

## **An Industrial Analysis of Trade Creation and Diversion Effects of NAFTA**

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### **Abstract**

*Welfare effects of economic integration are often studied with aggregate data, and as such provide limited insights about the effects of trade pacts to individual economic agents in the free trade area. In this study a three-digit disaggregated commodity/industry data grouped under the Standard International Trade Classification is used to empirically assess the economic benefits of the North American Free Trade Agreement (NAFTA). Import demand elasticities from a dynamic demand model were used to estimate both trade creation and trade diversion effects of removing all tariff barriers from among NAFTA countries – US, Canada and Mexico. Results show that US imports of crude oil and petroleum products from Canada and most US imports from Mexico are more sensitive to domestic prices than to bilateral import prices. Further, results indicate*

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*that US will benefit the most from the initial trade effects of NAFTA, while Mexico will benefit the least. Specifically, US exporters of automatic data processing equipment, and pulp and waste paper products will benefit the most from increased trade with NAFTA countries. Mexican exporters of crude oil, and vegetables and fresh produce; and Canadian exporters of paper and paperboard products will be the most beneficiaries of NAFTA among exporters in these respective countries. (JEL Classification: F1, F2)*

## I. Introduction

The North American Free Trade Agreement (NAFTA) is expected to offer benefits to several sectors of the US, Canadian, and Mexican economies. Both producers and consumers in the NAFTA countries should experience economic changes attributable to free trade. Studies that have tried to estimate potential effects of economic integration used aggregate or semi-aggregate data, and as a result, were unable to address the specific impacts of integration at the industry level (Wonnacott and Wonnacott [1982]; Jacobs [1991]; Yamazawa [1992]; and Brown [1992]). Karemera and Koo [1994] used a one-digit Standard International Trade Classification (SITC) data, which is more aggregated than the three-digit SITC data used in this study. Thus, this study assesses more comprehensively the impacts of NAFTA at the industry level than other studies of its kind (*e.g.*, Brown, Deardorff and Stern [1992]; Klein and Salvatore [1994]; Doroodian, Boyd and Piracha [1994]; and Casario [1996]). Additionally, we employed a partial equilibrium model that specifically indicates whether trade expansion associated with NAFTA stems from trade creation (TC) or is due to trade diversion (TD).<sup>1</sup> In other words, our model provides results that inform firms in analyzed industries as to whether NAFTA would affect them favorably or adversely. Firms in domestic industries that experience TC are likely to come under competitive pressures while those whose industries experience TD should see expanded production opportunities. Though Wylie [1995] addresses the issue of NAFTA's TC and TD, he restricts his analysis exclu-

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1. Trade creation and (TC) and Trade diversion (TD) are defined in the following paragraph.

sively to the manufacturing industry. Thus, we provide pertinent information that can aid economic agents in several more industries within NAFTA countries to restructure and reallocate resources in ways that optimize production and output.

When a country embarks on a free trade pact with a limited number of countries, two possible outcomes are common: Trade creation (TC) and/or trade diversion (TD) (Balassa [1975]). TC occurs when lower priced imports from a country's free trade partners replace higher priced domestic substitutes. TD occurs when restricted imports from nonbeneficiaries are displaced by imports from beneficiaries.

Verdoorn [1960, 1972], and Baldwin and Murray [1977] provide methods for estimating potential TC and TD that are due to economic integration. Both methods compute TC under the assumption that imports are perfect substitutes for domestic production, as such they yield identical TC estimates. However, the two methods compute TD under different assumptions. Consequently, they yield different estimates of TD. Thus, the accuracy of TD estimates has been an issue (Sawyer and Sprinkle [1989]). Baldwin and Murray compute TD as the ratio of imports from nonbeneficiaries to domestic production, while Verdoorn computes TD as the ratio of beneficiary's imports to total domestic imports. Pomfret [1986] suggests that Baldwin and Murray's method yields unreasonably low estimates and thus recommends Verdoorn's method, which is used in our analysis, as superior.

NAFTA countries' industries that recorded the highest trade volumes (according to the United Nations' records) were selected to calculate individual industry's potential trade expansion following the removal of tariff and nontariff barriers from among NAFTA countries. We use price elasticities of import estimates to derive industry level impacts and compare the potential gains from free trade between and among NAFTA countries. Traded commodities used are broadly classified under the three-digit SITC. This classification is somewhat arbitrary, but it does however, group similar commodities under the same code. To accommodate contemporaneous effects across industries that are often associated with such classification, we use Seemingly Unrelated Regression (SURE) to estimate potential imports demand changes that are due to NAFTA. Further, the SURE technique permits the provision of insights on imports' relative behaviors across NAFTA

countries. For instance, we found that some US imports from both Canada and Mexico are more competitive in import markets while some are more competitive in domestic markets. We further document that NAFTA elicits trade expansion for NAFTA countries, and that the expansion is due more to TC than to TD.

Section II provides a summary of key provisions of NAFTA. This section also presents import demand specification and import price elasticities estimation. Section IV describes procedures used to compute TC and TD. Section V discusses the estimated results and the relative gains of free trade for specific industries in the US, Canada, and Mexico. The last section summarizes and concludes the study.

## **II. Major Provisions of the North American Free Trade Agreement**

NAFTA was signed in December 1992, and after ratification by the US Congress and the governing bodies of Canada and Mexico, it became effective in January, 1994. NAFTA provides participants the removal of barriers to trade in goods and services. It promotes fair competition, fairly unrestricted investment opportunities, and protection of intellectual property rights. Specifically, duties on automobiles and computers were immediately removed. Duties on all other goods were scheduled to be eliminated over staggered 5-, 10- and 15-year intervals. As of January 1994, nontariff barriers, such as quota and licensing arrangements were proscribed.

The removal of Mexican duties off of US and Canadian goods, for example, should have a major impact on the competitiveness of Mexican import-substitutes. The duty-free trade impact on US goods should be more significant than that on Canadian goods. This difference is due to the fact Mexican tariffs on imports from the US range from 10% for some goods to as high as 20% for automobiles, while the average tariff on Canadian imports is about 12.38%. Consequently, the removal of these tariffs would provide larger trade (profit) opportunities for US exporters to Mexico than for Canadian exporters to Mexico, all other factors assumed constant. This observation has indeed been confirmed by Doroodian, *et al.* [1994], who found that US trade balance vis-a-vis Mexico's improves marginally due to NAFTA. Brown, Deardorff and Stern ([1995], pp. 156-157) provide similar confirmation in a

forward-looking context, wherein they gauge the effects of other Western Hemisphere countries' ascension to NAFTA. They show how US trade volume would increase as additional western hemisphere countries joined NAFTA, as well as how the overall trade in the region would increase proportionately with the ascension of other countries.

