Impacts of NAFTA on U.S.-Mexico Agricultural Trade

Dale Colyer
West Virginia University

Abstract: Data for 1989-99 indicate that U.S.-Mexico trade has increased substantially under NAFTA. Regression analyses do not provide strong evidence that NAFTA has been an important factor since the data indicate a continuation of previous trends. NAFTA resulted in trade under TRQs for previously prohibited products and enabled other trade to continue increasing.

Keywords: NAFTA, Agricultural Trade, Mexico, Agricultural Imports, Agricultural Exports

JEL Codes: F140 Country and Industry Studies of Trade, F150 Economic Integration

Agricultural and Resource Economics
2040 Agricultural Sciences
P.O. Box 6108
Morgantown, WV 26506-6108
Phone: 304-293-4832 x 4472
FAX: 304-293-3752
email: dcolyer@wvu.edu

Paper presented at the Northeastern Agricultural and Resource Economics Association's annual meeting, Bar Harbor, ME, June 10-12, 2001

Impacts of NAFTA on U.S.-Mexico Agricultural Trade

Dale Colyer
West Virginia University

Introduction

NAFTA has been in existence since 1994 and with several years of data is feasible to begin to analyze its impacts on the patterns of trade in agricultural products between the United States and Mexico. However, since the agricultural part of the agreement is being phased in over a 15-year period, the full impacts cannot yet be determined. Furthermore, there was a serious economic crisis in Mexico in 1995-96 that affected that country's capacity for expanding its imports. In addition, both the U.S. and Mexican agricultural sectors are operating under new policies that are profoundly affecting those sectors, the 1996 Federal Agricultural Improvement and Reform (FAIR) Act in the case of the U.S. and the PROCAMPO and other reforms in Mexico (see Diego Quintana et al.). NAFTA also has resulted in a number of disputes and disagreements, including the dispute over Mexican exports of tomatoes to the U.S. However, implementation of the agreements generally has proceeded smoothly and trade in agricultural products and has tended to continue on the growth path initiated when Mexico began to open its markets in the early 1980's and which was enhanced when the country became a member GATT in 1986 and then joined the OECD in 1994.

While it is clear that agricultural trade between the two countries has continued to increase, determining the role NAFTA has played in that growth is complicated due to policy changes, existing trends, complexities of trade among the various commodities, and the impacts of multiple factors that influence production, prices, supply, demand and trade in each of the countries (Rosson 2000). However, de Janvry, Sadoulet, and Davis (1997) concluded that NAFTA positively affected trade in its first three years based on counterfactual evidence, i.e., on forecasts of trade derived from regression models using pre-NAFTA data which indicated that trade in the post-NAFTA period was higher than it would have been in the absence of NAFTA.

This paper analyzes trade between the U.S. and Mexico in both total agricultural products and for several of the more important commodities or groups of commodities traded by the two countries. Data from the ERS's international trade data base for 1989-1999 are used for the analysis; it should be noted that there are a very large number of agricultural products traded and that this analysis is limited to the more important in terms of values traded. After a brief review of NAFTA's agricultural provisions, the average pre- and post-NAFTA levels of trade are calculated, compared and analyzed for statistical significance. Then regression models are used to further analyze the impacts of NAFTA on trade. These models use a time trend variable with a dummy variable to represent post-NAFTA trade (1989-1993 = 0, 1994-1999 = 1) as well as price, exchange rate, and per capita income as explanatory variables with values or volumes of exports and imports as the dependent variables. In a second model a dummy variable was used to represent Mexican economic crisis (1989-1994 = 0, 1995-1999 = 1) instead of NAFTA. Although there was only one year of difference in the dummy variable, the results were very different. Finally, the counterfactual approach used by de Janvry, Sadoulet and Davis is extended to determine if the early results they found have continued through 1999.

Agricultural Provisions of NAFTA

Agriculture is covered in Chapter 7 of the NAFTA agreement. The primary objective of the agreement is to completely eliminate barriers to trade between the U.S., Canada, and Mexico with the agreement being phased in over a fifteen-year period starting January 1, 1994–it is to be fully implemented by 2008 (see Smith, 1997 or United States-Mexico Chamber of Commerce, 2000, for more details). Provisions include tariff reductions with immediate elimination of many and eventual elimination of all tariffs, market access through tariff rate quotas (TRQ) which are to be increased gradually (generally at 3 percent per year), elimination of non-tariff barriers through conversion to TRQs, agreement not to use trade distorting agricultural support programs or export subsidies (except to offset those of other countries), grade and quality standards procedures, sanitary-phytosanitary regulations, and rules on origin. The agreement also established procedures for handling disputes and disagreements.

Results and Discussion

Analysis of the data on U.S.-Mexico agricultural trade is divided into two sections. The first examines average levels of trade during a five-year pre-NAFTA period (1989-93) and a six-year post-NAFTA period; this division was largely the result of use of the ERS online database which had data for 1989-1999 at the time this study was being conducted. Data on both total value of trade (see Figures 1 and 2) and volumes (or in some cases values) of trade for the more important–in terms of 1998-1999 values–agricultural commodities traded (see Tables 1 and 2). The second part utilizes regression analyses to evaluate the impacts of NAFTA and other factors on the levels of agricultural trade for the total volume and for the selected important commodities and the last part uses regressions for the period before NAFTA to further test the effects of NAFTA.

