

# NAFTA and the Realignment of Textile and Apparel Trade: Trade Creation or Trade Diversion?

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## Abstract

A modified version of the partial equilibrium gravity model, originally proposed by Fukao et al. (2003), is employed to investigate the changing patterns of U.S. textile trade. We use the data on *US Bilateral Manufacturing Imports and Exports by SIC4*, which covers the period 1989 to 2001 (Feenstra et al. 2002), to assess the impact of labor wages, tariffs, and exchange rates on the composition of U.S. textile imports before and after the creation of NAFTA. Unlike many previous studies, we also consider the effect of tariff removals under NAFTA on U.S. trade with non-NAFTA nations. The analysis is performed at the 2-digit industry level as well as the more disaggregated 4-digit sector level. We conclude that there is little evidence of trade diversion in textiles frequently attributed to NAFTA, while trade creation is clearly present. Furthermore, lower wages in some textile-exporting countries (e.g., countries in Asia) do not appear to significantly increase these countries' share of U.S. textile imports at the expense of other trading partners. Variations in currency exchange rates and tariffs, on the other hand, have substantial effects on the composition of U.S. imports.

## 1 Introduction

The passage of the North American Free Trade Agreement (NAFTA) in 1994 between the U.S., Canada and Mexico, has had a substantial impact on trade not just within the region, but also on countries outside of North America. In the case of the textile and apparel industries, NAFTA is reconfiguring the structure of production and trade,

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as US firms increasingly redirect their attention to Mexico, as a low wage country with a well-developed production base and geographical proximity and away from Asia. In 1990 Mexico together with the Caribbean Basin countries represented about 10 percent of total U.S. apparel imports; by 1996 this proportion had risen to 23 percent (USITC 1997). By 1998 Mexico had become the single largest apparel and textile exporter to the U.S. (U.S. Dept. of Commerce 1998).

The textile and apparel industries have long been protected in the U.S., as evidenced by the long lasting import quota structure of the Multi-Fiber Arrangement (MFA) and its predecessors. Traditionally, this sector has been very important to the U.S economy, accounting for a significant percentage of manufacturing output and employment. Together the two industries employed 1.4 million people and shipped about \$128 billion of output in 1990 (Hufbauer and Schott 1992).

The North American Free Trade Agreement negotiated between the governments of the U.S., Mexico, and Canada, removes traditional barriers to trade and investment in the member countries. To qualify for tariff concessions under NAFTA, goods must be produced within the NAFTA region, incorporate only those non-NAFTA materials that are sufficiently processed in North America and meet minimum content requirements (Wise 1998). Tariffs and quotas in textile and apparel, were traditionally subject to special rules-of-origin (ROO) requirements. While import quotas that met the ROO requirements were to be removed immediately, tariffs for similar items were to be phased out over a period of 10 years. NAFTA also provides a special rule of origin for textiles and apparels, namely the “yarn forward rule,” which specifies that only garments produced from yarn originating in North America qualify to receive concessions under NAFTA. Thus, the yarn forward ROO is particularly beneficial to the U.S. textile firms. Also, under the “fabric forward” scheme, quota-free and duty-free status is granted to garments assembled in Mexico from U.S.-cut and U.S.-formed fabrics. This was expected to encourage Mexican exporters to source their inputs from U.S. or Canada, rather than from East Asian producers. It was anticipated that under these provisions U.S. exports in unfinished goods to Mexico would increase, and in turn U.S. would import more finished products from Mexico, thereby taking advantage of lower labor costs (Hufbauer and Schott 1992 and USITC 1991).

The impact of NAFTA on the pattern of U.S. textile and apparel trade is thus of significant interest. It is important to examine the extent to which an increase in trade among the NAFTA partners reflects trade *creation* versus trade *diversion*. “Trade creation” refers to the effect of lower trade barriers on inducing countries to import goods previously produced at home (i.e., create trade in previously untraded commodities), whereas “trade diversion” describes the changes in trade patterns occasioned by preferential treatment under an agreement such as NAFTA (i.e., goods previously imported from a third country, are now imported from a trading partner within the PTA). An analysis of import shares held by different countries usually helps uncover trade diversion: as Krueger (1999) points out, a decline in the share of U.S. imports held by a given country or region and a concurrent increase in the

import share of NAFTA countries would lead one to conclude that trade diversion is being observed. On the other hand, if the volume of trade with both NAFTA partners and other countries, say, in Asia, increases substantially in *absolute* terms during the sample period, it is possible that trade diversion will go undetected. The logic is fairly straightforward: when the U.S.-China and U.S.-Mexico trade volumes both increase due to some factor unrelated to NAFTA, trade diversion may still be present as some of the new growth in imports from Mexico *would* have come from China in the absence of NAFTA. In other words, some of the increase in within-NAFTA trade is due to trade creation, some is due to trade diversion from other regions, but trade volumes with other regions may be increasing still due to some other force. Figure 1 displays weighted shares of imports held by countries in several major regions. While NAFTA countries' share has grown somewhat since 1993, share of Asian countries do not appear to decline appreciably. Instead, share of Western European nations shows the largest decline.

