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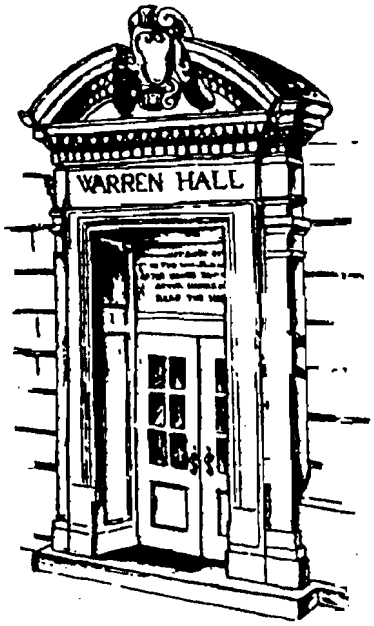

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THE G-3 FREE TRADE AGREEMENT: A PRELIMINARY EMPIRICAL ASSESSMENT

Ricardo Argüello and Steven Kyle

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December 1996

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ABSTRACT

The objective of the paper is to make an exploratory assessment of the impact of the G-3 free trade agreement on member countries' agricultural trade. To fulfill this objective, empirical estimates of changes in the structure of agricultural trade for four products traded between partner countries are obtained by means of a static, single-commodity, partial equilibrium trade model. Estimated variables refer to the volume of trade flows and their corresponding market shares and to economic welfare effects on producers, consumers, and tax payers.

Simulations are generated for the current provisions of the agreement and for an hypothetical tariff elimination applying to the products selected for the analysis. The results of the research indicate that the current status of the agricultural provisions of the G-3 make the agreement unlikely to have a important impact on member countries agricultural trade. Furthermore, they show that even if complete tariff elimination were achieved, the potential of the agreement to produce substantial changes in member countries agricultural trade and to bring meaningful economic welfare effects is rather limited. The apparent reason for this outcome is the low level of agricultural trade that exists among partner countries in the pre-agreement period. Unilateral tariff reductions accomplished in each of the member countries prior to the establishment of the agreement also play a role in determining this result.

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GLOSSARY OF ABBREVIATIONS

ECLA	United Nations' Economic Commission for Latin America (spanish acronym: CEPAL)
FTA	Free Trade Agreement
GATT	General Agreement on Tariffs and Trade
G-3	Group of Three
LAIA	Latin American Integration Association
MFN	Most Favored Nation
NAFTA	North American Free Trade Agreement
NTBs	Non-Tariff Barriers
QRs	Quantitative Restrictions
ROW	Rest of the World
SITC	Standard International Trade Classification
SWOPSIM	Static World Policy Simulation Framework

Introduction

The general objective of this paper is to provide a preliminary assessment of the impact of the G-3 Free Trade Agreement on member countries' agricultural trade. To reach this objective an empirical exploratory evaluation of the impact of the G-3 on agricultural trade flows, market shares, and economic welfare for four selected products was carried out by means of a single-product, static, non-spatial, partial equilibrium simulation trade model.

The results of the research suggest that in its current status the G-3 may perform poorly in liberalizing agricultural trade and may have a very limited effect on the trade structure and economic welfare of member countries. These findings confirm the conclusions of the qualitative evaluation of the G-3's agricultural provisions by Argüello and Kyle (1996)[1].

Largely as a consequence of the development of the oil industry, the agricultural sector is of less economic importance to Mexico and Venezuela than it is to Colombia. As of 1993, the share of agricultural trade within total trade (imports plus exports) was 18.9 percent for Colombia, 7.5 percent for Mexico, and 5.3 percent for Venezuela (Argüello and Kyle, 1996). However, irrespective of the relative importance of agricultural trade for member countries, intra-G-3 agricultural trade lacks significance in any case. As shown in Table 1, the volume of intra-G-3 agricultural trade is extremely

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[1] An overview of G-3 member countries agricultural policies and their trade structures as well as of the G-3's agricultural provisions is found in this paper.

low. Therefore, its share within member countries' agricultural trade is negligible, amounting to an average 0.2 percent in the cases of Colombia and Mexico, and 1 percent in the case of Venezuela between 1989 and 1993.

Table 1 Intra-G-3 Agricultural Trade ($ million)

Importing Country: Colombia					
Exporting Country:	1989	1990	1991	1992	1993
Mexico	0.8	0.8	0.9	1.8	3.0
Importing Country: Mexico					
Exporting Country:	1989	1990	1991	1992	1993
Colombia	4.4	7.6	0.8	1.6	1.5
Venezuela	2.0	30.4	1.7	0.4	3.2
Importing Country: Venezuela					
Exporting Country:	1989	1990	1991	1992	1993
Mexico	4.1	3.2	1.2	2.1	4.0

Source: U.N. (see References section)

Relative instability of trade flows is characteristic of intra-G-3 agricultural trade and is noticeable at the product level. Only a very few products show identifiable patterns in trade flows and a large number do not register commerce at all for some years[2]. Table 2 shows the average share of the main groups of agricultural products that were traded bilaterally by the G-3 partners from 1989 to 1993[3] and the coefficient of variation for their annual traded values.

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[2] There is the possibility that trade flows for certain products become so reduced that they do not appear reported on trade statistics. The U.N., for example, does not publish trade flows below $100.000.

[3] Groups are defined at the three-digit level of the SITC.

Table 2 Main Products in G-3 Agricultural Trade (average 1989-1993)*

Trade Between Colombia and Mexico:

	Colombian Imports		Mexican Imports	
	AS‡	CV#	AS‡	CV#
Fish, fresh/chilled/frozen			8.8	187.5
Shell fish, fresh/frozen			4.8	n.a.
Vegetables, fresh/s. preserved	5.5	193.2		
Sugar and honey	38.8	37.4	58.6	116.3
Coffee and substitutes	3.6	144.2		
Spices	7.3	62.6		
Edible products, nes (098)†	21.9	69.2		
Cotton			17.6	172.6
Crude vegetable materials	11.2	13.4	6.7	119.1
Other products	11.7	n.a.	3.5	n.a.
Total	100	31.3	100	79.6

Trade Between Mexico and Venezuela:

	Mexican Imports		Venezuelan Impts.	
	AS‡	CV#	AS‡	CV#
Fish, preserved/prepared	3.1	187.1		
Maize, unmilled			10.1	n.a.
Cereal preparations	6.5	196.0		
Vegetables, fresh/s. preserved			27.1	111.3
Sugar and honey	18.0	n.a.	20.1	147.4
Edible products, nes (098)	3.0	142.5	34.1	64.2
Unmanufactured tobacco	7.4	n.a.		
Seeds for soft fixed oil	61.1	53.7		
Crude vegetable materials			4.0	44.4
Other products	0.8	99.5	4.7	260.8
Total	100	151.7	100	38.5

* Percentages
‡ Average share for the period
# Coefficient of variation for the series of traded values
Source: Argüello and Kyle (1996) - based on U.N. data

Five groups of products may be selected as representative of G-3's agricultural trade on the basis of their importance within bilateral trade

flows, their importance within the structure of imports or exports for member countries, and their relative permanence in trade. These corrrespond to crude vegetable materials, sugar and honey, seeds for soft fixed oil, and vegetables (fresh/simply preserved). The traded value of these products accounted for an average of 40 percent of G-3's agricultural trade during the 1989-1993 period.

As discussed in Argüello and Kyle (1996), two out of the six most important products included in the four groups afore mentioned are scheduled for tariff elimination within the G-3. Two other products benefited from tariff reductions (although one of them not completely) with respect to the level of regional tariff preferences previously accorded within the LAIA. The two remaining products are excluded from trade liberalization, one of them (sugar) subject to programmed negotiations. In terms of their relevance in aggregate bilateral trade, the products that were included for liberalization account for 1.9 percent of trade, while the products that benefited from tariff reductions represent 10.3 percent. On the other hand, excluded products account for 27.4 percent[4]. This figures suggest that the G-3 does not have a great potential for trade expansion among partner countries. However, only empirical verification can help to achieve a more accurate assessment.

1. An Empirical Inquiry into the Effects of the G-3

Analyzing the outcome of any form of economic integration scheme is largely an empirical issue. In the context of this paper, use is made of a

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[4] Adding to the 40 percent share accounted for by the four groups of products.

simple trade model to explore the likely outcome of the G-3 agreement for member countries' agricultural trade. Its structure and basic assumptions are presented below.

The model follows the framework of the USDA's SWOPSIM and consequently may be characterized as a synthetic, static, non-spatial, multi-region, partial equilibrium trade model. It is synthetic in that model parameters (supply and demand elasticities, elasticities of substitution, and price transmission elasticities) are not estimated endogenously but rather obtained from other sources. Given its static nature, the model does not provide the time path of adjustment; instead trade and welfare implications of the trade agreement are obtained after full model adjustment. Being non-spatial, the model does not take transportation costs explicitly into account; however, the structure of trade prices that is employed is expected to reflect this variable. An Armington-type specification of the demand function allows for the estimation of origin-destination trade flows (required to model a free trade agreement) and market shares. Multi-region specification is needed since the FTA directly involves at least three regions (Mexico, Colombia and ROW - Rest of the World, or Mexico, Venezuela, and ROW) and indirectly takes into account trade flows between Colombia and Venezuela (linked by a separate trade agreement) as well as trade flows between Mexico and the U.S. (linked through the NAFTA). Finally, the model is partial equilibrium so that the effects of the trade agreement are emphasized.

The difficulty in obtaining adequate data and empirical estimates of the required parameters makes the model relatively fragile in its empirical

content. For this reason, a single-commodity treatment was preferred over a multiple-commodity approach since it allows a better idea of any possible bias in the results. If it is assumed that cross-price effects are mostly of the substitutive type it is expected that the results of the model (i.e. estimated trade flows) will be upward biased when competing products are not liberalized and the producing country does not have comparative advantage in producing the liberalized one and biased downward when it has comparative advantage. On the other hand, if the competing products are liberalized the results will depend on the competitive position of the country with respect to these products.

The structure of the model is as follows. The set of domestic supply and demand equations for each region is specified in a constant elasticity of substitution form (CES) and the corresponding trade equation is an identity that defines trade as a residual.

$$QS_i = K_i * PP_i^{\varepsilon_i} \tag{1}$$

$$QD_{ij} = L_{ij} * CP_{ij}^{\eta_{ij}} \prod_{k=1}^{n} CP_{kj}^{\eta_{ikj}} \tag{2}$$

$$QT_i = QS_i - QD_{ij} \tag{3}$$

QS_i, QD_{ij}, and QT_i are quantities supplied, demanded, and traded of a specific product in one country. 'Product' is defined as a good that is produced in a particular country, for instance dry beans produced in Colombia as opposed to dry beans produced in Mexico or Venezuela. Subscripts i and k stand for different products of the same kind (as in the

example before) and subscript j identifies a particular country (n represents the total number of countries). K_i and L_{ij} are constants that are calculated to fit the base period data. PP_i and CP_{ij} represent the prices before which producers and consumers of product i react in country j while CP_{kj} is the consumer price for product k in country j before which consumers react. ε_i is the own-price elasticity of supply of product i, η_{ij} is the own-price Armington elasticity of demand of product i in country j, and η_{ikj} is the Armington elasticity of substitution between products i and k in country j.

As mentioned earlier, the Armington-type specification of the demand equation is necessary to model FTAs since manipulation of tariff rates on a discriminatory basis requires identifying each country's trade flows. Since agricultural trade is not usually characterized by product differentiation according to firm of origin or by segmented markets, alternative modeling approaches are less appropriate than the Armington procedure (Liapis et al, 1992). Here, implementation of the Armington approach is done as in the USDA's SWOPSIM (Dixit and Roningen, 1986). First, Armington's two-stage process is modified into a one-stage procedure in which the quantity demanded of the good and the respective quantities demanded of the products that form this good's market are determined simultaneously. Second, own-price and cross-price elasticities for each product are calculated making use of Armington's equations in their market share form (an expenditure share approach was also developed by Armington). In so doing, no actual econometric estimation of these elasticities is necessary, since they are derived from the values of the own-price elasticity of demand of the good and each product's market share while an overall elasticity of substitution between pairs of products is assigned a judgment value.

