Kingdom, Venezuela, West Germany	1,422,399	2,162,904
Cold-rolled	Argentina, Belgium, Brazil, France, Italy, Luxembourg, Mexico, Netherlands, Republic of Korea, South Africa, Spain, United Kingdom, West Germany	1,414,028	2,272,090
Galvanized	Australia, Austria, Belgium, France, Italy, Luxembourg, Mexico, Netherlands, Republic of Korea, South Africa, Spain, United Kingdom, Venezuela, West Germany	830,783	2,105,674
Carbon steel strip:			
Hot-rolled	Belgium, Brazil, France, Italy, Luxembourg, Netherlands, United Kingdom, West Germany	3,612	39,514
Cold-rolled	Belgium, Brazil, France, Italy, Luxembourg, Netherlands, United Kingdom, West Germany	35,002	111,929
Stainless steel sheet:			
Hot-rolled	United Kingdom	26	3,878
Cold-rolled	United Kingdom	4,745	123,776
Stainless steel strip:			
Hot-rolled	United Kingdom	0	0
Cold-rolled	United Kingdom	464	9,848
Total	Argentina, Australia, Austria, Belgium, Brazil, France, Italy, Luxembourg, Mexico, Netherlands, Republic of Korea, South Africa, Spain, Sweden, United Kingdom, Venezuela, West Germany	3,711,059	6,829,613

Source: Products and countries compiled from data of the U.S. International Trade Commission; imports compiled from data of the American Iron & Steel Institute.

Table I-3
Steel sheet and strip: Countries and products subject to investigation under the antidumping statutes during Jan. 1, 1980-Oct. 1, 1987, actions taken, dates of action, margins, and U.S. imports of such products, 1986

Country	Product	Action taken 1/	Date of action	Margin	1986 imports
				Percent	Metric tons
Argentina.....	Cold-rolled carbon steel sheet	Negative-USITC	1985	30.3-242.5	65,229
Australia.....	Galvanized carbon steel sheet	Terminated	1985	36.28	82,441
Austria.......	Hot-rolled carbon steel sheet	Negative-USITC	1985	2.2	27,822
	Galvanized carbon steel sheet	Negative-USITC	1985	2/	5,701
Belgium.......	Hot-rolled, cold-rolled, and galvanized carbon steel sheet	Terminated	1980	2/	3/ 128,371
	Hot-rolled carbon steel sheet and strip	Terminated	1982	9.83	3/ 37,771
	Cold-rolled carbon steel sheet and strip	Terminated	1982	2/	3/ 70,144
	Galvanized carbon steel sheet	Negative-USITC	1982	2/	3/ 21,342
Brazil........	Hot-rolled carbon steel sheet	Affirmative-USITC	1984	6.45	142,648
	Cold-rolled carbon steel sheet	Negative-USITC	1984	.91	133,974
East Germany..	Galvanized carbon steel sheet	Negative-USITC	1985	2/	9,972
Finland.......	Hot-rolled carbon steel sheet	Terminated	1985	2/	46,395
France........	Hot-rolled, cold-rolled, and galvanized carbon steel sheet	Terminated	1980	2/	492,604
	Hot-rolled carbon steel sheet and strip	Terminated	1982	8.40	302,720
	Cold-rolled carbon steel sheet and strip	Terminated	1982	11.50	122,536
	Galvanized carbon steel sheet	Negative-USITC	1982	2/	68,793
	Stainless steel sheet and strip	Affirmative-USITC	1983	2.9-7.9	24,705
Hungary.......	Hot-rolled carbon steel sheet	Terminated	1985	2/	13,019
Italy.........	Hot-rolled, cold-rolled, and galvanized carbon steel sheet	Terminated	1980	2/	214,187
	Hot-rolled carbon steel sheet and strip	Terminated	1982	2.07	92,697
	Cold-rolled carbon steel sheet and strip	Terminated	1982	9.72	80,069
	Galvanized carbon steel sheet	Negative-USITC	1982	2/	41,912

See footnotes at end of table.

Table I-3--Continued
Steel sheet and strip: Countries and products subject to investigation under the antidumping statutes during Jan. 1, 1980-Oct. 1, 1987, actions taken, dates of action, margins, and U.S. imports of such products, 1986

Country	Product	Action taken 1/	Date of action	Margin	1986 imports
				Percent	Metric tons
Luxembourg....	Hot-rolled carbon steel sheet and strip	Negative-USITC	1982	2/	3/ 37,771
	Cold-rolled carbon steel sheet and strip	Negative-USITC	1982	2/	3/ 70,144
	Galvanized carbon steel sheet	Negative-USITC	1982	2/	3/ 21,342
Netherlands...	Hot-rolled, cold-rolled, and galvanized carbon steel sheet	Terminated	1980	2/	336,357
	Hot-rolled carbon steel sheet and strip	Terminated	1982	0.003	171,362
	Cold-rolled carbon steel sheet and strip	Terminated	1982	.37	151,248
	Galvanized carbon steel sheet	Negative-USITC	1982	2/	13,851
Romania.......	Hot-rolled carbon steel sheet	Terminated	1985	50	0
	Galvanized carbon steel sheet	Negative-USITC	1985	2/	5,544
South Africa..	Hot-rolled carbon steel sheet	Terminated	1984	2/	64,081
	Cold-rolled carbon steel sheet	Terminated	1984	2/	62,890
	Galvanized carbon steel sheet	Terminated	1984	2/	56,112
Spain.........	Cold-rolled carbon steel sheet	Terminated	1985	17.37-22.15	60,565
	Galvanized carbon steel sheet	Terminated	1985	19.52-24.38	68,727
United Kingdom	Hot-rolled, cold-rolled, and galvanized carbon steel sheet	Terminated	1980	2/	35,196
	Hot-rolled carbon steel sheet and strip	Terminated	1982	2/	8,619
	Cold-rolled carbon steel sheet and strip	Negative-USITC	1982	2/	22,691
	Galvanized carbon steel sheet	Negative-USITC	1982	2/	7,214
Venezuela.....	Hot-rolled carbon steel sheet	Terminated	1985	4.84	24,873
	Galvanized carbon steel sheet	Negative-USITC	1985	2/	14,566

See footnotes at end of table.

Table I-3--Continued
Steel sheet and strip: Countries and products subject to investigation under the antidumping statutes during Jan. 1, 1980-Oct. 1, 1987, actions taken, dates of action, margins, and U.S. imports of such products, 1986

Country	Product	Action taken 1/	Date of action	Margin	1986 imports
				Percent	Metric tons
West Germany..	Hot-rolled, cold-rolled, and galvanized carbon steel sheet	Terminated	1980	2/	946,772
	Hot-rolled carbon steel sheet and strip	Terminated	1982	3.94	339,449
	Cold-rolled carbon steel sheet and strip	Terminated	1982	6.43	398,570
	Galvanized carbon steel sheet	Negative-USITC	1982	2/	230,945
	Stainless steel sheet and strip	Affirmative-USITC	1983	1.49-7.76	13,696

1/ U.S. International Trade Commission referred to as USITC in this column.
2/ Case terminated before preliminary margins findings.
3/ Figure includes imports for Belgium and Luxembourg.

Source: Countries, products, actions taken, dates of action, and margins compiled from data of the U.S. International Trade Commission; imports compiled from data of the American Iron & Steel Institute.

Table I-4
Steel sheet and strip: Countries and products subject to investigation under the countervailing duty statutes during Jan. 1, 1980-Oct. 1, 1987, actions taken, dates of action, size of subsidies, and U.S. imports of such products, 1986

Country	Product	Action taken 1/	Date of action	Size of subsidy	1986 imports
				Percent	Metric tons
Argentina.....	Cold-rolled carbon steel sheet	Affirmative-ITA 2/	1984	2.34-6.42	65,229
Australia.....	Galvanized carbon steel sheet	Negative-ITA	1984	.04	82,441
Austria.......	Hot-rolled carbon steel sheet	Negative-USITC	1985	2.27	27,822
	Galvanized carbon steel sheet	Negative-USITC	1985	3/	5,701
Belgium.......	Hot-rolled carbon steel sheet and strip	Terminated	1982	0-13.411	4/ 37,771
	Cold-rolled carbon steel sheet and strip	Negative-USITC	1982	3/	4/ 70,144
	Galvanized carbon steel sheet	Negative-USITC	1982	3/	4/ 21,342
Brazil........	Hot-rolled carbon steel sheet and strip	Negative-USITC	1982	3/	144,618
	Cold-rolled carbon steel sheet and strip	Negative-USITC	1982	3/	142,172
	Hot-rolled carbon steel sheet	Affirmative-USITC	1984	17.49-36.95	142,648
	Cold-rolled carbon steel sheet	Affirmative-USITC	1984	17.49-36.95	133,974
France........	Hot-rolled carbon steel sheet	Terminated	1982	3/	302,720
	Hot-rolled carbon steel sheet and strip	Terminated	1982	4.038-21.416	302,720
	Cold-rolled carbon steel sheet and strip	Terminated	1982	3.702-19.494	122,536
	Galvanized carbon steel sheet	Negative-USITC	1982	3/	68,793
Italy.........	Hot-rolled carbon steel sheet and strip	Terminated	1982	6.32-14.56	92,697
	Cold-rolled carbon steel sheet and strip	Terminated	1982	6.32-14.56	79,162
	Galvanized carbon steel sheet	Negative-USITC	1982	3/	41,912
Luxembourg....	Hot-rolled carbon steel sheet and strip	Negative-USITC	1982	3/	4/ 37,771
	Cold-rolled carbon steel sheet and strip	Negative-USITC	1982	3/	4/ 70,144
	Galvanized carbon steel sheet	Negative-USITC	1982	3/	4/ 21,342
Mexico........	Hot-rolled, cold-rolled, and galvanized carbon steel sheet	Terminated	1984	4.98	93,318

See footnotes at end of table.

