Publication 4440

The Economic Effects of Significant U.S. Import Restraints

Eighth Update 2013

Special Topic: Services' Contribution to Manufacturing

Investigation No. 332-325

United States
International Trade
Commission

December 2013

U.S. International Trade Commission

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ACRONYMS

3-D	3-dimensional
AVE	ad valorem equivalent
BEA	Bureau of Economic Analysis (USDOC)
BLS	Bureau of Labor Statistics (USDOL)
CAD	computer-aided design
CAFTA-DR	U.S.-Central America-Dominican Republic Free Trade Agreement
CAM	computer-aided manufacturing
C.F.R.	Code of Federal Regulations
CGE	computable general equilibrium
CY	calendar year
EDA	electronic design automation
EIA	Energy Information Administration (USDOE)
ERP	enterprise resource planning
ERS	Economic Research Service (USDA)
EU	European Union
fab	semiconductor fabrication facility
FAO	Food and Agriculture Organization of the United Nations
FAS	Foreign Agricultural Service (USDA)
FCC	U.S. Federal Communications Commission
FDI	foreign direct investment
FDIC	Federal Deposit Insurance Corporation
FTA	free trade agreement
FY	fiscal year
GDP	gross domestic product
GSP	Generalized System of Preferences
GTIS	Global Trade Information Services, Inc.
GVC	global value chain
H.R.	House of Representatives
HTS	Harmonized Tariff Schedule of the United States
ICT	information and communications technology
INDA	Association of the Nonwoven Fabrics Industry
I-O	input-output
IT	information technology
ITA	International Trade Administration (USDOC)
KLEMS	capital, labor, energy, materials, and purchased services
LINC	Leaders in Innovation and Nonwovens Commercialization
MFA	Multifiber Arrangement
MILC	milk income loss contract
MNC	multinational company
mtrv	metric tons, raw value
mt	metric ton(s)
NWI	Nonwovens Institute
MY	marketing year

ACRONYMS—*Continued*

NAFTA	North American Free Trade Agreement
NAICS	North American Industry Classification System
NASS	National Agricultural Statistics Service (USDA)
n.e.c.	not elsewhere classified
NIPA	national income and product accounts
NTR	normal trade relations
ODC	other duty or charge (fuel ethanol imports)
OECD	Organisation for Economic Co-operation and Development
OES	Occupational Employment data Statistics
PPP	purchasing power parity
PTA	preferential trading agreement
R&D	research and development
ROOs	rules of origin
SaaS	software-as-a-service
SCP	sugar-containing product
strv	short tons, raw value (sugar)
TRQ	tariff-rate quota
USAGE	U.S. Applied General Equilibrium (economic model)
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USDOC	U.S. Department of Commerce
USDOD	U.S. Department of Defense
USDOE	U.S. Department of Energy
USDOL	U.S. Department of Labor
USITC	U.S. International Trade Commission
USTR	U.S. Trade Representative
WEF	World Economic Forum
WIOD	World Input-Output Database
WTO	World Trade Organization

Executive Summary

This is the eighth update of *The Economic Effects of Significant U.S. Import Restraints.* During the more than 20 years since this series of reports began, U.S. tariff and nontariff measures on imports have fallen, and trade has expanded markedly. Over this period, the U.S. services sector has also increased in importance considerably, in both absolute and relative terms, with important implications for other sectors of the economy. The contribution of services to U.S. manufacturing is the subject of a special-topic chapter in this report.

The United States is one of the world's most open economies. In 2012, the average U.S. tariff on all goods remained near its historic low of 1.3 percent on an import value-weighted basis—essentially unchanged from the previous update in 2011. Nonetheless, significant restraints on trade remain in certain sectors. The U.S. International Trade Commission (Commission) estimates that U.S. economic welfare, as defined by total private consumption, would increase on average by about $1.1 billion annually relative to the 2012–17 baseline calculated by the Commission if the United States unilaterally ended ("liberalized") all the significant restraints quantified in this report. Exports and imports would both expand by about $6.2 billion. These changes would result from removing import barriers affecting cheese, sugar, canned tuna, textiles and apparel, and certain high-tariff manufacturing sectors.[1] Restraints on the services sectors are discussed qualitatively.

Effects of Significant Import Restraints

As in previous updates, this report uses an economic model of the U.S. economy to analyze the economic effects of removing remaining significant U.S. import restraints. Sectors with significant import restraints, such as high tariff rates and restrictive "quantitative restraints," such as tariff-rate quotas (TRQs), were identified by Commission staff. Among agricultural products, the most restrictive restraints are currently applied to sugar. Among manufactured goods, the most restrictive restraints are in the textile and apparel sectors.

Removal of All Significant Restraints

As noted above, the Commission estimates that simultaneous liberalization of all significant import restraints quantified in this report would increase annual U.S. welfare by $1.1 billion per year by 2017 (table ES.1). This figure is substantially lower than the estimated welfare increase in the previous (2011) update, which was $2.6 billion;[2] most of this change is due to the elimination of a major U.S. import restraint on ethanol in 2011. This result is in line with recent Commission studies of the gains from liberalization: the Commission's estimates have trended downward as U.S. tariffs and quantitative restraints have been liberalized over the duration of the *Import Restraints* report series (figure ES.1).

[1] These include ball and roller bearings, ceramic and glass products, cigarettes, costume jewelry, footwear and leather, hand and edge tools, pens and mechanical pencils, residential electric lighting fixtures, and synthetic organic dyes.

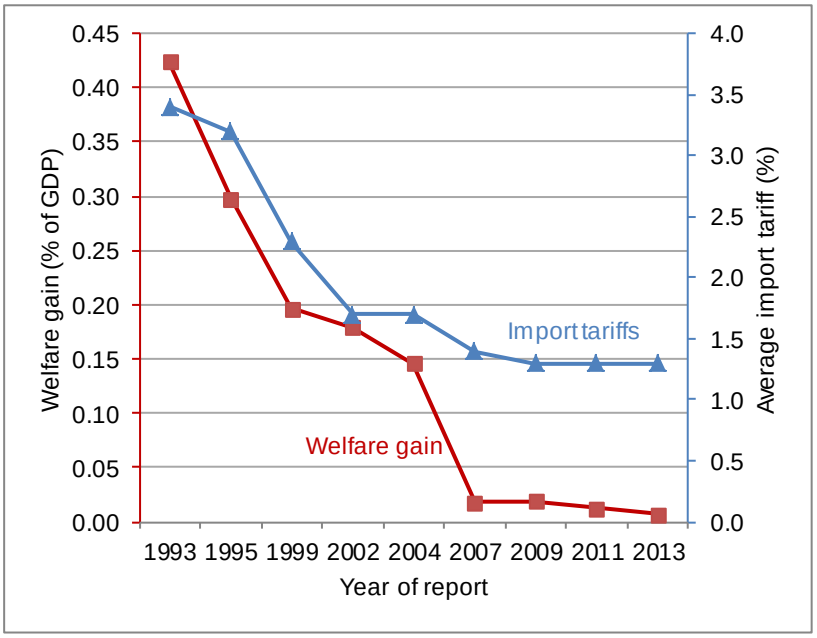
[2] As a percentage of U.S. GDP both estimated welfare gains are small (less than 0.05 percent).

TABLE ES.1 Average annual welfare gains from liberalizing significant import restraints relative to the model's baseline projection, million $, 2012–17

Sector	Change in economic welfare
Simultaneous liberalization of all significant restraints	1,126.3
Individual liberalizations	
Cheese	49.5
Sugar	276.6
Tuna	7.7
Textiles and apparel	483.4
Ball and roller bearings	–3.5
Ceramic and glass products	52.5
Cigarettes	139.5
Costume jewelry	5.3
Footwear and leather products	114.8
Hand and edge tools	7.1
Pens and mechanical pencils	–2.0
Residential electric lighting fixtures	–18.6
Synthetic organic dyes	–1.4

Source: Commission estimates.

FIGURE ES.1 Tariff rates and estimated welfare gains from liberalization have fallen over the life of the report, 1993–2013



Sources: USITC DataWeb/USDOC (December 10, 2012); Commission estimates.

Notes: The average tariff is the import-weighted tariff across all imports. The year of the report does not represent the year modeled. The current update (2013), for example, projects the U.S. economy to 2017. Although the data indicate a downward trend, the data may not be directly comparable across years, as the model and scope of analysis have been updated for each report.

By contrast with the previous update, this report does not include ethanol, tobacco, and certain dairy products as sectors with significant restraints. The exclusion of ethanol, which accounted for more than half of the welfare gain from liberalization in the previous update, reflects the expiration of the "other duty or charge" (ODC) on fuel ethanol imports at the end of 2011. Imports of tobacco and dairy subject to TRQs, as discussed in the previous update, have continued to decline in recent years, which has resulted in much less restrictive TRQs that are far from being filled. As a result, tobacco and most dairy products—aside from cheese—have not been included as sectors with significant restraints in this update.

Effects of Sector-by-Sector Liberalization

The Commission report examines each sector that has significant import restraints in order to estimate the economic effects of import liberalization (1) on U.S. consumers, producers, and workers in the sector, and (2) on related (upstream and downstream) sectors. A summary of the key results for each sector is provided below. Liberalization effects are reported relative to the baseline projected through 2017.

Textiles and apparel

The Commission estimates that liberalizing import restraints in textiles and apparel would increase welfare by $483.4 million. This value is very close to the estimate in the previous update, as little has changed with respect to restraints. Liberalization would reduce both shipments and employment in this sector by approximately 14 percent. Imports of textiles and apparel would increase by 2.9 percent.

Cheese

Liberalization of import restraints in cheese is estimated to increase U.S. welfare by about $49.5 million. The prior report estimated gains for the entire dairy segment and did not provide a welfare number for cheese alone. U.S. cheese shipments and employment are each expected to decline by 1–2 percent, while imports of cheese would increase by 40 percent.

Sugar

Removing tariffs and TRQs on imports of raw and refined sugar is estimated to increase welfare by $276.6 million. This is a significantly higher welfare gain than in the previous update, reflecting a projected larger gap between the domestic and world prices of sugar by 2017. Imports of raw and refined sugar would increase by 43 percent, while total U.S. shipments of sugar would decline by more than 14 percent. On the other hand, exports would increase by more than 18 percent. U.S. confectioners, benefiting from the decline in refined sugar prices, would increase shipments and exports by a small amount.

Canned tuna

Ending import restraints on canned tuna would increase welfare by $7.7 million, which is less than the estimated gain in the previous update. Imports of canned tuna would increase by 5 percent. U.S. shipments and employment would each fall by 5 percent.

Other high-tariff sectors

Nine other sector groupings were identified as subject to relatively high tariffs. The welfare effects of eliminating these tariffs are

estimated to range from a gain of $139.5 million for cigarettes to a loss of $18.6 million for residential electric lighting fixtures. Taken together, the gains in these high-tariff sectors are comparable in size to those estimated in the previous update. All sectors are expected to see increased imports and exports, lower shipments and employment, and lower consumer prices.

Services

The United States is very open to the imports of services from other countries. Nonetheless, some U.S. measures remain in place. The report describes import restraints in services qualitatively, with a focus on restraints in commercial banking and telecommunications. Regulations on foreign commercial banking in the U.S. market include minimum deposits by U.S. citizens and residents, and citizenship and residency requirements for board members. In telecommunications services, the main restraints relate to ownership limits on foreign investors.

Services' Contribution to Manufacturing

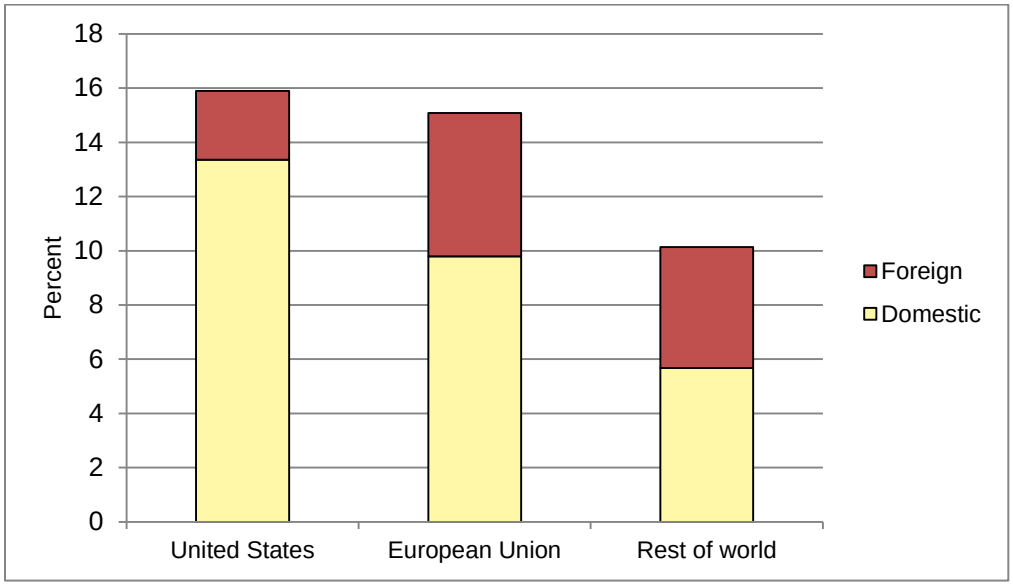
A strong and dynamic services economy can benefit manufacturers as they integrate services into their activities. More and more, manufacturing relies on services at every stage of the value chain, from product design and market research to warehousing and distribution. This increasingly important role of services reflects, in large part, how manufacturers have responded to the pressure of global competition and the opportunities presented by technological innovations.

A review of the literature highlights some of the competitive reasons driving the growing role of services in manufacturing in recent times. These include more widely distributed production networks or supply chains to take advantage of geographic specialization; the adoption of advances in information and communications technology to cut costs and improve efficiency; and the integration of services into marketed products to make them stand out from their competitors and strengthen customer relationships.

The United States has the world's largest services economy and one of the highest shares of services in its gross domestic product in the world. Business services in particular—those that are predominantly purchased by other businesses—have grown rapidly relative to other sectors of the economy. International data on value added shows that U.S. manufacturers are among the most intensive users of business services worldwide (figure ES.2). Business services have also benefited from significant innovations that, in turn, may enhance the productivity of the services users, many of which are manufacturers. The idea that innovative services are improving users' productivity is supported both by the data and by the case studies conducted for this study.

While many accounts point to a heavier reliance on services by U.S. manufacturing, the picture arising from recent trends in the data is more muted, partly reflecting some measurement issues. Although the levels of services use in manufacturing remain significant, the changes in various measures of services intensity are small. Nevertheless, certain patterns emerge. Both the value of certain services embedded in manufacturing and the use of services workers in manufacturing are increasing over time. Manufacturing sectors that are intensive users of business services—such as information services,

FIGURE ES.2 Business services' contribution to manufacturing value added by country, 2008



Sources: WIOD; Commission estimates.

Note: Foreign business services for the European Union (EU) include intra-EU trade in business services.

financial services, and professional services—also tend to employ business services workers more intensively within their operations. Moreover, the manufacturing sectors that have been using more business services as intermediate inputs have, on average, experienced higher productivity gains. Finally, the use of foreign business services inputs is currently small but growing rapidly.

Case studies in three selected manufacturing industries—semiconductors, medical devices, and performance textiles—illustrate the types of business services that have yielded efficiency improvements, lowered costs, and improved customer relationship management for manufacturing sectors.

The semiconductor case study describes services early in the design and testing stages that are important for this industry. Specialized software and engineering services enable designers in the semiconductor industry to leverage prior knowledge, thereby reducing costs. The case study also illustrates services provided by equipment manufacturers that enhance their relationship with their semiconductor customers.

The medical devices case study focuses on the use of software-enabled services to upgrade process efficiency. This case study illustrates the extensive use of services throughout the production process, as software-enabled services provide efficiency improvements at every stage of the value chain.

Finally, the performance textiles case study explores ways that services have been used to boost competitiveness within a sector that is facing substantial foreign competition. Research and development services have been key to this industry to improve efficiency, while allowing the development of niche products.

CHAPTER 1
Introduction

Overview

This is the eighth update in the series of reports entitled *The Economic Effects of Significant U.S. Import Restraints*. Since 1989, when the U.S. International Trade Commission (Commission or USITC) began investigating this topic,[1] U.S. import restraints have imposed increasingly smaller costs on the U.S. economy in terms of net economic welfare, output, employment, and trade. Estimates in this eighth update remain consistent with these trends. The current estimate of the total cost to U.S. consumers of all significant U.S. import restraints is approximately $1.1 billion per year, down sharply from $2.6 billion in the previous update in 2011.[2] The estimated effects on specific U.S. sectors of removing the remaining restraints—a process known as "liberalization"—are also generally lower than in the seventh update.

As in the previous update, this total cost estimate does not include the cost of significant restraints on services imports into the United States, which are difficult to quantify. However, although certain restraints remain in place, as noted in this report, the United States is one of the economies most open to services trade and is the world's largest importer of services. At the same time, the United States is the world's largest exporter of services and has the world's largest services trade surplus. In fact, the United States' strong domestic services sector accounts for the majority of U.S. economic activity, in terms of both value added and employment.[3]

A strong services economy can create unique opportunities for U.S. manufacturers, as they have access to high-quality and innovative business services that enable innovation and productivity. The role of services in U.S. manufacturing is the subject of this report's special topic.[4]

Scope and Organization of the Report

The rest of this chapter describes the scope of the next two chapters in the report and the methodological approaches used in each.

Chapter 2 provides updated estimates of the economic effects of liberalizing significant U.S. import restraints on U.S. firms, workers, and consumers. It also assesses the increase in net economic welfare from this liberalization. As discussed in the original letter by the

[1] The United States Trade Representative (USTR) originally requested this series of reports in May 1992. Before this series of investigations, the Commission conducted a similar study in three phases for the U.S. Senate Committee on Finance during 1989–91.

[2] USITC, *Import Restraints*, 2011, ix. The welfare value of $1.1 billion in this report represents the average annual cost of significant import restraints in 2012–17, measured in 2011 dollars. In the previous report, the cost was for 2015, measured in 2005 dollars.

[3] Services accounted for 82 percent of U.S. GDP in 2011 and 85 percent of total U.S. employment.

[4] In November 2012, the USTR, in addition to requesting an eighth update of this report, requested an overview of the role of services in manufacturing. See appendix A for facsimiles of both the 1992 and 2012 request letters.

U.S. Trade Representative (USTR) requesting this investigation, this report considers all U.S. import restraints except those originating from antidumping or countervailing duty investigations, section 337 or 406 investigations, or section 301 actions. The quantitative analysis in this report concentrates on measures that are applied at the border, such as tariffs and tariff-rate quotas (TRQs) applied to imports of goods.[5] Restraints on imports of services are discussed qualitatively.[6]

Chapter 2 focuses on the sectors with the most restrictive restraints. As indicated in the next section, this report defines "restrictive import restraints" as those that increase the price of imports or limit their quantity, including tariffs, quantitative restraints, and preferential rules of origin.[7] Historically, the most restrictive barriers have occurred in a fairly consistent list of sectors. Table 1.1 presents the sectors that produce goods identified as subject to significant import restraints for the purpose of this update.

Unlike the previous update, this update does not include ethanol, tobacco, and certain dairy products as sectors with significant restraints. Ethanol has been dropped because of the expiration of the "other duty or charge" (ODC) on fuel ethanol imports at the end of 2011. A decline in imports of tobacco and dairy products subject to TRQs, already noted in the previous update, has continued in recent years, resulting in much less restrictive TRQs that are far from being filled.[8] As a result, out of this group of products, only cheese is still considered to have significant restraints in this update.

Based on their high tariffs, residential lighting fixtures and synthetic organic dyes are two sectors included in the present analysis that were absent from previous *Import Restraints* studies. While there have been no policy changes in these sectors, they are identified as significant in this update because the Commission was able to make use of more detailed tariff data in making its analysis.[9]

Chapter 3, as requested by USTR, provides an overview of trends in U.S. manufacturers' use of services and in services' contribution to manufacturing output and productivity, as well as a description of manufacturing industries that may have experienced the biggest changes in this area. The chapter also examines the importance of services to U.S. manufacturing relative to other countries, as well as the role of foreign services use in U.S. manufacturing.

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[5] These measures are described later in this chapter.

[6] Restrictions on trade in services tend to be nontariff measures, which are often applied "behind the border" and so are harder to quantify. Researchers have begun to model services restraints and nontariff measures in computable general equilibrium models, which is the type of model used in this report. Some studies show large gains from liberalizing these restraints, but the results are highly variable, and there is no consensus on the best way to measure such restraints. See USITC, *Import Restraints*, 2009, 101–7.

[7] Preferential rules of origin determine whether a product is eligible to receive preferential access (reduced rates of duty) under free and preferential trade agreements. Globally, preferential rules of origin for apparel are the most restrictive, and impose the highest costs, because they have the most stringent eligibility requirements. Examples include requirements that a minimum share of value must be added in the country of origin (the country exporting the apparel) or that a "substantial transformation" of the product must occur in that country.

[8] See the discussion below on TRQ restrictiveness and fill rates.

[9] Tariff ad valorem equivalents (AVEs) in previous updates were calculated for each input-output (I-O) industry code in the benchmark I-O data. These I-O industry codes correspond to industries in the North American Industry Classification System (NAICS), but at varying levels of aggregation. Tariff AVEs in this update were calculated for each NAICS 6-digit industry. For example, synthetic organic dyes (NAICS code 325132) are part of synthetic dyes (32513) in the I-O data, which also include inorganic dyes (325131). While synthetic organic dyes are subject to significant tariffs, inorganic dyes are not.

TABLE 1.1 Restrictiveness of U.S. import restraints, percent increase in price of imports due to restraints, 2017

Sector	U.S. tariff[a]	U.S. TRQ[b]	Total[c]
Food and agriculture			
Cheese	7.3	5.4	13.1
Sugar	0.5	23.1	23.7
Tuna	11.7	0.0[d]	11.7
All textiles and apparel			
Yarn, thread, and fabric	5.0	0.0	5.0
Textile products	5.8	0.0	5.8
Apparel	12.2	0.0	12.2
Other manufacturing sectors			
Ball and roller bearings	5.8	0.0	5.8
Ceramic and glass products	4.6	0.0	4.6
Cigarettes	7.3	0.0	7.3
Costume jewelry	7.2	0.0	7.2
Footwear and leather products	9.6	0.0	9.6
Hand and edge tools	4.3	0.0	4.3
Pens and mechanical pencils	5.2	0.0	5.2
Residential electric lighting fixtures	5.0	0.0	5.0
Synthetic organic dyes	4.9	0.0	4.9

Source: USITC DataWeb/USDOC (accessed February 20, 2013) and Commission estimates based on tariff rates and TRQ commitments in the USAGE model projection for 2017.

Note: The table provides projected 2017 tariff and TRQ values, which may differ from their 2012 values. For example, projected tariffs may be below their 2012 values because of staged reductions in tariffs prescribed by U.S. trade agreements.

[a]Measured as an ad valorem equivalent share of the cargo, insurance, and freight (c.i.f.) value of imports.
[b]Measured as an export tax equivalent—that is, the degree to which a TRQ increases the "export price" of a commodity (defined as the price before entry into the United States).
[c]The total effect includes the interaction of tariffs and TRQs, and in some cases may exceed the sum of these effects.
[d]Imports of canned tuna packed in water are subject to a TRQ. Because the quota allocation is small, most imports are subject to the over-quota duty rate. See chapter 2.

Approach

This report uses substantially different analytical approaches to explore its two main topics. The analysis of significant import restraints in chapter 2 is largely based on an economic model that examines the effect of liberalizing significant import restraints in a medium-term economic projection to 2017. The overview of services' contribution to manufacturing in chapter 3 draws extensively on existing literature and case studies. Chapter 3 also measures the role of services in manufacturing based on available input-output (I-O) and occupational data. The differences in approach reflect the different objectives specified for the two topics in the original request letter and the letter for the current update, which asked for a detailed model-based examination of import restraints paired with an accessible overview of services' contribution to manufacturing. Both

chapters benefited from testimony presented during the Commission's public hearing on March 19, 2013, and written submissions from interested parties.[10]

Significant Import Restraints

To model the effects of a hypothetical trade policy liberalization in chapter 2, this update uses the U.S. Applied General Equilibrium (USAGE) model used in previous updates.[11] As its name indicates, this is a single-country model of the U.S. economy that incorporates the linkages among different economy sectors, consumers, the government, and foreign economies. These linkages enable the Commission to model the effect that trade policy changes can have on different, but interrelated, parts of the U.S. economy.

This update's analytical framework relies on annual I-O data for the United States as opposed to the I-O benchmark data used in the previous updates, which are estimated for every five-year period and released with delays.[12] Having up-to-date I-O information is useful, for example, when significant technological changes or macroeconomic shocks may have changed economic interactions among sectors in a relatively short time. The annual data, however, are reported at an aggregated level, so that some sectors central to this investigation had to be disaggregated from these accounts.[13]

The analysis of U.S. import restraints proceeds in three steps. These steps include (1) identifying sectors with significant restraints; (2) projecting the U.S. economy to 2017 to provide a baseline against which to measure the effects of liberalization; and (3) simulating the extent to which liberalizing the significant restraints will affect the trends present in the projected U.S. economy.

Tariff rates are the first, and simplest, criterion used to identify sectors having significant restraints. The analysis uses a standard statistical measure to determine large differences from the average level. For the purpose of the analysis in chapter 2, tariff rates are considered significantly restrictive if they exceed the average tariff by one standard deviation, which for 2012 included sectors with tariff rates greater than 4.1 percent.[14] Most sectors shown in table 1.1 were identified because of high tariffs.

In addition to tariff rates, selection is also based on the restrictiveness of TRQs for those sectors that are subject to them. A TRQ is a method of trade protection under the World Trade Organization (WTO) Agreement on Agriculture that imposes a relatively low "in-quota" tariff rate on imports of specific goods from specific countries until an annual allocation is met. Any imports beyond the TRQ allocation are subject to higher over-quota tariff rates. In the model, restrictiveness is measured by the amount that TRQs raise the prices of imported goods, which is largely determined by three factors: the over-quota tariff rate, the gap between U.S. and world prices, and the "fill rates" or the extent to which imports from specific sources approach or exceed their quantity allotments. As with tariffs, not all sectors subject to TRQs were deemed to have significant restraints.

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[10] See appendixes C and D.

[11] For an overview of the USAGE framework, see appendix E and USITC, *Import Restraints*, 2009, appendix E. For a complete specification of the model see Dixon and Rimmer, "USAGE-ITC," 2002.

[12] During the period of this investigation the latest benchmark data available are for 2002, while annual I-O data are available for up to 2011.

[13] See appendix E for a description of these sectoral splits.

[14] In detail, the average tariff rate among all NAICS 6-digit industries was 1.3 percent ad valorem based on the cost, insurance, and freight (c.i.f.) import value, and the standard deviation was 2.8 percent.

As noted above, the simulation analysis begins by generating a projection of the U.S. economy to 2017 to provide a baseline against which the effect of liberalizing significant import restraints can be compared. The projection uses the most up-to-date forecasts by other U.S. government agencies and international organizations to forecast the macroeconomy to 2017 and to project key U.S. macroeconomic variables such as consumption, investment, government spending, and imports and exports, as well as world gross domestic product (GDP). Using these macroeconomic projections, the model also generates baseline projections of output, employment, trade, and prices in each of the sectors of the model. These sectoral projections are further refined for the individual sectors that appear in this report, using forecasts from government and industry sources, as available, and observed industry trends.[15]

The baseline assumes that current U.S. import restraints will remain in place. At the same time, however, it incorporates known trade policy adjustments, such as changes to tariff rates and TRQ quantity allocations contained in tariff staging schedules[16] in U.S. free trade agreements (FTAs) and other trade agreements, as well as provisions of preferential trade arrangements (PTAs). These agreements provide the projected values of trade policy variables (such as tariff rates and TRQ fill rates) through 2017.[17]

For each product, the projected restrictiveness of the TRQs depends on the projected gap between U.S. and world prices as well as projected fill rates, which are specific to each exporting country. For many products, both price gaps and fill rates have declined in recent years, a trend that has made the TRQs less restrictive than in previous updates of this report and has reduced their effect on U.S. prices and net economic welfare. Table 1.1 summarizes the restrictiveness of import restraints in each sector in the model projection for 2017. The cheese, sugar, and apparel sectors have the most restrictive restraints in terms of their estimated ad valorem equivalents—i.e., the associated percentage increase in cost of the measure relative to the import price.

After the baseline projection is developed, the simulation can estimate the effects of liberalizing significant restraints, including tariffs, TRQs, and restrictive rules of origin. The liberalization of these restraints is modeled by setting the relevant tariffs to zero, removing TRQ quantitative restrictions, and removing preferential rules of origin in the textile and apparel sectors.[18] The model simulation solves for the new equilibrium with these changes in place. The simulation calculates new equilibrium values, consistent with supply and demand constraints, for all model sectors. This report, however, lists estimates for only the sectors of interest, along with key "upstream" and "downstream" sectors.[19]

Estimates of the effects of liberalizing each sector are presented relative to the baseline changes expected to take place through 2017. For example, U.S. manufacturers' shipments of cheese are projected to grow 13 percent between 2012 and 2017 in the absence of policy liberalization. Liberalization of cheese restraints would lower U.S. cheese shipments by about 2 percent, for an overall increase of approximately 11 percent

[15] Appendix E describes the sources and values of key macroeconomic variables and the sectoral baseline projections.

[16] U.S. FTAs require tariffs for certain products to be reduced by stages in accordance with "staging schedules."

[17] For imports from countries without such agreements, future tariffs and TRQ allotments are based on their 2012 values.

[18] Liberalizations of tariffs and TRQs directly affect imports into the United States. The removal of preferential rules of origin, in contrast, primarily affects U.S. exports by lowering foreign demand for U.S. inputs exported to U.S. FTA partners and preferential trading partners. See chapter 2 for details.

[19] An "upstream" sector provides output that is used as an input by a "downstream" sector.

through 2017. As the focus of this section is the economic effect of liberalization on consumers, firms, and workers, the key variables of interest are net economic welfare (i.e., the total purchasing power of U.S. consumers), shipments, and employment, in addition to imports and exports.

Services' Contribution to Manufacturing

The Commission used complementary approaches to develop the chapter on services' contribution to manufacturing. Unlike the import restraints analysis, the overview in chapter 3 involves no modeling. Instead, it reviews the literature on the role of services in manufacturing; describes publicly available data from sources including the U.S. Census Bureau, the U.S. Bureau of Economic Analysis, and the U.S. Bureau of Labor Statistics; examines statistics on the value of services embedded in manufacturing; and provides examples of the importance of services in manufacturing via case studies.

The chapter begins by examining the existing literature on the role of services in manufacturing. The discussion is particularly focused on changes in the economic environment in the last few decades. Information was gathered from a broad range of sources, including industry sources, academic research, government research, and the popular press.

Increased efficiency is a driving force behind increased use of services by manufacturing firms. Improved efficiency related to services use is assessed through the examination of productivity measures using available sectoral data.

Using similar sectoral data, broad patterns and trends of services inputs into manufacturing are discussed. Direct intermediate inputs of services into manufacturing are examined first; these are the services used by the manufacturing sector to complete their production. A second approach examines occupational data, which permits the analysis of the share of services workers within a manufacturing sector. This perspective is complementary to direct intermediate inputs in that it serves as a proxy for the services production occurring within a firm, whereas direct intermediate inputs are largely produced outside the firm.[20]

Data on value added are also used to examine the value contributed by services to manufacturing. Value-added databases collect the value contributed by each sector, both directly via direct intermediate inputs and indirectly, through other sectors. For services that are primarily sold to other businesses, it is particularly important to look at services value added, as a large share of these business services gets embedded within other intermediate inputs used in manufacturing goods. A global input-output database[21] is used to place the U.S. data in global context and to assess the role of services trade in manufacturing.

The chapter concludes with three case studies—on semiconductors, medical devices, and performance textiles—that illustrate ways in which these industries are integrating services into their manufacturing activities.

[20] In the database that describes direct intermediate inputs, services that are produced within a firm but provided across establishments (locations) are counted as direct intermediate inputs. See Horowitz and Planting, "Concepts and Methods," 2006.

[21] The data used are taken from the World Input-Output Database (WIOD).

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CHAPTER 2
Effects of Removing Significant Import Restraints

Overview

This chapter examines the effects that removing significant U.S. import restraints would have on U.S. consumers, firms, and workers. Removing these barriers to trade is expected to increase domestic welfare, exports, and imports. At the same time, however, it is expected to reduce shipments and employment in the U.S. sectors in which the restraints are removed.

For each industry with a significant restraint, the chapter presents updates on market conditions, explains and evaluates the import restrictions, and assesses the effects of removing those restrictions. Estimates are produced by the dynamic USAGE model (discussed in chapter 1) and are assessed relative to a baseline of projected industry changes to 2017.[1] As in previous updates, the modeling analysis does not account for liberalization in the services sector.

The chapter first presents the effects of simultaneously liberalizing all sectors with quantified import restraints, and then presents the effects of individual liberalization of specific sectors. Not every sector with a significant restraint receives an individual write-up; those are reserved for sectors with multiple restraints or more complex restraints. Sectors affected chiefly by high tariffs are discussed together. Services import restraints are discussed qualitatively at the end of the chapter.

As mentioned in chapter 1, the estimated annual cost of the restraints (in net welfare terms[2]) is about $1.1 billion, far lower than the $2.6 billion annual cost estimated by the previous (2011) update. The lower estimate largely reflects the expiration of the "other duty or charge" (ODC) on fuel ethanol imports at the end of 2011. Liberalization of restraints on textiles and apparel accounts for a little less than half of the welfare gains estimated in this update (table 2.1).

Although the model estimates that the size of the effects will differ by sector, the mechanism of the effects in the markets for liberalized goods is broadly similar across sectors. Removing a measure such as a tariff-rate quota (TRQ) reduces the landed, duty-paid price of the affected U.S. import. The decline in the import price reflects the restrictiveness of the trade measure; eliminating a more restrictive measure will trigger a larger decline. To compete with lower-priced imports, U.S. producers of similar commodities will reduce their own prices. Some producers may go out of business due to increased competition so that domestic shipments and employment decline in these

[1] See chapter 1 and appendix E for more details about the analytical framework and the baseline projection.

[2] Net welfare in the model is measured as the difference in real private consumption between the baseline projection and the liberalization scenario. Real public consumption is held constant across the two simulations and therefore contributes no change to total consumption.

TABLE 2.1 Average annual welfare gains from liberalizing significant import restraints relative to the model's baseline projection, million $, 2012–17

Sector	Change in economic welfare
Simultaneous liberalization of all significant restraints	1,126.3
Individual sector liberalizations	
Cheese	49.5
Sugar	276.6
Tuna	7.7
Textiles and apparel	483.4
Ball and roller bearings	–3.5
Ceramic and glass products	52.5
Cigarettes	139.5
Costume jewelry	5.3
Footwear and leather products	114.8
Hand and edge tools	7.1
Pens and mechanical pencils	–2.0
Residential electric lighting fixtures	–18.6
Synthetic organic dyes	–1.4

Source: Commission estimates.

industries; remaining U.S. producers of the good will become more competitive in the world economy and increase exports.

Users of the liberalized good benefit from these changes. As the prices of imported and domestic goods fall, consumption of the liberalized good increases. Consumers benefit because they can continue to buy the same quantity of the good at a lower price and have money remaining for other uses. Producers who use the product as an input become more competitive in both domestic and foreign markets. Overall, the gains typically outweigh the costs, although there are distributional effects. For example, workers employed in import-competing industries face the prospect of job loss and lower wages. Households broadly benefit from lower-cost consumption, but not every household gains. Those facing dislocation bear greater costs, barring any special assistance that they may receive. The same distributional effects hold for capital owners (owners or investors in firms) in different sectors of the economy.

As noted in chapter 1, estimates of the effects of liberalizing each sector are presented relative to the baseline changes expected to take place through 2017. For example, U.S. shipments of cheese are projected to grow 13 percent between 2012 and 2017 in the absence of policy liberalization. Liberalization of cheese restraints would lower U.S. cheese shipments by about 2 percent, for an overall increase of approximately 11 percent through 2017.

Effects of Removing All Significant Import Restraints

Effects of Liberalization on the Aggregate Economy Relative to Projected Trends

As the U.S. and global economies continue to emerge from the global recession, the model baseline projects an increase in gross domestic product (GDP) of 14.8 percent over

2012–17, or an average annual compounded growth rate of 2.3 percent per year. Employment is expected to grow more slowly, at 8.8 percent over the period. Trade will grow more briskly (table 2.2).

Eliminating the significant import restraints identified in the model is expected to increase economic welfare by $1,126.3 million on average over the period 2012–17 (table 2.1). Equilibrium employment in 2017 is expected to decline slightly relative to the benchmark, and 2017 GDP is expected to rise slightly—both by less than 0.05 percent (table 2.2). Imports are estimated to expand by 0.2 percent in 2017, while exports are expected to rise slightly faster, by 0.3 percent (table 2.2).

Effects of Liberalization on Individual Sectors Relative to Projected Trends

When all significant U.S. import restraints are eliminated at once, almost all liberalized sectors show the expected patterns of declining domestic shipments and employment, with increases in both imports and exports (table 2.3).[3] Among liberalized sectors, the largest proportional effects on shipments are seen in the textile and apparel sectors, which show declines of between 6.3 and 22.8 percent. Employment and shipments contract for most liberalized sectors. Imports of cheese, sugar, and cigarettes are all expected to respond strongly, due to the relatively high level of barriers removed for these goods.[4] With the exception of the textile and apparel sectors, exports from the liberalized sectors are expected to rise, though less than imports. Textile and apparel exports are expected to decline substantially, amplified by the removal of rules of origin requirements under full liberalization; yarn, thread, and fabric imports decline, driven by the contraction in demand from the apparel sector, while imports of textile products and apparel rise in response to liberalization.

Cheese

The cheese industry is an important component of the U.S. dairy industry, with roughly one-third of U.S. milk supplies annually going to produce cheese.[5] The value of cheese shipments in 2012 is estimated at about $36 billion, almost 30 percent higher than shipments in 2009 at $28 billion (table 2.4). Cheese manufacturing supports between 40,000 and 50,000 employees, with Wisconsin and California by far the leading producing states, followed by Idaho, New York, and New Mexico. Excluding changes in stocks, U.S. cheese consumption grew 8 percent annually between 2009 and 2012 (26 percent over the period), with mozzarella and cheddar the most popular cheese types.