Import-competitors in Mexico (*e.g.*, manufacturing firms) should experience some trade (profit) reduction in the early stages of NAFTA. Added pressure in the form of product price competition from US and Canadian produced imports, would force the reallocation of Mexico's scarce resources into productions where Mexico has comparative advantage over the US and Canada. On the other hand, the US average tariff on Mexican goods is about 4.6%. Therefore, removing US tariffs on Mexican goods should not elicit significant changes in Mexican exports to the US.

Table 1 shows the largest bilateral trade volumes between member countries of NAFTA by selected commodities. From 1990 to 1992 the average dollar value of selected US imports from Canada was \$18.61 billion (which constitutes 19% of total US imports from Canada) and the average from Mexico was \$7.41 billion (23% of US total imports from Mexico). The average Canadian imports of the selected commodity groups from the US was \$2.25 billion, while that of Mexican imports from the US, for the same period, was \$2.37 billion. For examples, US imports of Crude Oil from Canada accounted for about 5% of US total imports from Canada; and Mexican crude oil, which was the largest US imports from Mexico accounted for 14% of US total imports from Mexico. The largest Mexican imports from the US and Canada were Refined Petroleum products, and Passenger Motor Vehicles; and Paper and Paperboard products, respectively. The largest Canadian imports from the US were Vegetables and Fresh produce, and Paper and Paperboard. Interestingly, some of the sizeable Canadian imports from Mexico were Internal Combustion Engines and Automatic Data Processing Equipment, both of which seem to reflect transshipment trade (*i.e.*, Mexico does not yet possess the wherewithal to produce such items). Transshipment trade is where purchase of US or Japanese products by Canada, for instance, is effected through a firm located in Mexico.

Tariff is, by far, the most frequently used instrument of trade restriction. For example, the average tariff protection on the imports of NAFTA coun-

**Table 1**  
**Bilateral Trade Volume by Commodity Groups**  
**for the United States, Canada and Mexico**

**A. Selected US Imports from Canada (in 1,000 US \$)**

Commodity groups (SITC)	1990	1991	1992	Mean	Ratio <sup>a</sup>
Vegetables Fresh etc (054)	156,409	135,563	124,303	138,258	.010
Wood shaped sleepers (248)	2,950,035	2,887,892	3,730,063	3,189,330	.030
Pulp and waste paper (251)	2,662,976	1,983,148	1,894,059	2,180,061	.020
Crude petroleum (333)	4,704,218	5,214,462	5,488,354	5,135,678	.050
Petroleum product, ref. (334)	2,108,522	1,974,720	1,681,409	1,911,550	.020
Paper and Paperboard (641)	6,320,298	6,072,073	5,802,471	6,064,947	.060
Television Receivers (761)	133,424	148,016	153,500	144,980	.001
SUBTOTAL	19,035,882	18,415,874	18,874,159	18,764,804	.195
Total US import from Canada	93,688,864	93,585,013	101,241,410	96,171,762	.182
Total U.S. Imports from the World	<b>517,524,466</b>	<b>508,944,080</b>	<b>553,496,521</b>	<b>526,655,022</b>	

**B. Selected U.S. Imports from Mexico (in 1,000 US \$)**

Commodity groups (SITC)	1990	1991	1992	Mean	Ratio <sup>a</sup>
Vegetables Fresh etc (054)	977,969	867,630	76,723	871,074	.030
Wood shaped sleepers (248)	105,740	123,315	155,512	128,189	.004
Pulp and waste paper (251)	1,890	1,511	5,146	2,849	.000
Crude petroleum (333)	4,965,535	4,499,854	4,496,081	4,653,823	.140
Petroleum product, ref. (334)	315,671	312,792	309,914	312,792	.009
Paper and Paperboard (641)	97,636	48,602	61,560	69,266	.002
Pass motor veh. exc.. bus (781)	2,185,371	2,603,478	263,103	1,683,894	.050
SUBTOTAL	8,649,812	8,457,182	5,368,039	7,721,887	.235
Total US Imports from Mexico	30,769,707	31,771,519	35,865,045	32,802,090	.062
Total US Imports from the World	<b>517,524,466</b>	<b>508,944,080</b>	<b>553,496,521</b>	<b>526,655,022</b>	

**C. Selected Canadian Imports from the US (in 1,000 US \$)**

Commodity groups (SITC)	1990	1991	1992	Mean	Ratio <sup>a</sup>
Vegetables Fresh etc (054)	419,471	485,709	651,684	518,954	.007
Wood shaped sleepers (248)	362,364	304,860	443,998	370,407	.005
Pulp and waste paper (251)	215,648	162,912	253,408	210,656	.003
Crude petroleum (333)	97,578	24,678	29,098	50,401	.001
Petroleum product, ref. (334)	397,292	313,481	407,614	372,795	.005
Paper and Paperboard (641)	597,337	678,937	9,097,713	728,662	.010
SUBTOTAL	2,089,690	1,970,577	10,883,515	2,251,875	.030
Total Canadian imports from US	75,225,480	75,264,176	79,845,348	76,778,334	.645
Total Canadian Imports from the World	<b>116,453,476</b>	<b>118,088,355</b>	<b>122,583,705</b>	<b>119,041,845</b>	

**D. Selected Canadian Imports from Mexico (in 1,000 US \$)**

Commodity groups (SITC)	1990	1991	1992	Mean	Ratio <sup>a)</sup>
Paper and paperboard (614)	4,377	509	1,271	2,052	.001
Internal combust. pstrn. engin. (713)	260,795	193,121	116,437	190,118	.090
Automatic data proc. equip. (752)	143,523	106,230	85,670	111,808	.060
Electric. distribt. equip. nes. (773)	81,208	97,678	113,743	97,543	.050
Electric. mach. appart. nes. (778)	35,410	49,157	63,171	49,246	.020
Goods spcl. transport veh. (782)	19,174	35,999	59,631	38,268	.020
SUBTOTAL	544,487	482,694	439,923	489,035	.241
Total Canadian imports from Mexico	1,482,177	2,247,377	2,295,074	2,008,209	.020
Total Canadian imports from the World	116,453,476	118,088,355	122,583,705	119,041,845	