Table I-4--Continued
Steel sheet and strip: Countries and products subject to investigation under the countervailing duty statutes during Jan. 1, 1980-Oct. 1, 1987, actions taken, dates of action, size of subsidies, and U.S. imports of such products, 1986

Country	Product	Action taken 1/	Date of action	Size of subsidy	1986 imports
				Percent	Metric tons
Netherlands...	Hot-rolled carbon steel sheet and strip	Negative-ITA	1982	0.183	171,362
	Cold-rolled carbon steel sheet and strip	Negative-ITA	1982	.183	151,248
	Galvanized carbon steel sheet	Negative-USITC	1982	3/	13,851
Republic of Korea	Hot-rolled carbon steel sheet	Affirmative-USITC	1982	1.88	191,628
	Cold-rolled carbon steel sheet	Negative-USITC	1982	3/	264,130
	Galvanized carbon steel sheet	Affirmative-USITC	1982	1.36-1.74	143,068
	Cold-rolled carbon steel sheet	Affirmative-USITC	1985	3.60	264,130
South Africa..	Hot-rolled carbon steel sheet	Affirmative-ITA 2/	1982	0-13.0	64,081
	Cold-rolled carbon steel sheet	Affirmative-ITA 2/	1982	0-13.0	62,890
	Galvanized carbon steel sheet	Affirmative-ITA 2/	1982	0-9.9	56,112
Spain.........	Hot-rolled carbon steel sheet	Negative-USITC	1982	3/	4,683
	Cold-rolled carbon steel sheet	Affirmative-USITC	1982	1.74-38.25	60,565
	Galvanized carbon steel sheet	Affirmative-USITC	1982	4.54-10.12	68,727
Sweden........	Hot-rolled carbon steel sheet	Negative-USITC	1985	8.77	13,617
United Kingdom	Hot-rolled carbon steel sheet and strip	Negative-USITC	1982	3/	8,619
	Cold-rolled carbon steel sheet and strip	Negative-USITC	1982	3/	22,691
	Galvanized carbon steel sheet	Negative-USITC	1982	3/	7,214
	Stainless steel sheet and strip	Negative-USITC	1983	19.31	5,235
Venezuela.....	Hot-rolled carbon steel sheet	Terminated	1985	76.26	24,873
	Galvanized carbon steel sheet	Negative-USITC	1985	3/	14,566

See footnotes at end of table.

Table I-4--Continued
Steel sheet and strip: Countries and products subject to investigation under the countervailing duty statutes during Jan. 1, 1980-Oct. 1, 1987, actions taken, dates of action, size of subsidies, and U.S. imports of such products, 1986

Country	Product	Action taken 1/	Date of action	Size of subsidy	1986 imports
				Percent	Metric tons
West Germany..	Hot-rolled carbon steel sheet and strip	Terminated	1982	0.015-.235	339,449
	Cold-rolled carbon steel sheet and strip	Terminated	1982	.015-.235	398,570
	Galvanized carbon steel sheet	Negative-USITC	1982	3/	230,945

1/ The International Trade Administration is referred to as ITA in this column, and the U.S. International Trade Commission is referred to as USITC.
2/ Finding by U.S. International Trade Commission not required.
3/ Case terminated before preliminary margins findings.
4/ Figure includes imports for Belgium and Luxembourg.

Source: Countries, products, actions taken, dates of action, and size of subsidies compiled from data of the U.S. International Trade Commission; imports compiled from data of the American Iron & Steel Institute.

Table I-5
Steel sheet and strip: Countries and products subject to investigation under the countervailing duty statutes, nature of subsidies, and size of subsidies, Jan. 1, 1980-Oct. 1, 1987

Country	Product	Nature of subsidy	Size of Subsidy Percent
Argentina.....	Cold-rolled carbon steel sheet	Post-financing of exports under Circular OPRAC 1-9	0.01-0.49
		Government equity infusions	.41
		Loans and loan guarantees during the period Somisa is considered uncredit-worthy	.63
		Somisa's purchases of "oil residue coal"	.09
		Capital tax exemption for Somisa	2.66
		Import duty exemptions	1.85-2.62
Australia.....	Galvanized carbon steel sheet	Export expansion grants	.001
		Export market development grants	.04
Austria.......	Hot-rolled carbon steel sheet	Equity infusions	.04
		Grants to the Austrian steel industry	1.54
		Kontrollbank export financing to Voest-Alpine AG	.08
		Kontrollbank export financing to an East German company	.61
Belgium.......	Hot-rolled carbon steel sheet and strip	Capital grants	.208-0.41
		Loan guarantees	1/
		Exemptions from real property tax	.071-0.148
		Exemptions from capital registration tax	.4
		Loans to uncreditworthy companies	1.075
		Equity participation by the government of Belgium	4.981
		Assumption of financing costs	.177-4.159
		Preferential loans	.009-0.025
		Industrial investment loans from the European Coal and Steel Community (ECSC)	.036
		Reimbursement of worker training costs	.029
		Readaptation and retraining assistance	.045
		Funds for loss coverage	3.841
Brazil........	Hot-rolled carbon steel sheet	Government provision of equity capital	3.73-24.5
		Government guarantees on long-term loans	.06-0.37

See footnote at end of table.

Table I-5--Continued
Steel sheet and strip: Countries and products subject to investigation under the countervailing duty statutes, nature of subsidies, and size of subsidies, Jan. 1, 1980-Oct. 1, 1987

Country	Product	Nature of subsidy	Size of Subsidy Percent
Brazil--Continued		Short-Term Export Financing Resolution 674	1.82-22.36
		Export financing under the CIC-CREGE 14-11 Circular	.33-0.79
		IPI export credit premium	7.5-10.78
		Funding for expansion through IPI tax rebates	2.95-3.21
		CDI Program (exemption of IPI tax and customs duties on imported equipment)	.22-0.45
	Cold-rolled carbon steel sheet	Government provision of equity capital	3.73-24.5
		Government guarantees on long-term loans	.06-0.37
		Short-Term Export Financing Resolution 674	1.82-22.36
		Export financing under the CIC-CREGE 14-11 Circular	.33-0.79
		IPI export credit premium	7.5-10.78
		Funding for expansion through IPI tax rebates	2.95-3.21
		CDI Program (exemption of IPI tax and customs duties on imported equipment)	.22-0.45
France........	Hot-rolled carbon steel sheet and strip	Preferential financing, including equity infusions	4.031-20.458
		Certain labor-related aid	.595-0.951
		Assistance for plant operating expenses	.034
		Research and development	.007
	Cold-rolled carbon steel sheet and strip	Preferential financing, including equity infusions	3.695-18.54
		Certain labor-related aid	.593-0.947
		Assistance for plant operating expenses	.034
		Research and development	.007
Italy.........	Hot-rolled carbon steel sheet and strip	Recapitalizations and a conversion of debt to equity	8.24
		Preferential loans	15.37
		Capital grants	.7
		Social security payment exemption	1.65
		Preferential transportation rates	.02
		European Community (EC) labor assistance	.07

See footnote at end of table.

Table I-5--Continued
Steel sheet and strip: Countries and products subject to investigation under the countervailing duty statutes, nature of subsidies, and size of subsidies, Jan. 1, 1980-Oct. 1, 1987

Country	Product	Nature of subsidy	Size of Subsidy Percent
Italy--Continued	Cold-rolled carbon steel sheet and strip	Recapitalizations and a conversion of debt to equity	8.24
		Preferential loans	15.37
		Capital grants	.7
		Social security payment exemption	1.65
		Preferential transportation rates	.02
		EC labor assistance	.07
Mexico........	Hot-rolled, cold-rolled, and galvanized carbon steel sheet	Fund for the Promotion of Mexican Manufactured Products	1.56
		National Financiera, S.A. loans	1.05
		Fund for Industrial Development	.02
		Preferential federal tax incentives	2.3
		Article 94 Loans	.05
		Accelerated depreciation allowances	.001
Netherlands...	Hot-rolled carbon steel sheet and strip	Program for introducing new technology	.178
		ECSC loans	.005
	Cold-rolled carbon steel sheet and strip	Program for introducing new technology	.178
		ECSC loans	.005
Republic of Korea	Hot-rolled carbon steel sheet	Preferential export financing	.52
		Preferential tax incentives for exporters	1.45
		Special tax exemptions for government-owned firms	.33
		Preferential utility rates and port charges for steel producers	.05
		Tariff incentives	.05
	Galvanized carbon steel sheet	Preferential export financing	.6
		Preferential tax incentives for exporters	1.31
		Special tax exemptions for government-owned firms	.33
		Preferential utility rates and port charges for steel producers	.05
		Tariff incentives	.05

See footnote at end of table.

Table I-5--Continued
Steel sheet and strip: Countries and products subject to investigation under the countervailing duty statutes, nature of subsidies, and size of subsidies, Jan. 1, 1980-Oct. 1, 1987

Country	Product	Nature of subsidy	Size of Subsidy Percent
Republic of Korea--Continued	Cold-rolled carbon steel sheet	Short-term export financing under the export financing regulations	0.33
		Tax incentives for exporters under articles 22, 23, and 24 of the "Act Concerning the Regulation of Tax Reduction and Exemption"	.005
		Special depreciation under the "Act Concerning the Regulation of Tax Reduction and Exemption"	2.41
		Government equity infusions into POSCO	.71
		Reduction in port charges	.05
		Tariff reductions on plant and equipment under Article 28 of the Customs Act of Korea	.1
South Africa..	Hot-rolled carbon steel sheet	Assumption of financing charges	.35
		Railroad rate differential	10
		Central government rail rebate	2.4
	Cold-rolled carbon steel sheet	Assumption of financing charges	.35
		Railroad rate differential	8.4
		Central government rail rebate	2
	Galvanized carbon steel sheet	Assumption of financing charges	.35
		Railroad rate differential	6.9
		Central government rail rebate	1.6
Spain.........	Cold-rolled carbon steel sheet	Medium- and long-term preferential loans	6.26-11.1
		Short-term preferential loans (Privileged Circuit Exporter Credits which are working-capital loans)	1.53
		Capital infusions	2.33-25.62
	Galvanized carbon steel sheet	Medium- and long-term preferential loans	3.01-6.26

See footnote at end of table.

Table I-5--Continued
Steel sheet and strip: Countries and products subject to investigation under the countervailing duty statutes, nature of subsidies, and size of subsidies, Jan. 1, 1980-Oct. 1, 1987

Country	Product	Nature of subsidy	Size of Subsidy Percent
		Short-term preferential loans (Privileged Circuit Exporter Credits which are working-capital loans)	1.53
		Capital infusions	2.33
Sweden........	Hot-rolled carbon steel sheet	Regional development incentives	.26
		National government loans and grants	1.84
		Government funds for loss coverage	2.21
		Government equity infusions	3.33
		Government equity guarantees	.24
		Government acquisition of assets for SSAB	.84
		Employment promotion grants	.04-0.06
		Government research and development grants to SSAB	.01
United Kingdom	Stainless steel sheet and strip	Public dividend capital and new captial	15.88
		National Loans Fund loans and and loan conversions	2.21
		Regional development grants	.16-1.21
		Iron and Steel Industry Training Board grants	.01
Venezuela.....	Hot-rolled carbon steel sheet	Preferential government credit	2.02
		Export certificates for credit against income taxes	9.91
		Sales tax exemption	.16
		Multiple exchange rates	34.29
		Government equity infusions	23.74
West Germany..	Hot-rolled carbon steel sheet and strip	Investment Premium Act--articles 1, 2, and 3	.182
		Joint Scheme: Improvement of Regional Economic Structure (partially countervailable)	.001-0.004
		ECSC loans	.025-0.053
		ECSC interest rebates	.006
		Labor assistance from ECSC rehabilitation aids	.000002-0.014
		ECSC research and development (capital equipment)	.001

See footnote at end of table.

