



OFFICE OF ECONOMICS WORKING PAPER
U.S. International Trade Commission

**ESTIMATING TARIFF EQUIVALENTS OF
NONTARIFF BARRIERS**

Linda A. Linkins
and
Hugh M. Arce
Office of Economics
U.S. International Trade Commission

June 1994
Revised August 2002

The author is with the Office of Economics of the U.S. International Trade Commission. Office of Economics working papers are the result of the ongoing professional research of USITC Staff and are solely meant to represent the opinions and professional research of individual author. These papers are not meant to represent in any way the views of the U.S. International Trade Commission or any of its individual Commissioners. Working papers are circulated to promote the active exchange of ideas between USITC Staff and recognized experts outside the USITC, and to promote professional development of Office staff by encouraging outside professional critique of staff research.

address correspondence to:
Office of Economics
U.S. International Trade Commission
Washington, DC 20436 USA

ESTIMATING TARIFF EQUIVALENTS OF NONTARIFF BARRIERS

Linda A. Linkins
Hugh M. Arce

Office of Economics
U.S. International Trade Commission

June 1994

The views expressed herein are those of the authors and do not represent the views of the U.S. International Trade Commission or any of its Commissioners.

Prologue, August 2002

Since this paper was written, economists at the U.S. International Trade Commission have continued efforts to address the methodological and data limitations identified in this paper by developing new approaches to estimate the price effects of non-tariff barriers and identifying more comprehensive sources of data. This ongoing work has been included in studies regarding significant U.S. import restraints, which the Commission published in 1995, 1999, and most recently in 2002. (See www.usitc.gov for full text versions of these reports.) In each study, the specific approaches used to estimate the tariff or export tax equivalents of measures applied to trade in various agricultural goods, textiles and apparel, other manufactured goods, and services are fully discussed. The reports also provide estimates of the economy-wide and sectoral effects of the measures under examination.

ESTIMATING TARIFF EQUIVALENTS OF NONTARIFF BARRIERS

Estimates of the costs of protection, for both policy makers and economists who conduct applied commercial trade-policy research, depend on reliable estimates of the price or quantity distortions caused by trade barriers. In the case of tariffs, the estimates are straightforward and readily available; however, in the case of nontariff barriers, estimates of the corresponding price or quantity distortions are difficult to construct because of the lack of good data and often contain substantial methodological flaws. This paper provides a brief overview and critique of the methods used by the governments of Canada and the United States in estimating tariff equivalents of nontariff barriers (NTBs). The first part gives a brief overview of the measurement of NTBs with a specific focus on commonly used methods for measuring tariff equivalents. The second part provides a comparison of the Canadian and U.S. applications of these methods.

Definition and Measurement of Nontariff Barriers

The broadest definition of an NTB is any measure other than a tariff that distorts trade. NTBs generally are imposed to restrict trade. In addition, measures such as government procurement policies may affect trade by altering the demand for particular products. Moreover, government policies that are not designed to explicitly limit trade (e.g., technical regulations such as health and safety standards) may, in fact, limit imports from some exporting countries. UNCTAD's data base on trade control measures provides the most comprehensive list of various types of NTBs. The measures fall into five broad categories: quantitative restrictions; non-tariff charges; government participation in trade and similar restrictive policies; customs procedures and administrative policies; and technical barriers to trade.¹

¹ Deardorff and Stern (1985, pp. 13-14). See also Laird and Yeats (1990, pp. 244-251).

Various methods have been developed to estimate the economic effects of NTBs. Researchers have used a number of frequency measures to capture the scope and potential effects of NTBs across countries and industries as well as over time. Researchers have also used econometric techniques and developed various computational models (partial and general equilibrium) to estimate the effects of NTBs.²

A complete review of all of the issues associated with the estimation of the economic effects of NTBs is beyond the scope of this paper. Instead, the following discussion focuses on the various methods used to measure the effects of quantity restraints such as import quotas and voluntary export restraints (VERs). In particular, the following sections discuss the classification of NTBs (i.e., the construction of various frequency measures), the degree of restrictiveness of NTBs (i.e., whether or not the measures are binding), and the estimation of the tariff equivalents of quantity restraints.

Frequency measures

Frequency measures provide a means of capturing changes in government trade policies and comparing trade policies on a country-by-country basis. Various studies have identified the number of NTBs imposed on a country by country basis, and also have calculated the scope of coverage on a commodity basis.³ Surveys have also been conducted to assess the impact of NTBs.⁴ More recently, Erzan, Goto, and Holmes (1990) developed alternative measures to evaluate the scope of the Multi-fiber Arrangement (MFA). They constructed scattergrams relating the share of textile and apparel imports subject to MFA

² Recent econometric efforts are summarized in Council of Economic Advisors (March 1994). Recent studies using general equilibrium models to estimate the effects of NTBs on the U.S. economy include: U.S. International Trade Commission (1993) and de Melo and Tarr (1992). For a summary of earlier work on selected NTBs, see de Melo and Tarr (1992, p. 9) and ITC (1993, p. 14). One example of research based on partial equilibrium methods is Hufbauer and Elliott (1994).

