AGRICULTURAL TRADE LIBERALIZATION AND CAPITAL FLOWS IN THE AMERICAS

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Executive Summary: An Empirical Investigation into the Trade and Investment Effects of a Southern Hemisphere Free Trade Agreement*

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EXECUTIVE SUMMARY: AN EMPIRICAL INVESTIGATION INTO THE TRADE AND INVESTMENT EFFECTS OF A SOUTHERN HEMISPHERE FREE TRADE AGREEMENT

The year 1994 saw the ratification of the North American Free Trade Agreement (NAFTA), a trade agreement between the United States and Mexico which calls for the gradual phasing out of numerous government-erected barriers to trade (essentially in fresh fruits and vegetables), including both tariff and nontariff restraints. Proponents of the legislation contend that with the elimination of artificial inefficiencies NAFTA will result in increased production, the efficient allocation of resources, increased investment, and decreased prices for the consumer. Concurrently, some have argued that including additional Latin American countries in NAFTA or a similar free trade arrangement will result in even greater economic efficiencies and benefits.

The plausibility of increased trade is further buttressed by the recent changes occurring within the U.S. fresh fruit and vegetable market relative to both U.S. and Latin American productive capacity. Indeed, between 1970 and 1992, domestic per capita consumption of fresh fruit increased from 79.2 to 98.8 pounds, while the fresh vegetable market witnessed a corresponding increase from 110.6 to 133.4 pounds. At the same time, domestic supply remained relatively static, with technologically-based efficiencies at least partially offset by decreasing acreage under cultivation. As a result, while fresh fruit and vegetable imports accounted for 18 percent of domestic consumption in 1973, this had increased to 24 percent by 1992. When the relevant market is limited to fresh fruit, the increase was even more dramatic, rising from 28 percent in 1973 to 39 percent in 1992. Further, demographic and other changes strongly suggest a rising domestic demand in the foreseeable future.

With these aggregate economic considerations as background, this paper addresses the opportunity to establish new rules and mechanisms to promote freer trade and investment in the Americas, and the likely effect of taking such a move. Many Latin American countries have taken and continue to take great strides in changing and establishing the infrastructure and the rules and mechanisms, both private and public, needed to take advantage of the opportunity.

This paper further addresses the likely production, investment, and price repercussions of using NAFTA or a similar free trade agreement to include the United States and selected Southern Hemisphere neighbors in a regional free trade zone. Specifically, we examine the assumption that increasing the

number of participants in a Southern Hemispheric free trade agreement may portend lower prices, a surge of production in relevant Latin American countries, and a corresponding flow of investment to these countries as international investors realize the profit potential inherent within agreements predicated on pure comparative advantage. To further establish a preliminary estimate of the effects of extending NAFTA (or an equivalent agreement) to various Southern Hemisphere countries, we will detail the effects of the 1983 Caribbean Basin Initiative on prices, production, and investment flows. Using the empirical results of this factual example, we gauge the reliability of our study's findings.

Because of the sheer volume of products that are currently traded between numerous Latin American countries and the United States, selection criteria were used to segregate specific products and countries. Although it is arguable whether some products or countries should have been included, the intent was to include a diverse selection of product-country associations. Some established product-country combinations are supplemented by combinations which possess substantial growth potential over the foreseeable future. Further, we mainly chose products for which there existed a substantial period when U.S. domestic supply alone was unable to fill domestic demand.

Six countries were selected for the study: Argentina, Chile, Colombia, Guatemala, Honduras, and Mexico. Selection criteria included: 1) the availability of sufficient data; 2) the production of particular products; 3) the country's political system; 4) the country's economic and agricultural policies; 5) the country's infrastructure; 6) the country's marketing strategies and abilities; 7) the country's natural resources and climate; 8) the government's commitment to technological advances and growth in human capital stocks; and 9) an overall measure of the country's comparative advantage vis-à-vis the United States.

Clearly these countries run the gamut of socioeconomic and political development, with strong attributes in one field potentially offset by deficiencies in another. To develop an overall description of a particular country's current and future export strength, we weight each criterion to develop a readiness-for-export index. This index provides a reasonable and consistent basis upon which to predicate country selection. However, the constraint imposed by insufficient or nonexistent data renders this study less than ideally complete. Furthermore, the most significant effects of a hemisphere-wide free trade agreement might occur in countries that currently do not export any quantity of a particular good to the United States. Hence, it is very difficult to reliably estimate the effects of decreased trade barriers on a particular country's decision to *initiate* exporting a particular product to the United States.

Several products were selected for the study, including asparagus, bell peppers, cantaloupes, cucumbers, grapes, oranges, strawberries, and tomatoes. Selection criteria included: 1) the product's

price-to-weight ratio; 2) U.S. shipments; 3) the magnitude of current imports; and 4) the per capita growth in U.S. consumption over specified time periods. Similar to the country selection process already mentioned, we chose products based on both their current exportability and their future potential for export growth. Among the most attractive were those products for which future technological growth in Latin American countries might drastically alter the current competitive situation by providing these countries technologically-based lower costs in addition to their current labor-cost advantages.

One of the key determinants affecting any such study is measuring the time period each year when domestic production does not compete with Latin American production. We calculate this *window of opportunity* for each country–product combination. For some products, such as asparagus and cantaloupes, significant periods exist for which there is no domestic production. By assuming identical demand curves for domestic and Latin American products regardless of the time period, our analysis indicates substantial export potential for these products based on the current comparative advantage.

At the same time, products such as bell peppers and oranges currently have little or no window of opportunity. However, these products are included in the current study under the assumption that relaxed trade barriers could substantially increase their export potential based on lower Latin American prices.

Our examination of the existing literature and data leads us to several conclusions. Before identifying and briefly discussing these results, it is important to note, that the omission of countries which do not currently export particular products to the U.S. market may significantly understate the expected gains from free trade. It is possible that the elimination of trade barriers would provide sufficient incentive for such countries to commit resources to large-scale exportation. However, without adequate information to assess this potential, our study assumes no entry from these countries, an unlikely situation which leads to a systemic underestimation of price, production, and investment effects.

With this caveat in mind, we draw several conclusions from the current study. First, we conclude that there would be very modest price and quantity effects associated with extending NAFTA or a similar free trade agreement to the countries in question, with several exceptions briefly discussed below. Contrary to commentators and researchers who, a priori, insist on the substantial benefits of expanding free trade to Southern Hemisphere countries, our study indicates that there will not be large-scale shifts of output to the U.S. market for a majority of the products studied based on current comparative advantages. Additionally, we predict relatively inconsequential price effects for consumers, with slightly higher other-market and Latin American market prices generally offset by trivially lower cross-product average prices for the U.S. consumer.

We estimate price effects using two values for the elasticity of substitution: 4.00, for a low-range estimate, and 20.00 for an upper-bound (and more realistic) estimate. Additionally, we model both the short-run and long-run effects on prices and quantities. With a substitution elasticity of 4.00, the volume-weighted short-run price effect for many of the products is less than 1 percent. When the more probable elasticity-of-substitution value of 20.00 is used, realized export prices increase, but still remain somewhat unexpectedly trivial. When the long-run price effects are examined similar results occur. Finally, the actual dollar-per-pound export price increase is typically less than half a penny.

An examination indicates relatively modest quantity effects under a systematic and inclusive free trade agreement, with a large percentage of increased imports due to other-market shifting rather than an increase in production. For example, we predict Mexican asparagus imports would increase by approximately 51 million pounds in the short run (substitution elasticity of 20.00). However, less than half of these higher exports would be the result of increased Mexican production. We predict that underlying macroeconomic conditions will result in intermarket production shifts rather than strictly higher production.

Finally, and perhaps most importantly, our study finds that investment opportunities will be substantially less than predicted by free trade proponents. If a dollar increase in output yields a forty-six cent increase in investment, and assuming a free trade agreement incorporating all countries and products examined in this study, investment will increase by between $38 million to $89 million in the short run, a relatively insubstantial amount.[1] Even in the long run, we estimate that investment will increase by only $47 million to $133 million.

There are several empirical rationales for these conclusions. First, for some product–country combinations, duties and tariffs have already been substantially or wholly eliminated, either through the Caribbean Basin Economic Recovery Act or the Andean Trade Preference Act. A large percentage of the product–country combinations have realized import duty rates of close to 0 percent. *Ceteris paribus*, for these combinations current quantities and prices already closely approximate the free trade equivalents. Without additional macroeconomic or microeconomic changes (such as technological advances or changes in preferences and demographics), many of the studied countries have little incentive to increase imports and/or domestic production based on the reduction or elimination of the already innocuous trade restrictions currently applied.

A second explanation for the relatively insubstantial trade and investment effects is the relatively small proportion of the total percentage of Latin American production allocated to the U.S. market. For example, between 1989 and 1992, only U.S. exports of asparagus and cucumbers accounted for more

than 25 percent of total production by the studied countries, with a volume-weighted average of only 7.24 percent.[2] Because of the high substitutability between products regardless of production location (i.e., consumers are relatively indifferent to a choice between U.S. or Mexican tomatoes), and the resultant high substitution elasticities, Latin American producers are more likely to shift other-market exports to the U.S. market than to invest in new facilities capable of increasing aggregate production.