Figure 1: Import Shares by Region

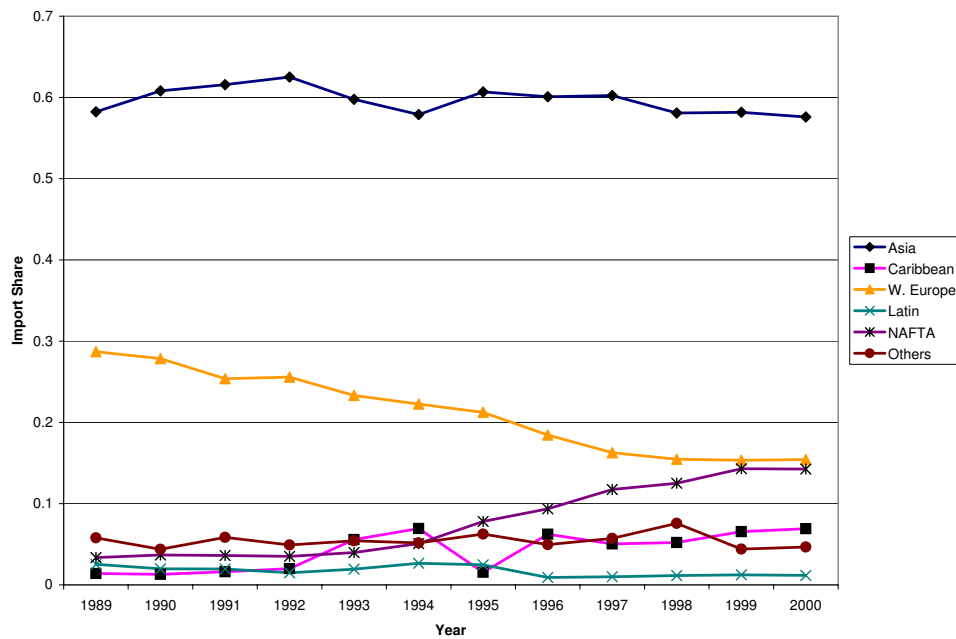
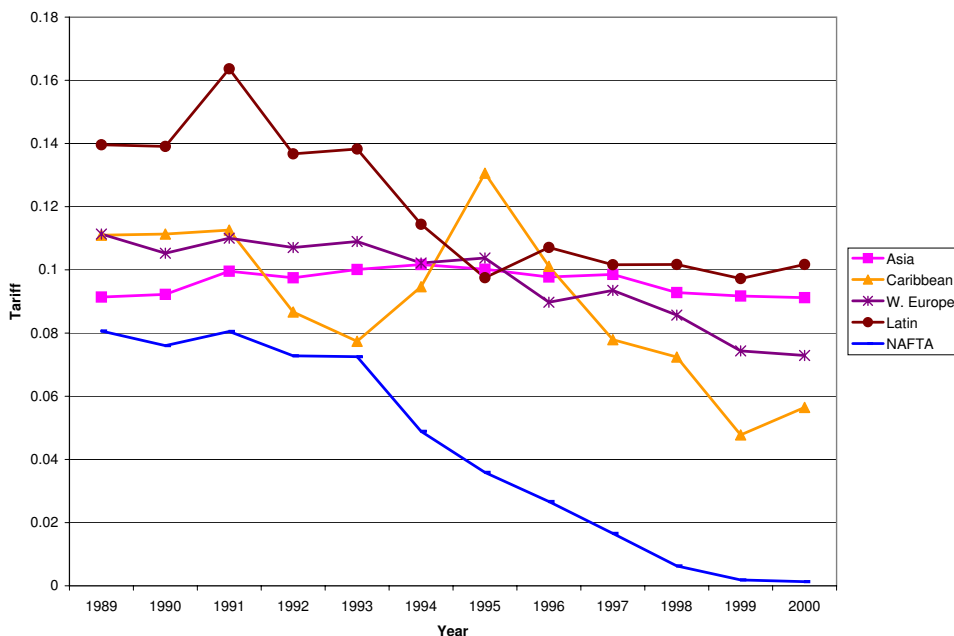


Figure 2: Tariff Rates by Region



Most empirical work estimating the effects of NAFTA on trade has been limited to U.S.-Mexico-Canada trade patterns, often ignoring the impact on and of the rest of the world. This paper employs a more general trade model to analyze the determinants of the pattern of U.S. textile and apparel trade. It then seeks to ascertain the shifts that may be due to NAFTA. We consider the share of U.S. imports of textile and apparel from countries in the different regions of the world in order to examine shifts in the pattern of trade. In this we consider the role of tariffs, labor wages, real exchange rates, and NAFTA. Dummy variables are used to capture regional effects of NAFTA.

Wages usually factor prominently in any discussion of trade effects on manufacturing industries, especially textiles and apparels as their production is largely labor intensive. Bureau of Labor Statistics (BLS) data show that labor costs have typically accounted for between 30 and 50 percent of total production costs for tex-

tiles.<sup>1</sup> Intuitively, this gives producers in low-wage countries a significant competitive edge, making labor wages in the exporting country a particularly important factor in explaining the sources of U.S. imports. Further, variation in the U.S. exchange rate, which determines the relative price of foreign goods, and tariff rates should also influence imports. Most textile tariffs have declined worldwide, as is evident from Figure 2, with the exception of those applied to Asian nations. Figures 3, 4, and 5 plot the effective tariff rates and corresponding import shares for individual regions. Note that Asia and Western Europe do not appear to display a strong (negative) relationship between tariffs and shares at all. Latin American countries and countries of the Caribbean Basin display such a relationship after 1995, suggesting a substantial impact of NAFTA.

The remainder of the paper is organized as follows: Section 2 provides an overview of recent studies of NAFTA and its effects on trade patterns; Section 3 discusses our theoretical and empirical approaches; Section 4 details the variables constructed and the sources of data; Section 5 discusses the estimation techniques employed and the results, and Section 6 concludes.

## 2 Survey of the Literature

We begin by summarizing the approach used by Fukao, Okubo, and Stern (2003) as much of the present research is motivated by and builds upon the findings in that paper. Fukao et al. (2003) investigate the effects of NAFTA on trade diversion at a highly disaggregated level. Using a version of their gravity model, they estimate the impacts of wages, tariffs and the inception of NAFTA on the change in shares of U.S.'s imports from different countries. The analysis is performed for all U.S. manufactured imports at the Harmonized System (HS) 2-digit level for the period 1992-98. The authors note that the HS 2-digit industries may be too broad to include too many goods for several industries. In order to account for this, they also estimate their model at the HS 4-digit level for select industries, such as sectors of textiles and apparels, TV receivers and Motor Vehicles.

Their results suggest, most interestingly, that some trade diversion in U.S. imports from Mexico, especially in textiles and apparels, can be attributed to NAFTA. On the other hand, little evidence of trade diversion is apparent in other industries. They also refer to other studies, which suggest that some of this diversion may be at the expense of trade with Asian countries. Out of the 70 commodities examined, in only 15 cases was the tariff measure's coefficient significantly negative. For textiles and apparels, the U.S. tariff rates against Canada and Mexico were reduced substantially, while they remained high against many other countries. However, the tariff rates were almost negligible for many other industries, even before 1994.

