Forthcoming in Robert M. Stern ed., *Issues and Options for U.S.-Japan Trade Policies,* The University of Michigan Press.

Trade Diversion under NAFTA

Kyoji Fukao

Toshihiro Okubo

Robert M. Stern

October 2001

I. Introduction

Prior to and since the inception of the North American Free Trade Agreement (NAFTA) in January 1994, there has been a great deal of interest in policy and academic circles about the impact that NAFTA might have on the trade and economic welfare of the NAFTA members – Canada, Mexico, and the United States – and nonmembers. In this chapter, we investigate the effects of NAFTA on trade diversion at a highly disaggregated level of commodity detail. The rationale for this approach is that the creation of a preferential trading arrangement like NAFTA involves the interplay of the removal of the differential structure of tariffs between member countries and the maintenance of these national tariffs with respect to nonmembers. In addition, we know that rules of origin were designed to provide special preferences for selected sectors in the NAFTA to the possible detriment of nonmembers.

We begin in Section II with a brief review of the complexities of distinguishing the effects of NAFTA from the myriad of other forces at work before and following the inception of NAFTA. We also discuss the approaches and conclusions of some pertinent studies of the effects of NAFTA. In Section III and the Appendix, we present the theoretical model that provides the basis for our analysis and the framework for our econometric investigation and a description of the data. Our empirical results are reported in Section IV. Conclusions and implications for further research are presented in Section V.

II. NAFTA in Context and a Review of the Literature

If we were able to do a controlled experiment, we would want to compare the economic situation before and after NAFTA was created. Unfortunately, in the social sciences, the ability to construct a controlled experiment is typically hampered because other things are happening that will serve to confound the design and interpretation of the experiment. Thus, for example, as Krueger (2000, pp. 762-65) has noted, there are a number of difficulties that arise in evaluating the effects of NAFTA. These include: (1) anticipation beginning in 1990 that negotiations would lead to creation of NAFTA; (2) the phasing out of NAFTA tariffs over a 10-15 year time period beginning in 1994; (3) trade liberalization being undertaken elsewhere at the same time that NAFTA was being implemented; (4)

continuing responses to Mexico's unilateral trade liberalization initiated in the late 1980s; and (5) the real appreciation of the Mexican peso from 1987-94 and subsequent depreciation in the course of Mexico's financial crisis in late 1994.[1] Given all of the foregoing currents of change, it is by no means an easy matter to isolate the effects of NAFTA. Nonetheless, some efforts have been made that are worthy of attention.

Gould (1998) used a gravity-model approach in determining how NAFTA may have affected the growth of North American trade. The model is estimated in log first differences with aggregated bilateral trade flows on a quarterly basis for 1980 through 1996 and measures of real GDP, GDP price deflators, real exchange rates, and dummy variables to represent changes in the trade regimes during the period involved. His empirical results suggest that, in its first three years: (1) NAFTA may have stimulated the growth of U.S. aggregate exports to Mexico but not U.S. imports from Mexico; (2) U.S. bilateral trade into Canada and Canadian-Mexican trade were not affected by NAFTA; and (3) trade diversion was probably negligible.

Krueger (1999b, 2000) examined the changing patterns of trade flows and noted that the trade relationships among the NAFTA countries intensified considerably in the 1990s. But she did not find much evidence that imports from the rest of the world declined as intra-NAFTA trade increased. Krueger also concluded that tariff differentials for U.S. imports from Mexico and East Asia did not appear to have changed dramatically. Further, she conducted a "shift in share" analysis and found that the increase of Mexico's share in its trade with the United States was not much different than with the rest of the world, reflecting both the impact of Mexico's unilateral liberalization and the peso depreciation after 1994. Finally, on the basis of fitting some gravity equations, she found little evidence that trade patterns had been significantly altered by preferential trading arrangements, although the results did suggest that NAFTA countries imported less than predicted from nonmember countries.[2] On the basis of the foregoing, Krueger concluded that NAFTA was almost certainly trade-creating rather than trade-diverting.

---

[1] See Lustig (2001) for a review of Mexico's economic performance and policies since 1980.

[2] For a more comprehensive study of preferential trading arrangements using a gravity-model approach, see Soloaga and Winters (2001). They find no evidence of trade diversion for NAFTA. Coughlin and Wall (2000) use a gravity-model approach in analyzing how NAFTA has changed the pattern of exports of U.S. states to

In some earlier work, Krueger (1993, 1999a) called attention to the importance of rules-of-origin (ROO) as protectionist devices in free trade agreements. In this connection, James and Umemoto (1999, 2000) focused attention on the restrictive ROO affecting especially market access in NAFTA for textiles and wearing apparel from East Asia. On the basis of examining changes in market shares prior to and following the implementation of NAFTA, they concluded that there was prima facie evidence of trade diversion. They also examined changes in trade shares of footwear and electrical machinery, which were also subject to ROO in the NAFTA, and concluded that there was little evidence of trade diversion in footwear and none in the case of electrical machinery. James and Umemoto present a model of ROO, but they do not implement this model in their empirical analysis of changes in trade shares.

Burfisher, Robinson, and Thierfelder (2001) provide a useful survey of the impact of NAFTA on the United States that covers both macroeconomic issues and structural adjustments. They point out the fallacies in much of the macroeconomic discussion related to NAFTA involving the effects on U.S. labor markets, the balance of trade, aggregate employment effects, and the effects of the peso crisis. With regard to structural adjustments, they focus on agricultural transition, the rationalization of automobile production and parts, and the effects of ROO on textiles and apparel. They note that intra-NAFTA trade in agricultural products has risen, and there is evidence that Mexico has taken steps to liberalize its agricultural policies and to lock in these reforms. Prior to NAFTA, Mexico had significant distortions in its automobile sector, and, with NAFTA, these distortions were phased out. In negotiating NAFTA, it was specified that vehicles should have a 62.5 percent North American content. In response to the phase-out of the Mexican restrictions and implementation of the ROO, Burfisher et al. cite evidence of significant rationalization effects in the production of autos and parts that have benefited the North American auto industry. However, they do not address the question of whether trade diversion has occurred. Finally, with regard to textiles and apparel, Burfisher et al. conclude that there is rather clear evidence of trade diversion especially vis-à-vis East Asia, which corresponds to what James and Umemoto (1999, 2000) found in their research as noted above.

---

foreign geographic destinations. See also Karemara and Ojah (1998) for a gravity-model analysis comparing the trade impacts for selected manufactures for the ASEAN members and NAFTA. Their data for NAFTA end

Arndt and Huemer (2001) provide graphical analyses of the changes in the dollar value of U.S. exports and imports and the shares accounted for by Canada, Mexico, and Japan on a quarterly basis from 1990-I to 2001-II. Since the inception of NAFTA in 1994, Mexico has displaced Japan as the second largest market for U.S. exports while Canada's share of U.S. exports has remained relatively unchanged. What is more striking is that Mexico's share of U.S. imports has risen from around 8 percent in 1994 to 12 percent in 2001, while Japan's share has fallen from about 18 percent to 12 percent in this same period. Arndt and Huemer also depict changes in U.S. imports and import shares at the industry level for motor vehicles, television sets, and textiles and apparel. They show that Mexico apparently increased its share of U.S. imports of automobiles at the expense of Japan, its share of U.S. television imports at the expense of China, Japan, Korea, and Taiwan, and its share of U.S. imports of textiles and apparel at the expense of China and other Asian suppliers. Finally, Arndt and Huemer provide graphical evidence of the importance of foreign outsourcing from the United States to Mexico especially and to Canada for motor vehicles, television sets, and textiles and apparel. While this outsourcing predates NAFTA, they show that there has been a significant increase in U.S. exports of components to and imports of end products from its NAFTA partners since 1994. Arndt and Huemer conclude accordingly that NAFTA has had a significant impact on intra-North American trade through the combination of discriminatory tariff reductions resulting in trade diversion and through increased outsourcing that reflects the reorganization and relocation of production and the exchange of component inputs and end products.

By far the most ambitious and comprehensive study of the trade effects of NAFTA is Romalis (2001), which came to our attention after we had completed our own study. Setting out a conceptual framework, Romalis develops reduced-form equations in which the shares of U.S. imports of commodities sourced from Canada or Mexico depend on the tariff preferences under NAFTA extended to the two countries. He makes allowance for the time varying effects of tariff preferences as well as control measures for commodity and industry characteristics. Working at the 8-digit Harmonized System (HS) level, he tracks U.S. bilateral trade with Canada and Mexico for 6,874 commodities annually from 1989 to 2000 and constructs the preferential tariff rates that apply to these

---

in 1993, however, so that they do not capture the trade effects following the inception of NAFTA in 1994.

commodities. Based on his regression results, he finds that NAFTA has had a significant effect on U.S. imports from Canada and especially from Mexico. Further, he finds no statistical evidence of trade creation in analyzing the growth of U.S. imports of the commodities covered. Romalis concludes therefore that NAFTA has been primarily trade diverting.

We turn now to our own research, which, as mentioned, will focus on a disaggregated level for selected manufactured goods, using a version of the gravity model that may serve to identify the presence or absence of trade diversion as the consequence of NAFTA. Our work is related to what James and Umemoto and Arndt and Huemer have done descriptively in intra-NAFTA trade and is in the same spirit as Romalis insofar as we use an explicit theoretical model and econometric analysis to try to identify the forces at work that have affected NAFTA's trade.

III. Conceptual Framework and Empirical Implementation

The Model

In order to illustrate the effects of NAFTA, we focus on how it may have affected the shares of member and non-member countries in U.S. imports at a detailed commodity level. For this purpose, we develop a partial-equilibrium trade model of differentiated-product industries under monopolistic competition with *N* countries. The model is patterned after earlier work along these lines by Helpman and Krugman (1985), Markusen (1986), and Bergstrand (1989). The technical details of the model are set out in the Appendix to the chapter.

