INTERNATIONAL TRADE DEVELOPMENTS

Key Methods for Quantifying the Effects of Trade Liberalization

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This article examines three key methods for quantifying the economic effects of removing import restraints on production, trade, employment, and economic welfare. Although many methodological tools exist for analyzing these effects, three models are commonly employed by economists: gravity, partial equilibrium, and general equilibrium models. Each model has relative strengths and weaknesses, which are described in this paper.

Introduction

Every economy imposes trade restrictions, although the form and the scope of those restrictions vary substantially from country to country. As trade liberalization efforts continue to advance in most regions of the world, economists often attempt to determine the costs and the benefits of easing these restraints for a given economy. This task is generally accomplished by measuring the economic costs of continuing to impose the restraints and comparing those costs to the impacts of easing the restrictions.

Several different approaches exist to quantify the effects of trade restrictions. The method selected depends on the type of research question that is addressed. This article does not represent an exhaustive literature review, but rather a short description of the most commonly used methodological tools. The tradeoffs associated with each method are included, as are general findings of recent studies that have employed these models.

Regardless of the model used, measuring the effects of liberalization generally has shown that liberalization increases economic welfare and trade flows. Often, these effects may appear small relative to the size of the whole economy. For example, depending on the model used, the welfare gain from eliminating all barriers is rarely more than 2 percent of GDP.[2] When one considers the effect of trade policy changes, it is important to recognize that other economic phenomena—such as changes in productivity, taxes and government expenditure, and monetary policy—can dwarf the long term effects of trade policy changes. Although the initial change may appear small, its impact can be leveraged for long term growth in an economy. Trade policies interact with these other phenomena, and may increase their impact on economic growth.

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[2] Some recent examples of CGE studies that confirm this include United States International Trade Commission, *The Economic Effects of Significant U.S. Import Restraints: Third Update 2002*, Investigation No. 332-225, USITC Publication 3519, June 2002. U.S. welfare is estimated to rise by approximately 0.2 percent as a result of the simultaneous removal of "all measured trade restraints." (p. 14, table 2-2). See also Thomas F. Rutherford and David G. Tarr, "Trade liberalization, product variety and growth in a small open economy: a quantitative assessment," *Journal of International Economics* 56 (2002), especially pp. 247-248; and Drusilla K. Brown, Alan K. Deardorff, and Robert Stern, "Multilateral, Regional and Bilateral Trade-Policy Options for the United States and Japan" Discussion Paper No. 490 (December 2002), found at *www.spp.umich.edu/rsie/workingpapers/wp.html.*

Ways to Quantify the Effects of Liberalization

Several methods exist for quantifying the effects of removing import restraints economywide and on individual industries. Three methods are described here: gravity, partial equilibrium, and general equilibrium models.

Gravity Models

Gravity models are econometric models that for the last 40 years have been applied to international trade. Before the early 1960s, gravity models were used extensively in the social sciences to explain the flow of migration and other social phenomena. Tinbergen (1962) and Poyhonen (1963) each independently developed early international trade gravity models.[3] The model name represents an analogy to Newtonian physics: the idea is that large economies—local or country—are thought "to exert pulling power on people or their products."[4] Although "allegedly lacking respectable theoretical foundations," the gravity model has recently experienced a revival within the field of international trade.[5] Much of this recent interest can be attributed to the model's empirical success in predicting economic impacts of trade liberalization, an improved theoretical foundation, and the growing interest among economists of the influence of geography on trade.[6]

A typical gravity model explains the relationship of bilateral trade (total exports, X, between country *i* and country *j*) to each country's national income, Y, and distance, D and *ln* stands for natural logarithm:

$$\ln X_{ij} = \beta_0 + \beta_1 \ln Y_i + \beta_2 \ln Y_j + \beta_3 \ln D_{ij} + \varepsilon_{ij}$$

Essentially, this gravity equation means that bilateral trade is proportional to the gross domestic product (GDP) of each trading partner and inversely related to the distance between them.[7] Other authors have added a cornucopia of other measures to the model. These variables include measurements of size (population, GDP per capita, and land area), and dummy variables to represent geography and cultural similarity (landlocked locations, common borders, common language, or membership in a certain trade agreement).[8]

The benefits of a gravity model are that it is a relatively simple empirical application and it utilizes panel data that are readily available from public sources.[9] One limitation of the gravity model is that, using analysis of historical data alone, it is challenging to sort out the effects of trade policy changes (such as membership in a trade agreement) from other economic factors or policy changes that may cause trade to be higher or lower than statistically expected. Analysts differ in their views on the accuracy of current techniques in explaining this relationship.

