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## Colombia and the NAFTA

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# Colombia and the NAFTA<sup>1</sup>

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## ABSTRACT

This paper presents an overview of the most recent trade policy reforms in Colombia and a brief analysis of their potential effects on this country's trade flows. This sets the stage for the main objective of this paper: a preliminary general equilibrium assessment of the economic effects of Colombia's hypothetical accession to the North American Free Trade Agreement. The results indicate that such an arrangement, dubbed here NAFTA+, has significant implications for Colombia, but very limited effects upon the NAFTA incumbents, the U.S., Canada, and Mexico. This follows intuitively from the size and proximity of the participating economies, but the sectoral and employment adjustments in Colombia are complex and would be difficult to anticipate from heuristic, partial equilibrium, or aggregate analysis. Generally speaking, Colombia would be a significant beneficiary of a NAFTA+ agreement, but the ensuing adjustments intensify traditional patterns of comparative advantage for this economy and, absent other co-ordinated policies, might undermine modernisation and sustainable growth. These results have implications for many NAFTA aspirants, but should not be generalised too freely. Each prospective entry should be evaluated by the same detailed empirical analysis as it is proposed for the Colombian case.

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## 1. Introduction

The signature of the NAFTA regional trade agreement and the recent positive results recorded for Mercosur has created expectations of further economic integration in the Americas. In December 1994, presidents from 34 American countries met to discuss the possibility of creating by the year 2005 a Western Hemispheric FTA. This idea was again formulated in 1996 at a similar meeting in Cartagena, Colombia.

Among the various possible regional agreements, those of particular interest to Colombia, involve the joining of the Andean Pact and Mercosur, or the southern extension of NAFTA.

While the benefits of multilateral trade liberalisation are now almost unconditionally accepted, those of bilateral, or regional, agreements are not. The main objection refers to the possibility that trade diversion might be larger than trade creation. Besides, it should be noticed that, in the context of trade liberalisation, aggregate results are relatively easy to predict. The removal of import distortions through enhanced comparative advantage and expanded trade, promotes greater efficiency and increases welfare. The structural adjustments which the economies undergo is more uncertain, but, given that trade policy reform usually creates winners and losers it might be important for its sustainability in the long term to have some ex-ante detailed sectoral information on the possible outcomes. In fact, sectoral results are essential in the analysis of the real structural adjustment and reallocations occurring in response to policy change. For it is individual sectors that seek import protection, aggregate real income or equivalent variation measures do not usually play a decisive role in the formulation of trade policy. In order to implement sustainable reforms is then crucial to have detailed information on sectoral adjustments and other trade-offs not discernible at the aggregate level.

For these reasons, the preferred approach to evaluate the possible Colombian entry in a regional trade agreement, or indeed any similar policy change, would be a detailed empirical analysis based on a Computable General Equilibrium (CGE) model. This has two important advantages for policy makers. First, it permits more accurate and timely anticipation of potential gains, losses, and their implication for negotiation and adjustment assistance. Second, this kind of analytical support can greatly facilitate the design of co-ordinated domestic policies to limit the losses and more fully realise the gains of more liberal trade.

The main objective of this paper is to offer this sort of quantitative analysis of Colombian accession to NAFTA. A four-country multi-sector CGE model is used to assess the effects of this regional agreement. The results indicate that substantial adjustments will indeed take place as a result of Colombian accession to the existing regional pact, but these are generally confined to Colombia itself. Its accession is more expansionary than diversionary from a trade prospective, yet ensuing adjustments intensify traditional patterns of comparative advantage for this economy and, absent other co-ordinated policies, might undermine modernisation and sustainable growth.



One additional objective of this paper is to present the course of the recent Colombian commercial policy and its related trade flows. This serves the purpose of putting into perspective the subsequent model simulations and it helps interpreting its results.

We should also add that although the political feasibility of a regional trade agreement between NAFTA and Colombia now appears rather low, the analysis presented here is motivated by various reasons, which are just mentioned in this introductory section, and fully documented below. Firstly, NAFTA is Colombia's main trading partner as both an imports source and exports destination. Secondly, the recent emphasis put on regional integration with southern partners (Andean Group, Mexico, Mercosur), although it may make political sense, it is not fully convincing from an economic point of view. Southern markets are still too small and the "open regionalism" idea that appears to motivate these South-South agreements, seems a shift at the regional level of the infant industry protection strategy. Although some recent economic analyses re-evaluate this development strategy<sup>3</sup>, various factors may undermine its effectiveness in Latin America. Among these are high labour costs, moderately low skill levels and a not too clearly focused public investment policy. Finally, a study of a regional integration with the North, although hypothetical, may be a useful learning exercise that may help to re-focus the Colombian commercial policy strategy and priorities.

The paper is organised as follows. The next section presents a brief overview of the most salient commercial policy measures adopted by the Colombian government. It also details the latest evolution of Colombian trade flows. Section A CGE model and database for NAFTA+, presents a summary of the main features of the model. This is followed by a description of the model data set and of the sources used in its construction. A preliminary examination of the crucial data used to calibrate the CGE model concludes this section and complements the analysis of section Recent commercial policy and trade flows in Colombia. Section Simulations and results presents the simulations and results of the CGE model. Some brief conclusions are reported in the last section.

## **2. Recent commercial policy and trade flows in Colombia**

### *2.1. Colombian commercial policy*

At the beginning of the 90's Colombia had the highest levels of tariffs in the Andean region (36.6% against 17% for Venezuela, 9.8% for Bolivia, 32.8% for Ecuador and 32.1% for Peru). The model of industrialisation through import substitution was showing its serious limitations and the rate of growth was falling.

The low competition level of the domestic market protected by high tariffs had various consequences. It increased the monopolistic (or oligopolistic) structure of national industries; it inflated its profits margins with adverse effects on income distribution; it expanded the scope and size of rent seeking activities; high costs for imports also reduced

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<sup>3</sup> See for instance the World Bank (1993) study on the East Asian Miracle.

the international competitiveness of domestic products creating an implicit anti export bias; finally, high tariffs created a strong dependency of the government on these taxes revenues, adding problems of uncertainty and instability.

This situation dramatically changed in correspondence with the election of president Gaviria in 1990. The new administration found itself in a favourable position to alter the Colombian commercial policy and, with it, its whole development strategy. The country had enough international reserves to allow a reduction in the tariff and in the connected revenues, and the low level of the peso, granting enough protection for the domestic industry, made this reduction politically feasible.

The primary objectives of the new policy, aptly named “Apertura”, were as follows. Firstly, stimulate growth. A reallocation of resources towards more productive uses accompanied with a weakening of the oligopolistic structure of the domestic industries was expected to create new growth opportunities, additionally these were enhanced by increased private capital inflows. A second objective was increasing equality. A specialisation towards labour intensive industries of the Colombian economy should have helped with this objective; besides a clearer trade policy should have decreased rent seeking activities and their negative income distribution effects. Lastly, the new strong structure of import and export flows should have helped Colombia to integrate its economy with that of the American continent, or even with global markets.

The main steps in the process of liberalisation were the elimination of quantitative restrictions (achieved by November 1990<sup>4</sup>) and the tariffs reduction. This was done in two phases. Firstly, a program of abatement of the average tariff level from 36% to 16% in 4 years and the parallel reduction in dispersion, was implemented. This did not work, initially importers were not convinced of the government’s commitment and reduced their imports. These problems of credibility and uncertainty eventually forced the government to a drastic reduction in tariff levels (a shock not gradual reform) by the end of 1991. This ended the uncertainty and helped the increase in the import flows which compensated the loss in tariff revenues (these represented 30% of the government budget). The final result was an 11% average level of tariff.

The “Apertura” policy package not only affected trade taxes, it also included other adjustments. These ranged from regulating trade issues, as anti-dumping and other unfair competition, to institutional reform, as the creation of a new independent Ministry of Foreign trade<sup>5</sup>, to the stipulation of International trade treaties. This last point was viewed as a means of gaining market access to Colombian exports, a way to push the supply side

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<sup>4</sup> It should be noticed that some Non-Tariff Barriers (NTBs) still exist, and that recently new ones have been introduced.