As indicated in the Appendix, the conceptual basis for the empirical analysis to be carried out is given by equation (1):

$$
\begin{aligned}
(21) \qquad \ln(s_{z,n,1}(t)) = {} & \lambda_{z,n} - \lambda_{z,1}\left(\ln(w_n(t)) - \sum_{i=2}^{N} {s_{z,i,1}}^{0} \ln(w_i(t))\right) \\
& - \lambda_{z,2}\left(\ln(T_{n,1}(t)) - \sum_{i=2}^{N} {s_{z,i,1}}^{0} \ln(T_{z,i,1}(t))\right) \\
& + \lambda_{z,3} {v_{z,n,1}}^{0}\left(\ln(T_{n,1}(t)) - \sum_{i=2}^{N} {s_{z,i,1}}^{0} \ln(T_{z,i,1}(t))\right) + \varepsilon_{z,n}(t)
\end{aligned}
$$

Where $s_{z,n,j}$, w_n, and $T_{z,n,j}$ denote the percentage of imports from country n in U.S. total imports of industry z products, country n's wage rate, and one plus the tariff and tariff equivalent of non-tariff barriers of U.S. imports used in the output by industry z in country n. $v_{z,n,j}$ is the percentage of exports of industry z products from country n to the U.S. in total products of industry z in country n $\lambda_{z,n}$ depends on country-specific factors such as distance from the United States and each county's endowment of industry-specific production factors $\varepsilon_{z,n}(t)$ is the usual error term.

The equation implies that the U.S. import share of country n is a decreasing function of country n's relative wage rate and U.S. trade barriers against country n. Moreover, the creation of NAFTA will reduce U.S. imports from non-member countries. Equation (1) implies that this trade-diversion effect will be greater, if the initial share of Mexico and Canada in U.S. imports is large (higher $s_{z,n,1}$ for n = Mexico and Canada) or if the U.S. initially is a very important destination for Mexico's and Canada's exports (higher $v_{z,n,1}$ for n = Mexico and Canada). As shown in the Appendix, the three elasticity values $\lambda_{z,1}$, $\lambda_{z,2}$, and $\lambda_{z,1}$ are positive. Using panel data, we can estimate the above equation as a fixed-effect model.

Empirical Implementation

As stated, our objective is to evaluate the trade-diversion effects from the creation of NAFTA in the U.S. import market on the basis of our theoretical model. For this purpose, we use a fixed-effect panel analysis for manufactured commodities at the Harmonized System (HS) 2-digit level from 1992 to 1998. Data for 1998 were the latest comprehensive data available at the time of writing (May 2001). Our regressions cover the entire spectrum of U.S. manufactured goods imports, for HS 30 to HS 99, for the domain of U.S. trading partners.

We derived the following equation for regression analysis from equation (1) above:

$$\text{(EQ1)} \qquad \ln(s_{z,n,1}(t)) = a_0 + a_{z,1}\ln(w_n(t)) + a_{z,2}\ln(T_{n,1}(t))$$

$$+ a_{z,3}v_{z,n,1}{}^{0}\ln(T_{n,1}(t)) + \sum_n a_{z,n,4}COUNTRYDUM_{z,n} + \sum_t a_{z,t,5}TIMEDUM_{z,t}(t) + \varepsilon_{z,n}(t)$$

The dependent variable is the natural logarithm of each country's import share in the U.S. market for each commodity in each year.[3] On the right-hand side, the first independent variable is the natural logarithm of wage rates in each year in each exporting country. We approximated each exporting country's wage rates by its GDP per capita in U.S. dollars. The second independent variable is the natural logarithm of one plus U.S. tariff rates against each exporting country. The third independent variable is the product of the percentage of exports of the commodity from each country to the United States in total exports of this country in 1991 and the natural logarithm of one plus tariff rates toward each export. [4] Based on our theoretical model, we expect negative signs for the coefficients of these three variables.[5] In order to control county-specific factors that are not included in independent variables, such as distance from the United States and each county's endowment of industry-specific production factors, we use country dummies. The time dummies stand for macro shocks such as changes in average U.S. tariff rates against all the countries and changes in world GDP.

The import shares are calculated from the HS 2-digit import data in U.S. Census Bureau, *U.S. Imports of Merchandise on CD-ROM* and *U.S. Imports History on CD-ROM*. GDP per capita data are from the *World Development Indicators on CD-ROM 2000* (World Bank). Percentages of each country's exports of each commodity to the United States in total exports of this country are taken from Statistics Canada, *World Trade Analyzer*. Data on bilateral tariff rates are taken from the

[3] When one country's import share is zero, we treated it as a missing observation. Therefore our data are an unbalanced panel. If there were some variables that strongly affect the chances for observation (non-zero imports) but not the outcome under study, it would be more appropriate to take account of the sample-selection process by estimating a selection model, such as Heckman (1979). But in our case, there seems to be no such variable. So we did not take account of sample-selection bias. For more detail on this issue, see Manning, Duan, and Rogers (1987).

[4] In addition, we considered U.S. NTBs. We used frequency measure of U.S. NTBs in 1993 at the HS 4-digit level, obtained from OECD, *Indicators of Tariffs and Non-Tariff Trade Barriers 1997*. We assumed that U.S. NTBs against all the countries were identical and constant until 1993, and that the NTBs against Canada and Mexico became zero after 1994. Therefore, our NTB variables were almost identical with the NAFTA dummy variables. As a consequence, we do not report below the results using the NTB measures.

[5] The question arises as to whether using import shares as the dependent variable is the best way of getting at trade diversion. That is, changes in import shares may be influenced by a variety of structural factors on both the supply and demand sides that are not being taken into account in the model. We had considered constructing a structural model, but time, resource, and data constraints prevented us from doing so.

TRAINS dataset of UNCTAD.[6] The data at the 2-digit level are compiled by taking a weighted average of 6-digit HS tariff rates, using U.S. import shares of each 6-digit HS commodity in 1991 as weights.

As we will report in the next section, $a_{z,3}$, the estimated coefficients of the product of the percentage of exports of the commodity from each country to the United States in total exports of this country in 1991 and the natural logarithm of one plus tariff rates toward each export, are not significant and do not have the expected negative sign in many commodities. Because of this we have also estimated the following equation, which does not include this variable:

$$\text{(EQ2)} \qquad \ln(s_{z,n,1}(t)) = a_0 + a_{z,1}\ln(w_n(t)) + a_{z,2}\ln(T_{n,1}(t)) + \sum_n a_{z,n,4} COUNTRYDUM_{z,n} + \sum_t a_{z,t,5} TIMEDUM_{z,t}(t) + \varepsilon_{z,n}(t)$$

Both reductions in tariff rates among NAFTA countries and removal of NTBs might have trade-diversion effects. In order to check this, we replaced the tariff variables with a NAFTA dummy in EQ3 below. The NAFTA dummy takes value one for Canada and Mexico after the creation of NAFTA in 1994. In order to take account of the fact that NAFTA trade barriers are phased out gradually over time, we also used a lagged NAFTA dummy in EQ4, which takes value one for Canada and Mexico after 1995:

$$\text{(EQ3)} \qquad \ln(s_{z,n,1}(t)) = a_0 + a_{z,1}\ln(w_n(t)) + a_{z,2} NAFTADUM_n(t) + \sum_n a_{z,n,4} COUNTRYDUM_{z,n} + \sum_t a_{z,t,5} TIMEDUM_{z,t}(t) + \varepsilon_{z,n}(t)$$

$$\text{(EQ4)} \qquad \ln(s_{z,n,1}(t)) = a_0 + a_{z,1}\ln(w_n(t)) + a_{z,2} LAGGEDNAFTADUM_n(t) + \sum_n a_{z,n,4} COUNTRYDUM_{z,n} + \sum_t a_{z,t,5} TIMEDUM_{z,t}(t) + \varepsilon_{z,n}(t)$$

We expect positive signs for coefficients of the NAFTA dummy and the lagged NAFTA dummy.

The above four equations are estimated by OLS with fixed effects with a correction for first-order autocorrelation in the disturbances. It should be noted that there is a possibility

[6] Data on tariff rates are available at 6-digit HS for 1993, 1994, 1996, and 1998. We have used 1993 tariff rates for 1992. Tariff rates for 1995 and 1997 are calculated as the average of 1994 and 1996 and 1996 and 1998, respectively.

that industries defined by HS 2-digit codes might be too broad and include too many commodities with different characteristics. To take this into account, we have also estimated the above equations for selected industries at the HS 4-digit level from 1992 to 1998.

V. Empirical Results

As mentioned above, we estimated regression equations for the HS 2-digit U.S. imports of manufactured goods for the period, 1992-98. There were 70 sets of regressions that were run. It turned out that the coefficients of the tariff rates were statistically significant in 15 of the 70 cases. The results for these 15 cases are reported in table 1.[7] The results for the other 45 cases are available from the authors on request.[8]

For the 15 commodities noted in table 1, the coefficients of tariff rates were negative and significant at the 5% level in either EQ1 or EQ2. In most cases, these coefficients were generally greater than 20. When this coefficient takes a value 20, it means that a 5% reduction of U.S. tariff rates on imports from one country will double that country's share in U.S. total imports. Therefore, our results suggest that tariff rates have significant effects on U.S. trade in the case of these commodities.

We should note that for a substantial number of commodities, such as pharmaceutical products and electric machinery, U.S. tariff rates on imports from Canada and Mexico were negligible even before 1994. In these cases, we cannot argue that NAFTA had a significant trade-diversion effect. Table 2 shows U.S. tariff rates on imports of the fifteen commodities from Canada and Mexico in 1993 and 1996. For six of the fifteen categories, indicated in boldface, U.S. tariff rates on imports from either Canada or Mexico were greater than 2.5% in 1993. Probably we can infer relatively large trade-diversion effects in these uses.

[7] The estimated coefficients of GDP, country dummies, and time dummies are not reported because of space limitations but are available from the authors on request.