There are several exceptions to these findings: Mexican production of asparagus, cantaloupes, and cucumbers; Colombian asparagus; and Chilean asparagus. Our analysis indicates several reasons for this. First, relatively substantial duties exist for these particular products when exported by Mexico, Chile, and Colombia. Second, as a percentage of their total domestic production, these countries export a large percentage of these products to the U.S. market. This high ratio decreases the possibility of sating higher expected U.S. demand with other-market exports.

As the results of this study indicate, the forecast of widespread and evenly distributed benefits to countries based simply on their inclusion in an agreement which obviates trade barriers is fallacious. It presents an overly simplistic view of free trade and comparative advantage. Nevertheless, the examination of several key interactions facilitates the prediction of free trade's likely effects. First, the presence and magnitude of existing trade barriers must be determined. If, as in this study, tariff and nontariff barriers are already trivial, the complete elimination of already-reduced impediments is likely to produce only limited trade increases. Second, consideration must be given to the amount of exports allocated to a particular market as a percentage of total domestic production. When this ratio is small, it is likely that the producer will shift exports between markets rather than increase production. As the Mexican example indicates, a larger ratio of exports to total production will increasingly lead to the augmentation of productive capacity. Of course, as the particular product's elasticity of substitution decreases, the exporter will be more likely to increase production than to shift current production.

Third, careful examination must be made of the product's window of opportunity. If current demand is generally filled by the producers within the importing country, the plausibility of large-scale imports is correspondingly decreased. Finally, it is important to remember that the total benefits that result when numerous countries are included in a free trade agreement are likely to be substantially less than the sum of the benefits that might accrue to each particular country if only they were included in the free trade agreement.

INTRODUCTION

In this paper, we develop a model that estimates the effects on prices, outputs, and trade flows arising from the elimination of U.S. import tariffs on nontemperate agricultural commodities from Latin America. Subsequently, we assess how the increased trade flows from Latin America to the United States are likely to create additional investment in the agricultural sector in Latin American countries.

In performing this analysis, it is important to note that some of the fresh fruit and vegetable trade from Latin America is already subject to the tariff relief provided by the Caribbean Basin Economic Recovery Act (CBERA) (affecting Guatemala, Honduras, Costa Rica, Nicaragua, and El Salvador) and the Andean Trade Preference Act (ATPA) (affecting Colombia, Bolivia, Ecuador, and Peru). Import tariffs were generally eliminated in 1984 for CBERA countries and in 1992 for ATPA countries.[3]

Our analysis examines eight agricultural commodities: asparagus, bell peppers, cantaloupes, cucumbers, grapes, oranges, strawberries, and tomatoes. Six countries—Argentina, Chile, Colombia, Guatemala, Honduras, and Mexico—are selected for this analysis, primarily because these countries produce significant quantities of the selected commodities and have historical experience exporting these commodities to the United States.

ECONOMIC IMPACT OF TRADE LIBERALIZATION

Our model, thoroughly described in Appendix 1, divides production into three regions: the United States, the relevant Latin American country (or region) under examination, and all other countries. Each country is assumed to produce a particular variety of each agricultural commodity that may be an imperfect substitute for the varieties produced in other countries.[4] In order to simplify the model, and to focus on the key determinants underlying its results, we assume that the elimination of import duties only affects the prices of the U.S. good and the good from the Latin American country benefiting from trade liberalization. That is, the U.S. import prices of goods from all countries except the country benefiting from trade liberalization are assumed constant. Since our model assumes that competition precludes price differences across geographic markets, implying that demand conditions in other markets influence the price received in the U.S. market, this assumption is consistent with the view that U.S. demand for these products is relatively small.

As is common with many models of international trade, it is difficult to assess the impact of removing import tariffs under conditions when there are presently no imports by the United States from a particular country. Given that there is insufficient data to assess the magnitude of producer price increases necessary to induce exportation to the United States, we are therefore unable to measure the effects of trade liberalization with respect to those countries and commodities where there are no current imports into the United States.

Our analysis is based on a static model that assumes agricultural markets in the United States are in equilibrium prior to trade liberalization. The model then measures how the equilibrium changes when import tariffs on agricultural commodities from selected countries are eliminated. Agricultural markets are assumed to be perfectly competitive, implying that there is a defined supply curve which describes how much output will be supplied to the U.S. market at a specified price. Equilibrium is achieved when prices are such that the quantity demanded of each variety at the specified price equals the quantity that producers are willing to sell in the U.S. market at that particular price. The quantity that Latin American producers are willing to sell in the United States depends on the export price, while the quantity demanded in the U.S. market depends on the import price inclusive of duties.

The removal of trade restrictions, such as import tariffs on Latin American agricultural products, reduces the selling price of Latin American agricultural products in the United States. This market situation creates excess demand for Latin American products in the U.S. market. To eliminate this unfulfilled demand and restore market equilibrium, price adjustments occur for both Latin American and U.S. products. The net result is that the export price of Latin American agricultural products increases while the price of U.S. agricultural products declines. The price of U.S. products declines because the decrease in import duties results in a decrease in the price paid by importers of Latin American products even though there is an increase in the (export) price received by Latin American producers. Due to the relative decline in the price of Latin American products, purchasers switch away from U.S.-produced varieties. The resulting decline in demand causes U.S. prices to fall.

Whether the increase in the prices received by Latin American producers stimulates a "substantial" increase in Latin American production depends on two factors: the magnitude of the production response to a given increase in price, and the magnitude of any price effect induced by trade liberalization. The first factor depends on the elasticity of production with respect to price. Of course, any estimate of the production elasticity is sensitive to the time period under examination. In the short run (consisting of an approximately one- to three-year period), agricultural producers may be able to take

actions to increase their productivity and switch acreage from one crop to another. Over a longer period, however, producers may be able to convert more acreage to producing a given commodity and bring new acreage under cultivation. Thus, the production response to a given price increase would be larger in the "long run" than in the "short run." Our analysis addresses the time considerations involved in assessing the production response to trade liberalization by using estimates of both "short-run" and "long-run" production elasticities.

The second factor, whether there will be a large export price increase for Latin American goods as a result of trade liberalization with the United States, depends on the relative ease with which a product can be diverted from other markets to satisfy increased U.S. demand. An increased ability to divert output to the United States from other markets (i.e., an increased elasticity of U.S. import supply) lessens the price increase that results from trade liberalization by the United States and restricts the production increase needed to offset increased U.S. demand. Consequently, the output effects are likely to be small, and the likely impact on investment flows will be limited as well.

It becomes easier to divert output from other markets to satisfy excess demand in the United States whenever sales to the U.S. market are small relative to a country's total production of a particular product, and whenever demand in non-U.S. markets for that country's product is extremely sensitive to changes in its price. If the share of total production sent to the U.S. market is relatively small, then only a small percentage of production sent to other markets needs to be diverted to the United States in order to accommodate an increase in U.S. demand. As demand outside the United State becomes increasingly price sensitive, a smaller price increase is required to free up sufficient quantities of the Latin American good to satisfy the increased U.S. demand resulting from trade liberalization. Other than Mexico and Chile, most of the other countries under consideration send only a small percentage of their entire production to the U.S. market. Thus, before undertaking a more rigorous analysis, a plausible hypothesis might be that Mexico and Chile would experience the most gains from trade liberalization with the United States. Since producers in these countries are already sending a substantial share of their output to the United States, they would not be able to absorb a significant increase in U.S. demand for their products without experiencing a substantial increase in export prices and production.

Another factor determining the magnitude of the production and export price increases associated with trade liberalization is the degree to which U.S. consumers shift their purchases to a Latin American variety of a given agricultural product when the price of that variety declines relative to the U.S. variety. As the degree of substitutability increases, a decline in the import price of the Latin

American variety will have a larger effect on the demand for that variety, inducing a larger increase in the export price and production of that variety. Since there is limited empirical evidence relating to this issue, we examine the sensitivity of our results to both "low" substitutability and "high" substitutability assumptions.

As explained in a later section, these "baseline" substitutability assumptions represent the assumed degree of substitutability when the variety produced by the Latin American country and the U.S.-produced variety are available in the marketplace at the same time. However, we adjust these substitution elasticities downward when there are periods of time that the Latin American variety of a particular agricultural commodity does not face competition from a U.S.-produced variety due to differences in growing seasons and other factors. The substitution elasticity should become smaller as the period of overlapping sales declines between the two varieties. Without competition from a U.S.-produced substitute, a drop in the import price of the Latin American variety will only stimulate additional sales by inducing new consumers to enter the market or existing consumers to purchase in larger quantities, rather than by inducing existing consumers to switch their purchases from the U.S. variety to the Latin American variety. Thus, we expect to obtain larger price and output effects when there is a larger overlap in the percentage of months when the U.S. variety and the Latin American variety are available simultaneously.