Therefore, a single product demand equation that permits substitution between all products of a kind, including the one that is produced domestically, is used for each region - equation (2) above.

Price linkage equations relate producer, consumer, and international prices and provide the mechanism for introducing policy variables; tariff modifications in this case.

$$PP_i = J_i + CP_{ij} \quad (4)$$

$$CP_{ij} = F_{ij} + (EX_{jl} * TP_{ij})^{\lambda_{ij}} \quad (5)$$

$$TP_{ij} = CP_{il} + TC_{ij} \quad (6)$$

J_i and F_{ij} are constants calculated to fit the base period data that represent the differentials between producer's and consumer's prices in the case of J_i and consumer's and trade prices in the case of F_{ij}. Hence, these constants reflect the effect of marketing margins and sectoral policies (such as producer subsidies and tariffs) on the respective price levels and policy changes may be introduced in the model by modifying the value of these constants. EX_{jl} represents the exchange rate of country's j currency with respect to that of country l, TP_{ij} is the trade price (border price) of product i in country j, λ_{ij} is the price transmission elasticity for product i in country j, and TC_{ij} represents international trade costs (mainly transportation costs) associated with selling product i in market j. The rest of the variables and subscripts are as defined above.

The model assumes that international prices are determined by export prices in the country of origin of the product and that border prices are equal

to this price plus international trade costs that, in turn, vary according to transportation costs. Tariff changes due to the G-3 or other policies implied in the analysis (tariff levels determined through the Colombia-Venezuela FTA, NAFTA, and Uruguay Round GATT commitments) are modeled by appropriately modifying the level of the price wedges (constants Jij and Fij). Therefore, the model assumes that domestic marketing margins and other support (or discriminatory) measures remain constant during the period of analysis. This is done to simplify the empirical requirements of the model given the relative unavailability of parameter estimates.

Finally, the market clearing condition is that excess supply should equal excess demand for each product. That is, excess supply of product i must be equal to the summation of the demands for product i over the n regions

$$QT_i = \sum_{j=1}^{n} QD_{ij} \qquad (7)$$

In summary, each region's model must have one supply equation (each country produces only one product), as many demand equations as producing regions of traded products of a kind exist, a net trade equation, a producer price equation, as many consumer price equations as producing regions of traded products, and the same number of trade price equations. On the other hand, each good's model must have as many regions as necessary to completely represent actual trade flows; the maximum number of regions in this case is five (Colombia, Mexico, Venezuela, U.S., and ROW). Additionally, a good's model requires as many market clearing

condition equations as producing regions of products of a kind exist; there is a market clearing price for each product in the model. The solution procedure is based on an iterative adjustment of international prices, such that equilibrium levels of these prices (guaranteeing that the market clearing conditions are met) are determined for each product.

As mentioned before, constant terms included in the domestic supply and demand equations as well as in the price linkage equations were calculated to fit the base data. This process of model calibration assuring that equilibrium is reached for the base year (the market clearing conditions are satisfied), implies a previous effort in ensuring data consistency. The critical aspect of data consistency in trade models is satisfying the condition stated in equation (7). Then, other conditions must be examined. Examples of these may be the relationship between domestic prices for a producing country (at the producer and consumer levels) and the corresponding trade (or border) prices for the product in importing countries. Model calibration is usually complicated when complex structural relationships are built into the model (an illustrative case is provided by models including different levels of multiplicative effects). Given the structural simplicity and modest size of the model employed here, in spite of being a multi-region model, calibration was relatively easy to perform.

The model outlined above is particularly appealing in that it conforms very closely to the standard single-commodity, partial equilibrium analysis in customs union theory. In this context, measurement of the welfare effects of forming a trade agreement can be done by means of estimating changes in producer surplus, consumer surplus, and government revenues arising

from tariff modifications. Estimates of these changes in producer and consumer surplus are obtained by calculation of the difference between the areas above the supply curve and below the producer price before and after tariff changes occur, in the first case, and the difference between the areas below the demand curve and above the consumer price level before and after tariff changes go into effect, in the second case. Changes in government revenues are calculated as the difference between the product of the initial ad valorem tariff and the volume of product that is imported at this tariff level and the corresponding values of these variables after the FTA is in force. Algebraic aggregation of these three values determines whether or not the FTA is trade creating in its effect.

Therefore, equations (1) and (2) can be integrated over PP_i and CP_{ij} in order to obtain estimates of changes in producer and consumer surplus and the calculation of changes in government revenues is straightforward.

$$\Delta PS_i = \int_{PP_{i0}}^{PP_{i1}} K_i * PP_i^{\varepsilon_i} \, dPP_i \qquad (8)$$

$$\Delta CS_{ij} = \int_{CP_{ij0}}^{CP_{ij1}} L_{ij} * CP_{ij}^{\eta_{ij}} \prod_{k=1}^{n} CP_{kj}^{\eta_{ikj}} \, dCP_{ij} \qquad (9)$$

$$\Delta GR_{ij} = T_{ij1} * QD_{ij1} * CP_{ij1} - T_{ij0} * QD_{ij0} * CP_{ij0} \qquad (10)$$

ΔPS_i, ΔCS_{ij}, and ΔGR_{ij} stand for changes in producer surplus, consumer surplus, and government revenues, respectively. Subscripts 1 and 0 represent the periods after and before the FTA and T_{ij} stands for the tariff level applied to product i in country j. The rest of variables are as defined before.

The solutions of these integrals reduce to simple algebraic expressions that are easily implemented in the solution procedure of the model. The derivation of these expressions is presented in Roningen et al (1991) and an extensive treatment of measuring economic welfare within the framework of SWOPSIM models is performed in Haley and Dixit (1988). The equations actually employed for estimating welfare effects on producers and consumers are as follows.

$$\Delta PS_i = [1/(1+\varepsilon_i)] \{(PP_{i1}QS_{i1} - PP_{i0}QS_{i0}) - PPB_i^{1+\varepsilon_i} [(QS_{i1}/PP_{i1}^{\varepsilon_i}) - (QS_{i0}/PP_{i0}^{\varepsilon_i})]\} \quad \text{if } \varepsilon_i \neq -1 \qquad (11.1)$$

$$\Delta PS_i = PP_{i1}QS_{i1} [\ln(PP_{i1}) - \ln(PPB_i)] - PP_{i0}QS_{i0} [\ln(PP_{i0}) - \ln(PPB_i)] \quad \text{if } \varepsilon_i = -1 \qquad (11.2)$$

$$\Delta CS_i = -[1/(1+\eta_i)] \{(CP_{i1}QD_{i1} - CP_{i0}QD_{i0}) - CPB_i^{1+\eta_i} [(QD_{i1}/CP_{i1}^{\eta_i}) - (QD_{i0}/CP_{i0}^{\eta_i})]\} \quad \text{if } \eta_i \neq -1 \qquad (12.1)$$

$$\Delta CS_i = -\{CP_{i1}QD_{i1} [\ln(CP_{i1}) - \ln(CPB_i)] - CP_{i0}QD_{i0} [\ln(CP_{i0}) - \ln(CPB_i)]\} \quad \text{if } \eta_i = -1 \qquad (12.2)$$

Where: $PPB_i = Pshr * MIN (PP_{i0}, PP_{i1}); 0 \leq Pshr \leq 1$ and

$CPB_i = Pshr * MAX (CP_{i0}, CP_{i1}); 0 \leq Pshr \leq 1$

The modeling approach has a number of advantages. First of all it is simple. It is based on straightforward supply and demand schedules linked through price and trade balance relationships. It also allows for a clear interpretation of the results, and uses a simple mechanism for modifying the required parameters. Second, it is consistent and easy to relate to the customs union theory. Third, as single-product partial equilibrium, the model 'isolates' the effects of the desired policy changes allowing for a straightforward analysis. Fourth, selecting an algebraic model may be the only alternative available to imposing artificial restrictions on mathematical programming models in order to adequately represent actual trade flows. Econometric estimation is ruled out or made extremely difficult when time series data are not available, are inconsistent from one reporting country to another, or are characterized by persistent lack of continuity (due to reasons other than those underlying the economic relationships that are modeled). A disadvantage of the modeling approach (shared with most trade models) is that in the cases in which there are no pre-agreement trade flows, the model assumes that they will remain at the zero level in the post-agreement period.

Two major limitations arising from the same source influence the reliability of the results. First, the empirical content of the model may be weak in that parameter estimates should be regarded as approximations of the 'true' parameters. In some cases direct estimates of the parameters were used. However, these do not pertain to the same time period as the rest of

the base data (most of these estimates come from the 1989 SWOPSIM data base while base data corresponds to the period 1991-1993). In other cases indirect estimates were used based on evaluation of the 'similarity' of behavior of the products and/or countries for which there are estimates available and those that were required. The second limitation refers to the time horizon. Short-term parameter estimates are used while the time horizon of the simulation is ten years. It is evident that long-term instead of short-term parameters should be used under these conditions; however, no long-term estimates were available for many of the required products and countries and those available did not provide an adequate basis for an informed guess about the (numerous) missing ones. Since long-term supply elasticities are usually larger than short-term and long-term demand elasticities may be lower or higher than short-term, it is difficult to guess the direction of the discrepancy between simulation results employing short and long-run elasticity estimates.[5] Hence, the effects of this limitation are unknown.

Another limitation of the analysis stems from its single-product nature. The single-product approach dismisses cross-price effects that may be important in assessing the impact of tariff changes on trade flows. Therefore, results of single-product models tend to be biased upward or downward depending on the relationship between the products (complementary/substitutive) and their tariff status. However, whenever there is a lack of reliable estimates of the corresponding cross-price elasticities of supply and demand, working in

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[5] As a reference, Gardiner and Carter (1988) provide an overview on the estimation and use of elasticities in international agricultural trade and its related problems.

a multi-product framework may be less illuminating than completely dropping the cross-price effects.

2. Products Analyzed

To keep this exploratory analysis as simple as possible a group of products was chosen on the basis of its relative importance within each country's G-3 bilateral agricultural trade during the period 1989-1993 and the availability of the information required by the trade model. As representative of trade flows from Mexico to Colombia the fourth largest traded group of products, peppers, was selected. It corresponds to spices, peppers being the only subgroup traded. Non-carded and non-combed cotton, the second largest traded group in the case of trade flows from Colombia to Mexico was also selected. Having the same relative importance within trade flowing from Mexico to Colombia, the group dry leguminous vegetables was included in the analysis. Finally, sesame seed, the most important export from Venezuela to Mexico was selected. Data sources are reported in Appendix 1.

As a group, these four products accounted for an average of 19 percent of G-3's agricultural trade during the period 1989-1993 (almost 49 percent if the group sugar and honey is excluded). The products selected yield appropriate measures of the impact of the G-3 on agricultural trade flows regardless of the fact that some of them do not record the highest share in their category. This is due to two reasons. First, model results are obtained in relative terms. Measurement of production, consumption, price, and welfare effects is calculated as a percentage change over the base year situation (in the case

of welfare effects as a percentage change over the value of trade for the base year). Second, the products that have been traded within the G-3 group are homogeneous in terms of their relative importance in member countries' agricultural trade. Even in the cases in which this is not strictly true (e.g. sugar), historically the share of intra-G-3 trade has been low.