³ See, for example, Laird and Yeats (1990) chapter 4.

⁴ One example of this approach are the survey results included in U.S. Tariff Commission (1974).

quotas and the average quota utilization rates for various developing country suppliers in the European Community (EC) versus the U.S. markets during 1981-83 and 1985-87. Generally, the figures show a corresponding increase in trade coverage and quota utilization.⁵

One problem associated with these measures is that they may be subject to aggregation bias. For example, frequency measures calculated at a relatively aggregated level, may understate coverage for a particular industry. Moreover, frequency measures generally provide little or no information regarding the actual effect on import quantities, prices, or trade flows.

Restrictiveness of quantitative restraints

Generally, quantitative restraints such as import quotas and VERs are considered binding when the utilization rate is high enough to effectively inhibit foreign manufacturers from exporting additional production to the importing country. In theory, a quota or VER is not considered binding until the utilization rate for the particular measure reaches 100 percent. In other words, import levels below 100 percent are the equivalent of what would prevail under free-trade conditions. However, this assumes that the administration of the quantitative restraint is relatively transparent. In addition, uncertainty on the part of suppliers regarding the permanency of the level of a particular restraint may also result in lower utilization rates. The administration of U.S. bilateral quotas under the multi-fiber arrangement (MFA) provides evidence of these types of problems.

MFA quotas control the quantity of imports entering the United States on a product (quota category) basis.⁶ In some instances, the quota applies only to a subset of products that fall within the quota category. In general, when

⁵ Erzan, Goto, and Holmes (1990, pp. 73-4).

⁶ Some bilateral agreements also include aggregate or group quotas that encompass a number of individual quota categories.

exports of products covered by a quota reach the quantity limit specified by the agreement, no additional products can enter the United States. However, provisions in the bilateral agreements, which often allow for flexibility through "swing," "carry-forward," and "carry-over" provisions, make the systematic analysis of quota utilization difficult.

The extent of coverage and the degree to which quotas were utilized in 1991 varied significantly from country to country, as shown below.

Country ¹	Number of quota categories covered by agreement	Utilization rate greater than or equal to:		
		80 percent	90 percent	100 percent
		(number of quota categories)		
Hong Kong	147	124	76	69
China	147	130	121	50
Taiwan	141	140	140	1
South Korea	141	85	69	0
Philippines	141	48	47	14

¹ Top five MFA suppliers.

Source: Department of Commerce and U.S. International Trade Commission

In addition, exporting countries' utilization rates may vary significantly from year to year.⁷

Recent studies have assumed that quotas are binding when utilization rates reach 90 percent or greater.⁸ However, the level at which the quota is assumed to be binding continues to be debated, in part because it is difficult to measure the degree to which foreign exporters can take advantage of the flexibility provisions in the agreements. In some instances, foreign suppliers may have sufficient information to utilize 100 percent of the available quotas. In other cases, current information on quota utilization

⁷ For example, the average quota utilization rate for India shifted from less than 40 percent during 1981-83 to over 90 percent during 1985-87. Erzan, Goto, and Holmes (1990, p. 74).

⁸ See, for example, Erzan, Goto, and Holmes (1990).

levels is not readily available.⁹ Thus, even though utilization rates for a particular country's products may be well below 100 percent, suppliers may be reluctant to commit additional resources to the production of goods for export to quota-restricted markets.¹⁰

Estimation of tariff or export tax equivalents

The use of partial or general equilibrium models to estimate the economic effects of NTBs requires some measure of the price wedge generated by the import restraint. This measure is generally expressed as the tariff equivalent of the import restraint. In the case of an export restraint, the measure is generally expressed as an export tax equivalent.

Estimates of tariff equivalents for NTBs may vary significantly as a result of differences in estimation methods and the base years selected for the estimates.¹¹ In addition, efforts to estimate tariff equivalents of specific import restraints are often hampered by data constraints and a lack of information regarding market structure and conditions of competition in the various country markets affected by the restraints. The following sections review various estimation methods and some of the limitations associated with these techniques.

Quantity measures

The quantity effect of NTBs can only be measured through the estimation of what imports would amount to if the NTB had not been imposed. One means of estimating the effect is to simply extrapolate postquota trade patterns from a

⁹ For example, Indian textile and apparel producers' ability (or lack thereof) to effectively utilize available quotas is discussed in Kumar and Khanna (1990). Also, see discussion in Trela and Whalley (1990, p. 1193, fn. 7).

¹⁰ Given these uncertainties, the ITC (1993) estimated two sets of export tax equivalents based on the assumption that MFA quotas were binding at utilization rates of 80 percent or greater and 90 percent or greater.

¹¹ Fluctuations in demand may further complicate the estimation process.

prequota time period. However, this approach may produce biased results.¹²

Researchers can also estimate what the volume of trade would have been in the absence of the NTB by constructing models with price elasticities. This approach is difficult to utilize given the data requirements involved. Information regarding the structure of the industries involved is often insufficient. Moreover, the data required to estimate the parameters of the model frequently are not available. Finally, the data used in these estimations must include periods in which trade was relatively unrestricted.

