Chapter 2

Trade Liberalization in the Western Hemisphere: Impacts on U.S. Agricultural Exports

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Experience with the regional trade agreements already in effect in the Western Hemisphere suggests that the trade effects of the FTAA will exceed the impact of its tariff and quota changes. For instance, to the extent that the FTAA requires closer cooperation on sanitary and phytosanitary issues, as is the case with the North American Free Trade Agreement (NAFTA), member countries are likely to adjust their import standards so that they do not restrict trade unnecessarily. Moreover, the FTAA is likely to have a myriad of indirect effects that ultimately expand trade, even though these changes may not be spelled out in the agreement. Many developments of this sort took place following the implementation of NAFTA and the Common Market of the South (MERCOSUR, or Mercado Común del Sur). Examples include increased investor confidence within the two regions, the further exploitation of scale economies, and the upgrading of transportation linkages along new and existing routes of trade.

To better understand the potential breadth of the FTAA's influence, this chapter assesses the impact that NAFTA, MERCOSUR, and related agreements have had on agricultural trade within the Western Hemisphere. Focusing on U.S. agricultural exports from 1980 through 1999, the chapter employs a series of modified gravity models, as suggested by Cheng and Wall (1999), to identify noteworthy changes in trade coinciding with these agreements. A main strength of this approach is that it distinguishes the impact of a trade agreement on U.S. exports to a specific country from the relative closeness of that country's bilateral trade relationship with the United States. However, the variables used to identify trade agreements may also capture the influence of other factors that were contemporaneous to these reforms.

To develop a complete picture of regionalism's impact on U.S. agricultural exports, separate models are estimated at the aggregate level and for 32 individual commodities. This analysis generates several important findings:

(1) Unilateral trade reforms undertaken by Mexico during the late 1980s and early 1990s have provided a sizable boost to U.S. agricultural exports to Mexico. According to gravity-model estimates, these unilateral reforms accounted for 39 percent of U.S. agricultural exports to Mexico from 1989 through 1999, or an average of roughly $1.7 billion per year. Thus, one of NAFTA's main benefits to U.S. agriculture has been to "lock in" reforms that Mexico had made prior to NAFTA.

(2) NAFTA's estimated influence on U.S. agricultural exports to Mexico is positive and statistically significant for four of the commodities studied (grapes, tobacco products, yarn and thread, and leather), and it is positive but statistically insignificant for 18 other commodities. Although the model differentiates NAFTA and Mexico's unilateral reforms, both were components of an integrated strategy for market reform that Mexico has pursued since the mid-1980s. Mexican trade liberalization, both unilateral and through NAFTA, accounted for an average annual increase in U.S. agricultural exports to Mexico of $3.1 billion during 1994-99.

(3) The estimated impact of the Canada-U.S. Free Trade Agreement (CFTA) and NAFTA on U.S. agricultural exports to Canada is not statistically significant. This finding,

which is observed both at the aggregate level and for all the individual commodities studied, may reflect the fact that most barriers to U.S.-Canada agricultural trade were relatively low prior to CFTA, while several important sectors—dairy, poultry, and eggs—were exempted from trade liberalization.

(4) MERCOSUR's application of a common external tariff has lowered some barriers to U.S. agricultural exports, creating new opportunities for trade. Relatively high levels of U.S. agricultural exports during the MERCOSUR period are observed at the commodity level for all four MERCOSUR countries and at the aggregate level for Argentina, Paraguay, and Uruguay. In the cases of Argentina and Brazil, several consumer-oriented food products from the United States appear to have benefited from tariff reductions linked to MERCOSUR's common external tariff, although the value of this trade is still small compared with exports to Canada and Mexico.

(5) MERCOSUR appears to have had a trade-diverting effect on U.S. wheat exports to Brazil. With the creation of MERCOSUR, Argentina has dramatically increased its share of the Brazilian wheat market, while U.S. wheat exports to Brazil have declined. Argentine wheat enters Brazil duty free, while U.S. wheat faces MERCOSUR's common external tariff for the product.

The rest of the chapter contains a methodological overview of the modified gravity models and an extensive discussion of their findings. Technical aspects of the models are discussed in appendix 2-1, while the International Bilateral Agricultural Trade (IBAT) database, the source of the export data used in the chapter, is profiled in appendix 2-2.

Gravity Model Methodology

In its most basic application, the gravity model of international trade posits that the level of exports from one country to another is a function of each country's gross domestic product (GDP) and its population, as well as the distance between the two countries. To estimate the trade effects of regional trade agreements, a number of "gravity modelers" (such as Frankel, 1997; Endoh, 1999; and Soloaga and Winters, 2001) have included additional explanatory variables that indicate a country's membership in a specific trade agreement or trade bloc. These variables, however, do not distinguish the influence of a trade agreement from the long-term, relative closeness of a specific bilateral trading relationship. Nor do they account for the strong likelihood that the impact of a trade agreement varies from one participant to another.

To overcome these shortcomings, this chapter features a different specification of the gravity model (table 2-1). Following Cheng and Wall, the modified models include two sets of fixed effects (variables with the value of one or zero) that respectively identify specific importing countries and specific years. The fixed effects for importing country play a crucial role in the analysis, as they control for the importing country's long-term bilateral trading relationship with the United States. This increases the likelihood that the trade-agreement variables capture the effects of those agreements, rather than the general closeness of a particular bilateral relationship. Moreover, the trade-agreement variables are country-specific in order to address the possibility that the impact of an agreement varies among its participants. Table 2-2 provides a definition of each trade-agreement variable.