One gravity model example comes from Howard Wall, economist at the Federal Reserve Bank of St. Louis. In a 1999 study, Wall provided estimates of the effect of liberalization on U.S. trade (in volume terms) and inferred welfare effects using a fixed-effect model, a type of gravity model.[10] Wall's criticism of earlier gravity models was that the standard gravity estimation method tended to underestimate trade between extensive traders and overestimate it between occasional traders.[11] Therefore, effects are underrepresented for smaller economies when trade relative to income is high, compared to larger economies, where trade is a lower ratio.

Wall considers the effect of protection on U.S. merchandise imports in 1996. Wall estimated that, if free trade had been in place, merchandise imports would have been 15.4 percent larger, equivalent to 1.66 percent of 1996 GDP. He also found that U.S. exports would likely have increased nearly 26 percent, the

[3] Ronald W. Jones and Peter B. Kenen, *Handbook of International Economics*, vol. 1 (New York, NY: North Holland, 1984), pp. 503-504. See also Jan Tinbergen, *Shaping the World Economy: Suggestions for an International Economic Policy* (New York, NY: 1962); and Pentti Poyhonen, "A Tentative Model for the Volume of Trade Between Countries," *Weltwirtschaftliches Archiv* 90(1), 1963, pp. 93-99.

[4] Howard Wall, "Using the Gravity Model to Estimate the Costs of Protection," *Federal Reserve Bank of St. Louis Review* (January/February 1999), p. 34.

[5] *Ibid*.

[6] Jeffery A. Frankel, *Regional Trading Blocks in the World Economic System* (Washington DC: Institute for International Economics, 1987), pp. 49-50.

[7] That is, the larger the GDP, the stronger the trade flows. Regarding distance, the farther apart the countries are, the lower the trade flows.

[8] *Dummy variables* are binary variables (off, on) used to include qualitative factors in a regression, such as policy on, policy off periods.

[9] Panel data are a cross-section of data (such as several variables for 10 specific firms at one point in time, say 2003) that is also collected over regular intervals of time (say, every year for the past 10 years). Data required for gravity models include trade flows, income, and a distance measure for each country.

[10] Wall identified two important benefits of this model. First, the fixed-effect model controls for variables that are unobservable or hard to measure through existing data. Second, economic distance variables are an integral part of the trading-pair intercept term, instead of the usual use of distance between capital cities. This second benefit is particularly important when a country, such as the United States, has more than one economic center. Howard Wall (1999), p. 35. See also I-Hui Cheng and Howard Wall, "Controlling for Heterogeneity in Gravity Models of Trade," Federal Reserve Bank of St. Louis, Working Paper 1999-010C (1999).

[11] Wall (1999), p. 35.

equivalent of 1.94 percent of GDP in 1996. These results are higher than those typically found using other tools, as will be discussed in the next section.

Wall concluded that the 1996 cost to consumers for import protection was $223 billion, or about 3.3 percent of GDP. Of the $223 billion, $109 billion was transferred from consumers to producers and $24.5 billion was a deadweight loss to society. The remainder consisted of tariff revenue and quota rents. Over 80 percent of the tariff revenue went uncaptured, with a mere $17 billion going to the U.S. Government as tariff revenue. Assuming that the quota rents were captured by producers outside the United States, the net welfare costs of U.S. protection in 1996 were about $97 billion, or roughly 1.5 percent of GDP.[12]

Partial Equilibrium Models

While gravity models deal with the effects of import restraints on an entire economy, other models deal with more specific effects through a counterfactual, "what if" scenario.[13] To estimate the effects of trade policy changes for a specific sector and its labor force, economists have often used computable partial equilibrium (PE) models. Often described as simulation models, PE models begin with base data and then explore what might happen under different circumstances, such as a change in economic factors or change in tax or trade policy. Economic simulation models are mathematical equations consistent with economic theory and observed economic data. They usually simulate what might happen to specific economic variables if some economic shock or policy change were to occur. PE models focus on one sector or just part of the economy. They do not try to link or describe the entire economy. PE models focus on a subset of the production and consumption of final and intermediate goods. What makes PE models particularly useful is that they are easy to use, the data to run them are generally publicly available, and results can be obtained by using a fairly small set of economic variables.