Trade among G-3 partner countries will be affected by the G-3 agreement itself, the commitments arising from the GATT's Uruguay Round, and the NAFTA. Therefore, three scenarios are considered in the simulation. In the first one, changes in trade flows and economic welfare are calculated for the hypothetical case in which there is no G-3 agreement but countries reduce their tariffs by at least 15 percent, according to their commitment to GATT, and the NAFTA goes into effect. The second scenario assumes that all GATT commitments, NAFTA, and the G-3 go into effect. Finally, the third scenario includes the fulfillment of both NAFTA and GATT commitments and the hypothetical complete elimination of tariffs within the G-3. The base period data for the simulation is the average for the years 1991 to 1993. Examination of trade data for this period shows that there are trade flows between the five regions considered in the simulation model for all products to be analyzed.

3. Simulation Results

Results for Trade in Pepper

The situation of this product in terms of tariff schedules is the following. Pre-G-3, pre-GATT, and pre-NAFTA ad-valorem tariffs in Colombia were at the 15 percent level vis-a-vis Mexico, the U.S. and ROW, and zero for Venezuela. Mexico's were at the 18.4 percent level for all of the other four regions. Venezuela's were at the same level as Colombia's (those for Colombia being zero). The U.S. does not impose tariffs on peppers. In the case of ROW a 14 percent tariff level was used, corresponding to the average tariff level for agricultural products in Latin American countries according to the International Agricultural Trade Research Consortium - IATRC (1994).

Under scenario 1 (no G-3), tariffs are supposed to diminish by 15 percent (for instance, to 12.75 percent in the case of Colombia) according to GATT's provisions,[6] while Mexican tariffs vis-a-vis the U.S. should disappear, as agreed in NAFTA. Since peppers are fully included in the G-3's tariff elimination schedule, the G-3 and the total liberalization scenarios are the same in this case. Therefore complete tariff elimination is considered to occur between Mexico and Colombia and Mexico and Venezuela, while GATT's and NAFTA's provisions must also be fulfilled. A severe limitation of the simulation results for this product is that no information

[6] GATT's Uruguay Round accord on tariffs for agricultural products determined an overall (not weighted average) tariff reduction of 36 percent and a minimum tariff reduction of 15 percent for each individual product (USDA, 1994).

was available on production and consumption for Colombia and Venezuela. As both countries are concurrently importing and exporting this group of products and re-exports are unlikely, it was assumed that production equals exports and consumption equals imports. The assumption has no basis in fact, but was necessary for the purpose of estimating changes in trade flows. Since traded quantities are small, this assumption does not have a large impact on the results. Annual average Colombian imports for the period 1989 -1993 were 353 tons, while average exports were 909 tons. In the case of Venezuela these figures were 289 and 183 tons for imports and exports respectively. Colombian intra-G-3 trade of pepper averaged 25 tons for the base period, while Venezuela did not register intra-G-3 trade of this product. Expected percentage changes in quantities produced, consumed, and traded, as well as in prices, are reported in Table 3 for the two relevant scenarios.

The results for the No-G-3 scenario are consistent with the behavior that might be expected as a response to the tariff modifications. Small variations in quantities and prices appear in Colombia and Venezuela, consistent with the low reductions in their tariffs and those of their trade partners. Similarly, negligible changes are calculated for ROW not only because tariff reductions are low in this case but also because of the large size of this region as compared to the others (ROW represents 97.6 and 94 percent of world production and consumption of pepper respectively).

Table 3 Percentage Changes in Production, Consumption, and Prices for Trade in Pepper

Percentage change in:	No-G-3 Scenario				
	COL	MEX	VEN	US	ROW
Production	0	-1.5	1.8	3.5	0
Colombian product consumption	-	-	-	0	-
Mexican product consumption	2.5	-2.0	-	2.2	-
Venezuelan product consumption	-	-	-	-	1.8
U.S.' product consumption	-	45.4	-	-7.6	-0.8
ROW's product consumption	0.8	3.3	0.9	0.3	0
Total consumption	1.0	0.9	0.9	0	0
Producer price	0	-0.8	2.2	4.3	0
Colombian product price	-	-	-	0.1	-
Mexican product price	-2.4	-0.5	-	-0.6	-
Venezuelan product price	-	-	-	-	-0.5
U.S.' product price	-	-12.8	-	2.8	0.3
ROW's product price	-1.9	-2.3	-1.9	0	0

Percentage change in:	G-3 Scenario				
	COL	MEX	VEN	US	ROW
Production	0	-1.5	1.8	3.5	0
Colombian product consumption	-	-	-	0	-
Mexican product consumption	43.7	-2.0	-	2.2	-
Venezuelan product consumption	-	-	-	-	1.8
U.S.' product consumption	-	45.5	-	-7.6	-0.8
ROW's product consumption	-1.3	3.4	0.9	0	0
Total consumption	1.9	0.9	0.9	0	0
Producer price	0	-0.8	2,3	4.4	0
Colombian product price	-	-	-	0.1	-
Mexican product price	-13.5	-0.5	-	-0.6	-
Venezuelan product price	-	-	-	-	-0.6
U.S.' product price	-	-12.8	-	2.8	0.3
ROW's product price	-1.9	-2.3	-1.9	0	0

A value of 0 stands for changes lower than 0.1 % while a "-" sign means that no production, consumption, or trade flows actually exist.
Source: simulation results

On the other hand, as a result of the NAFTA, sizable changes result for Mexico and the U.S. regarding their bilateral trade. U.S. exports to Mexico

increase by 45 percent as a response to a consumer price reduction of almost 13 percent, while domestic consumption of U.S. product decreases by more than 7 percent as a result of a consumer price increase near 3 percent. The increase in U.S. exports of pepper to Mexico, from 1,676 to 2,437 tons, is due to tariff elimination in Mexico. The own price Armington elasticity for this product in the Mexican market is -2.88, and its cross price elasticities range from 0.49 to 2.05[7]. Mexican exports to the U.S. grow slightly more than 2 percent due to a moderate reduction in prices (less than one percent). Consumption of local product in Mexico diminishes in spite of the fact that consumer prices decrease, largely as a consequence of substitutive effects with the U.S. product. The asymmetry of these changes is consistent with the movement in tariff levels. All variables register changes in the expected directions.

In general, the results for the G-3 scenario are the same. The obvious modification is that Mexican exports to Colombia increase by 43.7 percent with respect to the base period while in the previous scenario the rate of growth was just 2.5 percent. This increase moves Mexican exports up to almost 40 tons. The own price Armington elasticity of demand for this product in the Colombian market is -2.81 and its cross price elasticity vis-a-vis ROW's product is 2.38. Correspondingly, consumer prices for Mexican products in the Colombian market decrease by more than 13 percent.

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[7] Relatively large values are typical of Armington elasticities. In this case they are driven by an assumed value of 3 for the inter-commodity elasiticity of substitution. This topic is discussed in Appendix 3.

A substitution effect through which consumption of products originating in ROW is replaced by Mexican products takes place. With the G-3 in operation, exports from ROW to Colombia are not only unable to increase (as in the previous scenario) but also tend to diminish. Total consumption in Colombia grows by an additional 1 percent as a result of liberalization with Mexico. On the other hand, tariff elimination between Mexico and Venezuela may prove useless if the historic lack of trade flows was not due to the preexisting tariffs. It is also worth mentioning that even though there is a significant increase in Mexican exports to Colombia, due to the relatively small size of this trade, there are no effects on the outcome for the rest of the regions with respect to the former scenario.

The relatively large changes in trade flows encountered for the two scenarios are due to the small size of trade flows. This can be seen in the market shares data reported in Table 4. As is evident, tariff modifications do not produce large variations in market shares. In the first scenario, however, it is noticeable that the 45 percent increase in U.S. exports to Mexico becomes a 44 percent increase in market share for this product. As a consequence, domestic production loses market share at the expense of U.S. and ROW's products, while slightly increasing its participation in the Colombian and U.S. markets. This outcome shows that even though the initial level of tariffs in Mexico was not high, important changes accrue from complete bilateral trade liberalization. For the second scenario, the most important change is that Mexican exports increase their share of the Colombian market by 3 percent while that of ROW exports diminishes by almost the same amount.

Table 4 Market Shares for Pepper Before and After Tariff Modifications

Market Share of:		COL	MEX	VEN	US	ROW
Colombian product:	before	n.a.	-	-	1.7	-
	Non-G-3 Scenario	n.a.	-	-	1.7	-
	G-3 Scenario	n.a.	-	-	1.7	-
Mexican product:	before	7.2	77.4	-	5.4	-
	Non-G-3 Scenario	7.3	75.1	-	5.6	-
	G-3 Scenario	10.2	75.1	-	5.6	-
Venezuelan product:	before	-	-	n.a.	-	0
	Non-G-3 Scenario	-	-	n.a.	-	0
	G-3 Scenario	-	-	n.a.	-	0
U.S.' product:	before	-	4.1	-	6.5	0.1
	Non-G-3 Scenario	-	5.9	-	6.0	0.1
	G-3 Scenario	-	5.9	-	6.0	0.1
ROW's product:	before	92.7	18.4	100	86.2	99.8
	Non-G-3 Scenario	92.6	18.9	100	86.6	99.8
	G-3 Scenario	89.8	18.9	100	86.6	99.8

A value of 0 stands for shares lower than 0.1 % while a "-" sign means that no trade flows actually exist.
Source: simulation results

Results for Trade in Cotton

Tariff schedules for this product in the base period follow the pattern described below. Colombia and Venezuela impose a 15 percent ad-valorem tariff on all of their trading partners and levy no tariffs on bilateral trade among themselves. Mexico makes use of a 10 percent ad-valorem tariff vis-a-vis any exporting country. The U.S. allows tariff-free imports from Colombia and Venezuela because of the Andean Trade Preference Act (ATPA) and imposes a 4.4 cents per kilogram tariff on any other exporter.

IATRC's estimate of the average tariff for agricultural products in Latin America is assumed for ROW.

The first scenario considers the implementation of GATT's Uruguay Round agreement on tariffs for agricultural products as well as that of NAFTA. Therefore, tariffs are reduced by 15 percent in all regions and completely eliminated between Mexico and the U.S. The status of cotton within the G-3 establishes that the product is excluded from trade liberalization measures in the case of Mexico and benefits from a 12 percent reduction in tariffs applied by Colombia and Venezuela on Mexico. As a consequence, GATT commitments overcome G-3's dispositions for this product, making the latter irrelevant. This situation is modeled as the GATT/NAFTA scenario. The third scenario assumes complete tariff elimination for trade between Mexico and Colombia, and Mexico and Venezuela.

Table 5 shows that tariff reductions produce negligible effects on production and consumption for four out of the five regions included in the model. Significant results are found only in the case of Mexico which is completely eliminating tariffs vis-a-vis the U.S. and for which imports from the latter are important in consumption (as market share data in Table 6 illustrate). The increase in imports from the U.S. substitutes for considerable amounts of Colombian exports and consumption of domestic products and allows for a significant increase in total consumption of cotton in Mexico. The own price Armington elasticity of demand for U.S. cotton in Mexico is -1.33 and the corresponding cross price elasticities vis-a-vis Mexican and Colombian cotton are 0.73 and 0.005, respectively. On the other hand, the change in Mexican exports to the U.S. market (although less significant in terms of its

effect on aggregate consumption) responds to a near 7 percent price reduction as a consequence of tariff elimination. The own price Armington elasticity in this case is -2.98 and cross price elasticities range from 0.004 to 2.78.

Even though not relevant from the point of view of their impact on production and total consumption, tariff changes occasioned considerable movements in trade flows. Leaving aside substitution effects among alternative foreign suppliers, in general it appears that consumption of domestic products tends to be replaced by imports. However, data in Table 6 show that market shares suffer only marginal modifications as tariff changes occur. As mentioned, G-3's provisions are irrelevant in this case because they are superseded by GATT's.