[3] The effects of liberalizing all significant import restraints at once are broadly consistent with the effects (shown in later tables) of liberalizing restraints one sector at a time. However, they may differ slightly because of broader general equilibrium effects or linkages between liberalized sectors. For instance, shipments of synthetic organic dyes would fall by 3.1 percent in the simultaneous liberalization, while they would contract by somewhat less in the individual sector liberalization. Synthetic organic dyes are used as intermediate inputs by textile products. Thus, in the case of simultaneous liberalization, the effect on shipments of synthetic organic dyes reflects both the direct effects on dyes and the reduced demand for dyes by textile producers.

[4] See table 1.1 for information on the restrictiveness of the import restraints.

[5] About one-third of the milk is processed into fluid milk and cream products, one-third into cheese, and the remaining one-third into all other manufactured dairy products, such as butter, ice cream, and yogurt.

TABLE 2.2 U.S. national economy: Summary data and simulation results

Item	Summary data				Projected change, 2012–17 (%)	Effect of liberalization (%)
	2009	2010	2011	2012		
	Million employees					
Employment[a]	130.9	129.9	131.5	133.7	8.8	(–)
	Billion $					
GDP	13,973.7	14,498.9	15,075.7	15,684.8	14.8	(+)
Imports[b]	1,976.2	2,356.1	2,662.3	2,744.0	18.9	0.2
Exports[b]	1,587.4	1,844.4	2,094.2	2,184.0	34.4	0.3

Sources: USDOC, BEA, National Economic Accounts (accessed July 18, 2013)*;* USDOL, BLS, Current Employment Statistics (accessed July 18, 2013); EIA, *Annual Energy Outlook*, 2012; Commission estimates for projection and liberalization.

Note: (+) and (–) denote a small positive or negative change of less than 0.05 percent.

[a]Employees on nonfarm payrolls.
[b]Including goods and services.

TABLE 2.3 Simultaneous liberalization of all significant restraints: Effect on liberalized sectors, percent, 2017

Sector[a]	Employment	Shipments	Imports	Exports
Food and agriculture				
Cheese	–1.7	–1.5	40.2	0.9
Sugar	–13.6	–5.4	42.0	17.9
Tuna	–5.2	–5.2	4.8	0.5
All textiles and apparel				
Yarn, thread, and fabric	–24.7	–22.8	–5.6	–52.7
Textile products	–5.6	–6.3	3.6	–29.0
Apparel	–7.8	–7.7	3.4	–7.9
Other manufacturing sectors				
Ball and roller bearings	–2.1	–2.2	3.0	2.1
Ceramic and glass products	–2.3	–2.2	4.9	1.6
Cigarettes	–0.5	–0.4	26.1	0.6
Costume jewelry	–3.6	–3.3	1.1	0.8
Footwear and leather products	0.2	0.1	1.2	1.0
Hand and edge tools	–2.5	–2.2	2.0	1.1
Pens and mechanical pencils	–3.3	–2.5	2.3	1.8
Residential electric lighting fixtures	–5.1	–4.6	2.5	1.2
Synthetic organic dyes	–4.0	–3.1	3.1	1.0

Source: Commission estimates.

[a]See appendix E for sector definitions.

TABLE 2.4 Cheese: Summary data and simulation results

Item	Summary data				Projected change, 2012–17 (%)	Effect of liberalization (%)
	2009	2010	2011	2012		
Employment (employees)	41,400	44,400	50,300	48,700[a]	6.1	–1.7
Shipments (million $)	28,053	33,222	37,388	36,110[a]	13.1	–1.5
Imports (million $)	1,010	966	1,076	1,094	12.0	40.2
Exports (million $)	437	701	967	1,120	21.7	0.4

Sources: USDOC, Census, Annual Survey of Manufactures 2010 (accessed May 16, 2013); trade data from USITC DataWeb/USDOC (accessed May 17, 2013); Commission estimates for projection and liberalization.

Notes: Projected changes are based on quantity trends. Effects of liberalization represent deviations from the projected changes. See appendix E for details and sector definitions.

[a]Commission estimate.

The U.S. dairy industry operates under a complex system of federal and state programs. Federal programs include domestic price supports, milk marketing orders, the national Milk Income Loss Contract program, the Dairy Export Incentive Program, and domestic and international food aid programs.[6] These programs aim to raise and stabilize dairy prices and producer incomes.

U.S. international trade in cheese is small relative to total domestic shipments. During 2009–12, imports remained fairly stable at about $1 billion annually. Close to 80 percent of U.S. cheese imports are from the European Union (EU), with an additional 10 percent jointly from Switzerland and Norway.

In contrast to imports, U.S. cheese exports saw rapid growth over this period, rising from $437 million in 2009 to $1.1 billion in 2012 for an annual growth rate of over 36 percent. In 2012, the United States for the first time became a net exporter of cheese due to increased demand abroad. Leading markets for U.S. cheese exports are Mexico, the Republic of Korea, and Japan.

Nature of Trade Restraints

The cheese sector is subject to relatively high average tariffs and the greatest number of quantitative restraints of any sector in this report, with nine separate cheese TRQs (table 2.5).[7] Some cheeses imported into the United States are not subject to TRQs, including cheese made of sheep and goat's milk (e.g., feta and roquefort), and they accounted for about 36 percent of the total value of U.S. dairy cheese imports in 2012. Cheese imports not subject to TRQs typically face low or moderate tariffs, most less than 10 percent ad valorem.

Cheese products that are subject to TRQs encompass about 131 of the dairy sector's 157 10-digit tariff classifications in the Harmonized Tariff Schedule of the United States (HTS). All nine TRQs have country-specific in-quota volume allocations. In-quota tariff rates on these products are generally below 10 percent ad valorem, while over-quota ad

[6] Details on these programs and their economic implications can be found at USDA, ERS, "Dairy Policy" (accessed May 16, 2013).

[7] U.S. domestic and trade policies for dairy products were developed in the 1930s in response to price declines in the Great Depression. As part of the agreement establishing the World Trade Organization (WTO) that went into effect on January 1, 1995, a system of TRQs replaced fixed import quotas that were inconsistent with WTO disciplines.

TABLE 2.5 Cheese import restraint overview, representative products and sources, 2012

Item, with selected sources	AVE tariff rate (%)		Imports (metric tons)		TRQ	
	In-quota[a]	Over-quota[b, c]	In-quota[a]	Over-quota[b, c]	Fill rate (%)	Allocation (metric tons)
Subject to TRQ						
Other cheese (note 16)	10	20–40	36,262	3,042	74.6	48,627
Blue mold cheese (note 17)	10–20	17–28	2,792	722	95.9	2,911
Cheddar (note 18)	10–16	15–27	8,450	1,344	68.0	12,423
New Zealand			310		3.8	8,200
Australia			220		9.0	2,450
EU			1,032		78.6	1,313
American-type incl. colby (note 19)	10–20	13–22	3	8	0.1	3,523
Edam and gouda (note 20)	10–15	23–37	5,481	163	80.4	6,816
Italian-type (note 21)	7.5–25	8–62	6,909	6,807	51.2	13,481
Argentina			2,005		31.4	6,383
EU			4,214		77.9	5,407
Gruyere-processed (note 22)	6.4–10	17–39	2,442	18	31.1	7,855
Other cheese—low fat (note 23)	10	15	3	102	0.1	5,475
Swiss and emmenthaler (note 25)	6.4	28	19,181	35	55.6	34,475
Norway			6,038		87.7	6,883
Switzerland			2,576		71.0	3,630
EU			10,340		45.2	22,900
Grand total			81,523	12,242	60.1	135,586

Not subject to TRQ	Total AVE tariff rate (%)	Total imports (metric tons)
Sheep's milk cheeses	0.1	24,015.70
Stilton	13.5	502.00

Source: USDA, FAS, *Dairy Monthly Imports*, January 2013.

[a]Commission estimate. Imports for specific countries may have entered under the "all other country" and free trade agreement (FTA) TRQs.
[b]Over-quota imports may enter under separate tariff lines.
[c]Excluding over-quota shipments from FTA partners that enter duty free.

valorem equivalent (AVE) rates averaged about 27 percent in 2012.[8] For some products, such as "other cheese" (note 16),[9] cheddar cheese (note 18), and Italian-type cheese (note 21), the quantity of over-quota imports is high compared to the quota quantity. For example, in 2012, over-quota imports for cheddar cheese and Italian-type cheese were 1,344 metric tons and 6,807 metric tons, respectively, even where fill rates—the ratio between actual imports under the quota and the allotted quota level—were significantly below 100 percent. Over-quota imports sometimes occurred for high-value cheese imports, such as Italian-type cheeses from Italy. In these cases, the over-quota specific tariff was lower than the in-quota rate on an ad valorem basis.[10] TRQ fill rates can reflect

[8] In-quota tariffs are ad valorem (i.e., a percentage of a good's total value), while over-quota tariffs are specific (i.e., dollars per kilogram).

[9] "Note" refers to notes in chapter 4 of the HTS. Each TRQ has a separate note, indicating the quota quantity and the specific 8-digit tariff subheadings that are covered by the quota.

[10] For example, included in the Italian-type cheese quota (note 21) is 0406.90.41 (romano, reggiano, parmesan, provolone, and provoletti), which has an in-quota tariff of 25 percent. The over-quota rate (0406.90.42) is $2.146 per kilogram, which, combined with an average unit value of $15.24 per kilogram in 2012, translates into an ad valorem equivalent tariff of 14.1 percent, less than two-thirds of the in-quota tariff. Over-quota imports, which do not require licenses, also may occur when importers without licenses are able to sell at a profit in the U.S. market.

the restrictiveness of restraints: the higher the fill rate, the more restrictive the restraint. In 2012, the fill rates rose above 75 percent only for blue mold cheese (note 17) and edam and gouda (note 20).[11] For two quotas, American-type cheese including colby (note 19) and "other cheese—low fat" (note 23), fill rates were negligible. Low quota fill rates can be explained by global market forces, such as rising demand in emerging markets.[12] Global dairy exporters, such as New Zealand, Australia, and to a certain extent the EU, have begun exporting to expanding markets in Asia and the Middle East rather than to the United States. As dairy prices offered by rapidly developing economies converge with and, at times, surpass U.S. prices, the United States is no longer always the destination market of choice. Instead, major dairy-exporting countries (including the United States) are responding to market signals by shifting sales to regions of the world with previously low consumption of dairy products. These trends are expected to continue through the medium term (and likely longer) and are reflected in the sector-specific forecasts for dairy products in the simulation.

Projected Industry Trends

U.S. shipments of cheese are projected to increase by 13.1 percent between 2012 and 2017, equivalent to about 2.5 percent annual growth (table 2.4). This increase is largely in response to high expected domestic demand for cheese owing to a rise in U.S. consumption of prepared foods and increasing consumption of food away from home.[13] At the same time, U.S. milk shipments are expected to rise over this time, reflecting higher output per cow from improved technology and animal genetics. With expected lower consumption of fluid milk, higher milk production will be used to produce processed dairy products, of which cheese is the most important in the U.S. market. Projected employment growth in the sector reflects the higher levels of future shipments.

Larger projected cheese shipments are also a response to continued growth of U.S. cheese exports. U.S. cheese exports are projected to increase by about 22 percent between 2012 and 2017, reflecting continued demand growth for U.S. cheese, particularly in Mexico and in a number of other markets, such as Asia, with high rates of population and per capita income growth. U.S. cheese imports are projected to rise by 12 percent, or 2.3 percent annually during 2012–17, consistent with expected trends in U.S. population and per capita income growth.

Effects of Liberalization Relative to Projected Trends

Liberalization of U.S. import restraints on cheese is expected to increase U.S. welfare by $297 million over the six-year period from 2012 through 2017, or an average of about $50 million per year (table 2.1). Liberalization is modeled by removing all TRQs and duties on this product. Table 2.4 shows the effects of this liberalization on U.S. trade, shipments, and employment. Ending U.S. import restraints on cheese is expected to lower the landed, duty-paid price of cheese, which would lead to a rise in imports of over 40 percent and to dips in domestic shipments of cheese (1.5 percent) and U.S. employment

[11] Even in cases where broad quota categories remain unfilled, TRQs can restrain imports if limits on quantities allowed from specific countries are filled and importers are forced to shift to other suppliers.

[12] Low fill rates can also reflect market conditions, such as weak domestic demand for imports or increases in dairy consumption and imports in third-country markets. USDA, FAS, *Dairy*, July 2013.

[13] USDA, *USDA Long-term Projections*, February 2013, 82.

in the cheese industry (1.7 percent). Cheaper imported cheese would induce a decline in U.S. domestic prices relative to world prices, leading to a small increase in exports of 0.4 percent. While the percentage rise in imports is quite high, the effect on domestic producers would be rather modest because of the low level of import penetration in the domestic cheese market.

Sugar and Sugar-Containing Products

The United States ranks fifth in the world in sugar consumption, accounting for 6 percent of global consumption, or 10.0 million short tons, raw value (strv) in marketing year (MY) 2012.[14] U.S. sugar consumption increased in terms of quantity at an annual average rate of about 1.5 percent during calendar years (CY) 2009–12, mainly the result of population growth.

Sugar is produced in the United States from both sugarcane and sugar beets.[15] The sugarcane sector comprises two distinct segments: sugarcane milling and raw cane sugar refining. First, sugarcane is milled to produce raw cane sugar. Raw cane sugar is then further refined at raw cane sugar refineries. Refined beet sugar, by contrast, is produced from sugar beets in a continuous process.[16] Refined beet sugar and refined cane sugar are virtually identical and are interchangeable in use. Refined sugar is used directly by consumers and as an input in the manufacture of a multitude of food items. Many of these food items are included in the sugar-containing products (SCP) sector.[17] While the primary focus of this section is the sugar sector, there is a secondary discussion of SCPs because of the quantity of sugar contained within these products.[18]

U.S. producers supplied approximately 76 percent of U.S. sugar consumption in MY 2012.[19] The value of U.S. sugar processing totaled $10.1 billion in MY 2012 (table 2.6). In terms of quantity, U.S. sugar production increased, from 7.5 million strv in MY 2009 to 8.5 million strv in MY 2012.[20] Annual variations in sugar production result largely from weather conditions that affect both sugar beet and sugarcane production. The sugar processing sector employed 11,700 workers in CY 2012. Such employment has been in a long-term decline resulting from industry consolidation. Employment in

[14] Data are on a marketing year basis, generally October of the previous year through September of the stated year. USDA, FAS, Production, Supply and Distribution Online (accessed July 11, 2013).

[15] Sugarcane and sugar beet production, which are respectively categories 111930 and 111991 in the North American Industry Classification System (NAICS), are not explicitly included in the sugar sector, as the import restraint is applied to the manufactured product. In addition, the United States does not trade in sugarcane and sugar beets. However, the import restraints affecting the sugar sector have an indirect effect on the production of sugarcane and sugar beets, as they are the primary inputs for sugar production. The Commission's USAGE model accounts for adjustments among sectors and addresses the impact of sugar import liberalization on the sugarcane and sugar beet sector, which is discussed in this report.

[16] The sugar processing industry appears in NAICS categories 311313 (beet sugar manufacturing) and 311314 (cane sugar manufacturing). Before 2012 cane sugar processing comprised distinct NAICS codes for sugarcane mills (311311) and cane sugar refining (311312). This report uses the new NAICS grouping for cane sugar.

[17] NAICS categories for SCPs include chocolate and confectionery manufacturing from cacao beans (31132); confectionery manufacturing from purchased chocolate (31133); nonchocolate confectionery manufacturing (31134); bread and bakery product manufacturing (31181); cookie, cracker, and pasta manufacturing (31182); and flavoring syrup and concentrate manufacturing (31193).

[18] Most of these SCPs are not covered by TRQs.

[19] USDA, ERS, Sugar and Sweetener Yearbook Tables (accessed April 1, 2013). Share is for domestic food and beverage use, raw sugar basis.

[20] USDA, ERS, Sugar and Sweetener Yearbook Tables (accessed July 11, 2013).

TABLE 2.6 Sugar: Summary data and simulation results

Item	Summary data 2009	2010	2011	2012	Projected change, 2012–17 (%)	Effect of liberalization (%)
Employment[a]	Employees					
Sugar crop farming						
Sugarcane farming	3,675	4,292	4,344	4,400	–22.5	–20.5
Sugar beet farming	1,544	1,654	1,724	1,800	–0.6	–19.2
Sugar processing[b]	12,859	12,161	11,887	11,700	–6.3	–13.8
Shipments[c]	Million $					
Sugar crop farming						
Sugarcane	992	969	1,070	1,460	7.7	–14.2
Sugar beets	1,501	1,610	2,143	2,449	3.4	–16.9
Sugar processing	6,487	9,811	10,609	10,149	0.6	–5.3
Imports[d]						
Total sugar	1,243	1,850	2,532	2,534	30.2	43.0
Exports[e]						
Total sugar	87	156	185	186	–19.5	18.0

Sources: USDA, ERS, Sugar and Sweetener Yearbook Tables (accessed July 9, 2013); USDA, NASS, *Crop Production*, various annual summaries; USDOL, BLS, Quarterly Census of Employment and Wages (accessed July 9, 2013); Commission estimates for projection and liberalization.

Notes: Projected changes are based on quantity trends. Effects of liberalization represent deviations from the projected changes. See appendix E for details and sector definitions.

[a]Reported on a calendar year basis. Data for 2012 estimated by Commission.
[b]NAICS codes 311311 (sugarcane mills) and 311312 (cane sugar refining) were merged into NAICS code 311314 (cane sugar manufacturing) in 2012, and data are reported using the new codes.
[c]Reported on a marketing year basis. Raw cane sugar is valued at the U.S. duty-fee paid price for imported raw sugar, New York. Refined beet sugar is valued at the U.S. domestic wholesale price for refined beet sugar.
[d]Reported on a marketing year basis. Total sugar includes raw and refined cane and refined beet sugar.
[e]Reported on a marketing year basis. Includes exports of cane and beet sugar, including refined sugar exports under the sugar reexport program, which accounted for 25 percent of the total value of U.S. sugar exports in FY 2011.

upstream sectors—sugarcane and sugar beet farming—totaled 6,200 workers in CY 2012, reversing a long-term decline and rising from 5,219 in CY 2009.

The United States is a net importer of sugar, mostly raw cane sugar, and typically exports a minor amount.[21] The total value of sugar imports increased substantially from MY 2009 to MY 2012 as a result of both rising demand and rising domestic and world prices. Imports supplied about 33 percent of the U.S. sugar market in MY 2012 in terms of

[21] Some U.S. sugar exports (27 percent in MY 2012) fall under the refined sugar reexport program, which allows cane sugar refiners and manufacturers using refined sugar as an input to import raw cane sugar at or slightly above world prices. However, the equivalent quantity of imported sugar is reexported within a given time period. The refined sugar reexport program is designed to ensure the competitiveness of U.S. sugarcane product exports on the world market while offering U.S. cane sugar refiners access to the raw material they need to maintain utilization of their refineries' capacity.

quantity (raw basis), up from about 30 percent in MY 2009.[22] Mexico is the leading supplier of U.S. sugar imports, accounting for 29 percent of the total quantity (raw basis) of such imports in MY 2012. All U.S. imports of sugar from Mexico have entered free of duty under the North American Free Trade Agreement (NAFTA) since January 1, 2008. The United States also trades and consumes a significant amount of sugar found in SCPs that are not subject to sugar TRQs. The net domestic consumption of sugar in imported SCPs rose from 152,444 strv in CY 1995 to 620,798 strv in CY 2012; such consumption peaked at 834,058 strv in 2006.[23] The bulk of SCP imports consist of sugar-based confectionery as well as cocoa and cocoa preparations. The principal suppliers are Canada and Mexico, which together accounted for 69 percent of all such imports during CY 2012.[24] There has been a long-term shift in production capacity of U.S. confectionery and baking companies to these countries, contributing to this trade.

However, net U.S. imports of sugar in SCPs have generally declined in recent years, as imports leveled and exports increased. The increase in exports resulted, in part, from increased market access for U.S. SCP exports under the NAFTA and other free trade agreements (FTAs) and preferential trade arrangements (PTAs). Also, some U.S. SCP manufacturers have increased production capacity in the U.S. market in recent years.[25]

Nature of Trade Restraints

Trade restraints in the U.S. sugar sector are related to domestic policies that manage supplies to maintain market prices for raw cane and refined sugar.[26] If domestic prices fall below legislatively determined thresholds ("loan rates"), producers may opt to forfeit their supplies to the Commodity Credit Corporation of the U.S. Department of Agriculture at the loan rates.[27] To keep U.S. domestic prices sufficiently above the loan rates, the United States administers a system of TRQs for imports of raw cane and refined sugar, blended sugar syrups, and certain SCPs for member countries of the World Trade Organization (WTO) in accordance with the WTO Agreement on Agriculture, and for other countries under U.S. FTAs and PTAs.[28] WTO TRQs are based on minimum

[22] USDA, ERS, Sugar and Sweetener Yearbook Tables (accessed July 10, 2013).
[23] USDA, ERS, *Sugar and Sweeteners Outlook*, June 18, 2013, 15.
[24] USDA, ERS, email message to USITC staff, April 5, 2013
[25] ASA, written submission to the USITC, March 11, 2013, 21–22.
[26] The principal domestic policy elements include minimum prices (loan rates), a domestic marketing allotment that is set at a minimum 85 percent of U.S. consumption, and a feedstock flexibility program to divert surplus sugar to ethanol production. A summary of major changes that occurred to the U.S. sugar program under the 2008 farm bill is available at USDA, ERS, "2008 Farm Bill Side-by-Side" (accessed February 16, 2011).
[27] Threshold prices are known as loan rates because when sugar prices drop below the threshold, U.S. sugar producers may take non-recourse loans from the Commodity Credit Corporation, using their sugar as collateral.
[28] Sugar quotas were first established under the Jones-Costigan Act in 1934, largely in response to global competitive conditions and government support in other countries. The current TRQ structure was established on October 1, 1990, as a result of a complaint under the General Agreement on Tariffs and Trade by Australia. Suarez, "Origin of the United States Sugar Import," September 1997, 14; Proclamation No. 6179, September 13, 1990 (55 F.R. 38293).

commitments and may be increased under certain circumstances, while sugar TRQs under FTAs and PTAs are increased annually according to staging schedules.[29]

WTO Agreement on Agriculture TRQs

The United States maintains separate TRQs for raw cane sugar, refined sugar, certain SCPs, and blended sugar syrups, and an absolute quota for cocoa powder containing sugar under the WTO Agreement on Agriculture.[30] Imports within the quota are dutiable at relatively low in-quota tariff rates, while over-quota imports are subject to much higher duties. The majority of in-quota imports benefit from duty-free treatment under various FTAs or PTAs, mainly the Generalized System of Preferences (GSP). Over-quota imports are also subject to automatic safeguards, which add extra duties to the over-quota tariff depending on the price level of imports or, if announced by the Secretary of Agriculture, on the quantity of imports.[31]

The WTO raw cane sugar TRQ is allocated on a country-specific basis among designated sugar-exporting nations in proportion to their average market share of U.S. imports during 1974–1981. The four leading beneficiaries were allocated 46 percent of the total TRQ quantity, and only one of these (Brazil) filled its entire allotted amount in MY 2012 (table 2.7). Under Uruguay Round commitments, the United States is required to allocate at least 1.1 million metric tons, raw value (mtrv) annually. The raw sugar TRQ must be set at this minimum level at the beginning of each marketing year (October 1) and may not be increased before April 1 of the following year, except in emergencies.[32] In MY 2012, the final raw cane sugar TRQ totaled 1.5 million mtrv, with a fill rate of about 84 percent (table 2.7).

The WTO refined sugar TRQ is administered with lower allocations than the raw cane sugar TRQ, but with fewer regulatory restrictions as well. For example, while the required minimum level of the global refined sugar TRQ is 22,000 mtrv annually, it is not restricted to this minimum on October 1. The refined sugar TRQ typically is set at a substantially higher level than the minimum. Moreover, the refined sugar TRQ is administered on a first-come, first-served basis, except for reserved annual allocations for Mexico and Canada.[33] A certain amount of the refined sugar TRQ is reserved for

[29] "Staging schedules" are schedules for implementing provisions of a trade agreement in steps rather than all at once. Note that preferential treatment under the raw cane sugar and refined sugar TRQs was not provided in the FTA with Australia. In addition, in-quota imports of sugar benefit from duty-free treatment under the Generalized System of Preferences, the Andean Trade Preference Act, and the Caribbean Basin Economic Recovery Act.

[30] The WTO TRQs for raw cane sugar, refined sugar, certain SCPs, and blended sugar syrups are all provided for in the additional U.S. notes 5, 7, 8, and 9 to chapter 17 of the HTS and pertinent subheadings. The WTO TRQ for cocoa powder containing sugar is provided for in additional U.S. note 1 of chapter 18 of the HTS. 15 C.F.R. 2011 (2012).

[31] The safeguards do not apply to imports from countries with U.S. FTAs. U.S. note 1 to chapter 99, subchapter IV of the HTS.

[32] Emergencies include war, flood, hurricane, or other natural disaster, or other similar event as determined by the Secretary of Agriculture. 7 U.S.C. 1359kk. The current farm bill became effective October 1, 2008.

[33] Because of WTO commitments, Mexico and Canada still receive a refined sugar allocation despite their duty-free status under NAFTA. The Mexican allocation is 2,954 mt, while the Canadian allocation is 10,300 mt.

TABLE 2.7 Sugar: TRQ fill rates, 2009–12

TRQ[a]	TRQ fill rates (%) 2009	2010	2011	2012	Imports 2012	Allocation 2012
					mtrv	
WTO raw sugar quota	82.2	94.1	94.5	84.3	1,263,083	1,498,212
Australia	100.0	100.0	100.0	98.3	133,212	135,530
Brazil	98.4	100.0	100.0	100.0	236,770	236,770
Dominican Republic	95.5	100.0	100.0	99,5	217,696	218,908
Philippines	99.1	100.0	100.0	86.2	190,019	220,441
Other	65.9	87.6	88.1	70.7	485,386	686,563
WTO refined sugar quota	90.9	96.7	71.6	94.2	106,151	112,718
Mexico[b]	([c])	([c])	([c])	([c])	917,859	([c])
FTA sugar quotas[d]	96.5	95.6	86.3	81.9	150,642	183,999
CAFTA-DR	98.4	97.3	87.7	97.7	114,170	116,820
Other	0.9	1.0	0.7	54.3	36,472	67,179

Sources: USDA, FAS, *Sugar Monthly Import and Re-Export Data Report,* 2009–12; USDA, ERS, Sugar and Sweetener Yearbook Tables (accessed July 30, 2013); DHS, CBP, Historical Tariff-Rate Quota/Preference Level Fill Rates (accessed July 2, 2013); USITC DataWeb/USDOC (accessed July 2, 2013).

[a]On a marketing year basis, unless otherwise indicated.
[b]Imports unconstrained by TRQs since January 1, 2008.
[c]Not applicable.
[d]On a calendar year basis. Data are on a product weight basis for some products.

specialty sugars (initially 1,656 mtrv in MY 2012).[34] The refined sugar TRQ totaled 112,718 mtrv in MY 2012, with a fill rate of about 94 percent (table 2.7).

FTA TRQs

The United States provides TRQs for sugar and SCPs under various FTAs. FTAs include additional market access for imported raw cane sugar, refined sugar, and SCPs, and the allocations generally increase annually for the quantities specified in each FTA. As noted above, imports from Mexico under NAFTA now enter free of duty. Duty-free, quota-free access is also provided under FTAs with Israel and Korea. Currently, the countries in the U.S.-Central America-Dominican Republic Free Trade Agreement (CAFTA-DR) have the largest additional allocations among U.S. FTA partners. Sugar TRQs are also provided in FTAs with Bahrain, Chile, Colombia, Jordan, Morocco, Oman, Panama, Peru, and Singapore. FTA TRQs are subject to provisions that require partner countries to satisfy rules of origin and to have net trade surpluses of sugar, which must be larger than the staged allocation amount. Sugar TRQ allocations under FTAs totaled 183,999 mtrv in CY 2012, representing a fill rate of about 82 percent (table 2.7).

Projected Industry Trends

The baseline simulation projects only 0.6 percent growth in U.S. sugar processing shipments during 2012–17 (table 2.6). In the simulation, cane sugar refiners benefit from increased imports of raw cane sugar, while beet sugar refiners face increased competition, both from domestic cane sugar refiners and from imports of refined sugar.[35] Employment

[34] USTR, "U.S. Trade Representative Ron Kirk Announces," August 12, 2010. Specialty sugars are defined in 15 C.F.R. 2011.202(i).

[35] Although both domestic beet and cane refiners are subject to marketing orders, access to lower-cost imported raw cane sugar due to liberalization would enhance the relative competitiveness of cane refiners.

is projected to drop in all sugar sectors, with the greatest declines in sugarcane farming (23 percent) and sugar processing (6 percent). Total sugar imports are projected to increase by 30 percent during the period. Total U.S. sugar exports are projected to decline by a fifth during the baseline period.

Effects of Liberalization Relative to Projected Trends

Removal of restrictions on imports of sugar would result in a welfare gain to U.S. consumers of $1,660 million over 2012–17, or an average of $277 million per year (table 2.1). Liberalization would be achieved by eliminating the TRQs and the remaining in-quota tariffs. Sugar processing shipments and employment are each expected to decline, with employment declining more substantially than shipments. Sugar crops are expected to contract by 14 to 17 percent, while sugar processing would decline by only 5.3 percent (table 2.6). This is possible because of sugar processing's increased reliance on imported raw sugar feedstock. Total sugar imports would increase by 43 percent. Responding to the decline in domestic prices relative to world prices, producers would increase exports by 18 percent, albeit from a low basis.

Shipments of sugar-containing products would increase slightly, by 0.6 percent, in response to the lower sugar prices resulting from the liberalization. Imports would dip 1.0 percent, and exports would rise 1.3 percent.

Canned Tuna[36]

The United States is the world's third-largest canned tuna producer,[37] with shipments valued at an estimated $807 million in 2012 (table 2.8). It is also the world's leading market for canned tuna, accounting for about 24 percent of global consumption.[38] The U.S. canned tuna industry, which includes production facilities in the continental United States, American Samoa, and Puerto Rico, has become increasingly concentrated over time, such that three major brands—Bumble Bee, StarKist, and Chicken of the Sea—account for between 75 and 85 percent of the U.S. market.[39]

The industry's concentration is largely a response to competitive stresses linked to significantly higher U.S. wage rates in fish processing compared with those of foreign competitors, such as Thailand, Vietnam, and Ecuador. As a result, U.S. production has fallen from about 250,000 metric tons (mt) in 2002 to about 175,000 mt in 2012.[40] Similarly, industry employment has fallen significantly compared with 30 years ago. Operations in American Samoa—which were originally established to take advantage of Samoa's combination of proximity to tuna fisheries, relatively low wages, and duty-free access to the U.S. market—have not proved immune to this pressure. In 2009 and 2010, two major tuna companies eliminated or cut back operations in American Samoa,

[36] Throughout this section, the term "canned tuna" refers to both canned and pouched tuna. In the U.S. HTS, both tuna in cans and tuna in pouches are referred to as "tuna in airtight containers."

[37] FAO, Fishery Commodities Global Production and Trade database (accessed May 30, 2013).

[38] The Pew Charitable Trusts website, "Global Tuna Fishing," http://www.pewenvironment.org/news-room/other-resources/global-tuna-fishing-85899397309 (accessed May 30, 2013).

[39] Makoto et al., "Recent Developments in the Tuna Industry," 2010, 93, 98.

[40] USDOC et al., Fisheries of the United States 2003, October 2004, 56; USDOC et al., Fisheries of the United States 2011, August 2012, 55.

TABLE 2.8 Canned tuna: Summary data and simulation results

Item	Summary data				Projected change, 2012–17 (%)	Effect of liberalization (%)
	2009	2010	2011	2012		
Employment (employees)	7,500[a]	5,000[a]	5,000[a]	5,000[a]	–5.9	–5.2
Shipments (million $)	757	724	769	807[a]	–14.5	–5.2
Imports (million $)	779	901	987	1,156	20.0	4.8
Exports (million $)	8	7	7	8	34.8	0.0

Sources: USDOC et al., *Fisheries of the United States 2011,* August 2012, 55; USITC DataWeb/USDOC (accessed May 28, 2013); USDOC, Economic Census 2007 (accessed May 28, 2013); Rushford, "Charlie the Tuna's Economic Woes," July 7, 2010.

Notes: Employment and shipments estimates are for the United States, American Samoa, and Puerto Rico. Imports and exports are for the United States and Puerto Rico only (U.S. customs territory).

[a]Commission estimate.

reportedly due to an increase in the minimum wage there.[41] Tuna companies' remaining domestic operations have become increasingly mechanized in order to achieve efficiency through scale economies.[42]

The United States is the world's largest canned tuna importer,[43] with imports of over $1.1 billion in 2012. Recent high prices for canned tuna have affected trade levels; in 2012, U.S. imports of canned tuna declined in volume but increased in value. Imports are concentrated among a few major suppliers. In 2012, Thailand accounted for 47 percent of U.S. tuna imports, while the top five suppliers (Thailand, Ecuador, the Philippines, Vietnam, and China) together accounted for 79 percent. China has grown to become a major supplier of canned tuna; its shipments of canned tuna to the United States grew 389 percent between 2008 and 2012. Imports made up 59 percent of estimated U.S. consumption in 2012, up from 44 percent in 2008, and exports accounted for 1 percent of domestic production.

The canned tuna sector comprises two principal products: tuna packed in oil and tuna packed in water. Production costs for tuna in oil and tuna in water are nearly identical; canneries can switch production from one product to the other at little cost. For the same brand and size of can or pouch, the two products often have identical wholesale and retail prices. Tuna packed in water is by far the more popular product, accounting for about 85 percent of U.S. production and approximately 97 percent of total U.S imports.

Nature of Trade Restraints

Duties on tuna packed in oil are much higher than on tuna in water. Imports of canned tuna packed in oil are subject to a relatively high tariff of 35 percent, but are not subject to TRQs. U.S. imports of canned tuna packed in water are subject to a TRQ, but both the in-quota rate of 6 percent and the over-quota duty rate of 12.5 percent are far below the

[41] Rushford, "Charlie the Tuna's Economic Woes," July 7, 2010.

[42] Bumble Bee Foods, LLC, written submission to the USITC, January 12, 2011, 5.

[43] The United States is the largest single-country importer of canned tuna. If the EU countries are taken together, however, they are a larger import market. GTIS, World Trade Atlas (accessed May 31, 2013).

35 percent rate for tuna packed in oil.[44] The TRQ for any given calendar year is equal to 4.8 percent of apparent U.S. consumption (as reported annually by the USDOC) of canned tuna during the immediately preceding year.[45] There is substantial demand for canned tuna in the United States, however, and as the over-quota tariff is not prohibitive, in 2012 over-quota imports amounted to 209,813 mt, representing 92 percent of total canned tuna imports.

The TRQ is administered on a global first-come, first-served basis. Because the low in-quota tariff rate is about half the over-quota rate, importers attempt to qualify for as large a share of the TRQ as possible by storing thousands of cases of canned tuna in customs-bonded warehouses in late December, waiting to withdraw those cases as soon as the calendar year begins. As a result, the TRQ fills very rapidly. However, according to industry sources, this system is costly for importers because it raises storage costs and leads to uncertainty over whether an individual importer's product will face the in- or over-quota rate.

Projected Industry Trends

The baseline simulation projects a modest decline in U.S. canned tuna shipments to 2017, with shipments slowing at an average annual rate of about 3 percent. As domestic shipments fall, imports are expected to grow by about 20 percent over the five-year period. Meanwhile, exports are expected to grow moderately (for reasons discussed below), albeit from a very small base. Historically the industry has produced almost exclusively for the domestic market.

Effects of Liberalization Relative to Projected Trends

Liberalization in canned tuna was modeled by eliminating the ad valorem tariff equivalents of the duties on canned tuna packed in water and in oil. Removing these tariffs would lead to an increase in U.S. economic welfare of $46 million over the 2012–17 period, or $7.7 million per year on average (table 2.1). Because elimination of the duties would lower the domestic price of tuna, employment and shipments in the U.S. tuna sector would decline by over 5 percent, with imports rising by almost 5 percent (table 2.8). Because the domestic price would fall relative to the world price, U.S. producers would export a larger share of their reduced shipments, but there would be almost no change in exports.

Textiles and Apparel

The United States was the largest single-country importer of textiles and apparel in 2012, accounting for 23 percent of global imports by value.[46] Between 2009 and 2011, trade and shipments rebounded from the U.S. recession of 2007–09. This was followed by slower or slightly negative growth rates in 2011–12 (table 2.9). U.S. imports and exports

[44] Quotas on canned tuna imports were first introduced in 1956. This was in response to sharply increasing imports of canned tuna (nearly all from Japan) beginning in the early 1950s. See U.S. Tariff Commission, *Tuna Fish*, 1958; USITC, *Competitive Conditions in the U.S. Tuna Industry*, 1982.

[45] For example, for CY 2012, the TRQ on canned tuna was 17,270,370 kilograms. 77 Fed. Reg. 22797 (April 17, 2012).

[46] GTIS, World Trade Atlas (accessed May 20, 2013).