<sup>5</sup> The main mandate of this new ministry was to foster Colombian integration in the region and in the international environment. The Institute of External Trade was transformed from the institute that was issuing import licensing into a forum to discuss and correct unfair trade practices. Other transformations aiming at stimulating exports and diffusing information affected the Banco de Comercio Exterior; additionally, Proexport Colombia and the Puntos de Informacion Comercial were instituted.



of the national economy. The first step was establishing a FTA with Venezuela in 1991 and the contemporary reviving of the Andean Pact. Colombia signed another FTA with Chile in 1993 and the Group of 3 treaty with Mexico and Venezuela in 1994. An agreement with CARICOM was reached in 94. Meanwhile the US and EU rewarded the countries efforts against drug trafficking activities with unilateral trade concessions. Colombia regarded itself as a possible future member of NAFTA.

These policies were almost reversed in recent years with the new administration. Emphasis was placed on reciprocity in all future negotiations. One main result was the implementation of a Common External Tariff (CET) in the Andean Pact, effective since February 1995. Yet many exceptions on capital goods, raw materials and agriculture were included. Soon these exceptions became a source of conflict among the members of the pact. The regional integration policy was continued, but it changed direction. The negotiation with Mercosur was viewed as the most important. This was to be a negotiation among blocks: the Andean Pact and Mercosur. This created many administrative and institutional delays and not much progress has been made. Besides, NAFTA lost importance because of drug-related problems and the Mexican peso crisis.

## *2.2. Recent Trade Flows*

This section briefly illustrates the recent behaviour of Colombian trade flows. The geographical and sectoral composition of these flows is presented so that a very elementary assessment of the 90's commercial policy can be given. The following data are also useful in explaining some of the simulation results presented below.

Consider first the geographic composition. For brevity, exports and imports with 9 trading partners are analysed: US, EU, Venezuela, Ecuador and Peru (as main partners in the Andean Pact), Chile, Mexico, Brazil and Argentina (as the main partners of Mercosur).

Two main features should be noticed in the figures shown below. Firstly (consider Figure 1 and Figure 2), among the main trade partners of Colombia the developed countries weigh the most with the US as important as 50%. Secondly, as a direct effect of the "Apertura" and of the bilateral agreements with the south, almost uniformly across the region import and export flows seem to shift towards the south. This second feature clearly appears when considering Figure 3.

Here it clearly appears that Venezuela, Ecuador, Chile, and Mexico show above the average growth rates for imports (average is represented by the column total), and that the first three countries have a growth rate superior to that of US and EU. The same even more striking is true for exports. It is also possible to notice that it takes some time for exports growth rate to pick up those of imports. This delay is what sometimes creates problems to policy makers: economies adjust slowly. The literature on supply response is though quite firm: a credible and lasting effort to increase the supply price of exportables

(that is direct consequence of a trade liberalisation policy) is rewarded by large export response.

Consider now some compositional issues, see Figure 4 and Figure 5. For brevity, only the two major north and south Colombian trading partners are shown. In the graphs, the rightmost column labelled *% geo* measures the partner share of Colombian trade.

From these figures it clearly appears that manufacturing exports (what is normally considered non-traditional exports) to US had not increased their weight (the only sectors likely gaining is food products). On the contrary, notice the composition of exports to the Andean countries (only Venezuela is shown). Firstly, the weight of manufacturing is much higher and additionally is increasing. A sector especially dynamic has been light manufacturing. This picture does not change a lot when considering the other countries of South America.

When looking at the import side (consider Figure 6 and Figure 7) we notice again a difference in the weight of US with respect to other countries and especially in their contribution to capital goods imports. This is especially important because these goods incorporate new technology.

Overall it is possible to conclude that negotiating increased market access to North America should be of primary importance in the Colombian trade policy agenda. Although more attention has been recently given to an expansion towards the south of the continent, NAFTA, and the US in particular, remains a major export market and supplier of crucial capital goods. The idea of developing a regional southern American market without an immediate increased integration with more developed countries, which has been lately labelled as open-regionalism has some appeal but it also shows severe limitations. Firstly, as shown in the above figures, the southern market is still too small. Secondly, shifting the infant-industry idea at a southern regional level may be risky for two main reasons: high labour costs and relatively low skill levels. These may prevent a successful East Asian style export-led growth. Nevertheless, as shown above, some progress in South-South trade has indeed been made. A possibility of expanding non-traditional exports may arise. A clearer assessment of the above strategy with the analytical tools proposed here should be the next step in the analysis.

### **3. A CGE model and database for NAFTA+**

This section presents a brief description of the computable general equilibrium (CGE) model and database used to simulate the welfare and resource allocation effects of Colombia's joining Canada, the United States, and Mexico in a free trade area (FTA). For readers interested in more details, a technical appendix is available upon request.



### 3.1. The CGE Model

The four-country CGE model is based on a three-country kernel, which has been used for several types of NAFTA appraisal<sup>6</sup> in the past. Typical of most comparative static, multi-sectoral, economy-wide models in use today, it simulates price-directed resource allocation in commodity and factor markets. They maintain detailed information on sectoral prices, output, trade, consumption, and factor use in a consistent framework, which also accounts for aggregates such as income, employment, and revenue. The present model differs from conventional CGE specifications in two important ways. First, it is a *detailed and complete four-country model*, so domestic supply, demand, and bilateral trade for the United States, Canada, Mexico, and Colombia are fully endogenous at a 19-sector level of aggregation.

The extent of price adjustments, as well as the volume and pattern of trade creation and trade diversion, are important factors in determining the ultimate welfare and resource allocation effects of multilateral trade policy. A second important feature of the model addresses these responses to FTA trade liberalization. The model employs differentiated product specification of the demand and supply in tradeable commodities. In each sector of each country, domestic demand is constituted of goods which are differentiated by origin (domestic goods, imports from each FTA partner, and imports from the rest of the world). These goods are aggregated using a non-nested, constant elasticity of substitution (CES) functional form into a single consumption good for both intermediate and final use. This specification allows for substitution among origins in response to commercial policy and exchange rate changes. Demand for the 19 aggregate goods in each country is modeled using a linear expenditure system (LES). Also in each sector of each country, domestic production is allocated using a non-nested, constant elasticity of transformation (CET) functional form among differentiated destinations (domestic market, exports to each FTA partner, and exports to the rest of the world). This specification allows for substitution among destinations in response to commercial policy and exchange rate changes. Together, the above two trade specifications constitute product differentiation by country of origin and destination, allowing for intra-industry trade.<sup>7</sup> As such, the four countries maintain 12 pairs of 19-sector trade flows between them, governed by 12 endogenous price systems (U.S.-Canada, U.S.-Mexico, Canada-Mexico, U.S.-Colombia, Canada-Colombia, and Mexico-Colombia imports and exports). With respect to the rest of the world (ROW), each country faces import supply and export demand schedules, totaling four more price systems (U.S.-ROW, Canada-ROW, Mexico-ROW, Colombia-ROW imports and exports).<sup>8</sup>

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<sup>6</sup> See e.g. Reinert and Roland-Holst (1995) and Reinert, Roland-Holst, and Shiells (1993m 1994ab).

<sup>7</sup> For an introduction to this type of trade specification, see de Melo and Robinson (1989). The presence of intraindustry trade can modify results of simple interindustry models such as Stoper-Samuelson effects. See Reinert and Roland-Holst (1995) for an example.

<sup>8</sup> ROW import supply and export demand elasticities have been estimated by the authors for the United States, and in every case, for the present sectoral aggregation and magnitude of trade



Production takes place under constant returns to scale using constant elasticity of substitution functional forms, and all markets are perfectly competitive. In each domestic product market, prices are normalised to a fixed numéraire price index weighted by the base composition of sectoral final demand. On the external accounts, ROW exchange rates are assumed to be flexible while trade balances are fixed.