While the modified gravity models provide an improved framework for assessing regional trade agreements, the trade-agreement variables may still capture the influence of unrelated developments that are contemporaneous to these accords. Unusual weather patterns are an obvious

Table 2-1—Comparison of basic and modified gravity models

Basic gravity model	
Dependent variable:	Log of exports from country *i* to country *j*
Explanatory variables:	Intercept Log of GDP of country *i* Log of GDP of country *j* Log of population of country *i* Log of population of country *j* Log of distance between country *i* and country *j* Other variables selected by researcher, such as dummy variables to denote trade flows corresponding to particular trade agreements
Econometric Approach:	Ordinary least squares (usually)
Modified gravity model, as used in this chapter	
Dependent variable:	Log of U.S. agricultural exports to country *i* in year *t* (in U.S. dollars)
Explanatory variables:	Intercept Log of GDP of country i in year t (in U.S. dollars) Fixed effects denoting importing country For example, the fixed effect for Mexico equals one if Mexico is the importing country and zero otherwise. For purposes of comparison, no fixed effect is included for Canada. Fixed effects denoting year For example, the fixed effect for 1998 equals one if the year is 1998 and zero otherwise. For purposes of comparison, no fixed effect is included for 1999. Trade-agreement variables – dummy variables that identify country *i*'s participation in a particular trade agreement in year t
Econometric approach:	Tobit

Source: Economic Research Service.

Table 2-2—Trade-agreement variables in the modified gravity models

NAFTA countries	
Unilateral-Mexico	Equals one for exports to Mexico during 1989-99 and zero otherwise
NAFTA-Mexico	Equals one for exports to Mexico during 1994-99 and zero otherwise
CFTA-Canada	Equals one for exports to Canada during 1989-99 and zero otherwise
NAFTA-Canada	Equals one for exports to Canada during 1994-99 and zero otherwise
MERCOSUR countries	
Full members:	
Argentina/1991-99	Equals one for exports to Argentina during 1991-99 and zero otherwise
Argentina/1994-99	Equals one for exports to Argentina during 1994-99 and zero otherwise
Brazil/1991-99	Equals one for exports to Brazil during 1991-99 and zero otherwise
Brazil/1994-99	Equals one for exports to Brazil during 1994-99 and zero otherwise
Paraguay/1991-99	Equals one for exports to Paraguay during 1991-99 and zero otherwise
Paraguay/1994-99	Equals one for exports to Paraguay during 1994-99 and zero otherwise
Uruguay/1991-99	Equals one for exports to Uruguay during 1991-99 and zero otherwise
Uruguay/1994-99	Equals one for exports to Uruguay during 1994-99 and zero otherwise
Associate members:	
Bolivia/1997-99	Equals one for exports to Bolivia during 1997-99 and zero otherwise
Chile/1996-99	Equals one for exports to Chile during 1996-99 and zero otherwise

Source: Economic Research Service.

example of an unrelated phenomenon that causes short-term changes in agricultural production and trade, and less experienced observers might incorrectly attribute these changes to one or more trade agreements. By having encompassing measures of the effects of trade-policy reforms, the modified gravity models may offer better estimates of their impact than models that focus narrowly on tariff reductions. However, these measures may be so broad that they capture the influence of factors that have little to do with trade agreements.

Empirical Findings

Total Agricultural Exports. Table 2-3 summarizes the results from the model of total U.S. agricultural exports. Although each variable denoting exports to Canada or Mexico during the CFTA/NAFTA period obtains a positive coefficient, only the coefficient for Unilateral-Mexico is statistically significant. Thus, the model supports the theory that Mexico's unilateral reforms have boosted U.S. agricultural exports to Mexico since 1989. It also suggests that the role of NAFTA in "locking-in" Mexico's earlier reforms was an important one.[1]

Figure 2-1 contrasts the actual and expected values of U.S. agricultural exports to Mexico from 1980 through 1999, based on the coefficients from the model. The figure illustrates that the modified gravity model does a reasonably good job of capturing the broad features of this trade, given the relative simplicity of the model and the coarseness of the trade-agreement variables. The largest difference between the actual and predicted values occurs in 1995, right after the sudden devaluation of the Mexican peso in December 1994. This suggests that the inclusion of an exchange-rate variable might improve the performance of the modified gravity model.

Using the coefficients for Unilateral-Mexico and NAFTA-Mexico, one may calculate the expected value of U.S. agricultural exports to Mexico when these variables are held to zero.[2] This simulation reveals that the model attributes a great deal of influence to Unilateral-Mexico and NAFTA-Mexico. Mexico's unilateral reforms account for 39 percent of U.S. agricultural exports to Mexico during 1989-1993, while the reforms and NAFTA together account for 59 percent of this trade during 1994-99.[3] These percentages correspond to additional trade flows worth an average of $1.3 billion per year during 1989-93 and $3.1 billion per year during 1994-99. The impact of the unilateral reforms alone averages $1.7 billion per year during 1989-1999.

The simulation also provides an estimate (albeit insignificant) of NAFTA's impact on U.S. agricultural exports to Mexico. According to the model, NAFTA accounts for 20 percent of this trade during 1994-99. This estimate is substantially larger than the assessment of ERS's 1997 NAFTA Report (Crawford and Link, 1997), which concludes that U.S. agricultural exports to Mexico in 1996 were about 3 percent higher than they would have been in NAFTA's absence. This analysis relied upon a computable general equilibrium model and only examined the first 3 years of NAFTA's 14-year transition to trade liberalization. Based on careful consideration of

[1] A sample with more observations of U.S. agricultural exports to Canada and Mexico during the CFTA-NAFTA period might afford more precise estimates of these coefficients. To explore this possibility, an alternative model was estimated using the data for all 32 commodity groupings, but this model also yielded insignificant coefficients for CFTA-Canada, NAFTA-Canada, and NAFTA-Mexico. However, these coefficients were significant in another alternative model, estimated using ordinary least squares, in which the original sample was limited to countries with agricultural imports from the United States of at least $500 million. The results from both models are available from the authors.

