# Preferential Trading Arrangements in Western Hemisphere Countries

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Many countries of the Western Hemisphere in recent years have shown interest in
participating in preferential trading arrangements (PTA) in anticipation of expanding exports.
Results in this paper show that export expansion depends upon the type of agreement that is
formed and who else is participating. Trade of two agricultural commodities are examined;
wheat, and fruit and vegetable juices. Five PTAs are examined, each including the United
States and one or more Western Hemisphere countries.

Recently the United States and a number of other
Western Hemisphere countries have shown interest
in participating in preferential trade agreements
(PTA).[1] A PTA would reduce or remove tariff and
nontariff barriers to trade between the countries of
the PTA, but each country's barriers to trade with
non-member countries would remain unchanged.
The most common reason for a country to want to
join a PTA is to expand its exports.

In the context of recent events in the Western
Hemisphere, there are several alternative types of
PTAs that could evolve. The objective of this pa-
per is to see if the type of PTA matters for trade of
agricultural commodities. Two "case-study"
commodities are examined: wheat, and fruit and
vegetable juices.

In a recent article by Richard Lipsey entitled
"The Case for Trilateralism", Lipsey outlines
three models of PTAs: the hub-and-spoke model,
overlapping regional free trade areas, and plurilat-
eral regionalism. In the hub-and-spoke model, one
country, presumably the United States, could have
separate bilateral free-trade agreements with each
of the participating countries (Wonnacott). For ex-
ample, suppose the United States had separate
trade agreements with Canada, Mexico, and Chile.
While the "hub", the United States, could gain
tariff free access to these individual countries (the
spokes), the "spokes" could only gain tariff free

access to the United States. The "spokes" would
not realize gains vis-a-vis other spokes.

In the overlapping regional free trade model,
two countries such as the United States and Mex-
ico would form a free trade agreement. Some
countries might express interest in forming a free
trade agreement with Mexico (e.g. Costa Rica),
while other countries might initiate interest with
the United States (e.g. Chile). A series of overlap-
ping agreements could evolve in which the U.S.
and Mexico would be included in some arrange-
ments, while excluded in others. The practicality
of enforcing an overlapping free trade area would
be complex; a particular concern would be trans-
shipment across free trade areas and rules of origin
criteria.

In the plurilateral regional model, several coun-
tries would establish a regional free trade area in
which all members received tariff-free access to
the markets of all other members. This stands in
contrast to the hub-and-spoke model in which only
the hub country had tariff free access to the mar-
kets of all the spokes. For example, instead of the
United States having separate bilateral agreements
with Canada and Mexico, these three countries
would sign one agreement establishing common
access to each other's market—a North American
Free Trade Area (NAFTA). Any other countries
interested in joining the regional arrangement
would conform with the terms of NAFTA. A coun-
try, such as Chile, may want to "sign-up" with
NAFTA.[2]

[1] The interests of the United States were expressed in a 1990 White
House press release. It stated, "A comprehensive Free Trade Agreement
for Latin America is our long-term goal." (p. 2)

[2] Potential problems with transshipment may occur with all three
types of PTAs described. Non-member countries may attempt to export
their products through a member country with the lowest tariff.

Of the three types of trade arrangements, the United States and other Western Hemisphere countries have expressed the most interest in plurilateral regional arrangements. Nevertheless, participation and the process of negotiation seems to be uncertain at the present time.

Here, our goal is to examine how country participation and the type of agreement affect agricultural trade. Our approach is to undertake several simulation exercises which are intended to represent different preferential trading arrangements in Western Hemisphere countries. We examine the impacts on gains to trade if the United States, Mexico, and Canada were to sign an agreement. Then, we compare and contrast the changes in trade if a parallel agreement were formed by Mercosur (as proxied by Argentina and Brazil). The hub-and-spoke case is explored next; the U.S. is assumed to form bilateral agreements with several Western Hemisphere countries (Argentina, Brazil, Canada, Chile, Colombia, and Mexico). Finally, in our last experiment, we address the trade effects of a regional agreement where all participants remove their import protection vis-a-vis all partner countries.

Our analysis separately examines two agricultural commodities: wheat, and fruit and vegetable juices. We choose these products to serve as *examples* because of their importance to at least one exporting Western Hemisphere country and because of the various patterns of bilateral trade these goods represent in the Western Hemisphere. For example, the United States is a major exporter of wheat and a net importer of fruit and vegetable juices. In order to maintain a database of manageable size, we restricted our analysis to the Western Hemisphere countries of United States, Canada, Mexico, Argentina, Brazil, Chile, Colombia, and a Rest-of-World region.

These alternatives are examined with two single-commodity, static equilibrium, world trade models.

## Agricultural Trade Flows of Western Hemisphere Countries

Reviewing trade patterns provides a good basis for determining the qualitative importance of various preferential trading arrangements. The source of our data set is the UN Trade Statistics, which contains data on trade flows for the Western Hemisphere countries through 1987. Although this data source is generally considered not as accurate or as up-to-date as U.S. data sources (Foreign Agricultural Trade of the United States, FATUS, USDA),

it is the only single source of bilateral trade information.