The more important commodities exported to Mexico by the U.S. include the bulk grains, wheat, corn, soybeans, barley and rice as well as beef and poultry products. However, a wide variety of other products also are exported. The more important products in terms of value for 1997 and 1998, including agricultural production inputs, are shown in Table 1. Similar data for U.S. imports from Mexico are shown in Table 2 and include many fruits and vegetables as well as tropical products such as coffee, sugar, and cocoa. In terms of total value, U.S. exports tend to be more concentrated than imports since the latter are divided among a relatively large number of fruits and vegetables with none accounting for as large amounts as soybeans or wheat do for agricultural exports.

Pre- and Post-NAFTA Trade

The results of the pre- and post-NAFTA comparisons clearly indicate that total agricultural trade with Mexico, both total agricultural imports and exports, are substantially larger in the post-NAFTA era. The differences were statistically significant for both (Tables 3 and 4). Post-NAFTA agricultural exports of the U.S. to Mexico averaged nearly $2 billion more than in the five years preceding the agreement's implementation, with pre-NAFTA exports averaging over $3.1, while post-NAFTA they averaged nearly $5.1 billion for a 62 percent increase. U.S. post-NAFTA imports

from Mexico were about $1.5 billion greater with pre-NAFTA imports of around $2.5 billion and post-NAFTA imports of slightly over $4.0 billion, a 60.8 percent increase.

The results are similar for most of the individual products or groups of related products, although there was decreased trade for a few, generally minor, commodities. For most commodities, trade is measured in physical volume–generally in metric tons (hectoliters in the case of liquids)–rather than value. The differences were also statistically significant for most of the individual commodities or groups of commodities. However, the relative and absolute changes varied considerably from product to product and trade in some products was more variable than was true for others. The largest relative increases in volumes exported were cotton (226.7 percent), vegetable oils (186 percent), fresh and frozen vegetables (178.4 percent), wool and mohair (164.4 percent), unmilled wheat (152.1 percent), apples (120.8 percent), rice (112.5 percent), and corn (107.6 percent); for corn and wool and mohair the amounts exported are still relatively small –corn, for example, is exported under tariff rate quotas (TRQs) and will not be freely traded until 2008, although Mexico has allowed the quotas to be exceeded. The largest absolute volume increases were for wheat (749,206 mt), vegetable oils (230,047); cotton (139,196 mt), feeds and fodders (97,483 mt), and red meats (94,972)–beef and veal accounted for much of the change. Among the commodities analyzed, there were decreased exports for grain sorghums, soybean meal and wine.

In addition to agricultural commodities, the U.S. also exports agricultural inputs to Mexico. Among the more important were increases for agricultural chemical, fungicides, herbicides, and tractors, although the increase was not statistically significant for tractors. Decreases in exports occurred for fertilizers and insecticides. Except for phosphate fertilizers and tractors, the differences were statistically significant.

For agricultural imports from Mexico, the largest relative increases were for avocados (1,231.5 percent–few had previously been imported due to bans for phytosanitary reasons), beef and veal (442.0 percent--but relatively little is still imported), sugar and related products (232.9 percent), malt beverages (158.2 percent), pineapples (114.7 percent), and fats and oils (111.8 percent). The larger volume increases were for fresh and frozen fruits (365,701 mt, with melons accounting for 136,764 mt and mangos 59,488 mt). There also was a very large increase in the number of tractors imported, rising from a pre-NAFTA average if 13,105 to a post-NAFTA average of 118,058, a 800.9 percent increase.

Regression Results

The regression equations were first estimated with the trend and NAFTA dummies as the only independent variables. These regressions resulted in positive and statistically significant coefficients for the time trend line for both total U.S. agricultural exports to and imports from Mexico, but the dummy variables, while positive, were not statistically significant. For the full models (exports/imports = *f*(trend, NAFTA dummy, peso-dollar exchange rate, real GDP per capita), the time trend, exchange rate and per capita GDP variables were statistically significant for both exports to and imports from Mexico–the latter two were highly significant for U.S. imports (Table

5).[1] The NAFTA dummy variable was not significant in either model. U.S. per capita GDP increased steadily through the period and, thus, was strongly correlated with the trend variable.

Similar results were found for most of the individual commodities, although for a few products the dummy variables were significant (Tables 6 and 7). For U.S. imports, the post-NAFTA dummy variables were generally positive but nonsignificant, while they tended to be negative and also nonsignificant for U.S. exports to Mexico. For U.S. imports, the exchange rate and/or price variables were sometimes but not generally significant with the exchange rate being significant more frequently than the price variable. For exports, the findings were similar for exchange rates, prices and Mexican GDP/capita although the latter sometimes had a negative instead of the expected positive sign.

When the dummy variable was changed to reflect the Mexican economic crisis (made applicable to 1995-1999 instead of 1994-1999) and only the trend and dummy variables included in the equations, the results for the U.S. exports were different although the change had little impact on the estimated equations for U.S. imports (Tables 8 and 9). The dummy variables for the exports were generally negative and statistically significant, indicating that the U.S. exports dropped substantially during the first crisis year, 1995. The trend coefficients were still positive and generally significant reflecting the short term nature of the crisis due to a large to U.S. assistance to Mexico which enabled a quick recovery and resumption of the earlier trade patterns.