[8] The coefficients of the NAFTA dummies and lagged NAFTA dummies were either insignificant or had unexpected signs in most cases. Only in the cases of HS 43 (Furskins), HS 50 (Silk), and HS 60 (Knitted or Crocheted Fabrics) were the lagged NAFTA dummies positive and significant at the 5% level.

To clarify matters in more detail, figure 1 shows U.S. tariff rates on imports from Canada, Mexico, and the rest of the world and the two NAFTA country shares in U.S. imports for each of these 6 commodities. It would appear that for textiles and apparel products, which include HS 51 Wool & Animal Hair, including Yarn & Woven Fabric, HS 52 Cotton, including Yarn and Woven Fabric Thereof, HS 60 Knitted or Crocheted Fabrics, and HS 62 Apparel Articles and Accessories, Not Knit etc., U.S. tariff rates towards Canada and Mexico were reduced considerably after 1994. On the other hand, U.S. tariff rates toward the other countries remained relatively high during the period. Reflecting these discriminatory tariff cuts, the shares of Canada and Mexico in U.S. imports increased substantially. For the other two commodity categories, HS 46 Mfr of Straw and HS 79 Zinc, although U.S. tariff rates toward Canada and Mexico were reduced after 1994, the tariff rates towards the other countries were also reduced in a parallel fashion. We do not observe therefore substantial increases in the Canadian or Mexican shares in U.S. imports in these two cases. We conclude therefore, based on figure 1 and our regression results in table 1, that the creation of NAFTA had significant trade-diversion effects on U.S. imports mainly in the cases of textile and apparel products.

As already mentioned in the previous section, it is possible that commodities defined by HS 2-digit codes might be too broad and include too many commodities of different characteristics to permit rigorous analysis. To take this into account, we have also estimated our equations for selected commodities at the HS 4-digit level from 1992 to 1998. The commodities have been selected following James and Umemoto (1999, 2000), who focused on such labor-intensive goods as textiles, apparel, leather products and footwear, and electronic products. We also include motor cars and vehicles since these were subject to a rule of origin as noted earlier. The specific 4-digit commodities that we selected are as follows:

HS 4202 Travel Goods, Handbags, Wallets, Jewelry Cases, Etc.
HS 6002 Knitted or Crocheted Fabrics, NES
HS 6109 T-Shirts, Singlets, Tank Tops, Etc., Knit or Crochet
HS 6115 Pantyhose, Socks & Other Hosiery, Knit or Crochet
HS 6401 Waterproof Footwear, Rubber or Plastic, Bond Sole
HS 8529 TV Receivers, Incl. Video Monitors & Projectors
HS 8703 Motor Cars & Vehicles for Transporting Persons

In order to take account of the fact that NAFTA tariffs are being phased out gradually over time, we also used a lagged NAFTA dummy, which takes the value one for Canada and Mexico after 1995. In the case of automobile trade, the United States had already liberalized its imports from Canada prior to NAFTA. To take account of this, we used a Mexico dummy, which takes the value one for Mexico after 1994 for regressions for "motor cars and vehicles."

Before evaluating the regression results, we provide in figures 2 and 3 an overview of U.S. tariff rates and imports from NAFTA and non-NAFTA countries for the seven commodities defined by HS 4-digit code that we have selected. For almost all commodities, Canada and Mexico received substantial tariff margins of preference after NAFTA, and it can be seen that NAFTA tariffs were phased out gradually over time. We should further note that tariff rates were very low in the case of machinery. It appears from figure 2 that in the cases of apparel, such as "T-shirts" and "socks," and machinery, such as "TV receivers" and "motor vehicles," Mexico increased its share in U.S. imports more substantially than Canada. Canada gained more in "travel goods" and "waterproof footwear."

The regression results are reported in detail in table 3 and summarized in table 4. It is evident that both tariff rates and the NAFTA dummies are significant in general. For "travel goods" and "motor cars and vehicles," neither variable is significant.[9] For "socks," only the NAFTA dummy is significant. For "TV receivers," only tariff rates are significant. For many commodities, GDP per capita is insignificant or has an unexpected positive sign.

It thus appears from these more disaggregated results that NAFTA has resulted in significant trade diversion especially in textiles, apparel, and some footwear products. Since U.S. tariff rates were relatively low in the cases of "motor cars and vehicles" and "TV receivers" and since foreign direct investment and outsourcing may be important in these industries, the changes in import shares noted may reflect these determinants more than changes in tariff rates, which are the focus of our model.

[9] Probably, we obtained insignificant results in the case of "travel goods" because this category covers too many different types of commodities.

V. Conclusions and Implications for Further Research

In this chapter, we have developed a theoretical framework for analyzing how tariff preferences in the NAFTA may affect U.S. imports from Canada and Mexico. Using trade and tariff information at the 2-digit and 4-digit levels of the Harmonized System, our econometric analysis has suggested that there may be trade diversion especially in U.S. imports of textiles and apparel products from Mexico. Evidence based on other studies suggests that these imports have come at the expense especially of Asian suppliers.

Our research and some of the other studies that we have noted demonstrate the importance of commodity disaggregation in analyzing the effects of preferential trading arrangements. There is also a strong case to be made for analyzing how foreign direct investment and outsourcing interact with tariff preferences in influencing patterns of trade and specialization in member and non-member countries in preferential trading arrangements.

Appendix
Partial-equilibrium Trade Model of Differentiated-Product Industries under Monopolistic Competition with N Countries

In this Appendix we present a theoretical foundation of our empirical model. It is assumed that there are Z industries and N countries. Each firm produces a differentiated product. Let $H_{z,n}$ denote the number of firms in country n's industry z. $H_{z,n}$ is endogenously determined. All households have identical preferences. The utility-maximization problem of a representative household in importing country j is:

$$\max \prod_{z=1}^{Z} \left(\sum_{n=1}^{N} \sum_{h=1}^{H_{z,n}} c_{z,n,h,j}^{\frac{\theta_z - 1}{\theta_z}} \right)^{\eta_z \frac{\theta_z}{\theta_z - 1}}$$

subject to

$$\text{(A1)} \quad \sum_{z=1}^{Z} \sum_{n=1}^{N} \sum_{h=1}^{H_{z,n}} p_{z,n,h} T_{z,n,j} \Omega_{z,n,j} c_{z,n,h,j} = Y_j$$

where $c_{z,n,h,j}$ denotes country j's consumption of output by industry z's firm h in country n. θ_z is the elasticity of substitution (>1) between the output of different firms in industry z. η_z denotes the expenditure share of industry z's output in total expenditure. $p_{z,n,h}$ is the f.o.b. price of firm h's output of country n's industry z. $T_{z,n,j}$ is one plus the tariff and tariff equivalent of non-tariff barriers of country j's imports used in the output by industry z in country n. $\Omega_{z,n,j}$ is the c.i.f./f.o.b. factor (>1) to ship output of industry z from country n to county j. Finally, Y_j represents country j's national income.

Using utility maximization, we can derive country j's demand function for the output by firm h in industry z in country n:

$$\text{(A2)} \quad c_{z,n,h,j} = \frac{1}{\sum_{n=1}^{N} H_{z,n}} \left(\frac{p_{z,n,j} \Omega_{n,j} T_{z,n,j}}{p_{z,j}} \right)^{-\theta_z} \frac{\eta_Z Y_j}{p_{z,j}}$$

where $p_{z,j}$ denotes country j's price index of industry z's output. $p_{z,j}$ is defined as:

$$\text{(A3)} \quad p_{z,j} = \left\{ \frac{\sum_{n=1}^{N} \sum_{h=1}^{H_{z,n}} \left(p_{z,n,h} \Omega_{n,j} T_{z,n,j} \right)^{1-\theta_z}}{\sum_{n=1}^{N} H_{z,n}} \right\}^{\frac{1}{1-\theta_z}}$$

Next we formulate the profit-maximization behavior of firm *h* in industry *z* in country *n*. We assume that there are three factors of production: capital, labor, and sector-specific production factors. In our model, the comparative advantage of each country is determined by the endowment pattern of these sector-specific and non-specific production factors. Each firm in industry z produces a differentiated product in a market of monopolistic competition, using the three factors of production, labor (*L*), capital (*K*), and the industry-specific factor (Q_z). The production technology used in a particular industry z is identical for all firms in that industry. The technology function takes a linear form, yielding the following production function:

$$\text{(A4)} \quad \sum_{j=1}^{N} c_{z,n,h,j} = \frac{1}{\alpha_z^{\alpha_z} \beta_z^{\beta_z} \gamma_z^{\gamma_z}} K_{z,n,h}^{\alpha_z} L_{z,n,h}^{\beta_z} Q_{z,n,h}^{\gamma_z}$$

The left-hand side denotes the total output of firm *h*. We assume constant variable costs ($\alpha_z+\beta_z+\gamma_z=1$). The firm also incurs fixed costs:

$$\text{(A5)} \quad \delta_z = \frac{1}{\alpha_z^{\alpha_z} \beta_z^{\beta_z} \gamma_z^{\gamma_z}} K_{z,n,h,f}^{\alpha_z} L_{z,n,h,f}^{\beta_z} Q_{z,n,h,f}^{\gamma_z}$$

where $K_{z,n,h,f}$, $L_{z,n,h,f}$, and $Q_{z,n,h,f}$ denote the factor inputs required for the continuation of production.

Firm *h*'s profit-maximization problem is:

$$\max p_{z,n,h} \left(\sum_{j=1}^{N} c_{z,n,h,j} \right) - w_n (L_{z,n,h} + L_{z,n,h,f}) - r_n (K_{z,n,h} + K_{z,n,h,f}) - q_{z,n} (Q_{z,n,h} + Q_{z,n,h,f})$$

subject to equations (A4) and (A5), where w_n, r_n, and $q_{z,n}$ are country *n*'s wage rate, rental price of capital, and price of the industry-specific factor.