Table I-5--Continued
Steel sheet and strip: Countries and products subject to investigation under the countervailing duty statutes, nature of subsidies, and size of subsidies Jan. 1, 1980-Oct. 1, 1987

Country	Product	Nature of subsidy	Size of Subsidy
			Percent
	Cold-rolled carbon steel sheet and strip	Investment Premium Act--Articles 1, 2, and 3	0.182
		Joint Scheme: Improvement of Regional Economic Structure (partially countervailable)	.001-0.004
		ECSC loans	.015-0.053
		ECSC interest rebates	.006
		Labor assistance from ECSC rehabilitation aids	.000002-0.014
		ECSC research and development (capital equipment)	.001

1/ Not available.

Source: Compiled from data of the U.S. Department of Commerce.

Appendix J

Raw Material Supply Factors Influencing the Operation of the USS-Posco Industries Joint Venture in Pittsburg, CA

Counsel for Posco claims that the production of high grades of sheet and tinplate at USS-Posco Industries (UPI) will require high-grade, continuously cast hot-rolled bands for raw materials, and that such hot-rolled bands are produced in the United States in insufficient amounts to supply UPI's needs. Furthermore, significant transportation costs would make the cost of U.S.-produced hot-rolled bands so high that UPI's sheet and tinplate products would be uncompetitive. Counsel argues that it is significantly cheaper to ship the bands from Korea than to transport them from other parts of the United States to the west coast, and provides the following information on freight rates as justification.

UPI's current shipping costs for hot bands from Korea to UPI is $23.75 per metric ton for ocean freight and an additional $12.00 per metric ton for transportation from Oakland to UPI. However, these costs will be significantly reduced after 1989. UPI intends to eliminate the ground transportation costs by shipping directly to UPI's harbor, and with shipment quantities of 1 million tons per year of hot bands, ocean freight costs will be reduced through special contracts. Therefore, total shipping costs from Korea will be less than $23.75 per metric ton.

Transportation costs from a USX plant to UPI are almost triple that cost. Average freight costs are about $66 per metric ton from a USX plant, depending on the location. Special contracts discounts can be obtained based on the substantial quantities needed by UPI.

Appendix K

Description of How Sheet and Strip Products Are Traded

Description of How Sheet and Strip Products are Traded

Pricing and terms of sale

Steel sheet products are priced similarly to other steel products. The integrated producers publish list prices; however, sales are usually negotiated, and in recent years, steel has typically sold at lower, "discounted" prices. The size of the discounts (occasionally called a "competitive allowance") depends on market conditions, the terms of delivery, size of the order, relationship of the customer, and other variables. The secondary sources, such as the distributors, service centers, and cold rollers, do not always publish price lists, often quoting prices as inquiries are made.

Sheet price changes by the major producers are announced well in advance of implementation. Typically, a producer will announce its intention to increase or lower prices, an event that is normally reported widely in the trade press. Other producers often respond by indicating that they are examining the action taken. If the price change is perceived as warranted, other producers may follow suit, or alternatively announce their own price adjustments.

The terms of sale, spot or contract, often determines the volatility of prices faced by a customer. Price changes are usually different for spot sales and contract sales. Over the past 2 years (1986-87), a series of transaction price increases have taken place in the spot market. In most cases, these price increases have been a reduction in the discounts offered off the published list prices. Throughout this period, long term contract prices have generally not increased and, in some instances, have actually decreased. Buyers in the spot market and on medium-term contracts (quarterly) are the parties that have actually faced rising prices. 1/

Another factor affecting prices is transportation costs, as consumers are concerned with the delivered cost of steel. Since transportation costs for steel can be significant, sheet producers typically practice "freight equalization" when selling steel. The transportation cost of delivering steel to the consumer from the nearest steel production facility, be it the same firm or a competitor, is the cost passed on to the consumer. The differential between the actual transportation cost and the transportation cost from the nearest facility is absorbed by the steel firm. Thus, the cost of freight to the consumer is equalized among the various producers. 2/ As a result of freight equalization, in periods of strong demand, areas further from the producing regions often experience increased difficulty obtaining material. Recent reports during a period of tight sheet supplies indicate that producers would not even quote on orders that were distant from their production facilities. Since the producers were selling all the material they could produce, they chose to fill orders that entailed lower freight costs and therefore yielded greater net revenues. 3/

1/ American Metal Market, Sept. 28, 1987.
2/ Ibid., May 11, 1987.
3/ Ibid.

The book price for an order of steel is usually a compilation of several prices, including a base price, to which "extras" are added. These extras are based on a variety of factors, such as the thickness of the sheet, the size of the order, the weight of the coating, and charges for nonstandard sizes and certain processing. The extras can often add a significant amount to the price for the steel.

One major producer is leading the efforts to adopt cost based pricing, publishing an all new 1987 pricing book that differed significantly from their old formulas. The new formulas for determining extras have been simplified, standardizing width and gauge extras, removing extras from standard AISI-SAE grades, setting standard discounts for large orders, and establishing incentives for sizes that are optimum for the producer's equipment, among other changes.

One major change that may encounter customer resistance is quoting on nominal gauge and actual weight. In the past, orders were priced on theoretical weight that was calculated from the physical dimensions of the coil and the theoretical density of the steel. Steelmakers generally roll sheet slightly on the heavy side of the thickness specification; actual weight is typically heavier than theoretical weight. The perception on the buyers side of the market was that they were getting something extra: more steel than they were paying for. It is uncertain how the customers will react to the move to actual weights; however, the difference between actual and theoretical weights has been narrowing as the producers improve their control over the production processes.

Although other firms are reportedly examining this pricing method, there is scepticism on both sides of the market about this firm's ability to hold to the pricing book when the market turns down again. Many observers believe that negotiated prices will return when demand slackens. The new pricing schemes will reward buyers that purchase large lots, optimal size coils, or agree to a "ship when ready" clause that will cut the steel producers' inventory costs.

Type of sales

Sheet products are sold either on a contract basis or a spot basis. Contract sales are for medium- and long-term supply situations, i.e., generally for a period of one quarter or a year. Sales under contract usually are not delivered in their entirety at one time, but rather are filled through a series of partial lot deliveries. Spot sales are generally for smaller quantities and are subject to short-term supply and demand fluctuations in the market. Shipment is made within a relatively short period of time after the sale is made. Spot sales account for 25 to 35 percent of the flat rolled industry's sales, with medium- and long-term contracts accounting for the remaining 65 to 75 percent. 1/

There is great variability among the individual firms in the industry with respect to percentage of sales accounted for by long-term contracts. The

1/ Ibid., Nov. 10, 1986.

variability in part reflects the different markets in which the various producers concentrate. The automotive and appliance industries are the major consumers that buy on an annual basis. 1/ Long-term contracts have fallen somewhat into disfavor among some producers. Although long-term contracts offer certain advantages to producers in lending stability to product demand, the pricing rigidity they impose is beginning to outweigh the benefits for many producers. As both raw material costs and the sheet steel market become more volatile, some producers are seeking to reduce the percentage of product sold under long-term contracts. 2/ Other producers are seeking variable pricing formulas in their long-term contracts to address the volatility problem.

The automotive customers, which represent the largest direct buyers of steel, negotiate most contracts for sheet steel in the spring on an annual basis. Throughout the term of the contract, adjustments are made to quantity levels to meet market and production conditions. However, in the case of electrogalvanized sheet, some automakers have signed long-term contracts of 5 to 7 years. These contracts set minimum purchasing levels for electrogalvanized steel from the newly constructed electrogalvanizing lines in the United States. Such long-term contracts were needed to convince the steelmakers and their financiers that a solid market existed before investments in new equipment lines were initiated. 3/ Sales to the second largest customer, the service centers and distributors, are usually negotiated on a quarterly basis.

Channels of distribution

Steel sheet travels through a variety of channels from the producers to the end users. In addition to direct sales (producer-end user), various intermediaries further process the steel (re-rollers, stampers, coil coaters, and independent galvanizers), act as wholesalers (warehouses), or do both (service centers). The divisions between these groups are often blurred, with various firms emphasizing different services.

Steel mills have increased joint efforts with customers aimed at improving steel's performance in the customer's operations. Some customers, such as General Motors, are deemphasizing their service center purchases and increasing direct purchases from the mills. This is forcing the mills to provide more processing functions than in the past. 4/

Most integrated producers are increasing their downstream integration, moving into the field of intermediate processing. Several of the larger sheet producers, including USX, National, and Armco, are now or will soon be involved in slitting and blanking joint ventures for auto and other

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1/ Ibid., Sept. 28, 1987.
2/ Ibid.
3/ Metal Bulletin Monthly, March 1987.
4/ American Metal Market, June 11, 1987.

customers. 1/ In some cases, the processed steel is then sold through the steel company partner, moving the steel companies into new distribution channels and new markets.

Although some steel firms have sold service center subsidiaries, other firms are increasing their participation in this part of the processing industry. Part of the rationale for increasing downstream participation is to move into higher value niches in which imports will have a harder time competing.

Imported sheet steel is typically distributed by the traders that import it into the United States through the service center industry. Because of the distances involved with imported steel, problems often arise in providing the technical support that is important in high-quality, demanding applications of sheet steel. Many foreign producers do not try to compete in this upscale market, so large percentages of imported sheet are lower specification commercial grades that are used in less demanding production applications. The service center industry supplies many of the firms that seek such basic sheet steel.

The steelmakers sell considerable quantities of sheet to companies that add value to the steel without actually manufacturing a finished product or part. Included in this category are cold rollers, coil coaters, stampers and blankers, and to some extent service centers. The cold rollers buy hot- or cold-rolled sheet and subject it to additional finishing operations, including cold rolling, leveling, annealing, and tempering. Most of the cold rollers produce strip products that generally have more stringent dimensional specifications than sheet products. However, as the primary sheet producers improve their product, the difference between a true strip product and a strip slit from sheet continues to diminish.

The coil coaters buy hot- and cold-rolled sheet in coils and apply various coatings, including paints, primers, plastic laminates, and metallics. The coil coating industry is changing, as coated sheet is one of the fastest growing and most rapidly evolving product groups in the sheet markets. Statistics released by the National Coil Coaters Association show, on a North American basis, that the automotive and contractors products markets are the largest customers of the coil coating industry. Together they account for over 70 percent of sales on a tonnage basis. Acceptance of prepainted coil in the appliance industry is rapidly emerging, and the coil coaters look to this market as holding the best near term growth potential.

New technological developments are improving some markets at the expense of other markets. The decline in the market for Zincrometal, a corrosion-resistant coated product, because of electrogalvanized sheet substitution has significantly affected the coil coaters, which held a large share of the Zincrometal production. One U.S. coil coater reacted by becoming involved in one of the new electrogalvanizing facilities constructed in the United States in the past few years.

1/ Ibid., June 24, 1987.