### Wheat

The data on wheat trade suggest that any type of agreement would have small effects on United States and Canada but would be more significant for Argentina, Brazil, Mexico, Chile, and Colombia depending on the type of arrangement. Of the Western Hemisphere countries considered, three are exporters and four are importers. The United States, Canada, and Argentina are major world exporters with shares of world wheat trade of 34, 17, and 5 percent, respectively, in our 1987 base period. In contrast, the importing countries have very small shares of the world import market: Brazil has approximately 3 percent, Mexico and Colombia 0.5 percent, and Chile a negligible percent. The importance of these importing countries to the three exporters also tend to be small with one exception; 27 percent of Argentina's exports are purchased by Brazil in 1987.

From the importer's perspective the three exporting countries are critical. Mexico, Brazil, and Colombia rely on the United States, Canada, and Argentina for approximately 70 percent of their imports. Mexico imports mostly from Canada, Brazil, mostly from Argentina, and Colombia mostly from the United States. Chile imports almost all its wheat from the United States. Since the bilateral trading patterns are different across the exporters and importers, "who is in and who is out of an agreement" could lead to significant changes in the pattern of trade.[3]

### Fruit and Vegetable Juices

All of the countries in our Western Hemisphere sample are exporters of fruit and vegetable juices. However, only Brazil and the United States comprise a significant share of world exports, roughly estimated at 30 and 10 percent, respectively (1987). Argentina and Mexico have expressed interest in increasing their trade in fruit and vegetable juices which equal 4 and 2 percent, respectively, of world exports. The United States is also

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[3] To put the 1987 trading patterns in perspective, we reviewed the bilateral trade flows of wheat over the 1980–87 period. From the U.S. and Canadian viewpoint, the Western Hemisphere countries were small importers in any given year. However, 1987 did represent a year in which Western Hemisphere import shares of U.S. and Canadian wheat were smaller than in earlier periods. This, perhaps, reflects Latin American countries' foreign exchange constraints and negative or low real growth rates in the late 1980s. Brazil's importance as an importer of Argentine wheat, though, was nearly at a high point in 1987.

a major importer purchasing approximately 35 percent of world trade. Thus, there are three key differences in the fruit and vegetable juice traded market relative to the wheat market: first, the United States is the major importer in the Western Hemisphere rather than the major exporter; second, there is one country (Brazil) other than the United States which is a predominant international seller of fruit and vegetable juices and several smaller exporters and potential exporters in the region which provide additional competition and; third, the exporters and importers in the region rely heavily on each other for fruit and vegetable trade.

Western Hemisphere fruit and vegetable juice exporters are very dependent on the United States as an importer. Nearly 60 percent of Brazilian fruit and vegetable juice trade is shipped to the United States. Almost all of Brazilian exports is frozen concentrate orange juice (fcoj). For Argentina and Mexico, the United States accounts for over 60 and 90 percent share of their export markets. Approximately 80 percent of Mexican juice exports are orange juice. Argentina exports no orange juice.

From a U.S. import perspective, the Western Hemisphere exporters are also essential trading partners. In 1987, the U.S. purchased approximately 70 percent of its fruit and vegetable juice imports from Western Hemisphere countries: 57 percent from Brazil, 7 percent from Argentina, and 6 percent from Mexico, respectively, in 1987. Thus, there is dependency and symmetry in the fruit and vegetable juice market with the United States being the key importer and Brazil being the key exporter.[4]

## Modeling Framework

A simple trade model is used here to evaluate the potential effects of a PTA on individual commodity trade. It is based on the Armington version (which allows for bilateral trade flows) of the Static World Policy Simulation (SWOPSIM) modeling framework developed by Roningen.

We will discuss the characteristics of the model that are most relevant to this paper. (For more details see Dixit and Roningen, and Roningen, Sullivan, and Dixit.) Assume a three-country case for a single good in which consumers distinguish

purchases by *country of origin*.[5] The "home country" consumes its own produced product (j) and consumes (imports) similar but not identical "foreign" produced products from countries (i) and (k). The consumer demand functions for commodity j in countries i, j, and k, are represented by:

$$(1) \qquad Dij = Dij(CPii, CPij, CPik)$$

$$(2) \qquad Djj = Djj(CPii, CPij, CPik)$$

$$(3) \qquad Dkj = Dkj(CPii, CPij, CPik)$$

where CPii, CPij, CPik are the consumer incentive prices of product j in countries i, j, and k respectively.[6]

The supply of product j (which is only produced in country j) is a function of its own price

$$(4) \qquad Sjj = Sjj(PPjj)$$

where PPjj is the producer incentive price in country j. Product j is by definition only exported by country j (Sjj − Djj) and imported by countries i and k (−Dij and −Dkj).