If complete tariff elimination occurs for G-3 trade flows, no changes will take place in production, consumption, trade flows, prices, and market shares for all the regions with the only exception that Colombian exports to Mexico would increase by nearly 13 percent instead of decreasing (as in scenario 1). This increase allows Colombian exports to maintain their participation within the Mexican market as can be seen in Table 6. In this case, again, the modest size of trade between Colombia and Mexico prevents any further effect on the rest of trade flows and market shares. The Armington own price elasticity for Colombian cotton in the Mexican market is -2.99.

Table 5 Percentage Changes in Production, Consumption, and Prices for Cotton

Percentage change in:	GATT/NAFTA Scenario				
	COL	MEX	VEN	US	ROW
Production	0.1	-1.6	-0.1	0.8	-0.1
Colombian product consumption	-0.6	-11.7	-1.1	-	4.2
Mexican product consumption	-	-10.3	-	27.6	9.9
Venezuelan product consumption	-	-	-0.4	-	5.2
U.S.' product consumption	3.1	11.3	4.9	-0.3	1.8
ROW's product consumption	6.4	-	4.9	4.7	-0.1
Total consumption	0	4.7	0.1	-0.1	0
Producer price	0.2	-2.7	-0.3	1.1	-0.3
Colombian product price	0.1	-1.3	0	-	-1.6
Mexican product price	-	-1.8	-	-6.9	-3.3
Venezuelan product price	-	-	-0.2	-	-1.9
U.S.' product price	-1.1	-8.6	-1.9	1.0	-0.8
ROW's product price	-2.1	-	-1.9	-0.5	-0.2

Percentage change in:	G-3 Total Tariff Elimination				
	COL	MEX	VEN	US	ROW
Production	0.1	-1.6	-0.1	0.8	-0.1
Colombian product consumption	-0.6	12.6	-1.1	-	4.1
Mexican product consumption	-	-10.3	-	27.6	9.9
Venezuelan product consumption	-	-	-0.4	-	5.2
U.S.' product consumption	3.2	11.3	4.9	-0.3	1.8
ROW's product consumption	6.5	-	4.9	4.7	-0.1
Total consumption	0	4.7	0.1	-0.1	0
Producer price	0.2	-2.8	-0.3	1.1	-0.3
Colombian product price	0.1	-9.0	0	-	-1.5
Mexican product price	-	-1.8	-	-6.9	-3.3
Venezuelan product price	-	-	-0.2	-	-1.9
U.S.' product price	-1.1	-8.6	-1.9	1.0	-0.8
ROW's product price	-2.1	-	-1.9	-0.5	-0.2

A value of 0 stands for changes lower than 0.1 % while a "-" sign means that no production, consumption, or trade flows actually exist.
Source: simulation results

Table 6 Market Shares for Cotton Before and After Tariff Modifications

Market Share of:		COL	MEX	VEN	US	ROW
Colombian product:	before	85.8	0.2	13.9	-	0.1
	GATT/NAFTA Scenario	85.3	0.1	13.7	-	0.1
	G-3 Total Tariff Elimination	85.2	0.2	13.7	-	0.1
Mexican product:	before	-	30.5	-	0.5	0
	GATT/NAFTA Scenario	-	26.1	-	0.6	0.1
	G-3 Total Tariff Elimination	-	26.1	-	0.6	0.1
Venezuelan product:	before	-	-	71.7	-	0
	GATT/NAFTA Scenario	-	-	71.3	-	0
	G-3 Total Tariff Elimination	-	-	71.3	-	0
U.S.' product:	before	9.4	69.2	2.7	99.3	7.7
	GATT/NAFTA Scenario	9.7	73.6	2.8	99.1	7.8
	G-3 Total Tariff Elimination	9.7	73.6	2.8	99.1	7.8
ROW's product:	before	4.6	-	11.5	0.1	92.0
	GATT/NAFTA Scenario	4.9	-	12.0	0.1	91.8
	G-3 Total Tariff Elimination	4.9	-	12.0	0.1	91.8

A value of 0 stands for shares lower than 0.1 % while a "-" sign means that no trade flows actually exist.
Source: simulation results

Results for Trade in Dry Leguminous Vegetables

The subgroup includes dry beans, peas, chickpeas, and lentils. In the cases in which tariffs vary from one product to another, the starting tariff level for the group was determined as the non-weighted average tariff for the group. Tariff levels in Colombia and Venezuela are at the 15 percent level ad-valorem for all traders and zero for bilateral trade between the two countries. Mexican tariffs are fixed at the 10 percent level for imports from all origins. U.S. tariffs are zero for Colombia and Venezuela according to ATPA regulations and stand at 3 cents per kilogram for the rest of foreign

supplies. The same average tariff employed before (14 percent) was assumed for ROW.

GATT's and NAFTA's tariff reductions form the first scenario to be simulated. It coincides with scenario 2 since this group of products was excluded from the G-3's tariff elimination schedule. Therefore, in this scenario, identified as the GATT/NAFTA scenario, tariffs are reduced by 15 percent in all countries and for all origins, and complete tariff elimination occurs between Mexico and the U.S. As usual, the third scenario assumes complete tariff elimination applying to trade flows within G-3 member countries.

Data in Table 7 indicate that there are no changes of empirical importance in production or consumption levels as a result of the GATT/NAFTA scenario; hence, what happens as a result is mostly that trade flows suffer some adjustment following tariff changes and 'comparative advantage'. As a consequence of tariff elimination, significant trade flow increases occur for both Mexican exports to the U.S. and U.S. exports to Mexico. Substitutive effects between consumption of domestic production and Mexican or U.S. exports in each case are the source of such growth. Armington own price elasticity of demand for U.S. product in the Mexican market is -2.94 while its cross price elasticities with respect to Mexican and ROW's products are 2.53 and 0.018. Conversely, own price elasticity for the Mexican product in the U.S. market is -2.95 and its cross price elasticities vis-a-vis U.S. and ROW's products are 2.34 and 0.21.

Table 7 Percentage Changes in Production, Consumption, and Prices for Dried Leguminous Vegetables

	GATT/NAFTA Scenario				
Percentage change in:	COL	MEX	VEN	US	ROW
Production	-0.1	-0.1	-0.8	0.9	0
Colombian product consumption	-0.1	-	-0.6	-	6.8
Mexican product consumption	-	-0.4	2.5	15.8	5.7
Venezuelan product consumption	0.4	-	-0.9	-	23.5
U.S.' product consumption	-2.4	29.0	-0.9	-1.0	2.6
ROW's product consumption	2.3	3.4	2.0	4.4	0
Total consumption	0.5	0.1	0.6	-0.2	0
Producer price	-1.8	-0.1	-1.5	1.1	0
Colombian product price	-1.1	-	-1.0	-	-2.1
Mexican product price	-	-0.1	-2.1	-4.1	-1.8
Venezuelan product price	-1.3	-	-0.9	-	-6.8
U.S.' product price	-0.3	-8.3	-0.9	1.0	-0.8
ROW's product price	-1.9	-1.3	-1.9	-0.7	0
	G-3 Total Tariff Elimination				
Percentage change in:	COL	MEX	VEN	US	ROW
Production	-0.1	-0.1	-0.8	0.9	0
Colombian product consumption	-0.1	-	-0.7	-	6.8
Mexican product consumption	-	-0.4	46.7	15.7	5.6
Venezuelan product consumption	0.5	-	-1.0	-	24.1
U.S.' product consumption	-2.4	29.0	-1.0	-1.0	2.6
ROW's product consumption	2.3	3.4	1.9	4.4	0
Total consumption	0.5	0.1	0.6	-0.2	0
Producer price	-1.8	-0.1	-1.6	1.1	0
Colombian product price	-1.1	-	-1.0	-	-2.1
Mexican product price	-	-0.1	-13.1	-4.1	-1.8
Venezuelan product price	-1.3	-	-0.9	-	-6.9
U.S.' product price	-0.3	-8.3	-0.9	1.0	-0.8
ROW's product price	-1.9	-1.3	-1.9	-0.7	0

A value of 0 stands for changes lower than 0.1 % while a "-" sign means that no production, consumption, or trade flows actually exist.
Source: simulation results

With the exception of ROW, due to the large size of its market as compared to the other regions, consumption of domestic product diminishes in all

cases because of relatively larger decreases in competing products' prices. This situation allows competing suppliers to have a bigger 'market space' to adjust their participation. In this way, increases in ROW's product participation in the other four markets as well as the increase of Mexican exports to Venezuela should be regarded as stemming from their 'comparative advantage' (as expressed in larger price declines).

The scenario in which complete tariff elimination among G-3 partners is assumed basically leads to modifications in growth rates for Mexican exports to Venezuela and to a lesser extent Venezuelan exports to ROW. Tariff elimination makes Mexican exports to Venezuela increase more than 46 percent (from 410 to 601 tons.). However, price reductions are unable to produce a further expansion of total consumption (with respect to that in scenario 1) and consequently Mexican gains in market share (presented in Table 8) are obtained at the expense of Colombian and U.S. export reductions as well as a decrease in consumption of domestic products. The Armington own price elasticity of demand for Mexican products in the Venezuelan market is -2.99 while its corresponding cross price elasticities with respect to Colombian, Venezuelan, U.S, and ROW's products are 0.15, 0.84, 0.27, and 1.3. A very slight price decrease for Venezuelan products oriented to ROW's market moderately improves their rate of growth over that obtained in the former scenario. This change stems from the adjustment of producer prices for Venezuelan products in the process of reaching a new equilibrium level but due to its marginal nature it is not reflected in data on the Venezuelan market.

Table 8 Market Shares for Dried Leguminous Vegetables Before and After Tariff Modifications

Market Share of:		COL	MEX	VEN	US	ROW
Colombian product:	before	63.7	-	5.9	-	0
	GATT/NAFTA Scenario	63.3	-	5.9	-	0
	G-3 Total Tariff Elimination	63.3	-	5.9	-	0
Mexican product:	before	-	97.3	0.2	1.6	0
	GATT/NAFTA Scenario	-	96.7	0.3	1.9	0
	G-3 Total Tariff Elimination	-	96.7	0.4	1.9	0
Venezuelan product:	before	0.5	-	32.6	-	0
	GATT/NAFTA Scenario	0.5	-	32.1	-	0
	G-3 Total Tariff Elimination	0.5	-	32.1	-	0
U.S.' product:	before	3.6	1.9	10.7	90.0	0.8
	GATT/NAFTA Scenario	3.5	2.5	10.5	89.3	0.8
	G-3 Total Tariff Elimination	3.5	2.5	10.5	89.3	0.8
ROW's product:	before	32.0	0.7	50.3	8.2	99.1
	GATT/NAFTA Scenario	32.5	0.7	51.0	8.6	99.1
	G-3 Total Tariff Elimination	32.5	0.7	50.9	8.6	99.1

A value of 0 stands for shares lower than 0.1 % while a "-" sign means that no trade flows actually exist.
Source: simulation results

The lack of importance of trade flow changes reported in Table 7 in the context of this product's trade structure is reflected in the great stability of market share data presented in Table 8. Only in the case of complete tariff elimination (NAFTA countries), are relatively important modifications in market shares registered. As in the cases of other products, this outcome depends not only on the modest level of tariff reductions but also on the non-discriminatory basis of the GATT's commitment that reduces tariffs for all countries in the same proportion and therefore tends to maintain the existing price structure. As tariff reductions are small, consumer prices for imports are precluded from fully reflecting the differences in 'comparative

advantage' among suppliers and the trade structure tends to be more stable than in the case of complete liberalization. There is practically no modification in market share data when going from the first to the second scenario. The only difference in market share changes between the two scenarios is a 0.1 percent increase in market share for Mexican products in the Venezuelan market occurring at the expense of ROW's exports.