On the other hand, the use of preprimed electrogalvanized sheet is gaining favor, so the coil coaters have an opportunity to maintain their participation in the automotive market by processing electrogalvanized sheet. The coaters and automobile industry are currently involved in research on extending the manufacturing performance of prepainted sheet. This practice has been accepted more readily in the appliance industry than in the automotive industry (because of the less stringent forming requirements of appliance manufacturing). Further, the coil coaters are working hard to improve the performance and acceptance of preprimed sheet. 1/ Although investment for modernization is needed throughout much of the coating industry, the use of preprimed and prepainted sheet is expected to grow, and increasing quantities of sheet will most likely be distributed through this industry. 2/

The service centers, which started out cutting small orders from large lots, are increasing the amount of primary and intermediate processing they perform. High speed slitters, flame cutters, and leveling equipment are becoming increasingly common in the industry in order to upgrade material and serve more markets. The preproduction processing done by the steel service centers reduce their customers' inventories and costs. One service center, Heidtman Products, is even planning the construction of a small-scale hot-strip mill that will produce hot-rolled sheet from purchased slabs. Heidtman maintains that there is a market for tight specification hot-rolled product and feels that no domestic producer is adequately addressing that niche.

Blankers and stampers perform intermediate manufacturing operations on sheet. Generally, these firms do not participate in consumer markets, turning out partially or fully finished parts for further manufacturing or assembly. Blankers purchase flat sheet and cut flat "blanks" for stamping operations. Stampers take the blanks and form them through die stamping operations into parts, such as an automotive fender. In many instances, the stamper or blanker is toll processing steel for their customer; as such, they are not actually involved in the purchasing decision.

The ownership of the automotive stamping and blanking industry is slowly shifting. In the past, many of these operations were owned or controlled by the automotive companies. Recently, the steel producers are moving into the field as the automotive companies withdraw. Although controlling a blanking or stamping operation used to be an anomaly in the steel sheet industry, most of the integrated domestic sheet producers now have, or are seeking, participation in first or second stage blanking operations. 3/ The auto companies seem to desire greater steel company participation in early manufacturing stages, and foresee steel companies eventually supplying entire assemblies, such as doors. It is not clear as to what extent the steel companies can or will accept this idea.

1/ American Metal Market, Nov. 5, 1987.
2/ Modern Metals, August 1987.
3/ Iron Age, May 1987.

Appendix L

U.S. Trade Data

Table L-1
Total domestic imports of steel sheet and strip

Source	1980	1981	1982	1983	1984	1985	1986	January-October 1986	January-October 1987
	Thousand metric tons								
Japan	2,101	1,723	1,465	2,138	3,087	2,624	2,211	1,857	1,815
West Germany	585	731	826	731	893	984	999	828	685
Canada	395	432	300	459	803	744	769	601	847
South Korea	125	182	202	494	714	552	610	516	474
France	456	568	379	472	519	668	533	429	417
Netherlands	280	333	262	246	291	405	339	243	237
Brazil	6	21	82	564	522	277	287	232	239
Italy	39	119	114	164	184	210	222	202	125
Republic of South Africa	148	89	87	263	208	131	171	134	1/
Spain	30	82	80	160	348	117	154	126	87
Belgium and Luxembourg	111	118	192	111	152	183	148	121	94
Australia	64	75	81	124	146	110	132	122	95
Mexico	1	1	10	156	153	50	104	82	109
Argentina	0	2	96	126	157	108	98	84	119
Austria	7	10	4	18	216	169	92	69	66
Finland	8	49	29	78	115	87	79	65	60
Greece	0	21	24	45	59	61	70	59	39
Venzuela	1/	13	13	98	162	46	70	54	41
Taiwan	3	4	1	4	51	69	53	47	47
United Kingdom	6	23	41	39	38	70	45	38	23
Sweden	9	7	23	32	142	105	44	33	45
East Germany	0	0	1/	5	105	24	38	26	47
Turkey	0	0	1/	0	32	23	33	31	49
Portugal	0	0	0	0	35	64	24	24	27
Norway	1/	0	1/	1/	4	7	14	11	12
New Zealand	16	6	4	16	17	16	12	11	8
Algeria	0	0	0	0	12	11	10	10	10
Poland	1/	1	1/	1/	2	5	9	7	10
Hungary	0	1/	6	2	19	12	7	4	9
Romania	1	1/	1/	0	29	26	6	4	3
Indonesia	0	0	0	0	0	1	3	1/	16
Dominican Republic	0	1/	0	1/	0	8	2	2	1/
India	0	0	1/	0	0	1/	1/	1/	1
Denmark	1/	1/	1/	0	1/	1/	1/	1/	0
Total other	5	1/	1/	3	33	41	3	1	12
World	4,396	4,611	4,321	6,548	9,251	8,010	7,395	6,074	5,869

1/ Rounds to zero

Source: Compiled from official statistics of the U.S. Department of Commerce

Table L-2
Domestic imports of hot-rolled steel sheet and strip

Source	1980	1981	1982	1983	1984	1985	1986	January-October 1986	January-October 1987
	Thousand metric tons								
Canada	132	140	95	162	364	331	339	264	383
West Germany	187	199	243	206	240	302	288	244	202
France	265	318	149	238	275	374	273	215	210
Japan	478	395	314	329	407	296	271	224	213
South Korea	22	51	103	165	190	154	182	151	143
Netherlands	159	179	97	132	145	241	156	105	136
Brazil	5	3	41	228	238	129	131	104	96
Italy	19	39	36	69	70	73	81	73	49
Republic of South Africa	48	25	18	70	80	32	49	41	1/
Finland	6	45	23	51	54	35	34	28	19
Belgium and Luxembourg	16	62	59	38	26	37	31	26	26
Austria	7	10	4	5	67	55	22	15	29
Venezeuela	1/	11	13	54	99	28	21	18	15
Sweden	1/	1/	15	17	65	34	15	9	17
Argentina	0	2	2	13	1	8	12	12	35
United Kingdom	1/	1/	8	8	6	11	8	7	4
Hungary	0	1/	0	0	19	12	7	4	9
Taiwan	1/	1/	1/	2	26	18	4	3	1
Indonesia	0	0	0	0	0	1	3	1/	16
Mexico	1/	1/	1	49	30	6	2	2	8
Spain	1	4	4	24	45	34	2	2	4
Greece	0	0	0	0	1/	1	1	1	1
Australia	8	5	17	4	6	3	1/	1/	1
Kenya	0	0	0	0	0	0	1/	0	0
Uraguay	0	0	0	0	0	0	1/	1/	0
Switzerland	0	0	0	0	1/	0	1/	1/	0
Algeria	0	0	0	0	7	4	1/	1/	0
Philippines	2	0	0	0	1/	0	1/	1/	0
East Germany	0	0	0	1/	1	1/	1/	1/	1
China	0	0	0	0	0	0	1/	1/	0
Total other	4	1	1/	1/	41	35	0	0	13
World	1,359	1,490	1,241	1,863	2,503	2,254	1,936	1,549	1,631

1/ Rounds to zero

Source: Compiled from official statistics of the U.S. Department of Commerce

Table L-3
Domestic imports of cold-rolled steel sheet and strip

Source	1980	1981	1982	1983	1984	1985	1986	January-October 1986	January-October 1987
	Thousand metric tons								
Japan	600	429	371	654	937	730	652	556	475
West Germany	249	367	383	307	391	374	400	337	263
South Korea	94	92	60	173	340	236	262	225	185
Netherlands	109	141	154	105	134	144	160	124	84
Canada	85	113	68	90	131	126	148	117	162
Brazil	1	17	41	312	256	133	139	111	121
France	114	145	133	129	117	148	126	108	94
Italy	15	52	43	69	85	94	85	78	45
Belgium and Luxembourg	89	41	122	60	104	122	82	67	46
Greece	0	21	24	45	59	60	68	57	38
Argentina	0	1/	94	110	140	91	65	57	51
Republic of South Africa	39	36	38	88	70	45	63	48	1/
Spain	7	57	44	60	201	45	62	50	34
Austria	1/	1/	1/	12	136	101	62	47	28
Taiwan	1/	0	1/	1	25	51	44	40	42
Venezuela	0	2	1/	37	38	2	35	32	12
East Germany	0	0	1/	2	81	16	30	20	31
United Kingdom	3	16	18	18	23	30	23	20	12
Turkey	0	0	1/	0	6	14	18	18	1/
Australia	9	26	29	12	16	13	14	14	13
Finland	1/	1	4	26	44	36	14	9	15
Sweden	4	4	4	11	68	53	11	10	9
Mexico	1/	1/	1	37	53	6	9	8	9
Czechoslovakia	0	0	0	0	6	2	1	1/	2
India	0	0	1/	0	0	0	1/	1/	0
Switzerland	0	1/	0	1/	0	0	1/	1/	1/
Israel	0	0	0	1/	0	0	1/	1/	1/
Hungary	0	0	6	1/	0	0	1/	1/	1/
Total other	1/	1/	1/	1	33	19	0	0	2
World	1,420	1,559	1,635	2,360	3,495	2,691	2,572	2,154	1,772

1/ Rounds to zero

Source: Compiled from official statistics of the U.S. Department of Commerce

Table L-4
Domestic imports of coated steel sheet and strip

Source	1980	1981	1982	1983	1984	1985	1986	January-October 1986	January-October 1987
	Thousand metric tons								
Japan	1,010	886	768	1,134	1,715	1,573	1,268	1,061	1,107
West Germany	148	151	182	216	253	298	297	234	214
Canada	172	172	133	203	305	285	278	217	297
South Korea	8	37	37	150	171	151	158	133	140
Australia	46	44	35	108	123	94	118	108	82
France	71	92	78	87	95	123	108	84	96
Mexico	1/	1/	8	69	67	34	83	64	78
Spain	22	17	24	62	93	27	79	64	39
Republic of South Africa	61	28	30	105	58	54	56	42	1/
Italy	4	28	34	26	22	31	45	41	28
Belgium and Luxembourg	5	13	9	13	20	21	28	22	20
Portugal	0	0	0	0	31	61	24	24	27
Netherland	11	13	11	8	12	21	23	14	18
Finland	0	0	0	1/	11	11	23	20	21
Argentina	0	0	1/	4	16	9	21	15	33
Brazil	1/	1/	1/	24	26	15	17	16	22
Venezuela	0	0	1/	7	25	16	15	4	14
Norway	1/	0	0	1/	4	7	14	11	12
Turkey	0	0	0	0	1/	8	14	13	43
New Zealand	16	6	4	15	17	16	12	11	8
Sweden	1/	1/	1/	1/	1	12	11	9	13
Algeria	0	0	0	0	6	7	10	10	10
United Kingdom	2	4	12	10	7	19	9	7	5
Poland	1/	0	0	1/	1	4	9	7	10
Austria	1/	1/	1/	1/	14	13	9	7	9
East Germany	0	0	0	3	23	8	8	6	15
Romania	1	0	0	0	11	3	6	4	2
Dominican Republic	0	1/	0	1/	0	8	2	2	0
Greece	0	0	0	0	1/	1/	1	1	1/
Taiwan	2	4	1/	1	1/	1/	1	1/	3
Uraguay	0	0	0	0	0	0	1/	0	1
Jamaica	0	0	0	0	0	0	1/	1/	0
Jordan	0	0	0	0	0	1	1/	1/	0
Denmark	0	0	0	0	0	1/	1/	1/	0
Total other	1/	1/	1/	4	2	11	1/	1/	2
World	1,582	1,496	1,366	2,248	3,128	2,941	2,749	2,251	2,370