**E. Selected Mexican Imports from the US (in 1,000 US \$)**

Commodity groups (SITC)	1990	1991	1992	Mean	Ratio <sup>a)</sup>
Vegetables Fresh etc (054)	129,229	55,740	66,155	83,708	.003
Wood shaped sleepers (248)	150,375	201,405	261,442	204,407	.010
Pulp and waste paper (251)	317,318	284,465	295,641	299,141	.010
Petroleum product, ref. (334)	537,197	625,979	808,476	657,217	.020
Paper and Paperboard (641)	195,762	260,763	352,369	269,631	.010
Automatic data proc. equip. (752)	327,253	426,076	559,591	437,640	.010
Television receivers etc. (761)	121,226	118,656	141,563	127,148	.004
Goods, spcl. transport veh. (782)	80,356	113,605	141,720	111,893	.003
Pass. motor veh. exc. bus (781)	182,642	168,223	120,337	180,453	.010
SUBTOTAL	2,041,358	2,254,912	2,747,294	2,371,238	.070
Total Mexican Imports from US	27,449,501	32,252,759	39,651,431	33,084,563	.765
Total Mexican Imports from the World	29,559,541	38,121,500	61,924,225	43,235,089	

**F. Selected Mexican Imports from Canada (in 1,000 US \$)**

Commodity groups (SITC)	1990	1991	1992	Mean	Ratio <sup>a)</sup>
Paper and paperboard (641)	17,645	96,616	27,929	47,397	.080
Internal combust. pstrn. engin. (713)	15,460	4,602	7,941	9,334	.010
Automatic data proc. equip. (752)	797	364	1,010	724	.001
Television receiver, etc. (761)	103	21	90	71	.000
Electric. distribt. equip. nes. (773)	1,030	554	17	534	.001
Electric. mach. appart. nes. (778)	2,642	2,538	1,234	2,138	.003
Goods, spcl. transport veh. (782)	837	36,968	760	12,855	.020
SUBTOTAL	38,514	141,663	38,981	73,053	.120
Total Mexican Imports from Canada	390,370	677,527	810,842	626,366	.116
Total Mexican Import from the World	29,559,541	38,121,500	61,924,225	43,235,089	

Note: <sup>a)</sup> Represents ratios of average imports of each commodity group to the average total imports.

tries are 4.6% for the US, 12.38% for Canada, and 20% for Mexico. Nontariff trade restrictions, such as quota and voluntary import or export restrictions have only been sparingly used among NAFTA countries. Thus, the removal of tariffs alone, which form the basis for our analysis, would lead to the expansion of both individual commodities and overall trade volumes.

### III. Trade Creation and Trade Diversion Effects of NAFTA

The effects of removing or lowering trade barriers between two trade partners can be evaluated by estimating trade creation (TC) and trade diversion (TD) for each commodity for each of the participating countries. Most researchers use either the Baldwin and Murray [1977] method or Verdoorn's [1972] method to estimate TC and TD. The Baldwin and Murray methods for computing TC and TD effects are as stated in equations #3 and #4, respectively.

$$TC_i = M_i \eta_i (\delta t_i / 1 + t_i) \quad (3)$$

$$TD_i = TC_i (MN_i / V_i), \quad (4)$$

where:

$TC_i$  = trade creation effects for a selected commodity  $i$  in the NAFTA country,

$M_i$  = initial level of imports of commodity  $i$  from another NAFTA county,

$\eta_i$  = price elasticity of import demand for commodity  $i$ ,

$\delta_i$  = level of tariff cut in commodity  $i$  by the NAFTA country,

$t_i$  = initial level of tariff on commodity  $i$  in the NAFTA country,

$TD_i$  = trade diversion effects for a commodity  $i$  in the NAFTA country,

$MN_i$  = imports of commodity  $i$  from non NAFTA countries, and

$V_i$  = total domestic production of commodity  $i$  by the NAFTA country.

According to Verdoorn's method,  $TC$  is calculated similarly by equation #3. However, the Verdoorn estimate of  $TD$  is calculated differently from equation #4, as shown in equation #5:

$$TD_i = TC_i (M_i / (MN_i + M_i)), \quad (5)$$

where  $M_i/(MN_i + M_i)$  is the ratio of import  $i$  from another NAFTA country to the evaluated NAFTA country's total imports of a commodity group  $i$ . All other individual variables remain as described in equations #3 and #4 above.

For the empirical implementation of the integration theory, Baldwin and Murray's method requires each commodity group's domestic production, which is usually unavailable. Hence, the Verdoorn formula, which does not have a similar input requirement problem, is predominantly used to compute TD (Sawyer and Sprinkle [1989]).

#### IV. Specification of the Import Demand Behavior and Seemingly Unrelated Regression Equations (SURE)

The classical estimation of imports demand function for a country has traditionally been based on the following assumptions. Imports are directly proportional to the importing country's national income (or GNP), is inversely proportional to imports prices, and is directly proportional to prices of import-competing commodities. Hence, the following specification of the static classical imports demand model provides a basis for this study:

$$\ln Q_{it} = \lambda_0 + \lambda_1 \ln MP_{it} + \lambda_2 \ln DP_{it} + \lambda_3 \ln WP_{it} + \lambda_4 \ln Y_t + \ln e_{it}, \quad (1)$$

where  $Q_{it}$  is, for instance, the dollar volume of US imports from Canada or Mexico; alternatively, it could represent Mexican imports from the US or Canada;  $MP_{it}$  is the bilateral unit value index of imports;  $DP_{it}$  is the domestic wholesale price index of the importing country;  $WP_{it}$  is the imports' multilateral or world price index;  $Y_t$  is a measure of the importing country's national income. The subscript  $i$  identifies the selected commodity, which is alternately subbed into the model for each of the NAFTA countries. The subscript  $t$  identifies the sampling periods of the study.  $\ln$  designates natural log,  $\lambda$ 's are estimable parameters and  $e_{it}$  represents a disturbance term. Equation #1 hypothesizes that  $MP_{it}$  is negatively related to import demand,  $Q_{it}$ ; and that  $DP_{it}$ ,  $WP_{it}$  and  $Y_t$  are positively related to imports demand,  $Q_{it}$ .