Results for Trade in Sesame Seed

Of the four products included in this analysis, sesame seed is the most 'liberalized' in that neither the U.S. and Mexico impose tariffs on their imports from any supplier (on the grounds of the Generalized System of Preferences in the first case and the Most Favored Nation principle in the second). On the other hand, Colombia and Venezuela apply a 15 percent ad-valorem tariff on all imports and allow tariff-free imports for their bilateral trade. As in the cases of the other products, ROW is assumed to levy a 14 percent ad-valorem tariff on imports of this good.

Given that NAFTA's provisions are not relevant in this case, the first scenario only depicts the effects of GATT's commitment on trade (GATT scenario). Under G-3's regulations, Colombia and Venezuela are expected to apply a 12 percent reduction in their tariffs on Mexico. However, G-3's rules are redundant in this case since they are more lenient than GATT's and, additionally, there are no actual trade flows of this product going from Mexico to Colombia or Venezuela. Therefore, only the GATT scenario has relevance in terms of observing possible changes in trade flows, prices, and market shares.

Data in Table 9 show that marginal changes occur in production and consumption levels as well as in trade flows as a consequence of tariff reductions following GATT's compromises. These changes are largely driven by the fact that all countries trade (specifically export to) with ROW. Tariff reductions in ROW import regime pull up its imports from the four other regions and therefore the new equilibrium prices expressed in terms of each supplier's consumer price for domestic product increase. Consumers' response to this price increase translates into a diminution of domestic product consumption and allows for a limited substitution of imports for domestic product whose extent depends upon the differences in border prices among competing imports. As a result, bilateral trade (in both directions) between Colombia and Venezuela increases; Venezuelan exports to Mexico increase, although ROW's export increase is larger; and all exports to the U.S., with the exception of ROW's, decrease.

Market share data reported in Table 10 illustrate the relative importance of trade flow changes in affecting this product's trade structure. Given that the USDA does not report production of sesame for the U.S., re-exports are treated as 'domestic' production without being counted as consumption of domestic product. Market composition remains the same or almost the same for four out of the five regions while that of Colombia suffers a relatively sizable modification due to the lack of diversification in suppliers combined with its considerable dependency on imports.

Table 9 Percentage Changes in Production, Consumption, and Prices for Sesame Seed

Percentage change in:	GATT Scenario				
	COL	MEX	VEN	US	ROW
Production	1.0	0.5	1.1	1.0	0
Colombian product consumption	-3.3	-	4.6	-5.0	4.8
Mexican product consumption	-	-0.6	-	-1.2	5.1
Venezuelan product consumption	3.5	0.6	-0.4	-2.7	5.0
U.S.' product consumption	-	-8.8	-	-	4.1
ROW's product consumption	-	1.7	-	1.0	0
Total consumption	-1.1	-0.1	-0.4	0	0
Producer price	4.1	1.1	2.8	1.8	0
Colombian product price	2.5	-	0	2.0	-1.5
Mexican product price	-	0.7	-	0.7	-1.7
Venezuelan product price	0.2	0.3	1.7	1.2	-1.6
U.S.' product price	-	3.7	-	8.4	-1.3
ROW's product price	-	0	-	0	0

A value of 0 stands for changes lower than 0.1 % while a "-" sign means that no production, consumption, or trade flows actually exist.
Source: simulation results

Table 10 Market Shares for Sesame Seed Before and After Tariff Modifications

Market Share of:		COL	MEX	VEN	US	ROW
Colombian product:	before	67.2	-	0.5	0.1	0.1
	GATT Scenario	65.6	-	0.5	0.1	0.1
Mexican product:	before	-	56.2	-	48.8	0.3
	GATT Scenario	-	55.9	-	48.2	0.3
Venezuelan product:	before	32.7	17.1	99.4	3.9	0.2
	GATT Scenario	34.3	17.2	99.4	3.7	0.2
U.S.' product:	before	-	3.2	-	-	0
	GATT Scenario	-	2.9	-	-	0
ROW's product:	before	-	23.3	-	50.6	99.1
	GATT Scenario	-	23.7	-	51.2	99.1

A value of 0 stands for shares lower than 0.1 % while a "-" sign means that no trade flows actually exist.
Source: simulation results

Welfare Effects

Changes in 'quantity' variables and prices are indicative of the net effect of tariff reductions on producers and consumers, although they do not suffice to determine their effect on economic welfare for these agents or for the whole economy. Therefore, in order to assess the size and direction of economic welfare changes arising from trade liberalization, it is necessary to obtain direct estimates of these changes. The results of this exercise for each region, type of economic agent, and scenario are reported in this section and presented as a percentage of the value of trade for each country in the base period.

Table 11 Welfare Effects Arising from Tariff Reductions on Trade in Pepper (as a percentage of the value of its trade in the base period)

Percentage change in:		COL	MEX	VEN	US	ROW
Producer surplus:	no-G-3 scenario	0	-1.9	0	0.6	0.4
	G-3 scenario	0	-1.9	0	0.6	0.4
Consumer surplus:	no G-3 scenario	0.9	13.3	2.1	-0.5	-0.4
	G-3 scenario	1.6	13.3	2.1	-0.5	-0.4
Governmt. revenue:	no G-3 scenario	-0.6	-4.0	-2.0	0	-0.2
	G-3 scenario	-0.9	-4.0	-2.0	0	-0.2
Tot. welfare change:	no-G-3 scenario	0.3	7.5	0.2	0.1	-0.2
	G-3 scenario	0.7	7.5	0.2	0.1	-0.2

A value of 0 stands for zero or for changes lower than 0.1 %.
Source: simulation results

Table 11 presents estimates of the welfare effects corresponding to the two scenarios considered in the case of trade in pepper. These results indicate

that under both scenarios the only country that has significant changes in economic welfare is Mexico. In fact, the value of economic welfare gains in this case is equivalent to 7.5 percent of the value of its trade in pepper. Under the no-G-3 scenario, Mexican producers lose while U.S.' and ROW's producers gain. Consumers gain in Colombia, Mexico, and Venezuela and lose in the U.S. and ROW[8]. Obviously, government revenues decline in all regions, although losses in the U.S. are lower than 0.1 percent of this country's value of trade. Overall welfare effects are positive and negligible for Colombia, Venezuela, and the U.S.; positive and relevant for Mexico; and small and negative for ROW.

The G-3 scenario, which implies complete tariff elimination for trade flows between Mexico and Colombia and Mexico and Venezuela, affects only the outcome previously obtained for Colombia. Consumer surplus rises from 0.9 percent to 1.6 percent, government revenue further declines 0.3 percent, and total welfare improves 0.4 percent. These changes are modest indeed and as such do not affect those obtained for Mexico under the first scenario.

Tariff reductions applied to cotton trade bring welfare gains to all regions for the two scenarios. Data in Table 12 indicate that exactly the same outcome is reached under the two alternatives. As was the case with trade in pepper, Mexico reaps the largest benefits due to the effect of NAFTA. GATT and NAFTA regulated tariff reductions yield welfare gains for Colombian and U.S.' producers and losses for Mexican, Venezuelan and ROW's. However,

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8 It is worthwhile recalling that lack of information on Colombian and Venezuelan production and consumption severely limits the reliability of these results.

welfare changes for Colombian and Venezuelan producers are nil. On the other hand, with the exception of the U.S., consumers gain in all markets, Mexicans benefiting the most, followed by those of ROW. Government revenues decline worldwide (less than 0.1 percent in the U.S.).

Table 12 Welfare Effects Arising from Tariff Reductions on Trade in Cotton (as a percentage of the value of its trade in the base period)

Percentage change in:		COL	MEX	VEN	US	ROW
Producer surplus:	G/N scenario	0.3	-1.3	-0.2	2.8	-2.8
	no-tariffs scen	0.4	-1.3	-0.2	2.8	-2.8
Consumer surplus:	G/N scenario	0.4	17.0	2.2	-1.6	6.2
	no-tariffs scen	0.3	17.1	2.2	-1.6	6.2
Government revenue:	G/N scenario	-0.5	-7.7	-0.8	0	-1.6
	no-tariffs sce	-0.5	-7.7	-0.8	0	-1.6
Total welfare change:	G/N scenario	0.2	8.0	1.3	1.2	1.8
	no-tariffs scen	0.2	8.0	1.3	1.2	1.8

A value of 0 stands for zero or for changes lower than 0.1 %.
G/N scenario: GATT/NAFTA scenario
no-tariffs scenario: complete tariff elimination among G-3 partners
Source: simulation results

The G-3's tariff reductions for cotton have no practical meaning because reductions required by the GATT are greater. In the scenario of a hypothetical total tariff elimination among G-3 countries, welfare effects would register modifications only for Colombia and Mexico. Colombian producer's surplus would increase from 0.3 to 0.4 percent while consumer surpluses would decline for Colombian consumers and increase for Mexican consumers by 0.1 percent in both cases. As is evident, the impact of such a scenario on economic welfare would be small.

Table 13 Welfare Effects Arising from Tariff Reductions on Trade in Dried Leguminous Vegetables (as a percentage of the value of its trade in the base period)

Percentage change in:		COL	MEX	VEN	US	ROW
Producer surplus:	G/N scenario	-4.3	-2.3	-0.5	2.2	-0.5
	no-tariffs scen	-4.3	-2.1	-0.5	2.2	-0.5
Consumer surplus:	G/N scenario	12.7	11.0	6.4	-1.0	2.1
	no-tariffs scen	12.7	10.8	6.7	-1.0	2.1
Government revenue:	G/N scenario	-1.6	-3.0	-1.7	-0.2	-1.1
	no-tariffs sce	-1.6	-3.0	-1.8	-0.2	-1.1
Total welfare change:	G/N scenario	6.8	5.7	4.2	1.0	0.5
	no-tariffs scen	6.8	5.7	4.4	1.0	0.5

A value of 0 stands for zero or for changes lower than 0.1 %.
G/N scenario: GATT/NAFTA scenario
no-tariffs scenario: complete tariff elimination among G-3 partners
Source: simulation results

Welfare effects of tariff reductions applied to trade in dried leguminous vegetables are presented in Table 13. These estimates indicate that all regions derive benefits from tariff reductions and that, unlike the previous cases, they are significant for all G-3 member countries. Under the GATT/NAFTA scenario, U.S. producers benefit from tariff reductions while U.S. consumers lose. In contrast, the rest of the regions present producer surplus declines and consumer surplus increases. The apparent reason for this outcome is that tariff reduction in ROW on U.S. products leads to an increase of prices for U.S. exports that affects consumer prices in the U.S (substitution effects in consumption being unable to offset its negative effect on consumers). U.S. exports to ROW represent 89.3 percent of U.S. exports of these products in the base period and 36.1 percent of domestic production.

Since the rest of the regions face reductions in tariffs (except Mexico), substitution effects dominate and consumer gains result.

A complete tariff elimination among G-3 partners, considered in the second scenario, would alter economic welfare results for Mexico and Venezuela. As Mexican exports to Venezuela grow as a result of tariff elimination, Mexican producers lose less than in the previous scenario, and conversely, Mexican consumers gain less. In Venezuela, consumers marginally increase their gains, government revenue decreases further, and total welfare is slightly enhanced.

Table 14 presents estimates of changes in economic welfare in the sesame seed market stemming from tariff reductions agreed in the framework of GATT's Uruguay Round. As can be seen, all regions derive net benefits from tariff reductions; however, their significance is meager. Colombia, Mexico, Venezuela, and the U.S. present producer surplus gains and consumer surplus losses. This situation arises as a consequence of the fact that all regions export this product to ROW. Therefore, the increase in their export prices as a result of tariff reductions push consumer prices upward (tariff reduction makes ROW's imports grew 5 percent while its exports grew 1.1 percent). Government revenues remain unchanged because neither Mexico nor the U.S. levy tariffs on this product and Colombia and Venezuela import only from each other, these imports being tariff-free.

