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FTAA and Service Liberalization in Colombia

Miles K. Light*

Abstract

In a previous study we found that accession to the FTAA could be welfare-worsening for Colombia because exports to the USA will be diverted away from Colombia in favor of other Latin countries. In this paper we show that there remain potentially large gains from an FTAA-style agreement. These gains come from increased factor productivity and product variety as a result of service liberalization and foreign direct investment (FDI). These benefits are likely to be large enough to overcome the loss of competitiveness in US goods markets. We use a computable general equilibrium model of the Colombian economy that includes imperfect competition in order to highlight the pro-competitive effects from entry as well as productivity effects from increased product variety. In contrast to perfect competition models, such as the GTAP model, this analysis incorporates productivity effects in both goods and services markets endogenously, through a Dixit-Stiglitz framework. The numerical model is innovative as it recognizes that foreign direct investment or the availability of foreign expertise is necessary to have foreign firms compete in key business services; and it endogenously captures increases in total factor productivity from foreign direct investment liberalization.

Introduction

Colombia currently enjoys almost full access to US and European markets under the Andean Trade Preference Act (APTA)[1]. Because tariffs for Colom-

* Business Research Division, University of Colorado. Email: miles@mileslight.com

1 The name was changed to the ATPDEA: Andean Trade Preference and Drug Eradication Act. However, we have chosen here to maintain the orginial acronym, ATPA. The ATPA offers low or zero tariffs for most Andean exports into US markets in exchange for efforts to combat drug production.

bia's goods are already near zero, further gains from trade appear unlikely under the Free Trade of the Americas Agreement (FTAA). In particular, there are two daunting prospects that Colombia must confront when considering joining the FTAA. First, Colombia and the other ATPA countries (Peru, Bolivia, and Ecuador) will face increased competition for their exports as other Latin countries begin to enter US markets. By the same token, trade-preferences for Colombia within the Andean Pact will also face increased competition from non-Andean countries. Second, tariff elimination in Colombia will generate significant budget shortfalls. Current tariff collections represent about eight percent of total revenues for the government or about three percent of GDP. A reduction in domestic tariff rates must be accompanied by either an increase in value-added taxes or higher income taxes in order to replace lost revenues. These findings are not encouraging for Colombian trade negotatiors or businesses.

Despite these discouraging prospects, we find that Colombia stands to gain substantially from accession to the FTAA. However, these gains will come from liberalization in *services* rather than trade liberalization of *goods*. Using a small open-economy model which incorporates increasing returns to scale, we find that Colombian consumption could increase by 3.9% by joining the FTAA (Table 1). In the long-run, after capital and investment changes take effect, the gains are 5.9%. If the government must recover lost tariff revenues by raising VAT rates, we still find that welfare increases by 2.6%. In contrast, the traditional gains from trade in goods is small. If we assume constant returns to scale and consider only trade in goods, then welfare increases by 1.4% in the central FTAA scenario, and by only 0.2% in the balanced-budget scenario.

These significant differences are indicative of some important characteristics of the Colombian economy. First, services are the largest component of the economy. Depending upon their definition, services represent between 40-60% of the Colombian economy (and between 75-85% of the US economy). Because this sector is so large, even a small improvement in productivity can lead to a relatively large change in welfare. Second, most of the Colombian "core" manufacturing and production depends upon services as an intermediate input. Transportation services, financial services, consulting services, and communication services are all part of the production process. Finally, services are used both as intermediate inputs to production and as inputs to final consumption. Since services are so prevalent in production and consumption, we find that even a small increase in competitiveness or productivity has a large effect upon welfare because it lowers production costs and at the same time increases utility.

Table 1. Welfare Impact of FTAA Accession and Service Liberalization.

	Full Access		Steady-state		Equal Yield	
	IRTS	CRTS	IRTS	CRTS	IRTS	CRTS
Consumption (%)	3.9	1.4	5.9		2.6	0.2
GDP (%)	2.5	0.9	3.8		1.7	0.1
Revenues (%)	-4.1	-4.4	-8.4		0	0
VAT Change (%)					12.4	11.7

Impact Dimensions under the FTAA Using a small open-economy (SOE) economic model for Colombia, we can consider several effects from FTAA accession which are likely to be important. These effects are listed below.

- An impact upon goods markets which use CRTS technology in light of existing tariffs and trade preferences. Tariff elimination will improve resource allocation by eliminating price distortions.
- A shift in tax collections from import tariffs to value-added taxes. The impact upon tax-efficiency will depend upon the tariff rate structure and the efficiency of the replacement tax.
- An increase in overall factor productivity derived from increased product variety. The increases in variety come as more import varieties are avaialble for IRTS producers and as more domestic varieties are available as a result of increased Foreign Direct Investment (FDI).
- An increase in productivity coming from better techniques offered through the service sector. This improvement comes from liberalization in the service sector and from transfer of technology from multinational corporations.
- An impact upon the long-run, steady-state level of investment and production as a result of increased product variety and factor productivity.

I. Services and FDI

A. Theory

The notion of imperfect competition and increasing returns to scale has been recognized very early on in the international trade literature (e.g., Ohlin

(1924) and Graham (1923)), but it was not until a set of useful theoretical constructs were developed that the role of multinational corporations, and foreign direct investment could be characterized in a meaningful way. Work by Lancaster (1975), Spence (1976), and Dixit and Stiglitz (1977) was readily used as an approach to monopolistic competition –that could be applied to interindustry trade– could recognized that increasing returns to scale can lead to large-scale production and international specialization. Since 1985, the focus of international trade literature has been upon increasing returns to scale and imperfect competition. This new literature is often termed the *new trade theory*, because it moves beyond the standard Ricardian theory of comparative advantage to explain why countries with similar endowments might engage in trade. The impetous for the new trade theory was a series of empirical observations which contradicts standard trade theory. The main finding was that 80% of all trade occured between countries who have similar endowments. Also, most trade in manufactured and finished products moved between OECD countries, while most of the trade in primary factors and unfinished goods occured between developed and developing countries.