TABLE 2.9 Textiles and apparel: Summary data and simulation results

Item	Summary data 2009	2010	2011	2012	Projected change, 2012–17 (%)	Effect of liberalization (%)
Employment	Employees, thousands					
All textiles and apparel	418	396	389	381	–9.6	–14.5
Textile mills[a]	124	119	120	118	–9.6	–24.7
Textile products[b]	126	119	118	115	–9.6	–6.8
Apparel[c]	168	158	151	148	–9.6	–7.7
Shipments	Million $					
All textiles and apparel	62,675	65,955	67,383	68,619	–2.1	–13.9
Yarn, thread, and fabric	25,380	29,617	30,196	29,775	–6.3	–22.9
Textile products	21,774	21,557	22,543	23,523	5.1	–7.1
Apparel	15,521	14,781	14,644	15,321	–4.9	–7.7
Imports						
All textiles and apparel	85,338	97,760	106,375	106,026	13.8	2.9
Yarn, thread, and fabric	5,287	6,524	7,314	7,608	10.4	–5.8
Textile products	13,229	15,824	16,943	17,233	18.8	4.1
Apparel	66,821	75,412	82,118	81,186	13.1	3.3
Exports						
All textiles and apparel	11,508	13,471	15,006	14,715	8.4	–41.3
Yarn, thread, and fabric	6,431	7,822	9,063	8,573	10.4	–52.7
Textile products	2,267	2,583	2,740	2,853	12.0	–30.2
Apparel	2,811	3,066	3,203	3,289	18.8	–7.9

Sources: USITC DataWeb/USDOC (accessed April 29, 2013); USDOL, BLS, Quarterly Census of Employment and Wages (accessed July 2, 2013); USDOC, Census, M3 Survey (accessed April 30, 2013); Commission estimates for projection and liberalization.

[a]Yarn, thread, and fabric are primarily produced by textile mills (NAICS code 313).
[b]Textile products include carpets, rugs, home linens, canvas products, rope, twine, tire cord, and other miscellaneous made-up textile articles (NAICS code 314).
[c]Apparel includes knit, knit-to-shape, and woven garments and hosiery (NAICS code 315).

grew by 25 and 30 percent, respectively, between 2009 and 2011. From 2011 to 2012, U.S. exports contracted by 2 percent, while there was no change in imports. Shipments of textiles and apparel increased 9.5 percent during 2009–12 to $68.6 billion. Yarn, thread, and fabric output accounted for much of the increase in total shipments, increasing 17 percent during the period; shipments of apparel declined 1 percent.

As textile and apparel manufacturing has been outsourced to low-cost overseas producers, the number of U.S. textile and apparel plants has declined, with a corresponding decrease in the number of textile and apparel workers.[47] In 2012, there were 3,025 textile mills, down from 3,463 in 2009; 7,132 textile product mills, down from 7,810 in 2009; and 7,241 apparel firms, down from 8,339 in 2009.[48] Employment in the textiles and apparel sector experienced a consistent decline, falling 9 percent from 2009 to 2012 for a total loss of roughly 37,000 jobs.[49] The declines in employment can be

[47] Panteva, "Textile Mills in the U.S.," 2012, 6.
[48] USDOL, BLS, Quarterly Census of Employment and Wages (accessed July 2, 2013).
[49] USDOL, BLS, Quarterly Census of Employment and Wages (accessed July 2, 2013).

attributed to production moving overseas, as well as to steady increases in shipments per worker as innovations in production processes and equipment continue.[50]

The contraction of the U.S. industry is part of a longer-term trend that was exacerbated by the elimination of the United States' global quotas in 2005.[51] However, industry representatives project that the rate of decline in the U.S. textile and apparel industry will slow through 2017.[52] In part, this is because U.S. producers no longer compete directly with imports. U.S. production of textiles and apparel is primarily for high-end fashion and niche markets; U.S. government defense contracts under the Berry Amendment;[53] and performance textiles for medical and industrial purposes requiring specialized materials such as nonwoven, antiballistic, or flame-resistant fabrics.[54]

Since 2005, global textile and apparel production has become concentrated among a small group of lower-cost Asian suppliers, particularly China, whose exports to the United States accounted for 40.4 percent of total U.S. imports of textiles and apparel in 2012. Between 2009 and 2012, U.S. imports of textiles and apparel from China rose by 26.7 percent to $42.8 billion. Although China is the leading supplier to the U.S. market, its export growth to the United States has slowed in recent years; China's competitiveness versus other low-cost suppliers has weakened due to a stronger currency and rising costs for materials and labor.[55] U.S. imports from its second-largest supplier, Vietnam, increased 42.3 percent by value during the period to $7.5 billion. Further, U.S. imports from India, Indonesia, and Bangladesh continued to grow at above-average rates. U.S. imports of textiles and apparel from NAFTA and CAFTA-DR countries also increased by value during 2009–12, rising by 13.6 percent and 28.6 percent, respectively.

Nature of Trade Restraints

There are no quantitative restrictions on U.S. imports of textiles and apparel. However, U.S. tariffs on these goods remain high: the trade-weighted average ad valorem tariff on all U.S. imports of textiles and apparel was 11.2 percent in 2012.[56] In general, these tariffs rise with each stage of manufacturing—that is, the duty rates are usually higher on apparel than on yarn or fabric. In 2012, the trade-weighted average tariff on apparel was 12.8 percent, compared with 6.1 percent for textile products and 5.0 percent for textile mill articles (yarn, thread, and fabric).[57] Tariffs on many heavily traded apparel articles are much higher than the overall average cited above, particularly for articles produced

[50] Reichard, "Textiles 2012: The Prognosis Is Good," 2012, 26.

[51] Quotas were imposed on textile and apparel imports to prevent market disruption as part of the 1974 Multifiber Arrangement (MFA), an agreement reached among most of the major textile exporting and importing countries. In 1995, the WTO Agreement on Textiles and Clothing replaced the MFA and established a 10-year phaseout of textile and apparel quotas that ended on January 1, 2005. For additional information, see USITC, *Import Restraints*, 2007; USITC, *Import Restraints*, 2009; and USITC, *U.S. Imports of Textiles and Apparel*, 1991.

[52] Panteva, "Textile Mills in the U.S.," 2012, 8; Reichard, "Textiles 2012," 2012, 26.

[53] The Berry Amendment requires that clothing or textile articles procured by the U.S. Department of Defense (USDOD) be U.S.-produced, including the fibers, yarn, and fabric used to construct the articles (10 U.S.C. 2533a). See USDOD, "Berry Amendment FAQ" http://www.acq.osd.mil/dpap/cpic/ic/berry_amendment_faq.html (accessed May 28, 2013).

[54] Panteva, "Textile Mills in the U.S.," 2012, 8.

[55] Fangqing, "Sourcing Shifts," June 3, 2013.

[56] USITC DataWeb/USDOC (accessed May 29, 2013).

[57] These average tariffs were calculated using NAICS nomenclature. USITC DataWeb/USDOC (accessed May 29, 2013).

with manmade fibers. For example, the 2012 NTR duty rates on certain women's and girls' woven manmade-fiber pants and blouses were 28.6 percent and 26.9 percent respectively, and those on men's woven swimwear of manmade fibers were 27.8 percent. The United States also has several compound tariffs on certain articles of apparel, where a fixed cost per kilogram plus an ad valorem duty are levied. For example, men's manmade-fiber and wool blended coats classified under HTS 6201.13.30 are dutiable at 49.7 cents per kilogram plus 19.7 percent ad valorem.

FTAs, Preference Programs, and Rules of Origin

Qualifying U.S. imports of textiles and apparel are eligible for duty-free treatment under various FTAs and preference programs. The value of U.S. imports under FTAs or preference programs in 2012 was $17.5 billion, or 16.5 percent of total U.S. imports of textiles and apparel, with 70 percent of such imports originating from CAFTA-DR and NAFTA partner countries. In general, for apparel to qualify for duty-free entry under the rules of origin (ROO) requirements in U.S. FTAs, it must be made from U.S. or regional inputs (yarns and fabrics); the specific percentages and other requirements vary by program. Such requirements generate a large share of foreign demand for U.S. textile and apparel inputs in the Western Hemisphere.

Projected Industry Trends

The baseline simulation projects a 2.1 percent decline in U.S. shipments of textiles and apparel between 2012 and 2017. Domestic employment in the sector is projected to decline more steeply at 9.6 percent during the period. U.S. exports of textiles and apparel are projected to increase 8.4 percent, while U.S. imports are projected to increase by 13.8 percent. Overall household demand is estimated to rise by 17.3 percent over the six-year period.

Effects of Liberalization Relative to Projected Trends

The removal of import restraints in the textile and apparel sectors would increase U.S. welfare by over $3 billion from 2012 to 2017 ($483 million per year, on average) according to model results (table 2.1), similar to the $514 million projected for the year 2015 in the previous report. Liberalization consists of removing all duties on these goods, as well as removing ROO requirements on the subject goods. The removal of ROOs would reduce demand for U.S. exports of items that currently benefit from such a requirement. The size of the reduction in each sector depends on the amount of textile and apparel inputs that the United States exports to preferential trading partners that is subsequently exported back to the United States in finished textile goods and apparel.[58] Employment and shipments would each decrease by approximately 14 percent in the overall textile and apparel sectors (table 2.8). The textile sector would decline much more than textile products or apparel because much of the sector's exports are driven by ROOs. Full liberalization would not only increase import competition for the textile industry, but would also cause export demand to contract by over half.

[58] A more complete discussion of the approach used is in Fox et al., "Textile and Apparel," 2008. Following Fox et al. and using current trade data, the demand reduction from ROO elimination is estimated at 33.1 percent for yarn, thread, and fabric, 15.4 percent for textile products, and 4.6 percent for apparel.

Other Goods Sectors with Significant Import Restraints

The Commission identified a number of other small and large U.S. goods-producing sectors that face significant import restraints and that manufacture a wide variety of products. In 2011, these sectors represented over $70 billion in production and 179,000 employees. Among them, 45 percent of the production was accounted for by cigarette manufacturing, while footwear and leather products accounted for 62 percent of imports (table 2.10). Employment and exports were higher in the ceramic and glass products, footwear and leather products, and hand and edge tools sectors, though no sector was outstanding in either area.

Footwear and Leather Products

Since the footwear and leather products sector encompasses 10 different NAICS codes, it produces a large variety of goods, giving it the most employment, imports, and exports among the sectors in this section. Although both the footwear and the leather products categories are substantial in size, in order to maintain comparability with previous instances of this study, they have been kept together in the model.

The five-year projections for these two categories vary considerably, so that larger trends obscure smaller ones. For example, exports for footwear are projected to grow at 35.1 percent over the next five years, while exports of leather products are expected to decline by 5.3 percent. However, the value of the projected exports of leather products is much larger than that of footwear, depressing the five-year projected increase in exports by the sector as a whole to 2.5 percent.

Projected Industry Trends

Overall, it is expected that employment in five of these sectors will decrease over the next five years, with the largest decrease occurring in the costume jewelry sector. The outlook for these industries is especially noteworthy considering that the average change in shipments for this group of industries is 1.7 percent, while U.S. real GDP is expected to grow 14.8 percent over the same time period. The largest decrease in shipments is projected to occur in the hand and edge tools sector. Here the industry expects an increasing amount of production to shift to China, a change that underlies the expected increase in imports. Similarly, marked increases in imports are expected in other sectors that also produce items which are small and composed primarily of metal or plastic, and are hence relatively easy to ship in high volume, such as costume jewelry.

On the other hand, sectors in this group that are related to housing construction, residential electric lighting fixtures, and ceramics and glass will see increases in shipments, imports, and exports. All these trends reflect the continued recovery in the U.S. real estate market.

Export growth is projected to be flat or negative for the majority of industries in this group. This, along with the expected increase in imports, will expand the trade deficit within these sectors over the next five years.

TABLE 2.10 Sectors with significant tariffs: Summary data and simulation results

Item	Summary data 2011	Projected change, 2012–17 (%)	Effect of liberalization (%)
Employment	Employees		
Ball and roller bearings	22,320	–5.1	–2.4
Ceramic and glass products	75,032	4.6	–2.3
Cigarettes	7,309	–26.3	–0.4
Costume jewelry	4,862	–41.1	–3.8
Footwear and leather	28,220[a]	–11.8	–0.2
Hand and edge tools	26,490	–37.6	–2.6
Pens and mechanical pencils	3,707	–12.5	–3.4
Residential electric lighting fixtures	7,318	–2.5	–5.0
Synthetic organic dyes	3,806	–5.8	–2.6
Shipments	Million $		
Ball and roller bearings	6,461	19.0	–2.5
Ceramic and glass products	18,119	12.4	–2.2
Cigarettes	31,183	–1.7	–0.4
Costume jewelry	575	–21.7	–3.5
Footwear and leather	4,728[a]	–14.4	–0.3
Hand and edge tools	5,249	–28.6	–2.4
Pens and mechanical pencils	826	–13.2	–2.5
Residential electric lighting fixtures	1,371	27.6	–4.6
Synthetic organic dyes	2,170	14.8	–2.1
Imports			
Ball and roller bearings	3,041	84.9	2.8
Ceramic and glass products	9,059	7.4	4.9
Cigarettes	130	24.4	26.2
Costume jewelry	2,134	55.4	1.0
Footwear and leather	35,433	8.1	1.3
Hand and edge tools	3,112	42.8	2.0
Pens and mechanical pencils	990	–16.7	2.3
Residential electric lighting fixtures	1,920	50.4	2.5
Synthetic organic dyes	925	–3.1	5.2
Exports			
Ball and roller bearings	2,062	47.4	1.6
Ceramic and glass products	5,278	15.9	1.2
Cigarettes	386	–47.2	0.1
Costume jewelry	195	–17.2	0.3
Footwear and leather	2,803	2.5	0.6
Hand and edge tools	1,548	3.2	0.6
Pens and mechanical pencils	138	–28.1	1.3
Residential electric lighting fixtures	145	24.6	0.7
Synthetic organic dyes	711	–16.0	0.3

Sources: USITC DataWeb/USDOC data (accessed May 28, 2013); USDOC, Census, Annual Survey of Manufactures 2011 (accessed May 29, 2013); USDOC, Census, County Business Patterns 2011 (accessed May 29, 2013); Commission estimates for projection and liberalization.

Notes: Projected changes are based on quantity trends. See appendix E for details and sector definitions.

[a]Does not include data for the NAICS sector of house slippers (316213) due to lack of availability.

Effects of Liberalization Relative to Projected Trends

The effect of liberalizing imports in these sectors is modeled by removing tariffs, one sector (or category) at a time. Simulation results show that eliminating tariffs in these sectors would decrease the price of imported goods, increase imports, and generally

reduce shipments and employment in the domestic industry (table 2.10). Removing tariffs from almost all sectors would lead to a net welfare gain (table 2.1).

U.S. welfare would increase the most from the removal of tariffs on cigarettes, rising by an average of $140 million per year over 2012–17.[59] However, employment would contract, domestic shipments would decline, and imports of cigarettes would rise as the price of imported cigarettes falls, reducing prices for both domestic and foreign product in the U.S. market. The U.S. cigarette industry becomes slightly more competitive on world markets and exports rise as a result. This pattern of change is typical of the other sectors in this section.

Liberalization of footwear and leather products would increase welfare by $115 million per year over 2012–17 (table 2.10). Employment would fall 0.2 percent and shipments would shrink by 0.3 percent in response to liberalization. Meanwhile, exports would increase by 1.8 percent.

The pattern of effects is the same for most of the other sectors in this group, although the magnitude varies somewhat. The prices of imports decline, shipments and employment in the domestic industry fall, and welfare rises. However, for four sectors—ball and roller bearings, pens and mechanical pencils, residential electric lighting fixtures, and synthetic organic dyes—the declines in shipments and employment outweigh the benefits of reduced import prices to produce net welfare losses.

Services Import Restraints

In the United States, services sector industries account for a very large share of GDP and employment. In 2011, for example, the U.S. services sector accounted for approximately 82 percent ($12.4 trillion) of total U.S. GDP,[60] and employment in services industries represented 85 percent (104 million) of all employees in the United States.[61]

In terms of international trade, U.S. cross-border exports of private services were $586.8 billion in 2011, while imports were $393.1 billion, resulting in a services trade surplus of $193.7 billion. In addition to cross-border flows, international trade in services also occurs when U.S. and foreign companies sell services through affiliates in foreign countries. Services supplied abroad by U.S.-owned foreign affiliates were valued at approximately $1.1 trillion in 2010, whereas services supplied by foreign-owned affiliates in the United States totaled $696 billion.

Although there is considerable cross-border economic activity, both in trade and affiliate sales, import restraints in services remain and inhibit the freer flow of economic activity.

[59] These welfare gains do not account for the potential adverse effects from increased tobacco use.

[60] USDOC, BEA, GDP-by-Industry Data (accessed April 25, 2013). This figure is the sum of the totals for two broad BEA categories: private services-producing industries ($10.4 trillion) and government ($2.0 trillion). 2011 is the last year for which full-year data are available.

[61] USDOC, BEA, GDP-by-Industry Data (accessed November 13, 2012). This figure is the sum of full-time equivalent employees in private services-producing industries (83.6 million) and government (20.2 million).

Nature of Trade Restraints

Most U.S. government restrictions on services imports take the form of regulations that limit or prohibit foreign companies from operating and/or establishing subsidiaries in the United States. Foreign companies seeking to provide freight shipping services in the United States, for example, are restricted by U.S. cabotage[62] laws. Specifically, under the Merchant Marine Act of 1920—better known as the Jones Act—cabotage may be provided in the United States only by ships that are registered, built, and maintained in the United States and owned by a U.S. citizen or corporation.[63] Similarly, air cabotage regulations prohibit the transportation of persons, property, or mail (for compensation) between points within the United States in a foreign civil aircraft.[64]

Foreign services providers also face barriers to trade in the United States in the form of equity ownership restrictions and nationality requirements. In air transport services, for example, U.S. legislation not only limits foreign ownership of U.S. airlines to 25 percent of voting shares but also stipulates that the president and at least two-thirds of the board of directors (and other managing officers) must be U.S. citizens. Airplanes serving domestic routes within the United States are also required to be crewed by U.S. citizens or resident aliens.[65] Similarly, 75 percent of the crew of Jones Act-compliant ships must be U.S. citizens.[66]

Commercial Banking

The U.S. commercial banking industry offers a broad range of financial services, although its traditional intermediation services—deposit-taking and commercial, industrial, and consumer lending—continue to account for about 60 percent of industry revenues.[67] The remaining 40 percent of revenue comes from non-interest earnings, comprising fees and commissions for credit card services; real estate and mortgage transactions; and trading in securities and derivatives. Bank profit is normally estimated as the net interest margin—the percentage spread between deposit rates and lending rates —plus net non-interest revenue—the percentage spread between non-interest revenue and non-interest expenses such as salaries, lease or rental expenses, and other administrative expenses. During 2011–12, U.S. commercial banks continued their slow recovery from the financial crisis, experiencing increases in industry revenue, value added, and employment (table 2.11).

Cross-border trade in banking is limited to large money center banks and large, typically multinational, customers. The predominant mode of trade in commercial banking services is selling financial products through subsidiaries and branches located in foreign markets.

[62] Cabotage is defined as the transport of passengers and goods between two points within a country.

[63] 46 U.S.C.: Shipping. In 2002, the Commission modeled the impact of completely liberalizing the Jones Act's requirements on maritime cabotage, with welfare effects estimated at $656 million. Liberalizing only the Jones Act's requirement that the vessels need to be built domestically produced welfare effects of $261 million. USITC, *Import Restraints*, 2002, 115–29.

[64] 19 C.F.R. 122.165, "Air Cabotage" (2011).

[65] 49 U.S.C. § 40102(a)(15); 49 U.S.C. § 41102(a).

[66] 46 U.S.C.: Shipping.

[67] Standard and Poor's, *Banking: Current Environment,* 2013, 2.

TABLE 2.11 U.S. commercial banking industry: Revenue, value added, and employment, 2008–12

Year	Revenue (billion $)	Value added (billion $)	Employment
2008	544.1	179.2	1,945,672
2009	631.2	166.2	1,911,610
2010	631.8	272.4	1,919,644
2011	610.7	261.8	1,935,404
2012	613.5	262.2	1,950,887

Source: IBISWorld, *Commercial Banking in the US*, February 2013, 36.

In 2010, U.S. banking affiliates' sales abroad totaled an estimated $164.2 billion, whereas foreign banking affiliates' U.S. sales totaled $95.6 billion.[68]

Nature of Trade Restraints

The identification of trade restraints on commercial banking requires careful judgment. In particular, one must draw a distinction between prudential regulation, which is intended to ensure the safety and soundness of the banking system, and non-prudential regulation. Prudential regulation is practiced in every country, and ample room is made for such regulation in all trade agreements, though it is recognized that prudential regulation can increase costs and impede trade. Prudential regulations impose costs on foreign and domestic banks, both by increasing banks' cost structure, as Basel III[69] does by increasing capital adequacy ratios,[70] and by increasing compliance costs when new regulations are promulgated, as is reportedly happening under the Wall Street Reform and Consumer Protection Act (H.R. 4173), also known as the Dodd-Frank Act.[71]

Prudential regulation may impede trade, as screening and licensing a foreign bank requires a careful, and sometimes lengthy, assessment of the foreign bank's regulatory environment and the potential risks that that environment poses to the safety and soundness of the host country's banking system. Regulatory reform, too, may impede trade by interjecting temporary uncertainty and ambiguity into the regulatory environment, as the reform is formulated, debated, implemented, and interpreted.[72] Ultimately, every country is free to establish the prudential regulations and to undertake the regulatory reforms it deems appropriate.

For these reasons, this discussion focuses only on two non-prudential regulations. One regulation (actually a set of regulations) restricts the lines of business foreign banks may undertake in the U.S. market; the other restricts foreign representation on boards of directors. First, under the Foreign Bank Supervision Enhancement Act of 1991, branches of foreign-owned banks may receive deposits of any size from foreign customers, but are forbidden to receive deposits of less than $100,000 from U.S. citizens and residents. This

[68] USDOC, BEA, *U.S. International Services*, October 2012, 25, 27.

[69] Basel III imposes a stricter, more narrow definition of capital and requires that capital increase as risk factors increase. Standard and Poor's, *Banking: Current Environment*, 2013, 10.

[70] The capital adequacy ratio is a prudential measure intended to preserve the solvency of banks. It expresses share capital and reserves as a share of total assets, the latter of which will be risk-weighted according to Basel III guidelines.

[71] The Dodd-Frank Act entered into force on July 21, 2012. The act, among other things, establishes the Consumer Financial Protection Bureau to protect consumers from potential predatory practices of financial institutions, restricts banks' ownership of hedge funds and private equity funds, and limits speculative proprietary trading.

[72] For instance, DavisPolk reports that as of May 1, 2013, 153 (38 percent) of the 398 rulemakings necessary to the Dodd-Frank Act had been finalized and 129 (32 percent) rulemakings had yet to be proposed. DavisPolk, *Dodd-Frank Progress Report*, May 2013.

effectively keeps foreign banks from establishing any retail branches, which would serve individuals and small businesses.

The act also stipulates that deposits in any foreign-owned branch established after December 19, 1991, are not covered by U.S. deposit insurance.[73] While these restrictions may reduce the viability of foreign-owned banking branches in the U.S. market, their severity is moderated by the option of establishing a subsidiary, which would be free of such restrictions. Banks entering foreign markets often choose to do so through a subsidiary rather than a branch, in large part because it poses less risk to the parent bank should the foreign unit experience a crisis (see table 2.12). [74]

The second non-prudential regulation is that nationally chartered U.S. subsidiaries of foreign banks must have boards in which the majority of members are both U.S. citizens and residents. Board members are also expected to live near the subsidiary they govern, although the Office of the Comptroller of the Currency, which regulates nationally chartered foreign banks, may waive this requirement. Regulations pertaining to foreign banks chartered by U.S. states vary.[75]

Telecommunications

Both the wired and the wireless U.S. telecommunications industry experienced growth and change during 2008–12. Although the wired segment faced declining demand for traditional voice communications services, growing demand for wired broadband Internet services has offset these decreases, accounting for a projected 41.2 percent of industry revenues in 2013.[76] Overall, during 2008–12, revenue and value added in the wired segment grew modestly, and while employment declined, the number of broadband connections doubled (table 2.13).

The wireless segment of the U.S. telecommunications industry has seen increasing demand for mobile Internet access in recent years. Although cellular voice services account for a majority of industry revenue, projected at 52.2 percent in 2013, data services such as text messaging are the current drivers of growth.[77] During 2008–12, growth in industry value added outpaced revenue and employment growth. At the same time, the number of mobile subscriptions continued to rise, reaching 338.1 million in 2012—nearly 30 percent higher than the 2008 level (table 2.14). The main telecommunications firms, such as Verizon Communications and AT&T, each operate across several segments of telecommunications, including both wireless and wired.[78]

[73] Federal Reserve Bank of New York, "Foreign Banks," 2007; FDIC, *FDIC Consumer News*, 2010; representative of the Institute of International Bankers, email message to USITC staff, April 19, 2013.

[74] As Fiechter et al. explain, "A subsidiary is a separate legal entity, which is licensed and supervised by local regulators, with the parent having no legal obligation to support it if it falls into distress. In contrast, a branch is legally inseparable from the parent, which is fully responsible for its financial commitments." Fiechter et al., "Subsidiaries or Branches," 2011.

[75] World Bank, Services Trade Restrictions Index (accessed July 16, 2013); PricewaterhouseCooper, *A Regulatory Guide for Foreign Banks*, 2007.

[76] IBISWorld, *Wired Telecommunications Carriers*, 2013, 13–14.

[77] IBISWorld, *Wireless Telecommunications Carriers*, 2013, 13–14. Broadband-enabled mobile devices are generating more revenue than older cellphones, which provide comparatively limited services (voice and text messaging). Ibid., 5.

[78] IBISWorld, *Wired Telecommunications Carriers*, 2013, 5, 27–29.

TABLE 2.12 Top 10 global banks' holdings of foreign subsidiaries and branches

Bank	Foreign subsidiaries	Foreign branches
Industrial and Commercial Bank of China	19	2
China Construction Bank	4	1
JP Morgan Chase	11	1
Wells Fargo	1	0
Agricultural Bank of China	2	0
Bank of America	8	5
Banco Santander (Spain)	62	1
Citibank	69	5
Bank of China Limited	30	4
BNP Paribas (France)	66	0

Source: Bureau van Dijk, ORBIS database (accessed May 31, 2013).

Note: Banks are ranked by total assets.

TABLE 2.13 U.S. wired telecommunications industry: Revenue, value added, employment, and broadband connections, 2008–12

Year	Revenue (billion $)	Value added (billion $)	Employment	Number of broadband connections (million)
2008	117.3	66.7	321,283	117.5
2009	120.0	67.4	310,991	124.0
2010	123.4	67.9	295,721	159.2
2011	124.2	67.8	293,060	206.6
2012	128.3	68.7	294,232	237.2

Source: IBISWorld, *Wired Telecommunications Carriers in the US*, March 2013, 36.

TABLE 2.14 U.S. wireless telecommunications industry: Revenue, value added, employment, and wireless subscribers, 2008–12

Year	Revenue (billion $)	Value added (billion $)	Employment	Number of wireless subscribers (million)
2008	196.1	63.1	286,323	262.7
2009	198.7	65.2	277,590	276.6
2010	206.8	71.4	279,811	300.5
2011	207.0	73.5	283,168	322.9
2012	213.8	79.7	291,947	338.1

Source: IBISWorld, *Wireless Telecommunications Carriers in the US,* April 2013, 42.

The predominant mode of trade in telecommunications services is sales by establishments with commercial presence abroad. In 2010, U.S. telecommunications affiliates' sales abroad totaled $31.0 billion, whereas foreign telecommunications affiliates' U.S. sales totaled $30.8 billion.[79] A majority of U.S. foreign affiliate sales were accounted for by wired telecommunications carriers.[80]

[79] USDOC, BEA, U.S. International Services, "Table 9," 2006–10; USDOC, BEA, U.S. International Services, "Table 10," 2006–10. Cross-border exports and imports in 2011 totaled $12.7 billion and $7.7 billion, respectively. USDOC, BEA, U.S. International Services, "Table 1," 1999–2011.

[80] Affiliate sales data are broken out into three categories: wired telecommunications carriers, wireless (except satellite) telecommunications carriers, and other telecommunications services. In contrast to foreign affiliate sales abroad, the wired segment appeared to account for a minority of sales by U.S. affiliates of foreign companies. Data for the other two categories were unavailable.

Nature of Trade Restraints

In the telecommunication services sector, U.S. legislation restricts foreign investors to a direct ownership position of 20 percent in telecommunication services carriers (referred to as common carrier licensees), whereas indirect ownership is limited to 25 percent.[81] In practice, however, petitions to exceed the U.S. foreign ownership cap are typically approved by the U.S. Federal Communications Commission (FCC) on a streamlined basis for investors from WTO member countries. Indeed, two of the United States' three largest mobile carriers are fully or partially owned by foreign investors: Verizon Wireless is a joint venture with UK-based Vodafone, which owns 45 percent, and T-Mobile is the U.S. subsidiary of Germany's Deutsche Telekom. Tracfone, the leading prepaid provider of mobile services in the United States, is owned by Mexico's América Móvil. Besides the FCC, the federal government's so-called "Telecom Team" must also approve a petition to exceed the U.S. foreign equity restrictions. Approval by the Telecom Team, which is composed of representatives from the Department of Justice, Department of Defense, Department of Homeland Security, and several other government agencies, is reportedly more difficult to obtain, with issues ranging from lengthy review periods to nontransparent rules to high legal costs.[82]

The broadcasting segment is also subject to ownership restrictions. U.S. commitments under the WTO's Agreement on Basic Telecommunications Services exclude foreign ownership in companies that offer direct-to-home, direct broadcast, and digital audio services to the U.S. market.[83]

[81] 47 U.S.C. § 310(b)(3); 47 U.S.C. § 310(b)(4). This legislation also applies to broadcast and aeronautical radio station licensees. A direct owner holds an "immediate interest" in a company where an indirect owner holds a 10 percent or greater interest in a company through "intervening entity or entities in an ownership chain." FCC, "FCC Form 602: Instructions," January 2007, 2.

[82] Industry representative, email to USITC staff, August 3, 2011.

[83] WTO, "Schedule of Specific Commitments," 1997.

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CHAPTER 3
Services' Contribution to Manufacturing

Overview

Services are used throughout the manufacturing process and the manufacturing value chain.[1] Some services are needed early in the chain (e.g., research and development); some are needed at the end (retailing, maintenance and repair); and some are needed at every stage (telecommunications and financial services).[2] Individual manufacturers often require a full spectrum of services.[3] In the United States, on average, 25.3 percent of intermediate inputs purchased by manufacturers in 2011 were from the services sector. For certain manufacturing sectors, such as computer and electronic products, this percentage—a measure of "services intensity"—is as high as 47.6 percent.

Services can include a wide variety of activities, such as trade, transportation, information, education, health, and financial and professional services.[4] The emphasis in this chapter, however, is on business services. Business services are defined as those that are predominantly purchased by other businesses rather than final consumers; examples include legal, data processing, and accounting services, among many others (box 3.1).

These services play an important role in manufacturing. In 2008, business services accounted for nearly half of all services purchased by manufacturing sectors. Moreover, business services are dynamic, having grown more rapidly than the services sector as a whole: since 1980, the share of business services in the U.S. economy has increased by 59 percent, more than double the 24 percent share increase of overall services.[5] These sectors have benefited strongly from recent technological innovations, particularly those related to information and communications technologies (ICT), and in turn provide the benefits of improved productivity to the buyers of their products, many of whom are manufacturers.

In describing the contribution of services in manufacturing, the chapter considers services inputs broadly, including services purchased by manufacturers from other firms, as well as services tasks performed within the firm. Not every employee in a manufacturing firm is directly involved in the physical production of goods. Rather, many employees provide services that support the manufacturing process. Examples include in-house lawyers,

[1] Value chains encompass all activities necessary to bring a product from conception to consumption. To the extent that they involve suppliers in different countries, they are referred to as global value chains or global supply chains. See USITC, *Import Restraints*, 2011, chapter 3.

[2] Nordås, "Trade in Goods and Services," 2010; Miroudot and Rouzet, "Trade Policy Implications of Global Value Chains," 2013.

[3] Kommerskollegium, *At Your Service*, 2010.

[4] While there is no universal definition of services, a basic definition would correspond to the services activities described in industry classification systems. Most of the data presented later in this chapter are based on the North American Industry Classification System (NAICS) and similar categorizations. The statistical classification of economic activities in the European Community (Nomenclature Générale des Activités Économiques dans les Communautés Européennes, or NACE) forms the basis for the World Input-Output Database (WIOD).

[5] USDOC, BEA, GDP-by-Industry Data (accessed July 11, 2013).The trends in business services are discussed in more detail below.

BOX 3.1 Business services

Services sectors vary in how much they sell to final users versus how much they sell to producers. Some sectors sell primarily to final users; examples include restaurants, hotels, and public transportation. Business services, the sectors of interest to this study, sell the majority of their output, such as data processing, legal, and accounting services, to other firms.

In this chapter, **business services** are defined as those that primarily supply producers and use high-skilled workers. For a sector to be considered a business services sector, more than 50 percent of its output must be used as intermediate inputs, and more than 60 percent of its labor force must work in certain high-skilled occupations (described below).

Business services include the following activities, as classified by the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce:[a] (1) publishing (includes software), (2) motion picture and sound recording, (3) broadcasting and telecommunications, (4) information and data processing services, (5) services involving Federal Reserve banks, credit intermediation, and related activities, (6) services involving securities, commodity contracts, and investments, (7) insurance carriers and related, (8) rental and leasing services and services involving lessors of intangible assets, (9) legal services, (10) computer systems design and related services, (11) miscellaneous professional, scientific, and technical services, and (12) management of companies and enterprises.[b]

Employees in **business services-providing occupations** are defined as workers in several major occupation groups in the Occupational Employment Statistics (OES) database kept by the Bureau of Labor Statistics of the U.S. Department of Labor: (1) management, (2) business and financial operations, (3) sales and related, (4) office and administrative support, (5) computer and mathematical, (6) architecture and engineering, (7) life, physical, and social science, (8) legal, and (9) art, design, and media.

An extensive literature focuses on services sectors that supply producers. These are sometimes referred to as producer services. Depending on the author and the dataset examined, the sectors may also include wholesale trade and transport services, and may exclude communications.[c]

[a] These correspond to sectors in the U.S. annual input-output tables published by USDOC, BEA.

[b] The World Input-Output Database (WIOD) data source used in this chapter uses a slight variation on the BEA-based definition of the sector used in other parts of this chapter. In particular, WIOD includes national postal services and administrative and support services in addition to the business services used in this chapter's analysis. WIOD excludes publishing, software, motion picture and sound recording, and broadcasting.

[c] See Francois and Woerz, "Producer Services," 2008; Liu et al., "Embodied Services," 2013. Other research that examines business services includes Lesher and Nordås, "Business Services, Trade and Costs," 2006; Kox, "Unleashing Competition in EU Business Services," 2012; Antipa and de la Serve, "International Comparisons," 2010.

accountants, and researchers developing and applying technologies, as well as maintenance workers and administrative assistants. In 2012, about a third of all workers in U.S. manufacturing firms were in business services occupations, a share that has been rising in recent years.

The chapter first describes how U.S. manufacturers in the 21st century are taking advantage of services in new and innovative ways to manage global supply chains, cut costs, improve efficiency, and strengthen customer relationships. This description draws from the literature and industry accounts. The chapter then considers the linkages between the increased use of business services and manufacturing productivity using U.S. input-output (I-O) data. Also using I-O data and occupational data, the chapter describes recent trends and sectoral patterns in the use of services by manufacturers. A global I-O database permits the comparison of the services intensity of U.S. manufacturing with that of other economies, as well as an assessment of the importance of foreign services to U.S. manufacturers. Finally, three case studies—on semiconductors, medical devices, and

performance textiles—illustrate the types of services that have upgraded efficiency, increased competiveness, and enhanced customer relationships.

Rationales for the Increased Use of Services in the Manufacturing Sector

Services have always been embedded throughout the manufacturing value chain. In recent years, developments in the services economy have transformed the way traditional services activities are conducted and have even introduced new services related to the use of new technology. Manufacturing firms now have more employees conducting research and development (R&D), business information management, and accounting, given the huge increase in computational capacity brought about by advances in information technology (IT). They also have more employees in marketing and advertising, reflecting the expansion of customer channels of communication fostered by the Internet and social media.[6] At the same time, new communications technologies have enabled many activities previously maintained in-house to be outsourced to specialist services providers.[7] As a result of these trends, the U.S. manufacturing sector appears to be growing more business service-intensive over time.[8] This increased importance of services is especially marked in such manufacturing subsectors as computer and electronic products, where services represent a high and growing proportion of inputs purchased outside the company as well as activities undertaken in-house.

While changes in the pattern of manufacturers' use of services are likely to reflect how firms have responded to a variety of business and economic factors, three key drivers of manufacturing firms' use of services are identified and further discussed in this section:

1. **The increasing geographic dispersion of supply chains with specialization**. Firms are seeking opportunities to move low-skill production work to low-wage locations and to concentrate their intellectual property development efforts in high-skill locations with favorable regulatory environments.
2. **The need to cut costs and improve efficiency**. Firms are using a variety of new technologies, particularly technologies related to ICT, to improve production efficiency and lower costs.
3. **The desire to deepen customer relationships by providing services related to their products**. Firms are using new types of services to better differentiate and customize their products, increasing their opportunities for premium pricing or improved market position.

These prospective competitive gains encourage manufacturers to incorporate more services at all stages in the product value chain. In early stages, ICT and transportation services increase manufacturing productivity by allowing firms to take advantage of

[6] As discussed later in the chapter, the share of U.S. manufacturing employees engaged in business services activities rose from 29.7 percent in 2002 to 32.5 percent in 2012.

[7] For example, many manufacturing companies are increasingly purchasing "cloud" data processing services instead of maintaining their own data processing facilities. It is currently estimated that about 5 percent of all enterprise IT spending is on cloud services, but this is expected to rise exponentially in the next few years. USITC, *Digital Trade*, 2013, 3-4; Venkatraman, "The Battle for the Cloud," 2013, 19.