1/ Rounds to zero

Source: Compiled from official statistics of the U.S. Department of Commerce

Table L-5
Domestic imports of stainless steel sheet and strip

Source	1980	1981	1982	1983	1984	1985	1986	January-October 1986	January-October 1987
	Thousand metric tons								
France	6	13	20	18	32	24	25	21	17
Japan	14	14	13	21	29	26	20	17	20
West Germany	1/	14	18	3	10	9	14	13	7
Spain	1/	5	8	13	9	10	11	9	11
Mexico	1/	1/	1/	1/	2	3	10	8	14
Italy	0	1/	1	1	7	12	10	10	2
South Korea	1/	3	3	6	12	11	9	8	7
Finland	2	3	2	2	5	5	8	7	5
Sweden	5	3	4	3	7	7	7	6	5
Belgium and Luxembourg	1	1	2	1	2	3	7	6	2
United Kingdom	1	4	4	3	2	10	5	5	2
Canada	6	6	5	4	4	2	4	3	4
Taiwan	0	0	1/	0	1/	1/	4	3	1/
Republic of South Africa	1/	0	1/	1/	1/	1/	2	2	0
Jordan	0	0	0	0	0	1/	1/	1/	1/
Panama	0	0	0	0	0	0	1/	1/	0
Turkey	0	0	0	0	0	0	1/	1/	0
Austria	1/	1/	1/	1/	1/	1/	1/	1/	1/
Brazil	1/	0	1/	1/	2	0	1/	1/	1/
Switzerland	1/	0	0	1/	0	0	1/	1/	0
India	0	0	0	0	0	0	1/	1/	1/
Denmark	0	1/	0	0	1/	1/	1/	1/	0
Total other	1/	0	1/	1/	1/	1	0	0	1/
World	35	65	79	76	125	123	138	120	97

1/ Rounds to zero

Source: Compiled from official statistics of the U.S. Department of Commerce

Table L-6
Total domestic exports of steel sheet and strip products

Source	1980	1981	1982	1983	1984	1985	1986	January-October 1986	January-October 1987
	Thousand metric tons								
Canada	94	219	102	119	112	100	76	64	105
Mexico	293	182	71	35	51	43	68	55	96
Hong Kong	10	8	7	11	5	5	43	34	28
Italy	167	36	21	21	18	21	34	31	23
Pakistan	82	49	38	55	21	19	34	30	8
Taiwan	47	27	23	30	15	10	32	23	26
India	72	50	40	17	25	34	27	26	17
Japan	5	5	2	3	4	4	23	10	4
Egypt	45	34	5	15	16	28	17	12	18
China	11	1	1/	8	3	8	14	12	9
Bangladesh	8	10	7	10	17	8	9	9	6
United Kingdom	109	42	13	4	2	2	9	8	4
Thailand	26	15	14	13	6	5	7	6	5
Argentina	14	12	6	5	2	1	6	6	3
Indonesia	24	10	8	5	8	9	5	6	1
Dominican Republic	5	4	5	3	3	3	4	2	2
Belgium and Luxembourg	3	3	2	1/	1/	1/	4	4	1/
Portugal	53	6	1/	1/	1/	1/	3	2	2
Israel	3	3	2	2	4	4	3	2	1/
West Germany	12	3	2	2	2	3	3	2	2
Spain	3	1	1	1/	1/	1/	3	3	5
Peru	3	4	2	1/	2	1/	2	2	1/
Brazil	105	15	12	1	1/	1	2	1/	1/
Colombia	3	2	1	2	4	3	2	2	1
Venezuela	15	34	18	4	3	3	2	1	3
Switzerland	1	1	1/	1/	1	1/	1	1	1
Kuwait	1	3	1	1/	1/	1	1	1	1/
Netherlands	4	1/	1/	1/	1/	1	1	1/	1/
South Korea	9	1/	1	1	1	2	1	1	1
Australia	2	2	1	1	1	1	1	1/	1/
Sweden	5	2	3	1/	1	1/	1	1	1
Costa Rica	4	1/	1	2	1	1	1	1	1/
Singapore	4	5	3	2	2	1	1	1	1
France	3	1	1/	1/	1/	1/	1/	1/	1/
Total other	108	87	79	45	22	16	13	9	11
World	1,349	874	490	414	349	335	452	368	385

1/ Rounds to zero

Source: Compiled from official statistics of the U.S. Department of Commerce

Table L-7
Domestic exports of hot-rolled steel sheet and strip

Source	1980	1981	1982	1983	1984	1985	1986	January-October 1986	January-October 1987
	Thousand metric tons								
Japan	1/	1/	1/	1/	1	1	15	2	1
Mexico	64	32	7	7	9	13	14	13	18
Canada	17	103	30	33	31	25	11	10	13
United Kingdom	1	1	1/	1/	1/	1/	7	7	1
Italy	23	14	1/	1/	1/	6	5	5	1/
Portugal	29	1/	0	1/	1/	0	4	4	2
Sweden	1/	1	1	1/	1/	1/	1	1	1/
Taiwan	4	2	1	2	1/	1	1	1	2
Belgium and Luxembourg	1/	2	1	1/	1/	1/	1/	1/	1/
South Korea	8	1/	1/	1/	1/	1/	1/	1/	1/
Israel	1/	1/	1/	1/	1	1/	1/	1/	1/
Greece	11	1/	11	1/	1/	0	1/	0	1/
Argentina	3	2	1/	1/	1/	1/	1/	1/	1/
Dominican Republic	1/	1/	1/	1/	1/	1/	1/	1/	1/
Honduras	1/	1/	1/	1/	1/	2	1/	1/	1/
Thailand	3	0	1/	1/	1/	1/	1/	1/	1/
Saudi Arabia	1/	2	1	1/	1	1/	1/	1/	1/
China	1	1/	1/	0	0	1/	1/	1/	1/
Hong Kong	1/	1/	1/	1/	1/	1/	1/	1/	1/
India	2	1	1/	1/	3	1/	1/	1/	1/
Republic of South Africa	1/	1/	1/	1/	1/	1/	1/	1/	1/
Venezuela	2	24	15	1	1/	1/	1/	1/	1/
West Germany	1/	1/	1/	1/	1/	1	1/	1/	1/
Panama	1/	1/	1/	1/	1/	1/	1/	1/	1/
Switzerland	1/	1/	1/	1/	1/	1/	1/	1/	1/
Finland	1/	1/	0	0	0	0	1/	1/	1/
Colombia	1/	1/	1/	1/	1	1/	1/	1/	1/
Trinidad and Tobago	1/	1/	1/	1/	1/	1/	1/	1/	1/
Chile	1/	1/	1/	1/	1/	1/	1/	1/	1/
Singapore	1/	1/	1/	1/	1/	1/	1/	1/	1/
Philippines	1/	1/	1/	1/	1/	1/	1/	1/	1/
Netherlands	1/	1/	1/	1/	1/	1/	1/	1/	1/
France	1/	1/	1/	1/	1/	1/	1/	1/	1/
Jamaica	1/	1/	1/	1/	1/	1/	1/	1/	1/
Total other	9	13	4	1	1	1	1	1	1
World	181	198	75	48	52	52	61	45	39

1/ Rounds to zero

Source: Compiled from official statistics of the U.S. Department of Commerce

Table L-8
Domestic exports of cold-rolled steel sheet and strip

Source	1980	1981	1982	1983	1984	1985	1986	January-October 1986	January-October 1987
	Thousand metric tons								
Mexico	39	20	7	7	11	12	37	30	42
Canada	29	46	24	27	29	26	23	18	32
India	46	31	21	9	15	13	11	11	8
Taiwan	17	7	8	11	5	4	8	7	6
Pakistan	46	35	31	28	11	4	6	5	1
Japan	4	3	1	2	2	2	4	4	4
Hong Kong	3	1	1	5	1	1	3	3	1
Bangladesh	5	6	2	2	3	4	3	3	2
China	8	1	0	1/	0	1	2	2	1
Colombia	1	1	1/	1	2	2	2	1	1/
Italy	5	1	1	1/	1	2	1	1	2
West Germany	5	1	1	1	1	1	1	1	1
Egypty	1	1	1/	1	1/	1	1	1/	1/
Israel	2	1	1	1	1/	1	1	1	1/
Thailand	10	6	4	6	3	1	1	1	1
Argentina	2	2	1	1	1	1/	1	1	1
Venezuela	3	5	2	1	1	2	1	1	2
Peru	1	1	1	1/	1/	1/	1/	1/	1/
Chile	1/	1	1/	1/	1/	1/	1/	1/	1/
France	1/	1	1/	1/	1/	1/	1/	1/	1/
United Kingdom	4	2	1	1	1/	1/	1/	1/	1/
Sweden	1/	1/	2	1/	1/	1/	1/	1/	1/
Republic of South Africa	1/	1	1/	1/	1/	1/	1/	1/	1/
Brazil	42	1	3	1/	1/	1/	1/	1/	1/
Dominican Republic	1/	1/	1/	1/	1/	1	1/	1/	1/
Jamaica	1/	1/	1/	1	1	1/	1/	1/	1/
Australia	1/	1/	1/	1/	1/	1/	1/	1/	1/
Switzerland	1/	1/	1/	1/	1/	1/	1/	1/	1/
South Korea	1/	1/	1/	1/	1/	1/	1/	1/	1/
Poland	1/	1/	1/	1/	1/	1/	1/	1/	1/
Netherlands	1/	1/	1/	1/	1/	1/	1/	1/	1/
Spain	1/	1/	1/	1/	1/	1/	1/	1/	1/
El Salvador	1/	1/	1/	1/	1/	1/	1/	1/	1/
Greece	1/	1/	1/	1/	1/	1/	1/	1/	1/
Total other	35	9	6	4	3	2	1	1	1
World	307	184	118	109	93	81	110	94	107

1/ Rounds to zero

Source: Compiled from official statistics of the U.S. Department of Commerce

Appendix M

Steel Sheet and Strip Plants and Producing Facilities Shutdown, Completed or Authorized, 1971-87

Table M-1
Steel Sheet and Strip Plants and Producing Facilities Shutdown, Completed or Authorized, 1971-87

Company	Location	Facility	Year
Armco----------------	Middletown, OH	Open-hearth	1984
Bethlehem------------	Sparrows Point, MD	2 Blast furnaces	1974
		Blast furnace	1975
		Blast furnace	1976
		2 Coke batteries	1977
		3 Blast furnaces	1978
		2 Coke batteries	1980
		2 Coke batteries	1983
		2 Coke batteries	1982
		Galvalume coated	1983
		2 Coke oven batteries	1984
	Burns Harbor, IN	Tin mill halogen line	1983
	Lackawanna, NY	Open-hearth	1974
		Blast furnace	1977
		4 Coke batteries	1977
		Cold-strip mill	1977
		4 Blast furnaces	1983
		Hot-strip mill	1983
		Slab mill	1983
		3 BOF vessels	1983
	Pinole Point, CA	Galvanizing line 1/	1974
Eastmet--------------	Baltimore, MD	Sheet and strip lines	1986
Enduro Stainless-----	Massillon, OH	Stainless plant 2/	1985
Jones & Laughlin-----	Pittsburgh, PA	Hot-strip and finishing operations	1981
		Blast furnace, open-hearth, and maintenance units	1979
		Cold-strip mill units	1974
	Los Angeles, CA	Stainless and strip plant	1974
	Indiana Harbor, IN	No. 1 tin mill	1981
		Open-hearth	1975
Kaiser Steel---------	Fontana, CA	Integrated sheet and strip plant 3/	1984
Lone Star Steel------	Lone Star, TX	2 Open-hearths	1986
		Blast furnace	1986
LTV Steel------------	Cleveland, OH	Hot-strip finishing 4/	1984
	Gadsden, AL	Entire plant 5/	1984

See footnotes at end of table.