B. Quantifying the Barriers to Services and FDI

Unlike tariffs, there is no simple measure of the barriers to Foreign Direct Investment (FDI) and service provision by foreigners. Often, these barriers are vagely-defined in the law and they are imposed differently across sectors, often on a case-by-case basis. The non-standard nature of non-tariff barriers (from here on: NTBs) clearly causes problems when attempting to quantify the restrictiveness for a country.

Despite these challenges, economists have developed several means to identify the restrictiveness of trade, at least to a certain order of magnitude. For example, estimates of the quantity impact of NTBs have been derived from econometric trade models (Brown and Stern 2001). The difference between the observed trade flows and the predicted flows is assumed to result from NTBs. Of course, this method suffers the major problem that econometric models do not capture all of the determinants of trade and therefore some of the difference between predicted and actual flows is not caused by the presence of NTBs, but instead simply by a model with low explanatory power. Other methods which have been considered are:

- *Frequency measures* Counting the number of restrictions in each sector.
- *Price Differences* Attribute the difference in the price of services to non-tariff barriers.
- *Indices* Applying weights to various trade and investment restrictions in order to calculate a "restrictiveness index."

For the most part, and for lack of a better methodology, we use the "Trade Restrictiveness Index" (TRI) which applies weights to various barriers to investment in order to synthesize the barriers into a single number.

The second step in the process is to then *quantify* the ad-valorem equivalent of the TRI for each sector. We use TRI estimates for 38 other countries in each of the service and FDI sectors, then regress price against the RTI in order to compute percentage change in price related to the restrictiveness. Obviously, this method is somewhat arbitrary. The index weights have been chosen based upon personal judgment, only certain countries have been included in the regression due to data limitations, and the explanatory power of the regressions is necessarily low becuase market structure is not captured in the regression model. Despite these difficulties, we notice that the regression results are reasonable. As a defense against spurious calculations, we also compute a sensitivity analysis to the central *ad-valorem* estimates in the model. We calculate a range of scenarios where the TRI ad-valorem equivalents reach the boundries of their 95% confidence intervals.

Prior research resulting from the GATS negotiations can be used here to define the major barriers to FDI. Table 2 lists common barriers and classifies them into three main categories:*Restrictions on Entry, Ownership and control restrictions, and Operational restrictions*.

A 38-country study of the trade restrictiveness in services was conducted by the Australian Productivity Comission, and the resulting research findings were presented in an edited volume by Findlay and Warren (2000). Although the particular focus was trade impediments in Asian Pacific countries, Colombia appears to have been included as one of the 38 countries. Some of the findings from this research has been consolidated into Table 3.

Table 2. Common Barriers to FDI.

Restrictions on market entry
• Bans on foreign investment in certain sectors • Quantitative restrictions (eg limit of 25 per cent foreign ownership in a sector) • Screening and approval (sometimes involving national interest or net economic benefits tests) • Restrictions on the legal form of the foreign entity • Minimum capital requirements • Conditions on subsequent investment • Conditions on location • Admission taxes
Ownership and control restrictions
• Compulsory joint ventures with domestic investors • Limits on the number of foreign board members • Government appointed board members • Government approval required for certain decisions • Restrictions on foreign shareholders' rights • Mandatory transfer of some ownership to locals within a specified • time (eg 15 years)
Operational restrictions
• Performance requirements (eg export requirements) • Local content restrictions • Restrictions on imports of labour, capital and raw materials • Operational permits or licences • Ceilings on royalties • Restrictions on repatriation of capital and profits

Source: UNCTAD (2002)

Barriers to foreign direct investment have been estimated in a few Colombian service sectors, namely in telecommunications, banking, external maritime transportation services, and retail and wholesale distribution services. The methodology employed is an application of the methodology and data work of Christopher Findlay and Tony Warren. Findlay and Warren have employed cross-country data sets in several service sectors where the price and quantity of services in the sector is regressed on measures of regulatory barriers. Findley and Warren then infer from these regressions the impact of changes in any of the regulatory barriers on the price or quantity of the service. Using the estimated coefficients listed in Table 3, we find that the cost of banking services in Colombia are 18% higher due to barriers to FDI and the cost of telecommunications services are 24%higher.

Table 3. Colombia Trade Restrictiveness and Price-Effect Indices.

Sector	Trade Restrictiveness		Price Effects	
	Domestic	Foreign	Domestic	Foreign
Banking	0.2850	0.3997	3.54%	18.35%
Distribution	0.1238	0.1904		
Maritime	0.1805	0.4690		
Telecommunications	0.2000	0.4600	10.55%	24.26%

Definitions:
- Distribution: Wholesale and retail trade (except motor vehicles and motorcycles) including commission trade and repair of personal and household goods. (622,63,51-2).
- Banking: Financial intermediation services, except insurance and pension funds.(811).
- Maritime: Water transportation.
- Telecommunications: Telecommunications, including fixed line, mobile, and internet communications.

Source: McGuire/UNCTAD (2002)

The restrictiveness indices listed on the left-hand side of Table 3 represent an index value, between zero and one. The difference between the domestic index and the foreign index reflects the *discrimination* applied to foreign firms. On the right-hand side of the table are the estimated price effects. Although there is some ambiguity regarding whether *all* prices are raised by this number, or if this is effectively the *ad-valorem* equivalent of the restrictiveness index for Colombia. We adopt the latter meaning, and take these figures to be the ad-valorem equivalent for non-tariff barriers.