[8] The share of business services in U.S. manufacturing value added has held roughly steady at close to 16 percent from 1995 to 2008. Combining this with an observed increase in business services occupations may suggest an increase in services intensity overall. This and other trends are discussed later in this chapter.

global economies of scale and use new process-improving technologies. At later stages in the chain, integrating services with manufactured goods into a more tailored product offering allows firms to increase their product differentiation, creating new business opportunities. Additionally, advances in ICT, particularly Internet-enabled services, have enabled firms to establish dynamic feedback loops, allowing them to collaborate with their customers and to deliver more customized products.[9]

Services Enable the Geographic Dispersion of Global Value Chains

Better services provision, particularly in ICT, logistics, and financial services, has reduced the trade and coordination costs associated with greater geographic dispersion of global value chains (GVCs). Including more services components is likely to strengthen the competitiveness of an entire value chain, including both production and services activities, because more people are able to specialize in certain tasks along the chain and coordination is more effective.[10] High-quality ICT infrastructure—fast, reliable telecommunications networks and broadband access—has become more universally widespread, reducing the costs of coordination for GVCs.[11] At the same time, multinational manufacturing firms are seeing great benefits from integrating supply chain management services into their business. For example, Intel has been able to significantly shorten lead times, reduce inventory holdings, and respond much faster to customers using a networked GVC management system.[12]

Improvements in logistics services have also fueled the globalization of supply chains. Containerization transformed the logistics and warehousing industries in the 1970s and 1980s, while more recently the advent of location tracking and temperature sensors made possible by new digital communications (the so-called Internet of Things) has enabled more efficient shipment of parts and goods all around the world with reduced handling losses.[13] Shippers like UPS and FedEx increasingly provide maintenance and care services for the products they move, in addition to mere shipment.[14]

The quality of professional and financial services available locally or on a global-account basis may have also played a role in enabling GVCs. Global manufacturing firms are likely to find it easier to set up significant production or sales operations in countries with established legal and insurance services and strong financial sectors; local access to credit and efficient payment systems help improve efficiency and lower supply costs.[15] In addition, services providers have also expanded their range of products and geographic coverage in recent years in order to assist multinational corporations. For example, global supply chain management insurance is a relatively recent innovation designed to help

[9] Kommerskollegium, *Everybody Is in Services*, 2012; USITC, *Digital Trade*, 2013, F-6.

[10] Nordås and Kim, "Interaction between Goods and Services," 2013, 19.

[11] USITC, *Digital Trade*, 2013, 1-9.

[12] Intel, "Accelerating Business Growth through IT," 2013, 10.

[13] Copeland, "Identifying the Potential of Logistics Technology," 2013, describes DHL's use of digital technologies and radio frequency identification devices to improve logistics efficiency and tracking capabilities. See also Bernhofen et al., "Estimating the Effects of the Container Revolution," 2012; Notteboom and Rodrigue, "The Future of Containerization," 2009.

[14] Shactman, "UPS, FedEx Growing by Tapping 'Adjacent Business,'" 2012; Bughin et al., "Ten IT-Enabled Business Trends," 2013, 5.

[15] Arkell, "The Essential Role of Insurance Services," 2011, 2; OECD, "Global Value Chains (GVCs): United States," 2013, 3.

protect large multinationals setting up operations abroad against business continuity risks from supply disruption.[16]

Services Supported by New Technologies Help Firms Lower Costs and Improve Efficiency

Technology changes have led to improvements in existing services—as in the logistics industry, as described above—and have enabled the introduction of some entirely new services, such as software development for 3-D printing of prototypes.[17] Table 3.1 describes how technology enables services to provide direct benefits to producers in terms of improved processes, greater efficiency, and increased customization and customer interaction. The table also illustrates how these services advances percolate throughout the product value chain.

ICT services are seen to be central in helping companies develop better products and get these products to market more quickly. Along with widely adopted new organizational paradigms, such as "lean manufacturing," manufacturing companies now use enterprise resource planning and business information systems to manage suppliers, track parts and inventory, reduce energy costs and other production costs, track orders, and coordinate sales and after-sales services. Increasing reliance on these services has enabled companies to improve efficiency, cut costs, and diversify their products.[18]

Firms now need more scientific, engineering, and technical services for R&D, as well as maintenance and training services, as a result of major scientific advances in recent decades, including research into new materials in machinery and electronics, and progress in genetic engineering in the life sciences.[19] For example, the aircraft "composites revolution" has saved plane producers money by adding strength, reducing weight and fatigue, and decreasing production costs. However, designing and learning how to maintain new composite parts requires new performance measurement processes, both while new parts are in the design stage and after they have been produced and installed.[20]

Opportunities for new types of R&D and prototyping services have arisen with the advent of 3-D printing, robotics, and other forms of automation—and the IT and Internet technologies that they rely upon. Producers are now often able to customize products to specific customer requirements or to run smaller batch runs with little additional cost. Flexible machine tools and automated business processes allow cost-efficient batch production to take place at several sites, including locations in high-wage economies, if customer requirements dictate. Engineering and designing processes that automate customers' requests create more services opportunities.[21]

Innovations such as "Big Data" analytical services and cloud computing services are expected to have profound effects on manufacturers' business models. Big Data analytics

[16] Zurich Insurance, "Supply Chain Risk," 2012, 5.
[17] Brynjolfsson, "The 4 Ways IT Is Revolutionizing Innovation," 2010.
[18] Infor, "Supporting the Lean Value Stream," n.d. (accessed August 30, 2013); SAP, "Riding the Growth Wave," 2008; IBM, "IBS and IBM Optimize ERP," 2010.
[19] Lind and Freedman, "Value Added: America's Manufacturing Future," 2012.
[20] Careless, "The Aircraft Composites Revolution," 2012.
[21] Nordås and Kim, "Interaction between Goods and Services," 2012, 8.

TABLE 3.1 Services advances throughout the product value chain

Driver	Stage in the value chain	Service	Benefit to producer	Enabling technology
More efficiency and lower costs of product development, production, and overhead	Design	Design services	Makes process more efficient	Computer-aided design (CAD) software
				Information technologies
	R&D	R&D services; prototyping services	Improves products; reduces development costs and shortens product development cycle; increases product efficiency (in decreased cost of failure)	Advanced manufacturing
				–3-D printing
				–New composite materials and chemistry
				–Nanotechnology
	Sourcing of intermediate inputs	Logistics and transportation services; supply chain management services	Allows geographic dispersion of GVC with the aim of lowering costs	Containerization; digital communications; radio frequency ID tracking
	Manufacture and assembly	IT services/production process management services; testing services; parts inventory tracking	Makes process more efficient	Robotics and automation
		Network and communications services; data analytics and processing services	Makes process more efficient	Cloud computing
			Increases production process quality and cuts production times	Algorithms for processing Big Data
				"The Internet of Things": smart systems and sensor networks
		Utilities, including telecommunications and electricity	Makes manufacturing more efficient owing to high-quality provision of services (no interruptions)	Fiber optic telecommunications and broadband networks; smart grid
	Management of the firm	Human capital management services	Lowers overhead costs and improves coordination of the enterprise	Digital communications and cloud computing; enterprise management software
		IT services		
		Financial and treasury services	Lowers financing costs	
		Legal, accounting, and other professional services	Lowers overhead costs	
	Warehousing and distribution	Inventory management services; logistics and transportation services	Allows geographic dispersion of GVC with the aim of lowering costs	Containerization; digital communications
More product differentiation and customer satisfaction, enabling higher sales margins and more competitive product positioning	Marketing, branding, and sales	Online sales	Facilitates outreach to customers and offers ways to access new markets	Cloud computing; e-commerce platforms
		Sales force management services	Enables faster and more efficient customer targeting	Enterprise management software and networks; cloud computing
		Financial services (such as customer finance or equipment leasing services)	Enables sales of large-ticket items such as aircraft via customer financing solutions; allows customers to buy functionality that can be easily scaled up and down via equipment leasing	Innovative asset securitization structures; digital communications
	Aftermarket service	Digital services including cloud computing, social media, customer relationship management; IT services	Attracts more customer insights and collaboration	Cloud computing; digital communications technologies
		Maintenance and repair services	Shortens response times to repair products and upgrades ability to do preventative maintenance, improving customer service	"Internet of Things" communications; cloud computing; machine sensors

Sources: USITC, *Import Restraints,* 2011, 3-2; WEF, *The Shifting Geography of Global Value Chains*, 2012, 21; Kommerskollegium, *Everybody Is in Services*, 2012, 14; Ebner and Bechtold, "Are Manufacturing Companies Ready?" 2012**,** 4.

encompass a range of ICT services focused on gathering and interpreting large information datasets—such ICT services include wireless communications, software programming, data processing, mathematical modeling, and data storage and retrieval. On the factory floor, companies collect real-time metadata on their manufacturing processes through digitally connected testing and monitoring equipment, and use these data for ongoing process improvement.[22] Some use data approaches developed in-house, while others purchase the services of data scientists or data miners. In response to constant analysis of testing results, production process recipes can be quickly adjusted to meet technical and quality standards, with a minimum of downtime cost. Companies like GlobalFoundries, a semiconductor foundry, use Big Data analytics to monitor and refine manufacturing procedures, including forecasting quality and yields in new production batches. Big Data analytics are also helpful in the development phase of semiconductor manufacturing, enabling producers to model multiple client designs at one time or estimate the performance characteristics of a range of product variations.[23]

Cloud computing services have also become important in the manufacturing sphere. Amazon, Google, Microsoft, Rackspace, and many other companies provide cloud hosting, data communications, and infrastructure services for manufacturers of all sizes, often in coordination with software services offered by IBM, Oracle, or SAP. Clients pay according to amount of space they use, and besides hosting, securing, and maintaining data, services providers offer infrastructure services and applications. Because cloud services remove the need for a large IT infrastructure investment, businesses—especially small to medium-sized firms—often find them a cost-saving alternative. Small firms can also benefit from the economies of scale of large data centers, as cloud services providers can use their security systems to protect and store data from many different customers at once, passing on the unit cost savings to customers. [24]

Services Are Increasingly Part of Manufacturers' Product Offerings, Helping to Differentiate and Customize Goods

In addition to using services in the production process, manufacturing firms are combining goods with services to differentiate their products from those of other suppliers and to provide a more customized product offering. In so doing, they make themselves more appealing to shoppers and build a stronger relationship with their customers. Examples include the monitoring and evaluation capabilities that come with Emerson Electric devices[25] or the OnStar customer support system in new GM vehicles. Customizing goods through services components helps manufacturers stand out in a market that relies increasingly on non-price competition.[26] As a result, many firms that once saw services as merely part of operating costs now highlight them as essential for providing a premium product and building brand loyalty and product dependence.[27]

[22] McGuire et al., "Why Big Data Is the New Competitive Advantage," 2012.

[23] Industry representatives, interviews by USITC staff, May 2013.

[24] Brodkin, "Ten Cloud Computing Companies to Watch," 2009. Amazon Web Services website, http://aws.amazon.com/what-is-cloud-computing (accessed August 30, 2013); Oracle, "Managing the Product Value Chain," 2011; USITC, *Digital Trade*, 2013, 2-31.

[25] Emerson Process Management website, http://www2.emersonprocess.com (accessed September 17, 2013).

[26] Nordås and Kim, "Interaction between Goods and Services," 2012, 8; Lind and Freedman, "Value Added: America's Manufacturing Future," 2012.

[27] Aberdeen Group, "Service Excellence and the Path," 2012.

Advances in ICT Give Firms Enhanced Customer Information and Feedback

Manufacturers are also using services to create a system of dynamic feedback that uses an array of customer information to align production with customer needs and wants. An example of this is the use of analytics and metrics to analyze trends and develop customer insights. Like other services that support the customizing of goods, metadata analysis helps firms to segment the customer base and then tailor products for each market they serve, as well as to provide them with customer information that is valuable in shaping future product offerings.[28]

Hewlett-Packard, an IT company, uses software-as-a-service (SaaS)[29] to analyze customers' Web metrics and uses the results in a dynamic model of production. In addition to allowing Hewlett-Packard to use clickthrough information to improve product pages, Web metrics such as time spent viewing a page and click counts help the company to learn which products are most popular on their site and adjust production accordingly.[30]

Many firms are also using online interactions with their target market, including social media, to bolster sales, identify demand, and build brand loyalty. Customers can provide product feedback using firms' online presence and, in many cases, can expect a response. As described below, companies have also developed entire social media departments—often separate from customer service departments—to use Twitter and Facebook to interact with customers and improve customer service and brand recognition.[31]

Digital interaction services offer customers a direct line of feedback into a product that they care about, and they in turn provide firms with an inexpensive pool of testers, designers, and consumers. Frito-Lay used Facebook to host its "Do Us a Flavor" campaign, accessing customers from across the world and engaging them to suggest and vote on new potato chip flavors.[32] The contest created a buzz and caused many customers both to pay more attention to Frito-Lay's products and to buy more of them. This contest brought in more than eight million customers to vote from all over the world.[33]

Lego uses its CUUSOO platform to solicit suggestions for new toy sets and allow potential consumers to vote on the most popular sets. On CUUSOO, a set suggestion that receives 10,000 votes of support is reviewed for possible production, though Lego also provides feedback and encouragement on suggestions that have yet to receive that many votes.[34] Similarly, digital communications are enabling video game developers like Microsoft to access a global pool of beta testers.[35]

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[28] McGuire et al., "Why Big Data Is the New Competitive Advantage," 2012.

[29] Software-as-a-service (SaaS) refers to the provision of computer software applications from a remote "cloud" installation on an on-demand basis. USITC, *Digital Trade*, 2013, 2-29.

[30] Boulton, "H-P Using Its Analytics Software to Grow Sales," 2013.

[31] Oliver Wyman, "Social Media Management," 2013, 5.

[32] PepsiCo, "Lay's Potato Chips Teams Up," July 2012; Frito-Lay's Facebook website, https://www.facebook.com/FritoLay (accessed August 14, 2013).

[33] Champagne, "How Lay's Got Its Chips to Taste," 2013.

[34] Lego's CUUSOO website, http://lego.cuusoo.com (accessed August 9, 2013).

[35] Microsoft Game Studios Beta Program website, http://connect.microsoft.com/MGSBetas (accessed August 9, 2013).

Services Help Customers Purchase and Use Products

More and more, companies are integrating services into the latter stages of the manufacturing value chain, facilitating the purchase and consumption of the good. Manufacturers combine the sale of their goods with complementary services that enable purchasing firms to source and integrate the goods into their business, or help final consumers make their purchase. Examples include financial, transportation, and shipping services.

Leasing services also promote product sales. Many large machinery and equipment manufacturers, for example, are able to capture more of their potential market by offering both purchasing and leasing opportunities to their customers. Markets that involve large equipment or heavy machinery can have both large cost barriers to entry and high equipment maintenance fees. Leasing gives manufacturers a way to enable their customers to use a larger variety of their products over time rather than simply waiting for the old ones to break down before procuring new ones. Leasing also helps the manufacturers ensure that the newest of their product offerings can be the most prominent and best maintained of their offerings.[36]

Performance-based contract services are similarly gaining importance. Such arrangements allow buyers to outsource performance risk to suppliers, who differentiate themselves by being willing to take it on as part of a maintenance and service contract.[37] Rolls-Royce's "Power by the Hour" program provides an example. The program uses a complex combination of problem-detecting sensors and regular downtime maintenance to ensure that when an airline purchases a Rolls-Royce engine, buying high level of engine performance is guaranteed.[38]

Finally, many large machinery and transportation manufacturers provide basic training services to make their products useful for even the most inexperienced or small-scale customers. Companies like GE find these services offerings to be so beneficial that they are expanding them beyond their previously established customer base as a sales tool.[39] Another example is StartupBoeing, a services program that helps potential new airline owners with everything from maintenance and flight crew training to fuel conservation services. Boeing works with potential customers very early in the process, offering advice on when and how to start a new airline. It then builds and maintains its customer relationships by offering a range of products, product upgrades, and related services, such as training for maintenance workers and navigation services, to its new and existing airline customers.[40]

Services Enhance Manufacturing Productivity

The previous discussion has highlighted a number of the business strategies in which manufacturers use services to reduce costs, increase efficiency, and expand sales. This

[36] Cusumano et al., "A Theory of Services in Products Industries," October 2008, 27.
[37] Baiman et al., "Procurement in Supply Chains," 2004.
[38] Rolls-Royce, "Rolls-Royce Celebrates 50th Anniversary of Power-by-the-Hour," October 2012; Knowledge@Wharton, "'Power by the Hour,'" 2007.
[39] PWC, "Customer Collaboration Designs Excellence," 2011, 5.
[40] StartupBoeing website, http://www.boeing.com/boeing/commercial/startup/ (accessed August 30, 2013).

section turns to the available quantitative evidence linking the use of services with improved productivity in manufacturing. Productivity measurement seeks to find evidence that firms are producing a higher value of output with the same or fewer inputs. Productivity improvement can take the form of either cost savings (e.g., reduced materials or energy use) or improvements in product quality that raise the real value of output.

There is some evidence that productivity gains are, on average, larger for manufacturing industries that make greater use of business services, as well as for manufacturing industries with larger increases in the use of business services.[41] In addition, productivity gains within the services sectors themselves have enabled manufacturers to benefit from services inputs that are both lower-priced and more efficiently provided than before. While these findings are subject to the caveats associated with productivity measurement—particularly the challenges involved in constructing price indices for services—the evidence is nonetheless suggestive.[42]

Productivity Gains in Manufacturing Are Associated with Business Services

Many of the most widely used strategies and tactics for achieving productivity gains make intensive use of business services.[43] In the United States, there is a correlation across manufacturing sectors between the use of business services and productivity gains in manufacturing. That is, the manufacturing sectors in which the use of business services has grown the most rapidly have, on average, enjoyed the highest productivity growth (figure 3.1). This is true whether growth in the use of business services is measured by manufacturers' purchases of business services from other firms or by their employment of their own workers in business services occupations.[44]

Of the various U.S. manufacturing sectors, the one producing computers and electronics products uses business services the most intensively—both purchased and in-house—and has shown the greatest productivity gains. This sector is especially important as a driver of productivity gains for knowledge-based workers in other sectors and as a means of accessing information and communication services in general. However, even when computers and electronic products are excluded from the analysis, a positive correlation

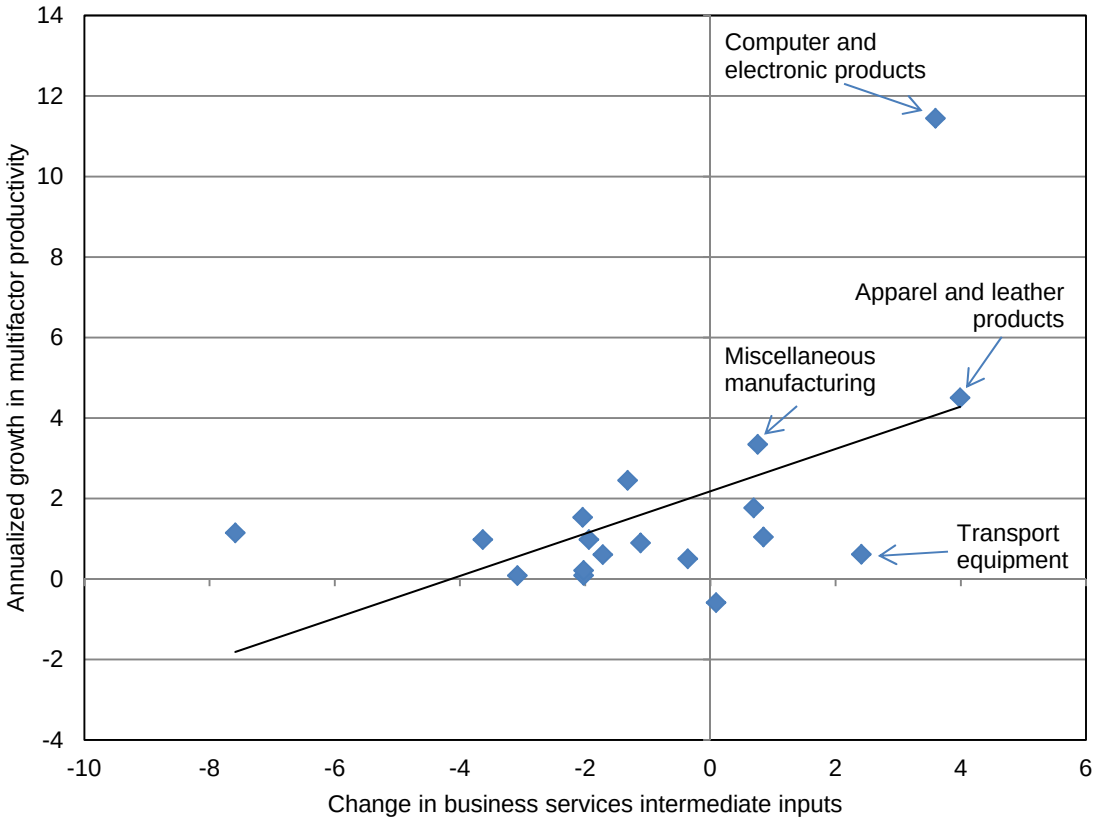
[41] Multifactor productivity or MFP (also called total factor productivity or TFP) measures how rapidly the real value of output is growing relative to a bundle of inputs. Measures of MFP used in this discussion are from the Bureau of Labor Statistics (BLS) of the U.S. Department of Labor. In the BLS's KLEMS framework, there are five inputs—capital, labor, energy, materials, and purchased services. For details of the techniques used by BLS in measuring multifactor productivity, see USDOL, BLS, "Technical Information," 2007.

[42] Challenges in the measurement of productivity include issues in measuring capital and difficulties with constructing appropriate price indexes for goods of variable quality. The price index problem is more challenging for services than for goods. For a discussion of productivity measurement issues in services industries see Triplett and Bosworth, "Productivity Measurement Issues in Service Industries," 2003.

[43] Although productivity gains can also be associated with other services—for example, transportation services linked to logistics—the focus on this section is on business services.

[44] It is also true that the level of business services used is correlated with growth in multifactor productivity, and that this is so whether or not business services use is measured by purchased services or business services employment. This correlation implies that increasing use of business services enhances productivity regardless of sector. At the same time, the relationship noted above between the level of business services use and productivity growth implies that sectors which use more business services may enjoy more opportunities for innovation.

FIGURE 3.1 Manufacturing sectors that buy more business services have had more rapid productivity growth, percent, 2002–11



Sources: USDOL, BLS, Multifactor Productivity tables (accessed May 22, 2013); USDOC, BEA, Annual Input-Output tables (accessed June 25, 2013); Commission calculations.

remains between use of business services and productivity gains for the rest of U.S. manufacturing.

In recent years, U.S. manufacturing output has grown more rapidly than purchased inputs in manufacturing (i.e., the productivity of purchased inputs has increased), implying increasing value added. Over the period 1997–2011, real output in manufacturing rose 5.9 percent while purchased inputs (energy, materials, and services) fell by 8.2 percent, enabling a 34.3 percent increase in real value added.[45] Thus, productivity gains in manufacturing led to increased payments to the factors of production.

Productivity Gains in Services Create Downstream Benefits for Manufacturers

Many of the services industries have themselves experienced significant productivity gains in recent years. Often, these gains have been made possible by ICT. Productivity gains in services have an effect on manufacturers purchasing those services analogous to a drop in the price of oil, or an improvement in the quality of materials. By either reducing costs or improving the quality of productive inputs, productivity gains in

[45] USITC calculation based on USDOL, BLS, Multifactor Productivity tables.

services have been passed on to manufacturers, leading to further benefits for manufacturing.

Because services are labor intensive, it is often thought that productivity gains in services are harder to achieve than in goods production. This observation may have been valid in the period before widespread computer use, and it is still valid for personal services such as education, healthcare, and entertainment.[46] However, productivity growth in services as a whole accelerated markedly beginning in the 1990s and is now on a par with productivity growth in goods.[47]

As table 3.2 shows, the types of services most purchased by manufacturers have shown significant productivity gains in recent years. In the period from 1987 to 2002, cumulative productivity gains exceeding 10 percent were observed in wholesale trade; securities, commodities, and investments; rail and truck transportation; and computer systems and related activities. In the most recent period for which data are available (2002–10), comparable productivity gains have been achieved in the utilities and computer systems design and related services sectors. Over a longer period, these productivity gains have been substantial. For the whole period 1987–2010, cumulative productivity gains have amounted to 53 percent for wholesale trade, 34 percent for truck transportation, 35 percent for rail transportation, 166 percent for the securities industry, and 56 percent for computer systems design and related activities. These gains are concentrated in sectors which are particularly relevant to the ability of manufacturers to upgrade the performance of supply chains and manage innovation.

Advances in ICT Generate Productivity Benefits

There is a sizable literature on the link between ICT and productivity growth. While earlier studies had difficulty identifying ICT's impact on productivity, it is now generally recognized that ICT has led to productivity improvements in services as well as manufacturing.[48] As noted above, productivity improvements in most of the services types most widely used by manufacturers have provided spillover benefits to manufacturing. Available estimates[49] broadly cluster around gains of 0.5–0.6 percent productivity growth associated with a 10 percent increase in ICT use. These gains appear to have accelerated over the last 20 years, to be stronger for firms that invest in organizational change and organizational capital, and to have been larger in the United States than the European Union (EU).

[46] The difficulty in achieving cost reductions in personal services has been recognized since the 1960s. See Baumol, "Health Care, Education, and the Cost Disease," 1993.

[47] See Triplett and Bosworth, "Productivity Measurement Issues in Service Industries," 2003; Triplett and Bosworth, "Productivity in the U.S. Services Sector," 2004.

[48] In the late 1980s, Nobel Prize-winning economist Robert Solow famously noted that "You can see the computer age everywhere but in the productivity statistics." See Solow, "We'd Better Watch Out," 1987. Brynjolfsson, "The Productivity Paradox of Information Technology," 1993, reviewed a number of studies which investigated the disconnect between the U.S. productivity slowdown that started around 1973 and the simultaneous rapid growth in computing power. Later analysis, focusing on the acceleration of U.S. productivity from about 1995 onward, provides a more optimistic view of the impact of computers and information technology on productivity. See Jorgenson et al., "A Retrospective Look," 2008.

[49] This discussion relies on the review in Kretschmer, "Information and Communication Technologies and Productivity Growth," 2009, wherein the range of available estimates is cited.

TABLE 3.2 Productivity gains for services most purchased by manufacturers

Sector	2011 Purchases by manufacturers, million dollars	2011 Share of total intermediate use in manufacturing, percent	Changes in multifactor productivity, cumulative percentage change 1987–2002	2002–2010	1987–2010
Wholesale trade	240,828	6.6	46.7	4.1	52.7
Management of companies and enterprises	128,242	3.5	3.9	–19.0	–15.8
Miscellaneous professional, scientific, and technical services	126,748	3.5	7.5	5.9	13.9
Utilities	75,192	2.1	–1.1	21.0	19.6
Truck transportation	65,265	1.8	23.0	8.6	33.6
Administrative and support services	42,160	1.1	2.0	9.8	12.0
Rail transportation	33,481	0.9	31.8	2.4	35.0
Rental and leasing services and lessors of intangible assets	32,819	0.9	–32.9	2.6	–31.1
Securities, commodity contracts, and investment	30,472	0.8	155.5	4.0	165.9
Real estate	20,328	0.6	–2.8	-5.7	-8.3
Federal Reserve banks, credit intermediation, and related activities	17,244	0.5	–14.2	0.6	–13.7
Computer systems design and related activities	16,362	0.4	15.8	34.3	55.5

Sources: USDOL, BLS, Multifactor Productivity tables (accessed May 22, 2013); USDOC, BEA, Annual Input-Output tables (accessed June 25, 2013); Commission calculations.

Services Are Associated with Intangible Capital, a Source of Gains in Labor Productivity

It is widely recognized that investments in capital, or "capital deepening," can increase labor productivity and boost wages. Capital is often thought of as consisting primarily of physical capital, such as equipment and structures. However, more broadly, capital consists of any asset that enhances productivity over an extended period of time—for example, a year or more—rather than being used up in the production process. Thus, there is also nonphysical or intangible capital,[50] primarily associated with the generation of knowledge-based assets. Most forms of intangible capital are produced by services activities.

Business intangibles can be grouped into three broad categories: computerized information, which includes software and computerized databases; innovative property, which is acquired both through R&D and through nonscientific inventive and creative activity; and economic competencies, which include knowledge embedded in human resources and firm-specific business and organizational practices, including brand names. Software and computer systems design, R&D, creative and artistic design (as in apparel and furniture, and certain features of motor vehicles and electronics), and certain management activities are examples of services which can give rise to intangible capital.

[50]Corrado et al. estimated that by the late 1990s, investment in business intangibles amounted to 10 to 12 percent of U.S. GDP, was at least as large as tangible capital spending in equipment and structures, and was growing more rapidly than tangible capital spending. Corrado et al., "Measuring Capital and Technology," 2005.

As of yet there is no readily available measure of intangible capital specific to the U.S. manufacturing sector.[51] Table 3.3, below, presents several measures related to intangible capital in manufacturing, as well as some other measures for comparison. These include investment in software, R&D expenses,[52] and wages spent by manufacturers in occupations associated with the creation of intangible capital.[53] These measures do not represent all intangible capital—for example, they do not include the value of brand names, nor all of the payments made to services firms that may provide intangible capital to manufacturing—nor should they be summed to provide an overall measure. Some of the measures are overlapping; both the software measure and the wages measure include certain items counted in R&D spending. Nonetheless, they provide a broad indication of the formation and growth of intangible capital in manufacturing.

Even if the measures are highly overlapping, it appears likely that investment in overall intangible capital in manufacturing is larger than tangible investment in equipment and structures, and growing more rapidly. Investment in software accelerated rapidly in the 1990s, though it decelerated thereafter, while R&D spending accelerated in the 2000s. Wages spent to create intangible capital, particularly wages of top-level scientific, technical, and creative personnel, have grown over the last decade significantly more rapidly than either software investment or wages in occupations not associated with intangible capital. Thus, the contribution of intangible capital to gains in manufacturing productivity has likely also been significant.

Services Liberalization Benefits Manufacturing

There is now substantial evidence that access to a wide variety of high-quality services promotes manufacturing competitiveness.[54] For example, countries and products that make greater use of services inputs exhibit higher product quality and higher export prices. As noted above, services inputs boost manufacturing competitiveness in several ways. They increase productivity in activities that manufacturers currently perform, give manufacturers the flexibility to specialize in new high-skill activities, and facilitate the outsourcing of less productive tasks.

Liberalization of services trade can reduce costs and increase the variety of services available to manufacturers. Hence, services liberalization can be an important component

[51] The role of intangible capital in U.S. official data is expanding significantly in the 2013 comprehensive revision of the national income and product accounts (NIPA). Historically, only one type of intangible capital—software—has been recognized and accounted for in U.S. official data on investment and fixed assets. The revisions recognize private and government expenditures on R&D as fixed investment, as well as private expenditures on entertainment, literary, and other artistic originals. Tables and reports reflecting the new concepts were phased in during July–August 2013. At the time of writing, the new measures of fixed investment were available on an economy-wide basis but not for manufacturing specifically. See McCulla et al., "Improved Estimates," 2013, for details.

[52] These include R&D expenses paid by manufacturers, by government, and by other organizations.

[53] The definition of "scientific, technical, and creative personnel" in table 3.3 includes most occupations in business and financial operations, computer, engineering, and science occupations, and certain arts and design occupations, as well as librarians and library technicians. This definition is somewhat narrower than the definition of "business services" occupations used elsewhere in the chapter. Following Corrado et al., the calculation in table 3.3 assumes that 20 percent of managerial time is spent on organizational innovation. Corrado et al., "Measuring Capital and Technology," 2005.

[54] This section summarizes empirical evidence presented in Francois and Woerz, "Producer Services, Manufacturing Linkages, and Trade," 2008; Francois and Hoekman, "Services Trade and Policy," 2010; Gonzales et al., "Globalisation of Services and Jobs," 2012; Nordås, "Business Services," 2010; Nordås and Kim, "The Role of Services," 2013.

TABLE 3.3 Indicators of intangible capital in manufacturing, 1992–2011

Indicator	2011[a]	Cumulative increase, percent 1992–2002	2002–11	1992–2011
Intangible capital				
Investment in software	30.5	111.8	19.9	154.1
Research and development expenditures[b]	195.1	20.9	79.0	116.3
Wages spent to create intangible capital	137.4	n.a.	28.2	n.a.
Top-level scientific, technical, and creative personnel	75.5	n.a.	52.7	n.a.
20 percent of wages of top-level managers[c]	61.8	n.a.	7.2	n.a.
Memo items				
Investment in equipment and structures	161.7	25.5	16.2	45.9
Wages in other occupations	334.4	n.a.	2.8	n.a.

Sources: USDOC, BEA, National Economic Accounts (accessed July 16, 2013); USDOL, BLS, Occupational Employment Statistics (accessed June 20, 2013); NSF, Business Research and Development and Innovation Survey, various issues (accessed July 15, 2013); Commission calculations.

Note: The indicators of intangible capital should not be summed in an attempt to create an overall measure, since they are partly overlapping.

[a]Billion current dollars.
[b]Data end in 2010. Expenditures include expenditures paid for by companies, by government, and by other organizations.
[c]Assuming that 20 percent of managerial time is spent on organizational innovation. See text and notes.

of efforts to boost manufacturing competitiveness. Increased business services openness has a strong positive effect on the competitiveness of downstream industries. As with any trade liberalization, however, the effects will differ by sector, and not every industry will benefit. Estimates in the literature suggest that reducing services trade costs would have strong positive effects on motor vehicles, plastics, and rubber, but no effect in apparel.[55] Increased use of imported business services raised exports of skill- and technology-intensive industries in a panel of Organisation for Economic Co-operation and Development (OECD) countries, but reduced exports of labor-intensive manufactures.[56]

The benefits of services liberalization are particularly marked in manufacturing industries that are tightly integrated into production networks. Parts and components that cross multiple borders are subject to regulations and potential restrictions in multiple countries. Restrictions on the services needed to produce these parts, or restrictions on the services that facilitate their movement, can occur in widely distributed places, and effects can compound as goods move through the supply chain. As supply chains spread through an increasing number of countries and industries, manufacturers are increasingly exposed to the effects of services restraints occurring in locations with which they may have no direct contact.

Manufacturers are also affected by regulations and restrictions affecting the movement of goods in these same locations. Hence, some studies conclude that broad regional or global trade liberalization, including both goods and services and affecting barriers both

[55] See Nordås, "Business Services," 2010; Francois and Woerz, "Producer Services, Manufacturing Linkages, and Trade," 2008.
[56] Francois and Woerz, "Producer Services, Manufacturing Linkages, and Trade," 2008.

at and behind the border, can most effectively address the potential inefficiencies along the entire supply chain.[57]

Services Inputs into U.S. Manufacturing: Patterns and Trends

Over the last several decades, services have become an increasingly large share of the U.S. economy. In 1950, business services contributed 8.7 percent of U.S. gross domestic product (GDP); in 2012, they contributed 21.5 percent (figure 3.2).[58] This growth became particularly pronounced in the 1980s and 1990s, but has plateaued in the last decade.

A few patterns and trends emerge from an analysis of aggregate-level databases. As U.S. business services sectors have increased relative to the size of the economy, some manufacturing sectors have increased their use of business services. In addition, there has been a recent increase in business services-providing occupations within manufacturing. At the sector level, there is a positive correlation between the use of business services inputs and the share of business service-providing occupations.

Most of the data described in the rest of this chapter are restricted to the last decade, due to the lack of longer time series. Again, the focus is on business services, which, as discussed at the beginning of the chapter in box 3.1, are the services that are primarily used as intermediate inputs by other businesses and that use high-skilled services workers intensively.[59]

The Share of Business Services-Providing Occupations in Manufacturing Has Risen Slightly Since 2006

The share of workers in business services occupations within manufacturing has grown in recent years.[60] Manufacturing sector employment includes significant numbers of services-providing staff, conducting activities such as R&D, accounting, or marketing and advertisement. This increasing share of services-providing staff in manufacturing suggests the importance of these activities for manufacturing.

From 2002 to 2012, the share of business services occupations in manufacturing employment increased by 2.8 percentage points, rising from 29.8 to 32.6 percent (figure 3.3). Much of this increase occurred beginning in 2008. While production occupations—occupations directly related to the production process—retained by far the largest share of total manufacturing employment, their share declined slightly from 54.5 percent in 2002 to 52.9 percent in 2012; there was an increase in the downward trend following the

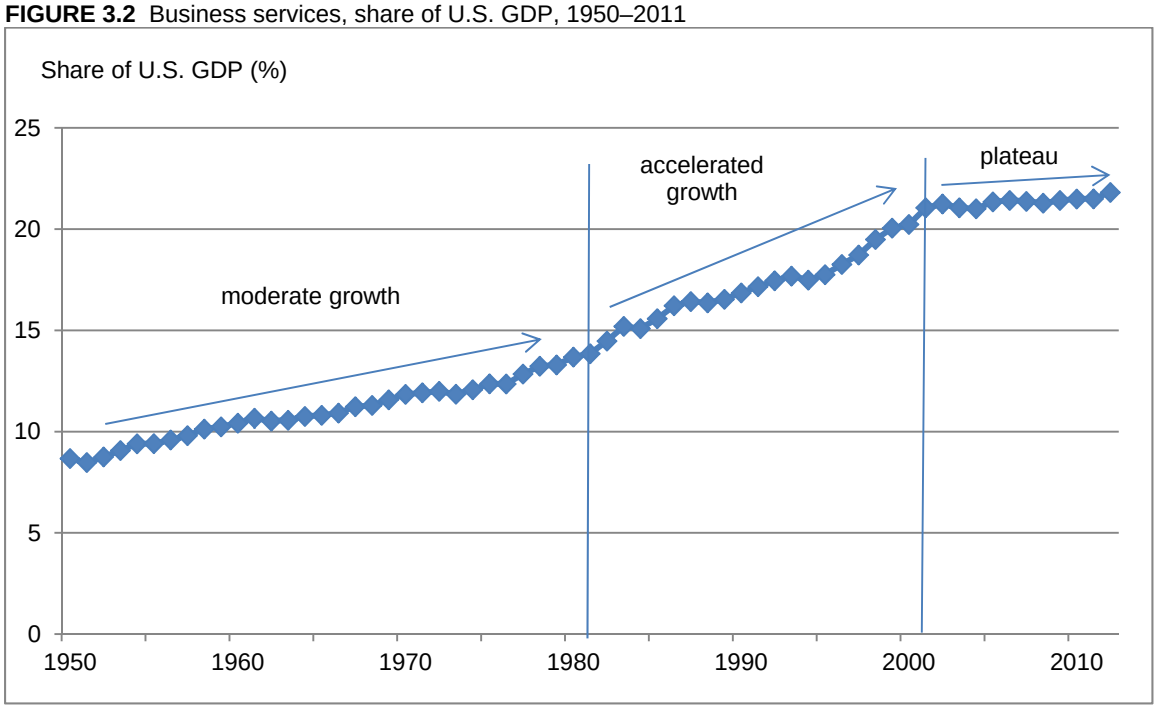
[57] Kommerskollegium, *Everybody Is in Services*, 2012, 22–23.