Price measures

The price effect of a NTB is the difference between the market price of the restricted product and the market price for the good that would have prevailed were it not for the restraint. This difference is generally expressed as a percentage of the free-trade price (i.e., the tariff equivalent). If certain conditions hold, the hypothetical price for the product would equal the prevailing world price (on a c.i.f. basis).¹³ The conditions are rarely met.

Frequently, the only available "pricing" data for imports and exports of the products are unit values calculated on the basis of available value and quantity data. Moreover, the available data for imports, exports, and domestically-produced products are reported under different classification systems. Even at relatively disaggregated levels, these classifications frequently include different types of products. In addition to differences related to product classification, the imported and domestically-produced

¹² Hypothetical imports can be estimated by assuming a constant growth rate would have occurred or that the import market share would have remained the same, absent the quota. Estimations based on market share may vary significantly, depending on the variable used as the basis for market share. See, ITC (1989a, p. 3-3). The ITC (1989b), for example, estimated the quantity effects of the quotas on U.S. steel imports and derived quota premia from these estimates. Also, see Morici and Megna (1983).

¹³ These conditions include perfect substitution between the imported and domestically-produced product and infinite supply elasticity of imports.

products are often imperfect substitutes because of differences in quality and/or the conditions of sale. Differences in quality often are problematic because the imposition of quantity restraints tends to encourage this process.¹⁴

In addition to the problems discussed above, estimating the price gap resulting from quantitative restraints is difficult, to say the least, when data on unrestricted world prices (or comparable third country prices) are unavailable. In some cases (e.g., textile and apparel products), the scope and duration of the NTBs create trade distortions that affect world prices as well as those of particular importing countries.¹⁵ In addition, foreign country export prices are frequently not available. Given these problems, some studies have used quota license prices as a proxy for the price wedge.¹⁶ The ITC used this approach to estimate export tax equivalents of U.S. bilateral quotas for textile and apparel products, as described below.

Estimation of the export tax equivalents of MFA quotas

In the ITC's 1993 study regarding the effects of import restraints on the U.S. economy, the export tax equivalents of MFA quotas were estimated using quota license prices from Hong Kong. The ITC estimated foreign country export prices by using available quota license prices and U.S. import data

¹⁴ Empirical work regarding quality upgrading includes: Feenstra (1988) and Cline (1987). Laird and Yeats (1990, pp. 268-9, fn. 22) note that governments in exporting countries often encourage this process. One approach suggested to deal with this issue would be to modify the modeling framework used by representing the import restraint as an upward sloping (rather than vertical) line. See, Martin and Suphachalasai (1990, pp. 58-9).

¹⁵ Sweden discontinued imposing quota restrictions on imports of textile and apparel products in 1991. However, it was not possible to use Swedish import data as a proxy for undistorted world prices, in part, because the Swedish Government does not report imports on a customs-value basis. A comparison of Swedish import data with U.S. import data would involve estimating differences in insurance, freight, and other charges as well as adjusting for product differences within each Harmonized Tariff Schedule (HTS) subheading. Currently, there is no reasonable way to adjust for these differences.

¹⁶ See, for example, Hamilton (1986, 1988) and Trela and Whalley (1990).

reported on a customs value basis. For products not restricted by quantitative limits, the ITC assumed that U.S. import prices were roughly equivalent to foreign country export prices.¹⁷ For products restricted by quotas, the U.S. import price represents the foreign country export price plus the quota rent (i.e., the value of the quota rights). Assuming that the prices of openly traded quotas reflect the value of the quota rents results in the following:

$$P^e = P^{cv} - QP \quad (1)$$

where P^e is the foreign country export price, P^{cv} is the U.S. import price, and QP is the quota price. From this expression, the ITC calculated the estimated tax equivalent (e) for a particular quota as follows:

$$e = (P^{cv} / P^e) - 1. \quad (2)$$

In the United States, MFA quotas are generally negotiated on a bilateral, quota category basis. The quota categories constitute a separate import classification system that is based on fiber content and type of product. The allocation of quotas (i.e., export rights) is administered by the respective foreign governments. With the exception of Hong Kong, these governments generally have not allowed quota holders to openly trade quotas.¹⁸ Quota recipients in Hong Kong are able to trade quotas (or portions of quotas) through private brokers.

In the ITC's analysis, average Hong Kong quota prices for 1991 were calculated based on weekly quota prices for the entire year.¹⁹ These prices

¹⁷ U.S. imports reported on the basis of customs value exclude insurance, freight, and other charges.

¹⁸ In earlier studies, prices for quotas traded in Taiwan were available. For example, Hamilton (1988) used Hong Kong and Taiwan quota prices to estimate the effects of the MFA on U.S. imports from Hong Kong, Taiwan, and South Korea. Kumar and Khanna (1990) used quota prices collected through surveys and, to a limited extent, from the Indian Government to estimate ad valorem tariff equivalents faced by Indian exporters.