II. The Model

A. Conceptual Framework

The trade model employed in this analysis is different from previous studies for Colombia. First, we do not use the multiregional framework and dataset from the trade-in-goods study by Rutherford and Light (2003). Instead, we model Colombia as a small open economy based upon 1997 national accounting data. The second major departure is the inclusion of increasing returns to scale technology (IRTS) based upon the Dixit-Stiglitz product variety framework.

There are 17 sectors in the model that are listed in Table A.1. This model can also be applied to a more detailed, 57-sector dataset for Colombia. However we found that the nature of the gains and the trade effects are likely to be similar between the 17-sector and the 57-sector aggregations. For computational simplicity and logical transparency, we use the 17-sector aggregation during this analysis.

The 17 sectors are listed in three separate categories. One category of sectors is those goods or services that are produced under constant returns to scale and perfect competition. In these sectors, competitive domestic firms face competition from foreign producers where goods are differentiated in the demand functions of Colombian consumers and firms. This is known as the Armington assumption.

A second category of sectors is those goods that are produced under increasing returns to scale and imperfect competition. These goods are characterized as Dixit-Stiglitz composites of domestic and import varieties with firm-level product differentiation. The efficiency gains associated with an increased number of varieties accrue to both consumers and firms using these goods as intermediate inputs. Foreign firms supply the Colombian market with production facilities abroad, but the number of foreign firms that are present in the Colombian market depends on quasi-rents available in the Colombian market, which in turn depends on the tariff rate.

The third category of sectors contains *services* which are produced under increasing returns to scale and imperfect competition. For these services, two types of firms operate: domestic and multinational. Multinational service firm providers must establish a domestic presence in order to compete in the Colombian market. They must import some of their technology or management expertise. They cannot supply the Colombian market from abroad as goods providers can do. Thus, their cost structure differs from goods providers. They incur costs related to both imported inputs and domestic good and factor inputs. Domestic service providers do not import foreign technology or management expertise. Hence, domestic service firms incur costs related to domestic goods and factor inputs only. These services are characterized by firm-level product differentiation. Restrictions on foreign direct investment, right of establishment, the movement of business personnel, and lack of intellectual property protection and contract enforcement have major, direct impacts on multinational firms providing services to the market.

B. Overview of the Model Formulation

The model algebra is very similar to the Jensen, Tarr, Rutherford (2003) model for Russia's accession into the World Trade Organization. Naturally, the model structure was altered in order to reflect special characteristics within the Colombian economy.

Primary factors include capital, skilled and unskilled labor, and sector-specific workers. Twenty-five percent of the labor in all sectors is assumed to be sector specific.

Goods produced subject to increasing returns to scale are differentiated at the firm level; firms in these industries set prices such that marginal cost equals marginal revenue; and there is free entry, which drives profits to zero. We employ the standard Chamberlinian large group monopolistic competition assumption, which results in constant markups over marginal cost.

Aggregate productivity is affected by the number of varieties using the standard Dixit-Stiglitz formulation. The effective cost function for users of goods produced subject to increasing returns to scale declines in the total number of firms in the industry.

For simplicity we assume that the composition of fixed and marginal cost is identical in all increasing returns to scale sectors. This implies that the ratio of fixed to marginal cost is a constant. This assumption in a large-group model assures that output per firm for all firm types remains constant, i.e., the model does not produce rationalization gains or losses.

We assume that manufactured goods are either produced domestically or imported, and the cost structure of domestic firms is defined by observed primary factor and intermediate inputs to that sector in the base year data. The CIF import price of foreign goods is simply defined by the import price and by the zero profits assumption. In equilibrium, the import price must cover fixed and marginal costs of foreign firms.

We assume that in the IRTS service sector, there are two types of firms providing services to the Colombian economy: (i) Colombian firms, who employ primary factors and intermediate inputs and (ii) multinational firms who provide services using imported inputs (FDI and foreign expertise) together with primary factors and intermediate inputs.

We assume that the structure of both the marginal and fixed costs of services firms are identical, so that output per firm is fixed and there are no rationalization gains. This assumption lies parrallel to the cost structure for IRTS producers of goods.

For multinational service providers, both the fixed and variable costs of service supply are assumed to be a convex combination of the domestic supply price in the same sector and the cost of imported inputs.

Comparative Steady State Formulation In this version of our model, we allow the capital stock to adjust to its steady state equilibrium along with all of the model features we employ in our FTAA reference case, i.e., we allow for tariff and FDI liberalization with endogenous productivity effects as above. We call this our comparative steady state model. In the comparative static model, we assume that the capital stock is fixed and the rental rate on capital is endogenously determined. In the comparative steady state model, the logic is reversed. We assume that the capital stock is in its initial steady state equilibrium in the benchmark dataset, but that the capital stock will adjust to a new steady state equilibrium based on a fixed rate of return demanded by investors. That is, if the trade policy shock happens to induce an increase in the rate of return on capital so that it exceeds the initial rate of return, investors will invest and expand the capital stock. Expansion of the capital stock drives down the marginal product of capital, i.e., it drives down the rental rate on capital, until the rate of return on capital falls back toward the long-run rental rate. To analyze trade policy, this comparative steady approach has been employed by many authors, including Harrison, Rutherford and Tarr (1997) and Francois et. al. (1997). The approach, however, dates back to the 1970s, when both Koopmans and Manne used it.

C. Algebraic Formulation

The model includes the standard general equilibrium consistency features. Final demand arises from a representative household who earns income from the sale of primary factors (capital, skilled and unskilled labor). The government levies direct and indirect taxes and purchases a vector of goods and services. In this section we outline the key features of the model in terms of the objectives and constraints facing various agents.