The opposite outcome is observed for ROW. Producer surplus decreases, consumer surplus increases, and government revenue decreases. All welfare changes in this case are driven by trade flows between ROW and the

rest of the regions. This is so because the existing trade flows among the latter group are performed under tariff-free conditions either in the framework of FTAs or zero tariff levels in the context of the Most Favored Nation principle (this situation is reflected in the absence of government revenue changes). ROW only exports to Mexico and the U.S., both countries being tariff-free for these products Therefore no trade gains arise from tariff reductions.

Table 14 Welfare Effects Arising from Tariff Reductions on Trade in Sesame Seed (as a percentage of the value of its trade in the base period)

Percentage change in:		COL	MEX	VEN	US	ROW
Producer surplus:	GATT scen.	3.6	0.9	4.3	0.3	-1.1
Consumer surplus:	GATT scen.	-2.7	-0.4	-2.7	-0.4	3.1
Government revenue:	GATT scen.	0	0	0	0	-0.5
Total welfare change:	GATT scen.	1.0	0.5	1.7	0	1.5

A value of 0 stands for zero or for changes lower than 0.1 %.
Source: simulation results

4. Implications of the Empirical Analysis

The simulation of the effects of G-3 provisions on member countries' production, consumption, prices, trade flows, and economic welfare related to agricultural trade is intended to explore the outcome of this trade agreement. The results of this effort are tentative in nature and are affected by the limitations that characterize the modeling approach. Nevertheless, they are consistent with both the theoretical foundation of the analysis of discriminatory trade policies (as applied to FTAs) and the empirical data

upon which the simulation is constructed. Furthermore, the coherence among the outcomes of the different scenarios considered indicates that the model behaves properly and yields reasonable results.

However, in analyzing the cases of three out of the four products that were selected, no modeling effort at all is required. G-3's tariff reductions for cotton and sesame seed were either overcome by GATT's Uruguay Round commitments or rendered pointless due to the actual direction of trade flows. The third product, dried leguminous vegetables, was excluded from tariff reductions. On the other hand, the fourth product (pepper) was scheduled for complete tariff elimination and as a consequence a relatively big increase in Colombian imports from Mexico is obtained. A modest improvement in Colombian economic welfare arises from this trade flow change and no welfare consequences are derived for Mexico.

This situation implies that G-3's provisions related to agricultural trade are likely to be largely irrelevant in bringing economic gains to member countries. The significance of estimating the possible outcome of a scenario in which tariffs were completely eliminated among G-3 partners is to foresee the potential of the agreement to become significant in enhancing agricultural trade and improving economic welfare. To assess this possibility all that is needed is to analyze the cases of cotton and dried leguminous vegetables, since pepper has already been liberalized and tariff elimination for sesame seed is meaningless.

The results of the simulation seem to indicate that there is not much potential for the G-3 in agriculture. If tariffs were eliminated for trade in

cotton, Colombian exports to Mexico would increase and would be able to offset their tendency to decline due to the competition of U.S.' cotton (stimulated through NAFTA). Furthermore, the net result would be an increase of nearly 13 percent in value with respect to that of the base period. However, this rate of growth would just keep the participation of Colombian exports in the Mexican market at the same level they had in the base period. Additionally, no welfare gain increases would be obtained either for Colombia or for Mexico over those of the GATT/NAFTA scenario.

In the case of complete liberalization of trade for dried leguminous vegetables, Mexican exports to Venezuela would grow almost 47 percent (but only 2.5 percent in the GATT/NAFTA scenario). In this way, Mexican products' market share in Venezuela would reach 0.4 percent, or twice their share in the base period. Consistent with the marginal magnitude of this change, no substantial modifications in economic welfare would occur from the results of the alternative scenario.

Therefore, the 'end result' of this analysis is that in the cases of these four products and presumably for member countries' agricultural sector in general, the G-3 lacks great economic importance. Furthermore, even if it were used to completely liberalize agricultural trade between member countries, the outcome would not be different in terms of improving their economic welfare. However, sizable increases in trade flows (in relative terms) would be obtained in three cases. The low volume of trade between Mexico and Colombia and Mexico and Venezuela, combined with relatively low tariff levels in the pre-G-3 period (reached in the process of unilateral

trade liberalization in each country), seem to determine this outcome. Besides these factors, the impact of NAFTA and GATT's Uruguay Round accord tend to diminish potential gains from the G-3. NAFTA affects the outcome of the G-3 because it creates other discriminatory trade relations that affect the behavior of Mexican agricultural trade with Mexico's most important trade partner (NAFTA being more powerful than the G-3 in its tariff effects). GATT's Uruguay Round affects the G-3 because the non-discriminatory nature of its tariff reduction lessen the effect of G-3's tariff discrimination.

5. Conclusions

The broadest conclusion of the research is that in its current status the G-3 performs poorly in liberalizing agricultural trade among G-3 partners. The reason for this is simple: the G-3 lacks wide coverage of agricultural products. Extensive lists of excluded products were established for each country on the grounds of their 'sensitivity' and others were subject to special provisions that restrict free trade (as in the case of sugar). Since the lists of exclusions are comprehensive, the agreement practically precludes the possibility of new products entering bilateral trade as a consequence of its implementation (tariffs, surcharges, and other trade restrictions normally applied to these products are maintained at their original levels).

The second general conclusion obtained is that even in the cases in which the agreement effectively liberalizes trade its results appear to be small. The empirical results indicate that the impact of the G-3 is marginal when considered in terms of each good's domestic production, total consumption,

or welfare effects. This is so because of the small absolute and relative level of trade between G-3 partners[9] and the relatively low level of tariffs applied in each country in the pre-agreement period. Therefore, it is expected that products currently scheduled for tariff elimination within the G-3 other than the ones included in the simulation analysis should show similar results. This is the case of the groups of products identified as the most important in intra-G-3 agricultural trade for which tariff elimination has been agreed, namely vegetable materials for perfumery and pharmacy and vegetable materials for different uses. This conclusion is consistent with Customs Union theory which states that a Free Trade Agreement is more likely to be trade creating when pre-agreement bilateral trade and tariff levels are relatively large.

The third conclusion is that the potential of the G-3 agreement to yield significant benefits to member countries in the case in which total tariff elimination is accomplished is limited. Simulation results under the scenario of total tariff elimination among G-3 partners show the same situation that was described in the previous paragraph. Low trade levels are pervasive in intra-G-3 agricultural trade and are responsible for this outcome. In this case, however, some qualifications are in order. First, relatively more important effects may arise if trade in groups of products currently excluded and recording high shares in historical bilateral flows were to be liberalized. Examples of this situation are trade in edible products and preparations and sugar and honey. However, products such as cotton

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9 It is worthwhile recalling that G-3's agricultural provisions rule trade between Mexico and Colombia and Mexico and Venezuela, while trade between Colombia and Venezuela is ruled according to the Andean Pact.

and fresh and simply preserved vegetables, which were included in the empirical analysis and also show relatively high shares in historical bilateral trade flows, support the idea that rather limited effects would arise from complete G-3 trade liberalization for agricultural products. The second qualification is that, under a complete liberalization scenario, intra-G-3 agricultural trade may diversify and include a number of products that regardless of their individual importance could account for sizable aggregate effects. This remains as an open question for the purposes of this study.

The fourth general conclusion is that the G-3 tends to be neutral in terms of its trade creating or trade diverting effects. When it is relevant (e.g. when it provides for complete tariff elimination in the market for pepper), the G-3 tends to be marginally trade creating in its effects on Colombia. However, simulation of complete tariff elimination for the rest of the selected products indicates that no welfare changes would be obtained with respect to the scenario that assumes only NAFTA's and GATT's tariff reductions. Thus, the whole effect of the agreement on each product's market may be best described as neutral either in the current status of the agreement or under the hypothesis of complete tariff elimination for all agricultural products. However, the same qualifications made in relation to the previous conclusion apply in this case. In this respect, the results of the research again seem to be consistent with Customs Union theory. As pre-agreement trade flows and tariff levels between partner countries are relatively low, the outcome of the agreement is less likely to be trade creating. On the other hand, as tariff levels vis-a-vis third countries are not very different from those between partner countries (as a consequence of initial low levels and the commitment to reduce them on a non-

discriminatory basis) the agreement is less likely to be trade diverting. Seemingly, it may be the situation that in this case the two tendencies counteract, producing a neutral effect.

Some other conclusions are also in order. The most relevant may be that the G-3 appears to be able to produce a significant impact on intra-G-3 agricultural trade flows if the member countries extend it to provide for complete tariff elimination. With the exception of trade in sesame seed (for which G-3 provisions, regardless of the level of tariff reductions, are irrelevant due to the actual direction of trade flows), tariff elimination produces increases in the relevant trade flows in the range of 24 to 40 percent. Under these conditions, the agreement would fulfill one of its stated objectives: that of boosting trade among partner countries. Furthermore, in the absence of complete tariff elimination within the G-3, bilateral trade between member countries may be reduced as a consequence of changes in tariff levels among individual member countries and third countries. An example of this situation is trade of cotton between Colombia and Mexico; under the current conditions (28 percent tariff reduction for Mexican imports from Colombia and complete tariff elimination for Mexican imports from the U.S.), Colombian exports to Mexico would decline by nearly 12 percent while if total tariff elimination is carried out through the G-3 they would increase more than 12 percent.

Nevertheless, simulation results also show that these increases in trade flows produce only slight changes in market shares. This finding contrasts

sharply with some expectations about the impact of the G-3[10]. This situation brings up two considerations. First, benefits accruing from trade agreements may have been overstated in the 'official' literature, perhaps as a result of lack of empirical validation. Second, the relevance of trade flows with third countries as well as of other trade agreements (bilateral or multilateral) must not be underestimated.

The empirical analysis shows that the G-3's agricultural provisions are limited for enhancing member countries' trade and improving their economic welfare but indicated that trade flows may be substantially affected by the agreement in the cases in which complete tariff elimination is achieved. However, even under complete tariff elimination for agricultural products within the G-3, it is likely that its impact on variables other than trade flows would be negligible. Since further 'modernization' and improvement of agricultural sector competitiveness is frequently sought by means of trade liberalization, the contribution of the empirical research may be significant for showing its limitations about attaining this objective. The point is that it may be the case that the current structure of trade makes trade liberalization a poor instrument for promoting improvements in the competitiveness of the agricultural sector of G-3 partner countries. Therefore, if enhancing competitiveness is a high priority objective of agricultural policy, alternative instruments should be employed.

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10 Officials of the Colombian Ministry of Foreign Trade, for instance, estimated that Colombian agricultural exports to Mexico could increase their market share up to 80 percent as a consequence of the G-3.

Although limited, the results of the empirical analysis of the impact of the G-3's agricultural provisions on member countries agricultural trade are robust and provide a reliable vision of the likely outcome of the agreement in this area. Nonetheless, it is worth recalling that these conclusions refer exclusively to the agricultural sector and do not imply any extension to other areas of action of the agreement.

Appendix 1

Data Sources

Production data come from different sources. The main source is the United Nations Food and Agriculture Organization (FAO), either from the AGROSTAT database or from the "Production Yearbook 1994". Complementary information come from the Colombian Ministry of Agriculture's "Agriculture and Livestock Sectors Statistical Yearbook" (1990 and 1994), the Venezuelan Ministry of Agriculture's "Agricultural Statistical Yearbook 1989/91" (1994), and the USDA-NASS' "Agricultural Statistics 1994". No information on pepper production was available for Colombia and Venezuela; hence, production was assumed to be equal to exports for these countries. In all cases consumption was treated as disappearance. Therefore it was calculated as the difference between production plus imports and exports. Consumption of pepper in Colombia and Venezuela was assumed as equivalent to the volume of imports. The Rest of the World (ROW) was assumed as a production and trade balancing region.