DATA SOURCES AND PARAMETER ESTIMATES

The results from our simulation model are dependent on actual market data pertaining to prices, quantities, and market shares. As shown in Appendix 1, the model also uses parameter estimates of the own-price and cross-price elasticities of demand pertaining to the variety of each commodity produced by each country, the U.S. production elasticity with respect to each commodity, and the U.S. import elasticities and total production elasticities with respect to each commodity from each Latin American country. As explained in equations (8) and (9) in Appendix 1, the own-price and cross-price price elasticities of demand with respect to a particular country's variety of a particular commodity are derived from the following information: (1) an estimate of the "overall" price elasticity of demand for the commodity, (2) an estimate of the elasticity of substitution between the varieties offered by any pair of countries, and (3) the share of the U.S. market captured by each country. Regarding the first requirement, estimates of the overall price elasticity of demand for various agricultural commodities are taken from a study by the European Commission, and are presented in the Table in Appendix 2. These

estimates are consistent with empirical studies of the U.S. agricultural market.[5] Regarding the second requirement, we consider two scenarios: one with a "low" substitution elasticity (assumed to equal four), and another with a "high" substitution elasticity (assumed to equal twenty).[6] We then adjust these "baseline" elasticities downward when there are months during the year that the imported Latin American variety does not face competition from a U.S.-produced variety.

This adjusted elasticity of substitution equals a weighted average of the baseline elasticity and a minimum elasticity,[7] where the weighting is based on the percentage of months that the Latin American variety competed against a U.S. variety during the time in each year that it is consumed in the U.S. market.[8] This downward adjustment has its greatest effect on asparagus and cantaloupes, where Latin American countries have less overlap in their growing seasons with U.S. producers. Regarding the third requirement, market shares are determined using data on prices, imports, and consumption obtained from the U.S. Department of Agriculture and the U.S. Department of Commerce. Our model also depends on estimates of the U.S. import supply elasticity from each Latin American country with respect to each commodity, where this elasticity is a weighted combination of the own-price elasticity of demand for that country's product outside the United States and the total production elasticity for that country's product.[9] Since data from the U.N. Food and Agriculture Organization indicate that there are only nominal amounts of Latin American export sales outside the United States for the agricultural commodities of interest, and that Latin American countries do very little importing of these agricultural commodities into their domestic markets, it is assumed that the remaining production of each Latin American country is consumed domestically with limited competition from varieties produced in other countries. Thus, we presume that the own-price elasticity of demand for Latin American varieties outside the United States is the same as the overall price elasticity of demand for the commodity.

We base our estimates of the total production elasticity on a variety of sources, including empirical studies of production elasticities of agricultural products for the United States and elasticities cited in cases for related products that have appeared before the U.S. International Trade Commission. These estimates, which we view as measuring short-run production elasticities, range between two and four (see the Table in Appendix 2). Since there is limited information concerning production responses over the long run, we double these estimates when considering long-run effects.

By using a constant elasticity of substitution model, we are able to calculate the percentage change in prices, exports, and production that results from trade liberalization by the United States. To convert these estimates into dollar values, we use data on prices and import values from the U.S.

Department of Commerce.[10] Production data for Latin American countries are obtained from the Food and Agricultural Organization of the United Nations. [11] Data on U.S. consumption, production, and domestic sales, which are relevant in calculating market shares, are obtained from the U.S. Department of Agriculture.[12]

For purposes of our model, we define trade liberalization as the act of diminishing the "realized" duty rate from its base level to zero, where the base duty rate is calculated as the ratio of total duties collected to the total value of U.S. imports in the base period for a given commodity from a given country. Data on duties and the value of imports are obtained from the U.S. Department of Commerce.[13]

To project the impact of the Andean Trade Preference Act initiated in 1992, the North American Free Trade Agreement (NAFTA) initiated in 1993, and any future trade liberalization that may occur with respect to agricultural commodities from Latin American countries, we must select a base period that is representative of market conditions prior to any trade liberalization. Consistent with that objective, we select 1991 as our base year and use annual data for our estimates.

RESULTS

Impact of Trade Liberalization on Prices, Exports, and Production

In this section, simulation results are presented showing the effects of trade liberalization by the United States on the prices, exports, and production of agricultural commodities from Latin America. We estimate not only the effects of eliminating U.S. import duties on individual commodities on a country-by-country basis, but also the effect of "regional" trade liberalization that would result in the elimination of duties on imports from all six countries considered in our analysis. For example, the results reported for asparagus from Mexico are the estimated effects of removing U.S. import duties on Mexican asparagus only. This implies that the U.S. import duty rate is assumed to remain constant for all other countries, including other Latin American countries. By contrast, the results reported for asparagus from Latin America represent the effect of eliminating the U.S. import duties on asparagus from all six Latin American countries.

The effects of regional trade liberalization are generally smaller than those obtained by summing the effects of trade liberalization for the individual countries. This result arises because the regional removal of import duties causes prices to fall on imports from several competing countries. Thus, the impact of regional trade liberalization on the demand for the products from any single country is less in comparison to the impact of removing duties on imports from that country alone.

Since trade liberalization leads to the elimination of import duties, the current magnitude of import duties is crucial in evaluating the likely effects. The realized import duty rates for the commodities and countries of interest are calculated as the actual import duties collected as a percentage of the value of imports (before duties). It is noteworthy that of the countries under consideration, Mexico is presently subject to the highest duty rates. Other countries face relatively high duties on selected products: Chile for asparagus and tomatoes, Colombia for asparagus, and Honduras and Argentina for tomatoes. As mentioned previously, Guatemala and Honduras receive duty-free treatment from the United States for most agricultural commodities under the Caribbean Basin Initiative. Considering that our sample includes those countries that are the primary exporters of nontemperate agricultural commodities to the United States, we might expect that trade liberalization will only have significant effects on selected countries, such as Mexico and Chile, and selected products, such as asparagus, cucumbers, cantaloupes, and tomatoes.

We provide two sets of estimates, based on short-run versus long-run elasticities of production. As mentioned previously, the long-run elasticity of production is assumed to equal twice the estimate of the short-run elasticity (as described in the Table in Appendix 2). The short-run effects of trade liberalization are presented in Tables 1 - 8, and the long-run effects are presented in Tables 1′- 8′. The first two tables in each set describe the percentage and dollar impact of trade liberalization on the export prices of each Latin American country; the next two tables describe the percentage and quantity impact on each country's exports to the United States; the following two tables describe the percentage and quantity impact on domestic production in each country; and the final two tables describe the dollar impact of trade liberalization on investment under two potential investment scenarios. Each table provides results under both our low and high baseline assumptions concerning the substitutability between the U.S.-produced and Latin American-produced varieties of a given commodity.

Tables 1 and 1′ indicate that, regardless of the assumption concerning the substitutability between goods produced by the Latin American countries and the United States, trade liberalization is likely to have only modest effects on the export prices of Latin American goods. Even under the high substitutability assumption, our model predicts that no export prices are likely to rise by more than 10 percent. The largest price effects are felt for Mexican exports since Mexico is already sending a substantial share of its domestic production to the U.S. market. Therefore, a significant percentage increase in U.S. demand for Mexican products cannot be satisfied unless export prices increase

sufficiently to both induce increased production and discourage consumption of Mexican products in non-U.S. markets, thereby freeing substantial quantities to enter the U.S. market.

As expected, the price effects from trade liberalization are smaller when we use the long-run production elasticities. Since the long-run elasticities reflect an increased responsiveness of production over the long term to a given change in price, it then follows that a smaller export price change is needed to alleviate an increase in U.S. demand for Latin American goods.

Consistent with the above results, Tables 2 and 2′ show that the impact of trade liberalization on the prices per pound of U.S. exports is extremely modest. The price of asparagus would be affected the most, but the impact is only six cents per pound even under the assumptions of a high baseline elasticity of substitution and a short-run period of adjustment.

Tables 3 and 3′ show that trade liberalization will result in substantial percentage increases in the quantity of exports from Latin American countries to the United States, particularly exports from Mexico. Exports from other countries benefiting from trade liberalization include Chilean tomatoes, asparagus, and bell peppers; Colombian asparagus; Honduran tomatoes; and Argentinean oranges and tomatoes. Overall, regional trade liberalization with these Latin American countries should produce substantial percentage increases in exports of asparagus, bell peppers, cantaloupes, cucumbers, oranges, and tomatoes to the United States. In terms of the annual increases in the pounds of these commodities exported to the United States, it is clear from Tables 4 and 4′ that Mexico is responsible for the bulk of these increases with the exception of grapes, where Chile experiences the largest increase.

Tables 5 and 5′ indicate that the percentage increases in the production of each commodity resulting from trade liberalization with the United States are relatively modest except for asparagus, cantaloupes, and cucumbers. Once again, the biggest percentage increases are sustained by Mexico (with the exception of Colombia's and Chile's exports of asparagus). For most other countries, the percentage increase in production induced by trade liberalization is small, which is not unexpected considering that tariffs are already at relatively modest levels and that these countries typically send only a small proportion of their total production to the United States. As shown in Tables 6 and 6′, the results concerning the absolute increase in production resulting from trade liberalization are similar to those described above.

Note that even though the long-run elasticity of production is twice the short-run elasticity, the long-run production effects presented in Tables 5′ and 6′ are substantially less than twice the short-run effects presented in Tables 5 and 6. That is because an increase in the elasticity of production signifies

that there is an increased production response to a given change in producer prices. Consequently, as the elasticity of production increases, a smaller increase in Latin American producer prices is sufficient to induce the additional supplies needed to offset the increased U.S. demand for Latin American products. Taken by itself, this smaller price effect reduces the magnitude of the production response resulting from trade liberalization.