Consumer Behavior Private consumption in the model arises from budget-constrained utility maximization. Preferences are represented as a Cobb-Douglas aggregate of goods and services:

$$U(C) = \sum_i \theta_i log\ (c_i)$$

in which $\theta_i > 0$ and $\sum_i \theta_i = 1$. Associated demand functions are defined in terms of goods prices p_i, consumption tax rates t_i^C and aggregate income, M:

$$c_i = \frac{\theta_i M}{p_i(1+t_i^C)}$$

Income is defined in terms of sources of factor income:

$$M = \sum_l \omega_l L_l + \sum_i \omega_{li}^S L_{li}^S + k(r_K \overline{K} - p^I \bar{I}) - T_{LS}$$

The right side of the budget constraint includes wage income from both mobile and sector-specific labor, and capital earnings. Investment demand is fixed when $k = 1$. In a steady-state equilibrium, both the capital stock and the level of investment adjust to a level $k > 1$ which equates the cost of capital formation and the discounted present value return to a unit of new capital. The final term on the right-hand side is the level of lump-sum tax adjust which is used to balance the government budget and hold public output constant (see below).

Domestic Supply Goods and services are produced for sale in the domestic and international markets. A constant elasticity of transformation (CET) function shows the transformation possibilities in a given period between domestic (D_i) and export (E_i) sales for a given composite output level (Y_i). The shares of sales at home and abroad are determined by relative prices given that firms produce the final good to maximize profit subject to the CET constraint:

$$Y_i = \left[\theta_D \left(\frac{D_i}{\overline{D_i}} \right)^{\frac{1+\eta}{\eta}} + (1-\theta_D) \left(\frac{E_i}{\overline{E_i}} \right)^{\frac{1+\eta}{\eta}} \right]^{\frac{\eta}{1+\eta}}$$

In this equation parameters bar $\overline{D_i}$ and bar $\overline{E_i}$ are the base year output for the domestic and export markets, respectively, and θ_D is the baseline value share of domestic sales in total sales (the base year production level is scaled to unity) and is the elasticity of transformation.

Production is associated with a nested production function of intermediate inputs x_{ji}, labor services left (L_{li} and L^S_{li}), and capital (K_i). Given prices of intermediate goods and labor, the aggregate production sector operates so to minimize the costs of producing a given output subject to the constraint:

$$Y_i = \min\left[\frac{a_{ji}}{\overline{a}_{ji}}, V_i\left(L_{li}, L^S_{li}, K_i\right)\right] \tag{1}$$

in which a_{ji} represents the intermediate input of good j to sector i. In this function, skilled and unskilled labor (both mobile and sector-specific) and capital enter in a Cobb-Douglas aggregate with value shares determined by base year demands.

Differentiated Goods Goods produced subject to increasing returns to scale are characterized as differentiated products of domestic and *foreign*firms. Effective supply of all firms in a given sector is described by:

$$\begin{aligned} X_i &= \left(\sum_{i=1}^{n_i} x_i^{\rho}\right)^{1/\rho} \\ &= \left(\sum_{i=1}^{n_i^D} \left(x_i^D\right)^{\rho} + \sum_{i=1}^{n_i^F} \left(x_i^F\right)^{\rho}\right)^{1/\rho} \\ &= \left(\left(X_i^D\right)^{\rho} + \left(X_i^F\right)^{\rho}\right)^{1/\rho} \end{aligned} \tag{2}$$

$n^D{}_i$ and $n^F{}_i$ are the numbers of domestic and foreign firms/varieties and $X^D{}_i$ and $X^F{}_i$ represent composites of domestic and foreign goods:

$$X_i^K = \left(\sum_{i=1}^{n_i^k} \left(\chi_i^k\right)^{\rho}\right)^{1/\rho} = \left(n_i^k \left(\chi_i^k\right)^{\rho}\right)^{1/\rho} = \left(n_i^k\right)^{\frac{1-\rho}{\rho}} \widetilde{X}_i^k \quad k \in \{D, F\} \tag{3}$$

In the final expression $\chi^k{}_i$ is output of a representative type k firm, and $\widetilde{X}_i^k = n_i^k \chi_i^K$ is resource inputs at marginal cost of all type k firms. The output of domestic firms, characterized by (3), is therefore equal to domestic supply less fixed costs of domestic firms, i.e.

$$\widetilde{X}_i^D = n_i^D \chi_i^D = D_i - n_i^D f_i^D \tag{4}$$

and the output of importing firms is defined by imported resource less the fixed cost of those firms:

$$\tilde{X}_i^F = n_i^F \chi_i^F = F_i - n_i^F f_i^F$$

Holding total output constant, *effective supply* of either domestic or foreign varieties of commodity i increases with $\left(n_i^k\right)^{\frac{1-\rho}{\rho}}$, which is the "variety effect multiplier." The multiplier increases with n^k_i and increases as the elasticity of substitution decreases toward 1.

The supply of good *i* equals aggregate demand, the sum of intermediate demand, consumer demand, investment demand and government demand:

$$X_i = \sum_j a_{ij} + c_i + Ia_i^I Gg_i \qquad (5)$$

The number of domestic and foreign varieties determine the *effective supply index*, X_i, and we thereby assume that the Dixit-Stiglitz productivity has an symmetric impact on both intermediate and final demand. Changes in the number of domestic and foreign varieties are reflected through changes in the price index of the commodity associated with X_i.