This approach is used appropriately when one is interested in examining a certain subsector. However, the subsector-specific focus is also one of the PE model's limitation. Since the PE model centers analysis on one specific subsector or industry, downstream or upstream effects are generally not usually captured. What this means, for example, is that if one examines the effect of removing all trade restrictions on the U.S. sugar industry, most PE models omit the effect of this policy change on downstream or sugar-using industries, such as bakeries and other processed food producers. Another limitation of PE models is the lack of detail on the response to trade policy changes on government, consumption, savings, investment, and income.

Often, PE models are used when larger, more complex models are not appropriate due to how a subsector under study is defined.[14] Such was the case for three agricultural subsectors–peanuts, canned tuna, and lamb in the USITC *Import Restraints (2002)* study.[15] For these three subsectors, the standard analysis using a computable general equilibrium model (see below) was not feasible because the relevant subsectors were not identified separately in the USITC's economywide model. Therefore, a PE model was used instead to assess the welfare implications of U.S. import restraint removal. The USITC *Import Restraints (2002)* study found that in 1999, if the industry-specific restraints were removed, the liberalization of the peanut subsector would likely generate a welfare gain of $2.2 million. For canned tuna, the expected welfare gain from liberalization was $1.6 million, and for lamb meat, it ranged from $500,000 to $1.4 million. Therefore, liberalization of these three policies would generate gains to consumers of approximately $5.2 million annually.

Hufbauer and Elliott—of the Institute for International Economics (IIE), a Washington, D.C. economic research organization—used a PE model to assess the impact of 21 high-profile protection cases in the United States in 1994. The authors assumed imperfect substitution between domestic and foreign goods, perfect competition in the domestic market, and a perfectly elastic foreign supply curve. Hufbauer and Elliott examined the status of protection as of 1990, and found that total U.S. protection cost U.S. consumers roughly $70 billion, or 1.2 percent of 1990 GDP.[16] Most of this cost was attributed to the protection afforded the U.S. textile and apparel industry.

With the average tariff-equivalent barrier at 35 percent for the 21 industries under examination, the authors estimated that approximately 190,000

[12] Wall (1999), p. 39. The tariff revenue that went uncaptured was $72.8 billion. Note that gravity model analysis usually does not contain the expected cost-benefit calculations included in Wall's work.

[13] The analysis in this article draws heavily on the application of these models in USITC, *The Economic Effects of Significant U.S. Import Restraints: Third Update 2002*.

[14] For more detail on complex models, see the section on CGE models in this article.

[15] USITC, *The Economic Effects of Significant U.S. Import Restraints: Third Update 2002*.

[16] In the PE model, consumers are broadly defined as both intermediate firms as well as households.

low-skilled jobs would have been eliminated if these industries had moved to free trade. The average cost to the U.S. consumer for each protected job in these industries was $170,000 per year. These jobs reflected 0.2 percent of the total 1990 U.S. employment.[17]

This same PE methodology was again employed by the Institute for International Economics to examine the economies of the European Union (EU), Japan, Korea, and China.[18] Table 1 shows a comparison of these five IIE studies. The Japanese cost of protection was much higher than the United States, EU, and Korea, largely due to higher tariff equivalents of Japanese import barriers. Relative to other countries under examination, the dollar cost of protection in China was significantly lower, due to lower estimated tariff equivalents of Chinese import barriers.

[17] Gary C. Hufbauer, "Surveying the Costs of Protection: A Partial Equilibrium Approach" in Jeffrey J. Schott, ed., *The World Trading System: Challenges Ahead* (Washington DC: Institute for International Economics, 1996), p. 29.