[58] USDOC, BEA, GDP-by-Industry Data (accessed July 11, 2013). This historical time series constructed using data from the Bureau of Economic Analysis (BEA) includes the sectors defined in box 3.1, with one addition and one omission: (1) funds, trusts, and other financial vehicles are included in the definition used in the historical time series; (2) rental and leasing services and lessors of intangible assets are excluded.

[59] The short time series availability is due to changes in sector and occupation classifications, as well as the lack of historical data for newly constructed databases.

[60] Similar analysis has been undertaken in Falk and Jarocinska, "Linkages between Services and Manufacturing," 2010, which uses EU data.

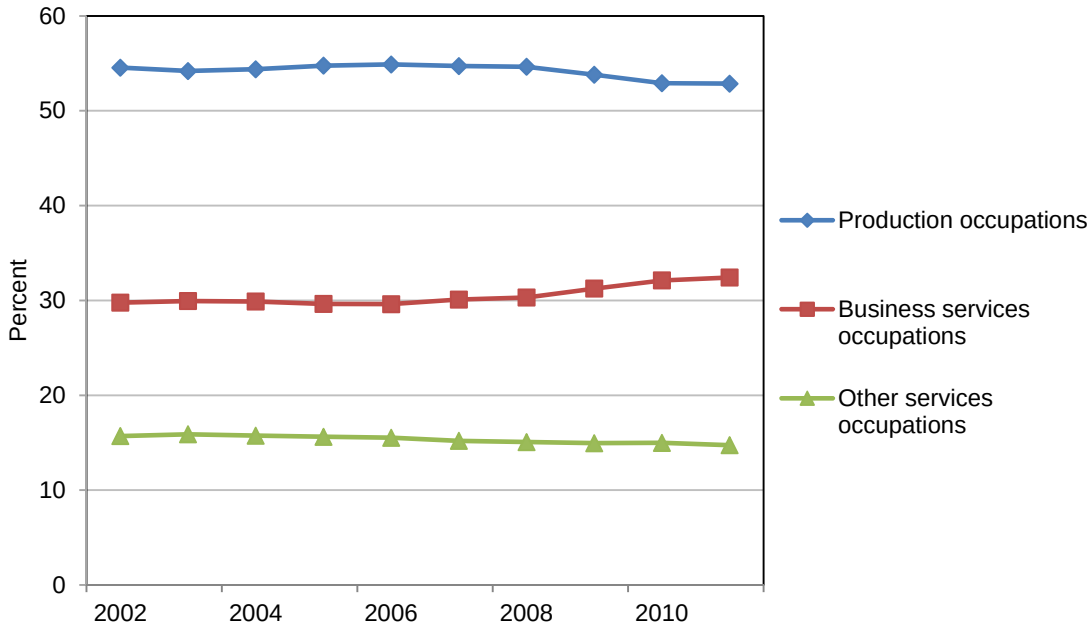
FIGURE 3.2 Business services, share of U.S. GDP, 1950–2011



Source: USDOC, BEA, GDP-by-Industry Data (accessed July 11, 2013); Commission calculations.

Note: The definition of business services used in this figure is slightly modified relative to the definition laid out in box 3.1: funds, trusts, and other financial vehicles are included in the definition, while rental and leasing services and lessors of intangible assets are excluded. This modification was necessary due to the lack of detailed sector-level data in earlier years.

FIGURE 3.3 The share of business services-providing occupations in U.S. manufacturing has increased over time, 2002–12



Sources: USDOL, BLS, Occupational Employment Statistics (accessed June 20, 2013); Commission calculations.

financial crisis in 2008. The share of other services-providing occupations dipped by 1.1 percentage point from 2002 to 2012.[61]

This structural shift of manufacturing employment toward business services occupations reflects the rising use of business services within manufacturing operations. It may also signal increased insourcing of business services products, with manufacturers hiring more business services workers even as they expanded purchases from other services sectors.

Nearly all sectors saw gains in the share of business services occupations employed; growth was most pronounced in computer and electronic products, apparel and leather, electrical equipment, and motor vehicles and parts (table 3.4), each of which has increased its share of business services-providing occupations by more than 5 percentage points. Only two sectors saw declines in their use of business services occupations: chemicals, and food, beverages, and tobacco.

The Share of Services as Direct Intermediate Inputs in Manufacturing Has Remained Stable since 1997

"Direct services" measures the direct contribution of each sector to manufacturing inputs.[62] On a constant-dollar basis, purchased services have remained stable at just under 20 percent throughout this time period.[63] Materials remain the largest intermediate input into manufacturing, and their share of total intermediate inputs increased slightly from 76.2 percent in 1997 to 78.8 percent in 2011 (figure 3.4). Energy is a fairly small portion of intermediate inputs into manufacturing at around 3 percent.

However, about half of all sectors increased their purchases of business services used as intermediate inputs (table 3.5) from 2002 to 2011. The fastest increases were seen in the computer and electronics and the apparel and leather products sectors—notably, the same sectors that experienced the fastest growth in business services occupation shares (table 3.4).[64]

Examining the levels of business services used, it appears that manufacturing sectors that use purchased business services intensively also have a high share of business services employment (figure 3.5). This relationship is most notable for computer and electronics products, which rank first both in purchased business services and in business services

[61] Other services-providing occupations include education, health care, social and personal services, transportation, and installation, maintenance and repair occupations.

[62] This section uses the data in Fleck et al., "A Prototype," 2012, as well as data from the BEA's input-output tables. Fleck et al. produce a constant-price time series (in 2005 prices) of the intermediate inputs in three cost categories—energy, materials, and purchased services. "Materials" includes the cost of raw materials and intermediate goods. This permits a discussion based on constant prices, although only for the aggregated cost categories. Fleck et al. apply a KLEMS production framework to BEA's estimates of industry production. See Strassner et al., "Annual Industry Accounts," 2005, for details.

[63] The last two years of data show a slight decline, but more data would be needed to establish a downward trend.

[64] Although both figure 3.5 and table 3.5 display direct services inputs into manufacturing, they are not directly comparable. Table 3.5 uses nominal values (not adjusted for inflation) as the basis for share calculations, while the Fleck et al. data displayed in figure 3.5 uses real (constant price) values as the basis for share calculations. Table 3.5 also uses only business services inputs, while Fleck et al. use all purchased services. Although constant-price adjustments are preferred, they are not available at a disaggregated sector level.

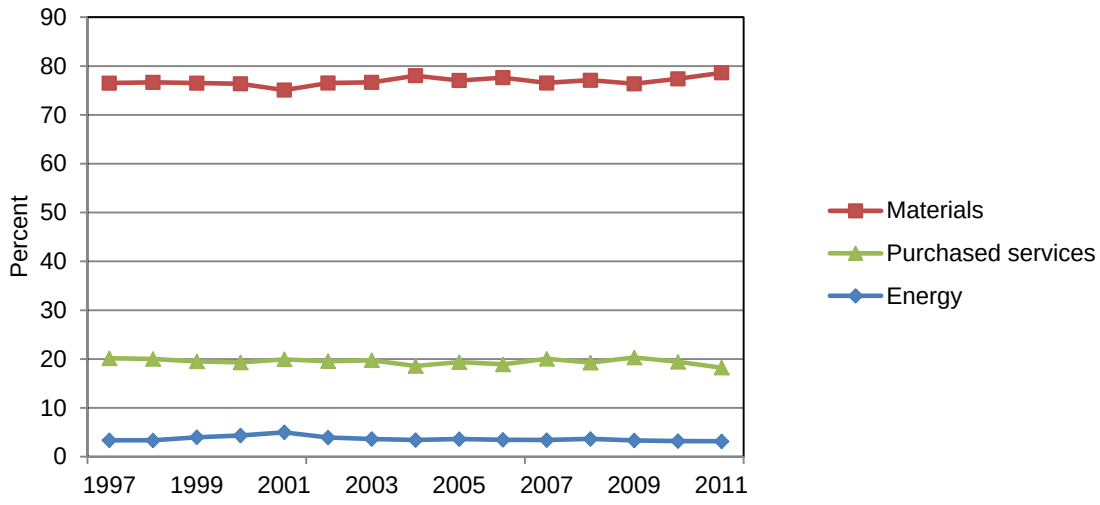
TABLE 3.4 Share of business services occupations in total U.S. manufacturing employment

Sector[a]	Percent 2002	Percent 2012	Change,[b] 2002–12
Computer and electronic products	59.5	67.2	7.7
Other transportation equipment	46.8	47.7	1.0
Chemical products	45.7	43.7	–2.0
Petroleum and coal products	35.5	38.7	3.2
Miscellaneous manufacturing	33.7	38.4	4.7
Printing and related support activities	36.6	38.3	1.7
Machinery	35.8	37.2	1.4
Electrical equipment, appliances, and components	29.0	35.6	6.6
Apparel and leather and allied products	20.3	28.7	8.4
Fabricated metal products	25.3	26.5	1.2
Furniture and related products	20.2	23.6	3.4
Motor vehicles, bodies and trailers, and parts	17.2	22.8	5.6
Plastics and rubber products	20.4	22.8	2.4
Paper products	21.1	22.6	1.5
Nonmetallic mineral products	20.5	21.9	1.4
Textile mills and textile product mills	18.6	20.9	2.3
Primary metals	18.8	19.5	0.7
Food and beverage and tobacco products	19.1	18.6	–0.5
Wood products	16.4	17.5	1.1
Average	29.8	32.6	2.8

Sources: USDOL, BLS, Occupational Employment Statistics (accessed June 20, 2013); Commission calculations.

[a]Sorted by the share of business services occupations in 2012.
[b]Percentage point difference.

FIGURE 3.4 Intermediate inputs of the manufacturing sector



Sources: Fleck et al., "A Prototype," 2012; Commission calculations.

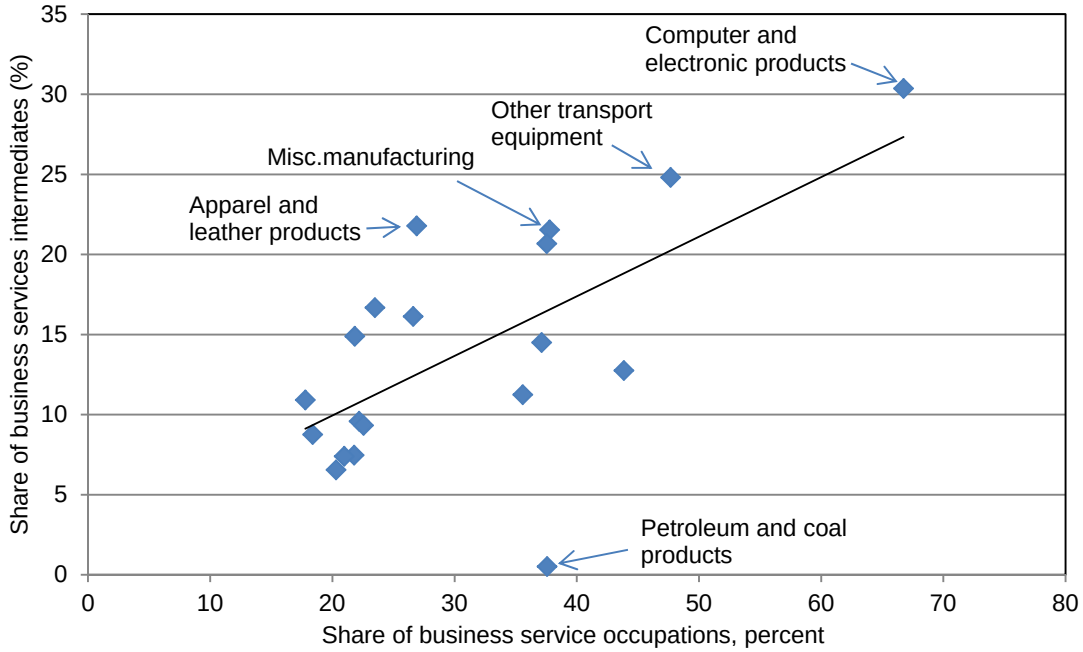
TABLE 3.5 Use of business services intermediates in manufacturing sectors

Sector[a]	Percent 2002	Percent 2011	Change,[b] 2002–11
Computer and electronic products	26.8	30.4	3.6
Other transportation equipment	19.1	24.8	5.7
Apparel and leather and allied products	17.8	21.8	4.0
Miscellaneous manufacturing	20.8	21.5	0.8
Printing and related support activities	19.8	20.7	0.8
Furniture and related products	17.8	16.7	–1.1
Fabricated metal products	18.1	16.1	–1.9
Nonmetallic mineral products	14.8	14.9	0.1
Machinery	15.8	14.5	–1.3
Chemical products	20.3	12.8	–7.6
Electrical equipment, appliances, and components	13.3	11.2	–2.0
Wood products	10.2	10.9	0.7
Plastics and rubber products	13.2	9.6	–3.6
Paper products	9.7	9.3	–0.4
Food and beverage and tobacco products	10.8	8.8	–2.0
Motor vehicles, bodies and trailers, and parts	7.2	7.5	0.2
Textile mills and textile product mills	9.1	7.4	–1.7
Primary metals	9.6	6.6	–3.1
Petroleum and coal products	2.6	0.5	–2.0
Average	14.0	10.4	–3.6

Sources: USDOC, BEA, Annual Input-Output tables (accessed June 25, 2013); Commission calculations.

[a]Sorted by the share of business services intermediates in 2011.
[b]Percentage point difference.

FIGURE 3.5 Manufacturing sectors that buy more business services also employ more workers in business services occupations, 2011



Sources: USDOL, BLS, Occupational Employment Statistics (accessed June 20, 2013); USDOC, BEA, Annual Input-Output tables (accessed June 25, 2013); Commission calculations.

employment. Leaving computers and electronics aside, the correlation between business services purchases and employment is more modest, but remains positive.

The Value Added of Business Services Has Remained Stable or Is Rising in Several Manufacturing Sectors

Services' full contribution to manufacturing is most accurately measured in terms of value added. Value added measures how much value (in terms of employee compensation and company profits) was generated by each sector. Consider the manufacture of a motor vehicle. The input-output (I-O) tables describe the production value of motor vehicles and their direct intermediate inputs, which may include auto parts, metal, glass, and electronics. However, embedded in each of these manufactured products may be accounting services provided to the auto parts company, computer services to the electronics manufacturer, and steel to the metals manufacturer; each of these sectors has in turn purchased goods and services embedded within them; and so on. The embedded values created by each sector can be summed up by transforming I-O tables, using certain assumptions, to recover the estimates of total value added (both direct and indirect) generated by each sector along the entire value chain.[65] In the discussion below, the total value added by all sectors of the economy in production of final manufactured goods is referred to as "manufacturing value added."[66]

Performing such calculations shows that as a share of value-added input into the aggregate U.S. manufacturing industry, services have remained relatively stable at approximately 34 percent (table 3.6). For the aggregate manufacturing sector, the share of services has decreased by 0.9 percent from 1995 to 2008, while the share of business services (at approximately 16 percent) has expanded slightly, by 0.2 percent, due to the expanded use of foreign business services.

At a more disaggregated level (table 3.7), manufacturing sectors differ substantially in the value added that is attributable to business services. Such value added ranges from as little as 8.2 percent of the share of total value added to the refined petroleum, coke, and other fuels sector to 23.2 percent for the pulp, paper, printing, and publishing sector. In the latter sector, a large part of business services value added is professional services. [67]

This is likely driven by the publishing segment, which requires extensive professional services in the production of content. The sector has also experienced the fastest growth of any manufacturing sector in the use of services, which reflects both the increased use of professional services by digital publishers and the decline in physical media.

[65] National-level I-O tables stop tracing value added at the border. As goods production has become increasingly fragmented across countries and sectors, an accurate assessment of value added requires I-O tables that link production processes within and across countries. To meet this need, the World Input-Output Database (WIOD) (a European Commission-funded program) has constructed a set of international I-O tables. The WIOD tables permit the tracing of value added across countries. See Timmer, "The World Input-Output Database," 2012. Because of international differences in the classification of services sectors, activities included in business services by WIOD differ slightly from those included by BEA. See box 3.1 for a comparison. A detailed explanation is provided in appendix F.

[66] This measure is distinct from GDP by industry, which would include only value added by firms and workers in the manufacturing sector, and is also known as "manufacturing value added."

[67] Professional services include activities such as legal, accounting, architectural, engineering, research and development, as well as the renting of machinery and equipment.

TABLE 3.6 Total services' contribution to U.S. manufacturing value added

Category	Percent 1995	Percent 2008	Change,[a] 1995–2008
Total services	34.7	33.7	–0.9
Domestic services	30.2	27.3	–2.9
Foreign services	4.5	6.5	2.0
Business services	15.7	15.9	0.2
Domestic business services	13.9	13.4	–0.5
Foreign business services	1.8	2.5	0.7

Sources: WIOD; Commission estimates.

[a]Percentage point difference.

TABLE 3.7 Business services' contribution to U.S. manufacturing value added[a]

Sector[a]	Percent 1995 Dom.	Percent 1995 Foreign	Percent 1995 Total	Percent 2008 Dom.	Percent 2008 Foreign	Percent 2008 Total	Change,[b] 1995–2008 Dom.	Change,[b] 1995–2008 Foreign	Change,[b] 1995–2008 Total
Pulp, paper, printing and publishing	16.9	1.5	18.4	21.0	2.2	23.2	4.1	0.6	4.7
Chemicals and chemical products	15.4	1.9	17.3	16.4	3.1	19.5	1.0	1.2	2.2
Transport equipment	12.1	2.2	14.3	14.2	3.3	17.5	2.1	1.1	3.2
Other nonmetallic mineral products	11.6	1.2	12.8	15.2	2.0	17.2	3.6	0.8	4.4
Rubber and plastics	13.2	1.8	15.0	13.8	2.9	16.7	0.6	1.1	1.7
Wood and wood products	10.8	1.3	12.1	14.3	2.0	16.3	3.6	0.7	4.3
Electrical and optical equipment	16.9	2.3	19.2	13.5	2.4	15.9	–3.4	0.1	–3.3
Basic metals and fabricated metal	11.9	1.6	13.5	13.3	2.4	15.7	1.4	0.8	2.2
Manufacturing n.e.c.	12.0	1.5	13.5	13.5	2.2	15.7	1.5	0.7	2.2
Machinery n.e.c.	13.1	1.8	14.9	13.0	2.6	15.6	–0.1	0.8	0.7
Food, beverages, and tobacco	14.2	1.4	15.6	13.6	1.9	15.5	–0.6	0.5	–0.1
Textiles and apparel	13.9	1.6	15.5	9.9	2.1	12.0	–4.1	0.4	–3.7
Footwear and leather products	16.1	2.2	18.3	9.0	2.0	11.0	–7.1	–0.2	–7.3
Refined petroleum, coke, and other fuel	9.3	2.0	11.3	5.5	2.7	8.2	–3.8	0.7	–3.1
Total manufacturing	13.9	1.8	15.7	13.4	2.5	15.9	–0.5	0.7	0.2

Sources: WIOD; Commission estimates.

Notes: Includes services value used directly and indirectly in the production of manufactured goods. n.e.c. means "not elsewhere classified."

[a]Sorted by total business services contribution in 2008.
[b]Percentage point difference.

Two other sectors also contain a large share of value added by business services, primarily due to high levels of R&D. The chemicals sector includes the highly R&D-intensive pharmaceutical manufacturers, while transportation equipment has a large share of embedded R&D in components and new materials, as well as in the development of new final goods such as motor vehicles and airplanes.

The footwear and leather products sector, one of the least business services-intensive sectors, has experienced the greatest decline in business services use since 1995. This decline is due primarily to the reduced use of professional services.

Foreign services inputs are used at similar rates across U.S. manufacturing sectors. Foreign business services accounted for 1.9–3.3 percent of sectoral output value in 2008 (table 3.7). Sectors with relatively high use of foreign business services include chemicals and transport equipment. This likely reflects the importance of intellectual property in these sectors,[68] and the significant presence of foreign-owned affiliates in these sectors.

Consistent with the increased globalization of value chains, foreign business services have grown increasingly important to U.S. manufacturing: use of foreign services rose in nearly every sector between 1995 and 2008, albeit from a low base. Although there is nothing to keep a sector from being an intensive user of both foreign and domestic services, in practice this is uncommon. Only three sectors (chemicals, transport equipment, and rubber and plastics) had above-average use of both types of services in 2008.[69]

International Comparisons and Services Trade in GVCs

Globally, business and distribution services are much more important to manufacturers than other types of services. In 2008, business services accounted for 12.6 percent of the value of manufacturing output; distribution services such as retail trade and transportation for an additional 14.0 percent; and other services, such as utilities, hotels, and government services, for a smaller 6.8 percent (figure 3.6 and appendix table F.5).[70]

There are stark differences across countries in the use of services by manufacturers. Among the countries in the dataset created by the World Input-Output Database (WIOD), services use ranges from a low of 20 percent in Indonesia to a high of 44 percent in Ireland. European countries dominate the ranks of countries with high services use, occupying the top 10 positions on the list in 2008. In the United States, services contributed one-third (33.7 percent) of U.S. manufacturing value added. The U.S. value was almost identical to the global average of 33.4 percent. In part, European prominence is due to the composition of countries in the WIOD dataset used to produce these estimates—27 of the 40 countries in the dataset are European. But the OECD, using a more inclusive (though non-public) dataset, largely confirms these findings. For example, OECD ranks France as the second-highest user of services in manufacturing (behind Iceland) in 2009, and it estimates that 9 of the 10 top services users are in Europe.

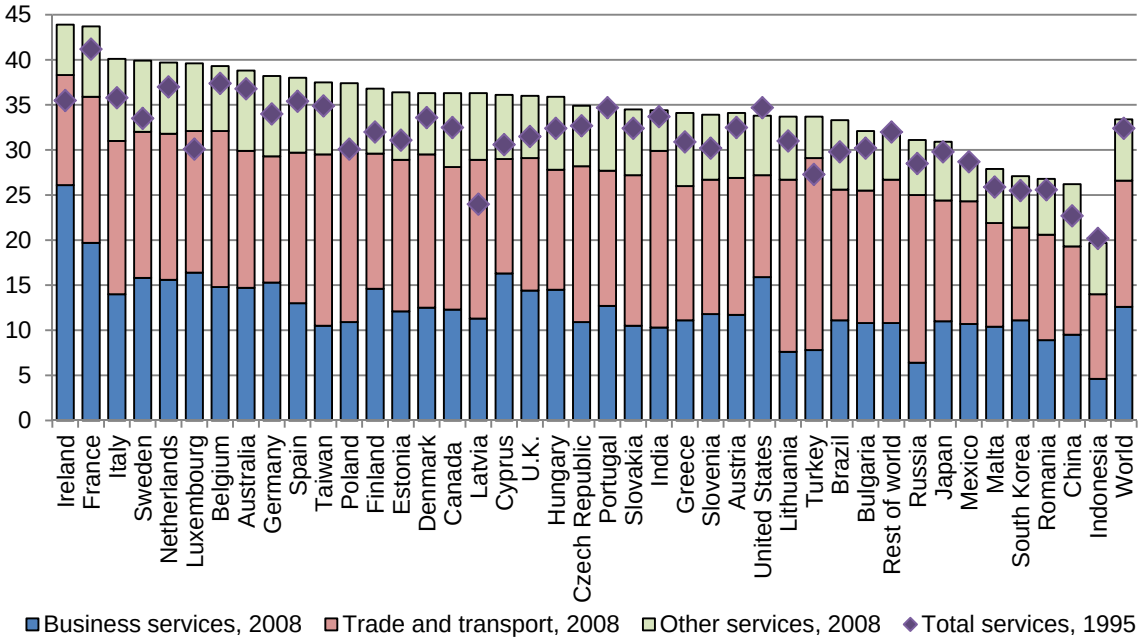
Although U.S. manufacturers use services less overall than their European counterparts, they use more business services inputs. In fact, the United States ranks fifth globally in the share of business services in manufacturing value added, behind only Ireland, France,

[68] Barefoot and Koncz-Bruner find that these sectors generated the most services imports among all manufacturing sectors, noting that for these sectors, "intellectual property forms an important part of firms' competitive advantage, which gives rise to transactions in royalties and license fees and R&D and testing services." Barefoot and Koncz-Bruner, "A Profile of U.S. Exporters and Importers of Services," 2012, 71–2.

[69] Rubber and plastics had only slightly above-average use of services.

[70] These estimates are generated using the WIOD database as described in appendix F and exclude construction. They are broadly confirmed by the OECD, which also finds that services contributed over 30 percent of the total value added in manufactured output, using a separate database. Miroudot and Rouzet, "Trade Policy Implications," 2013.

FIGURE 3.6 Services' contribution to manufacturing value added in each country, percent, 2008



Sources: WIOD; Commission estimates.

Note: Includes services in output of final goods only.

Luxembourg, and Cyprus. The United States also uses more business services (15.9 percent of manufacturing value added) than the EU as a whole (15.1 percent). High U.S. business services inputs may reflect both the nature of the advanced products produced by U.S. companies, which require these inputs, and the highly educated U.S. manufacturing and services workforce that provides them.

The higher value of overall services in Europe may reflect the high prices of many services there. Overall, services prices are 11 percent higher in the EU than in the United States, and prices for some types of services—such as utilities and transportation services—are much higher (about 25 and 50 percent, respectively).[71] Hence, the lower U.S. input share for trade and transportation services may simply be due to the lower U.S. cost of these inputs.

Although the differences in services use across countries can be at least partly attributed to services prices and the types of products produced by each country, the change over time is more difficult to explain. Figure 3.6 shows that while manufacturers in all of the countries with the highest services-to-manufacturing ratio increased their use of all services between 1995 and 2008, this ratio did not increase for the United States, which is

[71] According to 2008 benchmark purchasing power parity (PPP) data from the Eurostat-OECD PPP Programme, http://stats.oecd.org/Index.aspx?DataSetCode=PPP2008 (accessed August 1, 2013). "Overall services" excludes government services.

consistent with prior analysis in this chapter.[72] U.S. use of business services rose in the period, but by a very small amount (0.2 percent of manufacturing value added). The largest U.S. change in the period is a 1.1 percent decline in the share of trade and transportation services. Again, it is possible that this decline reflects better U.S. price performance in these sectors than in Europe in the period. International comparisons of services prices generally do not exist for the 1990s, however, so no definite conclusions can be reached.

The supply chain logistics literature emphasizes that more extensive global supply chains raise management and organization costs, but also allow companies to take advantage of economies of scale in trade and transportation.[73] At the country level, there appears to be some support for this conclusion. There is a positive correlation between a country's global engagement in 2008 and its use of business services in manufacturing.[74] The need for additional business services to coordinate international networks provides another reason why the business services share is high in tightly integrated Europe. In contrast to business services, there is no correlation between global engagement and the use of trade and transportation services. [75]

The Role of Services Trade in Manufacturing

Many manufacturers rely on both domestic and foreign goods and services. Worldwide, foreign services providers account for a small but growing share of services inputs.[76] As with total services inputs discussed above, the importance of imported services varies widely across countries; in some countries, such as Sweden, the importance of imported services is fairly substantial.[77]

Measured by the direct import of services, U.S. manufacturer's use of imported services appears quite low: direct services imports account for about 0.5–1 percent of the value of all U.S. manufacturing inputs.[78] However, as noted above, direct flows can present a misleading picture of total input use. A key source of indirect services inputs are the foreign services embedded in imports of parts and components used by U.S. manufacturers. Another important source of indirect inputs are services imported by

[72] Appendix table F.5 shows a 1 percentage point decline in U.S. services use in manufacturing *output*. Stehrer et al., "Value Added and Factors in Trade," 2012, 17, shows a small decline in U.S. services use in manufacturing *exports* in this period, while the OECD estimates a larger increase in services use in U.S. exports, particularly in the wood and transportation equipment sectors. See OECD and WTO, "OECD/WTO Trade in Value Added," 2013, 4. Though not all estimates agree, the overall change in U.S. services use has likely been minor.

[73] See Hesse and Rodrigue, "The Transport Geography of Logistics and Freight Distribution," 2004; Rodrigue, "Transportation and the Geographical and Functional Integration," 2006.

[74] Global engagement is measured by the share of imported intermediates that are used in exported products, as reported by the OECD. Business services use is given in figure 3.7. The correlation between engagement and services use is 0.32, and it is significant at the 5 percent level. This correlation does not imply causation. While global engagement may increase organizational complexity and the need for business services, it is also possible that greater use of business services generates products that succeed in the global marketplace.

[75] There is no evidence that it lowers use of these services as implied by the supply chain logistics literature. This correlation is 0.03, and it is far from significant. Trade and transportation use is given in figure 3.6 and appendix table F.5.

[76] Gonzales et al., "Globalisation of Services and Jobs," 2012.

[77] Kommerskollegium, *Servicification of Swedish Manufacturing*, 2010.

[78] Even in detailed manufacturing industries, this share rarely rises above 2 percent. For a review of manufacturing use of direct services imports, see USITC, *Import Restraints*, 2011, 3-13.

companies in other sectors of the economy (e.g., mining or services) to produce domestic inputs to manufacturing. Incorporating these sources of indirect services considerably raises the share of foreign services in U.S. manufacturing. Including indirect flows, foreign business services accounted for 2.5 percent of U.S. manufacturing value added, or about 16 percent[79] of all business services used by U.S. manufacturers in 2008 (table 3.6). This comes to just over 3 percent of the value of all U.S. manufacturing inputs. Hence, accounting for indirect inputs raises the importance of foreign business services to U.S. manufacturers at least threefold.[80]

U.S. services firms also provide inputs that are used abroad by foreign manufacturers. In 2008, the value of U.S. business services used by domestic manufacturers was about 2.5 times the value of U.S. business services used by manufacturers abroad.[81] However, foreign manufacturers have become more important to U.S. services providers as their purchases of U.S. services have risen steadily over time.

There are four channels by which U.S. services are used in goods consumed abroad. The first two channels constitute direct services exports, and the last two are indirect exports. They include:

1. direct U.S. services exports to foreign manufacturers;
2. direct U.S. services exports to foreign services firms that provide services to foreign manufacturers;
3. U.S. services used by U.S. goods producers that are subsequently exported to foreign manufacturers and consumers; and
4. U.S. services used by U.S. services providers that are subsequently exported to foreign manufacturers.

Of these channels, the first two (direct exports) have shown the most growth in recent years. According to services trade data compiled by the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce, U.S. direct exports of business, professional, and technical services doubled in value between 2003 and 2011, and tripled between 1998 and 2011.[82] In comparison, BEA annual I-O tables imply that indirect services exports grew only 4 percent overall from 1998 to 2011. Indirect exports through services sectors rose 44 percent, but indirect exports embodied in manufactured goods fell 16 percent (figure 3.7).

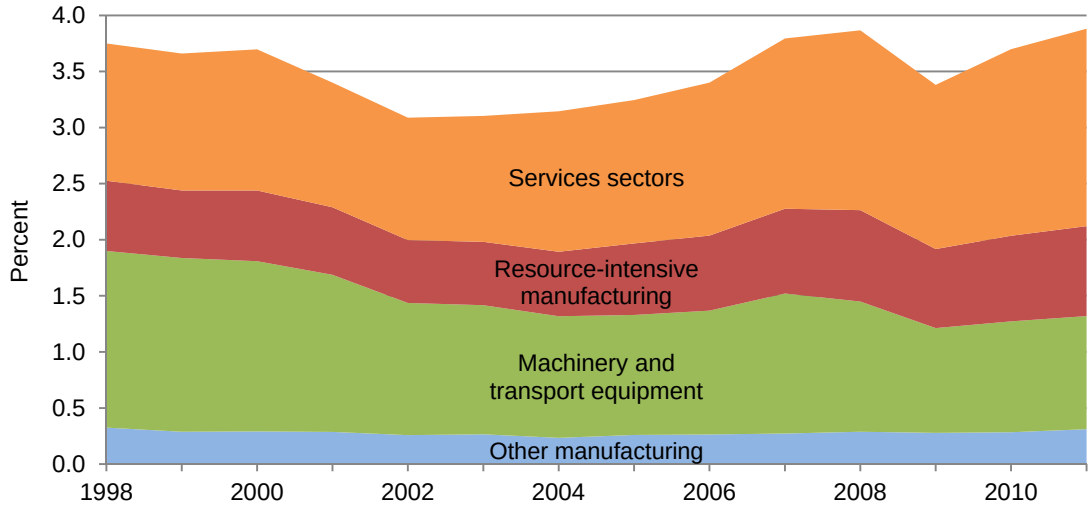
[79] Calculated as the ratio of foreign services (2.5 percent) to total services (15.9 percent) in 2008 (table 3.6).

[80] Including other embodied foreign services, such as the value of utilities used to produce foreign goods, raises the foreign services' share to 5 percent of the value of U.S. manufacturing inputs.

[81] According to Commission estimates using WIOD data, U.S. manufacturers used $265.3 billion of U.S. business services in the production of final manufactured goods, while foreign manufacturers used $106.7 billion of U.S. business services. Although foreign use is substantially less than domestic use of business services, this nevertheless indicates that a significant amount of U.S. business services is used by manufacturers abroad.

[82] Because of changes to U.S. export classifications over time, no precise match to business services as defined in box 3.1 is possible before 2006. The export category "business, professional, and technical services" is largely a subset of the services included in box 3.1. It excludes publishing, motion picture and sound recording, broadcasting and telecommunications, financial services, and royalties and license fees. It also includes some unrelated sectors such as medical services, construction, and mining services, though there is relatively little trade (less than $20 billion, or about 3 percent of total services exports in 2011) in these sectors.

FIGURE 3.7 Indirect exports of services, share of U.S. services value added, 1998–2011



Sources: USDOC, BEA, Annual Input-Output tables (accessed June 25, 2013); Commission estimates.

Notes: "Resource-intensive manufacturing" includes wood, metal, mineral, paper, petroleum, chemical, plastic, and rubber products. "Machinery and transport" includes machinery, electrical equipment, computer and electronic products, motor vehicles, and other transportation equipment; "other manufacturing" includes food, furniture, textiles and apparel, and miscellaneous manufacturing.

Most indirect U.S. services exports pass through U.S. manufacturers, and thus indirect services exports strongly reflect the export performance of U.S. manufacturers that use services intensively. As noted in table 3.7, these sectors include natural resource sectors, chemicals, and transport equipment. U.S. manufacturing exports respond to changes in global demand, and can rise or fall rapidly, leading to shifts in indirect services exports. For example, recession-driven manufacturing export declines in 2001–02 and 2009 resulted in declines in indirect services exports. Indirect exports are also driven by increases or decreases in manufacturers' use of services inputs, though this factor evolves more gradually.

Previous sections of this chapter have started by identifying specific manufacturing sectors, then have looked upstream at the types of services inputs that they use. A complementary picture emerges by starting with specific services sectors, and looking downstream at the ways they are used by manufacturers. Table 3.8 presents figures for direct exports of U.S. services sectors and the downstream sectors that use services and that account for indirect services exports.

The sector with the highest direct exports of services, as a share of total sectoral value, is "rental, leasing, and lessors of intangible assets" (23.5 percent). This sector includes royalties and license fees paid by foreign firms and U.S. affiliates to access U.S. intellectual property. Another sector with high direct exports of services is management (19.8 percent). These sectors are among the major contributors to U.S. services exports and the U.S. services trade surplus.[83]

Direct services exports account for a substantial share (3.7 percent) of the services sector's total value added, yet indirect exports account for an even greater share (3.9

[83] For a discussion of cross-border exports in these sectors, see USITC, *Recent Trends,* 2013, 1-8, 2-4.

TABLE 3.8 Direct and indirect exports of services, share of sectoral value added, percent, 2011

		Indirect exports				
		Manufacturing				
Sector	Direct exports[a]	Resource-intensive	Machinery and transport	Other	Total mfg.	Services
Business services						
Management	19.8	3.1	5.1	1.1	9.3	3.2
Miscellaneous professional, scientific, and technical	2.5	1.8	2.2	0.6	4.5	4.2
Rental, leasing, and lessors of intangible assets	23.5	1.8	1.8	0.6	4.2	3.4
Legal services	3.1	0.8	1.2	0.4	2.4	3.1
Information and data processing	0.5	0.8	1.3	0.3	2.3	2.8
Computer systems design	2.9	0.7	1.2	0.2	2.1	1.8
Financial services	5.0	0.6	1.0	0.4	2.0	3.1
Publishing, motion pictures	10.3	0.4	1.1	0.1	1.6	2.1
Broadcasting and telecoms	1.3	0.6	0.8	0.2	1.6	2.5
Insurance	2.5	0.2	0.3	0.1	0.7	2.6
Other services						
Wholesale trade	12.0	1.8	2.5	0.8	5.1	1.2
Utilities	0.1	2.5	1.4	0.6	4.6	1.0
Transportation and storage	13.8	2.1	1.7	0.7	4.5	3.4
Administrative and support	0.4	1.2	1.7	0.5	3.3	4.4
Waste management	0.8	1.1	1.0	0.4	2.4	1.8
Entertainment, food, hotel	0.1	0.3	0.4	0.1	0.9	1.3
Real estate activities	0.0	0.2	0.3	0.1	0.6	0.9
Retail trade	0.0	0.1	0.1	0.0	0.3	0.1
Social services	0.1	0.0	0.0	0.0	0.0	0.0
All services	3.7	0.8	1.0	0.3	2.1	1.8

Sources: USDOC, BEA, Annual Input-Output tables (accessed June 25, 2013); Commission estimates.

Notes: "Resource-intensive manufacturing" includes wood, metal, mineral, paper, petroleum, chemical, plastic, and rubber products. "Machinery and transport" includes machinery, electrical equipment, computer and electronic products, motor vehicles, and other transportation equipment; "other manufacturing" includes food, furniture, textiles and apparel, and miscellaneous manufacturing.