Differentiated Services Services supplied under conditions of increasing returns to scale are characterized as the differentiated products of domestic and *multinational* firms. Effective supply of all firms in a given sector is described by:

$$\begin{aligned} X_i &= \left(\sum_{i=1}^{n_i} x_i^\rho\right)^{1/\rho} \\ &= \left(\sum_{i=1}^{n_i^D} \left(x_i^D\right)^\rho + \sum_{i=1}^{n_i^M} \left(x_i^M\right)^\rho\right)^{1/\rho} \\ &= \left(\left(X_i^D\right)^\rho + \left(X_i^M\right)^\rho\right)^{1/\rho} \end{aligned} \qquad (6)$$

n^D_i and n^M_i are the numbers of domestic and multinational firms / varieties, and χ^D_i and χ^M_i are output per firm of those two types of firms. In the final equation χ^D_i and χ^M_i represent composites of domestic and multinational services, i.e.:

$$X_i^K = \left(\sum_{i=1}^{n_i^k} \left(\chi_i^k \right)^\rho \right)^{1/\rho} = \left(n_i^k \left(\chi_i^k \right)^\rho \right)^{1/\rho} = \left(n_i^k \right)^{\frac{1-\rho}{\rho}} \tilde{X}_i^k \quad k \in \{D, M\} \tag{7}$$

In the final expression $\chi^k{}_i$ is output of a representative type *k* firm, and $\tilde{X}_i^k = n_i^k \chi_i^k$ is resource inputs at marginal cost of all type *k* firms.

The crucial distinction between differentiated goods and differentiated services is that in the case of goods, domestic supply, characterized by (1), equals the value of domestic goods while for services this quantity is split between resources used in producing domestic services and resources employed by multinational firms. In the case of services, we may then define:

$$D_i - D_i^D + D_i^M \tag{8}$$

where D_i^D represents domestic resources used in the supply of services by domestic firms:

$$D_i^D = n_i^D \left(\chi_i^D + f_i^D \right)$$

while D_i^M represents domestic resources used in the supply of services by multinational firms.

We assume that multinational firms use domestic inputs in fixed proportion to imported inputs. Hence,

$$M_i = \theta_i^M n_i^M \left(\chi_i^M + f_i^M \right) \quad \text{and}$$

$$D_i = \left(1 - \theta_i^M \right) n_i^M \left(\chi_i^M + f_i^M \right)$$

in which θ_i^M represents the benchmark value share of imported inputs to multinational service supply.

As in the case of differentiated goods, holding total output of either domestic or multinational services constant, *effective supply* of either domestic or multinational varieties of service commodity increases with $\left(n_i^k \right)^{\frac{1-\rho}{\rho}}$, which is the "variety effect multiplier". The multiplier increases with and increases as the elasticity of substitution decreases toward 1.

Likewise, the supply of differentiated service i equals aggregate demand, the sum of intermediate demand, consumer demand, investment demand and government demand:

$$X_i = \sum_j a_{ij} + c_i + Ia_i^I Gg_i \qquad (9)$$

The number of domestic and multinational varieties determine the *effective supply index*, X_i, and we thereby assume that the Dixit-Stiglitz productivity has a symmetric impact on both intermediate and final demand. Changes in the number of domestic and foreign varieties are reflected through changes in the price index of the commodity associated with X_i.

Tax Revenue and the Public Budget In the model, the government collects a variety of indirect taxes. These taxes and the associated ad-valorem rates include the taxes on output t^Y_i, tariffs t^M_i, taxes on exports by trading partner t^x_{ir}, and taxes on consumption t^C_i. The government budget constraint is then:

$$p^G G = T_Y + T_M + T_X + T_C + T_L S$$

in which T_k represents revenue from tax instrument k, and $T_L S$ represents direct (lump-sum) taxes. The model features a constant level of public provision, which is achieved through adjustment of the level of lump sum tax.

III.Data

We use 1997 national accounts which have been compiled and documented by the Colombian national statistics office called "DIAN." This dataset is well-documented and has been used in several tax-reform studies in 2002[2].

The core input-output model is the 1997 table produced by the Colombian Ministry of Finance. The official table contains 17 sectors, five factors of production (capital and 5 labor types), five major tax streams, a single government agent, ten households distinguished by income level, imports, exports and rest-of-world net savings.

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[2] See Rutherford, Light and Hernandez (2002) and Rutherford and Light (2002).

Table 4. Services as part of the Production Process: Production and Services in the Colombian SAM.

	OUTPUT	% OUTPUT	% SERVICE
COF	2,284	1.2	15.8
CRO	8,084	4.3	12.4
LVS	6,420	3.4	8.9
FFH	1,032	0.5	8.0
OIL	6,258	3.3	30.6
MIN	1,188	0.6	13.0
THR	554	0.3	10.4
FOD	19,855	10.5	12.3
NRI	1,062	0.6	29.1
NSI	9,506	5.0	24.0
HTC	16,388	8.7	51.3
CON	15,429	8.2	27.8
TRN	10,972	5.8	35.3
ELE	7,477	4.0	17.1
COM	3,105	1.6	27.8
SER	54,107	28.6	27.7
GOV	25,398	13.4	24.4
TOTAL	189,127	100.0	25.9

Output values: Billions of Pesos
% Service: the percentage of services as a share of total intermediate inputs to production.
Sectors included in services are: SER,COM, and TRN.

The households have been combined into a single, representative-agent for simplicity. Futher analysis may include a disaggregation which can distinguish the effects of liberalization upon the poor. The structure of the 1997 SAM is consistent with current efforts to develop a new SAM for the year 2001. Future anlysis may incorporate these developments, but in the meantime we believe that most of the action can be captured with the current model implementation.

The second step in the process is to then *quantify* the ad-valorem equivalent of the TRI for each sector. We use TRI estimates for 38 other countries in each of the service and FDI sectors, then regress price against the RTI in order to compute percentage change in price related to the restrictiveness. Obviously, this method is somewhat arbitrary. The index weights have been chosen based upon personal judgment, only certain countries have been included in the regression due to data limitations, and the explanatory power of the regressions is necessarily low because market structure is not captured in the regression model. Despite these difficulties, we notice that the regression results are reasonable. As a defense

against spurious calculations, we also compute a sensitivity analysis to the central *ad-valorem* estimates in the model. We calculate a range of scenarios where the TRI ad-valorem equivalents reach the boundaries of their 95% confidence intervals.