Counterfactual Analysis

The counterfactual analysis followed procedures similar to those of de Janvry, Sadoulet and Davis, but with regression equations estimated using the ERS database and GDP per capita from the World Bank. This model included the real exchange rate (RER) and per capita GDP (Mexican for exports and U.S. for imports) and was estimated using data for 1976-93. The results are shown in Table 10 and Figure 2. For both total U.S. agricultural exports to and imports from Mexico, the calculated values, based on the regression equations estimated using pre-NAFTA data, are lower than actual exports and imports for every year since NAFTA was implemented. This finding is similar to that of de Janvry, Sadoulet and Davis for the 1994-96 period. While the differences vary from year to year, the general trend has been upward, indicating that impacts of NAFTA on agricultural trade continue to increase.

Conclusions

The major conclusion from the analyses of U.S.-Mexican agricultural trade data is that trade has continued to grow at rates similar to those in the decade or so preceding the implementation of the North American Free Trade Agreement. The trade patterns appear to have been largely shaped by comparative advantage, with U.S. exports of grains and some livestock products to Mexico increasing substantially, while Mexican exports of a number of fruit and vegetable products to the U.S. increased significantly. The U.S. continued to have a positive agricultural trade balance with

[1] When current GDP per capita was used as the variable, it was highly significant but the trend variable became non-significant.

Mexico although some critics of NAFTA had predicted the opposite. The opening of trade for commodities such as corn through tariff rate quotas on products where trade was previously restricted by non-tariff barriers meant increased trade even though some will not be freely traded until 2008 when NAFTA is fully implemented. However, evaluating the impacts of NAFTA is complicated due to factors such as changes in the agricultural policies of both countries, the implementation of the World Trade Organization under the Uruguay Round of GATT, the economic crisis in Mexico, and the long period of economic prosperity in the U.S.

The regression analyses conducted for this paper do not provide conclusive evidence that the increased U.S.-Mexico agricultural trade was due to the implementation of NAFTA, even though trade has increased substantially since its implementation and the post-NAFTA average annual levels were statistically significantly higher. The counterfactual analyses also indicate that NAFTA has had a positive and increasing impact on agricultural trade. However, trade had been increasing prior to NAFTA and the trends were similar in the post-NAFTA period; it also is probable that other factors such as economic and agricultural policy changes influenced trade. In the regression models with dummy variables representing the implementation period generally did not indicate a strong immediate impact on trade in most agricultural commodities, although t-tests indicated that average levels of trade in the post-NAFTA generally were statistically significantly higher than in the last five years of the pre-NAFTA era.

For total U.S. agricultural imports from and exports to Mexico, the full regression models indicated that time trend, exchange rates, and per capita GDP were strong explanatory variables, but the NAFTA dummy variable was not significant in either model. For most individual commodities, the time trend was significant but not the dummy variable while prices, exchange rates, and/or per capita GDP were significant in some of the models; generally only one of these was significant and there was no consistent pattern, although the exchange rate variable was significant more often than the others.

Although the dummy variables for the post-NAFTA period (1994-1999) generally were not significant and for exports to Mexico tended to be negative, a dummy variable representing the pre- and post-economic crisis in Mexico (1995-1999) produced a relatively large number of statistically significant negative coefficients. Thus, the crisis caused a decline in U.S. exports to Mexico, although it was relatively short lived and the upward trend resumed after one year due in large part, probably, to the assistance given to Mexico by the Clinton administration that enabled the country to respond more quickly and completely to the crisis.

While the results of this study cannot absolutely confirm that NAFTA has had a positive impact on agricultural trade between the U.S. and Mexico, it is probable that the agreement enabled the previous trends to continue without serious interruptions. These positive trends were initiated in the early 1980s as Mexico began to open its markets and to reduce barriers to trade and foreign investment. They continued with further liberalization when Mexico joined the GATT in 1986 and again when it joined the OECD in 1994. This conclusion is supported by the results of other studies, especially one by de Janvry, Sadoulet, and Davis which uses a counterfactual approach and finds that trade in 1994-96 was considerably higher than it would have been in the absence of NAFTA.

References

de Janvry, Alain, Elisabeth Sadoulet, and Benjamin Davis. "NAFTA and Agriculture: An Early Assessment." Working Paper No. 807, Giannini Foundation of Agricultural Economics, University of California, April 1997.

Diego Quintana, Roberto, Lucianao Concheiro Bórquez, and Ricardo Pérez Aviles. "Peasant Logic, Agrarian Policy, Land Mobility, and Land Markets in Mexico." Working Paper No. 21, Land Tenure Center, University of Wisconsin, Madison, October 1998.

Diao, Xinshen, Terry Roe and Agapi Somwaru. "What is the Cause of Growth in Regional Trade: Trade Liberalization or RTA's? The Case of Agriculture." Working Paper #99-1, International Trade Research Consortium, University of Minnesota, January 1999.

Link, John and Steven Zahniser. "NAFTA: The Record to Date." Economic Research Service, USDA, *Agricultural Outlook* (September 1999):13-16.

Rosson, Parr. "North American Free Trade and U.S. Agriculture." in Dale Colyer, P. Lynn Kennedy, William A. Amponsah, Stanley M. Fletcher, and Curtis M. Jolly, eds. *Competition in Agriculture: The United States in the World Market.* New York: Food Products Press, 2000.

Smith, Vincent H. "NAFTA, GATT, and Agriculture in the Northern Plains." Special Report, Northern Plains and Rockies Center for the Study of Western Hemisphere Trade, March 1997.

United States-Mexico Chamber of Commerce. "The North American Free Trade Agreement (NAFTA) at Five Years: What it Means for the U.S. and Mexico." http://www.usmocc.org /naftafor.htm, accessed December 1, 2000.