¹⁹ Data on current quota prices are collected by the Hong Kong Trade and Development Council. The quota prices used in this analysis were collected by private brokers and provided to Commission staff by International Business and Economic Research Corporation.

were used to calculate the estimated export prices and ad valorem tariff equivalents for the respective quota categories. The available Hong Kong quota prices were limited to apparel products. Based on previous research, it was assumed that the export tax equivalents for textile products amounted to 50 percent of the average export tax equivalent for apparel.²⁰ Following this approach, tariff equivalents were estimated for U.S. imports from Hong Kong for each quota category in which the United States imported products in 1991. The import data were then aggregated to the ITC sector level. Total trade-weighted export values for each ITC sector were then calculated under the assumption that the quotas were binding: (1) when quota utilization rates reached 80 percent and (2) when the utilization rates reached 90 percent.²¹

Export tax equivalents for U.S. imports from the remaining countries subject to MFA quotas were estimated as follows. For each country, the portion of U.S. imports covered by the bilateral agreement was identified on a quota category basis.²² The data were then aggregated to the ITC sector level. For each country, the Hong Kong estimated export price for the apparel sector was adjusted to account for differences in wage and productivity rates.²³ The resulting value served as a proxy for the foreign country export

²⁰ See Trela and Whalley (1990).

²¹ Bilateral agreements frequently include group limits in addition to restrictions on specific quota categories. Quota categories falling under binding group limits were classified as binding regardless of whether the utilization rates for the particular quota categories were binding. If the utilization rate for a particular quota category exceeded that for the group, it was classified according to the specific limit.

²² For many countries, the bilateral agreements cover only selected items in a particular quota category. The remaining imports entering under these categories are not subject to the quota levels imposed by the agreement. In addition, CBI countries are afforded special provisions for apparel products made with U.S.-produced fabric. Bilateral agreements with these countries include guaranteed access levels (GALs) for selected products. As a general rule, the GALs are not binding and, therefore, are treated as nonquota trade.

²³ Drawing from Trela and Whalley (1990) it was assumed that:

$$P_o^e = (W_o/W_{hk}) (g_{ohk}/g_{oo}) P_{hk}^e$$

where P_o^e equals the export price of the other exporter country, W_o equals the labor cost for apparel in the other exporting country, W_{hk} equals the labor

price. An estimated ad valorem tariff equivalent was calculated based on the difference between the estimated foreign country export unit value and the U.S. import unit value (measured on a customs value basis).²⁴

The resulting export tax equivalent was then applied to the other ITC sectors (with the export tax equivalent reduced by 50 percent for textile product sectors). This step yielded estimated export values for total imports covered by quota agreements on an ITC sector basis. The export values were then adjusted on the basis of whether or not the quotas covering the respective sectors were binding. As with Hong Kong, total trade-weighted export values for each ITC sector were calculated assuming that the quotas were binding 1) at 80 percent and 2) at 90 percent. For the remaining imports not covered by quotas or covered by quotas that were not binding, the customs value was assumed to be the equivalent of the foreign country export value.

The results of this step (estimated export values by ITC sector for each country) for each scenario were then aggregated and added to customs value data for U.S. imports from countries not covered by bilateral agreements. This step yielded estimated export values for total U.S. imports on an ITC sector basis. The result of this process allowed for the estimation of final ad valorem equivalents for each ITC sector.

cost for apparel production in Hong Kong, g_o represents the value of gross output per worker for the other exporting country, $g_{o_{hk}}$ represents the value of gross output per worker for Hong Kong, p_{hk}^e equals the export price for Hong Kong. Labor cost data were drawn from data published by the U.S. Department of Labor, Bureau of Labor Statistics, Werner International Management Consultants, and United Nations Industrial Development Organization (UNIDO) (1993).

²⁴ The export tax equivalent was estimated as follows:

$$e = (P^{cv}_o / P^e_o) - 1$$

where e equals the estimated ad valorem export tax equivalent, P^{cv}_o represents the customs value of the customs value unit price in the exporting country, and P^e_o represents the estimated export price for the exporting country.

Limitations related to the use of quota license prices

The use of quota license prices as a proxy for the export price wedge assumes that the quota license market is perfectly competitive. Although the quota license process administered by the Hong Kong government is relatively open, allocation procedures favor existing suppliers. Moreover, extreme fluctuations in reported weekly license prices are largely unexplained. Recent research examining Hong Kong license prices for textile and apparel quotas supports this anecdotal evidence. Krishna and Tan (1993) developed an econometric model to examine whether the Hong Kong quota license market was perfectly competitive and concluded that there was sufficient evidence of imperfect competition.²⁵ They note that estimates of the price wedge based on quota license prices are likely to be significantly overstated.

Deriving export tax equivalents for quotas imposed on third country suppliers from estimated Hong Kong export prices also rests on assumptions that may not conform to market reality. Although quota categories are relatively disaggregated, significant differences may exist across countries in terms of product type and quality. It is not clear that the wage and productivity adjustments adequately account for these differences.²⁶ There is a clear need for additional empirical research to attempt to resolve these issues.

²⁵ Krishna and Tan (1993) determined that, among other things, concentration in license holdings had a significant effect on the equilibrium time paths of quota license prices and quota utilization rates in Hong Kong. Earlier research by Krishna also examines the implications of imperfectly competitive quota auction markets. See, for example, Krishna (1990).