Barriers to foreign direct investment have been estimated in a few Colombian service sectors, namely in telecommunications, banking, external maritime transportation services, and retail and wholesale distribution services. The methodology employed is an application of the methodology and data work of Christopher Findlay and Tony Warren. Findlay and Warren have employed cross-country data sets in several service sectors where the price and quantity of services in the sector is regressed on measures of regulatory barriers. Findley and Warren then infer from these regressions the impact of changes in any of the regulatory barriers on the price or quantity of the service. We use the estimated coefficients listed in Table 3 as the domestic and foreign barriers to FDI in Colombia.

Table 5 reports the market share controlled by domestic and foreign firms in services. For foreign firms, the last column in table 5 lists the share of production that is imported from outside Colombia. This captures the amount of services and goods that the foreign firm that come from headquarters. Barriers that limit the use of these imported goods, such as limitations on foreign residence, taxes upon special machinery, or the ban on foreign-purchased cellular handsets, will limit the degree of new firm entry as well.

Table 5. IRTS Market participation of foreign firms in Colombia.

Sector	Market Share (θ)		Import Share for FDI (θ_M)
	Domestic	Foreign	Foreign
Banking	95%	5%	10%
Distribution	91%	9%	—
Maritime	97%	3%	—
Telecommunications	85%	15%	10%

Source: Colombian Department of National Planning (2003).

A. Tariff Data and Trade Volumes

Tariff and export tax rates are imputed from total tariff collections and total imports and exports. Tax collections divided by total trade values produce

the imputed rate. Because Colombia is part of the Andean Community, they share a common external tariff and similar institutional requirements for foreign investment. The imputed rates listed in Table 6 represent the average rates among several hundred rates. The actual rates for any particular commodity can vary from 0% to 200%. In particular, the case of commodity food imports are subject to a price-band system. In this system the import tariff for all Andean Community members is adjusted until food import prices are as high as local prices.

We do not attempt to capture all of the intricacies of specific tariff lines in this paper. Instead, we describe a simple tariff structure among the sectors listed below. More detailed import tariff rates at the tariff line level can be obtained from official government decrees which are available online[3].

Like most countries in Latin America, import tariffs are highest in the food and agriculture sector (11%), while most other tariffs are relatively low. Extensive trade reforms from 1990 and 1991 have sucessfully lowered the average tariff rate from 25-30% to their current levels which are 7%-10%. We also observe a current account deficit of about 4,000 billion pesos. This trade deficit is held constant for all of the scenarios in the model.

It is worth noting that import tariffs in the service sector (SER) and the transport sector (TRN) are both near zero. These goods are typically non-traded and require a local presence. On the other hand, the average import tariff for 'HTC,' high-technology and capital-intensive goods is relatively high, 6.4%, and trade in this sector is the largest in the economy. We model HTC as a "Dixit-Stiglitz'' sector, where increased firm entry or international competition will improve productivity in this sector.

IV. Policy Results

The role of service-liberalization and increasing returns to scale is important because services are widely used as an intermediate input to production. The potential gains from service liberalization are significant, especially when compared to traditional CRTS gains, for two reasons: 1) Production costs are lowered because of pro-competitive and efficiency effects. These

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[3] See the the *FTAA Hemispheric Database*. The data are current for Colombia as of 2002.

Table 6. Average Import Tariffs, Collections, Imports and Exports.

	RATE (%)	FDI-NTB (%)	REVENUES	IMPORTS	EXPORTS
COF	6.3		0.0	0	2,602
CRO	11.0		117.9	1,190	2,552
LVS	2.6		0.8	30	20
FFH	7.0		3.6	54	11
OIL	5.9		36.8	656	3,253
MIN	3.0		3.9	135	556
THR	3.8		0.0	0	188
FOD	6.5		105.5	1,739	902
NRI	5.7		0.1	1	978
NSI	4.6		159.2	3,588	1,532
HTC	6.4		798.3	13,294	2,951
TRN	0.4	25			799
ELE				2	0.4
COM		25		23.2	271
SER	0.2	25	0.3	129	230
TOTAL			1226.4	20,847	16,851

Values are: Billions of 1997 Colombian Pesos.
Rate: Imputed tariff rate (percentage).
FDI-NTB Calculated Non-tariff barrier to FDI.

cost-savings translate directly into lower prices for households and they do not require lower input prices in order to lower the costs, as is the case in CRTS technologies. 2) Existing distortions between goods and services are removed which increases efficiency of the overall economic system. Table 8 reveals, substantial gains from service liberalization in both goods and services. Consumption increases by 3.9%, and GDP increases by 2.5% relative to benchmark levels.

Table 7. Description of central scenarios using IRTS and CRTS technology and investment

Scenarios:	
FULL:	Full trade concessions for goods, services, and FDI with Increasing Returns to Scale Technology.
HALF:	Partial concessions, where Colombian import tariffs are reduced by 50% and barriers to FDI are similarly reduced. IRTS technology is assumed.
CRTS:	Full trade concessions for goods, but all sectors are assumed to have Constant Returns to Scale technology.
FDI:	Role of investment. FDI barriers are removed while import tariffs remain in place.
SS:	Full liberalization scenario results under the Steady-state (long-run) assumption.
CRTSYLD:	Equal-yield tax calculation. Impact of FTAA when tariff revenues must be replaced by value-added taxes. Trade in goods only.
IRTSYLD:	Equal-yield tax calculation under the IRTS technology and trade in services model.

Table 8. Summary Results Table.