Table 1. U.S. Exports of Agricultural Products to Mexico, Million $

Product	1998	1999
Total Agricultural Exports	51,829	48,299
Animals & Animal Products	10,674	10,286
Red Meat & Products	4,371	4,682
Beef & Veal	2,251	2,597
Pork	917	919
Poultry & Poultry Products	2,530	2,089
Poultry Meats	2,175	1,792
Chicken, Fresh or Frozen	1,736	1,423
Turkey, Fresh or Frozen	202	170
Dairy Products	915	934
Fats, Oils & Greases	664	525
Hides, Skins & Furs	1,259	1,141
Grains & Feeds	14,008	14,001
Wheat, unmilled	3,697	3,554
Rice Paddy, milled	1,208	944
Feed Grains & Products	5,210	5,745
Corn	4,382	4,916
Grain Sorghums	532	539
Feeds and Fodders (except oilcake)	2,391	2,244
Corn Byproducts	648	569
Other Feeds & Fodders	1,587	1,524
Fruits and Preparations, except juice	2,543	2,513
Fruits, Fresh	2,543	2,513
Citrus Fruits, Fresh	645	471
Fruits, Fresh Noncitrus	1,193	1,349
Apples	329	348
Grapes	262	309
Fruit Juices	657	750
Wine	510	517
Nuts & Preparations	1,360	1,184
Almonds	760	624
Vegetables & Preparations	4,222	4,297
Fresh Vegetables	1,045	1,054
Lettuce	167	159
Tomatoes	120	122
Potatoes, Fresh & Frozen	432	481
Vegetables, Canned	357	336
Pulses	336	264
Dried Beans	275	203
Oilcake and Meal	1,665	1,140
Soybean Meal	1,604	1,070
Oilseeds	5,558	5,403
Soybeans	4,835	4,517
Tobacco, Unmanufactured	1,459	1,294
Cotton, except linters	2,545	968
Sugar & related products	628	594
Coffee	234	245
Fertilizers	3,292	2,986
Farm Machinery	3,838	2,900

Table 2. U.S. Imports of Agricultural Products from Mexico, Million $

Product	1998	1999
Total Agricultural Imports	37,073	37,867
Animals & Animal Products	6,956	7,293
Live Animals, except poultry	1,656	1,522
Cattle & Calves	1,144	1,000
Red Meat and Products	2,815	3,210
Beef and Veal	1,842	2,135
Pork	682	753
Poultry & Products	200	210
Dairy Products	1,465	1,556
Cheese	635	705
Hides & Skins	169	146
Grains & Feeds	2,878	2,911
Wheat, unmilled	280	272
Biscuits & Wafers	751	859
Pasta & Noodles	284	278
Oats	166	144
Fruits and Preparations	2,185	2,756
Fruits, Fresh or Frozen	1,590	2,047
Citrus, Fresh	438	539
Strawberries	89	100
Other Berries	104	114
Grapes	438	539
Mangoes	136	151
Fruits, Prepared & Preserved	595	709
Fruit Juices	666	784
Nuts & Preparations	630	760
Cashews	319	448
Vegetables	4,375	4,583
Vegetables, Fresh & Frozen	2,632	2,589
Asparagus	96	114
Tomatoes	758	689
Cauliflower & Broccoli	143	169
Cucumbers	158	142
Onions	153	144
Peppers	356	328
Squash	112	100
Potatoes, Fresh & Frozen	342	382
Prepared and Preserved Vegetables	1,743	1,994
Tomatoes including pastes	109	132
Sugar & related Products	1,682	1,589
Wine	1,876	2,186
Malt Beverages	1,712	1,892
Vegetable Oils & Waxes	1,680	1,523
Coconut Oil	350	234
Olive Oil	347	350
Fertilizers	2,403	2,386
Agricultural Chemicals	1,106	977
Farm Machinery	3,455	3,069
Tractors	1,886	1,456