The CGE model was calibrated to an estimated 1992 social accounting matrix (SAM) for North America and Colombia discussed in greater detail in the next sub-section. The calibration of the model to the SAM relied on a set of behavioural parameters equivalent to those described in Roland-Holst, Reinert, and Shiells (1994) and making use of the non-nested elasticities of substitution among import sources estimated by Shiells and Reinert (1993).<sup>9</sup>

### *3.2. The SAM Database*

The central data source for this paper was a 1992 social accounting matrix (SAM) for Canada, the United States, Mexico, and Colombia. Construction of the 1992 SAM began with the transformation of 1992 national accounts for each country into four separate macroeconomic SAMs. The Canadian macroeconomic SAM was constructed by mapping the macroeconomic data presented in two sources (Statistics Canada 1993a and 1993b) into a matrix format. The U.S. macroeconomic SAM was constructed by transforming the U.S. National Income and Product Account (NIPA) accounts into matrix format. For the Mexican macroeconomic SAM, data from OECD (1992), Banco de México (1993), Instituto Nacional de Estadística, Geografía e Informática (1992), and International Monetary Fund (1993) were used. Finally, the Colombian macroeconomic SAM was constructed using data from official sources.<sup>10</sup>

Next, the individual macroeconomic SAMs were joined together into an integrated macroeconomic SAM for the four countries. This process was completed in three steps. First, the Canadian, Mexican, and Colombian macroeconomic SAMs were converted to 1992 U.S. dollars using yearly averages of market exchange rates from International Monetary Fund (1993). Second, trade flows among the four countries were added to the multi-country SAM and subtracted from the rest of the world account. Data on trade flows were taken from International Monetary Fund (1992). Total Mexican trade was adjusted for maquiladora trade using data from Banco de México (1993), since these activities were not reflected in the Mexican national accounts prior to 1992. Third, factor service flows and capital flows among the four countries were added with the appropriate subtractions from the rest of the world account. These flows were taken from U.S. Department of Commerce (June 1992) and Statistics Canada (1993b).

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adjustments, the small country assumption appears to be tenable. We extended this reasoning to Canada, Mexico, and Colombia and thus the ROW price systems are essentially exogenous.

<sup>9</sup> This detailed parametric information is available upon request from the authors.

<sup>10</sup> The new Colombian SAM, much more detailed than the NAFTA+ database, is described in greater detail in Bussolo, Correa and Prada (forthcoming).

The detailed sectoral accounts were constructed by disaggregating the commodity account rows and columns of the four-country macroeconomic SAM into 19 sectors. The disaggregated accounts include labour value added, property value added, indirect business taxes, value added taxes (for Mexico and Colombia), domestic final demand, imports, exports, and inter-industry transactions. This was done using 1990 Statistics Canada input-output accounts, 1987 U.S. Department of Labor input-output accounts, 1989 SECOFI input-output accounts<sup>11</sup> for Mexico, and 1992 input-output accounts for Colombia.

Sectoral trade flows were estimated using 10-digit HTS data for the United States and 3-digit SITC data and official national data for all four countries. The former was obtained from U.S. Department of Commerce (USDOC), Bureau of the Census data tapes, and the latter was obtained from United Nations data tapes and national statistics. Sectoral trade within North America was estimated using the import data from these data tapes. Canadian tariffs were estimated from the 1990 input-output data, U.S. tariffs were estimated from the USDOC data, Mexican tariffs were estimated from data presented in General Agreement on Tariffs and Trade (1993), and Colombian tariffs were estimated from data provided by official sources.

Some essential data on the economic structure and protection rates of the countries modelled are shown in Table 1 and Table 2.

This information on the general structure of production and trade will facilitate understanding the simulation results reported later.

The first table reports structural information on the US and Colombia.<sup>12</sup> The differences between these two economies appear clearly from inspecting this table: the US have a relatively small primary sector and a large service share of gross production, whereas 54 per cent of Colombian gross production is in primary and manufacturing sectors. US trade presents the typical pattern of intra-industry trade: notice the exact equal shares for imports and exports in the capital goods sectors (sectors 11 and 12). Conversely, Colombia exports are concentrated in the primary sectors and light manufacturing. Four sectors (Agriculture, Mining, Food Product, and Textiles) account for almost three-quarters of Colombian total exports. Its imports are also concentrated in manufacturing and a dependency on capital goods also emerges. The columns labelled  $Vl/Vk$  measure the ratio of labour over capital value added, this gives a measure of the returns to labour with respect to those to capital. Roughly we can expect that capital intensive sectors show a lower figure, as it is the case for *Electricity* and *Financial services* in the US or *Mining* in Colombia. The average higher values for the US than Colombia correspond intuitively to the higher labour returns of the northern country. The last four columns in Table 1 show Colombia exports by regional destination. As it was already pointed out above (see Figure 2), the US are the most important market, with its

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<sup>11</sup> SECOFI is the acronym for Secretaría de Comercio y Fomento Industrial

<sup>12</sup> The same data is available on Mexico and Canada upon request.



demand concentrated in primary sectors. Canada and Mexico represent very small markets for Colombian products.

A clear appraisal of existing barriers to trade should be the starting point of any evaluation of regional economic liberalization. The CGE model simulations later illustrated are in fact based on the removal of ad valorem-equivalent price distortions against imports. These distortions originate in tariffs but also on a wide variety of other import restraints.

Table 2<sup>13</sup> reports these distortion separately for Non Tariff Barriers (NTBs) and Tariffs. NTBs include real and implicit (contingent) quantity constraints, content requirements, rules of origin, and supervisory measures such as registration and inspection requirements. This table shows that North American tariff protection is relative low, but when NTBs are taken into account import distortions increase significantly. In the current version of the model, due to data limitation, NAFTA NTBs against Colombian products are set equal to those against the Rest of the World.<sup>14</sup> The last column shows Colombian tariff structure derived from the base year SAM tariff collection rates. The economy-wide average is relatively low, although some dispersion is shown in the rates. However, we should not expect dramatic structural adjustment effects from the simple removal of this remaining protection.<sup>15</sup>

## 4. Simulations and results

This section presents detailed interpretation for two of the many simulation experiments conducted with the NAFTA+ model described in the previous section. The policy scenarios presented here contrast two cases, original NAFTA implementation (the full results of which can still only be estimated), and a four-country liberalization. In both case, the removal of nominal protection as well as NTB-induced price distortions are considered. In both liberalizations, each trading partner maintains its existing protection with respect to the rest of the world.<sup>16</sup> Our results indicate that all four countries could realize gains from more liberal trade relations, and that each economy would undergo significant shifts in its trade and domestic resource use patterns. The differences between NAFTA and NAFTA+, however, are most significant for the new entrant, Colombia, indicating that all four economies have prior trade patterns which are complementary and minimize diversionary effects which would reduce incumbent advantages. The results are presented in three stages, beginning with a description of the experiments, followed by discussion of the aggregate results for several experiments and ending with a detailed sectoral discussion of the Colombian results.

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<sup>13</sup> This table is derived from Roland-Holst, Reinert, and Shiells (1992), Colombian data are added from official sources.

<sup>14</sup> For a few sectors (such as Mining) exception to this preliminary estimate is introduced.

<sup>15</sup> Some NTBs are adopted in Colombia and will soon be introduced in the analysis.

<sup>16</sup> It is possible that harmonization of ROW protection would alter the results given here, but such policies are not presently under consideration.

#### *4.1. NAFTA and Incremental NAFTA+ Effects: An Overview*

An empirical simulation model with this level of detail can generate quantities of results that defy detailed exposition. This section provides only an overview of the aggregate and main qualitative effects of Colombian accession to NAFTA. This first set of results contrasts three-country NAFTA liberalization estimates with the incremental effects of Colombia accession to the group.<sup>17</sup> The basic NAFTA scenario is described elsewhere, the reader is referred there for details (see e.g. Reinert and Roland-Holst:1995b). Suffice to say for the moment that it simulates a very liberal base NAFTA convention, one that entails removal of all three-country bilateral tariff and non-tariff barriers observed in the base year. The second experiment, NAFTA+ or the inclusion of Colombian accession, is the same except that it includes Colombia's removal of existing tariff.<sup>18</sup>

Table 3 presents the basic NAFTA results, which again have been presented elsewhere and will not be discussed in detail here. Beyond the member countries in Experiment 1, note that Colombia actually benefits from the formation of NAFTA even when it is excluded. This result is hardly surprising, given the magnitude of income effects among its three trading partners, but it may provide comfort for other neighbours who choose to remain outside of regional agreements, i.e. trade creation might generally be expected to outweigh trade diversion. Although Colombia experiences a small export decline when NAFTA is formed, the access to cheaper imported intermediates appears to slightly stimulate domestic employment from which modest welfare benefits are derived. The NAFTA results for Colombia are very small in any case, and one should be careful about generalising them.

The two most salient features of the NAFTA+ aggregate results are the significant gains for Colombia from accession and the negligible but positive difference it implies for the incumbents, and both results are intuitive. Colombia has a strong outward orientation and stands to gain appreciably from greater North American market access. It should be stressed that Colombian gains derive from this increased market access, given that its initial protection against North American imports is rather low. The Colombian absolute and relative magnitudes of the gains are smaller than those of its three trading partners because of its smaller economy and North American trade shares. Canada and Mexico have higher levels of trade dependency than the other two, and thereby enjoy greater relative stimulus from liberalization.