Equation #1 differs significantly from other import demand specifications by allowing for variation in imports demand behaviors across industries or commodity markets. Indeed imports demand behaviors vary with

commodity markets. A specification that allows for different import behaviors is most amenable to capturing the potential impacts of NAFTA for each traded commodity. Such specification is appealing because each commodity or industry faces different levels of competition (*i.e.*, different commodities tend to be traded under different market structures), and each faces different resource endowment. Zellner's [1962] SURE is an efficient estimation technique that accounts for cross-industry correlation and variation. SURE estimation is also motivated by the increase degrees of freedom associated with a SURE system. Furthermore, since most imports exhibit dynamic behaviors, demand specifications should also be modified to reflect the dynamic behavior of imports. To incorporate dynamism in equation #1, a stock adjustment mechanism is assumed for the imports demand function (*e.g.*, see Karemera and Koo [1994]). For a complete derivation of dynamic imports demand functions, see Goldstein and Khan [1978] and Koo et al. [1991]. For example, a dynamic model applied to quarterly data would require the use of three quarterly dummy variables,  $D_{2t}$ ,  $D_{3t}$  and  $D_{4t}$ , which capture the seasonality pattern in import behavior across NAFTA countries.

Trade data used in this study are classified under SITC at the three-digit level. Given there are numerous commodities involved in trade at this level of disaggregation, we selected the ten most traded commodities among NAFTA countries. The SURE system in a dynamic framework includes ten equations, if all required variables were available, each by commodity and by country. For each country the dynamic import demand in a SURE system is specified as:

$$\begin{aligned} \ln Q_{it} = & \beta_0 + \beta_1 \ln MP_{it} + \beta_2 \ln DP_{it} + \beta_3 \ln WP_{it} + \beta_4 \ln Y_t \\ & + \beta_5 D_{2t} + \beta_6 D_{3t} + \beta_7 D_{4t} + \beta_8 \ln Q_{it-1} + \ln U_{it} \end{aligned} \quad (2)$$

where  $i = 1$  to  $N$  (commodity) for each NAFTA country and  $t = 1, 2, \dots, T$  (observation period).

Equation #2 is a dynamic system of SURE models. The individual models contain lagged dependent variables ( $Q_{it-1}$ ) and autocorrelated error terms ( $U_{it}$ ). Thus, following the Durbin-h statistics, the analysis is based on the Three Step Gauss-Newton (3SGN) estimation procedure developed by

Wang *et al* [1981].

Before discussing the estimation results, some remarks about expected signs of estimated coefficients are in order. A rise in an importing country's income should increase the levels of imports. The import price coefficient is expected to be negatively related to imports. A rise in domestic price index should lead to an increase in imports as lower priced imports displace high cost domestic output. An increase in the world price index should lead to an increase in bilateral NAFTA imports as substitutes of high priced competing imports from the rest of world. Conversely, an increase in the world price index can lead to a decrease in bilateral imports if the world price index is higher than the domestic price index.

## V. Results and Interpretations

The sampling period for the US, Canadian, and Mexican quarterly trade is 1980.I to 1993.I. Quantities and dollar values of traded goods were obtained from the United Nations Statistical Division Office and from Statistics Canada. Unit prices were obtained by dividing trade dollar values by trade quantities. Domestic wholesale price indexes, multilateral price indexes and GNPs were obtained from the International Financial Statistics of the IMF. The ten highest trade volume commodities for each of the NAFTA countries were selected. However, data limitations forced us to reduce the number of estimable equations to six or eight, and data limitation also forced the use of some commodity groups that were not among the ten largest trade volumes for the Canada-Mexico analyzes. The automobile trade between the US and Canada was excluded because there has been a free movement of automobiles between both countries under the 1965 Auto Pact. However, the auto trade with Mexico is included in the analysis.

The following subsection reports results of the estimation of the U.S. import demand from Canada and Mexico, the Canadian import demand from the U.S. and Mexican import demand from the U.S. The subsection *B* follows with the industrial analysis of the benefits of NAFTA including the trade creation and diversion effects of NAFTA the three NAFTA countries.

The estimation results show that most explanatory variables have the expected signs. All of the lagged dependent variables are less than unity;

suggesting that the estimated model is stable. Further, for all the SURE models for each participating country, most of the lagged dependent variables are significant at the 5% level. The seasonality variables indicate that most imports exhibit seasonal behavior. Additionally, results suggest that imports demand functions exhibit strong dynamism and seasonality, except for notable commodity groups, such as US Crude Oil and Petroleum imports from Canada.

The estimates of income elasticities of imports are used to assess the income effects on imports. Results for most commodities indicate that increase in imports due to increase in income alone, would be largest for the US because income elasticities for the US are larger than those for Canada and Mexico for most commodities. Mexico's record of least increase in imports due to increase in income alone, as shown by all income elasticities being less than unity, reflects the lower income-level status of Mexico relative to other NAFTA members. This finding also contrasts with those of past studies that used aggregate or semi-aggregate data. Moreover, using industries identified by the 3-digits SITC, shows that specific commodities are relatively more competitive domestically while others are more competitive internationally. This behavior is a reflection of both the relative size of internal markets, and of the appeal and competitiveness of specific industry products.

Tables 2, 3, 4 and 5 report estimated results by commodity model and NAFTA country. For the US models of imports from Canada and Mexico, most variables have the expected signs and are significantly different from zero at the 5% level. The system's  $R^2$  is 0.900 for US imports from Canada and 0.924 for US imports from Mexico; suggesting that included variables explain most of the variation in imports. A similar conclusion applies to the Canadian model of imports from the US. The system's  $R^2$  is 0.946, implying that included variables explain a large portion of the variation in the Canadian imports from the US. The Mexican models of imports from the US show that most of the variables have the expected signs. The estimated coefficients are significant at the 5% levels. The System's  $R^2$  of 0.855 also implies that the included variables explain significantly the variation in Mexico's imports from the US. Due to data limitation on Canada-Mexico trade, we could not estimate SURE models for Canada-Mexico transactions.