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<sup>1</sup>Computations using the BLS data reported in Datta and Christoffersen (2004).

Figure 3: Tariff Rates and Import Shares for Selected Regions

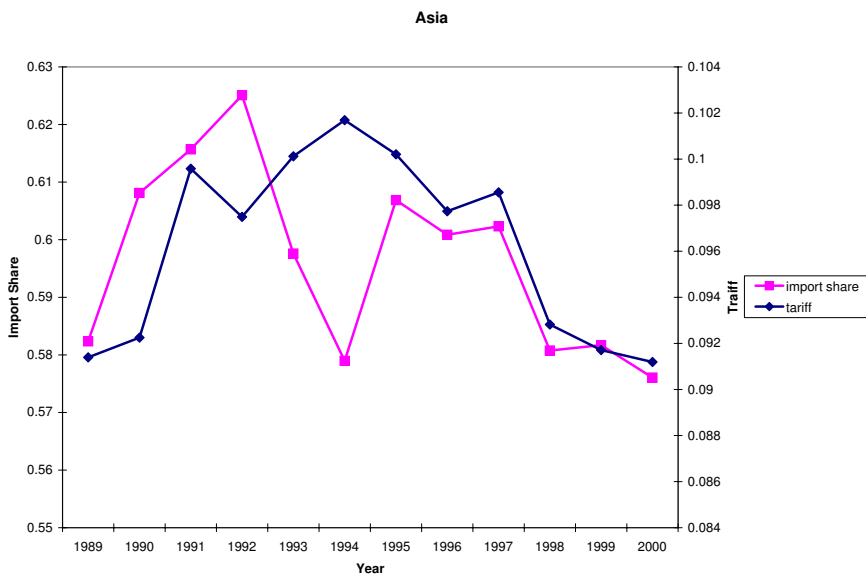
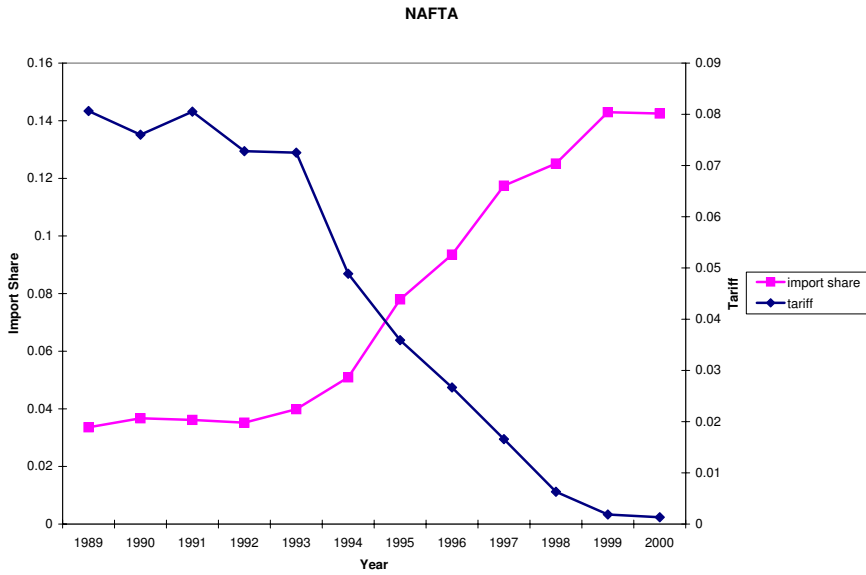


Figure 4: Tariff Rates and Import Shares for Selected Regions (cont'd)

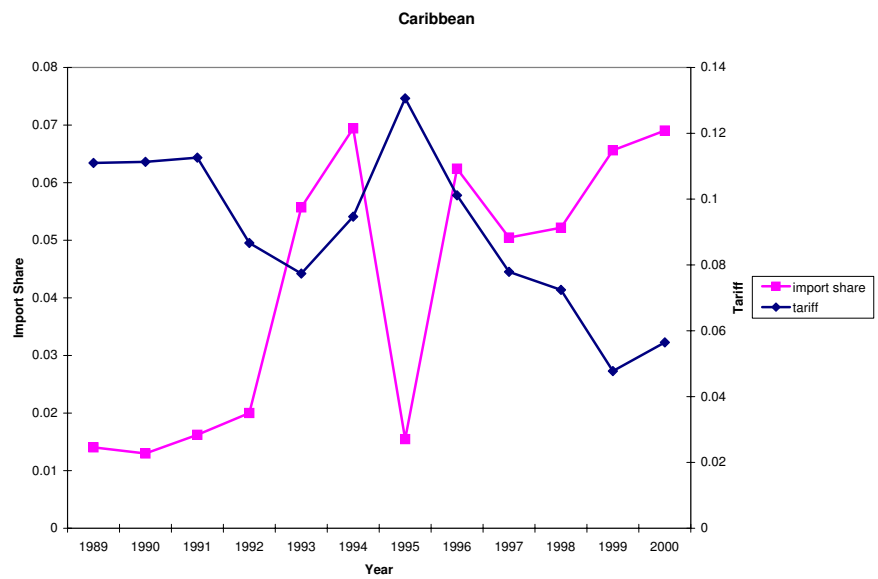
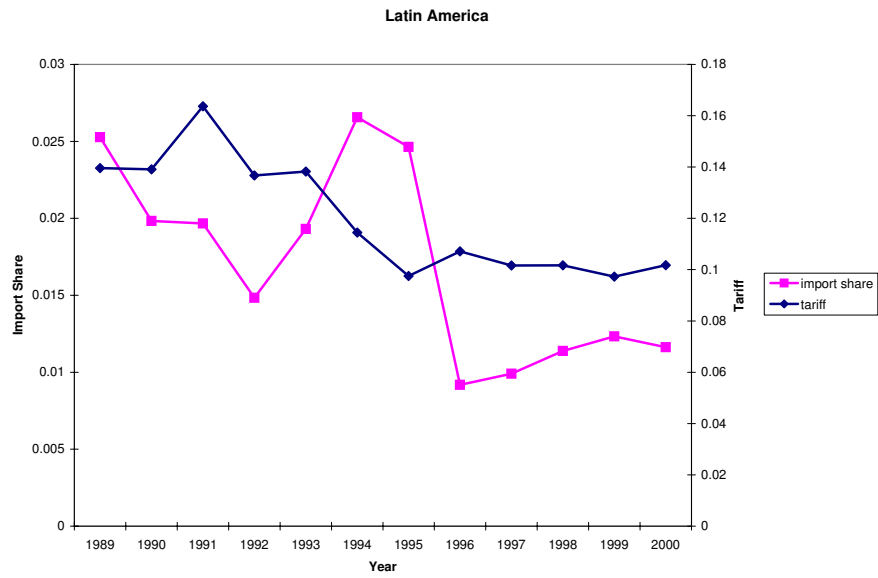