Like the U.S., Colombia experiences real exchange rate appreciation. This is a direct consequence of the closure of the external markets: with fixed trade balances a larger growth of imports than exports has to be balanced with a real exchange rate appreciation. Although Colombian resources are more efficiently allocated after liberalization, and

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<sup>17</sup> For convenience, we assume that the latter event happens simultaneously with original NAFTA formation, thereby avoiding issues of sequencing and timing which are in any case not appropriate to this comparative static model.

<sup>18</sup> Currently the model does not include any NTBs for Colombia due to limitations in the data.



thereby more exportables can be produced with the same resources, in order to pay for more imports and balance the trade account some appreciation is caused. Another way to see this adjustment process is the following. After reducing protection, NAFTA importers face cheaper prices for Colombian products (much cheaper for some of them, see Table 2). Therefore they increase their demands and this creates incentives to produce more exportables within Colombia. Production conditions here depend on substitution of inefficient domestic production with imports and on the supply constraints on primary factors. If factors are fixed, as in the current specification with a fixed capital stock and a positively sloped labour supply, only a limited expansion is possible before domestic resource cost goes up. Given that the real exchange rate basically represents this domestic resource cost, its appreciation is a direct consequence of NAFTA demand pressure on Colombian resources.

Judging from these results, the benefits of NAFTA incumbency are robust against this new entrant, although this conclusion might not generalize to economies which are more structurally similar to the incumbents (particularly Mexico). Apparently, Colombian export and import patterns with respect to the region are complementary with intra-regional bilateral trade, so relatively little net diversion occurs with Colombian accession.

#### 4.2. *Detailed Results*

In this subsection, the effects of NAFTA accession on Colombia are discussed in greater detail. From these adjustments, lessons can be drawn for aspirant members of such a regional agreement. Table 4 presents the four main sectoral components of supply and demand for NAFTA+, measured as changes in percentage and base real value terms.

The general pattern of structural adjustment that emerges is logical enough, stimulus to primary and textiles exports and imports of capital goods and chemicals. Both trends are consistent with and intensification of prior trade patterns for Colombia, particularly with respect to the US. The rise in imports is more monotone across sectors, largely because of net income gains and real exchange rate appreciation.

Export adjustments, on the other hand, are slightly more variegated. They are fully consistent with a neoclassical model and with Ricardo's theory of comparative advantage. The Colombia economy as seen from the NAFTA (and US especially) is mainly a supplier of raw materials: coffee and oil. The booming sectors are in fact *Agriculture*, *Mining* and *Textiles*. These sectors continue to be an engine of foreign exchange generation, and this is likely to continue well into the future on current domestic and regional trends, only accelerating with the advent North American trade preferences.

We also see a kind of "Dutch Disease" at work, where the rising value of export earnings induces resource flows out of non-tradeable sectors like services. To clarify this point consider the first column in Table 4 and the Colombian economic and trade structure in Table 1. In this latter table, oil (that accounts for almost all the sector *Mining*) represents 8 per cent of gross production and 32 per cent of all exports with 47 per cent

going to the US market. When barriers are removed, US demand for Colombia mining booms. Table 1 also shows that this sector is among the most capital intensive of Colombia. In order to expand *Mining* requires more capital and, given that this is fixed, the only source of capital is that released by the contracting sectors (non-tradeable sectors as services and other relatively capital intensive sectors as paper, chemicals and non metal products). This may not be sufficient and thus the price of capital goes up causing the real exchange rate appreciation. The real exchange rate appreciation also damages other exports: Colombia finds itself in a sort of Dutch disease situation.

Table 5 presents the NAFTA+ agreement effects on trade flows. Import variations (as percentage change with respect to the base year) are shown along the rows, whereas export differences can be read along the columns. The left panel of Table 5 displays these effects on total exports and imports, the two other panels illustrate the special cases of *Mining* and *Textiles*. One feature emerges clearly: trade within the region registers a large increase. Yet some expansion is also recorded for the flows with the rest of the world signalling that trade creation does indeed prevail trade diversion. The only exception seems to be for Colombia on the import side. Notice that both Colombia and Mexico strongly expand their bilateral mining flows as well as their exports to the US. In fact some competition for the US market can arise among these two Latin American suppliers. In Colombia *Textiles*, a more mature and integrated industry, does not register any trade diversion due to further liberalisation.

Overall, the expansionary effects of NAFTA+ are concentrated in Colombia's primary sectors. One hopes that this can be augmented by shifting industry and investment policy emphasis toward higher average education levels and by the endogenous growth externalities of accelerating technology imports.<sup>19</sup> Simply put, NAFTA accession confers upon Colombia an intensification of its traditional patterns of comparative advantage, and these are unlikely to lead the country to the highest, most sustainable growth trajectories without co-ordination with policies which foster greater human capital development and broad-based economic modernization. This is a lesson that is probably of relevance to a large group of NAFTA aspirants.

## 5. Conclusion and Extensions

The more articulated trade linkages embodied in the NAFTA agreement are now a fact of life. Implementation of the agreement, however, is still in progress, and its ultimate effects on the member and other economies in the region will take years to be fully discernible. Meanwhile, empirical studies such as the present one can elucidate the basic forces at work and provide a basis for analyzing other North-South trade liberalization initiatives. Many economy-wide evaluations of North American trade

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<sup>19</sup> See Collado, Roland-Holst, and van der Mensbrugghe (1994) for a discussion of these human capital issues in a regional context.



liberalization have been undertaken, but this one seeks to embark on an appraisal of the larger implications of Latin American regionalism. Using Colombia's NAFTA accession as a starting point, we attempted to assess the effects of a NAFTA+ arrangement for both the incumbents and the new entrant.

With a CGE model calibrated to a detailed four-country SAM, results were obtained which indicate that the North American trade relations are relatively robust to new membership in the trade compact by a more distant and structurally complementary economy like Colombia. While Colombia appears to enjoy substantial benefits from NAFTA+, most of the gains for the members of the original agreement are retained, and when they change it is usually for the better. In other words, Colombian accession appears to be more expansionary than contractionary for the North American incumbents.

The silver cloud of Colombian gains may have a somewhat tarnished lining, however, in the sense that accession appears primarily to intensify this country's traditional patterns of comparative advantage. This is typical of passive outward orientation, but Colombia has already demonstrated an understanding of this dilemma in its recent reformist experiments. It is still worth emphasizing, however, that opening markets alone is unlikely to get the country on the highest sustainable growth trajectories. These external reforms must be co-ordinated with domestic policies of human capital formation and investment which foster growth and modernization externalities. Such policies can best be formulated on the basis of more detailed empirical work of this kind.

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## **7. Appendix 1: Specification of the NAFTA + Colombia CGE Model**

For all the experiments reported above, a four-country Computable General Equilibrium (CGE) model was used. This section provides a more complete description of the model, whose main characteristics were introduced in section The CGE Model above.

The NAFTA + Colombia model is a four-country calibrated general equilibrium (CGE) model where domestic supply, demand, and bilateral trade for the United States, Canada, Mexico, and Colombia are fully endogenous. The second essential dimension of the model is the commodity (or sectoral) breakdown of economic activities. This version incorporates 19 sectors. The purpose of the commodity decomposition is to capture the essential features of NAFTA and Colombia structural adjustment in terms of domestic output, demand, factor use, and trade flows.

### *7.1. Production*

As with many applied general equilibrium models, the NAFTA + Colombia model decomposes the production structure into a series of nested decisions allowing for a wide range of substitution possibilities between the various inputs. Figure 0-1 provides a graphical depiction of the nested production structure.

The top level of the production structure decomposes the production decision between aggregate inputs and an aggregate bundle composed of capital and labor value added. While there is the possibility for allowing some substitution between intermediate inputs and value added, for the purposes of this paper, it is assumed that the substitution elasticity is zero, or in other words the value added is always mixed in fixed proportions with intermediate inputs. It is also assumed that all the intermediate inputs are consumed in fixed proportion amongst themselves, though it is possible to substitute between domestic and imported intermediate goods.

The next level of the production structure decomposes the value-added bundle into aggregate labor demand, on the one hand, and a capital on the other.