Impact of Trade Liberalization on Investment

Tables 7 - 8 and 7′ - 8′ provide estimates of the short-run and long-run impact of trade liberalization on the *annual* investment in each Latin American country in the production of each agricultural commodity. We derive these predictions by estimating the increased dollar value of production that results from trade liberalization, and then converting that estimated production increase into an estimate of the investment needed to support the additional production. Two scenarios are considered in calculating the increase in investment: (1) $1 of increased production leads to $1 of increased investment, and, (2) $1 of increased production leads to $0.46 of increased investment. The first scenario assumes that all costs associated with production, including materials (e.g., seed and fertilizers), labor, and capital (e.g., machinery, warehouses, and land), must be financed in order for production to occur. This scenario recognizes that significant time may elapse between the purchases of capital, labor, and materials and the end of the growing season where the product is harvested and sold. Thus, most of the costs associated with agricultural production are incurred significantly in advance of the associated revenues, implying that considerable investment is required. The second scenario assumes that only the capital costs associated with agricultural production require extended financing, which is more consistent with the traditional economic approach that investment is needed only to finance increased capital accumulation. Our estimates of the capital costs associated with agricultural production are taken from the U.S. input-output tables.[14]

The tables show that the investment opportunities clearly lie in Mexico, and pertain to the production of tomatoes, cucumbers, cantaloupes, bell peppers, and asparagus. For example, Table 8 shows that under the more conservative investment assumption, where $1 of increased production results in $0.46 of increased investment, the predicted short-run investment increase in Mexico lies in the range of $14 to 34 million for tomatoes, $7 to 14 million for cucumbers, $6 to 13 million for cantaloupes, $5 to 13 million for bell peppers, and $4 to 7 million for asparagus. As presented in Table 8′, the long-run effects are substantially higher, ranging from $18 to 52 million for tomatoes, $9 to 23 million for

cucumbers, $7 to 19 million for cantaloupes, $6 to 20 million for bell peppers, and $6 to 12 million for asparagus. This is to be expected since we would expect a larger production response over a longer time period.

ANALYSIS AND CONCLUSIONS

The realized U.S. import duty rates on nontemperate agricultural commodities are already low for many Latin American countries. On this basis alone, one might expect that the impact of extending trade liberalization through NAFTA, the Andean Trade Preference Act, or other trade measures would be modest in size. Our results generally confirm that impression.

Most Latin American countries export only a small share of their domestic production to the United States. For this reason, even if trade liberalization by the United States produces a substantial increase in U.S. demand for those countries' agricultural products, only a small increase in producer prices is needed to reduce demand in non-U.S. markets sufficiently to offset the excess demand in the United States. Since trade liberalization results in only a small price increase under these circumstances, the resulting increase in production and the associated increase in investment are likely to be small.

Mexico, however, exports to the United States a significant share of its output of nontemperate agricultural commodities and faces relatively high U.S. import duty rates on these commodities. Consequently, as predicted by our model, U.S. trade liberalization under NAFTA is likely to result in significant effects on the prices, output, and investment in nontemperate agricultural commodities in Mexico.

TABLES

Table 1. Short-run effect of trade liberalization on export prices of Latin American goods sold in the United States (percentage increase in export prices)

	Asparagus	Bell Peppers	Cantaloupes	Cucumbers	Grapes	Oranges	Strawberries	Tomatoes
Elasticity of Substitution=4.00								
Latin America	5.2279	0.7178	1.2937	2.7028	0.0104	0.0356	0.1092	0.3654
Mexico	5.9275	0.9258	2.1199	3.1086	0.0004	0.0558	0.1343	0.7133
Chile	1.4041	0.0003	0.0000	0.0000	0.0795	n/a	0.0000	0.0005
Colombia	4.5018	n/a	n/a	n/a	0.0000	n/a	0.0143	0.0000
Guatemala	0.0272	n/a	0.0068	0.0000	n/a	n/a	0.0000	0.0000
Honduras	n/a	0.0063	0.0000	0.0000	n/a	n/a	0.0000	0.0484
Argentina	0.5440	n/a	n/a	n/a	0.0000	0.0000	0.0007	0.0002
Elasticity of Substitution=20.00								
Latin America	8.3128	1.8722	2.7542	4.9086	0.0196	0.1432	0.3693	0.9383
Mexico	10.0560	2.2923	4.7760	5.7334	0.0017	0.2204	0.4438	1.6680
Chile	1.4041	0.0014	0.0000	0.0000	0.1584	n/a	0.0000	0.0027
Colombia	4.5018	n/a	n/a	n/a	0.0000	n/a	0.0338	0.0000
Guatemala	0.0272	n/a	0.0156	0.0000	n/a	n/a	0.0000	0.0000
Honduras	n/a	0.0149	0.0000	0.0000	n/a	n/a	0.0000	0.2385
Argentina	1.0945	n/a	n/a	n/a	0.0000	0.0001	0.0036	0.0008

Note: n/a indicates that exports were either zero or not available.

Table 1′. Long-run effect of trade liberalization on export prices of Latin American goods sold in the United States (percentage increase in export prices)

	Asparagus	Bell Peppers	Cantaloupes	Cucumbers	Grapes	Oranges	Strawberries	Tomatoes
Elasticity of Substitution=4.00								
Latin America	3.4025	0.4287	0.7726	1.6875	0.0065	0.0208	0.0691	0.2173
Mexico	3.8660	0.5579	1.2695	1.9502	0.0002	0.0327	0.0852	0.4310
Chile	0.9035	0.0002	0.0000	0.0000	0.0510	n/a	0.0000	0.0003
Colombia	2.8808	n/a	n/a	n/a	0.0000	n/a	0.0094	0.0000
Guatemala	0.0176	n/a	0.0041	0.0000	n/a	n/a	0.0000	0.0000
Honduras	n/a	0.0039	0.0000	0.0000	n/a	n/a	0.0000	0.0272
Argentina	0.3566	n/a	n/a	n/a	0.0000	0.0000	0.0004	0.0001
Elasticity of Substitution=20.00								
Latin America	6.0726	1.3633	1.9590	3.8963	0.0151	0.0910	0.2639	0.6793
Mexico	7.3938	1.7007	3.3612	4.5232	0.0010	0.1413	0.3197	1.2481
Chile	0.9035	0.0008	0.0000	0.0000	0.1200	n/a	0.0000	0.0015
Colombia	2.8808	n/a	n/a	n/a	0.0000	n/a	0.0271	0.0000
Guatemala	0.0176	n/a	0.0112	0.0000	n/a	n/a	0.0000	0.0000
Honduras	n/a	0.0115	0.0000	0.0000	n/a	n/a	0.0000	0.1351
Argentina	0.7926	n/a	n/a	n/a	0.0000	0.0001	0.0022	0.0004

Note: n/a indicates that exports were either zero or not available.

Table 2. Short-run effect of trade liberalization on export prices of Latin American goods sold in the United States (Increase in Export Price in Dollars per Pound)

	Asparagus	Bell Peppers	Cantaloupes	Cucumbers	Grapes	Oranges	Strawberries	omatoes
Elasticity of Substitution=4.00								
Latin America	0.0329	0.0027	0.0018	0.0054	0.0000	0.0001	0.0006	0.0012
Mexico	0.0378	0.0035	0.0032	0.0064	0.0000	0.0002	0.0007	0.0023
Chile	0.0080	0.0000	0.0000	0.0000	0.0002	n/a	0.0000	0.0000
Colombia	0.0156	n/a	n/a	n/a	0.0000	n/a	0.0002	0.0000
Guatemala	0.0001	n/a	0.0000	0.0000	n/a	n/a	0.0000	0.0000
Honduras	n/a	0.0000	0.0000	0.0000	n/a	n/a	0.0000	0.0003
Argentina	0.0023	n/a	n/a	n/a	0.0000	0.0000	0.0000	0.0000
Elasticity of Substitution=20.00								
Latin America	0.0523	0.0070	0.0037	0.0098	0.0001	0.0004	0.0021	0.0030
Mexico	0.0642	0.0086	0.0073	0.0118	0.0000	0.0006	0.0024	0.0053
Chile	0.0080	0.0000	0.0000	0.0000	0.0005	n/a	0.0000	0.0000
Colombia	0.0156	n/a	n/a	n/a	0.0000	n/a	0.0005	0.0000
Guatemala	0.0001	n/a	0.0000	0.0000	n/a	n/a	0.0000	0.0000
Honduras	n/a	0.0001	0.0000	0.0000	n/a	n/a	0.0000	0.0016
Argentina	0.0046	n/a	n/a	n/a	0.0000	0.0000	0.0000	0.0000

Note: n/a indicates that exports were either zero or not available.