Consumer incentive prices of product j in each country are determined by domestic policies, tariff and nontariff barriers, and the traded price:

$$(5) \qquad CPij = CSWij + Ei * TPj$$

$$(6) \qquad CPjj = CSWjj + Ej * TPj$$

$$(7) \qquad CPkj = CSWkj + Ek * TPj$$

where CSWs are policy created price wedges, Es are exchange rates in local currency per U.S. dollar, and TPj is the traded price for product j. International transaction costs are assumed to equal 0. Thus, the incentive consumer price is defined as equal to the traded price and a price wedge generated by quantifying agricultural policies. In the simulation experiments only the trade policy component (not the domestic policy component) is removed from the CSW.

The producer price of product j is determined by domestic and trade policy and the traded price:

$$(8) \qquad PPjj = PSWjj + Ej * TPj$$

where PSWjj is a domestic or trade policy created price wedge. World markets clear when net trade of product j across all countries (i,j,k) is equal to 0:

$$(9) \qquad Tj = Sjj - Dij - Djj - Dkj$$
$$= 0.$$

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[4] The export position of the United States and Brazil have changed dramatically over the 1980 decade. Brazil increased its quantity of exports over 90 percent in the 1980–87 period. As an exporter of fruits and vegetable juices, U.S. sales declined over 30 percent from the early 1980s. As U.S. exports declined, the U.S. shipped more to Rest-of-World in 1987 (72 percent) and less to Western Hemisphere countries.

[5] In the experiments discussed below the two single-commodity models contain seven countries and a Rest-of-World region.

[6] An "incentive price" is the observed market price plus positive or negative incentives such as subsidies and taxes.

Equations for i and k can be similarly expressed.

All supply and demand functions are defined such that an equilibrium solution of the model reproduces all prices and quantities observed in 1987. We call this our base solution which is assumed to be in intermediate-run equilibrium. When an exogenous change occurs in a policy variable, in particular the removal of an import tariff or nontariff barrier (CSWij or CSWik), the model generates a new equilibrium by recalculating domestic supply and demand levels, rebalancing world trade, production, consumption, and prices in the process. The pattern of prices and quantities observed in the base solution can then be compared to the pattern which emerges from the simulation exercise.

There are three sets of key parameters that determine the results. They are (1) base supply, demand, and trade data; (2) base prices and the price wedges that are removed by PTAs; and (3) own-price elasticities of each commodity and the elasticities of substitution in consumption among different country sources of the product. The Armington assumption—consumers distinguish the purchase of a commodity by country of origin—is parsimonious in parameter needs; the own price elasticity, the elasticity of substitution, and base shares are sufficient to generate own and cross price elasticities for each product.[7] The elasticities are assumed and can be found in Sullivan, Wainio, and Roningen for wheat and Liapis, Krissoff, and Neff (LKN) for juices. (The Mexican elasticities reported in LKN are used for the other Latin American countries.) Base quantities and prices are from UN Trade Data and FAO Production Yearbook. The base data and parameters are available in electronic form upon request of the authors.

## Simulation Analysis

To reflect different country participation in PTAs, five simulation experiments are undertaken for wheat and four for fruit and vegetable juices (see Figure 1). In the experiments import policies are only removed vis-a-vis other participating countries.

The quantification of wheat import policies is based on PSC/CSE calculations and includes all policy transfers to producers through price intervention (Webb, USDA). Of the importing countries, Brazil in 1987, had the highest import tariff

Experiment 1: {US - Mexico}

Experiment 2: {NAFTA: US - Mexico - Canada}

Experiment 3: {NAFTA: US - Mexico - Canada}

and

{MERCOSUR: Argentina - Brazil}

Experiment 4: {HUB-&-SPOKE: US - Mexico
                               US - Brazil
                               US - Chile
                               US - Colombia}

Experiment 5: {WHFTA: US - Mexico - Canada - Chile -
                         Argentina - Brazil - Colombia}

Experiments illustrate how different PTAs in the Western Hemisphere might affect a major traded commodity.

**Figure 1.  A Schematic of Preferential Trading Arrangements**

equivalents of 50 percent followed by Chile and Colombia at 40 percent and Mexico at 5 percent. Thus, we would anticipate that the removal of protection by Brazil would have the largest import effect, other things being equal. U.S. and Canadian wheat programs and Argentine wheat export taxes are assumed to continue at the 1987 subsidy (tax) levels.

For fruit and vegetable juices, import tariffs are assumed to be the only government policy intervention. The tariffs are based on the statutory rate in 1987 and are calculated as a weighted average of the different types of fruit and vegetable juices from all sources. The U.S. and Canadian import tariff are approximately 15 and 5 percent, respectively. Mexico, Brazil, and Argentina are exporters thus no changes are made in their price wedges.

The simulation results describe the impact of various regional arrangements for a typical year after each scenario is fully implemented and the agricultural sectors of the participating and non-participating countries have had several 1987-like years in which to adjust. Results for each of the following experiments are reported as percent and value changes from actual conditions in 1987 (i.e., changes from the 1987 base solution).