²⁶ In addition, available data on wages differ significantly, depending on the source. Although productivity data collected by UNIDO are relative comprehensive, the data are not available for all countries and are often reported for different years.

Canadian and U.S. Measurements

Canadian Measurements

The most recent estimates of tariff equivalents for Canadian NTBs were prepared by Canada's Department of Finance in 1988 in preparation for negotiations of the United States-Canada Free Trade Agreement. These estimates were reported in Moroz and Brown (1987) and Lester and Morehen (1988). Moroz and Brown reported estimates of tariffs and tariff valuations as well as tariff equivalents for quantitative restrictions and for preferential government procurement policies. Lester and Morehen focused on tariffs and tariff equivalents for quantitative restrictions and federal procurement policies.²⁷ Both papers relied primarily upon the traditional methods for estimating tariff equivalents discussed in the first section above, specifically: (1) the price-comparison method for many of the quantitative restrictions and (2) the elasticity approach for government procurement policies.

Moroz and Brown provided measurements of protection resulting from Canadian tariffs, valuation, quantitative restrictions, and government procurement at two levels of aggregation (26 and 92 sectors) for the Canadian economy. In addition, the authors reported two separate estimates of price protection for both aggregations. One set was for barriers affecting all Canadian imports and the other was for barriers affecting imports from the United States only. The following discussion of Moroz and Brown's paper focuses primarily on the estimates of tariff equivalents for quantitative restrictions and government procurement policies.²⁸

²⁷ Lester and Morehen also provided some discussion on the protection derived from contingent measures such as unfair-trade (e.g. antidumping) cases and safeguard or escape-clause cases. However, these are not reviewed in this paper. Lester and Morehen found the price protection provided by contingent protection measures to be small in Canada and the United States.

²⁸ Tariff estimates were based on 1979, pre-Tokyo Round tariff rates while valuation estimates were derived from the customs valuation system that was in effect prior to 1985. Canadian industries that received the greatest tariff

Moroz and Brown used measurements of quantitative restrictions for 12 commodities for the period 1980-1985 to construct the more disaggregated measures (26 and 92 sectors) described above.²⁹ The commodities included eight agricultural products along with footwear, apparel, and automobiles from Japan. Two sets of tariff equivalents were also calculated for the 12 commodities, one reflecting barriers facing all Canadian imports and the other reflecting barriers facing imports from the United States only.³⁰

The tariff equivalents for the restrictions on the agricultural products were constructed, for the most part, by using the price comparison approach described in the first section above. Tariff equivalents for the manufactured goods were obtained from a survey of the literature.³¹ For the agricultural products, the tariff equivalents reflects the average for the period 1980-85. The five-year average was selected because of the volatility of agricultural markets and prices. The price comparison measurement used by Moroz and Brown is depicted by the following *ad-valorem* tariff equivalent:

$$TE = P_c/P_w - (t+d+1) \quad (3)$$

where

TE = the tariff equivalent of the quantitative restriction
 P_w, P_c = world and domestic prices net of wholesale and retail trade margins
t = the tariff rate
d = the rate for international transportation including insurance

protection in 1979 were the rubber, leather, textiles, clothing, and furniture products sectors.

²⁹ See Moroz and Brown, table 11, p. 66.

³⁰ In the case of imports from the United States, only agricultural products and footwear were affected by quantitative restrictions. Differences between the two sets of measures can be attributed to differences in the composition of trade and to differences between the types of NTBs facing U.S. imports and those facing imports from the rest of the world during the period 1980-85.

³¹ See table 11, p. 66 for Moroz and Brown's sources of tariff equivalents for manufactured items.

In the cases of flour, feed, and live poultry, comparable price data were not available to construct tariff equivalents. However, the tariff equivalents of two related products, namely grain and processed poultry products, were constructed using the price comparison method. Restrictions are typically placed on related downstream and upstream products to maintain the protection offered by initial quantitative restrictions. Using the tariff equivalents for these related products, the authors estimated tariff equivalents for flour, feed, and live poultry using the cost-push method.³²

Under the cost-push method, the input-cost data for flour and feed were used to derive the price changes necessary to offset the higher cost of the grain resulting from the NTB facing grain. The tariff equivalent on live poultry was obtained by using the tariff equivalent on processed poultry and moving backwards through the cost of production to obtain the corresponding price change.

Moroz and Brown also provide tariff equivalents of price distortions resulting from Canadian non-defense government procurement policies based on 1981 data. These included discriminatory policies by federal and provincial governments designed to favor the purchase of Canadian products and services.³³ The basic elasticity method described in the first section was used to estimate the tariff equivalents for preferential procurement policies. The tariff equivalent used by Moroz and Brown is depicted by the following equation:

³² See Moroz and Brown, table D7, appendix D, p. 30 for further discussion of the cost-push method.