Table 2′. Long-run effect of trade liberalization on export prices of Latin American goods sold in the United States (increase in export price in dollars per pound)

	Asparagus	Bell Peppers	Cantaloupes	Cucumbers	Grapes	Oranges	Strawberries	Tomatoes
Elasticity of Substitution=4.00								
Latin America	0.0214	0.0016	0.0010	0.0034	0.0000	0.0001	0.0004	0.0007
Mexico	0.0247	0.0021	0.0019	0.0040	0.0000	0.0001	0.0005	0.0014
Chile	0.0051	0.0000	0.0000	0.0000	0.0002	n/a	0.0000	0.0000
Colombia	0.0100	n/a	n/a	n/a	0.0000	n/a	0.0001	0.0000
Guatemala	0.0001	n/a	0.0000	0.0000	n/a	n/a	0.0000	0.0000
Honduras	n/a	0.0000	0.0000	0.0000	n/a	n/a	0.0000	0.0002
Argentina	0.0015	n/a	n/a	n/a	0.0000	0.0000	0.0000	0.0000
Elasticity of Substitution=20.00								
Latin America	0.0382	0.0051	0.0027	0.0078	0.0001	0.0003	0.0015	0.0022
Mexico	0.0472	0.0064	0.0051	0.0093	0.0000	0.0004	0.0018	0.0040
Chile	0.0051	0.0000	0.0000	0.0000	0.0004	n/a	0.0000	0.0000
Colombia	0.0100	n/a	n/a	n/a	0.0000	n/a	0.0004	0.0000
Guatemala	0.0001	n/a	0.0000	0.0000	n/a	n/a	0.0000	0.0000
Honduras	n/a	0.0001	0.0000	0.0000	n/a	n/a	0.0000	0.0009
Argentina	0.0033	n/a	n/a	n/a	0.0000	0.0000	0.0000	0.0000

Note: n/a indicates that exports were either zero or not available.

Table 3. Short-run effect of trade liberalization on quantity of Latin American goods sold in the United States (percentage increase in quantity of exports)

	Asparagus	Bell Peppers	Cantaloupes	Cucumbers	Grapes	Oranges	Strawberries	Tomatoes
Elasticity of Substitution=4.00								
Latin America	57.11	21.50	21.28	24.58	0.80	13.49	4.37	17.81
Mexico	63.41	20.73	28.72	24.91	0.14	13.40	4.74	16.56
Chile	13.93	9.59	0.00	0.00	0.92	n/a	0.00	67.42
Colombia	50.97	n/a	n/a	n/a	0.00	n/a	0.15	0.00
Guatemala	1.32	n/a	0.07	0.00	n/a	n/a	0.00	0.00
Honduras	n/a	0.06	0.00	0.00	n/a	n/a	0.00	67.04
Argentina	5.21	n/a	n/a	n/a	0.00	10.34	7.03	44.72
Elasticity of Substitution=20.00								
Latin America	102.98	65.71	50.36	48.41	1.51	66.31	15.52	52.15
Mexico	126.40	58.92	75.34	49.94	0.63	64.33	16.49	42.85
Chile	13.93	58.00	0.00	0.00	1.84	n/a	0.00	1214.57
Colombia	50.97	n/a	n/a	n/a	0.00	n/a	0.35	0.00
Guatemala	1.32	n/a	0.16	0.00	n/a	n/a	0.00	0.00
Honduras	n/a	0.15	0.00	0.00	n/a	n/a	0.00	1151.46
Argentina	10.72	n/a	n/a	n/a	0.00	63.57	40.39	534.73

Note: n/a indicates that exports were either zero or not available.

Table 3′. Long-run effect of trade liberalization on quantity of Latin American goods sold in the United States (percentage increase in quantity of exports)

	Asparagus	Bell Peppers	Cantaloupes	Cucumbers	Grapes	Oranges	Strawberries	Tomatoes
Elasticity of Substitution=4.00								
Latin America	64.34	23.42	23.54	29.82	0.86	13.76	4.54	19.14
Mexico	72.18	22.93	32.28	30.62	0.14	13.71	4.95	18.31
Chile	15.07	9.59	0.00	0.00	1.04	n/a	0.00	67.42
Colombia	55.77	n/a	n/a	n/a	0.00	n/a	0.17	0.00
Guatemala	1.34	n/a	0.08	0.00	n/a	n/a	0.00	0.00
Honduras	n/a	0.07	0.00	0.00	n/a	n/a	0.00	67.18
Argentina	5.71	n/a	n/a	n/a	0.00	10.34	7.03	44.72
Elasticity of Substitution=20.00								
Latin America	139.96	94.64	70.37	81.52	2.01	75.53	18.46	72.65
Mexico	177.83	86.99	108.17	84.39	0.65	74.06	19.86	62.42
Chile	15.07	58.02	0.00	0.00	2.47	n/a	0.00	1214.90
Colombia	55.77	n/a	n/a	n/a	0.00	n/a	0.49	0.00
Guatemala	1.34	n/a	0.21	0.00	n/a	n/a	0.00	0.00
Honduras	n/a	0.22	0.00	0.00	n/a	n/a	0.00	1177.69
Argentina	13.11	n/a	n/a	n/a	0.00	63.58	40.43	534.78

Note: n/a indicates that exports were either zero or not available.

Table 4. Short-run effect of trade liberalization on quantity of Latin American goods exported to the United States (increase in exports in pounds)

	Asparagus	Bell Peppers	Cantaloupes	Cucumbers	Grapes	Oranges	Strawberries	Tomatoes
Elasticity of Substitution=4.00								
Latin America	25,719,707	41,426,536	109,505,760	91,154,276	5,796,988	7,746,661	1,334,380	138,926,930
Mexico	25,592,107	39,906,723	103,628,580	87,848,755	130,138	7,696,421	1,361,809	129,074,540
Chile	572,597	1,026	0	0	5,811,456	n/a	0	31,461
Colombia	11,395	n/a	n/a	n/a	0	n/a	1,247	0
Guatemala	3,857	n/a	26,956	0	n/a	n/a	0	0
Honduras	n/a	89	0	0	n/a	n/a	0	225,527
Argentina	12,993	n/a	n/a	n/a	0	1,345	620	13,775
Elasticity of Substitution=20.00								
Latin America	46,378,409	126,608,260	259,108,930	179,572,400	11,003,625	38,091,594	4,744,735	406,722,710
Mexico	51,017,011	113,445,040	271,817,030	176,122,130	597,768	36,948,422	4,741,682	333,981,270
Chile	572,597	6,208	0	0	11,627,944	n/a	0	566,803
Colombia	11,395	n/a	n/a	n/a	0	n/a	2,950	0
Guatemala	3,857	n/a	62,371	0	n/a	n/a	0	0
Honduras	n/a	210	0	0	n/a	n/a	0	3,873,781
Argentina	26,755	n/a	n/a	n/a	0	8,269	3,562	164,712

Note: n/a indicates that exports were either zero or not available.

Table 4'. Long-run effect of trade liberalization on quantity of Latin American goods exported to the United States (increase in exports in pounds)

	Asparagus	Bell Peppers	Cantaloupes	Cucumbers	Grapes	Oranges	Strawberries	Tomatoes
Elasticity of Substitution=4.00								
Latin America	28,977,646	45,125,008	121,105,600	110,618,420	6,285,365	7,901,837	1,388,474	149,244,530
Mexico	29,133,940	44,153,110	116,455,480	107,987,980	131,500	7,871,336	1,423,658	142,759,790
Chile	619,239	1,026	0	0	6,605,011	n/a	0	31,462
Colombia	12,467	n/a	n/a	n/a	0	n/a	1,413	0
Guatemala	3,914	n/a	30,221	0	n/a	n/a	0	0
Honduras	n/a	103	0	0	n/a	n/a	0	226,006
Argentina	14,255	n/a	n/a	n/a	0	1,345	620	13,775
Elasticity of Substitution=20.00								
Latin America	63,034,569	182,359,710	362,101,900	302,359,650	14,648,004	43,390,197	5,641,754	566,657,060
Mexico	71,776,727	167,491,380	390,222,880	297,593,870	616,034	42,532,240	5,708,988	486,545,100
Chile	619,239	6,210	0	0	15,640,854	n/a	0	566,957
Colombia	12,467	n/a	n/a	n/a	0	n/a	4,082	0
Guatemala	3,914	n/a	83,168	0	n/a	n/a	0	0
Honduras	n/a	303	0	0	n/a	n/a	0	3,962,022
Argentina	32,720	n/a	n/a	n/a	0	8,269	3,565	164,727

Note: n/a indicates that exports were either zero or not available.

Table 5. Short-run effect of trade liberalization on quantity of Latin American goods produced (percentage increase in quantity produced)

	Asparagus	Bell Peppers	Cantaloupes	Cucumbers	Grapes	Oranges	Strawberries	Tomatoes
Elasticity of Substitution=4.00								
Latin America	13.5866	2.5349	4.6015	9.7838	0.0234	0.0712	0.3280	1.2849
Mexico	15.4840	3.2781	7.6184	11.3096	0.0009	0.1116	0.4035	2.5190
Chile	3.5473	0.0010	0.0000	0.0000	0.1790	n/a	0.0000	0.0019
Colombia	11.6372	n/a	n/a	n/a	0.0000	n/a	0.0430	0.0000
Guatemala	0.0681	n/a	0.0236	0.0000	n/a	n/a	0.0000	0.0000
Honduras	n/a	0.0221	0.0000	0.0000	n/a	n/a	0.0000	0.1694
Argentina	1.3655	n/a	n/a	n/a	0.0000	0.0001	0.0022	0.0006
Elasticity of Substitution=20.00								
Latin America	22.0955	6.7076	9.9760	18.2603	0.0442	0.2865	1.1119	3.3226
Mexico	27.0675	8.2557	17.7381	21.5467	0.0039	0.4414	1.3373	5.9607
Chile	3.5473	0.0049	0.0000	0.0000	0.3568	n/a	0.0000	0.0094
Colombia	11.6372	n/a	n/a	n/a	0.0000	n/a	0.1016	0.0000
Guatemala	0.0681	n/a	0.0547	0.0000	n/a	n/a	0.0000	0.0000
Honduras	n/a	0.0520	0.0000	0.0000	n/a	n/a	0.0000	0.8372
Argentina	2.7589	n/a	n/a	n/a	0.0000	0.0003	0.0108	0.0028

Note: n/a indicates that exports were either zero or not available.