From cost-minimization conditions, we can derive the following marginal-cost function:

$$\text{(A6)} \quad MC_{z,n,h} = r_n^{\alpha_z} w_n^{\beta_z} q_{z,n}^{\gamma_z}$$

Fixed cost is expressed by:

$$\text{(A7)} \quad FC_{z,n,h} = \delta_z r_n^{\alpha_z} w_n^{\beta_z} q_{z,n}^{\gamma_z}$$

From profit-maximization conditions, we can derive:

$$\text{(A8)} \quad p_{z,n,h} = \frac{\theta_z}{\theta_z - 1} MC_{z,n,h}$$

We assume that new firms can freely enter industry *z*, and the following zero-profit condition holds in equilibrium:

$$\text{A(9)} \quad \left(\frac{\theta_z}{\theta_z - 1} - 1 \right) MC_{z,n,h} \sum_{j=1}^{N} c_{z,n,h,j} = FC_{z,n,h}$$

Using equations (A6) and (A7), we can simplify the zero-profit condition as:

$$\text{(A10)} \quad \frac{1}{\theta_z - 1} \sum_{j=1}^{N} c_{z,n,h,j} = \delta_z$$

We assume that since industry *z* is small in each country, the wage rate and the rental price of capital are exogenously determined. The price of the industry *z*-specific production factor, $q_{z,n}$, is determined by the market-equilibrium condition. Using equations (A6), (A7), and cost-minimization conditions, we can express firm *h*'s demand for the industry *z*-specific factor as:

$$\text{(A11)} \quad Q_{z,n,h} = \frac{\gamma_z}{q_{z,n}} r_n^{\alpha_z} w_n^{\beta_z} q_{z,n}^{\gamma_z} \left\{ \left(\sum_{j=1}^{N} c_{z,n,h,j} \right) + \delta_Z \right\}$$

From zero-profit condition (A10) and factor-demand function (A11), we get the market-equilibrium condition for the sector *z*-specific production factor:

$$\text{(A12)} \quad Q_{z,n} = H_{z,n} Q_{z,n,h} = \frac{\gamma_z}{q_{z,n}} r_n^{\alpha_z} w_n^{\beta_z} q_{z,n}^{\gamma_z} \theta_z \delta_z H_{z,n}$$

where $Q_{z,n}$ denotes the exogenously determined endowment level of the sector *z*-specific factor in country *n*. We assume that $Q_{z,n}$ is constant over time. The equilibrium price level of the sector *z*-specific factor in country *n* is expressed by:

$$\text{(A13)} \quad q_{z,n} = \left(\frac{\gamma_z \delta_z \theta_z}{Q_{z,n}} r_n^{\alpha_z} w_n^{\beta_z} H_{z,n} \right)^{\frac{1}{\alpha_z + \beta_z}}$$

The number of firms in country *n*'s industry *z* is implicitly determined by the zero-profit condition (A10). Using demand function (A2) and equation (A13), the zero-profit condition (A9) can be expressed by:

$$\text{(A14)}\quad \delta_z = \frac{1}{\theta_z - 1}\left\{\sum_{j=1}^{N}\frac{1}{\sum_{n=1}^{N} H_{z,n}}\left(\frac{\Omega_{n,j}T_{z,n,j}}{p_{z,j}}\right)^{-\theta_z}\frac{\eta_Z Y_j}{p_{z,j}}\right\}\left(\frac{\theta_z}{\theta_z - 1} r_n^{\alpha_z} w_n^{\beta_z} q_{z,n}^{\gamma_z}\right)^{-\theta_z}$$

$$= \frac{1}{\theta_z - 1}\left\{\sum_{j=1}^{N}\frac{1}{\sum_{n=1}^{N} H_{z,n}}\left(\frac{\Omega_{n,j}T_{z,n,j}}{p_{z,j}}\right)^{-\theta_z}\frac{\eta_Z Y_j}{p_{z,j}}\right\}$$

$$\left\{\frac{\theta_z^{\frac{1}{\alpha_z+\beta_z}}}{\theta_z - 1} r_n^{\frac{\alpha_z}{\alpha_z+\beta_z}} w_n^{\frac{\beta_z}{\alpha_z+\beta_z}}\left(\frac{\gamma_z \delta_z}{Q_{z,n}} H_{z,n}\right)^{\frac{\gamma_z}{\alpha_z+\beta_z}}\right\}^{-\theta_z}$$

We assume that $Q_{z,n}$ and the c.i.f./f.o.b. factor (>1) to ship industry *z*'s output from country *n* to county *j*, $\Omega_{z,n,j}$, are constant over time. By taking the natural logarithm and differentiating both sides of the equation over time, we get:

$$\text{(A15)}\quad G(H_{z,n}) = -\frac{\alpha_z + \beta_z}{\gamma_z}\sum_{j=1}^{N} v_{z,n,j} G(T_{z,n,j}) + \frac{(\theta_z - 1)(\alpha_z + \beta_z)}{\theta_z \gamma_z}\sum_{j=1}^{N} v_{z,n,j} G(p_{z,j})$$

$$+ \frac{\alpha_z + \beta_z}{\theta_z \gamma_z}\sum_{j=1}^{N} v_{z,n,j} G(Y_j) - \frac{\alpha_z}{\gamma_z} G(r_n) - \frac{\beta_z}{\gamma_z} G(w_n) - \frac{\alpha_z + \beta_z}{\theta_z \gamma_z} G(H_z)$$

where $G(x)$ denotes the growth rate of variable x; $v_{z,n,j}$ is the percentage of exports of industry *z* products from country *n* to country *j* in total products of industry *z* in country *n*; and H_z is the total number of industry *z* firms in the world.

Next we consider how trade barriers affect the U.S. import share of U.S. trade partners in our model. We treat the United States as country 1. Let $s_{z,n,j}$ denote the percentage of imports from country *n* in country *j*'s total imports of industry *z* products:

$$\text{(A16)}\quad s_{z,n,j} = \frac{p_{z,n,h}\Omega_{z,n,j}H_{z,n}c_{z,n,h,j}}{\sum_{i \neq j} p_{z,i,h}\Omega_{z,i,j}H_{z,i}c_{z,i,h,j}}$$

The growth rate of country *n*'s share in total U.S. imports of industry *z* products is expressed by:

$$(A17)\qquad G(s_{z,n,1}) = G(p_{z,n,h}) + G(H_{z,n}) + G(c_{z,n,h,1}) - \sum_{i=2}^{N} s_{z,i,1}\left(G(p_{z,i,h}) + G(H_{z,i}) + G(c_{z,i,h,1})\right)$$

We assume that international capital movements always equalize the rental price of capital across countries. Using equations (A2), (A8), (A13), and (A17), we get:

$$(A18)\qquad G(s_{z,n,1}) = -\mu_{z,1}\left(G(w_n) - \sum_{i=2}^{N} s_{z,i,1}G(w_i)\right) - \mu_{z,2}\left(G(T_{n,1}) - \sum_{i=2}^{N} s_{z,i,1}G(T_{z,i,1})\right) + \mu_{z,3}\left(G(H_{z,n}) - \sum_{i=2}^{N} s_{z,i,1}G(H_{z,i})\right)$$

where $\mu_{z,1}$, $\mu_{z,}$, and $\mu_{z,3}$ take positive values. Using equation (15), we get:

$$(A19)\qquad G(H_{z,n}) - \sum_{i=2}^{N} s_{z,i,1}G(H_{z,i}) = -\frac{\alpha_z + \beta_z}{\gamma_z}\left(\sum_{j=1}^{N} v_{z,n,j}G(T_{z,n,j}) - \sum_{i=2}^{N} s_{z,i,1}\sum_{j=1}^{N} v_{z,i,j}G(T_{z,i,j})\right) + \frac{(\theta_z - 1)(\alpha_z + \beta_z)}{\theta_z\gamma_z}\left(\sum_{j=1}^{N} v_{z,n,j}G(p_{z,j}) - \sum_{i=2}^{N} s_{z,i,1}\sum_{j=1}^{N} v_{z,i,j}G(p_{z,j})\right) + \frac{\alpha_z + \beta_z}{\theta_z\gamma_z}\left(\sum_{j=1}^{N} v_{z,n,j}G(Y_j) - \sum_{i=2}^{N} s_{z,i,1}\sum_{j=1}^{N} v_{z,i,j}G(Y_j)\right) + \frac{\beta_z}{\gamma_z}\left(G(w_n) - \sum_{i=2}^{N} s_{z,i,1}G(w_i)\right)$$

The calculation of the complex terms of equation (A19) is beyond the scope of this paper. In order to simplify our analysis we set the following assumptions: (1) compared with changes in U.S. trade policy, trade policies in other countries did not have a significant effect on the number of firms in industry *z* of the country they trade with; and (2) all firms in industry *z* have similar sales destination patterns, that is, ($v_{z,i,1}$, $v_{z,i,2}$, $v_{z,i,3}$, ,$v_{z,i,N}$)=($v_{zji,1}$, $v_{zj,2}$, $v_{zji,3}$, ,$v_{z,j,N}$) for all *i* and *j*. Under assumption (1), the first term on the right-hand side of equation (A19) is approximated by:

$$-\frac{\alpha_z + \beta_z}{\gamma_z} v_{z,n,1}\left(G(T_{z,n,1}) - \sum_{i=2}^{N} s_{z,i,1}G(T_{z,i,1})\right)$$

The second and the third terms are negligible under assumption (2). Therefore we get:

$$(A20) \qquad G(s_{z,n,1}) = -\lambda_{z,1}\left(G(w_n) - \sum_{i=2}^{N} s_{z,i,1} G(w_i)\right) - \lambda_{z,2}\left(G(T_{n,1}) - \sum_{i=2}^{N} s_{z,i,1} G(T_{z,i,1})\right) + \lambda_{z,3}\, v_{z,n,1}\left(G(T_{n,1}) - \sum_{i=2}^{N} s_{z,i,1} G(T_{z,i,1})\right)$$

Integrating the above equation over time, we have equation (1) that provides the basis for our empirical analysis:

$$(1) \qquad \ln(s_{z,n,1}(t)) = \lambda_{z,n} - \lambda_{z,1}\left(\ln(w_n(t)) - \sum_{i=2}^{N} s_{z,i,1}{}^{0} \ln(w_i(t))\right) - \lambda_{z,2}\left(\ln(T_{n,1}(t)) - \sum_{i=2}^{N} s_{z,i,1}{}^{0} \ln(T_{z,i,1}(t))\right) + \lambda_{z,3} v_{z,n,1}{}^{0}\left(\ln(T_{n,1}(t)) - \sum_{i=2}^{N} s_{z,i,1}{}^{0} \ln(T_{z,i,1}(t))\right) + \varepsilon_{z,n}(t)$$

$\lambda_{z,n}$ depends on country-specific factors such as $Q_{z,n}$. $\varepsilon_{z,n}(t)$ is the usual error term. The three elasticity values $\lambda_{z,1}$, $\lambda_{z,2}$, and $\lambda_{z,3}$ are complicated functions of the parameters, such as θ_z (the elasticity of substitution between the output of different firms) and γ_z (the income share of the industry z-specific factor). But it can be shown that these values are increasing functions of θ_z and decreasing functions of γ_z.