[18] Yoko Sanzanmi, Shujiro Urata, and Hiroki Kawai, *Measuring the Costs of Visible Protection in Japan* (Washington DC: Institute for International Economics, 1995); Namdoo Kim, *Measuring the Costs of Visible Protection in Korea* (Washington DC: Institute for International Economics, 1996); Zhang Shuguang, Zhang Yansheng, and Wan Zhongxin, *Measuring the Costs of Protection in China* (Washington DC: Institute for International Economics, 1998).

Some PE trade models add multiple goods markets and multiple regions, which can be simple or complex. These models introduce cross-price and cross-quantity linkages between markets that are related.[19] What these more complex PE models allow is for one to examine the effects of a policy change on more than one sector or more than one region, without looking at an entire economy.[20]

[19] A cross-price linkage occurs when an increase in the price of an input product, such as beef, shifts up the supply curve in the input-using market, say hot dogs. A direct cross-quantity linkage occurs when an increase in quantity of production of product 1 leads to a decrease in demand for input product 2. Vernon O. Roningen, "Multi-market, Multi-region Partial Equilibrium Modeling," in Joseph F. Francois and Kenneth A. Reinert, *Applied Methods for Trade Policy Analysis: A Handbook* (NY: Cambridge University Press, 1997), pp. 231-257.

[20] Examining the effects of the United Kingdom acceding to NAFTA, Michael Ferrantino and Keith Hall model supply linkages, which depend on the price of an upstream good while factor demand depends on the quantity of the downstream good in two regions. This approach follows Roningen (1997), *op. cit.* For specifics, see Michael J. Ferrantino and Keith H. Hall, "The Direct Effects of Trade Liberalization on Foreign Direct Investment: A Partial Equilibrium Analysis," USITC Office of Economics Working Paper (October 2001). This methodology was also followed to examine the escalation of tariffs on processed foods in USITC, *Processed Foods and Beverages: A Description of Tariff and Non-tariff Barriers for Major Products and Their Impact on Trade*, Investigation No. 332-421, USITC Publication 3455, October 2001.

Table 1
Comparison of aggregate costs of protection using PE models

	United States	EU	Japan	Korea	China
Year of data	1990	1990	1989	1990	1994
Number of industries surveyed	21	20	47	49	25
Average tariff equivalent for industries analyzed (percent)	35%	70%	40%	180%	44%
Costs to consumers:					
—U.S. dollars (billions)	$70	$67-$100	$75-$110	$12-$13	$35-$78
—Share of GNP (percent)	1.2%	1.1%–1.6%	2.6%-3.8%	3.8%-4.3%	6.2%
Jobs saved (if protection were kept in place)	190,000	1,500,000	180,000	174,000-405,000	11,200,000
Costs per job saved (U.S. dollars)	$170,000	$70,000	$600,000	$33,000-$67,000	$3,132

Source: For United States, Japan, Korea and EU, see Gary C. Hufbauer, "Surveying the Costs of Protection: A Partial Equilibrium Approach," in Jeffrey J. Schott, eds. *The World Trading System: Challenges Ahead* (Washington DC: International Institute of Economics, 1996). For China data, see Zhang Shuguang, Zhang Yansheng, and Wan Zhongzin, *Measuring the Costs of Protection in China* (Washington DC: International Institute of Economics, 1998).

General Equilibrium Models

Another type of simulation model is the computable general equilibrium (CGE) model. Using CGE models to quantify the effects of trade liberalization entails developing a "what if" scenario for certain conditions. In this respect, a CGE model is similar to a PE model. One way the CGE model is very different is that the CGE model encompasses all economic activity with an economy. It looks at the economic impact of changing a policy economywide, rather than focusing on a few specific sectors. CGE models focus in particular on the relationship between production and consumption of final goods, intermediate goods and primary factors of production (land, labor, and capital). Modelers often employ a multi-country model to provide economywide feedback effects resulting from a trade policy change in a given sector or industry, and to assess the impact on employment, production, and economic welfare. General equilibrium modeling is now a common approach for assessing the welfare impact of a particular policy. Its strength is in offering a comprehensive assessment of cross- and inter-industry linkages—including upstream and downstream effects—both worldwide and between regions.