**Table 2**  
**Estimated Bilateral Trade Relationships: SURE Estimates (t-values) of**  
**US Imports from Canada, by Selected Commodities.**

Model	Constant	Income	Import Price	Domestic Price	World Price	Lagged Dependent	Qtr2	Qtr3	Qtr4
SITC 054: Vegetables, fresh, etc	-1.021 (-0.39)	1.002 (5.05)	-0.922 (-4.77)	0.069 (0.03)	0.132 (0.96)	0.163 (1.46)	0.248 (3.05)	0.389 (4.15)	0.0472 (0.51)
SITC 248: Wood shaped sleepers	3.337 (4.65)	0.133 (4.33)	-0.411 (-2.11)	0.064 (1.14)	0.026 (2.15)	0.406 (5.84)	0.257 (2.42)	0.248 (2.40)	1.701 (1.65)
SITC 251: Pulp and waste paper	7.431 (6.12)	0.413 (5.39)	-0.065 (-1.63)	0.022 (2.35)	0.111 (2.65)	0.199 (1.83)	0.060 (2.66)	0.051 (2.36)	0.055 (2.54)
SITC 333: Crude petroleum	-5.881 (-2.14)	1.485 (5.29)	-0.796 (-10.5)	1.843 (3.98)	0.032 (1.30)	0.001 (1.21)	0.045 (0.50)	-0.009 (-0.08)	-0.034 (-0.37)
SITC 334: Petroleum product, ref.	-1.288 (-0.45)	1.124 (4.17)	-0.334 (-1.34)	0.702 (0.98)	0.082 (0.59)	0.159 (1.18)	-0.056 (-0.78)	0.029 (0.41)	0.012 (0.15)
SITC 641: Paper and paperboard	4.060 (2.35)	0.668 (4.17)	-0.383 (-2.25)	0.069 (2.71)	0.038 (0.82)	0.443 (3.34)	-0.007 (-0.37)	0.028 (1.23)	0.043 (1.93)
SITC 761: Television receiver,	-5.161 (-1.14)	1.093 (1.97)	-0.166 (-0.45)	0.050 (1.62)	0.023 (0.90)	0.446 (4.15)	-0.172 (-2.72)	0.248 (4.16)	-0.183 (-2.57)

System  $R^2 = 0.900$  System MSE = 1.002 System  $d.f. = 294$

**Table 3**  
**Estimated Bilateral Trade Relationships: SURE Estimates (t-values) of US Imports**  
**from Mexico, by Selected Commodities.**

Model	Constant	Income	Import Price	Domestic Price	World Price	Lagged Depend.	Qtr2	Qtr3	Qtr4
SITC 054: Vegetables, fresh, etc.	1.546 (0.62)	2.788 (3.81)	-0.012 (-0.13)	0.037 (0.68)	-	0.084 (0.52)	-0.639 (-2.51)	-1.655 (-8.26)	-1.055 (-6.30)
SITC 248: Wood shapes sleepers	-28.915 (-6.48)	3.990 (7.12)	-0.871 (-6.39)	0.180 (2.64)	0.448 (1.04)	0.312 (3.09)	0.170 (0.96)	0.115 (0.65)	-0.550 (-3.25)
SITC 251: Pulp and waste paper	-44.946 (-4.04)	4.803 (4.36)	-0.306 (-1.65)	0.164 (1.09)	1.389 (1.68)	0.399 (3.20)	0.554 (1.29)	0.124 (0.29)	0.419 (1.01)
SITC 333: Crude petroleum	-8.189 (-2.29)	0.583 (1.30)	-0.285 (-4.11)	3.416 (5.95)	-	0.329 (3.75)	0.048 (0.70)	0.026 (0.38)	0.059 (0.88)
SITC 334: Petroleum product, ref.	4.900 (2.68)	0.402 (1.09)	-0.415 (-2.70)	0.061 (0.77)	-	0.524 (4.65)	-0.252 (-1.06)	0.457 (1.95)	0.121 (0.53)
SITC 341: Gas, natural & Manufac.	5.651 (3.75)	0.094 (0.68)	-1.368 (-2.65)	-	0.411 (0.49)	0.301 (2.26)	0.152 (0.36)	-0.398 (-0.95)	-0.025 (-0.62)
SITC 641: Paper and paperboard	-25.437 (-5.31)	3.558 (5.82)	-0.955 (-4.19)	0.081 (1.56)	0.200 (0.76)	0.337 (3.16)	0.037 (0.28)	-0.002 (-0.01)	0.101 (0.77)
SITC 781: Pass. motor Veh. exc. bus	-70.607 (-4.91)	8.708 (4.93)	-0.911 (-3.25)	0.298 (1.95)	0.274 (0.31)	0.521 (5.68)	0.733 (1.71)	0.536 (1.27)	0.598 (1.46)

System  $R^2 = 0.924$  System MSE = 0.985 System D.f. = 337

**Table 4**  
**Estimated Bilateral Trade Relationships: SURE Estimates (t-values) of Canadian Imports**  
**from the US, by Selected Commodities.**

Model	Constant	Income	Import Price	Domestic Price	World Price	Lagged Dependent	Qtr2	Qtr3	Qtr4
SITC 054: vegetables fresh etc	-0.378 (-0.13)	1.561 (5.01)	-0.003 (-2.35)	-0.128 (-0.68)	0.062 (0.45)	0.234 (2.07)	0.174 (3.34)	-0.677 (-9.65)	-0.153 (-2.56)
SITC 251: Pulp and Waste paper	-0.378 (-0.13)	0.754 (1.70)	-0.174 (-1.30)	0.266 (1.19)	0.001 (0.04)	0.522 (4.20)	-0.1176 (-1.11)	-0.201 (-1.33)	-0.341 (-1.73)
SITC 333: Crude petroleum	7.104 (2.46)	1.176 (0.20)	1.418 (6.71)	0.467 (1.12)	-	0.442 (4.67)	1.986 (2.85)	1.767 (4.19)	2.028 (4.04)
SITC 641: Paper and paperboard	18.941 (1.54)	0.499 (0.51)	-0.974 (-9.62)	0.011 (5.72)	-12.341 (-2.72)	9.355 (3.73)	-0.068 (-2.23)	-0.104 (-3.69)	-0.057 (-1.92)
SITC 713: Internal combust., pstn. engin	-3.199 (-1.22)	1.639 (3.14)	-0.151 (-1.83)	0.165 (1.21)	0.028 (0.62)	0.396 (2.97)	-0.077 (-1.29)	-0.398 (-4.47)	-0.296 (-2.28)
SITC 773: Electric. distribt. equip nes.	-10.48 (-2.91)	1.160 (3.57)	-0.033 (-2.77)	0.319 (1.70)	0.313 (1.70)	0.789 (15.6)	-0.032 (-0.38)	-0.179 (-3.15)	-0.019 (-0.33)