### *7.2. Consumption*

For each household, there is a single representative consumer who allocates disposable income across the various commodities. The model uses an extension of the familiar Stone-Geary consumer demand system, known as the extended linear expenditure system (ELES). The ELES has several distinct advantages over other demand systems. It allows for commodity-specific income elasticities, which can either be

econometrically estimated or derived from literature searches, it is easy to calibrate and implement, and it integrates the household saving decision in the consumer optimization process. In the ELES system, consumption is represented as the sum of two components, a subsistence minimum, and a share of supernumerary income, which is the residual disposable income after subtracting expenditures on the subsistence minimum. Households direct taxation is a fixed proportion of income.

### 7.3. *Other Final Demand*

There are three other domestic final demand accounts: government expenditures, investment expenditures, and changes in inventory. Aggregate real government expenditure is assumed to be fixed, while aggregate real investment expenditure will depend upon the closure rule. The decomposition into demand for commodities is assumed to use fixed shares in both cases.

### 7.4. *Trade*

The model uses an extension of the familiar Armington hypothesis to implement trade equations. The principle behind the Armington assumption is that goods are differentiated according to region of origin. In practice this means that each agent specifies demand for a specific *aggregate* good (derived from maximizing utility for example). This good is a constant elasticity of substitution (CES) aggregate of imports and domestic products in each sector. At this stage of the demand system, agents decompose demand for the aggregate good into its domestic and (aggregate) import components based on relative prices and (calibrated) penetration shares.

Export supply is treated symmetrically to import demand, i.e. domestic producers are assumed to differentiate between domestic and export markets. A rise in export prices (relative to domestic prices), induces producers to shift production resources towards export markets. The model implements a constant elasticity of transformation (CET) curve to capture this assumption.

### 7.5. *Equilibrium*

Production is modeled with a constant-returns-to-scale technology, which guarantees that supply equals domestic plus external (export) demand for domestic output. Factor prices, wages and capital returns, are generally determined by equilibrium conditions. In both markets there are a wide range of possibilities. We assume that aggregate capital is fixed in supply and mobile between sectors. We assume that labor is perfectly mobile across sectors, which implies a single economy-wide average wage rate, assuming labor markets are competitive. A number of authors have demonstrated, however, that significant and persistent wage differentials exist across sectors for the same occupational



groups.<sup>20</sup> To account for this, we calibrate a distribution of inter-sectoral wage differentials, which are held constant during the simulations.

## 7.6. Closure

There are three key macro closure rules. The first concerns the government revenue-expenditure balance. For the purposes of the simulations, we assume real government saving is fixed in each region. The instrument used to achieve the balance is the household tax schedule, which will shift either right or left to guarantee the budget balance holds.<sup>21</sup>

The second closure rule concerns the saving-investment balance. Domestic investment is determined by the stock of domestic private and public saving, plus net foreign saving (which is exogenous).

The third and final closure rule governs the external account, where we assume that the trade balance is equal to the level of foreign saving. With fixed foreign saving, all adjustment is necessarily mediated by the real exchange rate, since increased import demands which follow from trade liberalization must be financed by increased exports. At rigid terms-of-trade, exports can only expand by attracting resources whose relative prices have declined due to structural adjustment in other sectors. These include tradeables, which are being displaced by new imports, and non-tradeables, whose price declines both contribute to falling domestic resource costs or real exchange rate depreciation.

### I. Sets and Indices

#### Sets

I	{1,...19}	sectors
J	{Canada(C), Mexico(M), United States(U), Colombia(CO)}	FTA countries
I	{C,M,U,CO, Rest of World (R)}	World countries

#### Indices

$h, i \in I$
$j \in J$
$k \in K$

<sup>20</sup> See e.g. Katz and Summers (1989).

<sup>21</sup> This is equivalent to lump sum taxation or rebates.

## II. Structural Equations

### Consumer Behavior

$$P_{ij}^Q C_{ij} = P_{ij}^Q \mu_{ij} + s_{ij} \left( Y_j - \sum_{j=1}^n P_{ij}^Q \mu_{ij} \right) \quad \forall i, j \quad (2.1)$$

### Production Technology

$$F_{ij} = (r_j K F_{ij} + w_j L F_{ij})^{1/n_{ij}} / n_{0ij} \quad \forall i, j \quad (2.2)$$

$$V_{ij} = (X_{ij} / a_{ij}) \left[ b_{ij}^{\Phi_{ij}} w_j^{(1-\Phi_{ij})} + (1 - b_{ij}^{\Phi_{ij}}) r_j^{(1-\Phi_{ij})} \right]^{1/(1-\Phi_{ij})} \quad \forall i, j \quad (2.3)$$

$$T_{ij} = F_{ij} + V_{ij} + \sum_h P_{hj}^Q i_{ohij} X_{ij} \quad \forall i, j \quad (2.4)$$

### Factor Demands

$$L_{ij} = V_{ij}^{\Phi_{ij}} X_{ij}^{(1-\Phi_{ij})} b_{ij}^{\Phi_{ij}} w_j^{-\Phi_{ij}} a_{ij}^{(\Phi_{ij}-1)} \quad \forall i, j \quad (2.5)$$

$$K_{ij} = V_{ij}^{\Phi_{ij}} X_{ij}^{(1-\Phi_{ij})} (1 - b_{ij}^{\Phi_{ij}}) r_j^{-\Phi_{ij}} a_{ij}^{(\Phi_{ij}-1)} \quad \forall i, j \quad (2.6)$$

### Factor Markets

$$\sum_i K_{ij} + \sum_i K F_{ij} (n_{ij} / n_{0ij}) = K_j \quad \forall j \quad (2.7)$$

$$w_j = w_{0j} \quad \forall j \quad (2.8)$$

### Commodity Demands, Supplies, and Allocation of Traded Goods

$$Q_{ij} = \alpha_{ij} \left[ \sum_k \beta_{ijk} D_{ijk}^{(\sigma_{ij}-1)/\sigma_{ij}} \right]^{(\sigma_{ij}-1)/\sigma_{ij}} \quad \forall i, j \quad (2.9)$$

$$(D_{ijk} / D_{ijj}) = \left[ (\beta_{ijk} / \beta_{ijj}) (P_{ijj}^D / P_{ijk}^D) \right]^{\epsilon_{ij}} \quad \forall i, j, k \quad (2.10)$$

$$X_{ij} = \gamma_{ij} \left[ \sum_k \delta_{ijk} S_{ijk}^{(\tau_{ij}-1)/\tau_{ij}} \right]^{(\tau_{ij}-1)/\tau_{ij}} \quad \forall i, j \quad (2.11)$$

$$(S_{ijk} / S_{ijj}) = \left[ (\delta_{ijk} / \delta_{ijj}) (P_{ijj}^S / P_{ijk}^S) \right]^{\epsilon_{ij}} \quad \forall i, j, k \quad (2.12)$$

### Commodity Prices

$$P_{ij}^Q Q_{ij} = \sum_k P_{ijk}^D D_{ijk} \quad \forall i, j \quad (2.13)$$

$$P_{ij}^X X_{ij} = \sum_k P_{ijk}^S S_{ijk} \quad \forall i, j \quad (2.14)$$

$$P_{ijk}^D = (1 + t_{ijk})(1 + \rho_{ijk})er_jPW_{ijk}^D \quad \forall i, j, k \quad (2.15)$$

$$P_{ijk}^S = er_jPW_{ijk}^S \quad \forall i, j, k \quad (2.16)$$

$$PW_{ijk}^D = er_jPW_{ijk}^S \quad \forall i, j, k \quad (2.17)$$

$$P_{ijj}^D = P_{ijj}^S \quad \forall i, j \quad (2.18)$$

$$PW_{ijR}^D = PW_{ijR}^S \quad \forall i, j \quad (2.19)$$

$$PW_{ijR}^S = PW_{ijR}^S \quad \forall i, j \quad (2.20)$$

#### Commodity Market Equilibrium

$$Q_{ij} = C_{ij} + \sum_h io_{ihj}X_{hj} \quad \forall i, j \quad (2.21)$$

$$D_{ijk} = S_{ikj} \quad \forall i, j, k \quad (2.22)$$

#### Income and Government Revenue

$$YL_j = w_j \sum_i [LF_{ij}(n_{ij}/n_{0ij}) + L_{ij}] \quad \forall j \quad (2.23)$$

$$YK_j = r_j \sum_i [KF_{ij}(n_{ij}/n_{0ij}) + K_{ij}] \quad \forall j \quad (2.24)$$

$$RT_j = \sum_i \sum_k t_{ijk} er_j PW_{ijk}^D D_{ijk} \quad \forall j \quad (2.25)$$

$$RQ_j = \sum_i \sum_k \rho_{ijk} (1 + t_{ijk}) er_j PW_{ijk}^D D_{ijk} \quad \forall j \quad (2.26)$$

$$Y_j = YL_j + YK_j + RT_j + RQ_j + \sum_i \pi_{ij} \quad \forall j \quad (2.27)$$