	FULL	HALF	CRTS	FDI	SS	CRTSYLD	IRTSYLD
EV (% CONS)	3.9	2.9	1.4	2.1	5.9	0.2	2.6
EV (% GDP)	2.5	1.9	0.9	1.4	3.8	0.1	1.7
REAL EX	3.3	2.6	1.2	2.0	2.9	0.8	2.8
GOV REVENUES ($)	-863.9	-371.4	-919.0	50.3	-1767.4	0.0	0.0
GOV REVENUES (%)	-4.1	-1.8	-4.4	0.2	-8.4	0.0	0.0
VAT (%-CHANGE)	0.0	0.0	0.0	0.0	0.0	12.4	11.7

Descriptions:

EV (% CONS): Equivalent Variation as a percentage of current consumption.

EV (% GDP): Equivalent variation as a percentage of original GDP.

REAL EX: Percentage change to the price of foreign exchange. This is computed using the price of foreign exchange (COP per USD, for example) and the domestic price index. The formula is: $100\left(\frac{P_{fx}}{P_c}-1\right)$.

GOV REVENUES ($): Change in government revenues denoted in Billions of 1997 Cololombian Pesos.

GOV REVENUES (%): Percentage change in government revenues.

VAT (%-CHANGE): Percentage change in value-added tax rates required to replace lost import tariff revenues. Only used in the 'equal-yield' calculations. A 12%increase in the VAT is equivalent to raising rates from 16% to 18%.

In order to identify where the gains from trade lie, we conduct several separate scenarios. These scenarios are each described in Table 7. We identify the role of FDI and IRTS technology, then compare these effects with the standard CRTS technology.

A. Trade in Goods with CRTS Technology

The impact of FTAA under CRTS production technology has been considered using the GTAP database in Rutherford and Light (2002). We calculate the ramifications using the SOE model here, but our results are necessarily biased. They do not reflect changes in comparative advantage and competition from foreign producers. They also do not reflect increased import demand from foreign agents. In this treatment FTAA implies full unilateral tariff elimination only.

In order to consider the role of trade-diversion and existing trade preferences, we have included results taken from Rutherford and Light and included them into the report. These results show that trade diversion is ultimately a very important component of FTAA accession for Colombia because the benefits of the ATPA agreement will be diluted under the FTAA.

The central findings from our SOE model are less optomistic when a full multi-regional trade model is used. When we consider the GTAPinGAMS model, which has been tailored for Colombia under the FTAA negotiations, we find that Colombian consumption *falls* by about 0.6% instead of rising. This change in welfare reflects the gains from eliminating domestic tariffs and distortions, but also captures a large loss in exports as competition to US markets increases.

FTAA enactment essentially eliminates any existing trade preferences by setting US import tariffs to zero for *all* countries in the agreement. In this respect, Colombia and other ATPA[4] countries will face increased competition for exports into the US, which in turn lowers domestic production.

An important finding using the current Dixit-Stiglitz model is that accession into the FTAA is not necessarily harmful to Colombia. The expected gains in productivity are expected to offset losses from trade diversion. Using the GTAPinGAMS model, we found that Colombian consumption fell 0.6%, using the model presented here, CRTS FTAA (CRTSYLD) consumption increased 0.2%, but with IRTS and FDI liberalization (IRTSYLD), welfare increases 2.6% (under equal-yield assumptions).

From table 8, it is fairly clear that welfare improvements come mostly from increased foreign direct investment, and less so from tariff elimination. Tariff elimination increases the number of varieties for IRTS sectors producing goods. A comparison between only-FDI, where barriers to investment are removed against only-tariff elimination, the results differ substantially. Welfare in the FDI scenario increases 2.1% versus 0.5% in gains from tariff elimination with IRTS sectors included. Most of the difference comes from the revenue-replacement requirement. A similar calculation which eliminates import tariffs, but does not replace the revenues yields an increase in welfare of 2.1%. Part of the gains are simply lower tax collections.

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[4] Under the ATPA, Andean countries including Colombia, Equador, Peru, and Bolivia enjoy low or zero import tariffs for goods entering the United States. Consequently, the US is the largest single trading partner for each of these countries. ATPA benefits are given to these countries in exchange for efforts to combat drug production.

B. Factor Market Impacts

In general, real wages and the return to capital rise unambiguously across most scenarios. Tariff elimination and service liberalization both tend to lower import prices and lower production costs. Lower consumption prices and higher factor productivity in turn increase the real-return to labor and capital, even low-skilled labor. Table 9 lists the change in the real return to factors.

Table 9. Factor returns under FTAA.

	FULL	HALF	CRTS	FDI	SS	CRTSYLD	IRTSYLD
UFS	3.2	2.5	0.1	2.9	6.9	-0.2	2.8
UFN	4.4	2.8	1.6	2.5	11.9	-0.3	2.4
UTC	4.4	2.7	1.8	2.3	11.8	-0.2	2.3
UMC	1.7	1.7	-1.2	2.7	3.7	0.1	2.9
RSW	3.8	2.8	1.4	2.3	3.5	1.0	3.4
RNW	4.4	2.9	2.1	2.1	4.2	1.0	3.3
K	4.7	3.2	1.5	2.8	0.6	0.2	3.3

Definitions:
UFS Urban, formal, salaried workers.
UFN Urban, formal, non-salaried workers.

UTC Urban traditional contract workers.

UMC Urban modern contract workers.
RSW Rural salaried workers.
RNW Rural non-salaried workers.
K Return to Capital.