System  $R^2 = 0.924$  System MSE = 1.001 System D.f. = 206

**Table 5**  
**Estimated Bilateral Trade Relationships: SURE Estimates (t-values) of Mexican Imports from the US, by Selected Commodity**

Model	Constant	Income	Import Price	Domestic Price	World Price	Lagged Depend.	Qtr2	Qtr3	Qtr4
SITC 054: Vegetables, fresh, etc	-1.533 (-1.18)	0.018 (0.30)	-0.507 (-2.40)	0.645 (3.16)	2.666 (4.65)	0.676 (8.89)	0.208 (0.80)	0.441 (1.69)	1.326 (5.16)
SITC 248: Wood shaped sleeper	3.338 (4.65)	0.132 (4.33)	-0.411 (-2.11)	0.164 (1.14)	0.026 (2.01)	0.405 (5.85)	0.256 (2.42)	0.248 (2.42)	0.170 (1.65)
SITC 641: paper and paperboard	4.447 (4.26)	0.078 (2.06)	0.067 (0.24)	-	0.591 (2.88)	0.528 (4.94)	0.195 (1.77)	0.183 (1.71)	0.197 (1.85)
SITC 752: Atomic data proces. equip.	3.071 (8.87)	0.185 (4.83)	-0.963 (-25.83)	0.232 (2.40)	0.490 (2.93)	0.126 (4.31)	0.016 (0.19)	-0.010 (-0.11)	0.140 (1.55)
SITC 761: Television receivers	3.767 (12.22)	0.093 (3.03)	-0.830 (-21.16)	0.122 (1.48)	0.362 (2.46)	0.118 (3.02)	0.043 (0.53)	-0.119 (-1.50)	0.078 (0.22)
SITC 781: Pass Motor veh. exc. bus	-0.352 (-0.38)	0.166 (2.72)	-0.206 (-1.33)	0.151 (0.91)	0.872 (1.82)	0.771 (10.08)	0.149 (0.72)	-0.222 (-1.09)	0.345 (1.63)
SITC 782: Lorries, specialities etc	2.485 (2.19)	0.145 (4.02)	-0.665 (-1.42)	0.026 (0.36)	0.295 (1.21)	0.510 (6.32)	0.155 (1.44)	0.175 (1.67)	0.081 (0.77)

System  $R^2 = 0.953$  System MSE = 1.003 System D.f. = 294

### ***A. The US Import Demand from Canada and Mexico***

The estimated coefficients of the US import demand models have signs expected signs for most commodities. The price elasticities of US imports from Canada and Mexico vary widely across commodities. The magnitude of import price elasticities varies from -0.065 to -1.37 as shown in Tables 2 and 3. Elasticities that are greater than 1.0, in absolute values, indicate relatively high competition for the commodities concerned. Further, relative differences in elasticities between commodity groups indicate relative differences in potential import price responsiveness between the commodity groups. For example, the results in Table 2 suggest that US imports of Vegetables and Fresh Produce from Canada are more sensitive to bilateral import prices (-0.92) than US imports of Refined Petroleum Products from Canada (-0.33). However it is interesting to note that US imports of Crude Oil and Refined Petroleum Products from Canada reflect more competitiveness of US internal market for these products while the other products face a relatively more competitive import markets. In Table 3, US imports from Mexico exhibit similar behavior as imports from Canada. However, estimated elasticities indicate relatively higher import price sensitivity for the following commodity groups: Wood Shaped Sleepers; Crude Petroleum; Petroleum Products; Paper and Paperboard; Gas, Natural and Manufactures; and Passenger Motor Vehicles except Buses. Most US Imports from Mexico seems to be more responsive to bilateral price changes than to domestic price changes. This finding contrasts results from past studies that used aggregate trade data, and indicated a domestic markets were more competitive than international markets for all commodity groups (*e.g.*, Karemera and Koo [1994]).

### ***B. Canadian Imports Demand from the US***

Like the US import price elasticities, the Canadian price elasticities of import demand vary widely. Table 4 shows that Canadian import price elasticities of US goods range from -0.003 (for Vegetables and Fresh Produce) to 1.42 (for Crude Petroleum). Large bilateral import price elasticities relative to domestic price elasticities recorded for Canadian imports of Crude Oil and Paper Board indicate that those commodities are sensitive to bilater-

al prices than to domestic prices. The remaining commodities seem to be more sensitive to domestic price changes than to bilateral import prices. This latter result suggests the existence of relatively competitive markets for those domestic products.

### ***C. Mexican Imports Demand from the US***

Mexico has a developing economy with a large internal market. The import price elasticities are less than 1.0, suggesting that imports from the US would face less competition in Mexico. However, among commodity groups considered, the commodity groups of Automatic Data Processing Equipment and Television Receivers are relatively more sensitive to bilateral import price changes than to domestic price changes. Unlike imports behaviors in the US and Canada, few Mexican import commodities, such as the group of Paper and Paperboard, and Wood Shaped Sleeper, exhibits sensitivity to seasonality. The responsiveness of imports to Mexican income change is relatively inelastic for all commodities imported from the US, reflecting the much talked about relative lower income status of Mexico vis-a-vis US and Canada (*e.g.*, see Doroodian, *et al.* [1994]; Brown, *et al.* [1995]; and Klein and Salvatore, [1995]).

Finally, a comparison of the four bilateral import demand models shows that the US and Canada have similar import demand behaviors. Canada and the US are high income countries with comparable technologies. In particular, a rise in international inflation significantly increases Mexican imports from the US for most commodities; while the effects of international price changes on US and Canadian imports remain highly commodity specific. For example, Table 5 indicates that a rise in world prices is found to be associated with higher levels of most Mexican imports from the US; while the effects of the world price inflation on the US and Canadian imports is either insignificant or is commodity group-specific, with the importation of some increasing and that of others decreasing.