Trade data, quantities and values, come from the United Nations Statistical Office's "Commodity Trade Statistics; according to the Standard International Trade Classification". Data are disaggregated at the four digits level of the SITC. Imports are reported at their CIF price level while exports at their FOB price level. Data for the period 1989 - 1993 were used to describe the structure of agricultural trade between G-3 partners. Average trade data for the period 1991 - 1993 was employed as base data for the simulation model. To conciliate differences in data reported by the trading countries, it was decided to average the corresponding reports.

Unit values, calculated from trade data, were used instead of prices. Each product's consumer price in a particular market was calculated as the corresponding imports' unit value plus tariff charges. Producer prices were estimated on the basis of average price differentials between consumer and producer levels adjusted according to producer, wholesale, and consumer price indexes for each country. Price differentials come from different publications such as USDA's serial "Situation and Outlook Report", Colombian Ministry of Agriculture's "Agriculture and Livestock Sectors Statistical Yearbook", and Venezuelan Ministry of Agriculture's "Agricultural Statistical Yearbook". Price indexes information come from International Monetary Fund's "International Financial Statistics Yearbook 1995". Trade costs were calculated as the difference between FOB and CIF unit values for each product.

Price elasticities of supply and demand as well as price transmission elasticities come form USDA's "A 1989 Global Database for the Static World Policy Simulation (SWOPSIM) Modeling Framework", Liapis et al (1992) "Modeling Preferential Trading Arrangements for the Agricultural Sector. A U.S-Mexico Example", and Colombian Ministry of Agriculture's "Final Report of the Commission for the Study of the Agricultural Sector". Parameter estimates for dried leguminous vegetables were assimilated to the corresponding to dry beans in Liapis et al for Mexico, the U.S., and ROW; in the cases of Colombia and Venezuela the values of ROW were employed as a proxy and the supply elasticity for Colombia come from the Colombian Ministry of Agriculture's study. The same procedure was followed to identify parameter estimates for pepper. In this case Liapis'

estimates for peppers were used, including those for Colombia. Price transmission elasticities were assumed unity; the assumption is based on appreciation of estimates from other studies such as Bolling (1988), Tyers and Anderson (1988), and the SWOPSIM's database (1992). Estimates for sesame seed and cotton for the whole set of regions come from the SWOPSIM's database with the only exception of Colombian elasticities of supply that are based on the Colombian Ministry of Agriculture's study. The group 'oil seeds' was used as a proxy for sesame seed and direct estimates were available for cotton. Parameter estimates for the SWOPSIM group "other Latin America", defined within the world model data set of this database, were employed to represent those of ROW. The Armington's elasticity of substitution between 'products' of the same kind was assumed to be -3 as it has been the case since early applications of the procedure - Grennes et al. (1977); Liapis et al. (1992); even though Dixit and Roningen (1986) do not use this value, they employ values around it).

Tariffs data come from the Colombian Manufacturers Association's G-3 database, the U.S. International Trade Commission's "Harmonized Tariff Schedule of the U.S.", and the International Agricultural Trade Research Consortium's study "The Uruguay Round Agreement on Agriculture: An Evaluation". Data on tariff changes come from the G-3 Agreement, the NAFTA agreement, and the IATRC's study.

Appendix 2

Base Data

Table A-2.1 Quantities, Prices, and Elasticities for the Simulation Model for Pepper (average 1991-1993)

	Colombia	Mexico	Venezuela	U.S.	ROW
Production [1]	1,353	35,500	103	10,000	1,886,544
Consumption [1]	344	40,400	331	76,782	1,815,643
Total Exports [1]	1,353	4,231	103	4,991	74,319
Total Imports [1]	344	9,131	331	71,773	3,418
Producers Price [2]	623	1,307	201	1,803	1,002.3
Consums. Price [2]	997	1,984	335.5	2,800	1,495.9
Price Trans. Elas.*	1	1	1	1	1
Supply Elasticity	0.81	1.79	0.81	0.81	0.81
Demand Elasticity	-0.5	-0.4	-0.5	-0.5	-0.5

1 Tons.

2 U.S. dollars

* Price Transmission Elasticity

Table A-2.2 Trade Data for the Simulation Model for Pepper (average 1991-1993)

Colombian		Mexico	Venezuela	U.S.	ROW
Imports	Quantities	50	0	0	294
	Values	92,000	0	0	398,000
Exports	Quantities	0	0	1,353	0
	Values	0	0	1,349,000	0

Mexican		Colombia	Venezuela	U.S.	ROW
Imports	Quantities	0	0	1,453	7,678
	Values	0	0	2,908,000	9,515,000
Exports	Quantities	0	0	1,982	2,249
	Values	0	0	5,105,000	3,290,000

Venezuelan		Mexico	Colombia	U.S.	ROW
Imports	Quantities	0	0	0	331
	Values	0	0	0	589,000
Exports	Quantities	0	0	0	103
	Values	0	0	0	35,000

U.S.		Mexico	Venezuela	Colombia	ROW
Imports	Quantities	7,840	0	234	63,699
	Values	14,347,000	0	101,000	102,638,000
Exports	Quantities	1,899	0	0	3,092
	Values	3,778,000	0	0	10,197,000

Quantities in tons.; values in U.S. dollars

Table A-2.3 Tariffs and Tariff Changes for the Simulation Model for Pepper (ad-valorem)

Importer	Exporter	Initial Tariffs	GATT/NAFTA	G-3
Colombia	Mexico	0.15	-0.0225	-0.15
	Venezuela	0	0	0
	U.S.	0.15	-0.0225	-0.0225
	Row	0.15	-0.0225	-0.0225
Mexico	Colombia	0.184	-0.0276	-0.184
	Venezuela	0.184	-0.0276	-0.184
	U.S.	0.184	-0.184	-0.184
	Row	0.184	-0.0276	-0.0276
Venezuela	Mexico	0.15	-0.0225	-0.15
	Colombia	0	0	0
	U.S.	0.15	-0.0225	-0.0225
	Row	0.15	-0.0225	-0.0225
U.S.	Mexico	0	0	0
	Venezuela	0	0	0
	Colombia	0	0	0
	Row	0	0	0
ROW	Mexico	0.14	-0.02	-0.02
	Venezuela	0.14	-0.02	-0.02
	U.S.	0.14	-0.02	-0.02
	Colombia	0.14	-0.02	-0.02

Table A-2.4 Quantities, Prices, and Elasticities for the Simulation Model for Cotton (average 1991-1993)

	Colombia	Mexico	Venezuela	U.S.	ROW
Production [1]	115,000	86,000	65,941	3,629,333	14,599,393
Consumption [1]	95,191	195,418	86,665	2,270,900	15,847,493
Total Exports [1]	33,233	26,283	3,719	1,373,500	17,696
Total Imports [1]	13,424	135,701	24,443	15,067	1,265,796
Producers Price [2]	869	1,018	363	1,254	994.8
Consumer Price [2]	1,391	1,545	605	1,322	1,484.7
Price Trans. Elas.*	1	0.9	0.5	1	1
Supply Elasticity	0.689	0.6	0.5	0.74	0.3
Demand Elasticity	-0.2	-0.6	-0.4	-0.2	-0.2

1 Tons.

2 U.S. dollars

* Price Transmission Elasticity

Table A-2.5 Trade Data for the Simulation Model for Cotton (average 1991-1993)

Colombian		Mexico	Venezuela	U.S.	ROW
Imports	Quantities	13,424	0	0	8,569
	Values	19,181,000	0	0	12,296,000
Exports	Quantities	33,233	405	12,246	295
	Values	46,233,000	414,000	19,342,000	25,000
Mexican		Colombia	Venezuela	U.S.	ROW
Imports	Quantities	135,701	412	0	126,590
	Values	149,174,000	542,000	0	136,800,000
Exports	Quantities	26,283	0	0	22,007
	Values	40,609,000	0	0	34,080,000
Venezuelan		Mexico	Colombia	U.S.	ROW
Imports	Quantities	24,443	0	11,880	2,480
	Values	37,439,000	0	18,460,000	3,719,000
Exports	Quantities	3,719	0	0	0
	Values	2,248,000	0	0	0
U.S.		Mexico	Venezuela	Colombia	ROW
Imports	Quantities	15,067	11,810	0	0
	Values	16,980,000	11,615,000	0	0
Exports	Quantities	1,373,500	145,022	2,314	9,367
	Values	1,815,846,000	161,183,000	2,860,000	12,875,000

Quantities in tons.; values in U.S. dollars

Table A-2.6 Tariffs and Tariff Changes for the Simulation Model for Cotton (ad-valorem)

Importer	Exporter	Initial Tariffs	GATT/NAFTA	Total Libln.
Colombia	Mexico	0.15	-0.0225	-0.15
	Venezuela	0	0	0
	U.S.	0.15	-0.0225	-0.0225
	Row	0.15	-0.0225	-0.0225
Mexico	Colombia	0.1	-0.015	-0.1
	Venezuela	0.1	-0.015	-0.1
	U.S.	0.1	-0.1	-0.1
	Row	0.1	-0.015	-0.015
Venezuela	Mexico	0.15	-0.0225	-0.15
	Colombia	0	0	0
	U.S.	0.15	-0.0225	-0.0225
	Row	0.15	-0.0225	-0.0225
U.S.	Mexico	0.045	-0.045	-0.045
	Venezuela	0	0	0
	Colombia	0	0	0
	Row	0.027	-0.004	-0.004
ROW	Mexico	0.14	-0.02	-0.02
	Venezuela	0.14	-0.02	-0.02
	U.S.	0.14	-0.02	-0.02
	Colombia	0.14	-0.02	-0.02

Table A-2.7 Quantities, Prices, and Elasticities for the Simulation Model for Dried Leguminous Vegetables (average 1991-1993)

	Colombia	Mexico	Venezuela	U.S.	ROW
Production [1]	178,000	1,347,000	47,000	1,183,764	53,037,569
Consumption [1]	264,284	1,338,581	138,665	782,998	53,268,805
Total Exports [1]	9,434	44,333	1,718	478,593	228,406.5
Total Imports [1]	95,718	35,914	93,383	77,827	459,642.5
Producers Price [2]	449.2	522.2	318.6	441	282.4
Consumer Price [2]	719.3	792.4	531	501	421.5
Price Trans. Elas.*	1	1	1	1	1
Supply Elasticity	0.065	0.7	0.5	0.81	0.5
Demand Elasticity	-0.4	-0.4	-0.4	-0.4	-0.4

1 Tons.

2 U.S. dollars

* Price Transmission Elasticity

Table A-2.8 Trade Data for the Simulation Model for Dried Leguminous Vegetables (average 1991-1993)

Colombian		Mexico	Venezuela	U.S.	ROW
Imports	Quantities	0	1,320	11,583	82,815
	Values	0	495,000	3,272,000	23,650,000
Exports	Quantities	0	9,394	0	40
	Values	0	6,719,000	0	67,000

Mexican		Colombia	Venezuela	U.S.	ROW
Imports	Quantities	0	0	21,638	14,276
	Values	0	0	12,833,000	5,011,000
Exports	Quantities	0	352	16,021	27,960
	Values	0	180,000	11,922,000	23,031,000

Venezuelan		Mexico	Colombia	U.S.	ROW
Imports	Quantities	467	7,241	20,316	65,359
	Values	245,000	5,625,000	9,170,000	31,123,000
Exports	Quantities	0	1,637	0	81
	Values	0	906,000	0	7,000

U.S.		Mexico	Venezuela	Colombia	ROW
Imports	Quantities	10,283	0	0	67,544
	Values	7,398,000	0	0	38,725,000
Exports	Quantities	31,417	9,497	7,705	429,974
	Values	17,449,000	3,592,000	2,511,000	216,445,000