## Wheat

In experiment 1 we assume that the United States forms an agreement with Mexico. This is modeled

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[7] See Dixit and Roningen or Liapis, Krissoff, and Neff for more details on the Armington assumption in the SWOPSIM framework.

by removing the price wedge that represents Mexican import restrictions for U.S. wheat. The elimination of Mexican border protection reduces the domestic price in Mexico of U.S. wheat imports and encourages increased Mexican consumption. U.S. exports to Mexico expand 20 percent from the 1987 base period (Table 1). Since Mexico is a small importer of wheat the increase in total U.S. wheat exports is negligible (indicated by a 0.1 percent in the column labeled WORLD). There is almost no effect on any other country.

In experiment 2 the United States, Mexico, and Canada form an agreement and Mexico eliminates border protection on wheat imports from the United States and from Canada. Once again this reduces the Mexican domestic price of wheat and provides the incentive to increase wheat imports from the United States and also Canada. U.S. and Canadian wheat exports to Mexico expand 18 and 12 percent, respectively (Table 2). With Canada in the PTA, the U.S. export expansion is reduced. The advantage to Canada in participating in the agreement, therefore, is to increase its share of the Mexican import market. In this sense a plurilateral regional arrangement is preferable to Canada rather than a hub-and-spoke (see experiment 4). However, since Mexico is a small importer of wheat, the increase in global U.S. and Canadian wheat exports is marginal. Once again there is basically no effect on any other country.

In experiment 3, we assume separate regional agreements among the United States, Mexico, and Canada (NAFTA), and Argentina and Brazil (MERCOSUR). The two importing countries, Mexico and Brazil, eliminate border protection vis-a-vis their partners. These policy changes lower the prices of U.S. and Canadian exports to Mexican consumers and the prices of Argentine wheat in Brazil. U.S. and Canadian exports to Mexico increase as before, 18 and 12 percent, and

Argentina expands its exports to Brazil by 193 percent (Table 3). Since Brazil is an important importer of Argentine wheat, Argentine total wheat exports expand 40 percent.

Other countries are effected by MERCOSUR. In removing their import barriers, Brazil increases its demand for Argentine wheat raising Argentine wheat prices. With the increase in price, Rest-of-World purchases nearly 15 percent less wheat from Argentina and purchases marginally more from the United States and Canada. More importantly, from the perspective of the United States and Canada, both countries' wheat exports to Brazil decline 23 percent. Since Brazil is a relatively small importer of U.S. wheat and there is an expansion of U.S. wheat exports to Mexico, Colombia, and Rest-of-World, there is a marginal increase, 0.1 percent, in overall U.S. wheat exports. However, Brazil is a relatively large importer of Canadian wheat; the decline in Brazilian imports leads to a marginal decline, 0.3 percent, of total Canadian wheat exports despite the increased purchases by Mexico, Colombia, and Rest-of-World.

In experiment 4 a hub-and-spoke arrangement is assumed with the United States as the hub. Each of the four wheat importing countries eliminates their restrictive barriers vis-a-vis the United States. Canada and Argentina enter in no agreements. Thus, U.S. exports to Mexico, Brazil, Chile and Colombia become comparatively less expensive in these four countries and there is an increase in demand for U.S. wheat relative to wheat from other exporters and domestic producers. U.S. exports increase significantly: 19 percent to Mexico; 292 percent to Brazil; 200 percent to Chile; and 62 percent to Colombia (Table 4). U.S. exports to other countries declined 0.6 percent. While some of these changes are large percentages they represent only a 1.3 percent increase in overall U.S. wheat exports.

**Table 1.  Experiment 1 (U.S. and Mexico): Change From Base in Value of Wheat Trade**

| | Importer | | | | | |
| | | | | | Rest of | |
| Exporter | Mexico | Brazil | Chile | Colombia | World | World |
|---|---|---|---|---|---|---|
| | --------------------------------------------------- percent ------------------------------------------------------- | | | | | |
| United States | 20.1 | | | | | .1 |
| Canada | −1.0 | | | | | 0 |
| Other | −1.0 | | | | | 0 |
| Total imports | 4.2 | | | | | |
| | ----------------------------------------------- million dollars ------------------------------------------------- | | | | | |
| United States | 3.0 | | | | −0.9 | 2.1 |
| Canada | −0.3 | | | | 0.2 | −0.1 |
| Other | −0.2 | | | | | −0.2 |
| Total imports | 2.5 | | | | −0.7 | 1.8 |

**Table 2. Experiment 2 (NAFTA): Change From Base in Value of Wheat Trade**

| | Importer | | | | | |
|---|---|---|---|---|---|---|
| Exporter | Mexico | Brazil | Chile | Colombia | Rest of World | World |
| | | | percent | | | |
| United States | 17.9 | | | | | 0.1 |
| Canada | 11.5 | | | | | 0.1 |
| Other | −2.9 | | | | | −0.3 |
| Total imports | 8.6 | | | | | |
| | | | million dollars | | | |
| United States | 2.7 | | | | −.4 | 2.3 |
| Canada | −3.1 | | | | −.9 | 2.2 |
| Other | −0.5 | | | | | −0.5 |
| Total imports | 5.3 | | | | −1.3 | 4.8 |

The hub-and-spoke experiment adversely affects wheat exports from Canada and Argentina, albeit marginally. Both of these exporters experience a decline of less than 1 percent of their overall exports.