References

Arndt, Sven and Alex Huemer. 2001. "North American Trade After NAFTA: Part I and Part II," *Claremont Policy Briefs*, Issue No. 01-01 and 01-02, Claremont Graduate University, April and July.

Bergstrand, Jeffrey H. 1989. "The Generalized Gravity Equation, Monopolistic Competition, and the Factor Proportions Theory of International Trade," *Review of Economics and Statistics* 71:143-53.

Burfisher, Mary E., Sherman Robinson, and Karen Thierfelder. 2001. "The Impact of NAFTA on the United States," *Journal of Economic Perspectives* 15:125-44.

Coughlin, Cletus C. and Howard J. Wall. 2000. "NAFTA and the Changing Pattern of State Exports," Working Paper 2000-029, Research Division, Federal Reserve Bank of St. Louis (October).

Gould, David M. 1998. "Has NAFTA Changed North American Trade?" Federal Bank of Dallas, *Economic Review*, First Quarter, pp. 12-23.

Heckman, James. 1979. "Sample Bias as a Specification Error," *Econometrica* 47:153-62.

Helpman, Elhanan and Paul Krugman. 1985. *Market Structure and Foreign Trade*. Cambridge: MIT Press.

James, William E. and Masaru Umemoto. 1999. "Rules of Origin and the Competitive Position of Asian Textiles and Apparel Producers in the North American Market," ICSEAD Working Paper Series, Vol. 99-1 (January).

James, William E. and Masaru Umemoto. 2000. "NAFTA Trade with East Asia: Rules of Origin and Market Access in Textiles, Apparel, Footwear, and Electrical Machinery," *ASEAN Economic Bulletin* 17:293-309.

Karemara, David and Kalu Ojah. 1998. "An Industrial Analysis of Trade Creation and Diversion Effects of NAFTA," *Journal of Economic Integration* 13:400-25.

Krueger, Anne O. 1993. "Free Trade Agreements as Protectionist Devices: Rules of Origin," National Bureau of Economic Research, Working Paper 4342.

Krueger, Anne O. 1999a. "Are Preferential Trading Agreements Trade-Liberalizing or Protectionist?" *Journal of Economic Perspectives* 13:105-24.

Krueger, Anne O. 1999b. "Trade Creation and Trade Diversion under NAFTA," National Bureau of Economic Research, Working Paper 7429 (December).

Krueger, Anne O. 2000. "NAFTA's Effects: A Preliminary Assessment," *The World Economy* 23:761-75.

Lustig, Nora. 2001. "Life is not Easy: Mexico's Quest for Stability and Growth," *Journal of Economic Perspectives* 15:85-106.

Manning, W. G., N. Duan, and W. H. Rogers. 1987. "Monte Carlo Evidence on the Choice Between Sample Selection and Two-Part Models," *Journal of Econometrics* 35:59-82.

Markusen, James. 1986. "Explaining the Volume of Trade: An Eclectic Approach," *American Economic Review* 76:1002-11.

Romalis, John. 2001. "NAFTA's Impact on North American Trade," in process.

Soloaga, Isidro and L. Alan Winters. 2001. "Regionalism in the Nineties: What Effect on Trade?" *North American Journal of Economics and Finance* 121:1-29.

Table 1. Statistically Significant Regression Results for HS 2-Digit Manufactured Commodities

		Equation 1			Equation 2		Equation 3		Equation 4	
HS Code	Definition	Tariff t-value	Share* Tariff t-value	No. of Obs F-value	Tariff t-value	No. of Obs F-value	Nafta Dummy t-value	No. of Obs F-value	Lagged Nafta t-value	No. of Obs F-value
30	Pharmaceutical Products	-35.43 (-3.13)	-31.68 (-0.39)	366 2.25	-17.57 (-1.78)	538 1.11	0.37 (0.44)	632 1.51	0.46 (0.61)	632 1.53
37	Photographic or Cinematographic Goods	-38.10 (-2.23)	-466.37 (-2.14)	306 3.45	-16.57 (-1.68)	537 1.52	-0.07 (-0.09)	588 0.85	0.02 (0.03)	588 0.85
44	Wood and Articles of Wood; Wood Charcoal	-69.71 (-3.93)	181.05 (1.22)	636 4.03	-43.89 (-2.93)	814 2.92	-0.27 (-0.46)	834 1.97	-0.20 (-0.37)	834 1.96
45	Cork and Articles of Cork	-183.42 (-4.50)	254.84 (0.90)	139 3.62	-11.17 (-0.75)	680 0.26	-0.10 (-0.14)	755 0.46	-0.02 (-0.03)	755 0.46
46	Mfr of Straw, Esparto etc.; Basketware & Wickerwrk	-17.07 (-1.98)	82.79 (3.26)	351 2.09	-3.48 (-0.65)	668 1.72	-0.36 (-0.56)	670 1.70	-0.29 (-0.50)	670 1.69
49	Printed Books, Newspapers etc; Manuscripts etc	-330.47 (-3.72)	156.36 (0.40)	483 2.66	-203.63 (-3.35)	721 2.25	0.13 (0.22)	789 0.85	0.17 (0.30)	789 0.86
51	Wool & Animal Hair, including Yarn & Woven Fabric	-91.60 (-3.73)	43.55 (3.21)	358 2.79	-10.06 (-1.36)	663 1.44	0.53 (0.74)	664 1.28	0.64 (0.98)	664 1.33
52	Cotton, including Yarn and Woven Fabric Thereof	-35.17 (-1.10)	46.93 (0.59)	502 1.79	-31.52 (-2.85)	715 2.15	0.91 (1.06)	716 1.25	1.06 (1.36)	716 1.34
60	Knitted or Crocheted Fabrics	-89.64 (-3.56)	86.33 (2.58)	377 4.40	-10.49 (-1.24)	584 4.44	1.17 (1.45)	585 4.50	1.43 (1.94)	585 4.72
62	Apparel Articles and Accessories, Not Knit, etc.	-56.69 (-2.86)	65.50 (2.55)	678 2.29	-8.57 (-1.37)	927 6.76	0.16 (0.22)	928 6.53	0.21 (0.31)	928 6.54
66	Umbrellas, Walking-Sticks, Riding-Crops etc. Parts	-12.92 (-1.61)	45.99 (1.25)	376 0.91	-12.80 (-2.42)	573 1.79	0.32 (0.36)	637 1.20	0.40 (0.50)	637 1.22
79	Zinc and Articles Thereof	-64.66 (-1.96)	29.62 (0.77)	256 1.33	-20.09 (-1.29)	568 1.44	-0.14 (-0.17)	586 1.09	-0.07 (-0.09)	586 1.09
82	Tools, Cutlery etc. of Base Metal & Parts Thereof	-31.37 (-2.90)	-12.65 (-0.16)	434 1.52	-5.26 (-0.89)	640 0.93	0.26 (0.39)	659 0.86	0.20 (0.33)	659 0.86
85	Electric Machinery etc; Sound Equip; TV Equip; Pts	-26.60 (-2.67)	218.66 (1.86)	650 2.69	-13.75 (-1.83)	855 4.06	0.02 (0.02)	881 3.78	0.19 (0.29)	881 3.79
90	Optic, Photo etc., Medical or Surgical Instruments etc.	-11.46 (-1.76)	-2.78 (-0.08)	583 1.49	-17.36 (-3.67)	755 4.28	0.14 (0.23)	778 2.23	0.09 (0.16)	778 2.23

Table 2. U.S. Tariff Rates: Selected HS 2-Digit Commodities

			U.S. Tariff Rates %	
HS Code	Definition	Year	On Imports from Canada	On Imports from Mexico
46	**Mfr of Straw, Esparto etc.; Basketware & Wickerwrk**	**93** **96**	**0.00** **0.00**	**3.01** **0.00**
51	**Wool & Animal Hair, including Yarn & Woven Fabric**	**93** **96**	**11.03** **1.01**	**15.75** **3.23**
52	**Cotton, including Yarn and Woven Fabric Thereof**	**93** **96**	**4.57** **0.88**	**8.98** **2.65**
60	**Knitted or Crocheted Fabrics**	**93** **96**	**6.66** **1.33**	**13.33** **4.55**
62	**Apparel Articles and Accessories, Not Knit etc.**	**93** **96**	**6.70** **1.23**	**12.93** **3.19**
79	**Zinc and Articles Thereof**	**93** **96**	**2.01** **0.35**	**2.69** **0.00**