#### Perfectly Competitive Behavior

$$P_{ijj}^D = \left( V_{ij} + \sum_i P_{ij}^Q io_{ihj}X_{ij} \right) / X_{ij} \quad \forall i, j \quad (2.28)$$

#### Balance of Payments

$$\sum_{k \neq j} \sum_i (PW_{ijk}^S S_{ijk} - PW_{ijk}^D D_{ijk}) = 0 \quad \forall j \quad (2.29)$$

### III. Variable and Parameter Definitions

#### Price Variables

- $er_j$  Exchange rate in country j
- $P_{ijk}^D$  Domestic purchaser price of good i in country j demanded from country k



$P_{ij}^Q$	Domestic purchaser price of composite consumption good i in country j
$P_{ijk}^S$	Domestic producer price of good i in country j supplied to destination country k
$P_{ij}^X$	Domestic producer price of composite production good i in country j
$PW_{ijk}^D$	World price of good i in country j demanded from source country k
$PW_{ijk}^S$	World price of good i in country j supplied to destination country k
$r_j$	Rental rate on capital in country j
$w_j$	Wage rate in country j

#### *Quantity Variables*

$C_{ij}$	Final demand for composite consumption good i in country j
$D_{ijk}$	Demand for good i in country j from source country k
$K_{ij}$	Variable capital used in sector i of country j
$L_{ij}$	Variable labor used in sector i of country j
$D_{ijk}$	Domestic demand for domestic capital
$n_{ij}$	Number of firms in sector i of country j
$Q_{ij}$	Final plus intermediate demand for composite consumption good i in country j
$S_{ijk}$	Supply of good i from country j to destination country k
$X_{ij}$	Gross Domestic output of sector i of country j

#### *Nominal Variables*

$F_{ij}$	Fixed costs in sector i of country j
$RQ_j$	Quota rents in country j
$RT_j$	Tariff revenues in country j
$T_{ij}$	Total costs in sector i of country j
$V_{ij}$	Variable costs in sector i of country j
$Y_j$	Income in country j
$YL_j$	Labor Income in country j
$YK_j$	Capital Income in country j
$\pi_j$	Profits in sector i of country j

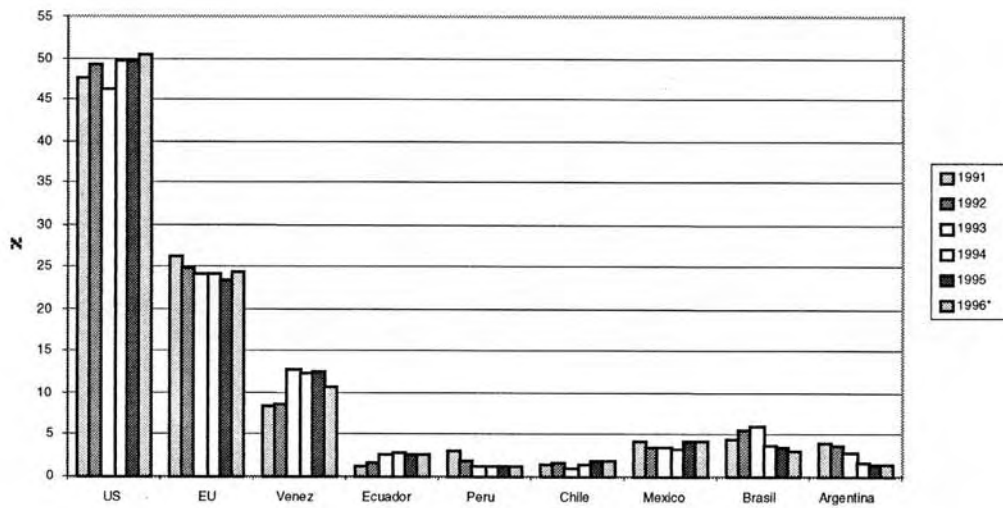
#### *Structural and Policy Parameters*

$a_{ij}$	Intercept parameter in CES production function in sector i of country j
$b_{ij}$	Share parameter in CES production function in sector i of country j
$io_{ijh}$	Input of sector h needed per unit of sector i output in country j

$K_j$	Total capital stock in country j
$KF_{ij}$	Fixed capital in sector i of country j
$LF_{ij}$	Fixed labor in sector i of country j
$n0_{ij}$	Number of firms in benchmark equilibrium in sector i of country j
$PW0_{ijR}^D$	World price of good i in country j demanded from the rest of the world in the benchmark equilibrium
$PW0_{ijR}^S$	World price of good i in country j supplied to the rest of the world in the benchmark equilibrium
$s_{ij}$	Consumption share for composite good i in country j
$t_{ijk}$	ad valorem tariff on imports of good i into country j from country k
$w0_j$	Wage rate in country j in benchmark equilibrium
$\alpha_{ij}$	Intercept parameter in CES product aggregation function in sector i of country j
$\beta_{ij}$	Share parameter in CES product aggregation function in sector i of country j
$\delta_{ijk}$	Share parameter in CET allocation function from sector i in country j to destination country k
$\gamma_{ij}$	Intercept parameter in CET allocation function for sector i in country j
$\mu_{ij}$	Subsistence minimum for composite consumption good i in country j
$\pi0_{ij}$	Profits in sector i of country j in benchmark equilibrium
$\phi_{ij}$	Elasticity of substitution between variable capital and variable labor in sector i production in country j
$\rho_{ijk}$	Ad valorem equivalent quota on imports of good i into country j from country k
$\sigma_{ij}$	Elasticity of substitution among sources of product i in country j
$\tau_{ij}$	Elasticity of transformation among destinations for product i of country j