[a]Includes only added value generated by the exporting sector.

percent).[84] For the overall services sector, and in 13 of 19 individual sectors, indirect value added through manufacturing exceeds services value added in direct exports.[85] Sectors that have the highest indirect exports through U.S. manufacturing include management (9.3 percent of sectoral value added), wholesale trade (5.1 percent), and utilities (4.6 percent). Management is used at every stage of the supply chain, from conception to delivery. Utilities, too, are required at all stages, particularly in resource-intensive manufacturing sectors such as rubber and plastics, other nonmetallic minerals, and basic metals and fabricated metals. Wholesale trade is another widely used service, often required when physical goods are transferred. Hence, indirect exports of these

[84] Including 2.1 percent of sectoral value added exported indirectly through manufacturing sectors and 1.8 percent through services sectors.

[85] For comparability, table 3.8 reports only each sector's value added for both direct and indirect exports. Thus direct exports exclude some value reported in official services export statistics. For example, direct exports in the second row exclude the value of legal services used to produce exports of computer systems design.

services are high because they are important inputs to the production of intermediate inputs and final goods that are subsequently exported.

U.S. services firms also indirectly export a substantial amount of value generated by other services firms, though such exports are not generally as large as indirect services exports by manufacturers. Services sectors that see a large share of their value added exported by other services firms include administrative and support services (4.4 percent), miscellaneous professional, scientific, and technical services (4.2 percent), and rental, leasing, and lessors of intangible assets (3.4 percent). Miscellaneous professional services include activities such as accounting, advertising, specialized design, technical services, and scientific research. U.S. services companies, like U.S. manufacturers, require substantial amounts of these services to produce their highly technical and specialized exports, along with the inputs of intellectual property and administrative services provided by the other sectors on this list.

There are also substantial indirect exports of transportation and storage services (3.4 percent of total value added in the sector). Although direct exports by wholesalers, logistics, and transport firms account for the majority of trade in these services, they may also be exported indirectly if goods that are shipped abroad have been transported or stored domestically at an earlier stage of production. Since these goods may be used by foreign manufacturers, a portion of this value will reenter manufacturing supply chains abroad.[86]

Manufacturing Case Studies

To illustrate in greater detail some of the ways in which services are being used in U.S. manufacturing, the Commission conducted case studies of three industries: semiconductors, medical devices, and performance textiles. [87]

As discussed above, innovations in information technology have enabled services to improve efficiency and cut costs in manufacturing sectors. A prime example of this is the semiconductor industry. Software-enabled services have given the semiconductor industry an important avenue to improving efficiency. The case study on the semiconductor industry presents an in-depth look at this effect; in addition, it presents an example of the use of services to enhance its customer relationships. The sector to which the semiconductor industry belongs—computers and electronics products—is generally a high user of services, and has experienced strong productivity growth as a result of technological innovation. Semiconductor manufacturing remains strong in the United States, and many of the world's largest semiconductor companies maintain headquarters and operations in the United States.[88] This case study describes the semiconductor industry from the point of view of the factory floor to provide some context about the changes in manufacturing that result in the aggregated statistical movements.

The case study on medical devices manufacturing presents another segment of the U.S. market in which software-enabled services have become critical to competitiveness.

[86] One limitation of using a single-country (U.S.) I-O table is that it cannot distinguish whether exports are ultimately used by foreign consumers, manufacturers, or services firms.

[87] For the purpose of this report, "performance textiles" includes textiles commonly referred to as technical, specialty, and/or industrial fabrics.

[88] Lineback et al., *McClean Report*, 2013, figure 3-2.

Software-enabled services assist medical device firms throughout each step of the value chain, from designing a new product to helping firms comply with regulations. The economic activity of medical devices manufacturing is scattered among several industry categories, and cannot be easily seen in the data.

The case study on performance textiles highlights the role of R&D in manufacturing. R&D is a service that directly produces technological innovation. Performance textiles are an interesting case study for exploring the use of services in manufacturing as a growth area in an industry hard hit by global competition. The U.S. textiles industry overall has experienced a significant decline in the contribution of services to its value added—as seen in table 3.7, the industry has reduced its use of services by 3.7 percent, more rapidly than any other sector besides footwear and leather products. By contrast, the positive outlook for the U.S. performance textile industry can be attributed to the vigorous use of services such as R&D to complement manufacturing capabilities. Unlike many other segments of the textiles industry, performance textiles have been able to retain manufacturing facilities in the United States due to substantial investments in R&D services to create new products.

Semiconductor Industry

The semiconductor industry buys, provides internally, or sells services along each step of the design and manufacturing process. These services include utilities and logistics, R&D, testing and validation, contract manufacturing, packaging and assembly, and marketing and sales. The semiconductor industry uses services to increase yield and output and to reduce the costs of producing semiconductor devices.

The semiconductor industry is highly globalized; companies in the United States have access to the same services as companies manufacturing in other countries, and semiconductor trade flows are almost entirely tariff free under the WTO's Ministerial Agreement on Trade in Information Technology Products.[89]

This case study describes two specific business services, offered at different steps of the production process, to demonstrate the importance of services in semiconductor manufacturing today. It first describes electronic design automation (EDA) providers, which offer test and validation tools and processes related to product design. The remainder of the case study describes services offered by semiconductor equipment suppliers, which also sell services that increase the performance of tools used in a semiconductor fabrication facility (fab).

Factors of Competition

The semiconductor industry designs and produces the integrated circuits that enable the operation of almost all electronic devices, industrial and consumer.[90] Computers and telecommunications devices account for nearly 60 percent of semiconductor usage. In

[89] WTO, Information Technology Agreement, http://www.wto.org/english/tratop_e/inftec_e/inftec_e.htm (accessed August 1, 2013).

[90] Semiconductor is a generic term for integrated circuits and discrete devices, such as transistors, resistors, capacitors, and diodes. Semiconductors are almost universally fabricated from a base of silicon.

2012, the value of worldwide semiconductor production accounted for 23 percent of electronic system production.[91]

Distinctive competitive challenges for semiconductor producers arise partially from the industry's own production cycle. The costs to produce semiconductors are enormous. Fabrication equipment and tools cost tens of millions of dollars,[92] while the average selling price per unit is relatively low.[93] The combination of large capital outlays and low product unit prices requires semiconductor companies to construct fabs that produce high volumes to achieve sufficient economies of scale. As a result, when a new fab enters service, the added capacity may overload the market or depress demand for technologies produced by older fabs, driving down selling prices across the industry.

To address these challenges, one strategy has been the separation of design and production. "Fabless" companies design semiconductors only, and "foundry" companies operate fabs to produce semiconductors only. Fabless designers share production capacity at foundries, a strategy which effectively increases fab utilization. In 2012, IC Insights reported that fabless companies accounted for nearly 30 percent of worldwide sales, and have grown at a faster rate than integrated device manufacturers.[94] A complementary strategy is pursued by integrated device manufacturers, which design and fabricate chips in a vertically integrated process and own their fabs. These companies have responded to the industry's challenges by building high-volume fabs allowing them to increase their economies of scale.[95] Both of these business strategies rely on the use of services, and this case study describes two specific services below.

Electronic Design Automation Services

EDA providers sell services that give access to proven simulation models, enabling designers to advance semiconductor capabilities. EDA companies offer services in five categories: software to engineer chips, software to lay out printed circuit boards, software to test and certify integrated circuits, consulting services, and access to semiconductor patents or intellectual property.[96] EDA is not a specific process, but rather a services sector "involved in developing and supplying highly specialized software- and hardware-based tools for the automated design of electronic products of all kinds."[97]

Two of the five EDA product categories—integrated circuits software testing and semiconductor intellectual property access—offer clear examples of services used in semiconductor manufacturing. One of the basic software offerings of EDA companies is Verilog hardware description language, which designers use to model integrated circuits. While early semiconductor designers could lay out the circuit designs by hand, the microscopic scale of advanced chips can only be tested using software. Semiconductor

[91] Lineback et al., *McClean Report*, 2013, 2–4.

[92] For example, the average selling price of a tool from ASML, a Dutch company that makes photolithography tools, is $20 million (ASML, *Annual Report*, 2012, F-38).

[93] Examples of prices: less than $0.50 for an analog chip, more than $3.50 for NAND flash memory units, and around $30.00 for top-level application-specific integrated circuit chips. See IC Insights, "May Update," 2013; Rassweiler, "Many iPhone 5 Components Change," 2012.

[94] IC Insights, "Fabless Companies Play Increasing Role," 2013.

[95] Naeher et al., "The Evolution of Business Models," 2011.

[96] For a description of software programs in each of the five categories, view the product category list at http://edac.org/initiatives/committees/mss.

[97] EDAC, "EDA Glossary," http://edac.org/industry/glossary (accessed July 24, 2013).

designers could not design new integrated circuits for manufacture without EDA test and validation tools. Another EDA offering is access to existing design patents. New integrated chips include, for example, "systems on a chip," which integrate both memory and logic processors. EDA companies acquire semiconductor patents and then license the intellectual property to other circuit designers. This service allows designers to use a proven design that they can modify or integrate with their new design. At the same time, it helps the semiconductor industry because it reduces design engineering labor needs by hundreds of hours and reduces costs by millions of dollars.[98]

Leading companies that offer all or some of these services include Cadence Design Systems, MentorGraphics, ARM, and Synopsys. In 2012, the EDA industry surpassed $6 billion in revenue, with nearly 40 percent in computer-aided engineering services. Since 1996, EDA revenues have increased steadily, around 4 percent annually on average and 6.7 percent in 2011–12.[99] However, EDA is a small sector, with revenues around 2 percent of the semiconductor industry's revenues annually over the past 15 years.[100]

Services Offered by Equipment Manufacturers

Semiconductor equipment manufacturers have in the past decade begun to offer specific services to help fabs operate their equipment and tools optimally and in concert. These services help fabs generate a higher yield of good semiconductor chips and therefore increase revenue. An analysis of public revenue data from three major tool and equipment suppliers shows that services revenue rose by about 4 percent on average annually during 2008–12.[101]

Services offered by equipment and tool manufacturers perform functions in two general categories: helping integrate the equipment into the manufacturing system, and ensuring that the equipment is working when it should. In the past, when a fab ramped up a new process, the yield of usable chips was low during the initial stages of its use. Therefore, equipment manufacturers started to offer models and simulations that accelerate the initial yield rates.[102] The second category of equipment manufacturer services places skilled technicians and certified engineers at or near customer sites to solve process problems.[103] Many equipment manufacturers provide services that ensure that tools operate correctly and do not go out of service unexpectedly. Equipment manufacturers can collect dozens to thousands of data points from all of their tools, and study the data to uncover trends indicating that a tool may fail.[104] When the trends are detected using millions of data points from thousands of machines—the Big Data analytics described earlier in the chapter—they enable still greater confidence in predicting the tool's future operating status.

[98] EDAC representative, telephone interview by USITC staff, July 30, 2013.

[99] EDAC, "Market Statistics Service 2012," n.d. (accessed June 26, 2013).

[100] Commission analysis using data from the World Semiconductor Trade Statistics and EDA Consortium.

[101] This analysis used all revenue not from the sale of physical equipment as a proxy indicator for services revenue. Data taken from 2012 annual reports of AMAT, ASML, KLA-Tencor, LAM, and Tokyo Electron.

[102] Tribula, "The Evolution of the Semiconductor Service," 2013; KLA-Tencor, *Annual Report*, 2012.

[103] Lam Research website, ValuePoint Expert Support, http://www.lam-research.com/CSBG_2.cfm (accessed June 26, 2013).

[104] Tribula, "The Evolution of the Semiconductor Service," 2013.

Finally, some services used in semiconductor manufacturing are not captured in revenue data or economic statistics. One such service offered by semiconductor equipment manufacturers is the installation of machinery. An equipment manufacturer will send an engineer or team of engineers to install the equipment as part of the price of the equipment sale. Another example is the creation of a manufacturing execution system, a complex program that runs wafers through processing steps. A fab manager will design a manufacturing execution system internally, where it is considered a cost of manufacturing and most likely would not be captured or reported as a services purchase. These two examples show that many services may not be captured by corporate financial analysts and reported for statistical purposes.

Medical Device Industry

Software-enabled services—the principal services used in the global medical device industry—have contributed significantly to the manufacturing of medical devices across various phases of the product lifecycle. This section will first identify the factors of competition in the global industry and then describe the ways in which software solutions enable firms to remain competitive.

Healthcare professionals use medical devices to treat, diagnose, and prevent various ailments and injuries.[105] Many medical devices fall within the computer and electronic products and miscellaneous manufacturing sectors, which according to table 3.5 are intensive users of services. The medical device industry is also highly capital intensive; the industry's capital intensity was measured at 40 percent by one survey.[106] Further, due to the complexity of some medical devices—for instance, diagnostic imaging technologies—the industry relies on a highly skilled workforce to develop, design, and test products. Employees' wages in the U.S. medical device industry exceed the national average.[107]

The medical device industry is highly regulated, owing to the potentially significant health risks associated with various devices. In the United States, the Food and Drug Administration categorizes devices into three classes, with the lowest-risk devices receiving a class one rating. Most manufacturers seek class two approvals for their devices, reflecting the relatively lower regulatory burden on these devices compared to class three devices.[108] Class two and three devices make extensive use of software services throughout the product life cycle, particularly with respect to software solutions, and will be the focus of this section.

[105] Relevant NAICS codes for these devices include 325413, in vitro diagnostic substances and devices; 334510 and 334517, electromedical equipment; 339112, surgical and medical instruments; 339113, orthopedic devices and hospital supplies; and 339114, dental equipment.

[106] Only four industries surveyed ranked higher in capital intensity than the medical device industry: chemicals (50 percent); refining petroleum, coke, nuclear (56 percent); computers and office machinery (41 percent); and basic metals (41 percent). McKinsey, *Manufacturing the Future*, November 2012.

[107] In 2008, the average salary in the medical device industry was $58,000, well over the national earnings average of about $42,000. Lewin Group, "State Economic Impact of the Medical Technology Industry," June 7, 2010.

[108] Zhong, "Primer," 2012. Manufacturers of class two devices are required to demonstrate that their device is fundamentally similar to an existing device that has been approved for sale, while manufacturers of most class three devices are required to submit data from clinical trials in order to demonstrate the efficacy of the device; trials can run more than a year. Most implantable devices, including orthopedic devices, are class three devices, while many non-implantable devices, such as diagnostic equipment, are generally considered class two.

Factors of Competition

Innovation and R&D

Innovation is one of the principal determinants of competitiveness in the global medical device industry; a McKinsey survey ranked the industry's R&D intensity at 35 percent, the highest among all the industries surveyed.[109] Further, in the United States, leading U.S. medical device manufacturers commonly devote between 9 and 10 percent of their annual revenues to R&D, in contrast to an average of 3–4 percent for other domestic manufacturers.[110] R&D spending is generally devoted to developing innovative (in particular, less invasive) technologies; designing prototypes; testing products; and improving existing devices.[111] To achieve these ends, R&D teams are generally composed of engineers, computer scientists, biologists, and other highly skilled professionals.[112]

Time to market

The life cycles of most advanced medical devices are relatively short, making the speed with which products are approved another critical factor affecting competitiveness.[113] However, the approval process for medical devices can be lengthy, commonly exceeding one year and, in some cases, reaching as high as five years, during which time a firm receives no income from the device.[114] Because of the long approval process and the short product life cycles, approved devices may enjoy success on the market for as little as a year before being made obsolete by a newer product.[115] As a result, firms that are able to efficiently move through each stage of the life cycle while maintaining detailed records for regulators are more likely to launch a successful product. One study suggested that lateness getting to market was the principal reason that devices failed in the marketplace.[116]

Reimbursement

Reimbursement for the use of medical devices is a critical determinant of the type of devices an end user chooses to acquire. In the United States, hospitals and other consumers of medical devices base much of each purchasing decision on the likelihood of being reimbursed by the government or third-party insurers—the principal U.S. reimbursement entities.[117] This factor is one reason that medical device manufacturers

[109] R&D intensity was measured as R&D expenditures as a share of value added. McKinsey, *Manufacturing the Future*, 2012.

[110] S&P, "Healthcare," 2013. R&D investment in the sector remained high during the economic recession of 2007–09, increasing by 11 percent during this time. Holtzman and Figgatt, "R&D," 2012.

[111] Johnson & Johnson, "Form 10-K" (accessed August 8, 2013); Zimmer Holdings, "2012 Form 10-K" (accessed August 8, 2013); Medtronic, "Form 10-K" (accessed August 8, 2013).

[112] S&P, "Healthcare," 2013.

[113] The estimated product life cycle for advanced medical devices is two years; USITC, *Medical Devices*, March 2007.

[114] Industry association conference (M2M), May 9, 2013, Cambridge, MA; industry representative, telephone interview by USITC staff, Washington, DC, February 24, 2010; industry representative, interview by USITC staff, Boston, MA, March 2, 2010.

[115] USITC, *Medical Devices*, March 2007.

[116] Matlis, "Design for Manufacturability," 2007.

[117] S&P, "Healthcare," 2013.

have become increasingly focused on reducing costs throughout the product life cycle, as affordability and efficacy can facilitate timely reimbursements.

Use of Services

Software-enabled services are used throughout the value chain

Software-enabled services have been the services most commonly used within the medical device industry over the past 30 years.[118] As previously stated, given the industry's competitiveness, manufacturers often try to achieve rapid time to market while keeping their costs low. To that end, software-enabled services are increasingly used throughout the value chain to facilitate production planning, parts procurement, supply chain management, product design and development, and manufacturing.[119] Although medical device firms have relied on software to manage inventories since the 1980s, the increasingly strict regulatory environment has led many manufactures to use software to document and manage risk throughout the value chain, a trend which has taken root within the past 20 years.[120] This approach, most commonly called enterprise resource planning, helps firms immediately detect and quantify the extent of problems incurred during production and digitally submit these data to regulators.[121]

Within the past 20 years, software has also become increasingly integrated into the product design and development phase, where innovation and planning often translates into eventual commercial success.[122] During this phase, computer-aided design (CAD) is commonly used to create and transmit 3-D images onto a computer screen, while also allowing sensitive data to be stored digitally.[123] 3-D modeling of prototypes has been one of the most critical drivers of manufacturing efficiencies, allowing designers to dramatically reduce the time needed to generate highly detailed designs.[124] The use of CAD became prevalent around 1995, when the software became accessible to users of personal computers.[125]

3-D printing services

Within the past decade, 3-D printing has emerged as a service used in the manufacturing of implantable devices in particular. Digitally produced designs generated during the prototyping phase can be translated into usable parts or finished products—both customized to meet a specific user's needs—using 3-D printing.[126] For instance, hearing aid manufacturers are able to use this service to create customized components that will perfectly fit a user's ear. Similarly, 3-D printing enables leading orthopedic manufacturers in the United States, such as Stryker and Zimmer, to produce joint implants that are specifically tailored to a particular user, taking into account users with a

[118] Barbella, "Agents of Change," 2013.
[119] Barbella, "Agents of Change," 2013.
[120] Barbella, "Agents of Change," 2013.
[121] Barbella, "Agents of Change," 2013.
[122] McKinsey, "Manufacturing the Future," 2012; Samuel, "The Value of High End," 2011; Delporte and Barbella, "Full-Service Outsourcing," 2013.
[123] Whitney, "The Computer Age," 2006.
[124] Bell, "Outwit," 2007.
[125] Freiherr, "CAD/CAM and Beyond," October 1, 1995.
[126] Marsh, "Technology: Game Changer," 2013.

weak bone structure, for example. With the personalized medicine market projected to double to $450 billion by 2015, customized medical solutions are expected to grow in significance.[127]

Cloud computing services

Cloud computing has also gained in popularity within the past decade, enabling users to manage each phase of the product's life cycle while achieving flexibility not allowed through other platforms. For example, whereas many of the software solutions previously discussed require installation, cloud computing is accessible from any location with an Internet connection.[128] During the product development phase, prototypes can be uploaded onto the cloud and immediately made accessible to suppliers and related partners. Similarly, data from clinical trials for certain class three medical devices can be accessed in real time by multiple users in various locations. Once the device is sold, the cloud-based service can continue; data generated from a patient with a cardiac defibrillator or an infusion pump, for example, can be transferred directly to the healthcare provider via the cloud. Additionally, the cloud enables manufacturers to give technical assistance to users of the device.[129]

Performance Textiles

In the highly competitive global textile industry, higher-cost manufacturers such as the United States must differentiate their products to remain competitive.[130] R&D services produced by private firms, collaborative organizations, and research institutions have enabled U.S. manufacturers in performance textiles to become leading producers and exporters. The traditional U.S. textile industry producing inputs for apparel and home furnishings has faced intense international competition over the past two decades; however, performance textiles have emerged as a growth area, built upon traditional textile expertise in states such as North Carolina.[131] Investments in R&D are important to the industry and result in differentiated products with technical characteristics that are not easily produced elsewhere (e.g., fireproof, water-resistant, and antiballistic products). [132]

Performance textiles are manufactured for their technical performance and functional properties rather than their aesthetic or decorative characteristics.[133] End users are found in a wide variety of industries, including the aerospace, automotive, farming, marine, medical, military, safety, transport, and construction industries.[134] The global performance textile industry is highly competitive, yet U.S. manufacturers are able to maintain a competitive advantage through innovation in highly specialized products. The

[127] Barbella, "Agents of Change," 2013.
[128] Bockrath, "Medical Devices Begin to Drift into the Cloud," n.d. (accessed July 10, 2013).
[129] Bockrath, "Medical Devices Begin to Drift into the Cloud," n.d. (accessed July 10, 2013).
[130] Nelson, "Building the Performance Cluster in North Carolina," 2007.
[131] Nelson, "Building the Performance Cluster in North Carolina," 2007.
[132] NC Textile Connect, "Summary," n.d. (accessed July 25, 2013).
[133] Textiles Intelligence, "Textile Outlook International," 2012, 187.
[134] Performance textiles are commonly divided into 12 functional areas: sport, agriculture, construction, apparel, geotextiles, industrial, home, hygiene, transportation, environmental, packaging, and protection/military. See Techtextil (International Trade Fair for Technical Textiles and Nonwovens), http://techtextil.messefrankfurt.com/ (accessed August 8, 2013). Geotextiles reinforce the soil or permit drainage in civil engineering applications, such as the construction of roads or dams.

U.S. performance textiles industry has been adding and improving production capacity in the past few years, which stands in contrast to the U.S. textile industry as a whole.[135]

Nonwovens

Nonwoven fabrics are a helpful focus for a case study in performance textiles, as they encompass a wide range of applications, including automotive, construction, personal care, and medical uses.[136] Well adapted to filtration and protection functions, common nonwoven products include medical masks and gowns; industrial filters; hygienic products such as diapers, pads, and wipes; and insulation wrap for construction. Engineered nonwovens also impart desired protection characteristics such as resistance to abrasion, impacts, ballistics, and fire. Reportedly, textiles for high-end markets, such as safety and technical textiles, are less affected by import competition than commodity-type fabrics.[137]

In 2011, the U.S. nonwoven fabrics industry employed about 17,000 workers in 228 establishments.[138] The performance textile industry is capital intensive, requiring few employees to manage large and complicated production machinery. However, while labor inputs are low, the sector requires skilled operators.[139] The value of nonwoven production rose from $7.7 billion in 2010 to $8.2 billion in 2011, accounting for roughly one-quarter of all U.S. textile production that year.[140] By volume, production of nonwoven fabrics has grown, on average, about 5 percent annually over the past 10 years and is forecast to grow 28 percent between 2012 and 2017.[141]

While the traditional U.S. textile industry has moved operations offshore, one industry source has predicted that advanced-technology manufacturing of textiles such as nonwovens will remain in the United States, as many lower-cost foreign producers are not able to produce these specialized materials.[142] In 2012, U.S. exports of nonwoven fabrics totaled $1.9 billion, or 2.3 times the value of U.S. imports of these goods.[143]

Factors of Competition

Lower shipping costs, robust domestic demand, the perceived high quality of U.S. manufacturing, and relatively low U.S. energy costs encourage domestic production and render the U.S. performance textiles industry globally competitive.[144]

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[135] See discussion, chapter 2. *Technical Textiles International*, "Signs of Recovery," March/April 2012.

[136] Nonwoven fabric mills are provided for under NAICS 31323 and classified under HTSUS 5603. A nonwoven fabric is a manufactured sheet of directionally or randomly oriented fibers bound together through heat or an adhesive. Textiles Intelligence, "Textile Outlook International," 2012, 180.

[137] Rasmussen, "2013 State of the Industry," 2013.

[138] Employment in nonwovens accounted for 14 percent of total U.S. textile employment in 2011. USDOC, Census, County Business Patterns (accessed July 8, 2013).

[139] Cotton Incorporated, telephone interview by USITC staff, June 13, 2013.

[140] USDOC, "Annual Survey of Manufacturers (ASM)" (accessed July 8, 2013).

[141] Association of the Nonwoven Fabrics Industry (INDA), telephone interview by USITC staff, June 5, 2013.

[142] Panteva, "Textile Mills in the U.S.," 2012, 4.

[143] USITC DataWeb/USDOC (accessed July 8, 2013).

[144] Reichard, "Capital Spending Perks Up," 2013; *Technical Textiles International*, "Signs of Recovery," March/April 2012.

Proximity to market

Though many nonwoven fabrics are lightweight, their bulk makes it cost prohibitive to ship such materials long distances. Therefore, manufacturing of nonwovens is concentrated near their end markets.[145] Both consumer and industrial demand drive growth in U.S. production of nonwoven fabrics. Consumer demand has diversified from diapers and feminine hygiene products in recent years as more nonwoven products are incorporated into everyday life. Consumer wipes and nonwoven cleaning products such as Swiffer products are now commonplace.[146] As baby boomers age, demand for adult incontinence products will likely grow as well.[147] U.S. demand for nonwovens is forecast to increase 5.7 percent annually through 2016.[148]

Nonwoven fabrics are also inputs used widely in a number of major U.S. industries. For example, nonwoven fabrics meet the increased demand in automotive manufacturing for lightweight materials to increase fuel efficiency.[149] They are also used to insulate vehicle interiors from noise and engine heat. In home construction, to take another example, durable nonwovens are used externally in insulation wraps, roofing products, and geotextiles, as well as internally in carpets, blinds, and rugs.[150]

Innovation

U.S. firms invested $1.2 billion in textile mills and textile product mills in 2011, up from $1.1 billion in 2010.[151] An industry source noted that the performance textile industry focuses its resources on "perpetual innovation,"[152] enabling the U.S. performance textile industry to be a global leader. One researcher found that R&D and the development of brands and markets are the highest value-adding activities in textile manufacturing.[153]

Research and Development

As indicated earlier in this chapter, high-tech textiles manufacturing involves complex production processes where R&D plays an important role. Such strategic business services are typically kept in-house and are put to use before or during product development. Private firms, collaborative organizations, and research institutions engage in R&D services that enhance the industry's competitiveness. Two examples are discussed below.

[145] Cotton Incorporated, telephone interview by USITC staff, June 13, 2013; INDA, telephone interview by USITC staff, June 5, 2013.
[146] INDA, telephone interview by USITC staff, June 5, 2013.
[147] INDA, telephone interview by USITC staff, June 5, 2013.
[148] Gangloff, "U.S. Nonwovens Fabric Demand," 2013.
[149] Cotton Incorporated, telephone interview by USITC staff, June 13, 2013.
[150] Cotton Incorporated, telephone interview by USITC staff, June 13, 2013.
[151] USDOC, Census, Annual Capital Expenditures Survey (accessed July 8, 2013).
[152] Reportedly, firms focus on developing new and better products, investment in new plants and equipment, and better marketing of their products to remain ahead of the competition. Rasmussen, "2013 State of the Industry, Part I," 2013.
[153] Frederick et al., "A Descriptive Analysis," 2007.

Cotton Incorporated

Cotton Incorporated (Cotton Inc.) is a private, not-for-profit organization based in Cary, North Carolina.[154] It has research projects throughout the entire cotton supply chain, from farm to market, and collaborates with private firms in their development of new technology to encourage increased use of cotton. For work on nonwovens in particular, Cotton Inc. has collaborated with the U.S. Department of Agriculture (USDA), academic research institutions, and private firms. The USDA's five-year-old research facility in New Orleans contains state-of-the-art equipment for developing and testing high-value-added nonwovens.[155]

Cotton Inc. has worked with USDA and private entities to develop cotton nonwovens for insulation (insulation is typically fiberglass);[156] with Texas Tech University, the USDA research center, and Sellars Absorbent Materials Inc. (Sellars) to develop nonwoven cotton booms for oil spill cleanup;[157] and with labs and academic institutions to develop nonwoven fabric treatments that wick moisture and perspiration, with the intention of sharing them across the textile and apparel industry.

The Nonwovens Institute

The Nonwovens Institute (NWI), housed within the North Carolina State University College of Textiles, is the largest cooperative research center in North America.[158] According to an industry source, NWI is valuable because it trains students and allows the industry access to new science.[159] NWI's research services focuses on nonwovens materials and processes technology, surface and bulk engineering, and analysis of material structure and performance.[160] NWI has spent over $30 million on its research over the past 10 years.

The NWI has facilities for product development and testing services. Its members, which include companies such as 3M, DuPont, and Procter & Gamble, as well as organizations such as Cotton Inc., can sponsor proprietary research at NWI's facilities. NWI product development examples include durable nonwovens for use in uniforms, 3-D nonwovens, and acoustical nonwovens for speakers.[161] NWI partners with a manufacturing incubator, Leaders in Innovation and Nonwovens Commercialization (LINC), that is also based at the university. LINC focuses on commercializing high-value technical nonwoven products, helping firms introduce and test new products.[162]

[154] Cotton Inc. website, http://www.cottoninc.com/ (accessed June 4, 2013).
[155] Nonwovens Industry, "USDA-Agricultural Research Service," 2011.
[156] Cotton Inc., telephone interview by USITC staff, June 13, 2013.
[157] Cotton is naturally hydrophobic and oleophilic; therefore, cotton booms repel water, absorb oil, and float when saturated so that the boom can be picked up. Cotton Inc., telephone interview by USITC staff, June 13, 2013; Nonwovens Industry, "TTU Research Proves Power of Cotton," 2013; Sellars website, http://www.sellarscompany.com/ (accessed June 13, 2013).
[158] NWI website, http://www.thenonwovensinstitute.com/about-nwi/ (accessed June 12, 2013).
[159] Cotton Inc., telephone interview by USITC staff, June 13, 2013.
[160] NWI website, http://www.thenonwovensinstitute.com/about-nwi/ (accessed June 12, 2013).
[161] NWI, email message to USITC staff, June 7, 2013.
[162] NWI, email message to USITC staff, June 7, 2013.

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APPENDIX A
Request Letters

THE UNITED STATES TRADE REPRESENTATIVE
Executive Office of the President
Washington, D.C. 20506

MAY 15 1992

The Honorable Donald E. Newquist
Chairman
U.S. International Trade Commission
500 E Street, S.W.
Washington, D.C. 20436

Dear Mr. Chairman,

The Commission's recent series of reports on the economic effects of significant U.S. import restraints (USITC publication 2222, dated October 1989; publication 2314, dated September 1990; and publication 2422, dated September 1991), prepared pursuant to a request from the Senate Committee on Finance dated September 12, 1988, has been an excellent source of objective, balanced information for the entire trade policy community. An understanding and appreciation of the economic implications of restraints imposed on trade are critical to any informed assessment of the trade policy options that confront the President and the Congress.

We would find it useful to have periodic updates of the types of assessments that the Commission has provided in its reports for the Finance Committee. Therefore, under authority delegated by the President and pursuant to section 332(g) of the Tariff Act of 1930, as amended, I request that the Commission periodically provide an updated assessment of the economic effects of significant U.S. import restraints. Each updating report should include quantitative assessments of the restraints' effects on U.S. consumers, on the activities of U.S. firms, on the income and employment of U.S. workers, and on the net economic welfare of the United States. The reports also should continue the broad analytical frameworks used in the original reports, namely partial equilibrium frameworks for the analysis of liberalization in individual sectors and a general equilibrium framework for assessment of the economy-wide effects of the simultaneous liberalization of all sectors covered.

With the exceptions noted below, the reports should consider the effects of all significant restraints on U.S. imports of goods and services whether they result from an act of Congress, an action taken under the fair trade laws of the United States (such as section 201 investigations), an international agreement, or voluntary export restraints by foreign nations. The reports should not include import restraints resulting from final

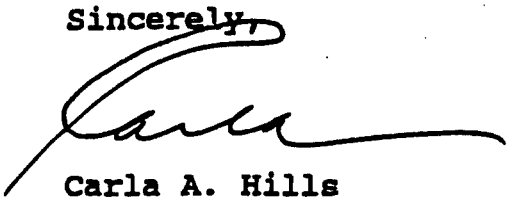
antidumping or countervailing duty investigations, section 337 or 406 investigations, or section 301 actions.

I would appreciate receiving the first updating report 18 months after receipt of this request. Subsequent reports should be provided thereafter at intervals of approximately two years until otherwise instructed.

In view of the outstanding instruction to the Commission on the security classification of reports prepared by the Commission at the request of the U.S. Trade Representative, I request that all reports on this investigation be made available to the public at the same time they are submitted to my office.

The Commission's assistance in this matter is greatly appreciated.

Sincerely,



Carla A. Hills

EXECUTIVE OFFICE OF THE PRESIDENT
THE UNITED STATES TRADE REPRESENTATIVE
WASHINGTON, D.C. 20508

NOV - 2 2012

The Honorable Irving A. Williamson
Chairman
U.S. International Trade Commission
500 E Street, SW
Washington, D.C. 20436

Dear Chairman:

The U.S. International Trade Commission's (Commission) series of reports on the economic effects of significant U.S. import restraints, prepared as part of Investigation No. 332-325, has been an objective and balanced source of information for the President, the Congress, the trade policy community, and the public. As your reports have shown, the costs imposed on U.S. economic welfare by U.S. import restraints have declined markedly since 1992, even as the volume of U.S. imports has grown substantially.

The United States is one of the world's most open economies. As the Commission begins work on the eighth update of its report, and in light of the high degree of openness of U.S. markets to imports that has already been achieved, I am requesting that the Commission include in its report information on another important development in U.S. trade.

Rapid growth and technological change in services are affecting economic activity throughout the world. These effects may be particularly relevant for the United States, where the services sector accounts for the majority of economic activity and contributes to the growth of other sectors, particularly manufacturing. A thoughtful overview of the contributions of services (both U.S. and global) to U.S. manufacturing that is accessible to a wide audience would be a useful special topic in the report. I am therefore requesting that the Commission provide in this eighth update an overview of the role of services in connection with the manufacturing sector. The Report should describe recent trends in U.S. and global sourcing of services and their contribution to manufacturing output and productivity, and identify sectors that have experienced the greatest changes. Also, to the extent practicable, the Report should include a discussion of services' indirect contribution to merchandise exports. Finally, the Report should provide a review of the available literature on this issue.

Please provide the eighth update of this Report, with the additional information, in November, 2013. As stated in the original 1992 request letter, subsequent updates of the Report should be provided thereafter at intervals of approximately two years. USTR intends to make the Commission's report available to the general public in its entirety. Therefore, the Report should not contain any confidential business or national security classified information.

The Commission's assistance in this matter is greatly appreciated.

Sincerely,

Ambassador Ron Kirk

APPENDIX B
Federal Register Notice

accepted by letter and may be addressed to: Bureau of Land Management-Eastern States, Attn: Kemba Anderson-Artis, 7450 Boston Blvd., Springfield, VA 22153. Comments may be sent via email to *kembaand@blm.gov,* or by fax to 703–440–1551. The lessee has paid the required $500 administrative fee and has reimbursed the BLM for the cost of publishing this Notice in the **Federal Register**. The lessee has met all the requirements for reinstatement as set out in the Federal Oil and Gas Royalty Management Act of 1982 (Pub. L. 97–451).

Kemba Anderson-Artis,

Supervisory Land Law Examiner.

[FR Doc. 2012–30860 Filed 12–21–12; 8:45 am]

BILLING CODE 4310–GJ–P

INTERNATIONAL TRADE COMMISSION

[Investigation No. 332–325]

The Economic Effects of Significant U.S. Import Restraints: Eighth Update Special Topic: Services' Contribution to Manufacturing

AGENCY: United States International Trade Commission.

ACTION: Notice of eighth update report, scheduling of public hearing, opportunity to file written submissions.

SUMMARY: Following receipt of a letter dated November 2, 2012 from the United States Trade Representative (USTR), the U.S. International Trade Commission (Commission) has announced its schedule for preparing the eighth update report in investigation No. 332–325, *The Economic Effects of Significant U.S. Import Restraints,* including the scheduling of a public hearing in connection with this update report for March 19, 2013. This year's report will include a chapter on services' contribution to manufacturing.

DATES:

March 6, 2013: Deadline for filing requests to appear at the public hearing.

March 11, 2013: Deadline for filing pre-hearing briefs and statements.

March 19, 2013: Public hearing.

March 26, 2013: Deadline for filing post-hearing briefs and statements.

April 12, 2013: Deadline for filing all other written submissions.

November 15, 2013: Transmittal of Commission report to USTR.

ADDRESSES: All Commission offices, including the Commission's hearing rooms, are located in the United States International Trade Commission Building, 500 E Street SW., Washington, DC. All written submissions should be addressed to the Secretary, United States International Trade Commission, 500 E Street SW., Washington, DC 20436. The public record for this investigation may be viewed on the Commission's electronic docket (EDIS) at *http://edis.usitc.gov/edis3-internal/app*.

FOR FURTHER INFORMATION CONTACT: Project Leader Jose Signoret (*jose.signoret@usitc.gov* or 202–205–3125) or Deputy Project Leader William Deese (*william.deese@usitc.gov* or 202–205–2626) for information specific to this investigation (the eighth update). For information on the legal aspects of this investigation, contact William Gearhart of the Commission's Office of the General Counsel (202–205–3091 or *william.gearhart@usitc.gov*). The media should contact Margaret O'Laughlin, Office of External Relations (202–205–1819 or *margaret.olaughlin@usitc.gov*). Hearing-impaired individuals may obtain information on this matter by contacting the Commission's TDD terminal at 202–205–1810. General information concerning the Commission may also be obtained by accessing its Internet server *(http://www.usitc.gov).* Persons with mobility impairments who will need special assistance in gaining access to the Commission should contact the Office of the Secretary at 202–205–2000.