Figure 5: Tariff Rates and Import Shares for Selected Regions (cont'd)

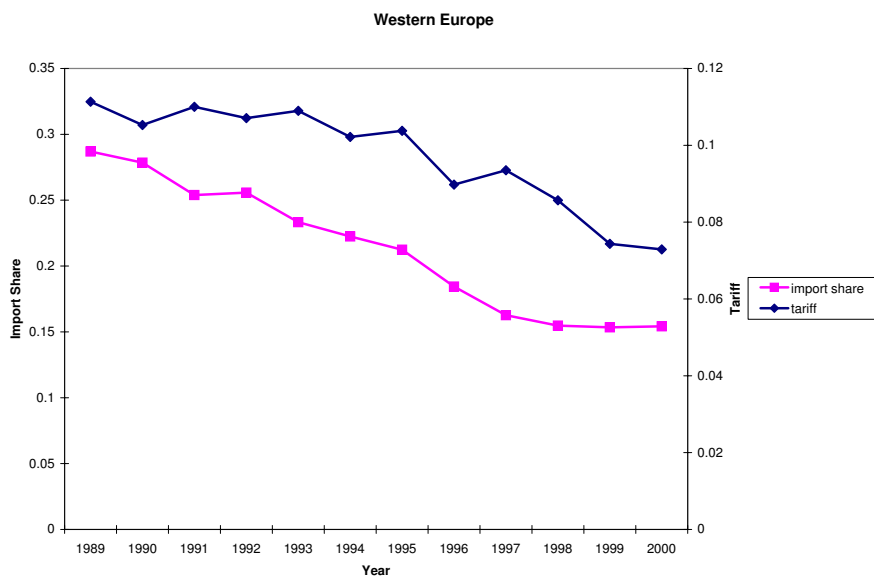


Table 1: U.S. Textile Imports by Region (in millions of U.S. dollars)

Year	Africa	Asia	Carib.	East. Eur.	West. Eur.	Latin	MENA	NAFTA	Australia
1989	10.135	820.397	19.779	10.168	404.245	35.607	19.351	47.314	41.771
1990	11.882	829.253	17.703	9.117	379.782	27.046	17.345	50.079	20.640
1991	10.491	955.706	25.178	11.920	394.077	30.524	43.475	56.113	24.579
1992	9.797	1013.609	32.447	13.089	414.680	24.066	24.951	57.068	29.102
1993	7.371	1003.448	93.533	10.328	391.148	32.420	33.332	66.955	30.593
1994	8.039	993.487	119.131	12.140	381.067	45.590	31.642	87.408	21.152
1995	6.346	1039.468	26.508	13.790	362.892	42.198	44.451	133.593	24.589
1996	3.039	1092.981	113.664	10.481	334.905	16.713	32.004	170.279	21.217
1997	3.864	1167.958	97.869	14.617	314.153	19.207	52.765	227.751	17.164
1998	6.485	1164.344	104.619	14.076	308.934	22.828	95.172	250.890	13.356
1999	1.999	1152.786	130.034	11.801	303.641	24.438	56.736	283.315	4.487
2000	2.292	1211.007	145.146	13.788	323.504	24.452	62.802	299.563	9.123

Fukao et al.'s results suggest that the textile and apparel sectors are significantly different from other manufacturing sectors and deserve special attention.

Use of gravity models is quite common in recent studies of NAFTA and its effects. For example, Krueger (1999, 2000) uses a basic gravity-model framework to assess the impact of NAFTA on North American trade. She considers the effect of countries' GDP-per-capita as well as that of the distance between trading partners, whether the countries use the same official language, and whether countries belong to a preferential trade area (PTA). Krueger also conducts a "shift-in-share" analysis of trade using data through 1997. She finds that, for example, the increase in Mexico's share of trade with the U.S. was not much different than that with the rest of the world, and was primarily driven by Mexico's own trade liberalization and the peso crisis of 1994. She also reports that at the 3-digit level, for very few commodities did the absolute volume of trade decrease between NAFTA members and other countries. Overall, she concludes that NAFTA was trade-creating rather than trade-diverting, but qualifies this statement based on the limited time-span of the data.

The vast majority of existing studies of NAFTA's impact on trade flows and patterns are confined to the examination of trade within North America. While such studies can be informative about the immediate effects of the removal of trade barriers between U.S., Canada, and Mexico, impact on trade with other partners is ignored. For example, using a (Bergstran 1985) gravity model, Gould (1998) estimates the effects of NAFTA on Canadian, Mexican and U.S. bilateral trade flows. Quarterly data for 1980-1996 are used to estimate equations for imports and exports expressed in growth-rate form (log first-differences). The impacts of each country's real GDP, price indices, and real exchange rates are measured; changes in tariff preferences not associated with NAFTA are controlled for with dummy variables. Gould finds that NAFTA had a significant impact on the U.S.-Mexico trade (in both directions), but not on U.S.-Canada or Canada-Mexico trade. Little to no evidence of trade diversion attributable to NAFTA is found.