In our last experiment a Western Hemisphere free trade agreement (WHFTA) is assumed to be formed: the NAFTA countries, United States, Canada, Mexico, accept Chile as a member country; the expanded NAFTA signs an agreement with MERCOSUR to remove all import barriers against all member countries; and Colombia joins the agreement (as a representative of the Andean countries).

In WHFTA the United States expands exports to Mexico, Brazil, Chile, and Colombia experiencing a 1 percent rise in overall wheat exports (Table 5). Brazil accounts for nearly 50 percent of the increase. Canada expands exports to Mexico and Brazil attaining nearly a 2 percent increase in overall exports. Argentina expands exports to Brazil and Colombia reaching a 28 percent increase in

overall exports. Note, however, that WHFTA relative to MERCOSUR, leaves Argentina with a smaller increase in wheat exports. This is not surprising since the United States and Canada compete with Argentina in the Brazilian market.

These results provide quantitative illustrations of Wonnacott's hypothesis about the differential effects of a hub-and-spoke compared to a plurilateral regional agreement. Our results show that U.S. wheat exports would expand more with a hub-and-spoke agreement than with a WHFTA, but wheat exports of Canada and Argentina would decline. As equal participants with the United States in a plurilateral arrangement, Canada marginally expands exports while Argentina significantly gains in their trade patterns.

In all five experiments, the domestic markets of the importing countries are affected. Regardless of participants in the PTA, importing member countries have less than a 4 percent reduction in the production of wheat when import protection is removed. There is one exception, Colombia, which

**Table 3. Experiment 3 (NAFTA & MERCOSUR): Change From Base in Value of Wheat Trade**

| | Importer | | | | |
|---|---|---|---|---|---|
| Exporter | Mexico | Brazil | Colombia | Rest of World | World |
| | | percent | | | |
| United States | 17.8 | −22.9 | 1.4 | 0.1 | 0.1 |
| Canada | 11.7 | −22.9 | 1.6 | 0.4 | −0.3 |
| Argentina | | 193.4 | −5.7 | −14.9 | 40.3 |
| Other | −2.3 | −23.0 | 1.4 | 0 | −15.6 |
| Total imports | 8.6 | 62.8 | 0.8 | −0.6 | |
| | | million dollars | | | |
| United States | 2.7 | −3.2 | 0.5 | 0.5 | 5.0 |
| Canada | 3.2 | −26.8 | 0.4 | 12.8 | −10.4 |
| Argentina | | 302.2 | −0.5 | −63.4 | 238.3 |
| Other | −0.6 | −24.6 | 0.4 | 0 | −24.8 |
| Total imports | 5.3 | 247.6 | 0.8 | −45.6 | 208.1 |

**Table 4.   Experiment 4 (Hub & Spoke): Change From Base in Value of Wheat Trade**

| Exporter | Importer | | | | | |
|---|---|---|---|---|---|---|
| | Mexico | Brazil | Chile | Colombia | Rest of World | World |
| | ----------------------------------------------------- percent ----------------------------------------------------- | | | | | |
| United States | 19.4 | 291.6 | 200.4 | 62.3 | −0.6 | 1.3 |
| Canada | 0 | −3.0 | | −17.1 | 0.2 | −0.1 |
| Argentina | | −3.0 | | −17.0 | 0.4 | −0.7 |
| Other | 0 | −3.1 | | −17.2 | 0 | 5.5 |
| Total imports | 4.0 | 7.4 | 176.4 | 11.9 | −0.2 | |
| | ----------------------------------------------------- million dollars ----------------------------------------------------- | | | | | |
| United States | 2.9 | 40.7 | 11.0 | 22.4 | −24.6 | 52.4 |
| Canada | −0.2 | −3.6 | | 3.8 | 5.4 | −2.2 |
| Argentina | | −4.7 | | −1.6 | 2.0 | −4.3 |
| Other | −0.2 | −3.3 | | −5.3 | | −8.8 |
| Total imports | 2.5 | 29.1 | 11.0 | 11.7 | −17.2 | 37.1 |

has a thin domestic market. On the consumer side, the removal of import barriers raises overall consumption in the importing countries. For Brazil, total consumption increases 12 percent with a WHFTA.

*Fruit and Vegetable Juices*

In experiment 1 the United States eliminates its bilateral import tariff with respect to Mexico.[8] As a consequence, U.S. consumers of imported Mexican fruit and vegetable juices experience a decline in price and Mexican exports to the United States expands over 24 percent (Table 6). With the in-

creased consumption by U.S. consumers of Mexican fruit and vegetable juices, the traded price of Mexican juices increases diminishing consumption by Canadian and Rest-of-World consumers of Mexican juice by approximately 8 percent. Since the United States is a major importer of fruit and vegetable juices, the increase in consumption in the U.S. market outweighs the declining purchases of other foreign consumers and overall Mexican fruit and vegetable juice exports expand by nearly 9 percent. Brazil and other smaller exporters experience less than 1 percent decline in trade to the United States.