Quantities in tons.; values in U.S. dollars

Table A-2.9 Tariffs and Tariff Changes for the Simulation Model for Dried Leguminous Vegetables (ad-valorem)

Importer	Exporter	Initial Tariffs	GATT/NAFTA	Total Libln.
Colombia	Mexico	0.15	-0.0225	-0.15
	Venezuela	0	0	0
	U.S.	0.15	-0.0225	-0.0225
	Row	0.15	-0.0225	-0.0225
Mexico	Colombia	0.1	-0.015	-0.1
	Venezuela	0.1	-0.015	-0.1
	U.S.	0.1	-0.1	-0.1
	Row	0.1	-0.015	-0.015
Venezuela	Mexico	0.15	-0.0225	-0.15
	Colombia	0	0	0
	U.S.	0.15	-0.0225	-0.0225
	Row	0.15	-0.0225	-0.0225
U.S.	Mexico	0.042	-0.042	-0.042
	Venezuela	0	0	0
	Colombia	0	0	0
	Row	0.052	-0.008	-0.008
ROW	Mexico	0.14	-0.02	-0.02
	Venezuela	0.14	-0.02	-0.02
	U.S.	0.14	-0.02	-0.02
	Colombia	0.14	-0.02	-0.02

Table A-2.10 Quantities, Prices, and Elasticities for the Simulation Model for Sesame Seed (average 1991-1993)

	Colombia	Mexico	Venezuela	U.S.	ROW
Production [1]	6,667	33,333	25,000	1,615	2,367,718
Consumption [1]	4,480	11,965	15,215	36,138	2,366,535
Total Exports [1]	3,656	26,599	9,863	1,615	21,105.5
Total Imports [1]	1,469	5,231	78	36,138	19,922.5
Producers Price [2]	479	811	431	-	612
Consumer Price [2]	767	1,231	719	1,091	913.4
Price Trans. Elas.*	0.7	0.75	0.4	1	0.7
Supply Elasticity	0.256	0.5	0.42	0.55	0.6
Demand Elasticity	-0.65	-0.27	-0.27	-0.29	-0.4

1 Tons.

2 U.S. dollars

* Price Transmission Elasticity

Table A-2.11 Trade Data for the Simulation Model for Sesame Seed (average 1991-1993)

Colombian		Mexico	Venezuela	U.S.	ROW
Imports	Quantities	0	1,469	0	0
	Values	0	800,000	0	0
Exports	Quantities	0	77	48	3,531
	Values	0	53,000	42,000	2,709,000
Mexican		Colombia	Venezuela	U.S.	ROW
Imports	Quantities	0	2,166	418	2,647
	Values	0	1,176,000	168,000	1,548,000
Exports	Quantities	0	0	17,442	9,157
	Values	0	0	22,836,000	9,897,000
Venezuelan		Mexico	Colombia	U.S.	ROW
Imports	Quantities	0	78	0	0
	Values	0	55,000	0	0
Exports	Quantities	1,938	1,505	133	6,287
	Values	1,246,000	1,007,000	118,000	4,720,000
U.S.		Mexico	Venezuela	Colombia	ROW
Imports	Quantities	17,835	149	43	18,111
	Values	22,765,000	146,000	41,000	19,355,000
Exports	Quantities	355	0	0	1,260
	Values	162,000	0	0	1,600,000

Quantities in tons.; values in U.S. dollars

Table A-2.12 Tariffs and Tariff Changes for the Simulation Model for Sesame Seed (ad-valorem)

Importer	Exporter	Initial Tariffs	GATT/NAFTA	Total Libln.
Colombia	Mexico	0.15	-0.0225	-0.15
	Venezuela	0	0	0
	U.S.	0.15	-0.0225	-0.0225
	Row	0.15	-0.0225	-0.0225
Mexico	Colombia	0	0	0
	Venezuela	0	0	0
	U.S.	0	0	0
	Row	0	0	0
Venezuela	Mexico	0.15	-0.0225	-0.15
	Colombia	0	0	0
	U.S.	0.15	-0.0225	-0.0225
	Row	0.15	-0.0225	-0.0225
U.S.	Mexico	0	0	0
	Venezuela	0	0	0
	Colombia	0	0	0
	Row	0	0	0
ROW	Mexico	0.14	-0.02	-0.02
	Venezuela	0.14	-0.02	-0.02
	U.S.	0.14	-0.02	-0.02
	Colombia	0.14	-0.02	-0.02

References

Argüello, Ricardo and Kyle, Steven (1996) The G-3 Free Trade Agreement: Member Countries' Agricultural Policies and its Agricultural Provisions; ARME Working Paper WP 96-17, Cornell University, Ithaca, NY

Asociación Nacional de Industriales de Colombia - ANDI (1994) Contenido del Acuerdo G-3. Comercio 1991-1993. Programa de Liberación; (Data Base) Bogotá, Colombia

Banco Interamericano de Desarrollo -IDB (1995) Integración Económica en las Americas. Nota Periodica; División de Integración, Comercio y Asuntos Hemisfericos; Julio

Comision Económica para America Latina y el Caribe - CEPAL (1995) Desenvolvimiento de los Procesos de Integración en America Latina y el Caribe; LC/R.1527; May 16th, Santiago de Chile

Dixit, Praveen and Roningen, Vernon (1986) Modeling Bilateral Trade Flows with the Static World Policy Simulation (SWOPSIM) Modeling Framework; USDA-ERS, Staff Report No. AGES 861124

FAO "Agricultural Statistics. AGROSTAT. Data Base"

FAO (1995) Production Yearbook. 1994; FAO Statistics Series; Vol 48, No. 125; Rome

Gardiner, Walter and Carter, Colin (1988) "Issues Associated with Elasticities in International Agricultural Trade"; in Colin Carter and Walter Gardiner (eds.) Elasticities in International Agricultural Trade; Westview Press, Boulder, CO

Haley, Stephen and Dixit, Praveen (1988) Economic Welfare Analysis. An Application to the SWOPSIM Modeling Framework; USDA-ERS, Staff Report No. AGES 871215

IATRC (1994) The Uruguay Round Agreement on Agriculture: An Evaluation; Commissioned Paper Number 9; July

Liapis, Peter; Krissoff, Barry; and Neff, Liana (1992) Modeling Preferential Trading Arrangements for the Agricultural Sector. A U.S.-Mexico Example; USDA-ERS, Staff Report number AGES 9212, July

República de Colombia. Ministerio de Comercio Exterior (1993) Tratado de Libre Comercio Entre Colombia, Mexico y Venezuela; Bogota, Colombia

República de Colombia. Ministerio de Agricultura (1995) Anuario Estadístico del Sector Agropecuario. 1994; Bogotá, Colombia

República de Venezuela. Ministerio de Agricultura y Cría (1994) Anuario Estadístico Agropecuario. 1989-90-91; Caracas, Venezuela

Roningen, Vernon; Sullivan, John; and Dixit, Praveen (1991) Documentation of the Static World Policy Simulation (SWOPSIM) Modeling Framework; USDA-ERS, Staff Report No. AGES 9151

Seeley, Ralph (1986) Equilibrium Price Solution of Net Trade Models Using Elasticities; USDA-ERS; Staff Report, No. AGES 860610

Sullivan, John; Roningen, Vernon; Leetmaa, Susan; Gray, Denice (1992) A 1989 Global Database for the Static World Policy Simulation (SWOPSIM) Modeling Framework; USDA-ERS; Staff Report No. AGES 9215

Tratado de Libre Comercio Entre Los Estados Unidos Mexicanos, La República de Colombia y La República de Venezuela, 1994

United Nations (1986) Standard International Trade Classification, Rev. 3; Department of International, Economic, and Social Affairs; Statistical Office; Statistical Papers; Series M, No. 34, Rev. 3

United Nations (1989) Classification by Broad Economic Categories. Defined in Terms of SITC, Rev. 3; Statistical Papers; Series M, No. 53, Rev. 3

United Nations (1991) Commodity Trade Statistics. According to the Standard International Trade Classification; Statistical Office of the United Nations; Series D, Vol. XXXIX, No. 11

United Nations (1991) Commodity Trade Statistics. According to the Standard International Trade Classification; Statistical Office of the United Nations; Series D, Vol. XXXIX, No. 12

United Nations (1991) Commodity Trade Statistics. According to the Standard International Trade Classification; Statistical Office of the United Nations; Series D, Vol. XL, No. 4

United Nations (1992) Commodity Trade Statistics. According to the Standard International Trade Classification; Statistical Office of the United Nations; Series D, Vol. XL, No. 22

United Nations (1992) Commodity Trade Statistics. According to the Standard International Trade Classification; Statistical Office of the United Nations; Series D, Vol. XL, No. 20

United Nations (1992) Commodity Trade Statistics. According to the Standard International Trade Classification; Statistical Office of the United Nations; Series D, Vol. XLI, No. 7

United Nations (1993) Commodity Trade Statistics. According to the Standard International Trade Classification; Statistical Office of the United Nations; Series D, Vol. XXXIX, No. 26

United Nations (1993) Commodity Trade Statistics. According to the Standard International Trade Classification; Statistical Office of the United Nations; Series D, Vol. XXXIX, No. 23

United Nations (1993) Commodity Trade Statistics. According to the Standard International Trade Classification; Statistical Office of the United Nations; Series D, Vol. XLII, No. 8

United Nations (1993) Commodity Trade Statistics. According to the Standard International Trade Classification; Statistical Office of the United Nations; Series D, Vol. XLII, No. 26

United Nations (1993) Commodity Trade Statistics. According to the Standard International Trade Classification; Statistical Office of the United Nations; Series D, Vol. XLII, No. 28

United Nations (1993) Commodity Trade Statistics. According to the Standard International Trade Classification; Statistical Office of the United Nations; Series D, Vol. XLII, No. 16

United Nations (1994) Commodity Trade Statistics. According to the Standard International Trade Classification; Statistical Office of the United Nations; Series D, Vol. XLI, No. 25

United Nations (1994) Commodity Trade Statistics. According to the Standard International Trade Classification; Statistical Office of the United Nations; Series D, Vol. XLI, No. 30

United Nations (1994) Commodity Trade Statistics. According to the Standard International Trade Classification; Statistical Office of the United Nations; Series D, Vol. XLI, No. 28

United Nations (1994) Commodity Trade Statistics. According to the Standard International Trade Classification; Statistical Office of the United Nations; Series D, Vol. XLIII, No. 6

United Nations (1994) Commodity Trade Statistics. According to the Standard International Trade Classification; Statistical Office of the United Nations; Series D, Vol. XLIII, No. 24

United Nations (1994) Commodity Trade Statistics. According to the Standard International Trade Classification; Statistical Office of the United Nations; Series D, Vol. XLIII, No. 29

United Nations Conference on Trade and Development -UNCTAD (1994) UNCTAD Commodity Yearbook. 1994; U.N.; New York-Geneva

United States Department of Agriculture (1992); Agriculture in a North American Free Trade Agreement: Analysis of Liberalizing Trade Between the United States and Mexico; USDA-ERS; Foreign Agricultural Economic Report Number 246; September

USDA (1994) Situation and Outlook Report. Cotton and Wool; Economic Research Service; U.S. G.P.O.; CWS-78; November; Washington, DC

USDA (1995) Situation and Outlook Report. Vegetables; Economic Research Service; U.S. G.P.O.; VGS-265; April; Washington, DC

USDA-NASS (1995) Agricultural Statistics 1994; Government Printing Office, Washington, DC

U.S. International Trade Commission (1993) Harmonized Tariff Schedule of the U.S. Annotated for Statistical Reporting Purposes; USITC Publication 2567, Washington, DC; 5th edition

U.S. International Trade Commission (1995) Harmonized Tariff Schedule of the U.S. Annotated for Statistical Reporting Purposes; USITC Publication 2831, Washington, DC; 7th edition

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