Table M-1--Continued
Steel Sheet and Strip Plants and Producing Facilities Shutdown, Completed or Authorized, 1971-87

Company	Location	Facility	Year
LTV Steel--Cont.			
	Indiana Harbor, IN	Slabbing mill	1986
		Coke plant	1986
		Shear line	1986
		Slitter	1986
	Aliquippa, PA	Ingot steel production unit	1984 4/
		Coke and byproduct	1985 4/
		Caster	1985 4/
		Blast furnaces	1985 4/
	Niles, OH	Cold-rolled sheet plant	1986
McLouth-------------	Trenton, MI	Blast furnace	1985
National Steel------	Weirton, WV	Plant 6/	1983
Republic Steel------	Canton, OH	Jobbing and hot steel mills	1981
	Chicago, IL	Open-hearth furnaces	1977
	Cleveland, OH	Sinter plant	1974
		No. 5 Open-hearth furnaces	1976
		Hot-strip mill	1977
	Warren, OH	No. 1 Galvanizing line	1974
		Sinter plant	1980
	Youngstown, OH	Plastic coating line	1974
		Sinter plant	1975
		Skelp mill	1975
		Fabricating and coil coating	1982
Sharon Steel 7/-----	Sharon, PA	No. 1 Cold roll department:	
		No. 1 Tandem	1971
		No. 2 Tandem	1971
		No. 8 Temper mill	1971
		No. 12 Temper mill	1971
		No. 18 Temper mill	1971
		No. 25 "Z" mill	1971
		No. 21 Rev. mill	1982
		No. 20 Rev. mill	1981
		No. 22 Rev. mill	1979
		No. 24 Slitter	1975
		No. 26 Slitter	1971
		No. 1 Edger	1984
		No. 2 Edger	1984
		No. 7 Straight and cut	1984
		Bright anneal	1981
		C Continuous pickle	1971

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See footnotes at end of table.

Table M-1--Continued
Steel Sheet and Strip Plants and Producing Facilities Shutdown, Completed or Authorized, 1971-87

Company	Location	Facility	Year
Sharon Steel--Cont.			
		A Pickler	1979
		No. 3 Anneal	1971
		No. 1 Anneal	1971
		No. 1 Murrayway grinder	1971
		No. 2 Murrayway grinder	1971
		No. 5 Shotblaster	1971
		No. 5 Pickler	1979
		No. 2 Pickler	1977
		No. 1 Grainbreakers	1971
		No. 2 Grainbreakers	1971
		No. 3 Grainbreakers	1971
		No. 4 Grainbreakers	1971
		No. 5 Grainbreakers	1971
		No. 19 Anneal	1971
		No. 17 Anneal	1971
		Hot mill department:	
		24" Hot mill	1974
		14" Hot mill	1971
		Fin. Div 'B'	
		No. 3 Slitter	1972
		No. 11 Slitter	1972
		No. 18 Slitter	1980
		No. 17 Pinch mill	1971
		No. 24 Pinch mill	1971
		No. 4 Butt weld	1972
		Automatic banding line	1971
		No. 10 Straight and cut	1970
		No. 4 Pickler	1971
		No. 15 Slitter	1970
		No. 17 Slitter	1970
		No. 14 Pinch mill	1985
		Blooming mill:	
		18" Bloomer	1973
		24" Bloomer	1973
		36" Bloomer	1973
		Primary division:	
		No. 1 BOF	1981 8/
		No. 2 BOF	1981 8/
		No. 2 Blast furnace	1983
		Open-hearth	1971
Stanley Works-------	New Britain, CT	Cold-rolled strip plant 9/	1986

See footnotes at end of table.

Table M-1--Continued
Steel Sheet and Strip Plants and Producing Facilities Shutdown, Completed or Authorized, 1971-87

Company	Location	Facility	Year
Stanley Works--Cont.			
	Ottawa, OH	Cold-rolled strip plant 9/	1986
	Hamilton, Ont.	Cold-rolled strip plant 9/	1986
Teledyne------------	McKeesport, PA	Specialty steel	1981
Three Rivers--------	Evansville, IN	Strip casting mill	1986
USS (U.S. Steel) 10/--------	Berwick, PA	Plant	1974
	Clairton, PA	18/22" Rolling mills	1983
		21" Mill	1983
		Miscellaneous coke, chemical and steel operations	1983
		Coke batteries No. 12, 12A, 18	1980
		Coke batteries No. 10, 11, 16, 17	1982
		No. 1 blast furnace	1978
	Cleveland, OH	Blast furnaces (central furnaces)	1979
	Cuyahoga, OH	No. 5 hot-strip mill	1980
		Stainless strip facilities	1982
		Plant 11/	1983
	Duluth, MN	Coke plant	1978
	Duquesne, PA	No. 3 and No. 6 blast furnaces	1983
		BOP shop	1983
		Maintenance shops	1983
		Blast furnace No. 1	1982
		No. 4 blast furnace	1980
	Braddock, PA	Blast furnace No. 5	1982
		Sinter plant	1978
		No. 6 blast furnace	1978
	Fairfield, AL	No. 6 blast furnace	1983
		Ensley plant	1983
		45" Bloom mill	1983
		Galvanizing opns. (excl. the No. 4 Line)	1983
		Paint line	1983
		No. 3 galvanizing line	1982
		Pig iron unit	1982
		Coke batteries 3 through 8	1982
		Sinter lines, 1, 2, 3	1981

See footnotes at end of table.

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Table M-1--Continued
Steel Sheet and Strip Plants and Producing Facilities Shutdown, Completed or Authorized, 1971-87

Company	Location	Facility	Year
USS--Cont.			
		No. 3 electro. tinning line	1980
		Ensley steelmaking	1976
		Bessemer rolling mill	1975
	Gary, IN	No. 10 Blast furnace	1983
	Fairless Hills, PA	No. 1 Electrolytic tinning line	1983
		Continuous anneal line	1980
		56" CR shear	1980
	Gary-South Chicago Works	Stainless steel operations	1983
		42" Continuous pickler	1983
		Miscellaneous hot-rolling, sheet, and tin equipment	1983
		54" Shear line	1982
		No. 9 Blast furnace	1982
		No. 14 Coke battery	1982
		Black plate shear line	1980
		Stainless temper mill	1980
		Open coil annealing furnace	1980
		4 High Stainless reversing mill	1980
		5-Stand CR mill	1980
		4 blast furnaces	1980
		Hot-rolled shear line	1980
		No. 7 Galvanize line	1980
		No. 4 Electro. tinning line	1980
		No. 2 Sinter plant	1980
		80" Hot-strip mill	1980
		2 blast furnaces	1978
		No. 4 Open-hearth shop	1975
		No. 1 Open-hearth shop	1974
	Geneva Plant, 12/ Provo, UT	Entire plant	1987
	Homestead, PA	Blast furnaces No. 6 and 7	1982
		Blast furnaces 3 and 4	1982
		No. 5 Open-hearth	1982
		No. 4 Open-hearth	1974
	Dravosburg, PA	Miscellaneous sheet and tin operations	1983
		36" Pickle line	1982
		3-Stand No. 1 & 4 temper mill	1980

See footnotes at end of table.

Table M-1--Continued
Steel Sheet and Strip Plants and Producing Facilities Shutdown, Completed or Authorized, 1971-87

Company	Location	Facility	Year
USS--Cont.			
	Vandergrift, PA	Conversion Process for outside companies	1983
		80" CR mill	1982
		80" 2-High temper mill	1982
		80" Drever roll hearth	1982
		No. 5 Continuous anneal line	1980
		Fibercon unit	1980
Wheeling-Pittsburgh--------	Allenport, PA	Hot-strip mill	1985
	Steubenville, OH	No. 1 Pickle line	1986
		No. 9 and 12" Temper mill	1986
		No. 1 Tandem mill	1986

1/ Subsequent to the shutdown, the Pinole Point galvanizing facility was purchased by Marwais Steel Co. and renamed the Pinole Point Steel Co. The company purchases cold-reduced coils for galvanizing.
2/ In February 1986, the Enduro Stainless facility was sold to Mercury Stainless.
3/ Portions of the facility were sold and are now operating as California Steel.
4/ Indefinitely idled.
5/ Sold to the Brehnlin Group and renamed Gulf States Steel.
6/ Sold to its employees and renamed Weirton Steel Corp.
7/ Company is currently in Chapter 11.
8/ Replaced by No. 4 BOF.
9/ Purchased by Cold Metal Products Inc. in July 1987. The Ottawa and New Britain facilities will operate as part of Cold Metal Products. The Hamilton operations will become Cold Metal Products Co., Ltd., a wholly owned subsidiary of Cold Metal Products Inc.
10/ A division of USX Corp.
11/ Portions sold to American Steel and Wire Corp.
12/ Purchased by Basic Manufacturing and Technologies of Utah, Inc., on Aug. 31, 1987, and renamed Geneva Steel of Utah. Steel production was resumed in September 1987.

Source: American Iron and Steel Institute and American Metal Market.

Appendix O

Methodology for Estimating the Effects of VRA'S on Steel Sheet and Strip Exports to the United States

This appendix describes the methodology and lists the data used to estimate the effects of the VRA's covering steel sheet and strip exports to the United States. The critical data in this analysis are the predicted 1987 values of the shares of apparent consumption accounted for by the exports of VRA and non-VRA countries, with and without the VRA's. The assumptions used to derive the forecasts are discussed below, and these and other forecasted values are listed in table O-1. Also described is the six-equation model used to estimate the effects of the VRA's. The results are presented in tables O-2, O-3, and O-4.