Background: The Commission instituted this investigation under section 332(g) of the Tariff Act of 1930 (19 U.S.C. 1332(g)) following receipt of an initial request from the USTR dated May 15, 1992. The request asked that the Commission assess the quantitative economic effects of significant U.S. import restraints on the U.S. economy and prepare periodic update reports after the initial report. The Commission published a notice of institution of the investigation in the **Federal Register** of June 17, 1992 (57 FR 27063). The first report was delivered to the USTR in November 1993, the first update in December 1995, and successive updates were delivered in 1999, 2002, 2004, 2007, 2009, and 2011.

In this eighth update, as requested by the USTR in a letter dated November 2, 2012, the Commission will, in addition to the quantitative effects analysis similar to that included in prior reports, include an overview of the contributions of services (both U.S. and global) to U.S. manufacturing. The USTR asked that the report describe recent trends in U.S. and global sourcing of services and their contribution to manufacturing output and productivity, and identify sectors that have experienced the greatest changes. The USTR also asked that the report include, to the extent practicable, a discussion of services' indirect contribution to merchandise exports and also a review of available literature on this issue. The USTR asked that the information be presented in a manner that makes it accessible to a wide audience.

As in previous reports in this series, the eighth update will continue to assess the economic effects of significant import restraints on U.S. consumers and firms, the income and employment of U.S. workers, and the net economic welfare of the United States. This assessment will use the Commission's computable general equilibrium model. However, as per earlier instructions from the USTR, the Commission will not assess import restraints resulting from antidumping or countervailing duty investigations, section 337 and 406 investigations, or section 301 actions.

Public Hearing: A public hearing in connection with this investigation will be held at the United States International Trade Commission Building, 500 E Street SW., Washington, DC, beginning at 9:30 a.m. on March 19, 2013. Requests to appear at the hearing should be filed with the Secretary no later than 5:15 p.m., March 6, 2013, in accordance with the requirements in the ''Submissions'' section below. All pre-hearing briefs and statements should be filed not later than 5:15 p.m., March 11, 2013; and all post-hearing briefs and statements addressing matters raised at the hearing should be filed not later than 5:15 p.m., March 26, 2013. In the event that, as of the close of business on March 6, 2013, no witnesses are scheduled to appear at the hearing, the hearing will be canceled. Any person interested in attending the hearing as an observer or nonparticipant may call the Secretary to the Commission (202–205–2000) after March 6, 2013, for information concerning whether the hearing will be held.

Written Submissions: In lieu of or in addition to participating at the hearing, interested parties are invited to file written submissions concerning this investigation. All written submissions should be addressed to the Secretary, and should be received not later than 5:15 p.m., April 12, 2013. All written submissions must conform to the provisions of section 201.8 of the *Commission's Rules of Practice and Procedure* (19 CFR 201.8). Section 201.8 Section 201.8 and the Commission's Handbook on Filing Procedures require that interested parties file documents

electronically on or before the filing deadline and submit eight (8) true paper copies by 12:00 noon eastern time on the next business day. In the event that confidential treatment of a document is requested, interested parties must file, at the same time as the eight paper copies, at least four (4) additional copies in which the confidential information must be deleted (see the following paragraph for further information regarding confidential business information). Persons with questions regarding electronic filing should contact the Secretary (202–205–2000).

Any submissions that contain confidential business information must also conform to the requirements of section 201.6 of the *Commission's Rules of Practice and Procedure* (19 CFR 201.6). Section 201.6 of the rules requires that the cover of the document and the individual pages be clearly marked as to whether they are the ''confidential'' or ''non-confidential'' version, and that the confidential business information be clearly identified by means of brackets. All written submissions, except for confidential business information, will be made available for inspection by interested parties.

In its request letter, the USTR stated that his office intends to make the Commission's report available to the public in its entirety, and asked that the Commission not include any confidential business information or national security classified information in the report it sends to the USTR. Any confidential business information received by the Commission in this investigation and used in preparing this report will not be published in a manner that would reveal the operations of the firm supplying the information.

By order of the Commission.

Issued: December 20, 2012.

Lisa R. Barton,

Acting Secretary to the Commission.

[FR Doc. 2012–31031 Filed 12–21–12; 4:15 pm]

BILLING CODE 7020–02–P

JUDICIAL CONFERENCE OF THE UNITED STATES

Hearings of the Judicial Conference Advisory Committee on Rules of Bankruptcy Procedure; Federal Register; Citation of Previous Announcement: 77FR 49828

AGENCY: Judicial Conference of the United States, Advisory Committee on Rules of Bankruptcy Procedure.

ACTION: Notice of Cancellation of Open Hearing.

SUMMARY: The following public hearing on proposed amendments to the Federal Rules of Bankruptcy Procedure has been canceled: Bankruptcy Rules Hearing, January 18, 2013, Chicago, IL.

FOR FURTHER INFORMATION CONTACT: Benjamin J. Robinson, Deputy Rules Officer and Counsel, Administrative Office of the United States Courts, Washington, DC 20544, telephone (202) 502–1820.

Dated: December 20, 2012.

Benjamin J. Robinson,

Rules Committee Deputy and Counsel.

[FR Doc. 2012–31040 Filed 12–21–12; 4:15 pm]

BILLING CODE 2210–55–P

JUDICIAL CONFERENCE OF THE UNITED STATES

Hearings of the Judicial Conference Advisory Committee on Rules of Appellate Procedure; Federal Register Citation of Previous Announcement: 77FR 49828

AGENCY: Advisory Committee on Rules of Appellate Procedure, Judicial Conference of the United States.

ACTION: Notice of Cancellation of Open Hearing.

SUMMARY: The following public hearing on proposed amendments to the Federal Rules of Appellate Procedure has been canceled: Appellate Rules Hearing, January 18, 2013, Chicago, IL.

FOR FURTHER INFORMATION CONTACT: Benjamin J. Robinson, Deputy Rules Officer and Counsel, Administrative Office of the United States Courts, Washington, DC 20544, telephone (202) 502–1820.

Dated: December 20, 2012.

Benjamin J. Robinson,

Rules Committee Deputy and Counsel.

[FR Doc. 2012–31042 Filed 12–21–12; 4:15 pm]

BILLING CODE 2210–55–P

DEPARTMENT OF JUSTICE

Notice of Extension to Public Comment Period for Remedial Design/Remedial Action Consent Decree under the Comprehensive Environmental Response, Compensation, and Liability Act

On December 6, 2012, the Department of Justice lodged a proposed Remedial Design/Remedial Action Consent Decree (''RD/RA Consent Decree'') with the United States District Court for the Northern District of Alabama, Eastern Division in the lawsuit entitled, *United States of America* v. *Pharmacia Corporation and Solutia, Inc.,* Civil Action No. 1;02–cv–0749–KOB. The RD/RA Consent Decree resolves a portion of the United States' claims against the Defendants. Under the RD/RA Consent Decree, the Defendants will undertake cleanup activities at an area that is part of the Anniston PCB Superfund Site designated as Operable Unit 3, which covers approximately 138 acres, including the active manufacturing area. OU 3 is generally bounded by to the north by the Northern Southern and Erie Railroads, to the east by Clydesdale Avenue, to the west by and including the West End Landfill and an Alabama Power Company substation, and to the south by and including the South End Landfill and Highway 202.

In addition to remedial activities, the RD/RA Consent Decree requires the Defendants to reimburse EPA for its oversight of work performed under the Decree by the Defendants.

The prior notice indicated that the Department of Justice would receive comments concerning the settlement for a period of thirty (30) days from the date of publication of the notice on December 13, 2012. Having received a request for an extension of the initial comment period and given the public interest in this settlement, the United States is extending the comment period for an additional thirty (30) days.

The Department of Justice will receive, for a period of thirty (30) days from January 14, 2013, any comments relating to the proposed RD/RA Consent Decree. Comments should be addressed to the Assistant Attorney General, Environment and Natural Resources Division, and should refer to the *United States of America* v. *Pharmacia Corporation and Solutia, Inc.,* D.J. Ref. No. 90–11–2–07135/1. All comments must be submitted no later than February 13, 2013. Comments may be submitted by email or by mail:

To submit comments:	Send them to:
By email	*pubcomment-ees.enrd@usdoj.gov.*
By mail ...	Assistant Attorney General, U.S. DOJ—ENRD, P.O. Box 7611, Washington, DC 20044–7611.

During the public comment period, the RD/RA Consent Decree may be examined and downloaded at the this Justice Department Web site: *http://www.usdoj.gov/enrd/Consent-Decree.html.* We will provide a paper copy of the RD/RA Consent Decree upon written request and payment of reproduction costs.

APPENDIX C
Calendar of Public Hearing

CALENDAR OF PUBLIC HEARING

Those listed below appeared as witnesses at the United States International Trade Commission's hearing:

Subject:	The Economic Effects of Significant U.S. Imports Restraints: Eighth Update Special Topic: Services' Contribution to Manufacturing
Inv. No.:	332-325
Date and Time:	March 19, 2013 - 9:30 a.m.

Sessions were held in connection with this investigation in the Main Hearing Room (room 101), 500 E Street, S.W., Washington, D.C.

ORGANIZATION AND WITNESS:

The Sweetener Users Association
Washington, D.C.

Thomas Earley, Vice President *and* Economist,
Agralytica Consulting

American Sugar Alliance
Arlington, VA

Jack Roney, Director of Economics and Policy Analysis

Don Phillips, Trade Adviser

Underwriters Laboratories Inc.
Washington, D.C.

Ann Weeks, Vice President, Global Government Affairs

-END-

APPENDIX D
Positions of Interested Parties

Introduction

The summaries of the positions of interested parties are based on information provided at a public hearing held on March 19, 2013, and material submitted to the Commission for this investigation. The summaries express the views of the submitting parties and not those of the Commission, whose staff did not attempt to confirm the accuracy of or make corrections to the information provided. The full text of the hearing transcript and written submissions for the current investigation can be found by searching the Commission's Electronic Docket Information System.[1]

TABLE D.1 Information provided by interested parties

	Hearing Testimony	Submission
American Apparel and Footwear Association		✓
American Sugar Alliance	✓	✓
Hildegunn Kyvik Nordås and Yunhee Kim, OECD		✓
Sweetener Users Association	✓	✓
Underwriters Laboratories	✓	

Source: USITC Electronic Docket Information System.

American Apparel and Footwear Association[2]

The American Apparel and Footwear Association (AAFA) said that it is a national trade association representing apparel and footwear industries and their suppliers. The association's submission said that 98 percent of all apparel and 99 percent of all footwear sold in the United States is imported, providing approximately 4 million American jobs.

The AAFA made four points in its submission:

- Imports allow the association's industries to concentrate U.S. employment on the elements in the global value chain where U.S. workers are most competitive. The submission explained that these imports make it possible for its companies to adapt to constantly evolving fashions, production, and distribution challenges.

- U.S. government trade programs and policies should promote needed imports for the U.S. apparel, footwear, and fashion industries, rather than treat textiles and apparel as an import-sensitive industry in need of special rules such as quota and safeguard programs. The AAFA submission said that in the past such policies tightly controlled the industry's trade patterns and hindered its competitiveness. The submission cited the so-called yarn-forward rules of origin, burdensome documentation, and out-of-date customs enforcement procedures as examples of provisions in U.S. trade agreements that damage U.S. economic interests. The association said that the yarn-forward rules limit suppliers and require expensive documentation that inflates costs. The higher costs imposed by these rules not only raise costs for U.S. firms, the submission contended, but also hinder U.S. exports of yarns and fabrics to customers in foreign markets by discouraging foreign customers from participating in yarn forward programs. The AAFA expressed concern that export opportunities for U.S. firms may be damaged if the

[1] Available online at http://edis.usitc.gov.
[2] AAFA, written submission to the USITC, April 12, 2013.

U.S. government tries to include these rules in negotiations for future trade agreements, such as the Trans-Pacific Partnership talks.

- The U.S. government should conclude an international services agreement. The AAFA said that foreign access to and cross-border trade in services have become equally as important as trade in physical goods, as supply chains for the apparel, footwear, and fashion industries have become more globalized.

- Continued U.S. trade barriers encourage the imposition of reciprocal barriers abroad that affect U.S. exports. The AAFA cited the U.S. application of consumer product safety laws as one example that has encouraged foreign countries to adopt variations of similar laws that have caused regulatory confusion rather than a reduction in trade barriers through harmonized regulatory frameworks that secure predictable market access.

American Sugar Alliance[3]

The American Sugar Alliance (ASA) said that it is a national coalition of the growers, processors, and refiners of sugarbeets and sugarcane. In its prehearing submission, the ASA said that U.S. sugar policy and import restraints provide a net benefit to the U.S. economy, rather than a net cost. In its submission, as well as in testimony to the Commission by Jack Roney and Don Phillips representing the ASA, the Alliance expressed the view that the USITC has consistently underestimated the number of jobs in the industry that would be harmed if U.S. import restraints were removed. The ASA also said that the USITC overestimates the job creation likely in the industry if restraints were removed. Its submission described the extent to which U.S. jobs would be lost as a result of significantly lower producer prices. It also sought to counter the argument that the U.S. confectionery industry is contracting, detailing instead examples showing that the sector is profitable and expanding.[4]

The Alliance also looked to counter USITC estimates that a substantial drop in producer prices would result in a passthrough of lower sugar prices to consumers if import restraints were lifted, based in large part on the relatively insignificant share of sugar in the retail cost of sweetened products, according to the submission.[5]

Concerning exports, the submission expressed the view that food manufacturers already have access to sugar at the world price for exported products through the U.S. sugar re-export program. As a result, manufacturers would not increase exports further if U.S. import restraints were removed to promote lower import prices for refined sugar.[6] In summary, the ASA said that far more U.S. jobs are dependent on the sugar-producing industry than previously estimated, and consumers are unlikely to see lower retail prices for sugar and sweetened products if import restraints are removed.

Hildegunn Kyvik Nordås and Yunhee Kim, OECD[7]

In a written submission to the Commission, the authors summarized a recent study by the Organisation for Economic Co-operation and Development (OECD) on the role of

[3] ASA, written submission to the USITC, March 11, 2013.
[4] USITC, hearing transcript, March 19, 2013. 13–15, 20.
[5] USITC, hearing transcript, March 19, 2013, 15–17, 20.
[6] USITC, hearing transcript, March 19, 2013, 17–18.
[7] Nordås and Kim, written submission to the USITC, n.d.

services in helping organize production in international merchandise trade, in support of the investigation's special focus on services' contribution to manufacturing. They said that their report analyzed the relation between manufacturing competitiveness and the quality of key intermediate services and reached the following conclusions:

- New technology is altering the way production is organized, making machine tools less scale-intensive.
- For high-tech industries, the import penetration of business services, while low, was increasing rapidly, whereas for low-tech industries, import penetration was growing fastest for transport, logistics, and travel services.
- Clothing and apparel and electronics, followed by motor vehicles, were the sectors most sensitive to services quality and policies.
- Restrictions on foreign direct investment in services, as well as services regulations beyond the border—such as burdensome technical standards, intellectual property rights rules, and other nontariff barriers—harm product differentiation and in turn manufacturing competitiveness.

Sweetener Users Association[8]

The Sweetener Users Association (SUA) said that its membership includes firms that use sugar and other sweeteners in their businesses, including confectioners, beverage companies, food manufacturers, bakers, dairy product manufacturers, cereal makers, and other companies, along with the trade associations that represent these firms. In its written submission to the Commission, the SUA highlighted recent developments affecting the sweetener trade, including effects of the 2008 farm bill, the integration of the U.S. and Mexico sweetener markets, sugar provisions in the recent U.S.-Colombia Trade Promotion Agreement, and unfilled allocations of the U.S. sugar quota distributed under WTO trade rules.

In its submission, the Association described changes to the U.S. sugar program in the 2008 farm bill, including new restrictions that reduce U.S. policymakers' authority to adjust sugar import quotas to meet domestic needs. The SUA cited both the shortages in 2008–12 and the emerging surplus in 2013 as evidence of this failure to adjust imports as needed. The Association said that a reliable, affordable, and sufficient supply of high-quality sugar is needed by its members to manufacture their products. The SUA cited an independent analysis that supports the view that the U.S. sugar tariff-rate quota results in a net welfare cost to society as well as a large transfer of income from consumers to sugar producers, but the SUA added that the analysis suffered from its inability to quantify the benefits of a stable and reliable domestic supply of sugar, as suggested by market disruptions in 2005 by Hurricane Katrina and in 2008 by the explosion of a major sugar cane refinery. The SUA also expressed support for conclusions in a U.S. Department of Commerce study that indicate that the cost of sugar was a major factor in the sharp decline in jobs in sugar-using industries over 1997–2011.

The SUA submission said that irregular sugar supplies on the U.S. market are compounded by out-of-date allocations of the U.S. raw sugar quota under past WTO trade rules, where allocations to 40 countries were based on the market shares prevailing during the 1975–81 period. The SUA said that world production and trade patterns have

[8] SUA, written submission to the USITC, March 19, 2013.

shifted considerably, while these quota allocations remain unadjusted. The SUA suggested setting up a system permitting some degree of quota tradability among countries, which would fill U.S. quota allocations more efficiently.

The SUA expressed support for a more market-based sugar policy, suggesting that better sugar TRQ administration was needed urgently, as these individual allocations are increasingly going unfilled. Regarding the Commission's research in particular, the SUA urged study not only of differences in raw sugar prices, but also in refined sugar prices, as well as greater focus on the inefficiencies, market distortions, and perverse incentives inherent in the current TRQ structure.

In a written statement as well as in his testimony, Tom Earley, Vice President of the economic consulting firm Agralytica and an economist representing the SUA at the hearing, called for a more efficient and market-based sugar U.S. policy that provides a reliable sugar supply to sugar users, such as through better administration of the U.S. sugar TRQ.[9]

Underwriters Laboratories[10]

In testimony before the Commission, Underwriters Laboratories (UL) described its business as a global independent safety science company dedicated to supporting the production and use of safe products. Ann Weeks, UL Vice President of Global Government Affairs, presented comments on U.S. policy to align regulatory requirements affecting manufacturers, and expressed support for U.S. participation in upcoming negotiations with like-minded trading partners toward an international services agreement.[11] Ms. Weeks addressed the value of and challenges to the testing, inspection, and certification industries that are central to UL's business as a standards development organization. She noted that these services industries can act as a multiplier for manufactured exports, where an agreed single test or certification can mean increased production of a single product that can be designed to reach multiple markets. She said that UL supports the improvement of definitions and classifications of these service industries as a way to end inconsistencies and gaps in classification that otherwise might undermine negotiated commitments and create loopholes in implementation and enforcement of an agreement to harmonize regulations and liberalize barriers in these industries.

[9] USITC, hearing transcript, March 19, 2013, 5–12.
[10] USITC, hearing transcript, March 19, 2013.
[11] USITC, hearing transcript, March 19, 2013.

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APPENDIX E
Model Projections and Additional Results

Overview of the Modeling Framework

The analytical framework used to analyze the economic impact of significant U.S. import restraints in this eighth update is similar to the U.S. Applied General Equilibrium (USAGE) framework that was used in the seventh and sixth updates. The USAGE model is a dynamic computable general equilibrium (CGE) model that describes consumption, production, and trade in over 500 U.S. sectors.[1] The current framework, USAGE 2.0, employs a second-generation version of the USAGE model.[2]

The behavioral equations that define the USAGE 2.0 model hew closely to those laid out in the USAGE model. The data structures, however, have changed substantially in the commodity, industry, and time dimensions. The emphasis in USAGE is on a highly detailed picture of the U.S. economy, relying on the 500+ commodity/industry benchmark input-output (I-O) table published by the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce. Benchmark I-O tables are only released every five years, and with considerable delay. USAGE 2.0, in contrast, relies on the annually updated 65-sector I-O tables that are also published by the BEA.[3] While the annually updated I-O tables provide less sectoral detail than the benchmark tables, using the time series of annual I-O tables beginning with 1998 makes it possible to develop dynamic economic relationships which expand the analytical capabilities of the model.[4]

The USAGE 2.0 model estimates the effects of removing (liberalizing) significant U.S. import restraints relative to a projection of the U.S. economy over the medium term. The model incorporates a baseline projection of the U.S. economy to 2017, based on both historical and forecast economic data, including estimates of the size of the import restraints. The projection assumes that current U.S. import restraints remain in place. Liberalizations reported in this update are alternative policy scenarios in which the significant import restraints are completely eliminated, either individually or all at once. The economic impact of liberalization is assessed by comparing the baseline and the alternative policy outcomes.[5]

The USAGE 2.0 model framework has three components: (1) input-output (I-O) accounts for approximately 65 sectors and commodities, (2) behavioral parameters, and (3) a system of equations that constitute the model specification or theory. The I-O accounts specify the transactions among U.S. individuals, firms, and the U.S. government, derived from the annual I-O accounts for U.S. industries and types of final demand (e.g., imports,

[1] For more detail on the USAGE framework, see USITC, *Import Restraints*, 2009, appendix E. For a complete specification of the USAGE model, see Dixon and Rimmer, "USAGE-ITC," June 2002.

[2] For more detail on the USAGE 2.0 framework, see Fox et al., "Using Annual Input-Output Accounts," June 2012; Dixon and Rimmer, "USAGE 2.0: Historical Simulations," August 2012.

[3] USDOC, BEA, Input-Output Accounts Data (accessed April 26, 2012).

[4] Fox et al., "Using Annual Input-Output Accounts," June 2012, describe how the annual 65-order BEA I-O tables for 1998 to 2009 were made suitable for the USAGE model.

[5] The baseline and the policy projections are each subject to their own "closure," that is, choice of variables within the USAGE framework to treat as exogenous (determined outside the model) or endogenous (determined by model equations). For example, in the baseline projection, growth rates for the components of GDP and for sectoral employment, shipments, exports, and imports of the import restraints sectors are taken from external sources. These choices, in turn, determine the evolution of taste and technology parameters. In the policy scenario, these taste and technology parameters are taken as fixed, and the liberalization of import restraints determines changes in employment, shipments, exports, and imports, which are treated as endogenous. Certain macroeconomic relationships are assumed to hold in the policy scenario, too: real government consumption is held to the same levels as in the baseline, overall labor force growth is assumed to be the same, and growth rates in the average export price and average import price also follow those of the baseline.

private and government consumption and investment expenditures, and inventory changes) published by the BEA.

For purposes of this study, sectors with significant import restraints are identified at a level of aggregation much narrower than those of the core USAGE 2.0 model. In order to analyze the effects of liberalizing these sectors, it is necessary to disaggregate each relevant aggregate sector into two sectors: one sector of interest and one "other" sector.[6] The process of disaggregation begins with identifying the relevant sectors in the full USAGE model based on the BEA's NAICS-based 1997 benchmark I-O table. Many sectors of interest either map exactly to a NAICS-based commodity/industry (e.g., cheese) or to a group of such commodities/industries (e.g., apparel). Certain sectors, however, are narrower than those of the 1997 benchmark: sugar beet and sugarcane; raw and refined sugar (and the associated raw cane sugar and refined beet and cane sugar industries); tuna; costume jewelry; residential electrical lighting fixtures; and pens and mechanical pencils. In these cases, additional data are drawn from the earlier USAGE model based on the BEA's non-NAICS-based 1992 benchmark table and from additional data sources, including the Census Bureau's Annual Survey of Manufactures for 2010 and 2011, the Census of Manufactures for 2007, exports and imports as reported by the USITC's DataWeb (based on data from the U.S. Department of Commerce), and industry sources where necessary (such as for tuna). These data are used to weight the disaggregation of the broader USAGE 2.0 sectors. The significant import restraint sectors are then benchmarked for 2011 to shipments, imports, and exports, as reported in chapter 2.

While the I-O accounts provide information on the initial equilibrium of the U.S. economy, a set of elasticities help the framework determine how the economy would respond to a policy change. Elasticities reflect the degree to which firms or consumers alter their behavior in response to certain economic developments, such as a drop in the price of imports. For example, an income elasticity of demand for a good is the percentage change in consumer demand for that good that occurs in response to a 1 percent change in household income. If demand for a given good is relatively inelastic, it will be little affected by changes in household income; if demand is relatively elastic, it will tend to rise when household income rises and to fall when housecome income falls. The types of elasticities used by USAGE 2.0 include elasticities of substitution between imported and domestic goods, elasticities of import supply, elasticities of export demand, elasticities of substitution between inputs in production, and income elasticities.

Where possible, the Commission has estimated some of these parameters using time series data that show how consumers and firms have responded to given changes in the past; otherwise, it has relied on published studies for estimates. With the exception of textiles and apparel, the elasticities of substitution between imported and domestic goods

[6] The new commodities and industries created through this process (and their associated "other," or residual, sectors) are sugar beet and sugarcane (other farms); ceramic and glass products (other nonmetallic minerals and products); hand and edge tools and ball and roller bearings (other fabricated metal products); residential electrical lighting fixtures (other electrical equipment); costume jewelry, pens, and mechanical pencils (other miscellaneous manufacturing); raw sugar, refined sugar, sugar-containing products, cheese, cigarettes, and tuna (other food, beverage, and tobacco); yarn, thread, and fabric and textile products (no residual sector); apparel, footwear, and leather products (leather and hide tanning and finishing); and synthetic organic dyes (other chemical products). Two industries, beet sugar and cane sugar, were created for the production of the single commodity refined sugar.

(known as Armington elasticities) are documented in Donnelly et al.[7] The Armington elasticities for the textile and apparel sectors are based on Hertel et al.[8]

The final component of the USAGE 2.0 framework is the system of equations that model the U.S. economy. These equations characterize three general conditions that together determine a general equilibrium solution.[9] First, activities are characterized by constant returns, so firms must earn zero real economic profits at the margin, and all the production technologies and preferences are derived from theoretical formulations constrained by these zero-profit conditions.[10] Second, the quantity supplied must equal the quantity demanded for each good and service in the economy. Third, all income must be accounted for by final demand or savings.

Model Projections

The USAGE 2.0 baseline is a "business as usual" projection of the U.S. economy to 2017. Developing this baseline involves shocking key observable variables in the model with projections about how the economy will behave, derived from research conducted by Commission staff and other sources, mainly other federal government agencies. The detailed theoretical and empirical structure of the model then allocates these projected shocks across a wide range of variables at the sectoral level.

Key shocks include macroeconomic expenditure and income aggregates (consumption, investment, government spending, imports, and exports). This study sourced macroeconomic forecasts from other federal agencies, principally the U.S. Energy Energy Information Administration. The USAGE 2.0 baseline adjusts these projections by taking in additional information from the International Monetary Fund and World Bank on the growth of world gross domestic product (GDP); from the Bureau of Labor Statistics (BLS) on population, demographics, labor supply, and employment; from government and the academic literature on "terms of trade" (the relative prices of imports and exports) and exchange rate adjustments; and from diverse sources (including government and academic) on productivity comparisons between the United States and the rest of the world. Table E.1 gives the projected growth in key U.S. and global macroeconomic variables in the forecast period.

Projections for specific sectors are also informed by supplemental data from a wide range of sources. As discussed in chapter 1, the projections of sectors with significant restraints are refined using data on recent growth in prices, output, imports, and exports; sector-specific forecasts from organizations such as the Food and Agricultural Policy Research Institute and the U.S. Census; and trade journals and industry research reports (such as those from IBISWorld). Table E.2 presents projected values and sources for selected sectors with significant restraints.

Projections in other important sectors of the U.S. economy rely on trends and data specific to those sectors. For example, the growth in health-related sectors is assumed to be determined less by relative prices and other typical economic variables and more by demographic changes (particularly aging, population growth, and changes in morbidity

[7] Donnelly et al., "Revised Armington Elasticities of Substitution," January 2004.

[8] Hertel et al., "How Confident Can We Be?" May 2003.

[9] Technically, this represents an Arrow-Debreu competitive general equilibrium. Debreu, *The Theory of Value*, 1959.

[10] When returns to scale are constant, the average cost of production does not decline as the volume of production rises.

TABLE E.1 Projected growth in macroeconomic variables, real percentage change, 2012–17

Macroeconomic variable	Projected real growth 2012–17
United States	
GDP	14.8
Consumption	12.5
Investment	38.2
Government expenditure	–2.7
Exports	34.4
Imports	18.9
World	
GDP	26.3

Sources: EIA, *Annual Energy Outlook 2012,* June 2012; IMF, World Economic Outlook Database, April 2013 release (accessed July 22, 2013).

TABLE E.2 Observed and projected changes in imported quantities, selected sectors

Sector	2007–12 change (%)	2012–17 projected change (%)	Main source(s) of sectoral projections[a]
Cheese	–8.4[b]	12.0	Commission estimate
Sugar	30.2	30.2	Historical trend
Tuna	15.7[b]	20.0	USDOC, Commission estimate
Textiles and apparel			
Yarn, thread, and fabric	–14.4	10.4	Historical trend, IBISWorld projection
Textile products	–3.2	18.8	Historical trend, IBISWorld projection
Apparel	–3.9	13.1	Historical trend, IBISWorld projection
Ball and roller bearings	30.1	84.9	Historical trend, IBISWorld projection
Ceramic and glass products	–8.5	12.4	Historical trend, IBISWorld projection
Cigarettes	–18.1	–1.7	Historical trend, IBISWorld projection
Costume jewelry	–9.9	–21.7	Historical trend, IBISWorld projection
Footwear and leather products	9.0	–14.4	Historical trend, IBISWorld projection
Hand and edge tools	9.2	–28.6	Commission estimate
Pens and mechanical pencils	–16.7	–13.2	Historical trend, IBISWorld projection
Residential elect. lighting fixtures	–17.7	27.6	Historical trend, IBISWorld projection
Synthetic organic dyes	15.2	14.8	Historical trend, IBISWorld projection

[a]See chapter 2 for specific sources for each industry.
[b]Change represents 2007–11.

rates) and technological change in medical services; data on these trends are sourced from agencies such as BEA and BLS. The analysis also uses sector-specific projections for energy sectors, using information on supply, production, consumption, prices, exports, and imports for sectors like coal, natural gas, petroleum, ethanol, and electricity. The world price of crude petroleum is particularly important, as it can substantially affect the U.S. trade balance and terms of trade. The energy sector data are sourced from the U.S. Department of Energy and the U.S. Energy Information Administration. The Commission incorporated the most recent sector-specific forecasts, as it did with the macroeconomic components discussed above. These forecasts are revised periodically as new data become available. Updated values will generally have much larger effects on the projection than on the simulation results, because the effects of liberalization will generally be similar whether growth is high or low.[11]

[11] In USAGE 2.0, the effect of tariff liberalization on domestic output in the directly affected sector depends on Armington elasticities, the size of the tariff cut, and imports as a share of GDP; only the import share can be affected by U.S. growth in the projection. If growth in U.S. output is lower than assumed in the current projection, for example, then import share in some sectors may be smaller than in the current projection, and tariff elimination would have slightly smaller effects than reported in chapter 2.

The baseline incorporates trade policy adjustments expected to be made by 2017, such as changes to tariff rates and to quantity allocations for tariff-rate quotas (TRQs) contained in the tariff staging schedules for U.S. free trade agreements (FTAs) and other trade agreements. These agreements provide the projected path of trade policy variables during the time horizon of the projection. For U.S. imports from countries that do not have such agreements with the United States, projected tariff rates and TRQs are set equal to their current values.

Some key model inputs, such as changes in consumer preferences, are not observable in projections. Values for these components of the USAGE 2.0 baseline come from simulation analysis of expected changes during the baseline period. By shocking the baseline data with expected percentage changes for a wide range of macroeconomic aggregates, as well as production, price, and volume variables, the model is able to endogenously quantify model-consistent estimates of "unobservable" data. In addition to preferences, such variables include detailed technical change information, shifts in preferences between domestic and imported goods and services, and shifts in export demand and import supply functions.

Additional Data and Results

Tables E.3 and E.4 show detailed model results, and table E.5 presents the classification of sectors discussed in chapter 2.

TABLE E.3 Effects of simultaneous liberalizations, percent, 2012–17

Sector	Change in quantity			Change in employment	Change in price	
	Imports	Exports	Output		Imports	Household
Cheese	40.2	0.9	–1.5	–1.7	–11.9	–0.3
Sugar	42.0	17.9	–5.4	–13.6	–19.0	–6.2
Tuna	4.8	0.5	–5.2	–5.2	–10.5	–5.7
Textiles and apparel	2.8	–41.0	–13.6	–14.2	–10.6	–4.5
Yarn, thread, and fabric	–5.6	–52.7	–22.8	–24.7	–4.8	–2.0
Other textile products	3.6	–29.0	–6.3	–5.6	–5.6	–1.8
Apparel	3.4	–7.9	–7.7	–7.8	–12.1	–5.4
Other high–tariff sectors						
Ball and roller bearings	3.0	2.1	–2.2	–2.1	–5.5	([a])
Ceramic and glass products	4.9	1.6	–2.2	–2.3	–4.4	–1.1
Cigarettes	26.1	0.6	–0.4	–0.5	–6.8	0.1
Costume jewelry	1.1	0.8	–3.3	–3.6	–6.7	–2.6
Footwear and leather products	1.2	1.0	0.1	0.2	–9.3	–4.3
Hand and edge tools	2.0	1.1	–2.2	–2.5	–4.2	–1.0
Pens and mechanical pencils	2.3	1.8	–2.5	–3.3	–5.0	–1.6
Residential electric lighting fixtures	2.5	1.2	–4.6	–5.1	–4.8	–2.5
Synthetic dyes	3.1	1.0	–3.1	–4.0	–4.7	([a])

Source: Commission estimates.

[a]Not applicable.

TABLE E.4 Effects of individual liberalizations, percent, 2012–17

Sector	Change in quantity			Change in employment	Change in price	
	Imports	Exports	Output		Imports	Household
Cheese	40.2	0.4	–1.5	–1.7	–11.8	–0.4
Sugar	43.0	18.0	–5.3	–13.8	–19.1	–6.4
Tuna	4.8	0.0	–5.2	–5.2	–10.4	–5.8
Textiles and apparel	2.9	–41.3	–13.9	–14.5	–10.6	–4.5
Yarn, thread, and fabric	–5.8	–52.7	–22.9	–24.7	–4.8	–2.1
Other textile products	4.1	–30.2	–7.1	–6.8	–5.6	–1.7
Apparel	3.3	–7.9	–7.7	–7.7	–12.1	–5.4
Other high-tariff sectors						
Ball and roller bearings	2.8	1.6	–2.5	–2.4	–5.5	([a])
Ceramic and glass products	4.9	1.2	–2.2	–2.3	–4.4	–1.2
Cigarettes	26.2	0.1	–0.4	–0.4	–6.8	–0.1
Costume jewelry	1.0	0.3	–3.5	–3.8	–6.7	–2.7
Footwear and leather products	1.3	0.6	–0.3	–0.2	–9.2	–4.4
Hand and edge tools	2.0	0.6	–2.4	–2.6	–4.2	–1.1
Pens and mechanical pencils	2.3	1.3	–2.5	–3.4	–4.9	–1.6
Residential electric lighting fixtures	2.5	0.7	–4.6	–5.0	–4.8	–2.6
Synthetic dyes	5.2	0.3	–2.1	–2.6	–4.7	([a])

Source: Commission estimates.

[a]Not applicable.

TABLE E.5 Classification of imports, exports, shipments, and employment, by sector, in summary tables

Sector	Imports (HTS)	Exports (Schedule B)	Shipments (NAICS)	Employment (NAICS)
Cheese	0406	0406	311513	311513
Sugar				
Farming				
Sugarcane farming	([a])	([a])	111930	111930
Sugar beet farming	([a])	([a])	111991	111991
Processing				
Beet sugar manufacturing	([a])	([a])	311313	311313
Cane sugar manufacturing	([a])	([a])	311314	311314
Sugarcane	1212.93.0000	1212.93.0000	([a])	([a])
Sugar beets	1212.91.0000	1212.91.0000	([a])	([a])
Total sugar	1701[b]	1701[b]	([a])	([a])
Tuna	1604.14	1604.14	([c])	311710[d]
	Imports (NAICS)	Exports (NAICS)		
Textiles and apparel				
Yarn, thread, and fabric	313	313	313	313
Other textile products	314	314	314	314
Apparel	315	315	315	315
Other high-tariff sectors				
Ball and roller bearings	332991	332991	332991	332991
Ceramic and glass products	3272	3272	3272	3272
Cigarettes	312221	312221	312221	312221
Costume jewelry	339914	339914	339914	339914
Footwear and leather products	3161, 3162, 3169	3161, 3162, 3169	3161, 3162, 3169	3161, 3162, 3169
Hand and edge tools	332212	332212	332212	332212
Pens and mechanical pencils	339941	339941	339941	339941
Residential electric lighting fixtures	335121	335121	335121	335121
Synthetic dyes	325132	325132	325132	325132

[a]Not applicable.
[b]Data are presented on a marketing year basis (October–September).
[c]Provided by USDOC et al., *Fisheries of the United States 2011,* August 2012.
[d]Commission estimate using data from USDOC, Economic Census 2007 (accessed May 28, 2013); Rushford, "Charlie the Tuna's Economic Woes," July 7, 2010.

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APPENDIX F
Embodied Services in Goods-Producing Industries

Concepts and Estimation Methods

An important subject of the analysis in chapter 3 of this study is "embodied services in goods-producing industries." These are defined as the value of the services that are embedded in manufacturing, either directly by manufacturing firms or indirectly via purchased intermediate inputs. To estimate the values reported in chapter 3, the Commission transformed input-output (I-O) tables in conjunction with other sector-level data to obtain a decomposition of value added that permits the analysis in the report. This method, which was developed by Koopman, Wang, and Wei, generalizes the vertical specialization measures proposed by Hummels, Ishii, and Yi; it is summarized below.[1]

Methodology

Assuming a world of G countries, each country produces goods and services in N tradable sectors. Goods and services produced in each sector can be either used as intermediate inputs or consumed directly. Each country exports both intermediate and final goods to all other countries. Gross outputs (X) produced by a country are used either as intermediate inputs or final goods and services (F), so

$$X_s = \sum_r^G (A_{sr} X_r + F_{sr}), \qquad \text{r,s = 1,2…. G} \tag{1}$$

where X_s is the N×1 gross output vector of country *s*, F_{sr} is the N×1 final demand vector that gives demand in country *r* for final goods and services produced in country *s*, and A_{sr} is the N×N I-O coefficient matrix, which gives the value of intermediate inputs produced by country *s* and used in country *r*.