Table 3. T-tests of Pre- and Post-NAFTA U.S. Agricultural Exports to Mexico

Product Exported	Avg. Pre-NAFTA	Avg. Post-NAFTA	Difference	Calculated t value	Prob. of t
Total Exports ($ million)	3,144	5,093	1,949	4.352	0.001
Apples (mt)	45,094	99,574	54,480	2.247	0.027
Barley (Quantity)	103,487	136,238	32,751	0.932	0.187
Beef & Veal (mt)	45,478	93,492	48,014	2.180	0.032
Chicken, F&F (mt)	61,007	112,761	51,754	4.489	0.001
Corn (mt)	2,014	4,182	2,168	2.297	0.023
Corn Byproducts (mt)	116,663	156,544	39,881	20198	0.029
Cotton (mt)	61,406	200,602	139,196	2.773	0.012
Feeds & Fodders (mt)	398,683	496,146	97,463	1.132	0.154
Feed Grains (mt)	5,548	7,143	1,595	1.720	0.062
Fruit, Fresh (mt)	99,282	198,035	98,753	2.860	0.009
Fruit Juices (mt)	110,070	160,103	50,033	1.342	0.106
Fruit, Non-citrus (mt)	97,355	192,538	95,183	2.274	0.012
Grain Sorghums (mt)	3,415	2,810	(605)	1.091	0.154
Hides & Skins ($1,000)	114,253	131,362	17,109	0.692	0.254
Nuts & Preps (mt)	1,557	2,832	1,275	3.989	0.002
Pork Fresh & Frozen (mt)	20,724	31,176	10,452	1.457	0.094
Poultry Meat (mt)	103,032	202,785	99,753	3.696	0.003
Red Meats (mt)	249,003	344,875	95,872	2.025	0.036
Rice, Paddy Milled (mt)	168,107	357,275	189,168	4.891	0.000
Soybeans (mt)	1,391	2,550	1,159	3.801	0.003
Soybean Meal (mt)	286,138	257,320	(28,818)	0.464	0.326
Turkey Meat (mt)	29,958	79,022	49,064	3.553	0.005
Vegetables, Fresh (mt)	62,846	79,888	17,042	1.052	0.161
Vegetables, Frozen (mt)	11,197	31,174	19,977	4.303	0.001
Vegetable Oils (mt)	123,696	353,743	230,047	4.980	0.000
Wheat Flour (mt)	28,703	35,393	6,690	0.512	0.312
Wheat, Unmilled (mt)	492,263	1,241,838	749,575	3.241	0.006
Wine (mt)	18,925	20,693	1,768	0.465	0.4327
Wool & Mohair (mt)	205	542	337	2.096	0.035
Inputs Exported					
Agricultural Chems. (mt)	10,053	19,195	9,142	4.464	0.002
Fertilizers (mt)	6,635	4,664	(1,971)	1.742	0.059
Fungicides (mt)	1,218	2,432	1,214	4.663	0.001
Herbicides (mt)	3,116	5,881	2,765	2.628	0.014
Insecticides (mt)	3,126	8,695	5,569	2.301	.0031
Phosphate Fertilizer (mt)	5,755	4,429	(1,326)	0.280	0.393
Tractor Exports (no.)	2,498	3,389	891	0.715	0.253

Table 4. T-Tests of Pre- and Post-NAFTA Agricultural Imports from Mexico

Product	Avg. Pre-NAFTA	Avg. Post-NAFTA	Difference	t-test of the Difference	Probability (one tail)
All Products ($ million)	2,506	4,030	1,524	5.031	0.001
Asparagus (mt)	17,844	24,461	6,617	1.838	0.051
Avocados (mt)	525	4,716	4,191	2.202	0.039
Bananas & Plantains (mt)	234,822	176,357	(58,465)	1.046	0.172
Beef & Veal (mt)	636	3,447	2,811	4.517	0.002
Cauliflower, Broccoli (mt)	158,416	192,699	34,283	3.113	0.007
Cocoa (mt)	11,578	16,075	4,497	1.322	0.111
Coffee (mt)	196,931	182,106	(14,825)	0.919	0.191
Cucumbers (mt)	179,230	278,150	98,920	5.811	0.000
Cut Flowers ($1,000)	12,926	22,352	9,426	4.786	0.001
Eggplant (mt)	17,528	28,419	10,891	4.818	0.001
Fruit Juice (1,000 hl)	1,871	2,703	832	1.976	0.053
Fruit, Fresh & frozen (mt)	537,878	903,579	365,701	4.051	0.003
Fruits & Preps. (1000 mt)	574	961	387	4.076	0.003
Lettuce (mt)	11,785	11,593	(192)	0.053	0.479
Malt Beverages (1,000 hl)	1,844	4,762	2,918	3.259	0.011
Mangoes (mt)	67,128	144,284	77,156	5.414	0.000
Melons (mt)	286,567	383,344	96,777	1.779	0.054
Onions (mt)	164,511	200,502	35,991	2.591	0.016
Oilseeds & Products (mt)	34,090	36,774	2,684	0.545	0.299
Peppers & Pimentos (mt)	2,951	3,719	768	1.782	0.063
Pineapples (mt)	5,441	11,684	6,243	2.569	0.021
Strawberries (mt)	35,532	53,288	17,756	2.879	0.014
Sugar, etc. ($1,000)	37,300	124,176	86,876	5.022	0.001
Tomatoes	335,083	606,250	271,167	4.266	0.001
Tractors (no.)	13,105	98,751	85,646	2.104	0.044
Vegetables (mt)	1,228,929	1,970,421	741,492	5.267	0.000
Other Vegetables (mt)	50,769	114,348	63,579	4.558	0.003

Table 5. Regression Results for Total U.S. Agricultural Trade with Mexico, 1989-99

	Constant	Trend	Dummy	X Rate	GDP/Cap.[a]	R^2
U.S. Imports	-6,249.020	154.850**	-291.478	325.983*	0.248*	.99
t-values		(2.551)	(-1.382)	(3.704)	(3.247)	
U.S. Exports	8820.238	300.372*	1109.692	-774.752**	-1.022***	.92
t-values		(3.1586)	(1.5596)	(-2.245)	(-1.710)	

* = significant at 1% level; ** = significant at 5% level; *** = significant at 10% level

[a] Mexican GDP per capita for exports, U.S. GDP per capita for imports (real)