## 8. Appendix 2: Figures and Tables

*Figure 1: Imports by region*



*Figure 2: Exports by region*

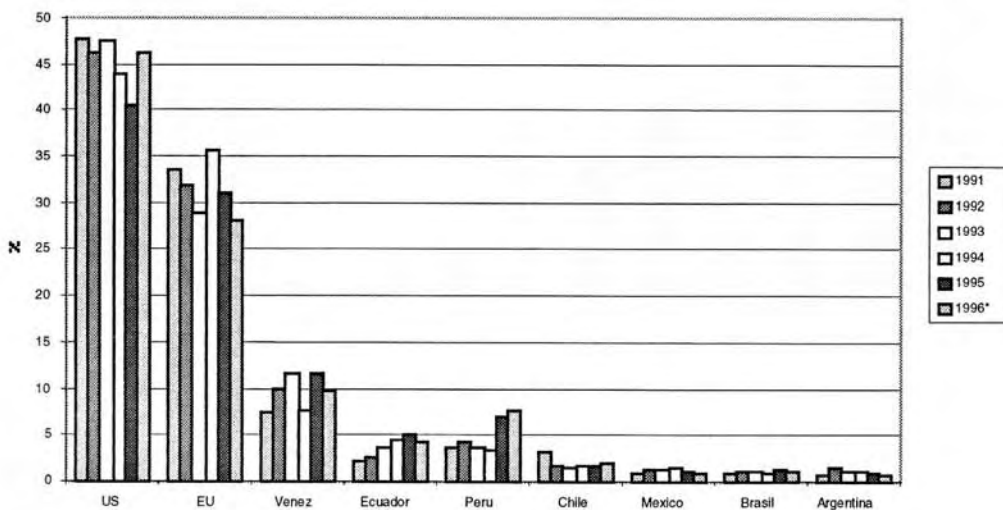




Figure 3: Average yearly growth rates

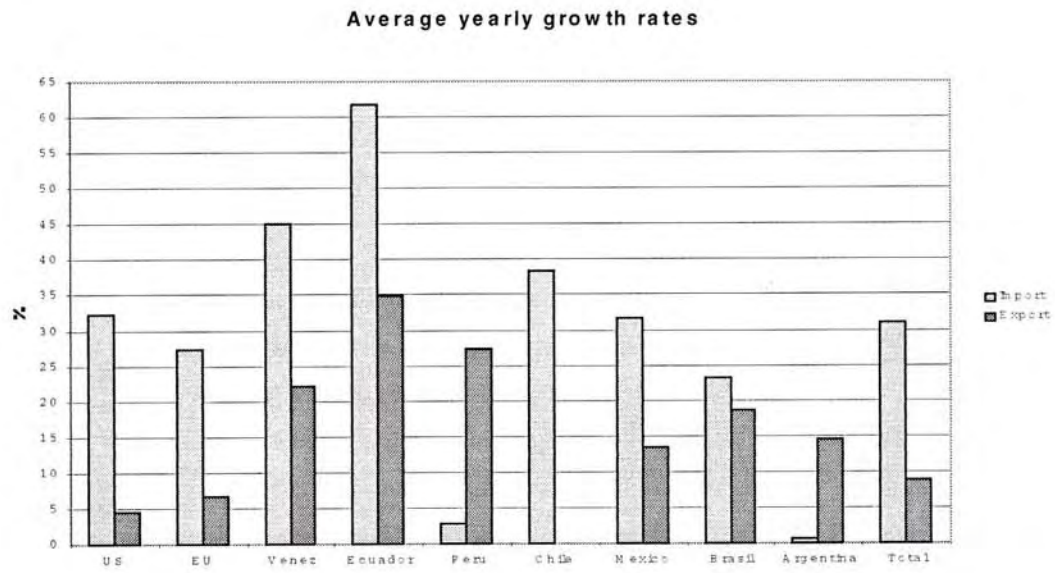
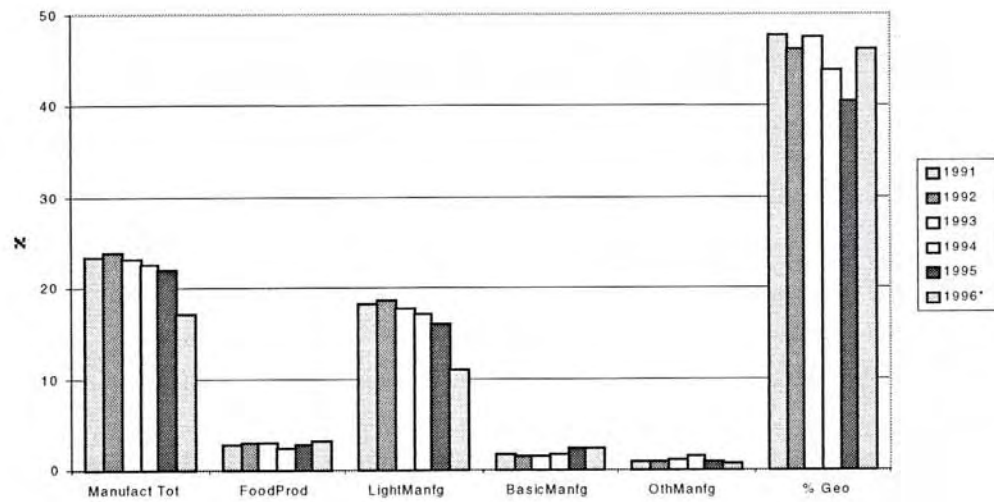
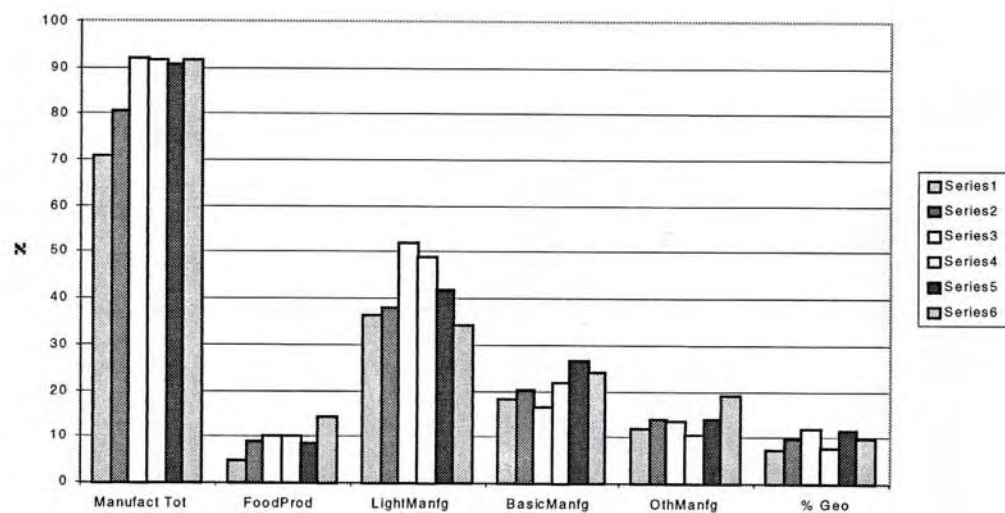


Figure 4: Exports to the US



*Figure 5: Exports to Venezuela*



*Figure 6: Imports from the US*

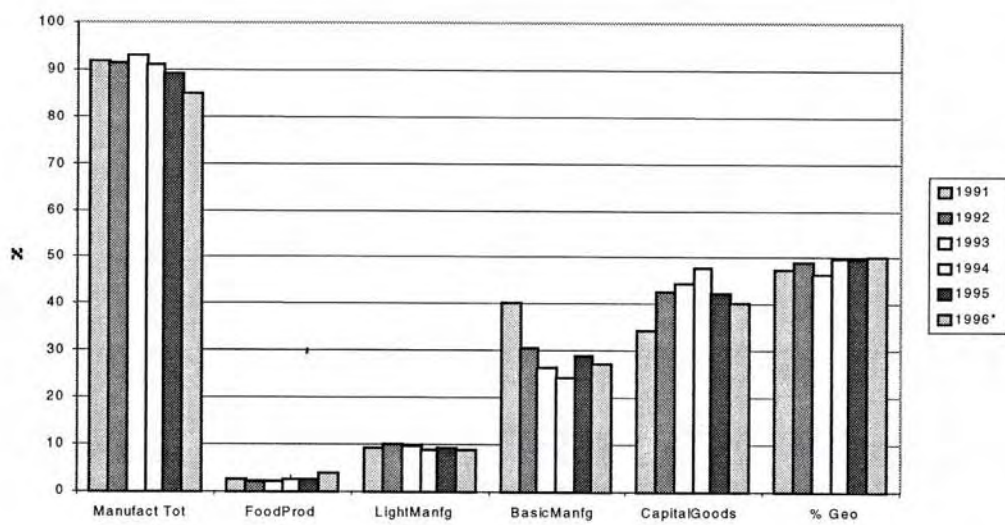


Figure 7: Imports from Venezuela

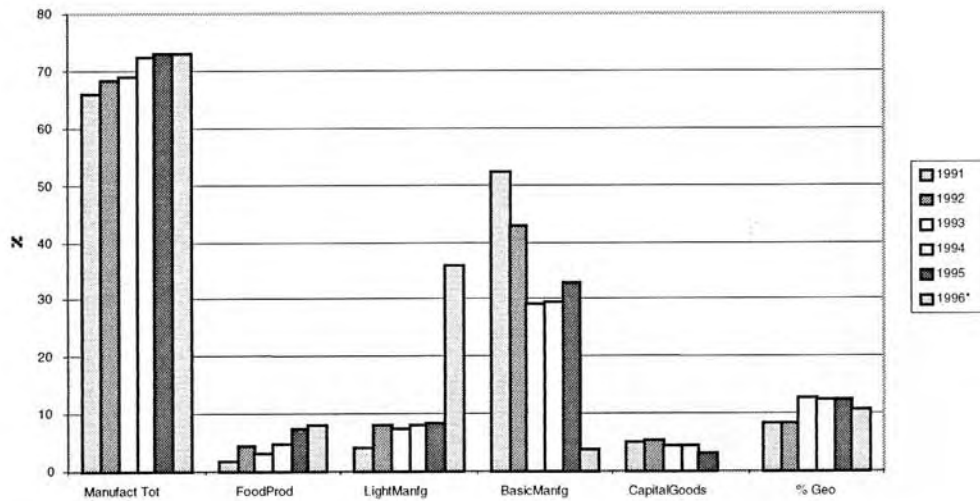


Table 1: US and Colombia Economic structure (% of base year SAM)