A similar approach is employed by Agama and McDaniel (2002) who use data on U.S.-Canada and U.S.-Mexico trade for 1983-2000 to estimate U.S. import and export demand equations. Their goal is to discern the effect of preferential tariff treatment on the volume of aggregate trade, for which they calculate the Fisher Ideal tariff index as a share-weighted geometric average of sector-specific tariff rates. They find that most of the variation in import demand is explained by changes in U.S. income (GDP) and the nominal exchange rate. Agama and McDaniel report that U.S. demand for Mexican goods was 0.1 percent higher between the last quarter of 1993 and the end of 2001 than for the entire sample period, but stop short of attributing this difference to NAFTA. As expected, U.S. import demand for Mexican output is sensitive to tariff changes: a one percent increase in the U.S. tariff preference for Mexico is associated with approximately 18.6 percent greater U.S. import demand when controlling for the Mexican peso crisis. They also find that the responsiveness of U.S. imports to tariff preference was greater during the NAFTA years. On the U.S. export side, Agama

and McDaniel find that Mexican demand for U.S. exports also responds positively to changes in tariff preference, but the effect is smaller than that for U.S. imports.

A sharply contrasting set of results – to those reported by Fukao et al. (2003) and many others – is obtained by Romalis (2001) who uses a clever approach to detect trade creation and trade diversion. Romalis studies the impact of NAFTA and the Canada-U.S. Free Trade Agreements (CUSFTA) on the volume of trade between U.S. on the one hand and Canada and Mexico on the other. Changes in tariff preferences extended by the U.S. to its North American trading partners are observed across many commodities as well as over time. He develops a theoretical model of bilateral trade in which trade is driven by consumers' preference for variety. The model is applied to annual data on 6,874 HS 8-digit level commodities for 1989-2000. To investigate the trade-creating or trade-diverting effects of the preferential trade agreements, Romalis considers trade between the U.S. and a set of countries with which tariff preference has remained relatively stable throughout the period and trade between the European Union (EU) and the same set of countries. He finds that NAFTA was primarily trade diverting: most of the increased trade with Canada and especially that with Mexico came at the expense of trade with other countries; moreover, this trade diversion would not have happened in the absence of NAFTA. No evidence of trade creation is found.

The above brief survey of the existing literature suggests that there is some disagreement on empirical grounds about the likely impact of NAFTA on trade creation and trade diversion, both among NAFTA members and with respect to other countries. In what follows, we attempt to address these issues further by considering a narrower set of traded commodities, but one in which changes in trade patterns occasioned by NAFTA are likely to be more discernible due to more pronounced changes in tariffs.

This paper extends the literature and especially the approach suggested by Fukao et al. (2003) in two major ways. First, we introduce the effects of fluctuating exchange rates as a factor determining changes in countries' shares of U.S. imports. The significance of currency exchange rates to trade flows is, of course, well-known, yet many recent papers fail to consider it. With respect to trade in textiles, Chmura (1987) has shown that exchange rates play a crucial role. Second, we go beyond examining NAFTA's impact on U.S.-Mexico and U.S.-Canada bilateral trade flows and assess the differential effect the trade pact has on non-North American textile exporters. This allows us to draw more definitive conclusions about the "trade diversion" property of NAFTA.

### **3 Theoretical Background and Empirical Approach**

We modify the partial-equilibrium trade model originally put forth by Fukao et al. (2003) to include the impact of currency exchange rate fluctuations. The model has  $z$

industries in  $N$  countries. The (endogenously determined) number of firms operating in industry  $z$  of country  $n$  is denoted by  $H_{z,n}$ . A representative household in country  $j$  solves the following problem:

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

subject to

$$\sum_{z=1}^Z \sum_{n=1}^N \sum_{h=1}^{H_{z,n}} p_{z,n,h} e_{n,j} T_{z,n,j} \Omega_{z,n,j} c_{z,n,h,j} = Y_j \quad (2)$$

where  $c_{z,n,h,j}$  is country  $j$ 's consumption of output by industry  $z$ 's firm  $h$  in country  $n$ , and  $\theta_z$  is the elasticity of substitution between different firms' outputs within industry  $z$ .  $\eta_z$  denotes the expenditure share of industry  $z$ 's output in total expenditure. Firm  $h$ 's output's f.o.b. price in country  $n$ 's industry  $z$  is  $p_{z,n,h}$ , measured in country  $n$ 's currency. The exchange rate  $e_{n,j}$  is units of country  $j$ 's currency for one unit of  $n$ 's currency.  $T_{z,n,j}$  is one plus the effective tariff rate of country  $j$ 's imports of the output of industry  $z$  in country  $n$ . Transportation costs are modelled using the standard iceberg approach, where  $\Omega_{z,n,h}$  is the c.i.f./f.o.b. factor ( $> 1$ ) to ship industry  $z$ 's output from country  $n$  to country  $j$ . Country  $j$ 's national income is denoted by  $Y_j$ .

The model yields the following estimable relationship between country  $i$ 's share of textile imports in U.S. total imports and wages, trade costs, and currency exchange rates:

$$\ln s_{it} = \beta_0 + \beta_1 \ln w_{it} + \beta_2 \ln T_{it} + \beta_3 \ln e_{it} + \varepsilon_{it} \quad (3)$$

where  $w$  is the labor wage,  $T$  is one plus the effective tariff applicable to imported textiles, and  $e$  is the real exchange rate;  $i$  indexes countries and  $t$  — time in years.<sup>2</sup>

Two noteworthy points are in order. First, equation (3) is a basic model and can be modified in various ways; for example, to estimate the regional effects of NAFTA on countries outside of North America. Second, use of the multi-industry model described above provides a good degree of flexibility in its application to various contexts. For example, in the following sections, we first consider industry-wide textile trade and then sector-level trade in individual textile commodities, where 4-digit SIC sectors can be thought of as “industries” — indexed by  $z$  — in our model.

## 4 Data

The data on trade in textiles is extracted from the *US Bilateral Manufacturing Imports and Exports by SIC4 (1987 revision), 1989 to 2001* dataset provided by Peter

<sup>2</sup>See Appendix A and the Fukao et al. (2003) paper for a detailed description of the model.