### ***D. Industrial Analysis of the Economic Benefits of NAFTA***

Trade Creation (TC) and trade diversion (TD) effects of NAFTA are calculated by using the estimated import demand elasticities and the 1990-1992

average imports levels shown in Table 1. The average tariff rates used were obtained from the Harmonized Tariff Schedule of the United States for the selected commodity groups. The Canadian and Mexican tariff rates were taken from the US Commerce Department's International Trade Division series. TD effects are calculated by using the Verdoorn model in equation #5. Table 6 (Panel-A, 4th column) shows that, under complete tariff cut following NAFTA, the US imports of both Paper and Paperboard products, and Vegetables and Fresh produce from Canada would increase by \$0.294 billion and \$0.0065 billion, respectively. These differing industry-specific trade increases occur in response to the removal of tariff barriers. This outcome is partly due to the replacing of higher cost domestic products with trade partners' imports (*i.e.*, NAFTA's TC effects of \$0.169 billion and \$0.006 billion for the Paper Products and Vegetables groups, respectively). The complete removal of trade barriers would equally contribute \$0.125 billion and \$0.498 billion, respectively, to the trade increase of the two commodity groups by displacing imports from non NAFTA countries with imports from NAFTA countries (NAFTA's TD effects are reported in the 3rd column). Clearly, TC is greater than TD for essentially all industries, suggesting increased competitive pressures for US firms in those industries.

Similarly, according to Panel-B of Table 6, completely eliminating tariff barriers in the US would increase US imports of Crude Oil from Mexico by \$0.106 billion as a result of TC effects and by \$0.012 billion as a result of TD effects. The largest increase in Canadian imports from the US would come from the group of Paper and Paperboard products, and would be \$0.031 billion from TC effects and \$0.018 billion from TD effects (for a total commodity trade expansion of \$0.049 billion) under the tariff cut following NAFTA. According to the commodity groups we evaluated for Mexico-Canada trade, Electrical Distribution Equipment and Automatic Data Processing Equipment would experience the highest Canadian import increase of Mexican products (\$0.100 billion and \$0.036 billion respectively, as in Panel-D).<sup>2</sup>

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2. It is worth mentioning at this point how trade expansion estimates for Canada-Mexico transactions were derived. Given we could not estimate SURE models for Canada-Mexico trades due to data limitation, we used price elasticity estimates from US-Mexico SURE models for similar commodities and other studies' estimates for other commodities.

**Table 6**  
**Potential Trade Creation and Diversion Effects of NAFTA Due to**  
**the Removal of Tariff Barriers for Selected Commodity Groups:**

**A. NAFTA Effects on Selected US Imports from Canada (in 1,000 US \$)**

Commodity group (SITC)	Trade Creation	Trade Diversion	Trade Expansion
Vegetables Fresh etc (054)	6,097.00	498.00	6,595.00
Wood shaped sleepers (248)	63,149.00	34,579.00	97,728.00
Pulp and waste paper (251)	97,122.00	104,875.00	201,997.00
Crude petroleum (333)	187,195.00	23,447.00	210,642.00
Petroleum product, ref. (334)	36,128.00	5,808.00	41,936.00
Gas, natural & manufac. (341)	129,854.00	89,379.00	219,233.00
Paper and paperboard (641)	169,212.00	125,539.00	294,751.00
Television Receivers (761)	1,240.00	64.00	1,304.00
<b>TOTAL EFFECTS</b>	<b>689,997.00</b>	<b>384,189.00</b>	<b>1,074,186.00</b>

**B. NAFTA Effects on Selected US imports from Mexico (in 1,000 US \$)**

Commodity group (SITC)	Trade Creation	Trade Diversion	Trade Expansion
Vegetables Fresh etc (054)	66,637.00	34,318.00	100,955.00
Wood shaped sleepers (248)	5,134.00	113.00	5,247.00
Pulp and waste paper (251)	106.00	0.00	106.00
Crude petroleum (333)	106,805.00	12,123.00	118,928.00
Petroleum product, ref. (334)	9,571.00	25.00	9,596.00
Gas, natural & manufac. (341)	21,727.00	1,320.00	23,047.00
Paper and Paperboard (641)	5,081.00	43.00	5,124.00
Pass. motor veh. except bus (781)	69,713.00	2,196.00	71,909.00
<b>TOTAL EFFECTS</b>	<b>284,774.00</b>	<b>50,138.00</b>	<b>334,912.00</b>

**C. NAFTA Effects on Selected Canadian Imports from the US (in 1,000 US \$)**

Commodity group (SITC)	Trade Creation	Trade Diversion	Trade Expansion
Vegetables Fresh etc (054)	47.00	28.00	75.00
Pulp and waste paper (251)	474.00	361.00	835.00
Crude petroleum (333)	4,241.00	61.00	4,302.00
Paper and paperboard (641)	31,806.00	18,170.00	49,976.00
Internal combus. pstrn. engin. (713)	1,311.00	6,234.00	7,545.00
Electric distribt. equip. nes. (773)	565.00	358.00	923.00
<b>TOTAL EFFECTS</b>	<b>38,444.00</b>	<b>25,212.00</b>	<b>63,656.00</b>

**D. NAFTA Effects on Selected Canadian Imports from Mexico (in 1,000 US \$)**

Commodity group (SITC)	Trade Creation	Trade Diversion	Trade Expansion
Paper and paperboard (641)	90.00	165.00	255.00
Internal combust. psth. engin. (713)	111.00	5,277.00	5,388.00
Automatic data proc. equip. (752)	1,157.00	35,360.00	36,517.00
Electric. distribt. equip. nes. (773)	878.00	99,317.00	100,195.00
Electric. mach. appart. nes. (778)	554.00	13,463.00	14,017.00
Goods, specl. transport veh. (782)	531.00	10,361.00	10,892.00
TOTAL EFFECTS	3,321.00	163,943.00	167,264.00

**E. NAFTA Effects on Selected Mexican Imports from the US (in 1,000 US \$)**

Commodity group (SITC)	Trade Creation	Trade Diversion	Trade Expansion
Vegetables Fresh etc (045)	1,959.00	1,689.00	3,648.00
Wood shaped sleepers (248)	2,576.00	1,821.00	4,397.00
Pulp and waste paper (251)	13,461.00	10,814.00	24,275.00
Paper and paperboard (641)	3,640.00	1,428.00	5,068.00
Automatic data proces. equip. (752)	18,906.00	7,627.00	26,533.00
Television receivers (761)	4,749.00	1,960.00	6,709.00
Passenger motor veh. (781)	4,141.00	1,897.00	6,038.00
Goods, spcl. transport veh. (782)	604.00	415.00	1,019.00
TOTAL EFFECTS	50,036.00	27,651.00	77,687.00