	<u>Gross Prod.</u>		<u>Imports</u>		<u>Exports</u>		<u>VI / V<sub>k</sub></u>		<u>Col Exp to:</u>			
	USA	Col	USA	Col	USA	Col	USA	Col	Can	USA	Mex	ROW
1 Agricult.	2	12	2	5	5	11	24	74	2	36	0	63
2 Mining	3	8	10	7	3	32	46	21	0	47	0	53
<b>Primary</b>	<b>5</b>	<b>20</b>	<b>12</b>	<b>13</b>	<b>7</b>	<b>43</b>	<b>35</b>	<b>53</b>	<b>0</b>	<b>44</b>	<b>0</b>	<b>55</b>
3 Food prd.	3	12	3	3	4	20	139	41	0	3	0	97
4 Beverage	1	2	1	0	0	0	83	171	0	69	0	31
5 Tobacco	0	0	0	0	1	0	41	226	0	36	0	64
6 Textiles	2	4	8	6	2	11	576	131	1	47	1	51
7 Paper	2	2	2	3	3	2	193	53	0	22	12	67
8 Chem.rub	4	7	6	20	10	6	153	82	0	7	3	89
9 Non met.	1	2	1	1	1	1	314	73	2	11	2	84
10 Metl.wood	4	3	8	10	6	2	1620	142	0	20	3	76
11 N.e.equip.	4	1	23	21	23	2	597	160	0	12	4	84
12 Trns.eqp.	4	1	15	10	15	1	370	396	0	16	1	82
13 Oth.man.	2	1	6	2	4	1	186	99	0	16	1	82
<b>Manuf.</b>	<b>27</b>	<b>34</b>	<b>72</b>	<b>78</b>	<b>69</b>	<b>46</b>	<b>301</b>	<b>84</b>	<b>1</b>	<b>17</b>	<b>2</b>	<b>81</b>
14 Construct.	6	5	0	0	0	0	290	59	0	0	0	0
15 Electricity	3	2	1	0	0	0	54	46	0	0	0	0
16 Commerce	13	7	3	0	5	1	275	32	0	30	1	68
17 Trns.com.	5	9	11	7	14	9	245	71	0	30	1	68
18 Fin.insur.	14	7	1	1	3	1	37	61	0	30	1	68
19 Oth.serv.	26	16	1	0	2	0	378	243	0	0	0	0
<b>Services</b>	<b>68</b>	<b>46</b>	<b>16</b>	<b>9</b>	<b>23</b>	<b>11</b>	<b>184</b>	<b>92</b>	<b>0</b>	<b>30</b>	<b>1</b>	<b>68</b>
<b>Tot</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>189</b>	<b>80</b>	<b>0</b>	<b>30</b>	<b>1</b>	<b>68</b>

Table 2: NAFTA and Colombia Trade Protection Rates

	NTBS ad Valorem estimates												Tariffs					
	USA NTBs against:				Can NTBs against:				Mex NTBs against:				USA Tar. against:		Can Tar. against:		Mex Tar. against:	
	USA	Can	Mex	Row	USA	Can	Mex	Row	USA	Can	Mex	Row	USA	Can	USA	Can	Mex	Row
1 Agricult.	12	43	23	82	97	80	83	100	80	1	4	0	0	0	1	2	6	6
2 Mining	66	96	90	47	7	26	84	0	26	0	0	1	0	0	0	4	5	4
3 Food prod	21	22	23	54	73	54	98	80	54	2	9	3	0	0	3	7	7	7
4 Beverages	94	93	94	0	0	0	100	0	0	1	3	2	0	0	30	37	11	6
5 Tobacco	81	23	11	0	0	0	100	0	0	6	6	8	0	0	20	30	8	11
6 Textiles	0	50	41	52	90	55	3	0	55	7	11	13	0	0	13	15	8	6
7 Paper	0	0	0	0	0	1	64	84	1	0	3	1	0	0	3	11	4	4
8 Chem.rub.	4	10	4	5	0	5	2	4	5	2	2	5	0	0	4	10	6	8
9 Non metal	0	57	3	9	3	14	3	0	14	1	3	6	0	0	4	10	7	10
10 Metl.wood	17	27	30	26	51	30	45	0	30	1	2	3	0	0	4	9	7	7
11 N.equip.	3	1	9	1	0	1	14	15	1	1	4	3	0	0	2	4	7	7
12 Trns.equip	65	4	68	57	76	61	17	0	61	0	2	2	1	1	1	4	7	15
13 Oth.man.	2	21	24	13	12	26	1	0	26	2	4	4	0	0	4	7	8	9
14 Construct.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15 Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16 Commerce	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
17 Trns.com.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18 Fin.insur.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19 Oth.serv	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Economy-wide	41	28	32	31	30	33	22	36	30	1	3	3	2	2	4	4	2	11

Table 3: Aggregate Simulation Results

	Experiment 1: NAFTA				Experiment 2: NAFTA+				Differences			
	USA		Colombia		USA		Colombia		USA		Colombia	
	Canada	Mexico	Colombia	Row	Canada	Mexico	Colombia	Row	USA	Canada	Mexico	Colombia
EV Income (%)	1.34	4.73	1.78	.08	1.36	4.74	1.78	.91	.02	.01	.01	.83
Real GDP	1.03	6.10	3.06	.00	1.05	6.11	3.07	.07	.02	.01	.01	.07
Imports	7.93	17.43	13.38	.33	8.00	17.46	13.41	6.44	.07	.03	.04	6.11
Exports	5.99	24.74	23.10	-.10	6.12	24.77	23.14	1.17	.13	.03	.04	1.27
Real ER	-35	-11	4.88	.02	-30	-09	4.91	-5.74	.05	.02	.03	-5.76
Employment(%)	1.25	5.79	3.25	.03	1.28	5.80	3.26	.31	.03	.01	.01	.28

Experiment 1: Bilateral Tariff and NTB Removal for the United States, Canada, and Mexico  
Experiment 2: Bilateral Tariff and NTB Removal, all Four Countries



*Table 4: Sectoral Adjustment for Colombia*

	Percentage Changes w.r.t. base year				Changes in 1992 USD			
	Domestic		Domestic		Domestic		Domestic	
	Supply	Exports	Demand	Imports	Supply	Exports	Demand	Imports
1 Agriculture	-.71	4.65	-.41	18.37	-76	43	-42	77
2 Mining	1.25	3.27	.43	4.54	87	92	20	26
3 Food prod	-1.34	-4.98	-.37	7.07	-134	-85	-31	18
4 Beverages	.02	10.26	.04	4.46	1	1	1	1
5 Tobacco	.27	1.46	.16	3.57	1	0	0	0
6 Textiles	6.97	15.73	4.34	7.12	267	157	143	33
7 Paper	-.57	-2.77	.19	3.99	-12	-5	4	10
8 Chem.rubb.	-.81	-5.89	.78	5.16	-53	-31	59	81
9 Non metal	-.22	-1.73	.32	5.90	-3	-2	4	6
10 Metal wood	.19	-1.58	1.37	4.55	5	-2	43	37
11 N-Ele equip.	1.06	-2.42	3.08	5.01	23	-5	112	84
12 Trnsp.equip.	4.62	.99	6.62	10.02	69	0	148	80
13 Oth. Mnfg.	1.69	-3.08	3.20	5.59	9	-2	21	10
14 Constructn	.42	.00	.42	.00	18	0	18	0
15 Electricity	.41	.00	.41	.00	7	0	7	0
16 Commerce	.50	-5.40	.55	7.99	35	-3	38	1
17 Trnsp.Com.	-.96	-6.24	.08	5.76	-77	-51	7	32
18 Fin.Insur.	-.15	-6.01	.03	5.80	-10	-6	2	6
19 Oth.services	-.11	.00	-.10	5.73	-14	0	-14	1

*Table 5: Trade effects: multilateral flows as percentages of base year*

	Total					Mining					Textiles				
	USA	CAN	MEX	COL	ROW	USA	CAN	MEX	COL	ROW	USA	CAN	MEX	COL	ROW
USA		24	23	8	2		29	36	7	1		27	6	8	2
CAN	33		89	12	9	39		7	10	13	7		7	10	6
MEX	29	42		11	10	76	31		23	52	35	56		12	11
COL	23	54	12		-9	23	32	22		-15	31	54	6		1
ROW	2	10	0	5		-2	6	-1	4		1	4	-1	6	

Figure 8-1: Production Structure