The most difficult part of this analysis is forecasting what the market conditions will be through 1987. This, however, is the most critical part of the analysis. The 1987 import share for countries covered by the VRA's is set at 14.57 percent. It was calculated using DRI forecasts of apparent consumption for 1987, and each country's agreed-upon import share for steel sheet and strip. In using this estimate, it is assumed that the restraints are binding (i.e., foreign suppliers would be willing to export a greater quantity of steel sheet and strip to the United States in the absence of the restraints) and that they effectively limit foreign suppliers to the negotiated import penetration shares.

The import share of countries not covered by VRA's must also be forecast. When VRA's cover only a subset of total exporters, the reduction in exports to the country serves to raise the price of the product subject to the VRA's. Yet, this in turn induces countries not covered by VRA's to increase their exports. As a consequence, both the volume of their exports and their share of apparent consumption are likely to rise. However, the import share of apparent consumption as well as the volume of exports by countries not covered by the VRA's has fallen in each year since 1984. 1/ These declines may have been the result of less favorable market conditions (the decline in the value of the dollar) or self-imposed restraint on the part of non-VRA countries in order to avoid being brought in under the agreements. Since the import share in 1986 is the latest available and also the lowest since 1984, it is assumed that this share, 2.5 percent, will also exist in 1987 when VRA's are in force. Therefore, the overall import share for steel sheet and strip in 1987 in the presence of VRA's is expected to be 17.07 percent (the sum of the import shares of VRA and non-VRA countries).

Since a large number of unknowns makes it impossible to estimate the actual import penetration level in absence of the VRA's, we have assumed three levels of "free-trade" import flows. The first case assumes an import penetration level equal to the import shares that existed in 1984. In that year, import penetration was at a historical high both in relative and

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1/ In 1984, countries not covered by the VRA's exported 1.40 million short tons of steel sheet and strip to the United States. This represented 2.76 percent of apparent consumption. In 1986, they exported 1.19 million short tons, or 2.5 percent, of U.S. apparent consumption.

absolute terms. This is true not only for the exports of countries subject to the VRA's, but, surprisingly, for those by countries not covered by the VRA's. In 1984, the import share of countries covered by the VRA's was 17.57 percent and the share for countries not covered was 2.76 percent. Thus, in our first case, imports in absence of VRA's are assumed to account for 20.33 percent of apparent consumption. It is unlikely that the import share for 1987 would exceed the share of 20.33 percent experienced in 1984. In that year, conditions, such as the value of the dollar, were especially favorable to foreign producers. Since then, the dollar has experienced a significant decline in its value, reducing incentives for all exporters. In addition, the import level found to be consistent with this import share, 11.9 million short tons, exceeds the historically high level of 10.3 million experienced in 1984. These and other forecasted values are listed in table O-1. The results of the model, under this assumption, are presented in table O-2.

We also estimated the market effects of the VRA's assuming import penetration values, absent the trade restrictions, as high as 25 and 30 percent. Although less realistic than the 20.33 percent assumption, these estimates provide a sense of the marginal benefits of the VRA's under increasingly restrictive trade conditions. The results are presented in tables O-3 and O-4.

In absence of the VRA's, as the level of steel sheet and strip imports (S_M) entering the United States is permitted to increase, the price of imported steel sheet and strip (p_f) declines. The reduction in the price of the imported product in turn induces domestic consumers to switch their purchases away from the domestic product. This reduction in the demand for domestic steel sheet and strip (D_d) causes its price (p_d) to fall and serves to lower domestic production (S_d), thus resulting in a loss of employment and sales opportunities. We now describe the six-equation model and other relations used to estimate all of these effects. The first three equations are as follows:

(1) $\ln(D'_f/D_f) = -\, n_{ff}\ln(p'_f/p_f) + n_{fd}\ln(p'_d/p_d)$

(2) $\ln(D'_d/D_d) = -\, n_{dd}\ln(p'_d/p_d) + n_{df}\ln(p'_f/p_f)$

(3) $\ln(S'_d/S_d) = e_d\ln(p'_d/p_d)$

A variable with a prime (" ' ") represents its value under the assumptions of 20.33, 25 or 30 percent import market share. These equations are, respectively, the percentage change in the demand for sheet and strip imports (D'_f/D_f); the percentage change in the demand for domestically produced sheet and strip (D'_d/D_d); and the percentage change in the supply of domestic sheet and strip (S'_d/S_d). The first two equations are derived from constant elasticity of demand equations that are a function of the foreign import price, as well as the price of domestically produced sheet and strip. The third equation is obtained from a constant elasticity domestic supply curve for sheet and strip that is a function only of the domestic price. n_{ij} is the elasticity of demand of the ith good with respect to the price of the jth good, and e_d is the elasticity of domestic supply. All elasticities are defined to be positive.

The fourth equation is an equilibrium condition for the domestic product. In equilibrium, demand must equal supply.

(4) $D'_d = S'_d$

The final two relations are constraints.

(5) $m = D_f/(D_f + D_d)$

(6) $m' = D'_f/(D'_f + D'_d)$

m is the share of imports as a percent of apparent consumption as forecasted for 1987, and m' is the assumed import market share, absent the VRA's. These constraints are assumed to always be binding.

The known variables of this system are p_f, p_d, D_f, D_d, and S_d. These are the forecasted values listed in table O-1. The parameters of the system are m, m', 1/ and the elasticities. 2/ These values are also listed in table O-1. The unknown variables are p'_f, p'_d, D'_f, D'_d, and S'_d. The latter can be solved in terms of the known variables and parameters as follows.

First, using equation (5) to solve (p'_d/p_d), we have the following:

(7) $(p'_d/p_d) = (p'_f/p_f) \exp [n_{df}/(n_{dd}+e_d)]$

Next, use equation (6) to express the percentage change in the import price in terms of m, m', and demand and supply elasticities. To do so, use equations (1) and (2) to substitute for D'_d and D'_f in equation (6). Then use equation (5) to replace D_f. Finally, replace (p'_d/p_d) with the above and solve (p'_f/p_f).

(8) $(p'_f/p_f) = [m(1-m')/m'(1-m)] \times$

$\exp [1/(n_{df}+n_{ff}) - (n_{df}(n_{fd}+n_{dd})/(n_{dd}+e_d))]$

1/ In general, m is a variable determined after equilibrium is obtained in both markets. However, for this analysis, m' is treated as a policy parameter.
2/ Since no generally accepted estimates of the domestic supply elasticity exist, values of 3 and 50 are used in the analysis. These assumptions also restrict the import supply. In order to be consistent with the 20.33 import share, the import price under the various market share assumptions is required to be lower in the moderate-excess-capacity case (e_d = 3) than in the high-excess-capacity case (e_d = 50).

These expressions can then be solved for the prices that would exist in absence of the VRA's, p'_f and p'_d. Then, the prices can be substituted into equations (1) and (2) to obtain the new level of domestic imports, D'_f, and domestic demand, D'_d. The latter is also equal to the new level of domestic production, S'_d.

Once the effects on prices and quantities purchased and sold are determined, it is then possible to estimate the changes in the value of producers' sales volume, PS, as follows:

$$PS = (p_d S_d - p'_d S'_d)$$

Finally, the change in employment is calculated by multiplying the average number of workers employed per unit of domestic production by the change in domestic production $(S_d - S'_d)$.

Table O-1 lists the data used to obtain these estimates. Tables O-2, O-3, and O-4 present the results of the model under the three different assumptions of import penetration level.

Table O-1.--Data for steel sheet and strip analysis, in terms of value

Parameter or variable	Value
$-n_{dd}$	1/ -0.58
n_{df}	0.52
$-n_{ff}$	-3.81
n_{fd}	12.01
e_d (moderate excess capacity)	3.00
e_d (high excess capacity)	50.00
m_{VRA} (percent)	2/ 14.57
$m_{non-VRA}$ (percent)	3/ 2.50
$m = m_{VRA} + m_{non-VRA}$ (percent)	17.07
m'_{VRA} (percent)	4/ 17.57
$m'_{non-VRA}$ (percent)	2.76
$m' = m'_{VRA} + m'_{non-VRA}$ (percent)	20.33
	25.00
	30.00
S_d (1,000 short tons)	39,359.4
S_f (1,000 short tons)	8,101.6
$D_d + D_f$ (1,000 short tons)	5/ 47,461.00
P_d	6/ $512.00
P_f	$464.00
Average jobs per unit output	7/ .0017

1/ These are weighted elasticities computed from estimates developed by Robert Crandall, The U.S. Steel Industry in Recurrent Crises, The Brookings Institution, 1981, pp. 180-181. The weights are based on the mean quantity of imports or domestic shipments for each product category used by Crandall to estimate the elasticities. These data can be found in pp. 158 and 166.
2/ The expected 1987 import share for VRA countries. Share calculated from agreed-upon-import-penetration shares and DRI forecasts of apparent consumption provided to the Office of Agreements Compliance, International Trade Administration, U.S. Department of Commerce.
3/ Import share of apparent consumption for 1986 for non-VRA countries. See Monthly Reports on the Status of the Steel Industry, USITC Publication 1974, various issues.
4/ m'_{VRA} and $m'_{non-VRA}$ are proxied by the 1984 import shares of apparent consumption. See Monthly Reports on the Status of the Steel Industry, USIC Publication 1974, various issues.
5/ Expected 1987 apparent consumption was derived from DRI forecasts of apparent consumption.
6/ Estimated 1987 unit value for domestic production. Proxied by the latest comparable information contained in Annual Survey Concerning Competitive Conditions in the Steel Industry and Industry Efforts to Adjust and Modernize, USITC Publication 1881, September 1986. See table D-2, p. 103.
7/ Data on average number employed obtained from table D-4, p. 105, Annual Survey Concerning Competitive Conditions in the Steel Industry and Industry Efforts to Adjust and Modernize, USITC Publication 1881, September 1986.