Table 6. Regressions of U.S. Agricultural Exports to Mexico

Product Exported	Avg. Pre-NAFTA	Avg. Post NAFTA	Pct. Chg.	Regression Coefficients[a]		R^2
				Time	Dummy	
Total Exports ($ million)	2,506	4,030	60.8	342.6*	64.7	.90
Apples (mt)	45,094	99,574	120.8	7,396.8	13,797.7	.44
Barley (Quantity)	103,487	136,328	31.7	-9,661.8	85,890.7	.16
Beef & Veal (mt)	49,645	98,094	97.6	16,894.4*	-44,904.7	.70
Chicken, F&F (mt)	61,007	112,761	84.8	9,891.3*	-2,647.7	.96
Corn (mt)	2,014	4,182	107.6	-100.3	2,719.3	.38
Corn Byproducts	116,663	156,544	34.2	-35.3	40075.5	.36
Cotton (mt)	61,406	200,602	226.7	35,759.2*	-57,479.8	.72
Feeds & Fodders (mt)	398,683	496,146	24.4	44,849.8**	-149,211	.45
Feed Grains (mt)	5,548	7,143	28.7	177.9	616.2	.26
Fruit, Fresh (mt)	99,282	198,035	99.5	13,421.9	24,932.0	.56
Fruit Juices (mt)	110,070	160,103	45.5	20,344.3**	-61,860.5	.44
Fruit, Non-citrus (mt)	97,355	192,538	97.8	12,978.6	23,801.1	.53
Grain Sorghums (mt)	3,415	2,810	(17.7)	286.0***	-2,177.8*	.39
Hides & Skins ($1,000)	114,253	131,362	15.0	12,465.2*	56,115.9***	.50
Nuts & Preps (mt)	1,557	2,832	81.9	273.9*	-231.5	.94
Pork Fresh & Frozen (mt)	20,724	31,176	50.4	3,654.3***	-9,647.5	.38
Poultry Meat (mt)	92,841	145,128	56.3	21,525.1*	18,635.3	.91
Red Meats (mt)	249,003	344,875	38.5	35,249.9*	-98,002.1	.70
Rice, Paddy Milled (mt)	168,107	357,275	112.5	25,368.3*	49,637.2	.86
Soybeans (mt)	1,391	2,673	92.2	270.6*	-206.8	.96
Soybean Meal (mt)	286,138	257,320	(10.1)	-18,501.3	72,939.3	.12
Turkey Meat (mt)	29,958	79,022	163.8	11,152.0*	12,272.1	.91
Vegetables, Fresh (mt)	62,846	79,888	27.1	7,844.0***	-26,099.9	.36
Vegetables, Frozen (mt)	11,197	31,174	178.4	3,876.6*	-1,344.5	.92
Vegetable Oils (mt)	123,696	353,743	186.0	39,463.8*	12,966.3	.94
Wheat Flour (mt)	28,703	35,393	23.3	6,109.9***	-26,914.4	.28
Wheat, Unmilled (mt)	492,623	1,241,829	152.1	185,732.8*	-271,965.0	.83
Wine (mt)	25,655	20,693	(19.3)	527.6	-1,134.0	.04
Wool & Mohair (mt)	205	542	164.4	-76.7	759.0*	.47
Inputs Exported						
Agricultural Chems. (mt)	10,053	19,195	90.9	-606.1	12,475.4*	.68
Fertilizers (mt)	6,635	4,664	(29.7)	-863.4*	2,777.2**	.75
Fungicides (mt)	1,218	2,432	99.7	144.6**	480.5	.85
Herbicides (mt)	3,117	6,910	121.7	736.2*	-1,283.9	.74
Insecticides (mt)	13,559	8,695	(35.9)	-1,149.2	11,888.5**	.47
Phosphate Fertilizer (mt)	5,755	4,429	(23.0)	-612.2*	2,040.7	.61
Tractor Exports (no.)	2,498	3,389	35.7	411.6	-1,372.4	.14

= significant at 1% level; ** = significant at 5% level; *** = significant at 10% level

[a] Based on regression equations with only time trend and NAFTA dummy variables.

Table 7. Regressions of U.S. Agricultural Imports from Mexico

Product	Avg. Pre-NAFTA	Avg. Post-NAFTA	Percent Change	Regression Coefficients[a]		R^2
				Time	Dummy	
All Products ($ million)	2,506	4,030	60.8	256.8*	111.9	.90
Asparagus (mt)	17,845	24,462	37.1	3,195.1*	-10,956.1*	.85
Avocados (mt)	425	5,659	1,231.5	1,909.6*	-5,257.5**	.80
Bananas & Plantains (mt)	235,067	173,030	(26.4)	24,417.9***	-192,74.0**	.35
Beef & Veal (mt)	636	3,447	442.0	460.7*	276.8	.84
Cauliflower, Broccoli(mt)	158,416	192,699	21.6	7,111.7*	-4,831.8	.75
Cocoa	11,578	16,075	38.8	2,479.6*	-9,140.7**	.69
Coffee (mt)	196,931	182,106	(7.5)	-3,039.4	1,891.9	.12
Cucumbers (mt)	179,230	278,150	55.2	12,365.8*	30,918.7	.89
Cut Flowers ($1000)	12,926	22,352	72.9	1,490.9*	1,225.5	.87
Eggplant (mt)	17,529	28,419	62.1	1,604.8*	2,063.6	.83
Fats and Oils (mt)	643	1,362	111.8	8.1	673.9*	.71
Fruit, Fresh-Frozen (mt)	537,878	903,579	68.0	70,388.0*	-21,432.8	.83
Fruit Juice (mt)	1,871	2,703	44.5	-86.6	1,308.1	.37
Fruits, Prepared	574	961	67.4	74.0*	-20.8	.83
Lettuce (mt)	11,785	11,593	(1.6)	-785.4	3,978.5	.05
Malt Beverages (hl)	1,844	4,762	158.2	703.5*	-1,104.7	.80
Mangoes (mt)	67,128	126,616	88.6	13,176.2*	4,687.0	.98
Melons (mt)	246,580	383,344	55.5	20,910.9	-18,232.5	.36
Oilseeds & Products (mt)	34,090	36,774	7.9	1,651.2	-6,397.7	.14
Onions (mt)	164,511	200,502	21.9	5.679.8	4,752.1	.54
Peppers & Pimentos (mt)	2,951	3,719	26.0	256.0**	-640.3	.48
Pineapples (mt)	5,441	11,684	114.7	2,098.3*	-5,297.3***	.82
Strawberries (mt)	35,532	53,288	50.0	2,446.6	4,299.1	.52
Sugar & Prod. ($1,000)	37,300	124,176	232.9	12,511.7*	18,601.4	.85
Tomatoes (mt)	335,082	606,250	80.9	24,363.4	137,168.5	.83
Tractors (no.)	13,105	118,058	800.9	30,367.5*	-81,375.4	.65
Vegetables (mt)	1,228,929	1,970,421	60	94.8**	219.5	.84
Other vegetables (mt)	50,769	114,348	125	10,541*	5,603.4	.84