³³ Tables 10 and D1 contain a single, aggregated tariff equivalent for federal non-defense and provincial government procurement policies for 26 and 92 sectors, respectively. Separate estimates at a 92-sector level of aggregation were provided for federal non-defense, federal defense, and provincial government policies in tables D2 through D4.

$$TE = \frac{APMP - APMG}{APMP} \times \frac{(1+t)}{n} \quad (4)$$

where

APMP = the average propensity to import by the private sector
 APMG = the average propensity to import by the government
 t = the tariff rate
 n = the elasticity of demand

To construct these tariff equivalents, Moroz and Brown assumed that, in the absence of the procurement policies, government would purchase a similar proportion of imports as the private sector; i.e., government and the private sector would have the identical average propensities to import. To obtain the total protection afforded each sector, the tariff equivalents were weighted by the government shares of total purchases in each sector, which were typically small. In most sectors, the share of federal nondefense and provincial government purchases fell below 2.5 percent of total sector purchases. Overall, the incremental protection provided by government procurement policies relative to Canadian tariffs and NTBs was found to be quite small; specifically, the additional increase of import prices was less than one percent in most cases.

Moroz and Brown also provide some information on the degree of protection provided to 19 U.S. sectors by U.S. tariffs and NTBs covering the period 1980-84.³⁴ In general, the authors concluded that Canada did not provide more protection through NTBs than other developed countries. Although Canadian tariffs were higher than U.S. tariffs, they also concluded that Canada resorted less to quotas and bilateral export restraints. Given the trade barriers and subsidies in effect at the time of the report, Moroz and Brown concluded that Canada provided more protection to its industries than the United States but less protection than Japan and the European Community.

³⁴ The U.S. estimates were obtained from a survey of the literature.

Lester and Morehen provide estimates of Canadian tariffs and tariff equivalents for NTBs using methods that are identical to those employed by Moroz and Brown. Indeed, the tariff equivalents for quantitative restrictions and government procurement policies reported by Lester and Morehen appear to come from the same database used by Moroz and Brown.³⁵ In contrast to Moroz and Brown, Lester and Morehen do not provide separate tariff equivalents for NTBs facing all imports and for those facing imports from the United States alone; however, they provide a more comprehensive look at measurements of NTBs for the United States.³⁶ The primary focus of the Lester-Morehen paper was a comprehensive comparison of Canadian and U.S. trade barriers.

In brief, Lester and Morehen's conclusions were very similar to those of Moroz and Brown. The average rate of protection was similar in both countries though somewhat higher in Canada: 6 percent in Canada and 5 percent in the United States. The price protection offered by preferential federal procurement in both countries was minimal. In general, industries that were highly protected in Canada were highly protected in the United States as well.

In constructing their tariff equivalents of NTBs, the authors of these two papers applied the three standard methods -- i.e., the price-comparison method, the cost-push method, and the elasticity approach -- in a straightforward and transparent manner and provided extensive information and documentation on how each of these measures was calculated. In evaluating the methods used in these two papers, we rely primarily on the discussion in the earlier section on "Definition and Measurement." Each of the three methods contains a number of shortcomings; notwithstanding, these are the methods that

³⁵ Tariff equivalents for quantitative restrictions reflect average 1980-85 estimates while those for government procurement policies reflect estimates for 1981. Moroz was cited as the source of these estimates. Differences in the measurements between both papers could possibly be attributed to the slight difference in sectoring schemes and the difference in weights used in constructing averages.

³⁶ See tables 2, C1 and C2 in Lester and Morehen.

are most commonly employed by researchers who examine applied commercial trade policy, and they provide definite advantages over alternative estimates such as "coverage-ratios" or frequency measures.³⁷

Because the elasticity approach used in both papers contains some unique features, it is worthwhile to briefly examine this application in more detail. The most notable feature of the elasticity approach in both papers is the assumption that, in the absence of the procurement policies, the government and private sectors would have the identical average propensities to import. One problem with this method is that not all of the differences in the average propensities to import will be explained by the procurement policies. Furthermore, the reliability of the tariff equivalent will depend on factors such as the existence of perfect substitutes and perfect competition. Finally, preferential government procurement may not change the overall level of imports because the policies cover only part of the market and would induce private-sector buyers to switch to imports.³⁸ All of these factors would cause estimates of the tariff equivalents to be highly overstated.

Finally, it should be noted that the estimates of tariff equivalents for Canadian NTBs reported in these two papers are the most recent estimates constructed by the Canadian Department of Finance. In addition, with the exception of Roland-Holst, Reinert, and Shiells (1992), other academic and government researchers have not attempted to update Canadian tariff equivalents.³⁹

³⁷ See Laird and Yeats (1990) for further discussion.

³⁸ See Moroz and Brown, appendix D, p. 9, and Lester and Morehen, p. 26 for further discussion. The authors of both papers describe some of the shortcomings in the tariff equivalents for procurement policies in more detail.

³⁹ The tariff equivalents estimated by Roland-Holst, et. al, were based on coverage ratios.

U.S. Measurements

Because the first section of this paper presents an extensive description of the different methods used in measuring NTBs, this part of the paper provides only a brief discussion of the most recent estimates of tariff equivalents for U.S. NTBs constructed by the U.S. government. In addition, this discussion provides some comparison in the methods employed by the governments of Canada and the United States in constructing these tariff equivalents. The tariff equivalents of U.S. NTBs are presented in table 1. These estimates were constructed by the U.S. International Trade Commission as part of a standing request from the U.S. Trade Representative to provide current estimates of the effects of significant U.S. import restraints every two years.⁴⁰ The set of estimates in table 1 are based on NTBs that were in binding in 1991.