Table 3. Regression Results: Selected HS 4-Digit Commodities

HS 4202 TRAVEL GOODS, HANDBAGS, WALLETS, JEWELRY CASES ETC
HS 6002 KNITTED OR CROCHETED FABRICS, NESOI
HS 6109 T-SHIRTS, SINGLETS, TANK TOPS ETC, KNIT OR CROCHET
HS 6115 PANTYHOSE, SOCKS & OTHER HOSIERY, KNIT OR CROCHET
HS 6401 WATERPROOF FOOTWEAR, RUBBER OR PLASTICS, BOND SOLE
HS 8528 TV RECVRS, INCL VIDEO MONITORS & PROJECTORS
HS 8703 MOTOR CARS & VEHICLES FOR TRANSPORTING PERSONS

[ ]: t-value
** 5% significant
* 10% significant

Country Dummies are omitted
Time dummies (t1=1992, t2=1993, t3=1994, t4=1995, t5=1996, t6=1997)

HS 4202 TRAVEL GOODS, HANDBAGS, WALLETS, JEWELRY CASES ETC

# of regressi	1	2	3	4	5	6
const	-8.619 [-40.33]**	-9.502 [-84.73]**	-8.583 [-32.73]**	-9.595 [-54.01]**	-9.667 [-73.03]**	-9.668 [-73.13]**
GDP per cap	-0.225 [-0.38]	1.079 [2.01]**	-0.642 [-0.73]	0.87 [1.04]	0.902 [1.08]	0.925 [1.10]
tariff	15.072 [0.85]	10.06 [0.8]	15.263 [0.85]	7.207 [0.57]		
share*tariff	-22.78 [-0.78]		-24.2 [-0.83]			
t1			0.149 [0.67]	0.018 [0.08]	0.035 [0.16]	0.033 [0.15]
t2			0.131 [0.68]	0.097 [0.5]	0.114 [0.59]	0.114 [0.59]
t3			0.037 [0.22]	0.131 [0.76]	0.143 [0.84]	0.151 [0.88]
t4			0.146 [0.87]	0.257 [1.56]	0.263 [1.60]	0.262 [1.59]
t5			0.026 [0.16]	0.028 [0.18]	0.028 [0.17]	0.027 [0.17]
t6			0.032 [0.2]	-0.091 [-0.57]	-0.092 [-0.57]	-0.091 [-0.57]
Nafta					0.341 [0.50]	
Nafta(Lag)						0.46 [0.74]
# of obv.	570	733	570	733	733	733
R-squared	0.002	0.009	0.0046	0.019	0.018	0.019
F-statistics	0.3	2.79	0.24	1.38	1.37	1.41

HS 6002 KNITTED OR CROCHETED FABRICS, NESOI

# of regressi	1	2	3	4	5	6
const	-5.34 [-4.72]**	-6.437 [-5.51]**	-5.908 [-4.7]**	-7.588 [-6.16]**	-7.741 [-6.25]**	-7.631 [-6.14]**
GDP per cap	1.708 [1.27]	1.125 [0.83]	0.731 [0.5]	-0.336 [-0.23]	-0.215 [-0.14]	-0.08 [-0.05]
tariff	-52.04 [-3.06]**	-20.37 [-3.06]**	-61.01 [-2.48]**	-18.71 [-2.59]**		
share*tariff	55.107 [1.45]		70.903 [1.41]			
t1			0.209 [0.75]	0.395 [1.61]	0.61 [2.54]**	0.613 [2.56]**
t2			-0.195 [-0.71]	-0.107 [-0.44]	0.128 [0.55]	0.132 [0.57]
t3			-0.445 [-1.61]	-0.269 [-1.12]	-0.075 [-0.32]	-0.028 [-0.12]
t4			-0.42 [-1.64]*	-0.279 [-1.14]	-0.166 [-0.68]	-0.161 [-0.66]
t5			-0.167 [-0.69]	-0.226 [-0.93]	-0.16 [-0.66]	-0.153 [-0.63]
t6			-0.036 [-0.15]	-0.257 [-1.08]	-0.212 [-0.89]	-0.207 [-0.86]
Nafta					1.19 [1.62]	
Nafta(Lag)						1.218 [1.8]*
# of obv.	385	421	385	421	421	421
R-squared	0.054	0.029	0.0887	0.0627	0.05	0.05
F-statistics	5.79	4.98	3.25	2.68	2.15	2.23

HS 6109 T-SHIRTS, SINGLETS, TANK TOPS ETC, KNIT OR CROCHET

# of regressio	1	2	3	4	5	6
const	-7.183 [-31.83]*	-8.046 [-141.60]	-7.817 [-27.57]*	-8.592 [-66.01]*	-8.642 [-66.74]*	-8.641 [-66.82]**
GDP per capi	-0.306 [-0.26]	0.0029 [0.05]	-0.072 [-0.64]	-0.063 [-1.15]	-0.065 [-1.18]	-0.066 [-1.19]
tariff	-55.471 [-1.82]*	-5.547 [-1.40]	-13.836 [-0.45]	-3.976 [-1.05]		
share*tariff	83.197 [1.51]		1.224 [0.02]			
t1			0.779 [3.42]**	0.902 [4.86]**	0.937 [5.04]**	0.935 [5.04]**
t2			0.733 [3.23]**	1.016 [5.60]**	1.056 [5.82]**	1.055 [5.82]**
t3			0.468 [2.12]**	0.794 [4.44]**	0.801 [4.50]**	0.831 [4.66]**
t4			0.419 [1.87]*	0.605 [3.34]**	0.606 [3.35]**	0.606 [3.35]**
t5			0.214 [0.96]	0.326 [1.82]*	0.325 [1.82]*	0.325 [1.82]*
t6			-0.189 [-0.86]	0.021 [0.12]	0.017 [0.10]	0.017 [0.10]
Nafta					1.712 [2.18]**	
Nafta(Lag)						1.655 [2.31]**
# of obv.	367	776	367	776	776	776
R-squared	0.02	0.003	0.1062	0.0915	0.097	0.098
F-statistics	2.01	0.99	3.87	7.87	8.37	8.45

HS 6115 PANTYHOSE, SOCKS & OTHER HOSIERY, KNIT OR CROCHET

# of regressio	1	2	3	4	5	6
const	-7.13 [-6.74]**	-6.3 [-5.61]**	-8.339 [-6.64]**	-6.982 [-5.22]**	-6.764 [-5.08]**	-6.921 [-5.20]**
GDP per capi	0.307 [0.22]	1.487 [1.30]	-1.173 [-0.68]	0.856 [0.61]	1.139 [0.82]	0.958 [0.69]
tariff	-1.821 [-0.17]	-0.821 [-0.11]	-4.556 [-0.42]	-1 [-0.13]		
share*tariff	-10.394 [-1.05]		-8.286 [-0.83]			
t1			0.414 [1.39]	0.195 [0.78]	0.249 [1.00]	0.236 [0.95]
t2			0.245 [0.92]	0.117 [0.47]	0.179 [0.73]	0.161 [0.66]
t3			0.26 [0.91]	0.235 [0.93]	0.244 [0.98]	0.238 [0.95]
t4			-0.08 [-0.24]	0.008 [0.03]	0.025 [0.10]	0.058 [0.23]
t5			0.184 [0.62]	0.045 [0.17]	0.065 [0.25]	0.052 [0.20]
t6			-0.324 [-1.12]	-0.143 [-0.55]	-0.123 [-0.48]	-0.135 [-0.52]
Nafta					1.757 [2.18]**	
Nafta(Lag)						1.283 [1.75]*
# of obv.	328	454	328	454	454	454
R-squared	0.008	0.005	0.0403	0.013	0.026	0.022
F-statistics	0.63	0.84	1.1	0.57	1.17	0.96

HS 6401 WATERPROOF FOOTWEAR, RUBBER OR PLASTICS, BOND SOLE

# of regressio	1	2	3	4	5	6
const	-5.269 [-4.73]**	-6.399 [-5.53]**	-4.325 [-3.57]**	-4.555 [-3.42]**	-4.679 [-3.46]**	-5.259 [-3.95]**
GDP per capi	-0.946 [-0.45]	0.119 [0.06]	-2.571 [-1.05]	-3.43 [-1.44]	-3.93 [-1.67]*	-3.036 [-1.31]
tariff	-38.176 [-3.23]**	-20.489 [-3.28]**	-33.194 [-2.62]**	-12.786 [-1.86]*		
share*tariff	-65.387 [-1.26]		-55.467 [-1.05]			
t1			0.355 [0.72]	0.772 [1.72]*	1.084 [2.56]**	1.083 [2.62]**
t2			-0.254 [-0.56]	0.277 [0.67]	0.646 [1.7]*	0.675 [1.82]*
t3			0.002 [0.00]	0.54 [1.39]	0.746 [2.02]**	0.902 [2.48]**
t4			-0.019 [-0.05]	0.443 [1.15]	0.617 [1.64]*	0.627 [1.71]*
t5			-0.826 [-2.26]**	-0.742 [-2.19]**	-0.681 [-2.01]**	-0.684 [-2.07]**
t6			-0.393 [-1.05]	-0.13 [-0.37]	-0.107 [-0.31]	-0.098 [-0.29]
Nafta					1.48 [1.5]	
Nafta(Lag)						2.788 [3.28]**
# of obv.	199	238	199	238	238	238
R-squared	0.114	0.057	0.1442	0.1744	0.138	0.178
F-statistics	6.37	5.4	3.36	3.64	3.47	4.69

