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**A Decomposition of North American Trade Growth  
since NAFTA**

Russell H. Hillberry  
U.S. International Trade Commission

Christine A. McDaniel  
U.S. International Trade Commission

December 2002

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

# A Decomposition of North American Trade Growth since NAFTA

Russell H. Hillberry

Christine A. McDaniel\*

December 2002

## **Abstract**

Total U.S. trade with NAFTA partners has increased 78 percent in real terms since 1993—U.S.-Mexico trade alone is up 141 percent—compared to a 43 percent increase in U.S. trade with the rest of the world. In this article we compare the nature of U.S. trade growth with Canada and Mexico to growth in U.S. trade with non-NAFTA partners. We apply a simple decomposition of trade growth offered by Hummels and Klenow (2002) that provides insights into whether the United States is trading more of the same goods with NAFTA partners since 1993, or trading new products. The results provide evidence of both. A sizeable component of U.S. trade growth since 1993 can be explained by increases in the variety of products the U.S. imports from Mexico.

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\* The authors are with the Research Division, Office of Economics, U.S. International Trade Commission, 500 E Street, SW, Washington, DC 20436. McDaniel is the corresponding author and may be contacted by email at [cmcdaniel@usitc.gov](mailto:cmcdaniel@usitc.gov). Office of Economics working papers are the result of the ongoing professional research of USITC Staff and are solely meant to represent the opinions and professional research of individual authors. These papers are not meant to represent in any way the views of the U.S. International Trade Commission or any of its individual Commissioners. Working papers are circulated to promote the active exchange of ideas between USITC Staff and recognized experts outside the USITC, and to promote professional development of Office staff by encouraging outside professional critique of staff research.

## **Introduction**

U.S. trade with Canada and Mexico is up sharply since the North American Free Trade Agreement (NAFTA) went into effect. Since 1993, the year prior to NAFTA implementation, the value of U.S. imports from Canada and Mexico is up 100 percent in real terms, while U.S. exports to its NAFTA partners have risen by 77 percent. Such changes are substantially higher than measured changes in U.S. trade growth with the rest of the world.

Such sizeable changes in U.S. trade patterns warrant closer scrutiny. This paper offers some basic insights into the nature of U.S. trade growth since NAFTA. We apply a simple but informative approach to decomposing trade growth offered by Hummels and Klenow (2002). This decomposition can be used to establish some basic facts about the nature of trade growth over the period 1993 to 2001. This period is of interest because it begins just before NAFTA was implemented in 1994.

Trade growth can be broken down into three parts: more units of each good are traded, the unit prices of traded goods are rising, and the number of traded varieties is rising. A noticeable contributor to increased U.S. exports has been a net increase in the number of HTS lines in which trade occurred. Similarly, a large part of the increased imports from Mexico can be attributed to trade in a larger number of HTS lines.

## **Decomposition of Trade Growth**

Some basic facts about recent U.S. trade patterns are reported in Table 1. U.S. imports and exports with Canada and Mexico have increased at higher rates than that with non-NAFTA countries and U.S. trade has been reoriented toward NAFTA partners since 1993. In real (inflation-adjusted) terms, exports to Canada and Mexico are up by 35 and 93 percent, respectively, while exports to the rest of the world are up 20 percent. Imports from Canada are up by 69 percent and imports from Mexico are up by 190 percent, while imports from the rest of the world are up by 59 percent.

While the shift toward NAFTA partners is notable, this article offers an explanation of the nature of trade growth since 1993. The direct effects of NAFTA on trade growth are outside the scope of this article.<sup>1</sup> A methodology proposed by Hummels and Klenow (2002) is adopted in order to decompose trade growth into three potential sources of changes in trade volumes. First, trade growth may occur because more units of each type of good are traded. Second, the value of trade might change because the unit prices of traded goods are changing. Third, the number of traded varieties (measured in HTS lines at the 10-digit level) might also change over time.

**Table 1. Value of U.S. goods trade with NAFTA partners and Rest of World, 1993, 2001, in billions of 2001 dollars**

	1993	2001	Percentage Change
U.S. Exports to:			
Canada	107	145	35
Mexico	47	91	93
Rest of world	357	431	20
World	511	666	30
U.S. Imports from:			
Canada	129	217	69
Mexico	45	131	190
Rest of world	495	785	59
World	548	1133	70

Source: U.S. Department of Commerce and authors' calculations.