Similar to the Canadian economy, most of the significant NTBs in the U.S. economy occurred in the textile and apparel sector and in the agricultural sector. Canadian and U.S. estimates of tariff equivalents for agricultural products were based primarily on the price-comparison method. U.S. tariff equivalents of the MFA quotas were constructed using the quota-license method while Canadian estimates were taken from a survey of the literature. The only other significant NTB in the U.S. manufacturing sector was the voluntary export restraint for machine tools.⁴¹ In this case, the estimate was taken from a survey of the literature.⁴² The final tariff equivalent reported in the ITC report measures the effects of the Merchant Marine Act of 1920 (Jones Act) on the U.S. waterborne transportation sector.

⁴⁰ U.S. International Trade Commission (1993).

⁴¹ The USITC study found that VERs for steel products and Japanese automobiles were not binding in 1991 and, therefore, did not affect the U.S. import price of these products. The VERs for steel and machine tools are no longer in existence.

⁴² The tariff equivalent for the machine tool VERs was based on measures constructed by Dinopolous and Kreinen (1991).

To date, this is the one of few tariff equivalents estimated for a barrier affecting trade in services.⁴³

The ultimate purpose of these tariff-equivalent estimates was to measure the costs to the U.S. economy resulting from significant U.S. import restraints. The tariff equivalents in table 1 were applied in various trade liberalization experiments using a computable general equilibrium model. To briefly summarize these results, the liberalization of sectors with NTBs produced the largest welfare gains for the economy. The single largest gains came from liberalizing the MFA quotas.⁴⁴

Conclusion

From this overview we can see that Canada and the United States generally have used similar methods to construct tariff equivalents of NTBs. When directly estimating these tariff equivalents, both countries rely primarily on the price-comparison method, especially for agricultural sectors where good pricing data on domestic and world prices were available. All of these methods come with the attendant flaws discussed above; notwithstanding, these are the methods most commonly accepted and applied by researchers.

There is an obvious need to conduct additional theoretical and empirical research to separate the effects of NTBs from factors such as imperfect substitution and market power that may also account for distortions in the price of U.S. imports. Moreover, there are a number of other theoretical and empirical issues related to the estimation of the effects of NTBs that warrant

⁴³ Hufbauer and Elliott (1994) also provide a tariff equivalent of the Jones Act.

⁴⁴ These results are summarized in U.S. International Trade Commission (1993), table ES-1, page ix.

additional research.⁴⁵ Outlining the approach for such a task is a topic beyond the scope of this paper and is left open for further discussion and development.

⁴⁵ In particular, further development of models that account for product differentiation, market power, and the dynamic effects of NTBs is desirable.

Table 1
 Significant U.S. import restraints, by sector, 1991

Sector	Average MFN Tariff Rate ¹	Quota Premium ²
	-----(<i>Percent</i>)-----	
Textiles:		
Broadwoven fabric mills	12.5	8.5
Narrow fabric mills	7.4	3.4
Yarn mills and textile finishing.	8.9	5.1
Thread mills	10.1	4.6
Floor coverings	5.9	2.8
Felt and textile goods, n.e.c. . .	4.8	1.0
Lace and knit fabric goods . . .	13.2	3.8
Coated fabrics, not rubberized . .	9.5	2.0
Tire cord and fabric	5.6	2.3
Cordage and twine	4.5	3.1
Nonwoven fabric	3.5	0.1
Apparel and fabricated textile products:		
Women's hosiery, except socks . . .	15.7	5.4
Hosiery, n.e.c..	15.9	3.5
Apparel made from purchased materials	16.9	16.8
Curtains and draperies	12.1	5.9
House furnishings, n.e.c.	7.7	8.3
Textile bags	7.1	5.9
Canvas and related products . . .	8.0	6.3
Pleating, stitching, trimmings, and schiffli embroidery	9.5	5.2
Fabricated textile products., n.e.c.	4.1	9.2
Luggage	15.7	2.6
Women's handbags and purses . . .	13.3	1.0
Machine tools	4.3	0.2
Agricultural sectors:		
Sugar	0.7	124.8
Sugar-containing products	6.2	10.0
Butter	5.1	26.9
Cheese	10.4	35.4
Dry/condensed milk products . . .	5.6	60.3
Cream	3.7	60.3
Meat	1.9	6.5
Maritime transport (Jones Act) . . .	(³)	133.0

¹ Ad valorem tariff rate, dutiable value basis, except for the MFA sectors, which are concorded specifically for the ITC's CGE model.

² Tariff or export tax equivalent quota premium rate.

³ Not applicable.

Source: U.S. International Trade Commission, *The Economic Effects of Significant U.S. Import Restraints*, USITC pub. 2699, November 1993, Table 1, p. 6.