[2] Appendix 2-1 describes this calculation in greater detail.

[3] A one-tailed t-test supports the joint hypothesis that the coefficients of Unilateral-Mexico and NAFTA-Mexico in Model 1 are greater than zero at the 90-percent confidence level, even though NAFTA-Mexico's coefficient by itself does not pass such a test.

Table 2-3—Parameter estimates for gravity models of total U.S. agricultural exports

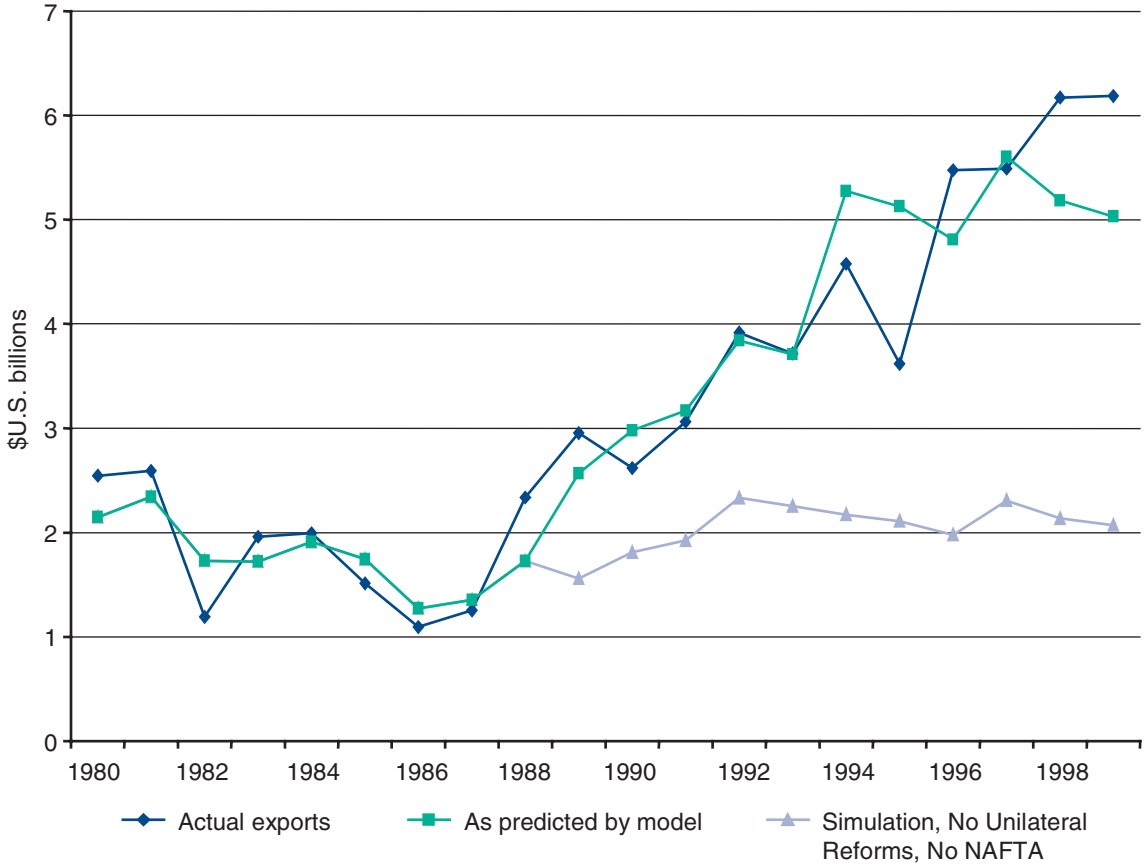
Variable	Parameter Estimate	Standard Error		Interpretation
Number of observations	2,540			
Number of left-censored observations	5			
Intercept	12.7975	0.3690	***	
Log of importing country's GDP	0.3183	0.0438	***	U.S. agricultural exports increase with the importing country's GDP
Participation in NAFTA or MERCOSUR				Impact on U.S. agricultural exports:
CFTA-Canada (1989-99)	0.3758	0.3758		Insignificant
NAFTA-Canada (1994-99)	0.3028	0.4081		Insignificant
Unilateral-Mexico (1989-99)	0.4987	0.3759	*	Positive
NAFTA-Mexico (1994-99)	0.3892	0.4080		Insignificant
Argentina, 1991-99	1.0117	0.4390	***	Positive
Argentina, 1994-99	0.7019	0.4764	*	Positive
Brazil, 1991-99	-0.9025	0.4397	**	Negative
Brazil, 1994-99	0.8627	0.4764	**	Positive
Paraguay, 1991-99	1.5880	0.4389	***	Positive
Paraguay, 1994-99	0.2927	0.4765		Insignificant
Uruguay, 1991-99	0.0012	0.4390		Insignificant
Uruguay, 1994-99	0.6360	0.4765	*	Positive
Bolivia, 1997-99	-0.3799	0.4219		Insignificant
Chile, 1996-99	0.1391	0.3770		Insignificant
Fixed effects for importing country				Compared with exports to Canada, U.S. agriculture is:
Argentina	-4.2950	0.3059	***	Less likely to export to Argentina
Bolivia	-3.0016	0.3403	***	Less likely to export to Bolivia
Brazil	-1.8809	0.3021	***	Less likely to export to Brazil
Chile	-2.4824	0.3032	***	Less likely to export to Chile
Mexico	-0.2212	0.3178		Just as likely to export to Mexico
Paraguay	-5.5870	0.3617	***	Less likely to export to Paraguay
Uruguay	-4.9627	0.3477	***	Less likely to export to Uruguay
Scale	0.6710			
Log-likelihood	-2,595.8			