8528 TV RECVRS, INCL VIDEO MONITORS & PROJECTORS

# of regressio	1	2	3	4	5	6
const	-7.927 [-20.19]*	-8.599 [-80.08]*	-8.109 [-14.09]*	-8.869 [-28.39]*	-9.097 [-40.89]*	-9.086 [-40.96]**
GDP per capi	0.346 [0.19]	-0.208 [-0.12]	0.28 [0.15]	-0.138 [-0.08]	-0.322 [-0.18]	-0.409 [-0.23]
tariff	-89.614 [-3.22]**	-51.075 [-2.68]**	-83.962 [-1.87]*	-32.479 [-1.05]		
share*tariff	99.218 [1.66]*		96.675 [1.52]			
t1			0.532 [1.25]	0.68 [1.72]*	0.887 [2.58]**	0.875 [2.56]**
t2			-0.139 [-0.33]	0.003 [0.01]	0.212 [0.64]	0.201 [0.60]
t3			0.213 [0.51]	0.341 [0.9]	0.574 [1.86]*	0.556 [1.79]*
t4			0.184 [0.43]	0.253 [0.65]	0.507 [1.63]	0.509 [1.64]*
t5			0.276 [0.84]	0.149 [0.48]	0.142 [0.46]	0.143 [0.46]
t6			0.108 [0.33]	0.121 [0.39]	0.133 [0.43]	0.132 [0.43]
Nafta					-0.139 [-0.16]	
Nafta(Lag)						-0.341 [-0.42]
# of samples	281	320	281	320	320	320
R-squared	0.046	0.03	0.0647	0.0489	0.045	0.045
F-statistics	3.52	3.62	1.62	1.48	1.34	1.36

8703 MOTOR CARS & VEHICLES FOR TRANSPORTING PERSONS

# of regressio	1	2	3	4	5	6
const	-8.617 [-8.73]**	-10.575 [-26.49]*	-8.518 [-2.41]**	-10.648 [-24.17]*	-10.521 [-24.42]*	-10.526 [-24.46]**
GDP per capi	0.251 [2.03]**	0.276 [2.13]**	0.251 [2.01]**	0.261 [1.97]**	0.255 [1.92]*	0.254 [1.92]*
tariff	-72.9 [-0.51]	39.727 [1.63]	-28.937 [-0.06]	36.401 [1.48]		
share*tariff	51.06 [0.29]		-2.787 [0.00]			
t1			-0.429 [-0.64]	0.131 [0.46]	0.18 [0.62]	0.183 [0.64]
t2			-0.467 [-0.7]	0.223 [0.8]	0.268 [0.94]	0.271 [0.96]
t3			-0.236 [-0.36]	0.155 [0.57]	0.181 [0.67]	0.217 [0.79]
t4			-0.497 [-1.18]	0.1 [0.38]	0.113 [0.43]	0.113 [0.43]
t5			-0.847 [-2.59]**	-0.312 [-1.12]	-0.318 [-1.13]	-0.319 [-1.14]
t6			-0.418 [-1.26]	0.028 [0.1]	0.027 [0.10]	0.027 [0.10]
Nafta					0.548 [0.79]	
Nafta(Lag)						0.61 [0.96]
Mexico						
# of samples	173	278	173	278	278	278
R-squared	0.038	0.035	0.0926	0.0567	0.049	0.05
F-statistics	1.75	3.55	1.43	1.44	1.23	1.28

# of regre	7
const	-10.79 [-24.14]**
GDP per	0.261 [1.99]**
tariff	54.569 [2.02]**
share*tariff	
t1	0.18 [0.63]
t2	0.27 [0.96]
t3	0.143 [0.53]
t4	0.096 [0.37]
t5	-0.311 [-1.12]
t6	0.029 [0.11]
Nafta	
Nafta(Lag)	
Mexico	1.679 [1.59]
# of sam	278
R-square	0.069
F-statisti	1.57

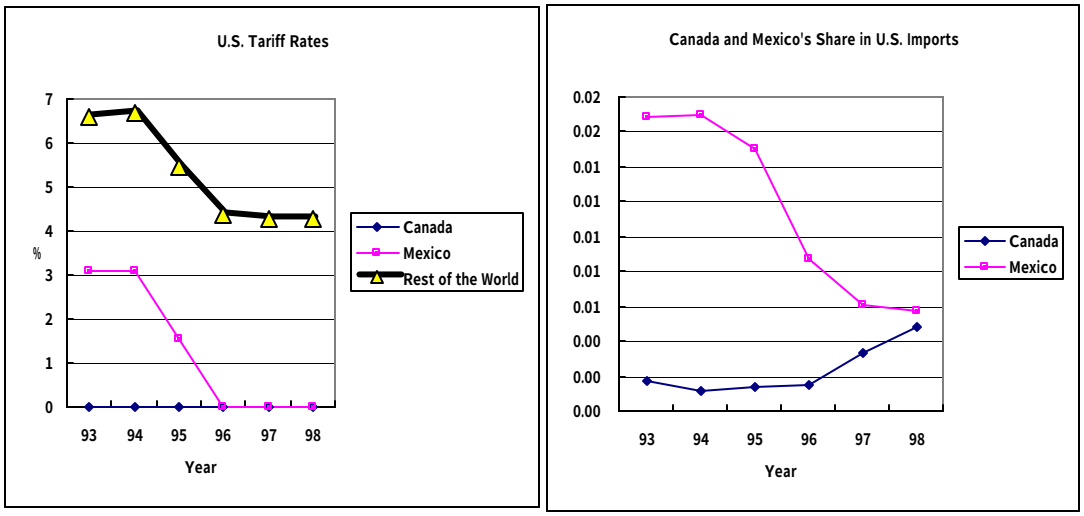
Table 4. Summary of Regression Results of Table 3

Commodities		Tariff	NAFTA or NAFTA(Lag)
HS 4202	TRAVEL GOODS, HANDBAGS, WALLETS, JEWELRY CASES E	-	-
HS 6002	KNITTED OR CROCHETED FABRICS, NESOI	**	*
HS 6109	T-SHIRTS, SINGLETS, TANK TOPS ETC, KNIT OR CROCHET	*	**
HS 6115	PANTYHOSE, SOCKS & OTHER HOSIERY, KNIT OR CROCHET	-	**
HS 6401	WATERPROOF FOOTWEAR, RUBBER OR PLASTICS, BOND S(	**	**
HS 8528	TV RECVRS, INCL VIDEO MONITORS & PROJECTORS	**	-
HS 8703	MOTOR CARS & VEHICLES FOR TRANSPORTING PERSONS	-	-

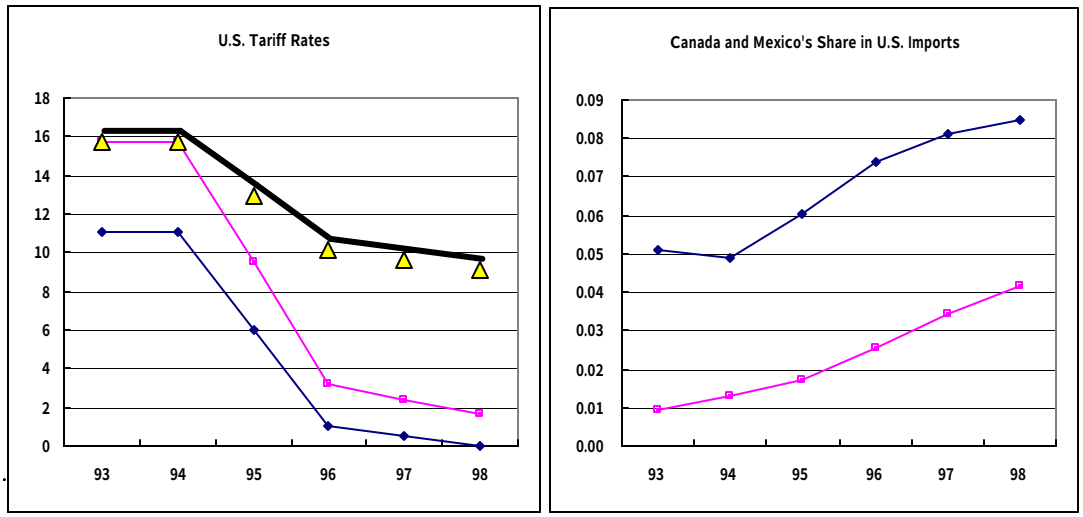
* Significant at 10 percent level.
** Significant at 5 percent level.
- Not significant.

Figure 1. U.S. Tariff Rates and Imports: Selected HS 2-Digit Commodities

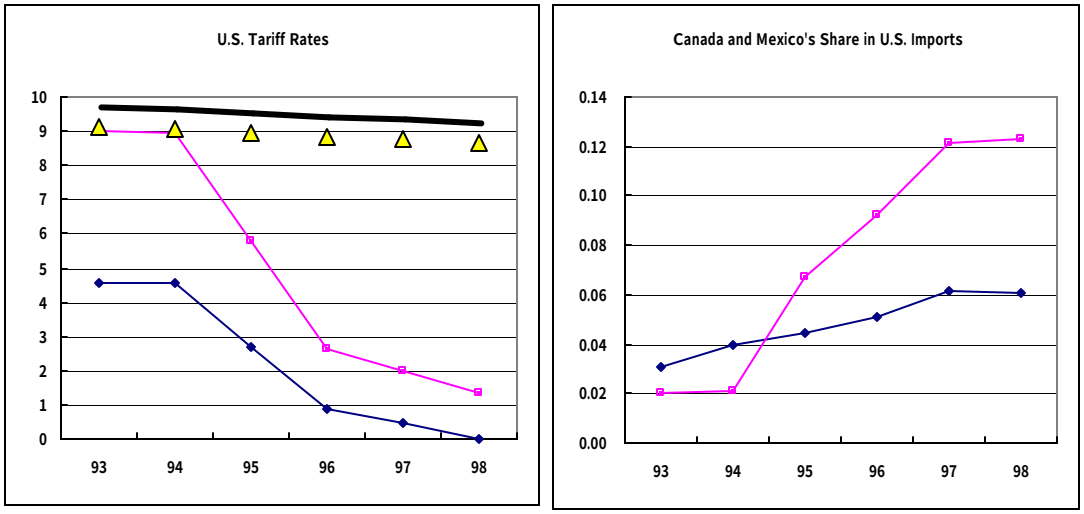
HS 46 Mfr of Straw, Esparto etc.; Basketware & Wickerwork