**F. NAFTA Effects on Selected Mexican Imports from Canada (in 1,000 US \$)**

Commodity group (SITC)	Trade Creation	Trade Diversion	Trade Expansion
Paper and paperboard (641)	\$518.00	\$17,913.00	18,431.00
Internal combust. psth. engin. (713)	\$210.00	\$3,817.00	4,027.00
Automatic data proc. equip. (752)	\$31.00	\$24.00	55.00
Television receivers etc. (761)	\$2.00	\$1.00	3.00
Electric. distribt. equip. nes. (773)	\$16.00	\$6.00	22.00
Electric. mach. appart. nes. (778)	\$67.00	\$83.00	150.00
Goods, spcl. transport veh. (782)	\$58.00	\$5,255.00	5,313.00
TOTAL EFFECTS	902.00	27,099.00	28,001.00

Results suggest the Canada-Mexico trade expansions would occur via TD rather than via TC, which supports the earlier observation that more transshipment trade seem to be occurring between Canada and Mexico than is occurring between Canada and the US. Mexico would increase its imports

of Television Receivers and Automatic Data Processing Equipment from the US by \$0.004 billion and \$0.018 billion respectively from TC effects, and by \$0.001 billion and \$0.007 billion respectively from TD effects (see Panel-E).

Mexico's largest imports from Canada would occur in the Paper and Paperboard commodity group (\$0.018 billion, Panel-F). The TD of this potential trade expansion would be \$0.017 billion versus TC of \$0.518 billion, which again corroborates the observation of substantial transshipment trade between Canada and Mexico. In fact, a comparison of Panels A and B, and Panels D and F seems to suggest that NAFTA would create new trades via US-Canada and US-Mexico transactions, and would divert (replace) non NAFTA trades via Canada-Mexico transactions.

In general, under a complete removal of tariff barriers, the trade volume of the analyzed commodities examined would experience an increase of \$1.074 billions in US imports from Canada, and an increase of \$0.334 billion in US imports from Mexico. Canadian imports of the selected commodities from the US and Mexico would increase by \$0.063 billion and \$0.167 billion, respectively. Mexico's imports from the US and Canada would increase by \$0.077 billion and \$0.028 billion, respectively. The differences in NAFTA trade effects reflect differences in import demand elasticities and sizes of internal markets among the NAFTA countries. Mexico has a larger internal market than Canada, but Mexico's price elasticities of import demands are more relatively inelastic than Canada's. Therein lies the explanation of the limited trade gains for Mexico recorded for the early stages of NAFTA's implementation. The US import demand behavior indicates that the US has a higher internal market and higher import market competition than the other NAFTA countries, thus suggesting higher potential trade benefits for the US at the early stages of NAFTA's implementation.

The effects of income change on imports under NAFTA yield mixed results. Income elasticities of imports show that the US and Canada would contribute to larger trade volume increases due to increase in income than Mexico would contribute. This income elasticity result is not surprising given US and Canada are high income economies while Mexico is not. The results show that the US would benefit the most under NAFTA in the early stages. Mexico would benefit minimally during the early stages of the agreement's implementation, but has a better potential than Canada to benefit

substantially from the trade area's expanding trade volume (i.e., due to the high absorptive capacity of Mexico's large internal market). The preceding deductions from our empirical results do not preclude countries like the US which are supposed to experience short-run NAFTA benefits from experiencing same or more NAFTA benefits in the medium- and/or long-run. In fact, we expect the income elasticities of imports for Mexico to become more important than it appears now when Mexico experiences growth in its pool of the middle-class. Perhaps, this growth would come as a result of the initial benefits offered by the implementation of NAFTA.

The foregoing analysis was limited to the ten most traded commodity groups among NAFTA countries. The results suggest differential competitive behavior in domestic and import markets for all commodities in the US, Canada and Mexico. A similar analysis may be expanded to other commodities groups.

## V. Conclusion

Overall, the removal of all tariff barriers from among NAFTA countries would increase NAFTA countries' trade to an estimated tone of about \$2 billions for the 6-10 most traded commodity groups studied. The estimated trade expansion would occur differently across countries and industries. Some industries would experience trade increase and others would experience trade contraction, notwithstanding the trade area's overall trade increase. Of the three NAFTA countries, US and Canada have developed economies with advanced technologies and similar cultural heritage. Mexico is a developing country with less advanced technologies, but it has a large internal market. Thus, the documented price and income elasticities estimates suggest that the US will benefit the most from initial trade increases attributable to NAFTA, while Mexico will benefit the least. This outcome is also consistent with the fact that US tariffs against Mexican products were already low compared to Mexican tariffs on US products.

As the results suggest, some industries in each country will experience expansion, when in addition to domestic demand, more of the industries' exports are demanded by other NAFTA countries. Some will experience contraction or limited expansion, when more imports from NAFTA coun-

tries than domestic substitutes are demanded domestically. The income and/or import price elasticities of individual industries suggest directional impacts of NAFTA that each examined industry should expect. For instance, among the commodities analyzed, the removal of tariff barriers will have greater effects on US imports of Vegetables from Canada, and of Gas, Natural or Manufactures from Mexico than other examined imports from these countries. NAFTA effects will be greatest on the Canadian imports of Crude Oil from the US. Automatic Data Processing Equipment, and Television Receivers would be the largest beneficiary industries or commodity groups among US exporters to Mexico. Canadian exporters of Paper and Paperboard products would benefit most from trade with Mexico, as it would in trade with the US. Furthermore, we document that NAFTA elicits more trade creation than it elicits trade diversion. This suggests NAFTA countries, especially the US and Canada already had in place low tariffs with non NAFTA member countries through various bilateral trade pacts.

In conclusion, it is important to note that our study addresses the static effects of NAFTA by assuming that industry (market) structures in all NAFTA countries remain unchanged. However, in the long run industries should change in adjustment to, for instance, changing availability of resources, evolving market structures, evolving technologies, accession of other Western Hemisphere's countries to NAFTA (as suggested by Brown, *et al.* [1996] and Casario [1996]). These changes may lead to more investments and more trade than expected. That is, in the long run actual effects of NAFTA could turn out to be larger for individual industries and countries than those suggested by our research.

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