n.a. = not applicable
Coefficients for fixed effects for year and some fixed effects for importing country are not reported.
Results of one-tailed *t*-test of parameter estimate's significance:
***Passes at 99-percent confidence level; **passes at 95-percent level; and *passes at 90-percent level.
Source: Economic Research Service.

NAFTA's commodity-specific provisions, ERS's 2002 NAFTA Report (Zahniser and Link, 2002) identifies several U.S. agricultural exports to Mexico whose trade volume during 1994-2000 increased by more than 15 percent as a direct result of NAFTA: rice, dairy products, cotton, processed potatoes, apples, and pears.

Figure 2-2 presents a similar simulation of U.S. agricultural exports to Canada in the absence of CFTA and NAFTA. Although the coefficients for CFTA-Canada and NAFTA-Canada are not statistically significant, the trade effects associated with these coefficients are large in value. Specifically, the model attributes an annual average of $2.3 billion of U.S. agricultural exports to Canada during 1989-1999 to the two agreements. Since 1985, U.S. agricultural exports to Canada have increased steadily and without interruption, a pattern that may correspond to the insignificance of CFTA-Canada and NAFTA-Canada.

Figure 2-1
Actual and expected values of U.S. agricultural exports to Mexico, 1980-1999

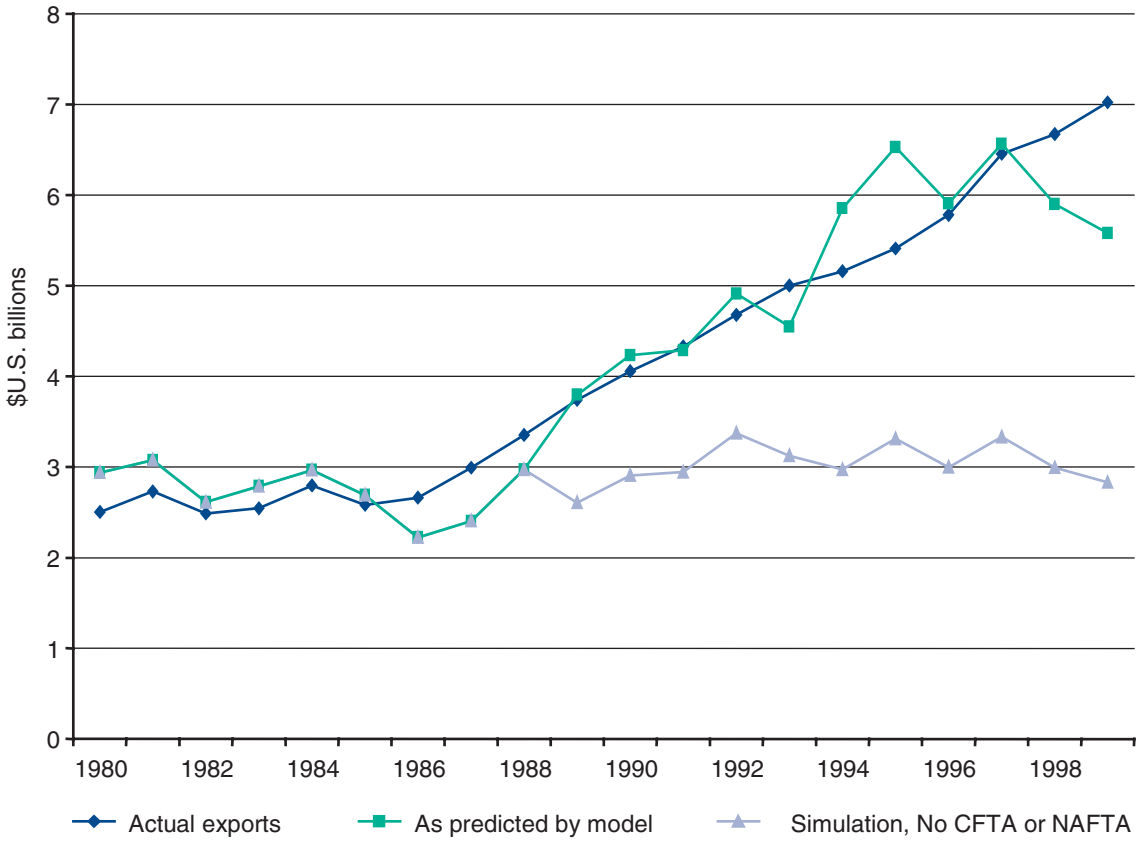


Source: Economic Research Service.

MERCOSUR appears to have had a trade-creating effect on U.S. agricultural exports to Argentina, Uruguay, and Paraguay. This trade has grown dramatically since MERCOSUR's implementation, but each of these countries is still a relatively minor market for U.S. agricultural products, especially when compared with Canada or Mexico. According to the IBAT database, U.S. agricultural exports to these three countries totaled $176 million in 1999, compared with $13.2 billion for Canada and Mexico combined. Argentina is the largest customer of U.S. agricultural products in MERCOSUR, with agricultural imports from the United States totaling $154 million in 1999. A simulation of this trade in MERCOSUR's absence suggests that the common market increased U.S. agricultural exports to Argentina by an average of $117 million per year during 1991-99 (fig. 2-3).