* = significant at 1% level; ** = significant at 5% level; *** = significant at 10% level

[a] Based on regression equations with only time trend and NAFTA dummy variables.

Table 8. Regressions of U.S. Agricultural Exports to Mexico with Crisis Variable

Product Exported	Avg. Pre-Crisis	Avg. Post-Crisis	Regression Coefficient		R^2
			Time	Dummy	
Total Exports ($ million)	3,386	5,194	419.7*	-500.4	.86
Apples (mt)	63,079	88,888	23,035.7*	-100,885*	.75
Barley (mt)	101,666	145,093	-15,539.5	128,994*	.34
Beef & Veal (mt)	49,654	98,094	16,657.3*	43,166	.70
Chicken, F & F (mt)	67,788	114,974	12,649.3**	-20,923.5**	.98
Corn (mt)	2,021	4,046	-74.4	2,794	.45
Corn Byproducts (mt)	130,859	147,485	12,649.3**	-52,944.9	.43
Cotton (mt)	72,252	215,427	33,588.8**	-41,563.3	.71
Feeds & Fodders (mt)	421,147	488,683	61,173.6*	-268,919**	.64
Feed Grains (mt)	5,711	7,265	200.1	453.5	.25
Fruit, Fresh (mt)	129,684	181,303	39,131.1*	-163,303	.87
Fruit Juices (mt)	126,090	150,887	34,109.3*	-162,804*	.81
Fruit, Non-citrus (mt)	127,735	175,118	35,051.7*	-167401*	.87
Grain Sorghums (mt)	3,408	2,697	343.6**	-2,600.2*	.55
Hides & Skins ($1,000)	112,439	131,362	8,829.9***	-30,190.8	.34
Pork: Fresh & Frozen (mt)	23,908	29,445	6,34.9*	-29,304.9*	.67
Poultry Meat (mt)	117,334	205,510	27,865.0*	-65,129**	.97
Rice, Paddy Milled (mt)	182,490	377,849	21,992.4**	74,401.1	.88
Soybeans(mt)	1,505	2,793	267.1*	-181.2	.96
Turkey Meat mt)	36,087	81,479	13,154.0*	-26,975*	.95
Vegetables, Frozen (mt)	13,987	31,823	5,044.2*	-9,907.2*	.96
Vegetable Oils (mt)	138,670	381,741	32,336.5*	65,263.1	.95
Wheat Flour (mt)	26,731	39,097	3,014.1	-4,211.9	.16
Wheat, Unmilled (mt)	514,399	1,365,179	148,646.7*	132,890.7	.81
Wine (mt)	21,379	18,103	3,280.0*	-21,316.4*	.80
Wool & Mohair(mt)	229	580	-84.4***	815.3*	.52
Inputs Exported					
Agricultural Chemicals (mt)	11,990	18,699	721.2	2,742.1	.39
Fertilizers(mt)	6,666	4,233	-612.0*	933.7	.63
Fungicides(mt)	1,300	2,576	144.6*	480.5	.85
Herbicides(mt)	3,367	6,134	735.4*	-1,287.1	.74
Insecticides(mt)	4,736	7,876	175.1	2,176.9	.11
Phosphate Fertilizer(mt)	5,832	4,071	-375.1	302.3	.49
Tractor Exports (no.)	2,469	3,601	280.2	-408.9	.12

* = significant at 1% level; ** = significant at 5% level; *** = significant at 10% level

Table 9. Regressions of U.S. Agricultural Imports from Mexico with Crisis Variable

Product	Avg. Pre-Crisis	Avg. Post-Crisis	Regression Coefficient		R^2
			Time	Dummy	
All Products ($ million)	2,571	4,257	168.3*	760.9**	.95
Vegetables (mt)	1,255	2,606	46.8*	3.70	.94
Cocoa (mt)	10,851	17,848	1,115.8	860.6	.51
Coffee (mt)	189,582	187,960	-10,241**	54,703***	.40
Cut Flowers ($1000)	13,333	23,749	950.8**	5,186.5**	.92
Eggplant (mt)	18,111	29,898	1,115.1**	5,654.8***	.87
Fruit Juice (mt)	1,953	2,771	79.2	1,253	.35
Fruits, Prepared	36,676	60,557	1,964.5***	13,076.40	.88
Fruit, Fresh & frozen (mt)	544,388	968,907	38,305.9**	213,835***	.88
Malt Beverages (mt)	1,918	5,257	502.5**	573.4	.79
Melons (mt)	275,064	416,503	-3,450.2	160,465	.53
Lettuce (mt)	74,162	151,274	13,200.0*	4,511.1	.98
Oilseeds & Products (mt)	32,493	39,288	-558.6	9,807.9	.20
Peppers & Pimentos (mt)	2,983	3,835	210.4	-305.7	.45
Pineapples (mt)	5,528	12,828	1,51.8**	-1,069.7	.76
Bananas & Plantains (mt)	227,851	173,030	22,430	-178,188**	.30
Beef & Veal (mt)	739	3,885	277.5**	1,620.3**	.89
Cauliflower, Broccoli (mt)	159,108	198,724	6,552.8*	16,503.9	.75
Sugar, etc. (mt)	42,583	135,212	9,373.1**	41,077***	.88
Avocados (mt)	501	5,535	1,171.3**	-1,293.3	.66
Asparagus (mt)	17,878	25,746	2,512.7*	-5,951.9	.73
Strawberries (mt)	218,840	278,547	1,639.0	10,221.5	.55
Tractors (no.)	11,289	118,058	18,845.5***	3,118.7	.59