For example, if one examined the likely impact of liberalization of sugar policies worldwide, seeking to pinpoint potential winners and losers, this tool could be used to estimate the expected changes in the U.S. sugar market, the U.S. sugar-using market (i.e., downstream industries), as well as the intra- and inter-industry changes in other countries. Exactly how many countries can be examined at once depends on how a CGE model user chooses to disaggregate the model, data availability and, of course, constraints on computing capabilities. The general assumption behind CGE models is one of imperfect substitution between domestic and foreign goods. In more elaborate CGE models, induced investment and growth aspects of trade liberalization are sometimes included.

CGE models are also characterized as "static" or "dynamic." Static or steady-state models are simulation models in which the economy responds only to the trade policy change that is being examined. All other economic changes are held constant, so that the researcher may analyze the impact of a single potential "shock" from the anticipated trade policy change. Static models have been the CGE models of choice over the past few decades.

Recently, model technology has improved such that economists now have developed dynamic models that take into account that a baseline economy will grow over time. As such, GDP, employment, prices, and other macroeconomic variables change in the model, as they ordinarily do in any given economy over time. Dynamic models tend to produce larger economic effects from the removal of trade barriers. When comparing results from static and dynamic models, it is important to keep this effect in mind.[21]

The benefits of CGE models include the ability to analyze policy implications both at the sectoral level and economywide; and to provide behavioral detail on production, private and government consumption, savings, investment, and income.

The challenges of CGE methodology include its complexity, data requirements, disaggregation issues, and model sensitivity to the selection of key parameters. Model usage typically requires very large start-up costs, so that the use of a CGE model often is limited to larger institutions with skilled resources in this area of economics.

The data requirements in CGE modeling are extensive. The mere task of inserting current data into a model and "balancing" it so that the data are usable can take a trained modeler several weeks to several months to complete. These two challenges especially make the expense of creating and maintaining these models costly. In addition, "aggregation issues" may arise when one seeks to isolate a policy change regarding an industry that is narrowly defined. For example, if one seeks to understand the effect of removing tariffs on frozen bakery products (Standard Industrial Classification (SIC) code 2053: Frozen Bakery Products, Except Bread), one may find that for CGE models, frozen bakery products are included together with several dozen other slightly related but not identical industries. For example, bottled and canned soft drinks (SIC 2086), cereals (SIC 2043), and chewing gum (SIC 2067) are included in the combined sector of "food products." Thus, the frozen cake industry may be too small a part of a model's food products sector to give meaningful results due to "aggregation bias." Put another way, there are too many other products in the model's sector to accurately isolate the frozen bakery products industry. To study a narrowly defined industry, the partial equilibrium model would be a better choice.

[21] For two comparisons between static versus dynamic results for trade liberalization, see Thomas F. Rutherford and David G. Tarr, "Regional Trading Arrangements for Chile: Do the Results Differ with Dynamic Models?" (December 2001), mimeo; and USITC, *U.S.-Taiwan FTA: Likely Economic Impact of a Free Trade Agreement Between the United States and Taiwan*, Investigation No. 332-438, USITC Publication 3548, October 2002, chapter 7.

Finally, it is well documented that these models are extremely sensitive to how the user chooses key parameters, especially the parameter that governs how substitutable imported goods are for their domestic counterparts. Despite these limitations, CGE models are still the methodology of choice in assessing intra- and inter-country effects of a possible change in trade policy.

The USITC *Import Restraints (2002)* study examines the impact of removing most U.S. import restraints on domestic economic welfare, employment, production, and trade. Restraints examined for 1999 included tariffs, quotas on textiles and apparel, agricultural tariff-rate quotas (TRQs),[22] actions under section 201 of the Trade Act of 1974 on wheat gluten and lamb, nontariff measures (NTMs) such as quotas, maritime cabotage[23] restrictions in transportation services, and certain peak tariffs not included elsewhere.[24]

The USITC CGE model of the U.S. economy is based on a system of equations that are consistent with the U.S. Department of Commerce (USDOC), Bureau of Economic Analysis (BEA) input-output table for the U.S. economy. Two types of CGE analysis are used in the USITC *Import Restraints (2002)* study. The first type estimates the economywide effects of removing all significant import restraints at once. The second type estimates the effects of eliminating barriers on individual sectors. For each simulation, estimated effects on economywide welfare changes, trade, employment, and output for the liberalized sector and the overall economy are reported.