Overall, the United States increases its foreign fruit and vegetable juice imports by over 1 percent. The increase in Mexican exports, though, has only a marginal effect on the Mexican share of the U.S. market; sales share increases less than a half a percent. The Brazilian and U.S. producer shares of the U.S. market each decline minimally.

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[8] We did not remove the Mexican ad valorem tariff on juice imports because the volume of imports were minimal for the base year. The Armington framework is particularly dependent on base levels; changes in Mexican demand would be marginal with the elimination of the import tariff.

**Table 5.   Experiment 5 (Western Hemisphere FTA): Change From Base in Value of Wheat Trade**

| Exporter | Importer | | | | | |
|---|---|---|---|---|---|---|
| | Mexico | Brazil | Chile | Colombia | Rest of World | World |
| | ----------------------------------------------------- percent ----------------------------------------------------- | | | | | |
| United States | 17.8 | 137.6 | 200.5 | 19.7 | 0 | 1.0 |
| Canada | 10.5 | 66.5 | | 0 | −0.7 | 1.9 |
| Argentina | | 134.2 | | 15.0 | −10.5 | 28.2 |
| Other | −2.6 | −41.3 | | 4.1 | | −27.5 |
| Total imports | 8.2 | 66.6 | 176.5 | 10.0 | −0.9 | |
| | ----------------------------------------------------- million dollars ----------------------------------------------------- | | | | | |
| United States | 2.7 | 19.2 | 11.0 | 7.1 | 0.7 | 40.7 |
| Canada | 2.9 | 77.9 | | 0.1 | −21.9 | 59.0 |
| Argentina | | 209.7 | | 1.4 | −44.7 | 166.4 |
| Other | −0.3 | −44.2 | −0.1 | 1.3 | | −43.3 |
| Total imports | 5.3 | 262.6 | 10.9 | 9.9 | −65.9 | 222.8 |

**Table 6. Experiment 1 (U.S. and Mexico): Change From Base in Value of Fruit and Vegetable Juice Trade**

| Exporter | Importer | | | |
|---|---|---|---|---|
| | United States | Canada | Rest of World | World |
| | ---------------------- percent ---------------------- | | | |
| United States | | | | |
| Mexico | 24.3 | −8.1 | −8.9 | 8.7 |
| Brazil | −.4 | | | ' |
| Argentina | −.4 | | | |
| Other | −.4 | | | −0.2 |
| Total imports | 1.2 | 0 | 0 | |
| | ---------------- million dollars ---------------- | | | |
| United States | | | | |
| Mexico | 14.7 | −.2 | −.2 | 14.3 |
| Brazil | −2.1 | | | −2.1 |
| Argentina | −0.3 | | | −0.3 |
| Other | −1.1 | | | −1.1 |
| Total imports | 11.2 | −.2 | −.2 | 10.8 |

The value of fruit and vegetable trade is estimated by multiplying the volume of trade times an average U.S. import unit value.

**Table 7. Experiment 2 (NAFTA): Change From Base in Value of Fruit and Vegetable Juice Trade**

| Exporter | Importer | | | |
|---|---|---|---|---|
| | United States | Canada | Rest of World | World |
| | ---------------------- percent ---------------------- | | | |
| United States | | 11.4 | 0 | 3.2 |
| Mexico | 23.7 | 3.6 | −8.9 | 21.8 |
| Brazil | −0.8 | 1.1 | 0 | −0.4 |
| Argentina | −0.8 | 1.1 | 0 | −0.4 |
| Canada | 27.9 | | −5.7 | 26.7 |
| Other | −0.9 | 1.1 | | 0 |
| Total imports | 1.7 | 2.6 | 0 | |
| | ---------------- million dollars ---------------- | | | |
| United States | | 6.7 | | 6.8 |
| Mexico | 14.4 | 0.1 | 0.1 | 14.3 |
| Brazil | −4.5 | 0.8 | −0.2 | −3.4 |
| Argentina | −0.6 | 0.1 | 0.3 | −0.5 |
| Canada | 9.2 | | 0 | 9.1 |
| Other | −2.2 | 1.9 | −0.1 | −0.3 |
| Total imports | 16.3 | 9.6 | 0.2 | 26.1 |

In experiment 2, the NAFTA simulation, the United States and Canada eliminate their import tariffs with respect to each other and with respect to Mexico. Canadian consumers face relatively lower prices of U.S. produced fruit and vegetable juices and U.S. bilateral exports increase 11 percent. Since Canada is an important importer of U.S. fruit and vegetable juices, the increased Canadian purchases contribute to the total expansion of the U.S. fruit and vegetable juice exports of over 3 percent (Table 7). U.S. imports also expand from Canada and Mexico contributing to these countries' increases in overall fruit and vegetable juice exports, nearly 27 and 24 percent, respectively.[9] Mexico expands marginally less in the NAFTA experiment compared to a U.S.—Mexican experiment because of the slight increase in competition from Canada. There also is some trade diversion in this scenario as the U.S. purchases less fruit and vegetable juices from Brazil and Rest-of-World.