Trade growth to be explained is in the last column in table 1. The results of the decomposition of this trade growth are reported in Table 2, specifically, the percentage changes over 1993 to 2001 in the trade volume attributable to each potential source of change: changes in traded varieties and changes in

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<sup>1</sup> There is considerable academic interest in the question of whether NAFTA has been trade diverting or trade creating. Romalis (2001) argues for trade diversion, and finds little direct evidence of trade creation. The Canada-United States Free Trade Agreement, on the other hand, has been found to be more trade creating, on balance (Clausing, 2001).

products already traded, further divided into quantity and price changes.<sup>2</sup> These figures can be interpreted as the percentage changes in the respective trade volumes that would have occurred if the other two factors were constant. For example, U.S. export quantities to Canada increased by 47 percent. If real prices of U.S. exports to Canada had remained constant, as had the number of traded HTS lines, then U.S. exports to Canada would have risen by 47 percent because quantities exported rose by that amount. The reported percentage changes in prices and in HTS lines traded have similar interpretations. The product of the three components is the total trade growth.<sup>3</sup>

**Table 2. Decomposition of trade growth: Percent changes in bilateral trade attributable to changes in the number of traded varieties, quantities traded, and prices of goods traded**

	(Extensive Margin)	(Intensive Margin)	
	Trade growth attributable to an increase in the number of traded varieties	Change in quantities imported of goods traded in 1993	Change in average real price per unit of U.S. goods traded in 1993
U.S. Exports to:			
Canada	3.4	47.0	-7.1
Mexico	8.3	147.6	-17.8
Rest of world	0.0	20.9	-13.4
World	7.4	19.2	-13.2
U.S. Imports from:			
Canada	4.4	48.3	9.7
Mexico	23.8	74.4	46.6
Rest of world	6.9	45.7	0.9
World	20.7	49.3	6.3

Source: U.S. Department of Commerce and authors' calculations.

Column 1 measures the trade growth that can be attributed to a larger number of traded varieties.

<sup>2</sup> Adjustments to the data were made to account for HTS lines with missing quantity information and with unusually large price and quantity changes.

<sup>3</sup> For example, U.S. imports from Canada increased 69 percent (Table 1) and the product of the three components (Table 2) implies a 69.8 percent increase  $((1.044*1.483*1.097)*100=169.8)$ . The discrepancy between 69 and 69.8 is due to an adjustment for missing quantity data.

Hummels and Klenow label this the "extensive margin." The "intensive margin" measures trade growth within HTS lines that had trade in both 1993 and 2001. The intensive margin can be further decomposed into quantity changes or changes in the number of units traded (Column 2), and, price changes or changes in the average price of the traded units (Column 3).

Column 1 shows that the extensive margin has been an important source of trade growth, especially for U.S. imports from Mexico. Trade in new HTS lines has increased Mexican exports to the United States by 23.8 percent. The 8.3 percent increase in the extensive margin for U.S. exports to Mexico and the 3.4 percent increase for U.S. exports to Canada suggest that a growing number of U.S. industries have entered these markets since NAFTA. There is also a sizeable increase in the extensive margin for total U.S. imports.<sup>4</sup>

Changes in the extensive margin have important consequences for economic modeling of trade agreements and the interpretation of those results. Many commonly used trade policy models focus on the intensive margin, missing the effects of an increase in the number of traded goods on the affected economies. Most *ex post* studies of free trade agreements have also failed to consider the possible link between trade policy changes and growth along the extensive margin. A growing academic literature focuses on the benefits of product differentiation, and argues that growth in the extensive margin is more valuable to importing countries than growth in the intensive margin.<sup>5</sup>

Column 2 reports quantity changes, or changes in the average number of units sold within an HTS line that was filled in both 1993 and 2001. There have been sizeable increases in the quantities sold,

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<sup>4</sup> The academic literature typically treats growth in the number of HTS lines with positive trade as an economic process – a wider variety of goods can be profitably traded. Another explanation is that growth in tariff lines is an administrative or political process. HTS lines could be created as a part of trade negotiations, for example. If new tariff lines simply are the result of reclassification, the economic benefits of growth in the extensive margin would not be as large as if the new lines represented greater product differentiation in trade. We find considerable turnover in the range of products that are traded, suggesting that reclassification may be an important part of our measured growth in the extensive margin.

<sup>5</sup> Krugman (1981) and Romer (1994) offer theoretical models that incorporate extensive margins; Klenow and Rodriguez-Clare (1997) and Feenstra, Madani, Yang and Liang (1999) provide empirical evidence of variety effects and trade.

both by importers in the U.S. and by U.S.-based exporters in other countries. The quantity changes for both exports and imports were largest for Mexico: U.S. export quantities to Mexico rose by 148 percent, and U.S. import quantities from Mexico rose by 74 percent. The other markets also experienced double-digit percentage increases in the quantity measure.