Table 5'. Long-run effect of trade liberalization on quantity of Latin American goods produced (percentage increase in quantity produced)

	Asparagus	Bell Peppers	Cantaloupes	Cucumbers	Grapes	Oranges	Strawberries	Tomatoes
Elasticity of Substitution=4.00								
Latin America	18.2101	3.0401	5.5350	12.4274	0.0294	0.0834	0.4155	1.5309
Mexico	20.8835	3.9709	9.2318	14.4764	0.0010	0.1309	0.5123	3.0566
Chile	4.5997	0.0011	0.0000	0.0000	0.2297	n/a	0.0000	0.0021
Colombia	15.2584	n/a	n/a	n/a	0.0000	n/a	0.0565	0.0000
Guatemala	0.0880	n/a	0.0286	0.0000	n/a	n/a	0.0000	0.0000
Honduras	n/a	0.0274	0.0000	0.0000	n/a	n/a	0.0000	0.1909
Argentina	1.7957	n/a	n/a	n/a	0.0000	0.0001	0.0027	0.0006
Elasticity of Substitution=20.00								
Latin America	34.2812	9.9425	14.5457	30.6779	0.0682	0.3646	1.5936	4.8529
Mexico	42.8549	12.5301	26.0388	36.2974	0.0047	0.5663	1.9336	9.0709
Chile	4.5997	0.0056	0.0000	0.0000	0.5411	n/a	0.0000	0.0106
Colombia	15.2584	n/a	n/a	n/a	0.0000	n/a	0.1629	0.0000
Guatemala	0.0880	n/a	0.0787	0.0000	n/a	n/a	0.0000	0.0000
Honduras	n/a	0.0807	0.0000	0.0000	n/a	n/a	0.0000	0.9497
Argentina	4.0262	n/a	n/a	n/a	0.0000	0.0003	0.0134	0.0031

Note: n/a indicates that exports were either zero or not available.

Table 6. Short-run effect of trade liberalization on quantity of Latin American goods produced (increase in quantity produced in pounds)

	Asparagus	Bell Peppers	Cantaloupes	Cucumbers	Grapes	Oranges	Strawberries	Tomatoes
Elasticity of Substitution=4.00								
Latin America	14,641,871	30,638,846	84,243,087	76,288,282	4,173,373	5,375,725	839,815	102,304,270
Mexico	14,492,995	30,069,480	79,625,325	74,813,070	93,123	5,350,105	861,246	98,425,112
Chile	364,455	762	0	0	4,459,563	n/a	0	18,705
Colombia	6,504	n/a	n/a	n/a	0	n/a	903	0
Guatemala	2,187	n/a	23,006	0	n/a	n/a	0	0
Honduras	n/a	76	0	0	n/a	n/a	0	134,485
Argentina	8,520	n/a	n/a	n/a	0	945	367	8,856
Elasticity of Substitution=20.00								
Latin America	23,811,642	81,073,552	182,637,760	142,383,010	7,894,543	21,639,535	2,847,128	264,553,890
Mexico	25,335,200	75,728,307	185,393,340	142,531,170	426,699	21,167,007	2,854,133	232,901,300
Chile	364,455	3,808	0	0	8,890,441	n/a	0	93,509
Colombia	6,504	n/a	n/a	n/a	0	n/a	2,135	0
Guatemala	2,187	n/a	53,216	0	n/a	n/a	0	0
Honduras	n/a	180	0	0	n/a	n/a	0	664,585
Argentina	17,213	n/a	n/a	n/a	0	4,724	1,832	44,275

Note: n/a indicates that exports were either zero or not available.

Table 6′. Long-run effect of trade liberalization on quantity of Latin American goods produced (increase in quantity produced in pounds)

	Asparagus	Bell Peppers	Cantaloupes	Cucumbers	Grapes	Oranges	Strawberries	Tomatoes
Elasticity of Substitution=4.00								
Latin America	19,624,491	36,744,671	101,332,490	96,901,562	5,251,750	6,297,383	1,063,969	121,894,940
Mexico	19,546,973	36,424,668	96,488,500	95,761,133	109,666	6,280,115	1,093,469	119,427,750
Chile	472,577	857	0	0	5,724,377	n/a	0	21,043
Colombia	8,527	n/a	n/a	n/a	0	n/a	1,187	0
Guatemala	2,826	n/a	27,828	0	n/a	n/a	0	0
Honduras	n/a	94	0	0	n/a	n/a	0	151,500
Argentina	11,204	n/a	n/a	n/a	0	1,087	455	9,963
Elasticity of Substitution=20.00								
Latin America	36,943,816	120,173,870	266,297,330	239,207,720	12,172,232	27,531,324	4,080,579	386,401,570
Mexico	40,112,217	114,936,160	272,149,710	240,107,490	512,450	27,156,945	4,126,934	354,425,000
Chile	472,577	4,286	0	0	13,481,385	n/a	0	105,208
Colombia	8,527	n/a	n/a	n/a	0	n/a	3,425	0
Guatemala	2,826	n/a	76,550	0	n/a	n/a	0	0
Honduras	n/a	278	0	0	n/a	n/a	0	753,906
Argentina	25,121	n/a	n/a	n/a	0	5,436	2,275	49,812

Note: n/a indicates that exports were either zero or not available.

Table 7. Short-run effect of trade liberalization on investment in Latin America (assuming that $1.00 increase in output equals $1.00 increase in investment)

	Asparagus	Bell Peppers	Cantaloupes	Cucumbers	Grapes	Oranges	Strawberries	Tomatoes
Elasticity of Substitution=4.00								
Latin America	$9,213,371	$11,466,687	$11,442,209	$15,287,465	$1,449,491	$1,575,387	$478,070	$32,810,487
Mexico	$9,250,651	$11,243,796	$12,152,756	$15,428,117	$53,096	$1,567,742	$474,616	$31,551,988
Chile	$207,730	$831	0	0	$1,400,468	n/a	0	$3,030
Colombia	$2,258	n/a	n/a	n/a	0	n/a	$1,273	0
Guatemala	$911	n/a	$2,682	0	n/a	n/a	0	0
Honduras	n/a	$59	0	0	n/a	n/a	0	$88,275
Argentina	$3,563	n/a	n/a	n/a	0	$384	$166	$2,000
Elasticity of Substitution=20.00								
Latin America	$14,983,432	$30,342,038	$24,806,538	$28,532,237	$2,741,923	$6,341,589	$1,620,748	$84,846,334
Mexico	$16,171,061	$28,316,872	$28,295,522	$29,393,095	$243,292	$6,202,569	$1,572,857	$74,660,814
Chile	$207,730	$4,151	0	0	$2,791,928	n/a	0	$15,148
Colombia	$2,258	n/a	n/a	n/a	0	n/a	$3,007	0
Guatemala	$911	n/a	$6,204	0	n/a	n/a	0	0
Honduras	n/a	$139	0	0	n/a	n/a	0	$436,228
Argentina	$7,199	n/a	n/a	n/a	0	$1,919	$831	$10,001

Note: n/a indicates that exports were either zero or not available.

Table 7′. Long-run effect of trade liberalization on investment in Latin America (assuming that $1.00 increase in output equals $1.00 increase in investment)

	Asparagus	Bell Peppers	Cantaloupes	Cucumbers	Grapes	Oranges	Strawberries	Tomatoes
Elasticity of Substitution=4.00								
Latin America	$12,348,675	$13,751,812	$13,763,355	$19,418,176	$1,824,032	$1,845,484	$605,672	$39,093,504
Mexico	$12,476,527	$13,620,173	$14,726,486	$19,748,073	$62,529	$1,840,263	$602,589	$38,284,773
Chile	$269,356	$934	0	0	$1,797,667	n/a	0	$3,409
Colombia	$2,960	n/a	n/a	n/a	0	n/a	$1,672	0
Guatemala	$1,177	n/a	$3,244	0	n/a	n/a	0	0
Honduras	n/a	$73	0	0	n/a	n/a	0	$99,443
Argentina	$4,686	n/a	n/a	n/a	0	$442	$207	$2,250
Elasticity of Substitution=20.00								
Latin America	$23,246,830	$44,975,456	$36,169,492	$47,935,011	$4,227,645	$8,068,211	$2,322,898	$123,924,680
Mexico	$25,602,999	$42,977,754	$41,536,647	$49,515,500	$292,185	$7,957,801	$2,274,273	$113,617,480
Chile	$269,356	$4,671	0	0	$4,233,655	n/a	0	$17,044
Colombia	$2,960	n/a	n/a	n/a	0	n/a	$4,824	0
Guatemala	$1,177	n/a	$8,925	0	n/a	n/a	0	0
Honduras	n/a	$215	0	0	n/a	n/a	0	$494,857
Argentina	$10,507	n/a	n/a	n/a	0	$2,208	$1,032	$11,252

Note: n/a indicates that exports were either zero or not available.