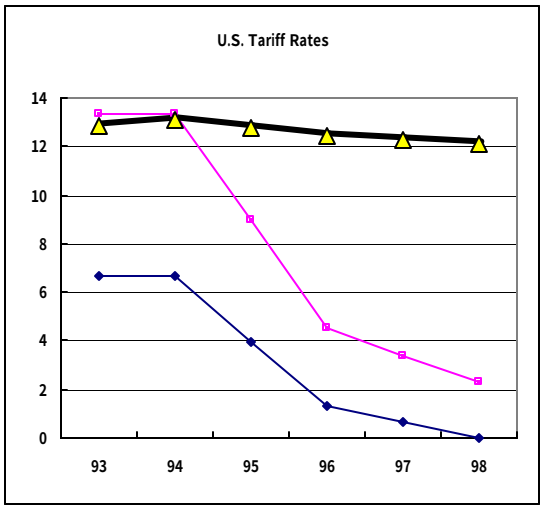
HS 51 Wool & Animal Hair, including Yarn & Woven Fabric

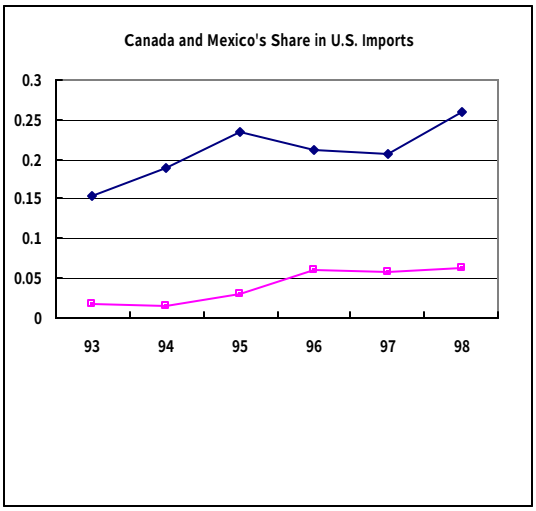


HS 52 Cotton, including Yarn and Woven Fabric Thereof

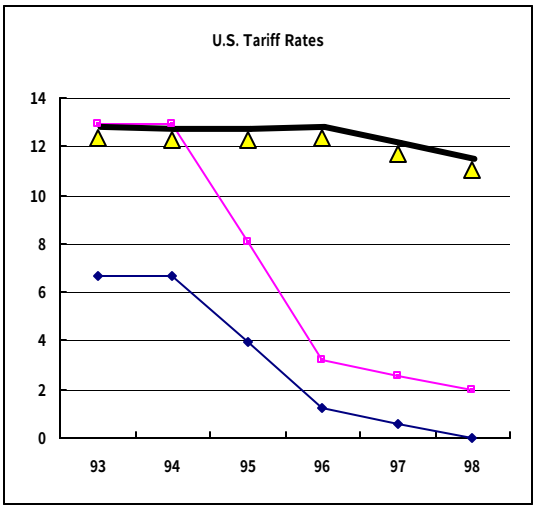


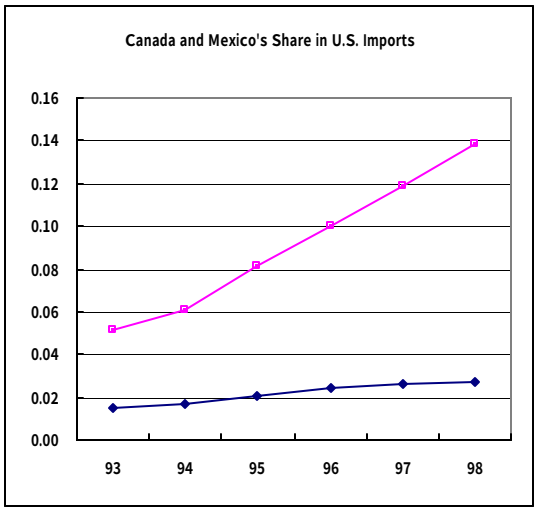
HS 60 Knitted or Crocheted Fabrics



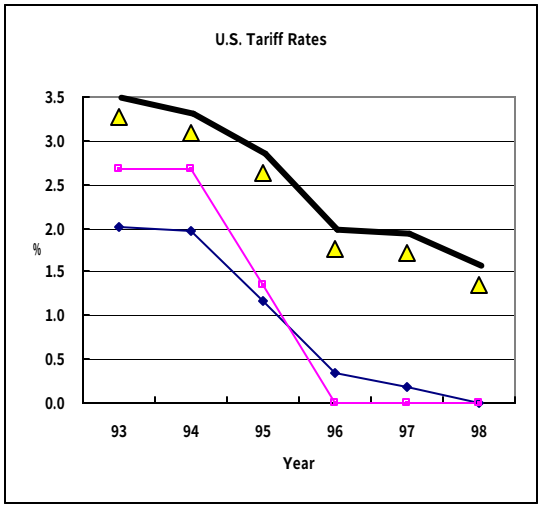


HS 62 Apparel Articles and Accessories, Not knit etc.





HS 79 Zinc and Articles Thereof



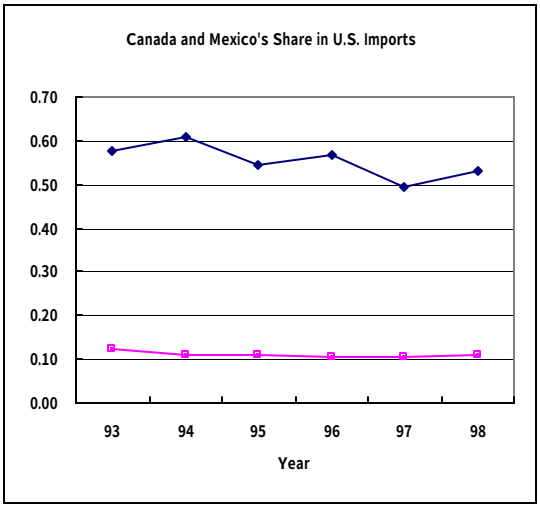


Figure 2. U.S. Tariff Rates: Selected HS 4-Digit Commodities

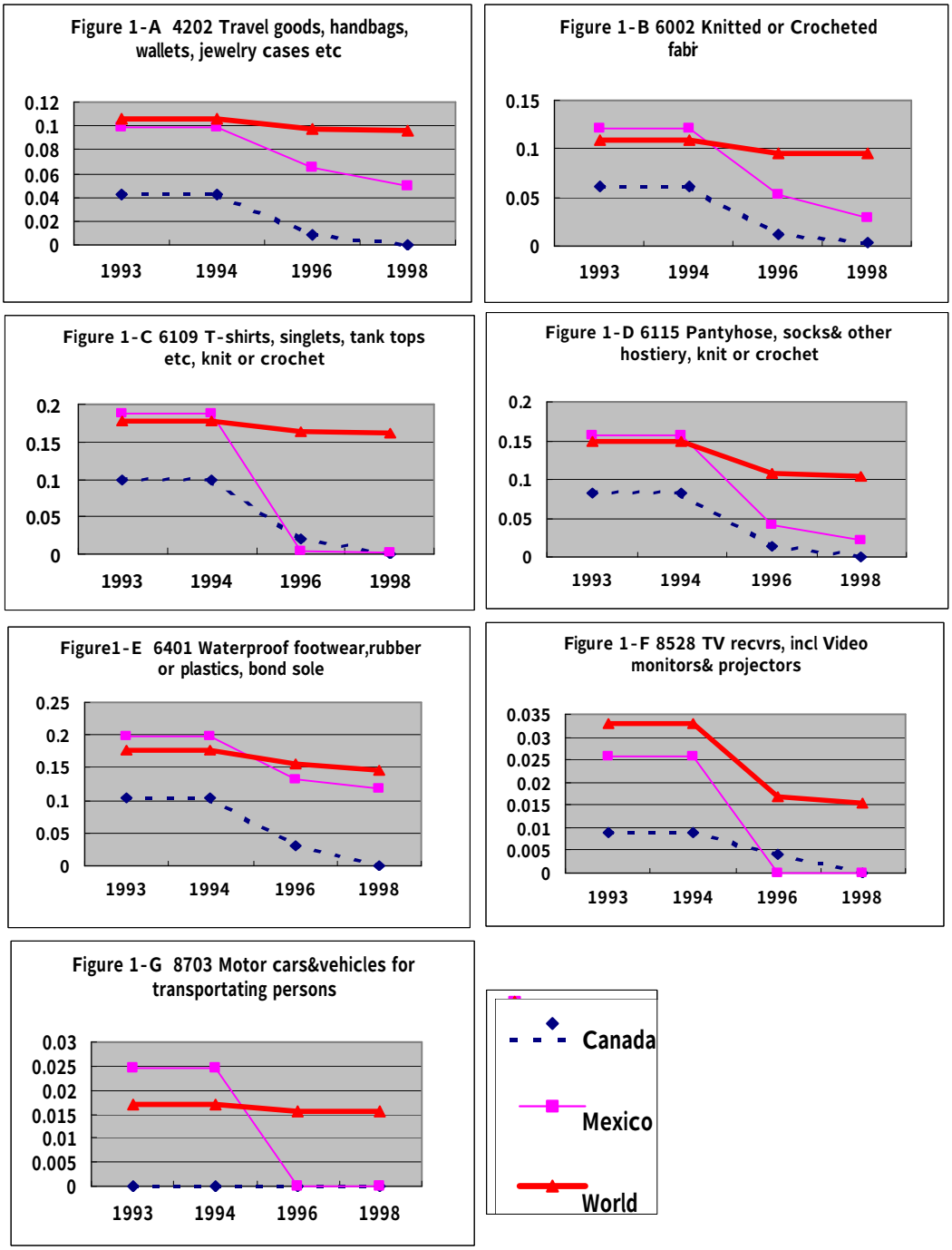


Figure 3. U.S. Imports: Selected HS 4-Digit Commodities