If all of the trade barriers considered in this study had been simultaneously eliminated during the base year of 1999, the result would have been equivalent to an approximate welfare gain of $14.5 billion to the U.S. economy. During 1999, U.S. GDP was slightly less than $9.3 trillion.[25] The welfare gain therefore represents less than one-tenth of 1 percent of GDP. This small percentage is in line with what previous authors using static CGE models have predicted would be the expected effect on the United States from removing all tariffs and NTMs.[26]

Consistent with previous USITC *Import Restraints* reports, the largest effect from trade policy changes corresponded to industries that experience the highest tariffs or tariff-equivalents. Table 2 shows that the largest gains resulted from the individual liberalization of textiles and apparel, which is expected to cause an estimated economywide welfare gain of about $13 billion, assuming that both peak tariffs and all quotas are removed simultaneously.[27] The second largest individual liberalization effect resulted from the complete liberalization of maritime cabotage services under the so-called Jones Act, where the estimated gain would be slightly more than $656 million.

Liberalization of two high-profile agricultural sectors—sugar and dairy—showed the largest subsector-specific benefits. When liberalization of sugar and dairy was conducted individually, the sugar sector was expected to experience an economywide welfare gain of about $420 million, while dairy was expected to experience a $109 million economywide gain.

Although the number of jobs due to trade liberalization may appear high in absolute value, the percentage of jobs lost appears very small if calculated relative to the total U.S. employment during the year in question. For example, if the United States were to eliminate all significant trade restrictions, approximately 175,000 full-time equivalent (FTE) workers would be displaced from their current industries and would need to seek employment in industries other than those being liberalized. That estimate represents only a small percent of the number of people who typically apply for unemployment each week in the United States. For example, during a typical week in 1999, between

[22] Agricultural TRQs included dairy, sugar and sugar-containing products, peanuts, cotton, tobacco and tobacco products, canned tuna, ethyl alcohol, beef, and olives.

[23] Cabotage is the transport of products or people between two points within a country.

[24] Peak tariff sectors are defined as those with trade-weighted, average ad valorem tariffs equal to or greater than 5.1 percent. To identify the relevant sectors, the Commission calculated the trade-weighted average tariff by BEA sector. The average tariff is constructed by dividing the calculated duties for the model sector by the cost-insurance-and-freight (c.i.f.) value of imports for consumption. Peak tariffs are identified as sectors with a tariff of more than one standard deviation (3.3 percent) above the U.S. simple average of the trade-weighted aggregate tariff of 1.7 percent, that is, equal to or above 5.1 percent. This simple average includes sectors that are duty-free.

[25] White House, Table B-1, *Economic Report of the President* (Washington DC: U.S. Government Printing Office, February 2002) p. 320.

[26] Drusilla K. Brown, "Properties of CGE Trade Models with Monopolistic Competition and Foreign Direct Investment," presented at the USITC symposium on the North American Free Trade Agreement (NAFTA) on Feb. 24, 1992. For a summary of this paper and the symposium, see USITC, *Economy-Wide Modeling of the Economic Implications of an FTA with Mexico and a NAFTA with Canada and Mexico,* USITC Publication 2516, May 1992. Other CGE models have predicted larger effects. From the same publication, see David Roland-Holst *et al*., "North American Trade Liberalization and the Role of NTBs," which reports gains up to about 2.5 percent with a dynamic model, with all tariffs and nontariff measures removed.

[27] Note that results from an experiment in which restraints for many sectors are removed simultaneously are *not* equivalent to adding up the results from experiments that remove the same restraints individually.