MERCOSUR's positive influence on U.S. exports probably stems from the common market's external tariff. In many instances, this external tariff is substantially lower than the tariffs previously applied individually by MERCOSUR's member countries. For example, Argentina's average applied tariff rate dropped from 20 percent to 10 percent between 1987 and 1995, while Brazil lowered its average from 58 percent in 1986 to 10 percent in 1995 (Stout and Ugaz-Pereda, 1998: p. 134). However, the model suggests that MERCOSUR has diverted U.S. agricultural exports away from Brazil, especially during 1991-93 (fig. 2-4). The initial decline in this trade corresponds not with the start of the common market in 1991 but instead with the year 1987. Thus, factors other than MERCOSUR may be partially responsible for the reduced level of exports. In addition, the commodity models analyzed below indicate that developments in wheat trade account for a substantial portion of the negative effect associated with MERCOSUR.

Figure 2-2
Actual and expected values of U.S. agricultural exports to Canada, 1980-1999



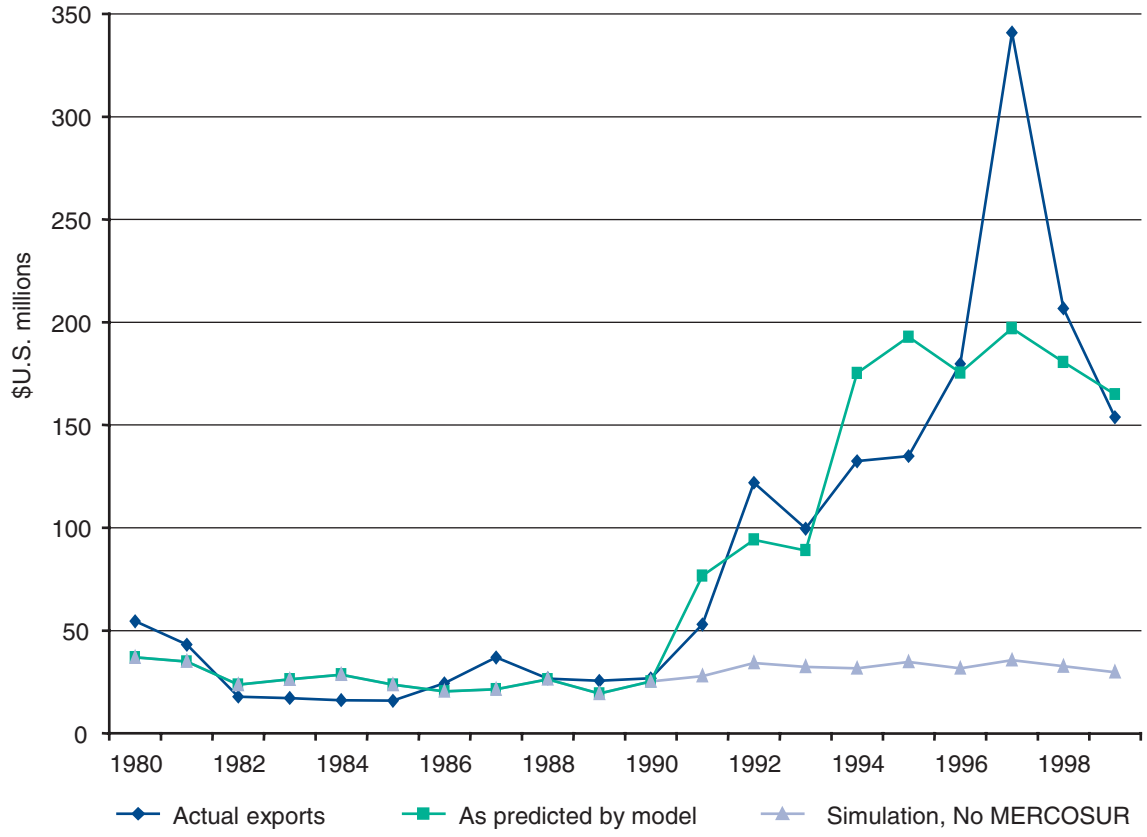
Source: Economic Research Service.

One additional result of interest lies among the fixed effects for importing country. Each fixed effect for the MERCOSUR countries is negative and strongly significant, a result that should not be surprising given that the excluded country for purposes of comparison is Canada. But the coefficient for exports to Mexico is statistically indistinguishable from zero. This suggests that the long-term U.S. trading relationship with Mexico is about as close as the long-term relationship with Canada, once the size of the two economies and the differing impacts of CFTA, NAFTA, and Mexico's unilateral reforms are taken into account.

Commodity Models. To explore the impact of regional trade agreements at the commodity level, we estimate 32 additional models, each for a specific commodity or group of commodities. Table 2-4 summarizes the results of these models with respect to the trade-agreement variables. As a group, these models provide additional support for the hypothesis that Mexico's unilateral trade reforms have strengthened U.S. agricultural exports to that country. Unilateral-Mexico obtains a positive and significant coefficient in 14 commodity models: beer, cotton, flowers and foliage, apples, rice, wheat, peanuts, macaroni, beef, pork, prepared breakfast food, soda and bottled water, tobacco, tobacco products, and tomatoes. In contrast, NAFTA-Mexico is positive and significant in only four commodity models (grapes, yarn and thread, leather, and tobacco products), but it is positive and insignificant for 18 other commodities.[4]

[4] The 18 commodities include cotton, cut flowers, fruit or vegetable juice, apples, corn, rice, wheat, peanuts, beef, poultry meat, plants and bulbs, prepared breakfast food, soybean oil, soybeans, sunflower seed oil, raw tobacco, tomatoes, and legumes.