Table O-2
Steel sheet and strip: Estimated level of consumption, import and domestic prices, domestic production, and employment for steel sheet and strip, under the assumption of 20.33 percent import penetration level

Forecast 1987 data:	
Ratio of total imports to apparent consumption (percent) 1/..	17.07
Apparent consumption (net tons) 2/	47,461,000
Domestic production 3/ (net tons)	39,359,407
Domestic production (1,000 dollars) 4/	$20,152,016,384
Total imports (net tons) 5/	8,101,593
Import price	$464.00
Domestic price 6/	$512.00

Ratio of total imports to apparent consumption (percent)		20.33
	Moderate excess-capacity	High excess-capacity
Apparent consumption (net tons)	47,587,855	48,120,902
Domestic production (net tons)	37,913,244	38,337,923
Domestic production (1,000 dollars)	19,170,865	19,618,696
Total imports (net tons)	9,674,611	9,782,980
Change in employment (jobs)	(2458)	(1736)
Import price	$425.80	$440.86
Domestic price	$505.65	$511.73

1/ This figure includes an implicit share limit of 14.57 for VRA countries, calculated on the basis of established export limits and DRI forecast of U.S. consumption and an assumed 2.50 share for countries not covered by the VRA's (the same as in 1986).
2/ Derived from DRI forecasts of apparent consumption provided to the Office of Agreements Compliance, International Trade Administration, U.S. Department of Commerce.
3/ The share of domestic production is obtained by multiplying apparent consumption by (1 minus import share).
4/ Expressed in terms of value by multiplying the quantity of domestic production by an estimate of the unit value. The unit values for domestic production and for imports were proxied by the latest comparable information contained in Annual Survey Concerning Competitive Conditions in the Steel Industry and Industry Efforts to Adjust and Modernize, USITC Publication 1881, September 1986. See table D-2, p. 103.
5/ Total imports are calculated on the basis of the forecasted import share (17.07) and the DRI forcast of the 1987 U.S. apparent consumption.
6/ Estimated 1987 unit value for domestic production. Proxied by the latest comparable information contained in Annual Survey Concerning Competitive Conditions in the Steel Industry and Industry Efforts to Adjust and Modernize, USITC Publication 1881, September 1986. See table D-2, p. 103.

Table O-3
Steel sheet and strip: Estimated level of consumption, import and domestic prices, domestic production, and employment for steel sheet and strip, under the assumption of 25 percent import penetration level

Forecast 1987 data:	
Ratio of total imports to apparent consumption (percent) 1/..	17.07
Apparent consumption (net tons) 2/	47,461,000
Domestic production 3/ (net tons)	39,359,407
Domestic production (1,000 dollars) 4/	$20,152,016,384
Total imports (net tons) 5/	8,101,593
Import price	$464.00
Domestic price 6/	$512.00

Ratio of total imports to apparent consumption (percent)	25.00	
	Moderate excess-capacity	High excess-capacity
Apparent consumption (net tons)	48,251,940	49,472,925
Domestic production (net tons)	36,188,955	37,104,694
Domestic production (1,000 dollars)	18,017,250	18,975,202
Total imports (net tons)	12,062,985	12,368,231
Change in employment (jobs)	(5390)	(3833)
Import price	$382.66	$413.69
Domestic price	$497.87	$511.40

1/ This figure includes an implicit share limit of 14.57 for VRA countries, calculated on the basis of established export limits and DRI forecast of U.S. consumption and an assumed 2.50 share for countries not covered by the VRA's (the same as in 1986).
2/ Derived from DRI forecasts of apparent consumption provided to the Office of Agreements Compliance, International Trade Administration, U.S. Department of Commerce.
3/ The share of domestic production is obtained by multiplying apparent consumption by (1 minus import share).
4/ Expressed in terms of value by multiplying the quantity of domestic production by an estimate of the unit value. The unit values for domestic production and for imports were proxied by the latest comparable information contained in Annual Survey Concerning Competitive Conditions in the Steel Industry and Industry Efforts to Adjust and Modernize, USITC Publication 1881, September 1986. See table D-2, p. 103.
5/ Total imports are calculated on the basis of the forecasted import share (17.07) and the DRI forcast of the 1987 U.S. apparent consumption.
6/ Estimated 1987 unit value for domestic production. Proxied by the latest comparable information contained in Annual Survey Concerning Competitive Conditions in the Steel Industry and Industry Efforts to Adjust and Modernize, USITC Publication 1881, September 1986. See table D-2, p. 103.

Table O-4
Steel sheet and strip: Estimated level of consumption, import and domestic prices, domestic production, and employment for steel sheet and strip, under the assumption of 30 percent import penetration level

Forecast 1987 data:	
Ratio of total imports to apparent consumption (percent) 1/..	17.07
Apparent consumption (net tons) 2/	47,461,000
Domestic production 3/ (net tons)	39,359,407
Domestic production (1,000 dollars) 4/	$20,152,016,384
Total imports (net tons) 5/	8,101,593
Import price	$464.00
Domestic price 6/	$512.00

Ratio of total imports to apparent consumption (percent)		30.00
	Moderate excess-capacity	High excess-capacity
Apparent consumption (net tons)	49,483,876	51,401,339
Domestic production (net tons)	34,638,713	35,980,938
Domestic production (1,000 dollars)	16,995,585	18,389,203
Total imports (net tons)	14,845,163	15,420,402
Change in employment (jobs)	(8025)	(5743)
Import price	$346.09	$389.67
Domestic price	$490.65	$511.08

1/ This figure includes an implicit share limit of 14.57 for VRA countries, calculated on the basis of established export limits and DRI forecast of U.S. consumption and an assumed 2.50 share for countries not covered by the VRA's (the same as in 1986).
2/ Derived from DRI forecasts of apparent consumption provided to the Office of Agreements Compliance, International Trade Administration, U.S. Department of Commerce.
3/ The share of domestic production is obtained by multiplying apparent consumption by (1 minus import share).
4/ Expressed in terms of value by multiplying the quantity of domestic production by an estimate of the unit value. The unit values for domestic production and for imports were proxied by the latest comparable information contained in Annual Survey Concerning Competitive Conditions in the Steel Industry and Industry Efforts to Adjust and Modernize, USITC Publication 1881, September 1986. See table D-2, p. 103.
5/ Total imports are calculated on the basis of the forecasted import share (17.07) and the DRI forcast of the 1987 U.S. apparent consumption.
6/ Estimated 1987 unit value for domestic production. Proxied by the latest comparable information contained in Annual Survey Concerning Competitive Conditions in the Steel Industry and Industry Efforts to Adjust and Modernize, USITC Publication 1881, September 1986. See table D-2, p. 103.

Summary of results:

Case 1: Effect of the VRA's under the assumption that the underlying "free-trade" import penetration level is 20.33 percent (see table O-2).

Under this assumption, the price of imports under the VRA's increases by 5 to 9 percent, whereas domestic price rises only by 0.05 to 1 percent. Consumption declines by approximately 1 percent; domestic production increases by approximately 2 to 4 percent and sales revenue rises by 2 to 5 percent. On the basis of an estimated workforce of 90,000, employment gains range from 2 to 3 percent.

Case 2: Effect of the VRA's under the assumption that the underlying "free-trade" import penetration level is 25 percent (see table O-3).

In this case, the price of imports under the VRA's increases by 11 to 18 percent, whereas the domestic price increases by under 3 percent at the most. The price increase results in a decline in consumption between 2 and 4 percent. Domestic shipments increase by approximately 6 to 8 percent, and producers' sales increase by 6 to 12 percent. Under the VRA's, employment increases by 4 to 6 percent.

Case 3: Effect of the VRA's under the assumption that the underlying "free-trade" import penetration level is 30 percent (see table O-4).

Given an import penetration level of 30 percent, the enforcement of a 17.07 VRA restraint would result, according to the model, in an import price increase of between 19 and 34 percent. Domestic price would not increase by more than 4 percent and domestic consumption would decline by 4 to almost 8 percent. Domestic shipments would increase by 9 to 14 percent and sales revenue would increase by 10 to 19 percent. Gains in employment would amount to 6 to 9 percent.

Appendix P

International "Spot" Price Comparisons for Sheet Products

Table P-1
Spot steel price history: Hot-rolled coil, by periods, July 1981-May 1987

(U.S. dollars per net ton)

Period	United States 1/	Canada 2/	French/ German border	Japanese dealer	Japanese big buyer
1981:					
July..............	390	308	261	325	302
1982:					
March.............	370	307	359	301	305
July..............	340	337	327	290	297
December..........	320	258	243	288	315
1983:					
April.............	330	307	317	292	318
July..............	320	288	280	297	320
October...........	330	306	253	299	329
1984:					
January...........	344	307	230	311	329
May...............	360	295	248	321	329
September.........	365	284	237	297	314
1985:					
January...........	325	334	240	290	307
April.............	320	314	229	288	304
July..............	304	314	256	297	322
December..........	304	314	278	332	379
1986:					
April.............	330	310	298	347	425
July..............	320	312	288	362	470
September.........	334	315	280	375	477
December..........	334	319	256	334	454
1987:					
May...............	360	338	279	389	528
Percentage change May 1987 from December 1985.....	+18.4	+7.6	+.4	+17.2	+39.3

1/ U. S. prices reflect those spot prices in the midwestern market.
2/ Canadian prices reflect those spot prices in the eastern market.

Source: Compiled from pricing data published by World Steel Dynamics, Steel Price Trak #19-22.

Table P-2
Spot steel price history: Cold-rolled coil, by periods, July 1981-May 1987

Period	United States 1/	Canada 2/	French/ German border	Japanese dealer	Japanese big buyer
	U.S. dollars per net ton				
1981:					
July..............	470	370	327	397	361
1982:					
March.............	440	378	395	378	364
July..............	384	385	383	333	356
December..........	365	360	340	352	376
1983:					
April.............	380	405	370	368	381
July..............	410	371	354	379	383
October...........	420	405	338	384	391
1984:					
January...........	450	405	379	389	391
May...............	460	402	323	391	391
September.........	470	375	309	356	374
1985:					
January...........	390	410	295	345	365
April.............	380	394	293	338	362
July..............	380	394	334	362	383
December..........	368	394	361	422	452
1986:					
April.............	430	400	384	459	506
July..............	420	404	399	479	559
September.........	435	408	417	503	571
December..........	445	392	377	456	543
1987:					
May...............	460	440	431	531	631
Percent change...... May 1987 from December 1985.....	+25.0	+11.6	+19.4	+25.8	+39.6

1/ U. S. prices reflect those spot prices in the midwestern market.
2/ Canadian prices reflect those spot prices in the eastern market.

Source: Compiled from pricing data published by World Steel Dynamics, Steel Price Trak #19-22.

Table P-3
Spot steel price history: Galvanized steel, by periods, July 1981-May 1987

(U.S. dollars per net ton)

Period	United States 1/	Canada 2/	French/ German border	Japanese dealer	Japanese big buyer
1981:					
July..............	560	473	375	532	429
1982:					
March.............	564	479	476	505	433
July..............	500	470	459	464	417
December..........	440	477	424	491	441
1983:					
April.............	473	470	450	497	446
July..............	440	454	450	499	448
October...........	580	485	401	510	458
1984:					
January...........	580	500	368	510	458
May...............	595	500	363	532	458
September.........	580	502	331	487	437
1985:					
January...........	570	452	336	475	427
April.............	560	467	363	472	424
July..............	542	482	405	499	449
December..........	570	482	452	589	529
1986:					
April.............	629	486	473	660	593
July..............	610	440	487	729	655
September.........	640	469	507	767	667
December..........	640	464	480	729	634
1987:					
May...............	620	476	517	849	739
Percentage change May 1987 from December 1985.....	+8.8	-1.2	+14.4	+44.1	+39.7

1/ U. S. prices reflect those spot prices in the midwestern market.
2/ Canadian prices reflect those spot prices in the eastern market.

Source: Compiled from pricing data published by World Steel Dynamics, Steel Price Trak #19-22.