Column 3 reports inflation-adjusted changes in the unit prices of U.S. exports and imports by market. There are two notable results in this column. First, U.S. export prices have fallen, relative to prices in the United States. Real prices of U.S. goods, as measured by the GDP deflator and reported by the BEA, have risen by 16.3 percent since 1993. The prices of U.S. exports have not risen as fast, resulting in a relative decline in the price of U.S. exports. Second, the average unit price of Mexican exports to the U.S. rose by a notable 46.6 percent. Such a sizeable change in relative prices may suggest the existence of sizeable changes in Mexican production costs, including exchange rate changes and production decisions.

### **Interpretation of Results**

Broadly, these results can be understood to differentiate between a widening (extensive margin) and a deepening (intensive margin) of the effects of international trade on U.S. industries. The distinction between price and quantity change offers a glimpse at the nature of trade growth within commodities that were already traded. Most of the post-NAFTA changes in U.S. trade patterns are increases in the quantity of goods traded in HTS lines that were already traded in 1993. In U.S. exports, quantity growth suggests that industries that were already exporting in 1993 are doing considerably more of it since NAFTA. On the import side, quantity growth suggests that industries facing import competition in 1993 are facing more of it now.

There has been a slight decline in the real prices of U.S. exports. This may have occurred because U.S. per capita incomes have raced ahead of most other countries' during this period, allowing U.S. consumers to buy higher quality goods than their foreign counterparts. If U.S. firms producing relatively

low quality goods have turned to export markets, in response, the average quality of U.S. exports would have fallen relative to U.S. consumption, reducing the relative price of exports. The relative price of U.S. exports falls fastest with respect to Mexico. It is possible that prior to NAFTA, American firms were targeting only the more affluent parts of the Mexican market. To reach a broader set of customers after NAFTA, U.S. firms might have chosen to lower their unit prices. Another explanation might be that production sharing has increased since NAFTA, and firms are selling earlier stages components to Mexico at lower prices.

U.S. import quantities from all sources have risen substantially. This suggests that U.S. industries competing with imports in 1993 face even more competition today. Higher U.S. real incomes might also have contributed to increased quantity growth, as import demand is sensitive to changes in income. Quantity changes from Mexico are the largest of the markets considered here.

Real prices of U.S. imports have not changed much, relative to inflation, with one exception: imports from Mexico. Real prices of U.S. imports from Mexico have risen substantially in the years since NAFTA. Hummels and Klenow suggest a possible explanation for rising prices of goods imported from a developing country. Relative price increases can reflect an upgrade in the quality of traded goods. Perhaps access to demanding consumers in the U.S. market has induced an increase in the average quality of Mexican output, allowing Mexican producers to command higher prices.<sup>6</sup>

One might have expected the rather large exchange rate movements that have occurred since NAFTA to have an effect on the relative prices, particularly in the case of Mexico. During the period of time we investigate, Mexico experienced much more rapid inflation than the U.S. The difference in inflation rates was sufficient to offset the nominal depreciation of the peso, leaving only a small change in the real exchange rate. We calculate only a 1% change (a real appreciation for Mexico) for the period

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<sup>6</sup> Schott (2001) also notes that unit values of U.S. imports are higher among rich countries than among poor countries. Over time, economic growth in Mexico might be expected to raise the unit prices of their exports to the U.S.

1993 to 2001.<sup>7</sup>

## Conclusion

The above ex post assessment of U.S. trade data reveals a broadening of international trade activity in North America. Commodities that were not exported to NAFTA markets in 1993 are exported now, and industries that did not face competition from NAFTA markets are facing it now. The largest changes in the extensive margin are in U.S. imports from Mexico. This suggests that a new set of industries has had to face competition from Mexican varieties. At the same time, consumers and manufacturers have been given a broader set of suppliers, which would reduce prices and improve the selection of goods available.

This article compares the nature of trade growth with Canada and Mexico to that with non-NAFTA partners. The descriptive analysis presented above is highly suggestive of quality and variety upgrading effects, particularly with respect to U.S. trade with Mexico. To the degree that free trade agreements lead to changes in the extensive margin, standard economic models that do not account for variety effects may underestimate the economic effects of free trade agreements. These findings also suggest that trade in new varieties should be considered when measuring trade effects of NAFTA. However, more formal econometric analysis is necessary in order to examine whether, and to what extent, each source of trade growth can be attributed to NAFTA.

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<sup>7</sup> IMF International Financial Statistics and authors' calculations.

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