Figure 2-3
Actual and expected values of U.S. agricultural exports to Argentina, 1980-1999



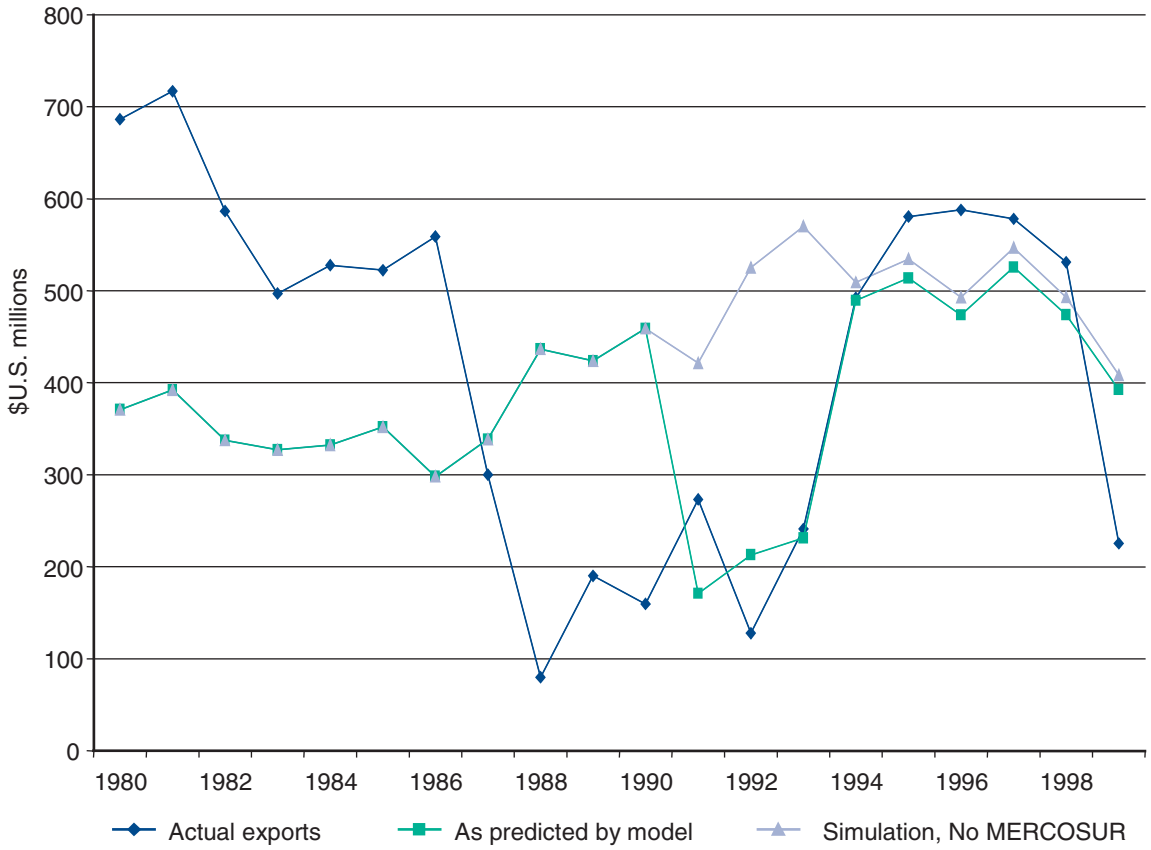
Source: Economic Research Service.

Given ERS's previous research about NAFTA, it is not surprising that grapes and yarn and thread are among the commodities where NAFTA-Mexico is significant. The 2002 NAFTA report describes Mexico's elimination of its import-licensing requirement for U.S. grapes as an important element of NAFTA. It also emphasizes the importance of NAFTA's rules of origin for textiles and apparel, which restrict NAFTA trade benefits to articles produced from fabric, yarn, thread, and fiber manufactured in the NAFTA countries. These rules are likely to have boosted demand of Mexican textile and apparel producers for U.S. yarn and thread.

But there are also many noteworthy absences from the list of commodities where NAFTA-Mexico is significant. The 2002 NAFTA report concludes that NAFTA provided a moderate boost (a 6-percent to 15-percent increase in trade volume during 1994-2000) to U.S. exports to Mexico of corn, oilseeds, beef, and sorghum. They also indicate that NAFTA provided a strong boost (more than 15 percent) to U.S. exports to Mexico of rice, dairy products, cotton, processed potatoes, apples, and pears. These findings suggest that the commodity models in this chapter would benefit from a NAFTA variable that more precisely measures the agreement's commodity-specific provisions.

Similar to the model of total agricultural exports, the commodity models provide no evidence that CFTA and NAFTA have had a significant impact on U.S. agricultural exports to Canada. The coefficient for CFTA-Canada is positive in 8 commodity models, while the coefficient for NAFTA-Canada is positive in 20 commodity models. However, none of these coefficients are statistically significant. Again, these results differ from ERS's commodity-level assessments of

Figure 2-4
Actual and expected values of U.S. agricultural exports to Brazil, 1980-1999



Source: Economic Research Service.