In the hub-and-spoke experiment the hub (U.S.) removes its import tariffs vis-a-vis the spokes (other Western Hemisphere exporting countries) and the spokes remove their tariffs, to the extent that they exist, vis-a-vis and United States. Consumers in the U.S. benefit by facing a 6 to 7 percent decrease in the price of Canadian, Mexican,

Argentine, and Brazilian fruit and vegetable juices and they increase their foreign purchases by about 14 percent (Table 8). The U.S. share of the U.S. fruit and vegetable juice market declines 3 percent.

With the U.S. being a major importer, the increases in total exports for these Western Hemisphere countries are nearly as high as the percent increase in exports to the United States. For Mexico and Canada, the 19 and 21 percent increase in exports to the U.S. translates into nearly 17 and 20 percent in total exports. For Argentine and Brazil-

**Table 8. Experiment 3 (Hub and Spoke): Change From Base in Value of Fruit and Vegetable Juice Trade**

| Exporter | Importer | | | |
|---|---|---|---|---|
| | United States | Canada | Rest of World | World |
| | ---------------------- percent ---------------------- | | | |
| United States | | 5.1 | 3.3 | 3.9 |
| Mexico | 18.5 | −3.8 | −6.2 | 16.8 |
| Brazil | 21.0 | −2.2 | −4.1 | 10.4 |
| Argentina | 20.7 | 1.1 | −4.6 | 11.5 |
| Canada | 21.0 | | | 20.2 |
| Other | −5.8 | 2.6 | | −2.7 |
| Total imports | 13.9 | 1.5 | 2.1 | |
| | ---------------- million dollars ---------------- | | | |
| United States | | 3.0 | 5.2 | 8.2 |
| Mexico | 11.3 | −0.1 | −0.2 | 11.0 |
| Brazil | 117.6 | −1.6 | −14.3 | 101.7 |
| Argentina | 13.8 | −0.1 | −1.5 | 12.2 |
| Canada | 6.9 | | | 6.9 |
| Other | −14.2 | 5.0 | | −9.2 |
| Total imports | 135.4 | 6.2 | 10.8 | 130.8 |

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[9] U.S. specific tariffs on juices are refundable if the importing firm re-exports a comparable amount within three years. This drawback arrangement is not considered in the simulations.

ian fruit and vegetable juice trade, the U.S. is less important as an importer. Brazil exports 57 percent of its fruit and vegetable juices to the United States, relying more heavily on Canada (7 percent) and Rest-of-World (36 percent). In this hub-and-spoke simulation Brazil expands exports by over 21 percent to the United States but this amounts to only 10 percent in total Brazilian fruit and vegetable juice exports.

Interestingly Rest-of-World exports less and imports more fruit and vegetable juices in this experiment. The Rest-of-World export decline is due to the U.S. diverting purchases away from the ROW and to the spokes. The ROW increase in imports, which is mainly from the United States, is due to the relative decline in traded prices for U.S. fruit and vegetable juice. U.S. prices fall 2 percent as U.S. consumers reduce their demand for domestic fruit and vegetable juices and increase their purchases of fruit and vegetable juices from other Western Hemisphere countries. Note, that U.S. producers benefit from the increase in foreign demand—from Rest-of-World, Canada, and Mexico, and thus, U.S. production falls less than 2 percent.

A Western Hemisphere FTA experiment provides similar results to the hub-and-spoke experiment (Table 9). This is not surprising since the U.S. and non-Western Hemisphere countries are so critical for the exporting countries that is does not matter significantly if other Western Hemisphere countries remove their barriers vis-a-vis each other. The only notable difference in the two experiments is that with the WHFTA, Canadian

**Table 9.   Experiment 4 (Western Hemisphere FTA): Change From Base in Value of Fruit and Vegetable Juice Trade**

| Exporter | Importer | | | |
|---|---|---|---|---|
| | United States | Canada | Rest of World | World |
| | --------------------- percent --------------------- | | | |
| United States | | 13.6 | 3.1 | 6.0 |
| Mexico | 18.6 | 5.2 | | 17.1 |
| Brazil | 21.2 | −3.0 | −4.2 | 10.4 |
| Argentina | 20.3 | 43.7 | −5.1 | 12.6 |
| Canada | 21.9 | | | 21.0 |
| Other | −5.8 | 1.0 | | −3.4 |
| Total imports | 14.0 | 2.8 | −2.2 | |
| | ---------------- million dollars ---------------- | | | |
| United States | | 7.9 | 4.7 | 12.6 |
| Mexico | 11.3 | 0.1 | | 11.4 |
| Brazil | 117.6 | −2.2 | −14.6 | 101.8 |
| Argentina | 13.6 | 1.6 | −1.5 | 13.7 |
| Canada | 7.2 | | | 7.2 |
| Other | −13.9 | 1.8 | | −12.1 |
| Total imports | 136.8 | 9.2 | 11.4 | 134.6 |

fruit and vegetable juice imports rise providing some additional benefits to the other Western Hemisphere exporters including the United States. Canadian exports also increase. Thus, a WHFTA generates a greater expansion of trade than the hub-and-spoke.