Table 8. Short-run effect of trade liberalization on investment in Latin America (assuming that $1.00 increase in output equals $0.46 increase in investment)

	Asparagus	Bell Peppers	Cantaloupes	Cucumbers	Grapes	Oranges	Strawberries	Tomatoes
Elasticity of Substitution=4.00								
Latin America	$4,238,151	$5,274,676	$5,263,416	$7,032,234	$666,766	$724,678	$219,912	$15,092,824
Mexico	$4,255,300	$5,172,146	$5,590,268	$7,096,934	$24,424	$721,161	$218,323	$14,513,914
Chile	$95,556	$382	0	0	$644,215	n/a	0	$1,394
Colombia	$1,039	n/a	n/a	n/a	0	n/a	$585	0
Guatemala	$419	n/a	$1,234	0	n/a	n/a	0	0
Honduras	n/a	$27	0	0	n/a	n/a	0	$40,606
Argentina	$1,639	n/a	n/a	n/a	0	$177	$77	$920
Elasticity of Substitution=20.00								
Latin America	$6,892,379	$13,957,337	$11,411,007	$13,124,829	$1,261,285	$2,917,131	$745,544	$39,029,314
Mexico	$7,438,688	$13,025,761	$13,015,940	$13,520,824	$111,914	$2,853,182	$723,514	$34,343,974
Chile	$95,556	$1,909	0	0	$1,284,287	n/a	0	$6,968
Colombia	$1,039	n/a	n/a	n/a	0	n/a	$1,383	0
Guatemala	$419	n/a	$2,854	0	n/a	n/a	0	0
Honduras	n/a	$64	0	0	n/a	n/a	0	$200,665
Argentina	$3,312	n/a	n/a	n/a	0	$883	$382	$4,601

Note: n/a indicates that exports were either zero or not available.

Table 8′. Long-run effect of trade liberalization on investment in Latin America (assuming that $1.00 increase in output equals $0.46 increase in investment)

	Asparagus	Bell Peppers	Cantaloupes	Cucumbers	Grapes	Oranges	Strawberries	Tomatoes
Elasticity of Substitution=4.00								
Latin America	$5,680,391	$6,325,834	$6,331,143	$8,932,361	$839,055	$848,923	$278,609	$17,983,012
Mexico	$5,739,202	$6,265,280	$6,774,184	$9,084,114	$28,763	$846,521	$277,191	$17,610,996
Chile	$123,904	$430	0	0	$826,927	n/a	0	$1,568
Colombia	$1,362	n/a	n/a	n/a	0	n/a	$769	0
Guatemala	$541	n/a	$1,492	0	n/a	n/a	0	0
Honduras	n/a	$34	0	0	n/a	n/a	0	$45,744
Argentina	$2,156	n/a	n/a	n/a	0	$203	$95	$1,035
Elasticity of Substitution=20.00								
Latin America	$10,693,542	$20,688,710	$16,637,966	$22,050,105	$1,944,717	$3,711,377	$1,068,533	$57,005,353
Mexico	$11,777,380	$19,769,767	$19,106,858	$22,777,130	$134,405	$3,660,589	$1,046,166	$52,264,041
Chile	$123,904	$2,149	0	0	$1,947,481	n/a	0	$7,840
Colombia	$1,362	n/a	n/a	n/a	0	n/a	$2,219	0
Guatemala	$541	n/a	$4,106	0	n/a	n/a	0	0
Honduras	n/a	$99	0	0	n/a	n/a	0	$227,634
Argentina	$4,833	n/a	n/a	n/a	0	$1,016	$475	$5,176

Note: n/a indicates that exports were either zero or not available.

APPENDIX 1

The Trade Liberalization/Capital Flows Model

We assume that there are three regions: (1) The United States (denoted U); (2) the Latin American coountry or countries benefiting from trade liberalization (denoted L); and (3) all other countries (denoted O). Each region produces a potentially distinct variety of a particular agricultural commodity, which it sells in the United States and other geographic areas. We assume that there is perfect competition: producers treat the prices they receive as fixed by the market. Under this assumption, there is a distinct supply curve that describes the quantity which producers are willing to supply at each price level. Moreover, arbitrage will ensure that the prices received by producers (net of transportation and other delivery costs) are the same in all geographic markets.

The quantity demanded in the United States of each region's product is dependent on the region's price, inclusive of any U.S. import duties, relative to the prices from other regions. The U.S. import price is equivalent to the export price received by producers from that region, multiplied by one plus the duty rate.[15] Based on these assumptions, the following equations express the demand relationships:

$$Q_U = D^U(P_U, P_L(1+t_L), P_O(1+t_O)) \tag{1a}$$

$$Q_L = D^L(P_U, P_L(1+t_L), P_O(1+t_O)) \tag{1b}$$

$$Q_O = D^O(P_U, P_L(1+t_L), P_O(1+t_O)) \tag{1c}$$

where Q denotes the quantity sold in the United States, P denotes the export price to the United States, and t denotes the U.S. import duty rate.

As expressed below, the supply relationship for a particular agricultural product is a function of that prduct's export price:

$$Q_U = S^U(P_U) \tag{2a}$$

$$Q_L = S^L(P_L) \tag{2b}$$

$$Q_O = S^O(P_O) \tag{2c}$$

Combining equations (1) and (2), we obtain the following system of equations:

$$D^U = (P_U, P_L(1+t_L), P_O(1+t_O)) = S^U(P_U) \tag{3a}$$

$$D^L = (P_U, P_L(1+t_L), P_O(1+t_O)) = S^L(P_L) \tag{3b}$$

$$D^O = (P_U, P_L(1+t_L), P_O(1+t_O)) = S^O(P_O) \tag{3c}$$

Logarithmically differentiating equation (3), we obtain:

$$\varepsilon_{UU} d\ln P_U + \varepsilon_{UL}(d\ln P_L + d\ln(1+t_L)) + \varepsilon_{UO}(d\ln P_O + d\ln(1+t_O)) = \eta_U d\ln P_U \tag{4a}$$

$$\varepsilon_{LU} d\ln P_U \varepsilon_{LL}(d\ln P_L + d\ln(1+t_L)) + \varepsilon_{LO}(d\ln P_O + d\ln(1+t_O)) = \eta_L d\ln P_L \tag{4b}$$

$$\varepsilon_{OU} d\ln P_U + \varepsilon_{OL}(d\ln P_L + d\ln(1+t_L)) + \varepsilon_{OO}(d\ln P_O + d\ln(1+t_O)) = \eta_O d\ln P_O. \tag{4c}$$

Rearranging into matrix form, and assuming that the only tariff change involves imports from Latin America, we obtain the following:

$$\begin{bmatrix} \varepsilon_{UU}-\eta_U & \varepsilon_{UL} & \varepsilon_{UO} \\ \varepsilon_{LU} & \varepsilon_{LL}-\eta_L & \varepsilon_{LO} \\ \varepsilon_{OU} & \varepsilon_{OL} & \varepsilon_{OO}-\eta_O \end{bmatrix} \begin{bmatrix} d\ln P_U \\ d\ln P_L \\ d\ln P_O \end{bmatrix} = \begin{bmatrix} -\varepsilon_{UL} \\ -\varepsilon_{LL} \\ -\varepsilon_{OL} \end{bmatrix} d\ln(1+t_L) \tag{5}$$

where $\varepsilon_{ii}(<0)$ is the own-price elasticity of demand for good i, $\varepsilon_{ij}(>0)$ is the cross-price elasticity of demand for good i with respect to good j, and $\eta_i(>0)$ is the elasticity of (export) supply for good i.

It is not uncommon in models of this nature to treat the prices of goods from other countries as given. To the extent that non-Latin American countries sell most of their goods outside the United States, their pricing may be largely unaffected by changes in conditions within the U.S. market. Taking the price from this region as given, the above system of equations reduces to the following:

$$\begin{bmatrix} \varepsilon_{UU}-\eta_U & \varepsilon_{UL} \\ \varepsilon_{LU} & \varepsilon_{LL}-\eta_L \end{bmatrix} \begin{bmatrix} d\ln P_U \\ d\ln P_L \end{bmatrix} = \begin{bmatrix} -\varepsilon_{UL} \\ -\varepsilon_{LL} \end{bmatrix} d\ln(1+t_L). \tag{6}$$

For relatively small tariff changes, it holds that $d\ln(1+t_L) \approx dt_L$. Using this result, the above system of equations can be solved as follows:

$$\frac{d \ln P_U}{dt_L} = \frac{\varepsilon_{UL}\eta_L}{|A|} > 0$$

$$\frac{d \ln P_L}{dt_L} = \frac{-\varepsilon_{LL}(\varepsilon_{UU} - \eta_U) + \varepsilon_{UL}\varepsilon_{LU}}{|A|} < 0, \tag{7}$$

where $|A| = (\varepsilon_{UU} - \eta_U)(\varepsilon_{LL} - \eta_L) - \varepsilon_{UL}\varepsilon_{LU} > 0$.