REFERENCES

- Cline, William R. (1987) *The Future of World Trade in Textiles and Apparel* (Washington, D.C.: Institute for International Economics).
- Deardorff, Alan V. and Robert M. Stern (1985) *Methods of Measurement of Non-tariff Barriers* (Geneva: UNCTAD).
- de Melo, Jaime and David Tarr (1992) *A General Equilibrium Analysis of U.S. Foreign Trade Policy* (Cambridge, MA: The MIT Press).
- Dinopoulos, Elias and M. Kreinen (1991) "The U.S. VER on Machine Tools: Causes and Effects," in Robert Baldwin, (ed.), *Empirical Studies of Commercial Policy* (Chicago: University of Chicago Press).
- Erzan, Refik, Junichi Goto, and Paula Holmes (1990) "Effects of the Multi-Fibre Arrangement on Developing Countries' Trade: An Empirical Investigation," in Carl B. Hamilton, (ed.), *Textiles Trade and the Developing Countries: Eliminating the Multi-Fibre Arrangement in the 1990s* (Washington D.C.: The World Bank).
- Feenstra, Robert (1988) "Quality Change in U.S. Autos", in Jagdish Bhagwati (ed.), *International Trade: Selected Readings*, 2nd edn (Cambridge, MA: M.I.T. Press).
- Hamilton, Carl (1986) "An Assessment of Voluntary restraints on Hong Kong Exports to Europe and the USA," *Economica* 53 (August) pp. 339-350.
- Hamilton, Carl (1988) "Restrictiveness and International Transmission of the 'New' Protectionism," in Robert E. Baldwin, Carl B. Hamilton, and Andre Sapir (eds.), *Issues in US-EC Trade Relations* (Chicago: The University of Chicago Press).
- Hufbauer, Gary Clyde and Kimberly Ann Elliott (1994) *Measuring the Costs of Protection in the United States* (Washington, D.C.: Institute for International Economics).
- Krishna, Kala (1990) "The Case of the Vanishing Revenues: Auction Quotas with Monopoly," *American Economic Review*, 80 (4) pp. 828-836.
- Krishna, Kala and Ling Hui Tan (1993) "The Dynamic Behavior of Quota License Prices: Theory and Evidence from the Hong Kong Apparel Quotas," (Washington D.C.: The World Bank).
- Kumar, Rajiv and Sri Ram Khanna (1990) "India, The Multi-Fibre Arrangement and the Uruguay Round," in Carl B. Hamilton, (ed.), *Textiles Trade and the Developing Countries: Eliminating the Multi-Fibre Arrangement in the 1990s*, (Washington D.C.: The World Bank).
- Laird, Sam and Alexander Yeats (1990) *Quantitative Methods for Trade-Barrier Analysis* (New York: New York University Press).
- Lester, John and Tony Morehen (1988) "Trade Barriers Between Canada and the United States," Department of Finance, Economic Studies and Policy Analysis Division, Working Paper No. 88-3, (Ottawa: Government of Canada).

- Martin, Will and Suphat Suphachalasai (1990) "Effects of the Multi-Fibre Arrangement on Developing Country Exporters: A Simple Theoretical Framework," in Carl B. Hamilton, (ed.), *Textiles Trade and the Developing Countries: Eliminating the Multi-Fibre Arrangement in the 1990s*, (Washington D.C.: The World Bank).
- Morici, Peter and Laura Megna (1983) *U.S. Economic Policies Affecting Industrial Trade: A Quantitative Assessment* (Washington D.C.: National Planning Association).
- Moroz, Andrew R. and Stephen L. Brown (1987) "Grant Support and Trade Protection for Canadian Industries," Institute for Research on Public Policy, Report prepared for the Department of Finance, (Ottawa: Government of Canada).
- Roland-Holst, David, Kenneth A. Reinert, and Clinton R. Shiells (1992) "North American Trade Liberalization and the Role of Nontariff Barriers," in USITC, *Economy-wide Modeling of the Economic Implications of a FTA with Mexico and a NAFTA with Canada and Mexico*, USITC Publication 2508 (Washington, D.C.: USITC).
- Trela, Irene and John Whalley (1990) "Global Effects of Developed Country Trade Restrictions on Textiles and Apparel," *The Economic Journal*, 100 (Dec. 1990) pp. 1190-1205.
- United Nations Industrial Development Organization (1993), *Handbook of Industrial Statistics, 1992* (New York: UNIDO).
- U.S. Council of Economic Advisors (1994) "Indicators of Government Assistance" (Washington D.C.: CEA, unpublished).
- U.S. International Trade Commission (1989a) *The Economic Effects of Significant U.S. Import Restraints, Phase 1: Manufacturing*, USITC Publication 2222 (Washington, D.C.: USITC).
- U.S. International Trade Commission (1989b) *The Effects of the Steel Voluntary Restraint Agreement on U.S. Steel Consuming Industries*, USITC Publication 2182 (Washington, D.C.: USITC).
- U.S. International Trade Commission (1993) *The Economic Effects of Significant U.S. Import Restraints*, USITC Publication 2699 (Washington, D.C.: USITC).
- U.S. Tariff Commission, *Trade Barriers: An Overview* (Washington D.C.: U.S. Tariff Commission) 1974.