*Sensitivity Analysis*

Three variants of a WHFTA experiment are undertaken to provide some sensitivity of our analysis to changes in parameter values. First, we doubled the U.S. demand elasticity; the removal of the U.S. import tariff lowers import prices and, with the larger responsiveness of U.S. demand for foreign juices, generates a 15.9 percent increase in total U.S. imports compared to 14.0 percent in our initial WHFTA experiment. Second, we doubled the U.S. demand and supply elasticities; an enhancement of consumer and producer responsiveness augments U.S. imports by 16.3 percent rather than 14 percent. These two variants of the WHFTA experiment, therefore, suggest that even large changes in our demand and supply elasticity parameters lead to only small changes in total imports.

The third variation of the WHFTA experiment provides a much larger shock; we double demand and supply elasticities and the elasticities of substitution between U.S. and foreign produced juices. Increasing the elasticity of substitution implies that American consumers are less discerning with respect to domestic and foreign produced juices. Total U.S. imports expand 22.4 percent, rather than 14 percent, suggesting that the more substitutable the foreign and domestic juices are, the larger the effect of a price change on U.S. imports.

**Conclusions**

In this paper we present quantitative examples of how various PTAs might affect U.S. agriculture. These rough estimates give quantitative content to the theoretical discussions of other authors. We examine the impact of alternative PTAs among Western Hemisphere countries on wheat trade and on fruit and vegetable juice trade. These two commodities were chosen to illustrate the effects of different country participation in alternative trade arrangements. In wheat, the U.S., Canada, and Argentina compete in both Western Hemisphere and non-Western Hemisphere markets. In fruit and vegetable juices, Brazil, Mexico, Argentina, and potentially other Western Hemisphere countries

compete for the U.S., Canadian, and non-Western Hemisphere markets.

Two conclusions may be drawn from our analysis. First, countries usually wish to participate in PTAs in order to expand export markets. Our results show that export expansion occurs but the extent of the expansion depends upon the type of agreement and which other countries are party to the agreement. Second, the impact of any of five PTAs examined here for wheat and juices would have relatively small impacts upon U.S. consumers and producers, but they could have major impacts on trade of some of the countries.

These results are largely dependent on the size of the domestic market of each participating country and the share of that market represented by trade. The United States has a large domestic market but trade represents a small share of it. The Latin American states have (relatively) small domestic markets but trade represents a large share. Elasticity estimates are less important.

Our experiments demonstrate that the United States and Canada are only marginally affected by Western Hemisphere preferential trading arrangements in wheat. Depending on country participation in the PTA, total U.S. wheat exports expand in the range of 0.1 to 1.3 percent. Canadian exports could change from $-0.3$ to $+1.9$ percent. Argentina, on the other hand could gain much more significantly, as high as 40 percent. This reflects the importance of Brazil as an import market for Argentina.

With respect to fruit and vegetable juice, our experiments indicate that each Western Hemisphere country could increase its exports by as much as 20 percent relative to each country's initial value of exports. The main factor in determining the trade expansion is access to the U.S. market. As a purchaser of fruit and vegetable juice, U.S. imports also could rise moderately, up to 14 percent, depending on which country participates in the trade arrangement.

The experiments provide quantitative examples of how a hub-and-spoke type of PTA would affect trade flows relative to the same countries joining a free trade (plurilateral) agreement. The hub-and-spoke expanded wheat exports of the hub (U.S.) more than with a plurilateral arrangement. On the other hand, wheat exporting spokes would export less wheat with a hub-and-spoke than with a plurilateral arrangement. As for the case of a dominant importing hub (the U.S. in fruit and vegetable juices), the results for the hub are virtually the same as with a plurilateral agreement. However, in the case where another fruit and vegetable importing country (Canada) is added to the agreement,

the exporting spokes can increase their export gains with a plurilateral agreement.

These wheat and fruit and vegetable juice experiments also show that as countries are added to an existing agreement all other members are affected, albeit marginally in some cases. If additional exporting countries are added to an agreement, countries already in the agreement could lose exports. Some could expand exports at the expense of non-participants if additional importing countries are added to an agreement.

The results from the simulations should be interpreted in context; they are illustrative examples. They indicate what might have happened if a PTA existed under world market conditions as observed in 1987, and if all other exogenous variables pertinent to the markets remained the same. Changes in macroeconomic variables such as income growth, for example, are not considered. If a comprehensive PTA generated increased economic growth among importing Western Hemisphere countries, we would anticipate a larger trade expansion for member exporters than reported here. Other changes generated by a PTA such as investment, exchange rates, capital flows, and relative prices across sectors also would feedback to agricultural markets and could substantially modify our findings.

Since we only considered two commodities, any broad conclusion concerning the benefits of a PTA would be unfounded.[10] To try to develop a fuller understanding of the implications of various PTA arrangements, additional commodities would need to be examined and general equilibrium conditions and intertemporal producer and consumer decision making would need to be considered.

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[10] Erzan and Yeats discuss a Western Hemisphere Free Trade Agreement for all merchandise trade. They conclude that most Latin American countries would gain less than the United States in a Free Trade Agreement.

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