Schott. That data in turn uses Robert Feenstra’s import and export data as a source.<sup>3</sup> Our dependent variable, log of import share of country  $n$  in U.S. total imports of textiles in year  $t$  is computed as a natural log of the ratio of customs value of general imports to the total customs value of general imports from all countries for that year. The tariff series is calculated as follows: the implied tariff rate for each 4-digit sector country and year equals the ratio of duties collected to the dutiable value of imports. We use the natural log of one plus this implied rate in our empirical analysis.<sup>4</sup>

Data on real GDP per capita, used to proxy the effect of labor wages, come from the most recent version of the Penn World Table (PWT) (Heston et al. 2002). The real exchange rate series is constructed using the nominal exchange rate values (also from PWT) and data on countries’ Consumer Price Indices (CPI), obtained from the International Monetary Fund’s *International Financial Statistics*. Table 2 displays the descriptive statistics for these variables.<sup>5</sup>

Table 2: Descriptive Statistics

Variable	Mean	Std. Dev.	Min.	Max.
IMPSHARE	0.0159	0.0264	$0.2214 \times 10^{-6}$	0.1409
RGDPPC	10364.226	8795.21	681.07	43989.44
RXRATE	22862.837	399831.126	0.01433	9876193.62
TARIFF	0.0953	0.0484	$0.2451 \times 10^{-3}$	0.4471
XPRT_TAR	0.00186	0.00789	$0.1523 \times 10^{-8}$	0.1541

*Notes:* IMPSHARE is a country’s share in U.S.’s textile imports (the dependent variable), RGDPPC is real GDP per capita, RXRATE is real exchange rate, TARIFF is the effective tariff rate, and XPRT\_TAR is sector  $z$ ’s share in country  $i$ ’s total exports to U.S. multiplied by TARIFF. All variables enter the regression equation as natural logs.

## 5 Results

Estimation results are presented in Table 3. The dependent variable in each regression is  $\ln s_{it}$ , the natural log of country  $i$ ’s share in U.S. textile imports in year  $t$ . Model 1 is similar to that estimated by Fukao et al. (2003) for the manufacturing sector.<sup>6</sup>

<sup>3</sup>See Feenstra, Romalis and Schott (2002) for a detailed description. The US Bilateral Manufacturing Trade data are available for download on Peter Schott’s website at [http://www.som.yale.edu/faculty/pks4/sub\\_international.htm](http://www.som.yale.edu/faculty/pks4/sub_international.htm).

<sup>4</sup>See Bernard et al. (2004) for a detailed discussion of trade costs and an application of this technique.

<sup>5</sup>Since we are dealing with panel data, the overall mean and other descriptive statistics are rather meaningless. However, we include them to provide the reader with a sense of relative magnitude of the regressors we use.

<sup>6</sup>Following Fukao et al. we attempted to include the  $v_{z,n,1} \ln(T_{n,1}(t))$  term — that is, the share of country  $n$ ’s industry  $z$ ’s output in total exports from that country to the U.S. multiplied by the tariff — in our regression equations. This variable essentially gauges how important a given industry’s exports are to that country’s economy. While the inclusion of this variable yielded significant

The righthand side variables are log of real GDP per capita (to proxy wages), log of the real exchange rate, log of one plus the effective tariff rate, and a dummy NAFTA\_94, which takes the value of one for Canada and Mexico in 1994 and subsequent periods and zero everywhere else. The presence of both TARIFF and NAFTA\_94 is designed to separate the effects of independent changes in tariff rates from the systematic reductions in tariffs among North American countries due to NAFTA. The model is estimated as a two-way fixed-effects model — i.e., with a full set of country-specific and period-specific intercepts.

The tariff and exchange rate measures are significant and have the expected signs: a depreciation of country  $i$ 's currency against the U.S. dollar is associated with an increase in  $i$ 's share of U.S. textiles imports,<sup>7</sup> while an increase in the effective tariff rate against country  $i$ 's textile output lowers that country's share. The coefficient on NAFTA\_94 is positive and significant, indicating that the shares of Canada and Mexico increased after 1994.

The somewhat surprising result is the positive coefficient of real GDP per capita: one would expect a negative relationship between the country's prevailing wage rate and its importance in exporting textiles (a labor-intensive good) to the U.S. However, a number of caveats are in order. First, use of GDP per capita as a proxy for textile wages may not be appropriate if the wages in this sector are not close to the overall average wage rate in some countries.<sup>8</sup> Second, the wage distribution *across* countries' textile sectors may not be the same, forcing our measure to capture some other unintended effect. Third, it may be that the role of income is misspecified in our model: richer countries tend to make better trading partners (due perhaps to better infrastructure, property rights, and law enforcement), and production wages have little to do with this. In any event, we find that the conventional (and convenient) "cheap labor" argument frequently cited by U.S. textile manufacturers as the main cause of their woes, is not supported by evidence.

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coefficients in all our specifications, other estimates were not substantially affected; in fact, all retained their respective signs and approximate magnitudes. We removed this variable from the results and discussion presented here mainly to maintain consistency with Fukao et al.'s work, on which we build. A full set of these estimates is available from the authors upon request.

<sup>7</sup>Exchange rates are in terms of units of country  $i$ 's currency for one U.S. dollar.

<sup>8</sup>Proxying manufacturing wages in general by GDP per capita may be okay, but for any individual industry it is not guaranteed to be a good approximation.

Table 3: Estimation Results

	Model 1 2-way FEM	Model 2 2-way FEM	Model 3 2-way REM
Constant	-8.0379*** (8.513)	-8.1039*** (8.6)	-8.4762*** (8.165)
RGDPPC	0.2277** (2.247)	0.2345** (2.319)	0.2667** (2.495)
RXRATE	0.0907*** (2.891)	0.0912*** (2.915)	0.0955*** (3.069)
TARIFF	-2.5867** (1.974)	-2.5467** (1.95)	-2.6432** (2.027)
NAFTA_94	0.9958*** (2.655)		0.9033** (2.376)
NAFTA_93		1.0649*** (3.095)	
NAF_AFRICA			-0.3354 (1.613)
NAF_ASIA			-0.0145 (0.085)
NAF_CARIBB			0.0654 (0.251)
NAF_LATIN			-0.5203** (2.053)
NAF_WEUR			-0.1696 (1.054)
NAF_MENA			0.1429 (0.573)
NAF_AUSTRALIA			-0.8971* (1.729)
Adj $R^2 = 0.8867$			Adj $R^2 = 0.8871$

Absolute value  $t$ -statistics in parentheses

$N = 735$

\* significant at the 0.10 level, \*\* significant at the 0.05 level, \*\*\* significant at the 0.01 level.