The above results represent the percentage impact on the price of the U.S.-produced good and the export price of the Latin American good that results froma one-percentage-point *increase* in the U.S. import duty rate. Trade liberalization by the United States, which would lead to a *decrease* in import duties, would have the opposite effects. When trade liberalization leads to the total elimination of import duties, the percentage price effects can be approximated by multiplying the above expressions by the existing duty rate (and reversing the sign of the results).

The solutions described in equation (7) require information concerning the various own-price and cross-price elasticities of demand involving U.S. and Latin American goods. In particular, the own- and cross-priced elasticities can be expressed as follows:[16]

$$\varepsilon_{ii} = s_i\varepsilon - s_j\sigma_{ij} - s_k\sigma_{ik} \tag{8}$$

$$\varepsilon_{ij} = s_i(\sigma + \varepsilon), \tag{9}$$

where ε is the elasticity of the aggregate demand for that good with respect to a general price increase for that good, σ_{ij} is the elasticity of substitution between i and j, and s_i is the share of U.S. sales from producers in region i. Moreover, it is commonly assumed that $\sigma_{ij} = \sigma_{ik} = \sigma$ —i.e., the elasticity of substitution is the same between goods from any two regions. Using this assumption, equations (8) and (9) can be expressed as follows:

$$\varepsilon_{ii} = s_i\varepsilon - s_j\sigma - s_k\sigma \tag{8'}$$

$$\varepsilon_{ij} = s_j(\sigma + \varepsilon). \tag{9'}$$

Thus, all own-price and cross-price elasticities of demand can be expressed as functions of the aggregate demand elasticity for the good in question, the elasticity of substitution between goods from different

regions, and each region's share of U.S. sales. In estimating the effects of trade liberalization, it is more convenient to use parameter estimates aof the aggregate demand elasticity and the elasticity of substitution, and derive the elasticities required by the model using equations (8′) and (9′).

Now that the price effects from trade liberalization are estimated, it is straightforward to estimate the effect of trade liberalization on the quantity sold, per region, in the United States. These quantity effects can be measured as follows:

$$d\ln Q_U = \eta_U \left(\frac{\partial \ln P_U}{\partial t_L} \right) dt_L \tag{10}$$

$$d\ln Q_L = \eta_L \left(\frac{\partial \ln P_L}{\partial t_L} \right) dt_L \tag{11}$$

Note that equation (11) describes the change in Latin American exports to the United States that results from trade liberaliation by the United States. To obtain the change in Latin American production, we merely replace the export supply elasticity, η_L, with the total production elasticity, η_L^T, in equation (11). It can be shown that these elaticities are related as follows:

$$d\ln TQ_L = \frac{Q_L}{TQ_L}\eta_L + \frac{D^{NU}(P_L)}{TQ_L}\varepsilon_{LL}^{NU} dP_L \tag{12}$$

where ε_{LL}^{NU} is the own-price elasticity of demand for the Latin American good outside of the United States, TQ_L is the total quantity of that good produced by the Latin American country (or countries), Q_{NU} is the quantity that the Latin American country sells outside the United States, and Q_L is the quantity it sells in the United States.

APPENDIX 2

Relevant Elasticity Estimates Used in the Model

Here are estimates of the aggregate price elasticity of demand and the elasticity of production for each agricultural commodity. The production elasticities are used for both the United States and the individual Latin American countries. We also assume that the aggregate price elasticity of demand for each agricultural commodity is the same inside and outside of the United States.

Demand and Production Elasticities by Commodity

Commodity	Demand Elasticity[a]	Production Elasticity	
		Short-run[b]	Long-run[c]
Asparagus	-2.07	2.50	5.00
Bell Peppers	-1.00	3.50	7.00
Cantaloupes[d]	-1.00	3.50	7.00
Cucumbers	-0.80	3.50	7.00
Grapes	-0.90	2.25	4.50
Oranges	-0.71	2.00	4.00
Strawberries	-1.90	3.00	6.00
Tomatoes	-1.00	3.50	7.00

a R.D. Hunt, "Fruit and Vegetable Exports from the Mediterranean Area to the ECC," World Bank Staff Working Paper No. 321, The World Bank, 1979.

b Short-run production elasticities are "consensus" estimates based on empirical studies and elasticities cited in U.S. International Trade Commission investigations.

c By assumption, long-run production elasticities equal twice the short-run elasticities.

d The Hunt study calculated a 0.87 demand elasticity for all melons, which we assume is slightly less elastic than for cantaloupes because other melons may be considered fairly close substitutes.

These estimates are taken from relevant empirical studies and elasticity estimates cited in investigations of alleged unfair trading actions conducted by the U.S. International Trade Commission. Referring to equations (8′) and (9′) in Appendix 1, the individual own-price and cross-price elasticities of demand for the United States and each Latin American country can be derived from the estimates of the aggregate price elasticity of demand and the assumed elasticity of substitution.

Referring to equation (12), the elasticity of each Latin American country's export supply to the United States is derived from estimates of the total elasticity of production and the elasticity of demand for that country's product outside the United States. Since, with the exception of U.S. exports, the production of each Latin American country is typically consumed in the domestic market under conditions where there is either no import competition or limited import competition, we used the aggregate price elasticity of demand for the commodity as a proxy for the elasticity of demand for each country's product outside the United States.

ENDNOTES

1. Depending on the supply elasticity.

2. U.S. Department of Commerce Trade Database for average annual imports, 1989 - 1992.

3. The Caribbean Basin Economic Recovery Act (CBERA) became effective on January 1, 1984, and the Andean Trade Preference Act (ATPA) became effective on December 4, 1991.

4. This is a common assumption in the economic literature. See, especially, Paul S. Armington, "A Theory of Demand for Products Distinguished by Place of Production," *International Monetary Fund Staff Papers*, 1969, pp. 159-175; and, Robert E. Baldwin and Tracy Murray, "MFN Tariff Reductions and Developing Country Trade Benefits under the GSP," *Economic Journal*, 1977, pp. 30-6.

5. See, for example, Kuo S. Huang, *U.S. Demand for Food: A Complete System of Price and Income Effects*, National Economics Division, Economic Research Service, U.S. Department of Agriculture, December 1985.

6. In cases before the U.S. International Trade Commission regarding domestic injury allegedly caused by the "unfair" subsidization of dumping of imports into the U.S. market, economic estimates of injury to domestic producers are often presented based on a model that is similar in nature to the model used for this analysis. There is considerable debate and attention given to the appropriate substitution elasticities for use in the ITC model. In these proceedings, an elasticity of substitution equal to twenty is considered high while an elasticity of substitution equal to four is considered low. Very few cases involve the use of elasticities outside of this range.

7. An elasticity of substitution equal to two was considered the "minimum" estimate. Since the cross-price elasticity of demand depends on the sum of the elasticity of substitution and the overall price elasticity of demand for the product (where the overall elasticity is defined to be negative in sign–see equation (9) in Appendix 1), and since the overall elasticity of demand was near two for commodities such as asparagus, this assumption implied that the cross elasticity of demand between the U.S. and Latin American varieties was close to zero for those commodities where there was limited overlap in the growing seasons of U.S. and Latin American producers.

8. For instance, if a U.S.-produced substitute was available during 75 percent of those months when a particular Latin American country's variety was available to the U.S. market, then the elasticity of substitution was assumed to equal 75 percent of the baseline elasticity plus 25 percent of the minimum elasticity.

9. See equation (12) in Appendix 1.

10. U.S. Department of Commerce, Trade Database for Average Annual Imports, 1991, and Trade Database for F.A.S. Unit Values, 1989-92.

11. Food and Agriculture Organization of the United Nations, 1991. Bell peppers include both chili and green peppers. Cantaloupes also include some other types of melons. Cucumbers include gherkins.

12. U.S. Department of Agriculture, *Vegetables and Specialties, Situation and Outlook Yearbook*, July 1993 and *Fruit and Tree Nuts, Situation and Outlook Yearbook*, July 1993.

13. Note that the Duty Rate is calculated as Duty/F.A.S. Value. Further, duties are not imposed on most Guatemalan and Honduran fresh produce due to exemptions stipulated in the Caribbean Basin Economic Recovery Act.

14. "Benchmark Input-Output Accounts for the U.S. Economy, 1987," *Survey of Current Business*, U.S. Department of Commerce, Bureau of Economic Analysis, May 1994, pp.62-86. The figure of $0.46 per dollar of output was based on Tables 3.1 and 3.2, which provide direct input requirements per dollar of output, for an industry category entitled, Other Agricultural Products. The $0.46 figure equals the value contained in categories pertaining to machinery and other producer durables, as well as a portion of the value contained in a "value added" category. From the "value added" category, we have excluded the value attributed to employee compensation and indirect business taxes (see Table 3.2). The remaining portion, known as "other value added," contains the value of production that may be attributable to land and other types of capital that have not been previously identified. Note that our approach suffers from the limitations that the agricultural technology of Latin American producers may differ from that of U.S. producers described in the U.S. input-output table. However, a paucity of data on Latin American agricultural production precludes further investigation of this issue.

15. The results of our model are not significantly affected by the presence of transportation and other distribution costs, so we omit them from the analysis. Hence, the export price is considered equivalent to the price received by the producer.

16 See Armington, "A Theory of Demand for Products."

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