Table 2
Comparison of economic effects of trade liberalization in selected sectors, using the USITC CGE model

	Textiles and Apparel	Sugar	Economy
Year	1999	1999	1999
Model	CGE	CGE	CGE
Costs to consumers (Welfare effect)			
—U.S. dollars (billions)	$13.04	$0.420	$14.48
—Share of GDP (percent)	(0.001%)	(0.00005%)	(0.0015%)
Change in:			
—Employment, raw (FTE jobs, percent)	-70,320 (-17.2%)	-2,390 (-9.4%)	35,320 (0.0003%)
Change in:			
—Output, raw (million dollars, percent)	-$9,478 (-17.2%)	-$748.9 (-9.4%)	$59,702 (0.4%)
Trade			
—Imports (million dollars, percent)	$12,401 (26.5%)	$435.8 (108.0%)	$29,395 (2.4%)
—Exports (million dollars, percent)	-$1,225 (-17.1%)	-$11.4 (-7.4%)	$15,429 (1.6%)
Composite prices (percent)	-17.2%	-6.2%	(not aggregated)

Note.—Results shown for individual sectors reflect liberalization within the model framework of only that specific sector; whereas all sectors adjust to trade liberalization together in the final column.

Source: United States International Trade Commission, *The Economic Effects of Significant U.S. Import Restraints: Third Update 2002*, Investigation No. 332-225, USITC Publication 3519, June 2002; see tables 2-2, 3-6, and 4-5.

300,000 and 400,000 U.S. workers applied for unemployment compensation. Therefore, the total number of workers displaced as a result of liberalizing all U.S. import restraints might approximate just half the number of workers registering in one week for unemployment benefits during 1999.

Moreover, at the same time, approximately 192,000 FTE jobs will be created, resulting in a net gain in employment. The estimates in the study indicated that the elimination of all significant import barriers would result in the net addition of nearly 17,400 full-time equivalent workers into the labor force–less than one-one hundredth of 1 percent of the 1999 national labor force of 122.1 million persons.[28]

Conclusions

When deciding what methodology is appropriate for quantifying the economic effects of liberalization, it is important to consider the type and scope of economic analysis to be performed. Some research questions require an analysis of bilateral trade policy-changes between economies of differing sizes. These questions may be easily analyzed with the use of a gravity model, which takes into account the proportional relationship of trade to GDP and the geographical distance between the two trading partners. Other questions relate to the impacts of a trade policy change on a specific industry or subsector of the economy, and partial equilibrium analysis has proved a useful methodological tool in answering these questions. Still other, broader research questions focus on the regional impacts of plurilateral trading arrangements. For these issues, computable general equilibrium models may be the most useful analytical tool, although the time and expense needed to run these models limits their use by many institutions, and the aggregation issues associated with their use may limit their applicability to certain sectors.

Regardless of the methodology used to analyze the effects of liberalization, some trends emerge. Model results are generally consistent for all three approaches. In each case, removal of trade barriers results in small changes to the economy. Generally, the effects of trade barriers on the economy appear both at the intermediate level, by increasing the costs of inputs; and at the final level, by making consumer goods more costly. Using a gravity model, Wall found that trade

[28] According to USDOC/BEA, full-time equivalent employees are defined as "the number of employees on full-time schedules plus the number of employees on part-time schedules converted to a full-time basis." Thus, FTE employees can include both full-time and part-time workers as well as an adjustment for overtime worked. For more information, see *http://www.bea.gov/bea/dn/nipaweb.*

effects were between 1.5 and 2 percent of GDP, based on 1996 data. Using a partial equilibrium model, IIE's Hufbauer and Elliot examined 21 high-profile protection cases and found that U.S. protection cost consumers about 1.2 percent of GDP, based on 1990 data. Using a static CGE model, the USITC *Import Restraints (2002)* study found that removing all import restraints improves welfare by less than one percent annually, based on 1999 data.

Most countries consistently apply the highest trade barriers to similar sectors, such as textiles and apparel, and—for developing countries—automobiles and parts. Thus, the use of any model to analyze trade policy changes in these sectors will tend to show more dramatic results. A PE model might easily capture these sector-specific effects, although it may overestimate them. In contrast, a CGE model which is trying to capture all the effects on an entire economy including upstream and downstream sectors, might distort or understate these effects. CGE model upkeep tends to be very cost- and labor-intensive and hence are not for the occasional user. Furthermore, simulation models do little to give the user a sense of what the transition costs to actually make the jump might be.

Because many of the import restraint studies undertaken at the USITC involve multiple research questions that vary in scope, a combination of models is generally used for each. Thus, USITC studies are able to simultaneously answer questions about the economywide effects of a trade policy change, while determining the more specific effects of that trade policy change on a given sector.