The G-country, N-sector production and trade system can be written as an inter-country input-output (ICIO) model in block matrix notation

$$\begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_G \end{bmatrix} = \begin{bmatrix} A_{11} & A_{12} & \cdots & A_{1G} \\ A_{21} & A_{22} & \cdots & A_{2G} \\ \vdots & \vdots & \ddots & \vdots \\ A_{G1} & A_{G2} & \cdots & A_{GG} \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_G \end{bmatrix} + \begin{bmatrix} F_{11} + F_{12} + \cdots + F_{1G} \\ F_{21} + F_{22} + \cdots + F_{2G} \\ \cdots\cdots \\ F_{G1} + F_{G2} + \cdots + F_{GG} \end{bmatrix}. \tag{2}$$

Rearranging,

$$\begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_G \end{bmatrix} = \begin{bmatrix} I - A_{11} & -A_{12} & \cdots & -A_{1G} \\ -A_{21} & I - A_{22} & \cdots & -A_{2G} \\ \vdots & \vdots & \ddots & \vdots \\ -A_{G1} & -A_{G2} & \cdots & I - A_{GG} \end{bmatrix}^{-1} \begin{bmatrix} \sum_r^G F_{1r} \\ \sum_r^G F_{2r} \\ \vdots \\ \sum_r^G F_{Gr} \end{bmatrix} = \begin{bmatrix} B_{11} & B_{12} & \cdots & B_{1G} \\ B_{21} & B_{22} & \cdots & B_{2G} \\ \vdots & \vdots & \ddots & \vdots \\ B_{G1} & B_{G2} & \cdots & B_{GG} \end{bmatrix} \begin{bmatrix} F_1 \\ F_2 \\ \vdots \\ F_G \end{bmatrix} \tag{3}$$

[1] Koopman, Wang, and Wei, "Tracing Value-added and Double Counting in Gross Exports," forthcoming; Hummels, Ishii, and Yi, "The Nature and Growth of Vertical Specialization in World Trade," 2001.

where B_{sr} denotes the N×N block Leontief inverse matrix, which is the total requirements matrix that gives the amount of gross output in producing country *s* that is required for a one-unit increase in final demand in the destination country *r*. $F_s = \sum_r^G F_{sr}$ is an N×1 vector that gives the total production of final goods and services of country *s'* and can be split into $FD_s = F_{ss}$ and $FE_s = \sum_{r \neq s}^G F_{sr}$ to represent the country's domestic and external final demand, respectively.

Let V_s be the N×1 direct value-added coefficient vector. Each element of V_s gives the ratio of direct domestic value added to total output for country *s*. This is equal to 1 minus the intermediate input share from all countries (including the country's own intermediates):

$$V_s = (I - \sum_r^G A_{rs}) . \tag{4}$$

Putting all V_s vectors on the diagonal and denoting them with a circumflex ($\hat{V}_s$), we can define a GN×GN matrix of direct domestic value added for all countries as

$$\hat{V} = \begin{bmatrix} \hat{V}_1 & 0 & \cdots & 0 \\ 0 & \hat{V}_2 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \hat{V}_G \end{bmatrix}. \tag{5}$$

Similarly, putting all countries' domestic and external final demand on the diagonal, we can define another GN×GN matrix of all countries' final demand as

$$\hat{F} = \begin{bmatrix} F_1 & 0 & \cdots & 0 \\ 0 & F_2 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & F_G \end{bmatrix} = \begin{bmatrix} \sum_r^G \hat{F}_{1r} & 0 & \cdots & 0 \\ 0 & \sum_r^G \hat{F}_{2r} & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \sum_r^G \hat{F}_{Gr} \end{bmatrix} \tag{6}$$

Finally, the decomposition of gross domestic product (GDP) by industry and value added in final demand can be represented by the following system of equations:

$$\hat{V}B\hat{F} = \begin{bmatrix} \hat{V_1} & 0 & \cdots & 0 \\ 0 & \hat{V_2} & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \hat{V_G} \end{bmatrix} \begin{bmatrix} B_{11} & B_{12} & \cdots & B_{1G} \\ B_{21} & B_{22} & \cdots & B_{2G} \\ \vdots & \vdots & \ddots & \vdots \\ B_{G1} & B_{G2} & \cdots & B_{GG} \end{bmatrix} \begin{bmatrix} \hat{F_1} & 0 & \cdots & 0 \\ 0 & \hat{F_2} & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \hat{F_G} \end{bmatrix}$$

$$= \begin{bmatrix} \hat{V_1} B_{11} \hat{F_1} & \hat{V_1} B_{12} \hat{F_2} & \cdots & \hat{V_1} B_{1G} \hat{F_G} \\ \hat{V_2} B_{21} \hat{F_1} & \hat{V_2} B_{22} \hat{F_2} & \cdots & \hat{V_2} B_{2G} \hat{F_G} \\ \vdots & \vdots & \ddots & \vdots \\ \hat{V_G} B_{G1} \hat{F_1} & \hat{V_G} B_{G2} \hat{F_2} & \cdots & \hat{V_G} B_{GG} \hat{F_G} \end{bmatrix} \quad (7)$$

where $\hat{V}B\hat{F}$ is a GN×GN square matrix that gives the estimates of sector and country sources of value added in a country's total (domestic and external) final demand. Each block matrix $\hat{V_s} B_{sr} \hat{F_{rr}}$ is an N×N square matrix, with each element representing the value added from a source sector in a source country directly or indirectly used by an absorbing sector in a destination country's total (domestic and external) final demand. If we replace $\hat{F_r}$ in equation (7) by each country's bilateral final exports, we also can decompose the value of each bilateral final trade flow value into its country and sector sources.

Application to Services' Contribution to Manufacturing

Exports of direct and indirect services value added are estimated in this report by summing the $\hat{V}B\hat{F}$ matrix across columns (i.e., along each row). This provides estimates of each country's domestic value added in all countries' foreign and domestic final demand of the value added-producing sectors, regardless of the absorbing sectors and geographic destinations. It is the value-added contribution made by production factors employed at the producing sector in the source country. It provides a supplier (producer)-side perspective on the use of each country's GDP by industry, whether directly or indirectly, to satisfy domestic or external final demand.

Summing up the $\hat{V}B\hat{F}$ matrix across rows (along the column) provides the country and sector sources of value added in each country's final goods and services output (sales), and thus a decomposition of a particular sector's final goods and services sales into its various country and sector sources. Based on the I-O identity, all of these sources should sum to the total value of the sectoral final products output. It provides a user (consumer)-side perspective that decomposes a country/sector's final goods and services into its original country/sector sources (this is how the embedded service in final manufactured goods is estimated in this report). These two different ways to decompose value-added production and final demand have distinct economic interpretations and therefore different roles in the economic analysis. [2] However, they are equivalent in the aggregate because global value-added production equals global final demand.[3]

[2] This value-added (final demand) decomposition method differ from the gross exports accounting method proposed by Koopman, Wang, and Wei, "Tracing Value-added and Double Counting in Gross Exports" (forthcoming). Accounting for double-counting in gross exports in additional to value added is an

Sector level value-added decompositions can be conducted from both the producer and user perspectives. The production factor content method counts the domestic value added that originated in a particular sector in the source country and is embodied in that sector and all its downstream sector's exports. This supply-side perspective would include, for example, the value created by production factors employed in the telecommunications sector and incorporated into gross exports of telecommunications services (direct domestic value-added exports), as well as exports of computers, consumer appliances, and automobiles (indirect domestic value-added exports). In other words, it decomposes GDP (domestic value added) by industries in a country according to where (sector/country) it is used. It has been called a forward-looking decomposition in the literature on I-O.

As an alternative, sector-level value-added decompositions also can be conducted from the user perspective. This will include all upstream sectors/countries' contributions of value added to a specific sector/country's final goods output. For example, in the electronics sector, it includes value added in the electronics sector itself as well as value added in inputs from all other upstream sectors/countries (such as glass from country A, rubber from country B, transportation and design from the home country) used to produce electronics to satisfy domestic or foreign final demand by the home country (direct/indirect domestic value added in exports, and foreign value added in exports). In other words, it decomposes a particular final product according to its value-added sources. It has been called a backward-looking decomposition in the literature on I-O. Such a perspective aligns well with case studies of supply chains of specific sectors and products, such as the iPod or iPhone examples frequently cited in the literature.

Measurement of Embodied Services and Data Sources

After understanding how production of value added (GDP) by country/industries sources and production of final products by country/sectors value-added sources can be usefully decomposed, embodied services can be defined as service sectors' indirect value-added contribution to a goods-producing sector—i.e., the indirect contribution by labor and capital employed in services sectors to a country's final goods production and sales.[4]

The value-added estimates in this report are based on two primary data sources: (1) annual U.S. make and use tables from the BEA, which cover 65 U.S. industries from 1998 to 2011; (2) global industry by industry ICIO tables from the World Input-Output Database (WIOD), which cover 35 industries and 41 countries from 1995 to 2009.

Appendix tables F.1 and F.2 report backward-looking decompositions (user perspective) based on WIOD data that sum across the rows (along the columns) of $\hat{V}B\hat{F}$ matrix. In the exports decomposition table (F.1), U.S. manufactured final goods exports are first decomposed into domestic and foreign sources. Returned U.S. domestic value added is included in U.S. domestic value-added shares. Then each source is further split into four

important part of their methodology, while here only the decomposition of value-added production is considered. Therefore, $B\hat{F}$ decomposes gross output based on where it is produced. It does not equal the gross export decomposition matrix defined in equation (29) in Koopman et al.; it decomposes gross output based on where it is absorbed.

[3] See proof in Timmer et al., "Fragmentation, Incomes, and Jobs," 2013; Koopman, Wang, and Wei, "Tracing Value-added and Double Counting in Gross Exports" (forthcoming).

[4] This measure is different from HIY's measures of vertical specialization, because the latter is not net value-based measures as discussed in Koopman, Wang, and Wei.

sector groups: (1) resources, including agriculture, hunting, forestry, fishing, and mining industries; (2) manufacturing, including all manufacturing industries; (3) construction; and (4) services, including all service industries and government services. Business services, which include telecommunication, financial, and other business services, are reported separately, since they are the key sectors of interest of this report.

The imports decomposition table (F.2) is constructed by summing up all of the countries' bilateral exports of final goods to the United States. It first decomposes the total value of U.S. final goods imports into three sources: (1) value added that is exported to the United States directly by the exporting countries; (2) value added that is exported indirectly to the United States via a third country; and (3) value added that is created by U.S. production factors and returns home after being processed abroad (used by other countries as intermediate inputs to produce final manufacturing goods and shipped back to the United States). These three sources are further split into sector groups, as in the exports decomposition table.

Appendix table F.3 reports a forward-looking decomposition (producer perspective) based on the WIOD data that sum across the columns (along the rows) of $\hat{V}B\hat{F}$ matrix. It decomposes GDP created by each U.S. services sector into six components: direct value-added exports (1–2); indirect service sector value-added exports that go to third countries via the direct importers (3); returned U.S. service sector value added via final goods and services imports that fit U.S. domestic final demand (4); returned U.S. service sector value added via intermediate imports that are used to produce final goods and services consumed at home (5); and domestic value added directly used at home (6). The first three components sum to total value-added exports, and the first five terms sum to GDP in exports, which can also be derived from the BEA's annual U.S. I-O tables as a whole (reported in appendix table F.4 below). However, components 2 to 5 cannot be estimated from the BEA data individually, because the BEA I-O tables do not include the detailed ICIO transactions. The estimates of components 4 and 5 provide some indication of how much bias may occur in estimating domestic and foreign value-added shares by using single country I-O tables instead of global ICIO tables when there are two-way intermediate goods trade involved, because domestic value added embodied in imports cannot be estimated from single country I-O table.

Appendix table F.4 reports a forward-looking decomposition based on the BEA U.S. annual I-O table that sums across the columns (along the rows) of $\hat{V}B\hat{F}$ matrix. The table decomposes the GDP created by each U.S. service industry as reported in the BEA use table (which gives more sector detail than the WIOD table) according to its use: directly used by domestic consumers and exports, or indirectly used by downstream industries to meet domestic and foreign final demand.

Appendix table F.5 reports a backward-looking decomposition (user perspective) based on WIOD data that sums across the rows of the services sectors (along the columns that correspond to all of the manufacturing sectors) of the $\hat{V}B\hat{F}$ matrix. It includes service intermediate inputs sourced both domestically and internationally, and provides the information on value-added shares of three major services groups in manufacturing final goods production across countries

.

TABLE F.1 Domestic and foreign value-added sources of U.S. final manufacturing goods exports

		1995													
		M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14
U.S. final manufacturing goods exports (million $)		25,664	7,621	844	61	5,876	2,834	8,330	1,627	243	3,333	37,018	52,207	41,654	8,781
Domestic sources (%)	Resources	13.9	2.2	3.1	10.4	1.3	20.8	2.4	1.7	3.9	1.7	0.8	0.6	0.8	1.4
	Manufacturing	42.6	56.8	47.8	48.9	55.4	30.2	53.4	56.5	59.4	58.0	59.3	51.8	56.3	60.9
	Construction	0.5	0.4	0.3	0.6	0.5	0.4	0.5	0.5	0.7	0.6	0.4	0.4	0.3	0.4
	Services	33.8	30.3	33.8	29.9	33.9	21.2	32.7	29.6	28.4	27.6	27.5	32.6	26.5	27.5
	Business services	14.2	13.9	16.1	10.8	16.9	9.3	15.4	13.2	11.6	11.9	13.1	16.9	12.1	12.0
	Other services	19.7	16.3	17.7	19.1	17.0	11.9	17.3	16.4	16.8	15.7	14.4	15.7	14.4	15.4
	Total	90.8	89.7	85.0	89.8	91.1	72.7	88.9	88.4	92.3	87.9	88.0	85.5	84.0	90.2
Foreign sources (%)	Resources	3.0	1.2	1.9	2.2	0.8	17.5	1.8	1.3	1.2	1.2	0.8	0.8	0.9	1.0
	Manufacturing	2.9	5.2	7.4	4.5	4.5	2.7	4.9	5.9	3.5	6.5	6.7	8.3	9.4	5.1
	Construction	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Services	3.2	3.9	5.6	3.5	3.5	7.0	4.3	4.3	2.9	4.3	4.4	5.3	5.7	3.6
	Business services	1.4	1.6	2.2	1.3	1.5	2.0	1.9	1.8	1.2	1.6	1.8	2.3	2.2	1.5
	Other services	1.8	2.2	3.4	2.2	2.0	5.0	2.4	2.5	1.7	2.6	2.6	3.0	3.5	2.2
	Total	9.2	10.3	15.0	10.2	8.9	27.3	11.1	11.6	7.7	12.1	12.0	14.5	16.0	9.8

		2008													
		M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14
U.S. final manufacturing goods exports (million $)		40,146	7,399	742	187	8,718	25,782	29,210	3,974	296	6,815	70,229	74,179	99,113	19,959
Domestic sources (%)	Resources	16.4	2.3	3.6	9.3	1.8	18.9	4.0	2.7	5.8	2.9	1.2	0.7	1.5	1.6
	Manufacturing	37.4	60	59.5	41.3	48.8	25.8	43.2	47.8	45.7	47.1	52.5	59.8	47.2	55.4
	Construction	0.5	0.3	0.3	0.7	0.6	0.4	0.5	0.6	0.8	0.6	0.4	0.3	0.4	0.4
	Services	31.8	22.6	19.7	34.9	37.5	11.5	31.3	28.9	34.6	29.9	27.4	24.1	27.9	28.1
	Business services	13.6	9.9	9.0	14.3	21.0	5.5	16.4	13.8	15.2	13.3	13.0	13.5	14.2	13.5
	Other services	18.2	12.7	10.8	20.6	16.6	6.0	15.0	15.1	19.3	16.6	14.3	10.7	13.7	14.5
	Total	86.1	85.2	83.2	86.2	88.6	56.6	79.0	79.9	86.8	80.5	81.5	84.9	76.9	85.4
Foreign sources (%)	Resources	5.4	3.4	3.8	4.0	2.4	30.7	6.4	4.6	4.0	3.9	2.8	2.0	2.9	2.6
	Manufacturing	3.9	6.3	7.6	5.0	4.3	3.0	7.2	8.3	4.5	9.2	9.2	7.6	11.9	6.7
	Construction	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Services	4.6	5.1	5.3	4.8	4.6	9.7	7.3	7.1	4.6	6.4	6.4	5.4	8.1	5.2
	Business services	1.9	2.1	2.0	2.0	2.2	2.7	3.1	2.9	2.0	2.4	2.6	2.4	3.3	2.2
	Other services	2.7	3.0	3.3	2.8	2.4	7.0	4.2	4.2	2.6	4.0	3.8	3.0	4.9	3.0
	Total	13.9	14.8	16.8	13.8	11.4	43.4	21.0	20.1	13.2	19.5	18.5	15.1	23.1	14.6

Sources: World Input-Output Database; Commission estimates.

Notes: M1: food, beverages, and tobacco; M2: textiles and textile products; M3: leather and footwear; M4: wood and wood products; M5: paper, printing, and publishing; M6: coke, refined petroleum, and nuclear fuel; M7: chemicals and chemical products; M8: rubber and plastics; M9: other non-metallic minerals; M10: basic metals and fabricated metal; M11: machinery; M12: electrical and optical equipment; M13: transport equipment; M14: manufacturing (n.e.c.) and recycling; Resources: agriculture, hunting, forestry, and fishing and mining and quarrying; Business services: post and telecom, financial, renting of machinery and equipment (M&E), and other business services; Other services: utilities, trade, transport, hotel and restaurants, real estate, and other services; All services: business services and other services.

TABLE F.2 Domestic and foreign value-added sources of U.S. final manufacturing goods imports

		1995													
		M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14
U.S. final manufacturing goods imports (million $)		18,785	49,098	12,134	1,351	4,511	2,937	11,270	4,933	2,852	6,945	37,480	93,097	83,423	24,133
Direct Importers (%)	Resources	20.5	7.3	8.2	14.7	2.7	24.9	4.7	4.2	6.2	3.7	1.0	2.0	0.6	3.7
	Manufacturing	38.0	46.4	47.5	47.2	53.6	28.1	48.5	50.8	54.8	49.5	56.5	47.5	48.4	49.6
	Construction	0.4	0.2	0.3	0.3	0.4	0.4	0.5	0.3	0.5	0.5	0.5	0.3	0.4	0.3
	Services	24.6	18.4	23.5	19.2	23.9	17.7	24.9	21.4	23.9	23.4	23.1	19.7	22.0	23.7
	Business services	7.0	5.1	6.3	4.7	8.2	5.1	9.4	6.0	7.1	6.5	8.4	6.7	6.9	8.3
	Other services	17.6	13.3	17.3	14.4	15.7	12.7	15.5	15.5	16.9	16.9	14.7	13.0	15.1	15.4
	Total	83.5	72.3	79.5	81.4	80.7	71.2	78.5	76.7	85.4	77.1	81.1	69.5	71.4	77.3
Third countries (%)	Resources	2.7	1.9	1.8	3.1	1.1	10.1	2.0	1.7	2.8	2.6	1.2	1.2	0.9	2.1
	Manufacturing	3.9	11.3	7.8	6.1	7.3	4.4	7.9	7.7	5.1	8.7	8.2	11.3	7.4	8.7
	Construction	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Services	5.1	9.1	7.0	5.9	6.3	9.1	7.2	5.7	4.8	6.2	5.8	7.2	4.9	6.9
	Business services	1.7	2.8	2.2	1.7	2.5	2.3	2.7	2.1	1.7	2.1	2.1	2.6	1.9	2.3
	Other services	3.3	6.3	4.8	4.1	3.8	6.7	4.6	3.6	3.1	4.1	3.7	4.6	3.0	4.6
	Total	11.8	22.5	16.6	15.2	14.8	23.7	17.2	15.2	12.8	17.6	15.4	19.8	13.2	17.7
Domestic value-added return home (%)	Resources	0.6	0.3	0.3	0.3	0.1	0.9	0.2	0.3	0.1	0.3	0.1	0.2	0.2	0.5
	Manufacturing	1.3	1.8	1.3	1.0	1.8	1.1	1.6	4.3	0.7	2.7	1.7	5.8	9.6	1.9
	Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0
	Services	2.8	3.1	2.3	2.2	2.5	3.1	2.4	3.5	1.0	2.4	1.7	4.7	5.6	2.6
	Business services	1.2	1.4	1.0	1.0	1.4	1.4	1.2	1.8	0.5	1.1	0.9	2.2	2.8	1.2
	Other services	1.6	1.8	1.3	1.1	1.2	1.7	1.3	1.8	0.5	1.2	0.9	2.4	2.8	1.4
	Total	4.8	5.2	3.8	3.4	4.5	5.1	4.3	8.2	1.8	5.3	3.6	10.7	15.4	4.9

Sources: World Input-Output Database; Commission estimates.

Notes: M1: food, beverages, and tobacco; M2: textiles and textile products; M3: leather and footwear; M4: wood and wood products; M5: paper, printing, and publishing; M6: coke, refined petroleum, and nuclear fuel; M7: chemicals and chemical products; M8: rubber and plastics; M9: other non-metallic minerals; M10: basic metals and fabricated metal; M11: machinery; M12: electrical and optical equipment; M13: transport equipment; M14: manufacturing (n.e.c.) and recycling; Resources: agriculture, hunting, forestry, and fishing and mining and quarrying; Business services: post and telecom, financial, renting of M&E, and other business services; Other services: utilities, trade, transport, hotel and restaurants, real estate, and other services.

TABLE F.2 Domestic and foreign value-added sources of U.S. final manufacturing goods imports—*continued*

		2008													
		M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14
U.S. final manufacturing goods imports (million $)		54,162	104,340	21,678	1,848	9,502	32,354	69,085	12,367	2,859	16,169	85,839	210,058	158,717	62,654
Direct Importers (%)	Resources	18.6	10.2	14.2	14.5	2.1	23.9	5.4	5.4	9.6	5.8	2.4	3.0	0.8	5.0
	Manufacturing	37.4	43.1	45.3	46.1	49.1	21.9	38.8	44.4	45.9	40.8	46.3	38.3	43.2	46.4
	Construction	0.3	0.2	0.2	0.2	0.4	0.2	0.3	0.2	0.4	0.3	0.3	0.1	0.3	0.3
	Services	23.2	14.5	17.8	17.8	26.8	12.8	21.5	19.3	19.4	19.1	19.5	16.8	22.5	17.9
	Business services	7.0	4.5	5.3	5.0	10.3	3.5	8.5	5.8	6.0	5.4	7.0	6.3	7.7	6.2
	Other services	16.1	9.9	12.4	12.8	16.4	9.3	13.0	13.6	13.4	13.7	12.4	10.5	14.8	11.6
	Total	79.6	68.0	77.5	78.6	78.3	58.8	66.0	69.3	75.3	66.0	68.4	58.2	66.7	69.5
Third countries (%)	Resources	3.9	4.7	4.5	6.7	2.8	18.3	5.7	5.8	6.6	10.0	4.5	4.8	3.3	4.5
	Manufacturing	4.4	10.9	7.2	5.4	6.9	4.9	10.2	9.6	6.4	9.5	12.4	17.1	11.9	11.6
	Construction	0.1	0.2	0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2
	Services	7.4	12.0	7.8	6.8	8.0	13.9	13.1	8.7	8.6	8.9	10.2	12.5	8.7	9.2
	Business services	2.8	4.4	2.9	2.3	3.4	3.2	5.5	3.3	3.1	3.1	3.9	5.1	3.2	3.3
	Other services	4.7	7.5	4.9	4.5	4.7	10.7	7.6	5.4	5.6	5.8	6.3	7.4	5.4	5.8
	Total	15.8	27.8	19.6	18.9	17.8	37.2	29.2	24.2	21.8	28.6	27.4	34.6	24.1	25.4
Domestic value-added return home (%)	Resources	0.7	0.4	0.3	0.2	0.2	0.7	0.3	0.4	0.2	0.9	0.2	0.2	0.3	0.2
	Manufacturing	1.1	1.3	0.9	0.7	1.3	0.8	1.5	3.0	0.8	1.9	1.9	3.9	5.0	2.2
	Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Services	2.8	2.5	1.7	1.5	2.4	2.4	3.0	3.1	1.9	2.6	2.2	3.2	3.8	2.6
	Business services	1.2	1.2	0.8	0.6	1.3	1.0	1.7	1.6	0.8	1.2	1.1	1.6	2.0	1.2
	Other services	1.5	1.3	0.9	0.9	1.1	1.4	1.4	1.5	1.1	1.4	1.1	1.5	1.8	1.4
	Total	4.6	4.2	2.9	2.4	3.8	4.0	4.8	6.5	2.9	5.4	4.2	7.3	9.2	5.1

Sources: World Input-Output Database; Commission estimates.

Notes: M1: food, beverages, and tobacco; M2: textiles and textile products; M3: leather and footwear; M4: wood and wood products; M5: paper, printing, and publishing; M6: coke, refined petroleum, and nuclear fuel; M7: chemicals and chemical products; M8: rubber and plastics; M9: other non-metallic minerals; M10: basic metals and fabricated metal; M11: machinery; M12: electrical and optical equipment; M13: transport equipment; M14: manufacturing (n.e.c.) and recycling; Resources: agriculture, hunting, forestry, and fishing and mining and quarrying; Business services: post and telecom, financial, renting of M&E, and other business services; Other services: utilities, trade, transport, hotel and restaurants, real estate, and other services.

TABLE F.3 Decomposition of value added created by U.S. services sectors (WIOD), percent

	1995					
Sector	Value added in final goods exports	Value added in intermediates absorbed by direct importer	Indirect value-added exports to third countries	Total value-added exports	Returned value added in intermediate goods	Domestic value added used at home
Utilities	2.1	3.4	0.4	6.0	0.5	93.5
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel	0.5	1.0	0.1	1.6	0.2	98.2
Wholesale trade and commission trade, except of motor vehicles and motorcycles	4.6	12.4	1.3	18.3	1.2	80.5
Retail trade, except of motor vehicles and motorcycles; repair of household goods	0.5	0.8	0.1	1.3	0.2	98.5
Hotels and restaurants	0.8	1.3	0.2	2.3	0.2	97.5
Inland transport	4.2	9.2	0.9	14.4	1.1	84.6
Water transport	12.4	35.6	2.7	50.7	2.2	47.1
Air transport	7.0	13.5	1.2	21.6	1.0	77.4
Other supporting and auxiliary transport activities	4.2	12.9	1.4	18.4	1.1	80.4
Post and telecommunications	2.5	6.2	0.7	9.4	0.6	90.0
Financial intermediation	2.3	6.9	0.6	9.8	0.6	89.6
Real estate activities	0.6	1.1	0.1	1.8	0.2	98.0
Renting of manufacturing and equipment and other business activities	3.6	7.4	1.0	12.0	0.9	87.0
Public administration and defense; compulsory social security	0.3	0.5	0.1	0.8	([a])	99.1
Education	0.3	0.6	0.1	1.0	([a])	98.9
Health and social work	0.0	0.0	0.0	0.0	0.0	100.0
Other community, social and personal services	1.6	3.2	0.4	5.1	0.4	94.5
Private households with employed persons	0.5	1.0	0.1	1.6	0.2	98.2

Sources: World Input-Output Database; Commission estimates.

[a]Less than 0.05 percent.

TABLE F.3 Decomposition of value added created by U.S. services sectors (WIOD), percent—*continued*

	2008					
	Value added in final goods exports	Value added in intermediates absorbed by direct importer	Indirect value-added exports to third countries	Total value-added exports	Returned value added in intermediate goods	Domestic value added used at home
Utilities	2.4	4.1	0.8	7.3	0.6	92.1
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel	0.4	0.9	0.2	1.5	0.2	98.4
Wholesale trade and commission trade, except of motor vehicles and motorcycles	4.6	12.7	2.1	19.5	1.4	79.2
Retail trade, except of motor vehicles and motorcycles; repair of household goods	0.3	0.6	0.1	1.1	0.0	98.8
Hotels and restaurants	0.6	1.4	0.2	2.2	0.2	97.6
Inland transport	4.8	11.0	1.7	17.5	1.2	81.3
Water transport	12.8	37.4	5.2	55.4	2.8	41.7
Air transport	6.4	15.4	2.0	23.8	1.3	74.9
Other supporting and auxiliary transport activities	4.2	14.4	2.7	21.3	1.3	77.4
Post and telecommunications	1.9	5.5	1.0	8.4	0.6	91.1
Financial intermediation	2.4	7.5	0.9	10.8	0.7	88.5
Real estate activities	0.5	1.2	0.2	1.9	0.2	98.0
Renting of manufacturing and equipment and other business activities	3.0	7.7	1.4	12.1	0.8	87.0
Public administration and defense; compulsory social security	0.3	0.7	0.1	1.1	0.1	98.9
Education	0.2	0.5	0.1	0.8	0.0	99.2
Health and social work	0.0	0.0	0.0	0.0	0.0	100.0
Other community, social and personal services	1.4	3.4	0.6	5.4	0.4	94.2
Private households with employed persons	0.4	0.9	0.2	1.5	0.2	98.4

Sources: World Input-Output Database; Commission estimates.

TABLE F.4 Decomposition of value added created by U.S. services sectors (BEA), percent

	2002			
	Value-added exports		Share of sector value added used to satisfy domestic demand	
Sector	Direct	Indirect	Direct	Indirect
Utilities	0.1	5.2	44.0	50.6
Wholesale trade	7.8	5.9	48.4	37.9
Retail trade	([a])	0.4	90.2	9.4
Air transportation	17.7	3.1	52.1	27.1
Rail transportation	10.5	9.4	14.2	65.8
Water transportation	25.8	2.3	53.3	18.6
Truck transportation	6.8	6.3	35.3	51.5
Transit and ground passenger transportation	0.1	2.2	58.5	39.2
Pipeline transportation	2.7	6.6	5.5	85.1
Other transportation and support activities	12.1	9.6	10.6	67.7
Warehousing and storage	2.7	9.8	0.8	86.7
Publishing industries (includes software)	5.3	4.4	53.8	36.6
Motion picture and sound recording industries	10.3	3.8	39.4	46.5
Broadcasting and telecommunications	1.1	4.1	40.2	54.6
Information and data processing services	0.4	6.4	26.2	67.0
Federal Reserve banks, credit intermediation, and related activities	3.2	4.1	30.5	62.2
Securities, commodity contracts, and investments	4.0	3.9	31.1	61.0
Insurance carriers and related activities	1.1	2.3	45.2	51.5
Funds, trusts, and other financial vehicles	([a])	0.4	92.3	7.3
Real estate	0.0	1.4	70.3	28.2
Rental and leasing services and lessors of intangible assets	16.1	6.6	24.6	52.7
Legal services	2.1	4.6	35.8	57.5
Computer systems design and related services	2.2	4.0	57.9	35.8
Miscellaneous professional, scientific and technical services	1.5	8.4	9.1	81.1
Management of companies and enterprises	13.7	12.7	-0.1	73.7
Administrative and support services	0.4	6.9	7.3	85.4
Waste management and remediation services	0.3	3.4	18.3	77.9
Educational services	0.3	0.6	89.7	9.4
Ambulatory health care services	0.0	0.0	96.2	3.8
Hospitals and nursing and residential care facilities	0.0	0.0	99.5	0.5
Social assistance	0.0	0.0	98.3	1.7
Performing arts, spectator sports, museums, and related activities	0.2	3.6	46.7	49.4
Amusements, gambling, and recreation industries	([a])	0.5	92.0	7.4
Accommodation	0.0	3.2	62.3	34.5
Food services and drinking places	0.1	1.5	78.9	19.5
Other services, except government	0.0	2.1	69.5	28.3

Sources: BEA Input-Output Table; Commission estimates.

[a]Less than 0.05 percent.

TABLE F.4 Decomposition of value added created by U.S. services sectors (BEA), percent —*continued*

	2011			
	Value-added exports		Share of sector value added used to satisfy domestic demand	
Sector	Direct	Indirect	Direct	Indirect
Utilities	0.1	6.3	53.1	40.4
Wholesale trade	12.0	6.9	47.8	33.2
Retail trade	([a])	0.4	94.5	5.1
Air transportation	24.9	3.5	47.8	23.9
Rail transportation	17	15.2	11.6	56.2
Water transportation	18.7	4.6	49.9	26.9
Truck transportation	11.0	8.5	34.7	45.8
Transit and ground passenger transportation	0.1	2.5	62.9	34.6
Pipeline transportation	10.3	11.0	7.7	71
Other transportation and support activities	16.1	11.7	11.1	61.1
Warehousing and storage	5	11.1	0.7	83.3
Publishing industries (includes software)	10.1	4.2	58.4	27.4
Motion picture and sound recording industries	10.8	4.7	32.5	52.1
Broadcasting and telecommunications	1.3	5.1	43.2	50.4
Information and data processing services	0.5	7.0	35.8	56.7
Federal Reserve banks, credit intermediation, and related activities	4.5	5.4	27.5	62.5
Securities, commodity contracts, and investments	7.6	7.2	25.0	60.2
Insurance carriers and related activities	2.5	3.7	44.1	49.8
Funds, trusts, and other financial vehicles	([a])	0.8	92.4	6.9
Real estate	0.0	1.7	71.5	26.8
Rental and leasing services and lessors of intangible assets	23.5	8.4	19.6	48.5
Legal services	3.1	6.1	35.9	54.9
Computer systems design and related services	2.9	6.3	50.1	40.6
Miscellaneous professional, scientific and technical services	2.5	10.7	9.8	76.9
Management of companies and enterprises	19.8	13.3	-0.1	67.0
Administrative and support services	0.4	8.9	6.9	83.8
Waste management and remediation services	0.8	4.8	18.5	76.0
Educational services	0.5	0.2	93.5	5.7
Ambulatory health care services	0.0	0.0	95.3	4.6
Hospitals and nursing and residential care facilities	0.0	0.0	99.4	0.5
Social assistance	0.0	0.0	97.4	2.5
Performing arts, spectator sports, museums, and related activities	0.4	4.5	47.7	47.4
Amusements, gambling, and recreation industries	([a])	0.6	93.5	5.9
Accommodation	0.0	3.8	63.6	32.6
Food services and drinking places	0.1	1.9	78.8	19.2
Other services, except government	0.0	2.6	70.5	26.9

Sources: BEA Input-Output Table; Commission estimates.

[a]Less than 0.05 percent.

TABLE F.5 Share of services in output of final manufactured goods, percent

	1995				2008			
Country	Business services	Trade and transport	Other services	Total	Business services	Trade and transport	Other services	Total
Australia	12.1	16.4	8.3	36.8	14.7	15.2	8.9	38.8
Austria	11.7	14.0	6.8	32.5	11.7	15.2	7.2	34.0
Belgium	14.2	17.0	6.1	37.4	14.8	17.3	7.2	39.3
Brazil	10.2	13.0	6.6	29.8	11.1	14.5	7.7	33.3
Bulgaria	10.5	14.5	5.2	30.2	10.8	14.7	6.6	32.0
Canada	10.6	14.2	7.7	32.5	12.3	15.8	8.2	36.3
China	6.6	10.9	5.2	22.7	9.5	9.8	6.9	26.1
Cyprus	12.3	12.7	5.6	30.6	16.3	12.7	7.1	36.0
Czech Republic	9.7	15.0	8.0	32.7	10.9	17.3	6.7	34.9
Denmark	10.4	16.7	6.5	33.6	12.5	17.0	6.8	36.3
Estonia	7.8	16.3	7.0	31.1	12.1	16.8	7.5	36.4
Finland	11.3	14.6	6.2	32.0	14.6	15.0	7.2	36.8
France	17.8	15.2	8.3	41.2	19.7	16.2	7.8	43.6
Germany	14.5	12.0	7.5	34.0	15.3	14.0	8.9	38.2
Greece	9.1	15.2	6.7	30.9	11.1	14.9	8.1	34.1
Hungary	12.6	11.9	7.9	32.4	14.5	13.3	8.1	35.8
India	8.2	16.7	8.8	33.7	10.3	19.6	4.5	34.4
Indonesia	6.1	10.8	3.2	20.2	4.6	9.4	5.7	19.8
Ireland	15.0	14.8	5.6	35.5	26.1	12.2	5.6	43.8
Italy	10.8	17.4	7.7	35.8	14.0	17.0	9.1	40.0
Japan	9.5	13.1	7.2	29.8	11.0	13.4	6.5	30.9
Korea, Republic of	10.8	9.1	5.6	25.5	11.1	10.3	5.7	27.1
Latvia	6.0	11.2	6.7	24.0	11.3	17.6	7.4	36.3
Lithuania	5.3	16.8	8.9	31.0	7.6	19.1	7.0	33.7
Luxembourg	10.9	12.6	6.6	30.1	16.4	15.7	7.5	39.6
Malta	8.2	12.7	5.0	25.9	10.4	11.5	6.0	27.9
Mexico	10.7	13.3	4.6	28.7	10.7	13.6	4.4	28.7
Netherlands	14.9	14.6	7.5	37.0	15.6	16.2	7.9	39.7
Poland	7.0	16.4	6.7	30.1	10.9	19.4	7.1	37.4
Portugal	12.1	15.9	6.7	34.7	12.7	15.0	6.7	34.4
Romania	10.6	10.0	5.0	25.6	8.9	11.7	6.2	26.7
Russia	3.2	19.6	5.7	28.5	6.4	18.6	6.1	31.0
Slovakia	8.6	16.6	7.2	32.4	10.5	16.7	7.3	34.4
Slovenia	10.8	13.6	5.9	30.2	11.8	14.9	7.2	34.0
Spain	11.4	16.8	7.3	35.4	13.0	16.7	8.3	38.0
Sweden	12.2	14.9	6.3	33.5	15.8	16.2	7.9	39.9
Taiwan	11.3	15.0	8.6	34.9	10.5	19.0	8.0	37.5
Turkey	7.5	16.2	3.7	27.3	7.8	21.3	4.6	33.6
United Kingdom	12.5	13.3	5.6	31.5	14.4	14.7	6.9	36.0
United States	15.7	12.2	6.7	34.7	15.9	11.3	6.6	33.7
Rest of world	9.4	17.9	4.7	32.0	10.8	15.9	5.1	31.7
World	11.8	14.0	6.6	32.4	12.6	14.0	6.8	33.4

Sources: World Input-Output Database; Commission estimates.

Note: "Other services" includes utilities, hotel and restaurants, real estate services, government, education, health, and social services.

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