CFTA and NAFTA. The 2002 NAFTA report indicates that the two agreements have provided a moderate stimulus to U.S. exports to Canada of cotton and processed tomatoes and a strong stimulus to exports of beef and wheat products (flour, bulgur wheat, starch, gluten, and uncooked pasta). The general lack of significance of CFTA-Canada and NAFTA-Canada in the modified gravity models may be due to the relatively low level of Canadian protection that existed prior to CFTA against U.S. exports. Moreover, dairy products, poultry, and eggs were exempted from the process of U.S.-Canada trade liberalization. In any case, within the context of this chapter's modified gravity models, the size of the Canadian economy and the historically close trading relationship between the two countries are the main explanatory factors of U.S. agricultural exports to Canada.

The finding that MERCOSUR has boosted U.S. agricultural exports to Argentina and Paraguay is mirrored in several commodity models. Of the 15 commodity models in which Argentina is included, 3 models obtain a positive and significant coefficient for Argentina/1991-99: fruit or vegetable juice, edible nuts, and prepared breakfast food. For prepared breakfast food, MERCOSUR's positive influence on U.S. exports is even stronger during 1994-99, as evidenced by the positive and significant coefficient for Argentina/1994-99. Many of these exports benefited from tariff reductions linked to MERCOSUR's external tariff. During the 1980s, Argentine tariffs on dairy products, processed fruits and vegetables, fruit and vegetable juices, and other consumer-oriented agricultural products ranged from 20 to 38 percent. By 1995, the average tariff for consumer-oriented agricultural products had fallen to 14 percent (Stout and Ugaz-Pereda, 1998: p. 134).

Table 2-4—Overview of commodity-specific gravity models of U.S. agricultural exports

Model	Parameter					
	Unilateral-Mexico	NAFTA-Mexico	Argentina, 1991-99	Argentina, 1994-99	Brazil, 1991-99	Brazil, 1994-99
Total agricultural exports	Positive	Insig.	Positive	Insig.	Negative	Positive
Beer	Positive	Insig.	n.a.	n.a.	n.a.	n.a.
Cheese	Insig.	Insig.	n.a.	n.a.	Positive	Positive
Distilled alcoholic beverages	Insig.	Insig.	Insig.	Insig.	Positive	Positive
Cotton	Positive	Insig.	Insig.	Insig.	Insig.	Insig.
Flowers and foilage (cut)	Positive	Insig.	n.a.	n.a.	n.a.	n.a.
Fruit or vegetable juice	Insig.	Insig.	Positive	Insig.	Positive	Positive
Apples (fresh)	Positive	Insig.	n.a.	n.a.	Insig.	Positive
Grapes (fresh)	Insig.	Positive	n.a.	n.a.	Insig.	Positive
Corn	Insig.	Insig.	Insig.	Insig.	Insig.	Insig.
Rice	Positive	Insig.	n.a.	n.a.	Positive	Insig.
Wheat	Positive	Insig.	n.a.	n.a.	Negative	Insig.
Peanuts	Positive	Insig.	n.a.	n.a.	Positive	Insig.
Leather	Insig.	Positive	Insig.	Insig.	Insig.	Insig.
Live poultry	Insig.	Insig.	n.a.	n.a.	Insig.	Insig.
Macaroni	Positive	Insig.	Insig.	Insig.	n.a.	n.a.
Beef (fresh or frozen)	Positive	Insig.	n.a.	n.a.	Insig.	Positive
Pork (fresh or frozen)	Positive	Insig.	n.a.	n.a.	n.a.	n.a.
Poultry (fresh or frozen)	Insig.	Insig.	n.a.	n.a.	n.a.	n.a.
Milk and cream	Insig.	Insig.	Insig.	Insig.	Negative	Insig.
Edible nuts	Insig.	Insig.	Positive	Insig.	Insig.	Insig.
Plants and bulbs (live)	Insig.	Insig.	Insig.	Insig.	Insig.	Positive
Prepared breakfast food	Positive	Insig.	Positive	Positive	Positive	Positive
Soda and bottled water	Positive	Insig.	n.a.	n.a.	Positive	Positive
Soybean oil	Insig.	Insig.	n.a.	n.a.	n.a.	n.a.
Soybeans	Insig.	Insig.	Insig.	Positive	Insig.	Insig.
Sunflower seed oil	Insig.	Insig.	n.a.	n.a.	n.a.	n.a.
Tobacco (unmanufactured)	Positive	Insig.	Negative	Positive	Insig.	Insig.
Tobacco products	Insig.	Positive	Insig.	Insig.	Insig.	Insig.
Tomatoes	Positive	Insig.	n.a.	n.a.	n.a.	n.a.
Legumes	Insig.	Insig.	Insig.	Insig.	Negative	Positive
Wine	Insig.	Insig.	n.a.	n.a.	Insig.	Positive
Yarn and thread	Insig.	Positive	Insig.	Insig.	Insig.	Insig.

n.a. = not applicable
Sign of parameter estimate and estimate's significance according to a one-tailed *t*-test:
Insig. = Insignificant at 90-percent level
Positive = Positive coefficient, significant at 90-percent level
Negative = Negative coefficient, significant at 90-percent level
None of the parameter estimates for CFTA-Canada or NAFTA-Canada are significant.
Source: Economic Research Service.