To account for the effects of anticipation of the passage of NAFTA, Model 2 replaces NAFTA\_94 with its lagged variant, NAFTA\_93. While the magnitude of this variable's coefficient is slightly larger than in Model 1, other results are qualitatively and quantitatively the same.

We investigate the impact of tariff reductions under NAFTA on countries in different regions by constructing a full set of dummy variables similar to NAFTA\_94 for each of the eight major regions: Africa, Asia, the Caribbean, Latin America, East-

ern Europe, Western Europe, Middle East and North Africa, and Australia.<sup>9</sup> Each dummy takes the value of one for all countries in that region in 1994 and thereafter and zero everywhere else. The rightmost column in Table 3 reports these results. Eastern Europe is omitted to avoid perfect collinearity.<sup>10</sup>

The explanatory variables have the same signs and similar magnitudes relative to the simpler models discussed above, which provides some reassurance about the robustness of our approach. The addition of regional NAFTA measures, however, provides little explanatory power: all but three of the constructed dummies are statistically insignificant. The NAFTA\_94 variable is still significantly positive confirming the boost in Canadian and Mexican import shares, while NAF\_LATIN has a significant negative coefficient indicating that countries of Latin America saw a decrease in their shares of U.S. textile imports after 1994. The coefficient on Australia's dummy is also negative, but is only marginally significant.

The main result of interest in this model is the insignificance of the NAF\_ASIA's coefficient. It appears that NAFTA did not increase the shares of Mexico and Canada *at the expense* of Asian countries' textiles. In other words, we find no significant evidence of trade diversion attributable to the passage of NAFTA.

## 6 Concluding Remarks

In this paper we attempt to explain the observed changes in the pattern of textile trade between the U.S. and a large sample of other countries as a function of several factors, such as prevailing wages, currency exchange rates, and trade barriers. The textile industry presents a particularly interesting case study for a number of reasons. First, it is one of the manufacturing sectors arguably the most profoundly affected by the developments in international trade as well as recent changes in productivity. Second, recent studies have found the textile and apparel industries to behave differently from many other sectors when it comes to adapting to rapidly changing conditions. Third, several of those studies, as mentioned above, have concluded that a substantial amount of trade diversion is observed in textiles but not in the manufacturing sector in general, while others maintain that no evidence of trade diversion is apparent.

Using a modified model of bilateral trade, we examine the changes in countries' shares of U.S. imports of textile goods, and find little support for the conclusion that NAFTA is trade diverting — shares of Asian countries, for example, do not exhibit large declines accompanied by corresponding increases in Mexican and Canadian shares, which is what trade diversion would predict. We qualify this finding, however, by noting that trade creation, attributable to NAFTA may mask some trade diversion, which in this case would not be easily detectable.

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<sup>9</sup>A list of countries included in each region is available from the authors upon request.

<sup>10</sup>The model is estimated using a two-way random effects approach because the regional NAFTA dummies are collinear with fixed intercepts in the corresponding FEM specification. See Wooldridge (2002) for more on this issue.

We also find that low wages (approximated by real GDP per capita) do not appear to play a significant role in determining the source of textile imports into the U.S. Thus, the popular among industry leaders claim that “China is killing us with its cheap labor, with which we can’t compete” is not supported by empirical evidence.

## A Theoretical Model

From utility maximization given in (1), country  $j$ 's total demand of firm  $h$ 's output of industry  $z$ 's product in country  $n$  is

$$c_{z,n,h,j} = \frac{1}{\sum_{n=1}^N H_{z,n}} \left( \frac{p_{z,n,h} e_{n,j} T_{z,n,j} \Omega_{n,j}}{p_{z,j}} \right)^{-\theta_z} \frac{\eta_Z Y_j}{p_{z,j}} \quad (4)$$

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

$$p_{z,j} = \left\{ \frac{\sum_{n=1}^N \sum_{h=1}^{H_{z,n}} \left( p_{z,n,h} e_{n,j} T_{z,n,j} \Omega_{n,j} \right)^{1-\theta_z}}{\sum_{n=1}^N H_{z,n}} \right\}^{\frac{1}{1-\theta_z}} \quad (5)$$

Firms produce differentiated products using common (to that industry) technology and three inputs, labor ( $L$ ), capital ( $K$ ), and the sector-specific factor ( $Q_z$ ). The production function is given by

$$\sum_{j=1}^N c_{z,n,h,j} = \frac{1}{\alpha_z^{\alpha_z} \beta_z^{\beta_z} \gamma_z^{\gamma_z}} K_{z,n,h}^{\alpha_z} L_{z,n,h}^{\beta_z} Q_{z,n,h}^{\gamma_z} \quad (6)$$

Constant returns to scale are assumed by imposing  $\alpha_z + \beta_z + \gamma_z = 1$ . The firm also incurs fixed costs:

$$\delta_z = \frac{1}{\alpha_z^{\alpha_z} \beta_z^{\beta_z} \gamma_z^{\gamma_z}} K_{z,n,h,f}^{\alpha_z} L_{z,n,h,f}^{\beta_z} Q_{z,n,h,f}^{\gamma_z} \quad (7)$$

Firm  $h$  (in industry  $z$  located in country  $n$ ) solves the following optimization problem

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

subject to (7). Here  $L_{z,n,h,f}$ ,  $K_{z,n,h,f}$ , and  $Q_{z,n,h,f}$  represent the factor requirements to produce positive output and  $w_n$ ,  $r_n$ , and  $q_{z,n}$  are country  $n$ 's wage rate, rental price of capital, and price of sector-specific input, respectively. From profit maximization for firm  $h$  we get

$$p_{z,n,h} = \frac{\theta_z}{\theta_z - 1} MC_{z,n,h} \quad (8)$$

where marginal cost is a function of input prices:

$$MC_{z,n,h} = r_n^{\alpha_z} w_n^{\beta_z} q_{z,n}^{\gamma_z} \quad (9)$$

Fixed cost is expressed by

$$FC_{z,n,h} = \delta_z r_n^{\alpha_z} w_n^{\beta_z} q_{z,n}^{\gamma_z} \quad (10)$$