* = significant at 1% level; ** = significant at 5% level; *** = significant at 10% level

Table 10. Results of the Counterfactual Analysis ($ Million)

Exports	Estimate	Actual	Difference
1994	4,058	4,593	535
1995	2,698	3,539	841
1996	3,089	5,447	2,358
1997	3,796	5,183	1,387
1998	3,742	6,163	2,421
1999	4,403	5,637	1,234
Imports			
1994	2,729	2,895	166
1995	2,822	3,836	1,014
1996	2,937	3,765	828
1997	3,131	4,112	981
1998	3,272	4,691	1,419
1999	3,434	4,883	1,449

Exports: -1953.806 + 1.1058396*GDP + 183.26179*RER, R^2=.87
(0.1176386) (96.154299)

Imports: -213.2370 + 0.1162707*GDP - 8.56533*RER, R^2=.90
(0.0099923) (46.612787)

FIGURE 1. U.S.-MEXICO AGRICULTURAL TRADE

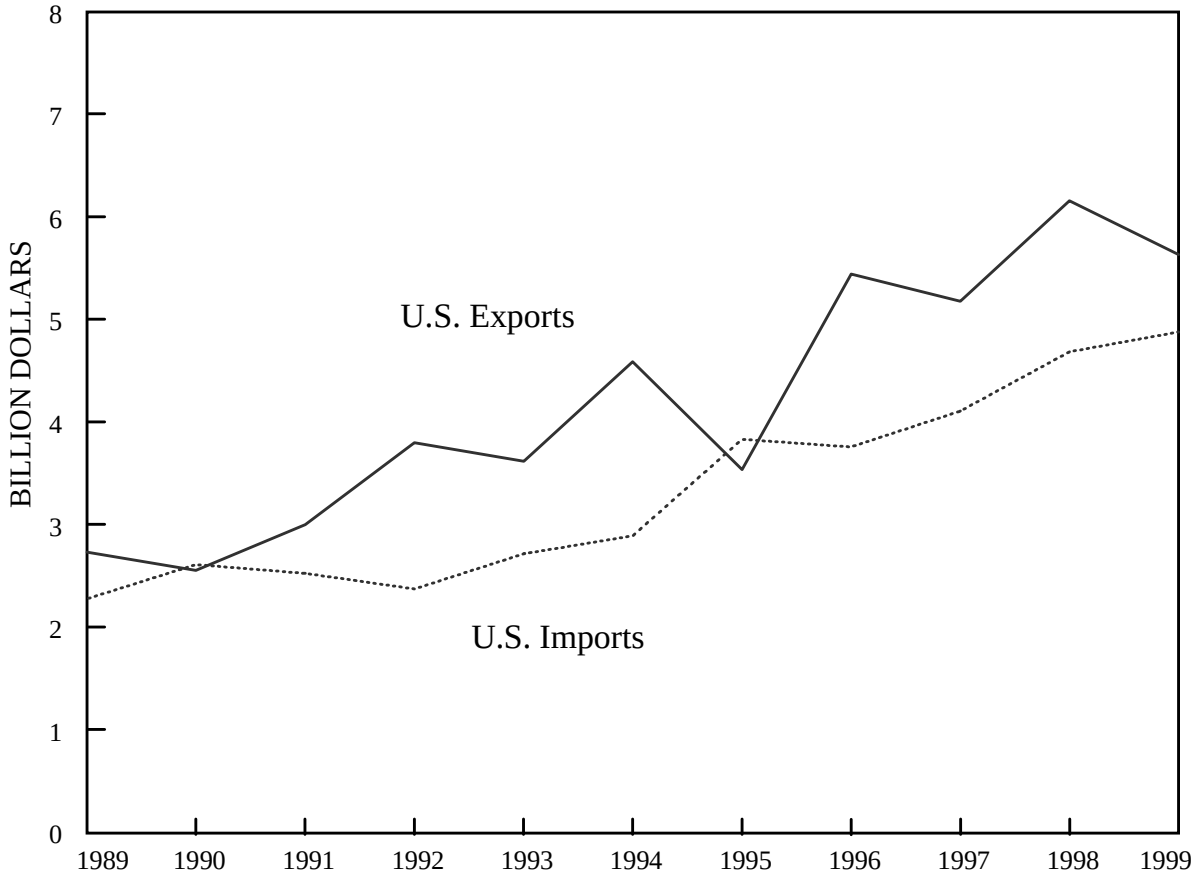

Figure 2. Actual and Estimated Trade from Counterfactual Analysis