In the model of U.S. soybean exports, the coefficient for Argentina/1994-99 is positive and strongly significant, which at first glance suggests that MERCOSUR has had a positive impact on this trade. However, the significance of this coefficient is more likely due to a severe drought that sharply reduced the size of Argentina's 1996/97 soybean crop (U.S. Department of Agriculture, Foreign Agricultural Service, 1997). As a result, U.S. soybean exports to Argentina, usually less than $200,000 per year, climbed to $124 million in 1997 and $10 million in 1998. Only the commodity model for raw tobacco shows that MERCOSUR has depressed U.S. exports to Argentina. U.S.-Argentina trade in this commodity was customarily small during 1980-1999, with exports to Argentina never exceeding $500,000 per year.

Paraguay appears in just seven commodity models, two of which indicate that MERCOSUR is a significant factor influencing U.S. exports to that country. First, the common market is found to have increased U.S. beer exports to Paraguay during 1991-99. This trade averaged $12 million per year during 1997-99, compared with just $204,000 per year during 1988-1990. Second, MERCOSUR is associated with lower U.S. exports of milk and cream to Paraguay. Like U.S. tobacco exports to Argentina, this trade was extremely small throughout the sample period, last exceeding $100,000 in 1983.

Although the model for total agricultural exports indicates that MERCOSUR has reduced U.S. exports to Brazil, the commodity models suggest that the common market has stimulated many aspects of this trade. The coefficient for Brazil/1991-99 is positive and significant for seven commodities: cheese, distilled alcoholic beverages, fruit or vegetable juice, rice, leather, prepared breakfast food, and soda and bottled water. In addition, the coefficient for Brazil/1994-99 is positive and significant for 11 commodities: cheese, distilled alcoholic beverages, fruit or vegetable juice, apples, grapes, beef, plants and bulbs, prepared breakfast food, soda and bottled water, legumes, and wine. In many instances, U.S. exports of these products are likely to have benefited from Brazilian tariff reductions associated with MERCOSUR's common external tariff. Stout and Ugaz-Pereda emphasize that Brazil's applied tariffs on agricultural products prior to MERCOSUR were much higher than Argentina's, with most tariff rates exceeding 40 percent.

The commodity models also provide evidence that MERCOSUR has limited some U.S. exports to Brazil, as the coefficient for Brazil/1991-99 is negative and significant in the models for wheat, milk and cream, and legumes. (The coefficient for Brazil/1994-99 is not negative and significant in any of the commodity models.) Among these products, milk and cream and legumes are not prominent candidates for trade diversion. Milk and cream exports to Brazil averaged less than $1 million per year during 1988-90 and only $3 million per year during 1997-99. Legume exports to Brazil actually have grown under MERCOSUR, from an average of $2 million per year during 1988-90 to $6 million per year during 1997-99.

Wheat, in contrast, is a completely different case. U.S. wheat exports to Brazil dropped from an annual average of $23 million during 1988-90 to just $4 million during 1997-99. Across the same two periods, Argentine wheat exports to Brazil surged from $183 million to $801 million per year. MERCOSUR's tariff preference partially explains this shift, as the common market's external tariff for wheat equaled 11.5 percent in 2002 (Svec, 2002: p. 12). But improved wheat yields in Argentina also help to explain the changing fortunes of U.S. wheat exports to Brazil. In fact, Argentine wheat producers have nearly closed the yield gap that separates them from their U.S. counterparts (Schnepf, Dohlman, and Bolling, 2001: pp. 30-31).

Conclusion

The modified gravity models in this chapter highlight a number of important recent developments in the pattern of U.S. agricultural exports. First and foremost, exports to Mexico during 1989-1999 are significantly higher than previous exports to Mexico, once the changing size of the Mexican economy and the historic closeness of the U.S.-Mexico trading relationship are taken into account. This result is obtained both at the aggregate level and for 14 different commodities. Unilateral reforms by Mexico to open its market in the late 1980s and early 1990s are responsible for most of the heightened level of this trade. The additional trade benefits secured by NAFTA appear to be less important to U.S. agricultural exports to Mexico, providing a significant stimulus only to grapes, yarn and thread, leather, and tobacco products. As a practical matter, the unilateral and regional trade reforms are both parts of the profound economic reorientation that Mexico has undergone since the late 1980s, and the two types of reform *together* are found to

have a significant impact on U.S. agricultural exports to Mexico. With the exception of one alternative model, none of the models associate the CFTA/NAFTA period with a significant change in U.S. agricultural exports to Canada. Previous ERS assessments of NAFTA's commodity-specific provisions (included those originally negotiated in CFTA) suggest that CFTA and NAFTA have had a much broader impact on U.S. agricultural exports to both Canada and Mexico.

The models suggest that MERCOSUR has had a mixed effect on U.S. agricultural exports. For all four countries, there are commodities where MERCOSUR is linked to increased U.S. exports, and at the aggregate level, MERCOSUR is found to have created trade in the cases of Argentina, Paraguay, and Uruguay. With respect to Brazil, however, a finding of trade diversion is obtained at the aggregate level and for milk and cream, legumes, and wheat. Among these commodities, wheat is the most likely case of trade diversion, as Argentina has dramatically increased its share of the Brazilian wheat market.

Care must be taken in the evaluation of these findings, as the variables that denote the participation of a country in a particular trade agreement also capture the influence of other contemporaneous factors. Incorporating additional variables that more fully describe international markets for specific commodities should improve the performance of the models in this chapter. Examples include volume measures of trade, actual transportation costs, levels of production by country, changes in yields, the amount of consumption, and quantitative measures of trade impediments. Of course, additional data collection usually comes at a cost, and one of the main attractions of gravity models as they stand is that their data requirements are relatively small. The next generation of gravity models is likely to depart from this tradition.

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