Firms are assumed to enter and exit the industry freely, so in equilibrium firms in industry  $z$  earn zero profit. The following condition must hold

$$\left( \frac{\theta_z}{\theta_z - 1} - 1 \right) MC_{z,n,h} \sum_{j=1}^N e_{n,j} c_{z,n,h,j} = FC_{z,n,h} \quad (11)$$

Using the expressions for marginal and fixed costs, equation (11) can be rewritten as

$$\frac{1}{\theta_z - 1} \sum_{j=1}^N e_{n,j} c_{z,n,h,j} = \delta_z \quad (12)$$

The wage rate and the rental price of capital are assumed to be given exogenously. The price of sector-specific input is determined by firm  $h$ 's demand and the fixed endowment level of  $Q_{z,n}$ . Fukao et al. (2003) show that the equilibrium price level of the sector  $z$ -specific factor is

$$q_{z,n} = \left( \frac{\gamma_z \delta_z \theta_z}{Q_{z,n}} r_n^{\alpha_z} w_n^{\beta_z} H_{z,n} \right)^{\frac{1}{\alpha_z + \beta_z}} \quad (13)$$

Consider the percentage of imports from country  $n$  in country  $j$ 's total imports of industry  $z$  products, denoted by  $s_{z,n,j}$ :

$$s_{z,n,j} = \frac{p_{z,n,h} e_{n,j} \Omega_{z,n,j} H_{z,n} c_{z,n,h,j}}{\sum_{i \neq j} p_{z,i,h} e_{i,j} \Omega_{z,i,j} H_{z,i} c_{z,i,h,j}} \quad (14)$$

Following Fukao et al. (2003), we assume that  $\Omega_{z,n,j}$  is constant over time. Let  $G(x)$  denote the growth rate of  $x$ . Then the growth rate of country  $n$ 's share of imports in U.S. (country 1) total imports is given by

$$\begin{aligned} G(s_{z,n,1}) &= G(p_{z,n,h}) + G(e_{n,1}) + G(H_{z,n}) + G(c_{z,n,h,1}) \\ &\quad - \sum_{i=2}^N s_{z,i,1} \left( G(p_{z,i,h}) + G(e_{i,1}) + G(H_{z,i}) + G(c_{z,i,h,1}) \right) \end{aligned} \quad (15)$$

We assume that movements of capital across countries equalize the rental price of capital. Collecting terms in equation (15) and using equations (4), (8), and (13) we get

$$\begin{aligned}
G(s_{z,n,1}) = & -\mu_{z,1} \left( G(w_n) - \sum_{i=2}^N s_{z,i,1} G(w_i) \right) \\
& -\mu_{z,2} \left( G(e_{n,1}) - \sum_{i=2}^N s_{z,i,1} G(e_{i,1}) \right) \\
& -\mu_{z,3} \left( G(T_{n,1}) - \sum_{i=2}^N s_{z,i,1} G(T_{z,i,1}) \right) \\
& +\mu_{z,4} \left( G(H_{z,n}) - \sum_{i=2}^N s_{z,i,1} G(H_{z,i}) \right)
\end{aligned} \tag{16}$$

where  $\mu_{z,i} > 0$ .

Fukao et al. (2003) apply the following two simplifying assumptions: (1) changes in the trade policies of other (than U.S.) countries have no effect on the number of firms in their trading partner's industry  $z$ , and (2) all firms in sector  $z$  have similar sales destination patterns. Let  $v_{z,n,j}$  be the share of exports of  $z$ 's products from country  $n$  to country  $j$  in country  $j$ 's total imports from  $n$ . Then the second assumption is equivalent to  $(v_{z,i,1}, v_{z,i,2}, \dots, v_{z,i,N}) = (v_{z,j,1}, v_{z,j,2}, \dots, v_{z,j,N})$  for all countries  $i$  and  $j$ .

With these assumptions the term on the last line of equation (16) can be 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 growth rate in the import share then becomes

$$\begin{aligned}
G(s_{z,n,1}) = & -\lambda_{z,1} \left( G(w_n) - \sum_{i=2}^N s_{z,i,1} G(w_i) \right) \\
& -\lambda_{z,2} \left( G(e_{n,1}) - \sum_{i=2}^N s_{z,i,1} G(e_{i,1}) \right) \\
& -\lambda_{z,3} \left( G(T_{z,n,1}) - \sum_{i=2}^N s_{z,i,1} G(T_{z,i,1}) \right) \\
& +\lambda_{z,4} v_{z,n,1} \left( G(T_{z,n,1}) - \sum_{i=2}^N s_{z,i,1} G(T_{z,i,1}) \right)
\end{aligned} \tag{17}$$

Integrating equation (17) over time forms the basis for the empirical analysis used in this paper:

$$\begin{aligned}
\ln(s_{z,n,1}(t)) = & \lambda_{z,n} - \lambda_{z,1} \left( \ln(w_n(t)) - \sum_{i=2}^N s_{z,i,1} \ln(w_i(t)) \right) \\
& - \lambda_{z,2} \left( \ln(e_{n,1}(t)) - \sum_{i=2}^N s_{z,i,1} \ln(e_{i,1}(t)) \right) \\
& - \lambda_{z,3} \left( \ln(T_{n,1}(t)) - \sum_{i=2}^N s_{z,i,1} \ln(T_{z,i,1}(t)) \right) \\
& + \lambda_{z,4} v_{z,n,1} \left( \ln(T_{n,1}(t)) - \sum_{i=2}^N s_{z,i,1} \ln(T_{z,i,1}(t)) \right) + \varepsilon_{z,n}(t)
\end{aligned} \tag{18}$$

The intercept  $\lambda_{z,n}$  captures the effects country- and sector-specific factors, such as  $Q_{z,n}$  and  $\lambda_{z,1}$ ,  $\lambda_{z,2}$ ,  $\lambda_{z,3}$  and  $\lambda_{z,4}$  are functions of the structural parameters of the model.

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