V. Conclusions and Further Work

The government of Colombia is currently in a position to help domestic producers participate in the global market for goods and services. Although most of the traditional gains from trade have already been utilized, there remain large gains from trade in services and from market liberalization and standardization. We estimate that Colombia has been able to enjoy a 1% increase in household consumption as producers take advantage of ATPA preferences in the US. A bilateral agreement would ensure that these preferences are not lost in the medium term, but it would also open Colombian markets to US goods. The elimination of Colombian tariffs is a mixed bag: prices for final goods and for intermediate inputs will fall, helping to raise

the standard of living, but producers will face increased competition from US imports, which could lower production and raise unemployment. The combined effect of keeping ATPA preferences and lowering Colombian tariffs is positive, leading to net consumption gains of approximately 0.7%-1%.

The most important component of a bilateral trade agreement has to do with the services sector and foreign direct investment. If done correctly, liberalization of financial, shipping, professional, and communications services may have a dramatic effect upon economic growth. Using a Dixit-Stiglitz product variety approach to increasing returns to scale technology, we find that gains from elimination of barriers to firm entry and to FDI will increase GDP by 3.2% in the medium term and by as much as 5.8% in the long run, after the capital stock has had time to adjust to a new, higher marginal product. These gains come mostly from improved factor productivity and lower costs of production.

We note that some caution is warranted because there exist several potential impediments to firm entry and foreign investment that have not been included in the model. One example is the high incidence of violence in Colombia. A higher level of domestic uncertainty will limit investment compared to a region where property rights and civil law are well-enforced. Also, a poorly designed reform program can substiantially undercut the benefits of liberalization. In a report to the Brazilian government, Fink et. al. (2003) discuss common pitfalls:

> *...For example, if privatization of state monopolies to private owners is conducted without the introduction of competition, the result may be merely transfers of monopoly rents to private (sometimes foreign) owners. This has partly been the case in the Colombian wireless communications market. If increased entry into financial sectors is not accompanied by adequate supervision and full competition, the result may be insider lending and poor investment decisions. If policies to ensure universal service are not put into place, liberalization need not improve access to essential services for the poor. Managing reforms of these service sectors requires complementing trade-openess with the appropriate regulation.*

Agriculture Agricultural subsidies and protection are usually the most difficult barriers to dismantle. This study finds that there are gains from trade in agriculture, but that a cautious and measured pace of tariff reduction will is not costly to the overall economy. That is because the remaining protected agricultural sectors do not constitute a large component of overall GDP. The agri-chemical industry may deserve more attention.

A. Directions for Further Research

Multiple Households and Poverty Reduction A key consideration for developing countries is the effect of free trade upon poverty. A microsimulation analysis which combines the IRTS (macro)scale effects with a standard household living survey (microeffects) would improve the understanding of the trade-poverty interaction substantially. Development of this technique is currently underway in the Trade Research Division of the World Bank.

Service Export Potential Existing data for Colombian exports reports very limited exports in the service sector. While this may have been the case in the past, the current surge in services trade between OECD countries and developing countries like India and China suggest that there is a large potential market for exports of Colombian services. An analysis of the Colombian comparative advantage in professional services could help identify how Colombia can take advantages of technilogical improvements for tranporting information.

Data Improvements for the Services Sector A major difficulty in assessing the potential welfare and production gains for Colombia in the services sectors is the lack of concrete data. This is not by accident. For the most part, there are no standards for accounting and tracking service provision and trade. Any advances in the understanding of service provision and trade by the Colombian government will in turn improve the precision of economic analysis dramatically. Many standards have been proposed under the General Agreement for Trade in Services (GATS), should be implemented by the Colombian government.

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Data Tables

Table A-1. Sectoral Definitions.

Identifier	Description
	Constant Returns Sectors
COF	Coffee
CRO	Other crops
LVS	Livestock
FFH	Forestry fishing and hunting
OIL	Oil
MIN	Other Minerals
THR	Coffee Threshing
FOD	Foodstuffs
NRI	Natural Resources Intensive Industries
NSI	Non-skilled Labor Intensive Industries
CON	Construction
ELE	Electricity Gas and Water
COM	Communications
GOV	Government Services
	Increasing Returns Goods
HTC	Capital and High Technology Industries
	Increasing Returns Services
COM	Communications
TRN	Transport
SER	Private Services

Table A-2. Labor Categories.

Identifier	Description
UFS	Urban formal salaried work
UFN	Urban formal non-salaried work
UTC	Urban traditional contract work
UMC	Urban modern contract work (consulting)
RSW	Rural salaried work (organized farming work)
RNW	Rural non-salaried work (farming)

Table A-3. Labor Allocation Between Sectors for Each Labor Type.

	%-Y	UFS	UFN	UTC	UMC	RSW	RNW
SER	29	32	56	59	28	11	16
GOV	13	33			62	15	
FOD	10	5	5	2	0	2	2
HTC	9	7	5	3	1	1	1
CON	8	5	12	10	4	2	2
TRN	6	5	12	17	0	2	3
NSI	5	4	5	4	0	1	1
CRO	4					28	32
ELE	4	3	0	0	0	1	
LVS	3					22	25
OIL	3	3	1	1	1	1	1
COM	2	1	2	3	0	0	1
COF	1					10	11
MIN	1	1	1	1	1	2	1
NRI	1	0	0	0	0	0	0
FFH	1					2	2
THR	0	0	0	0	0	0	0
TOTAL		100	100	100	100	100	100

Table A-4. Structure of Value-Added in Colombia.

	%-Y	%-VA	%-L/VA	%-K/VA	%-SKL/L
SER	29	64	63	37	70
GOV	13	65	81	18	80
FOD	10	26	51	48	76
HTC	9	33	51	46	82
CON	8	47	52	48	71
TRN	6	43	89	10	64
NSI	5	31	64	33	74
CRO	4	81	98	2	
ELE	4	56	25	73	80
LVS	3	69	94	6	
OIL	3	46	44	54	71
COM	2	66	35	63	58
COF	1	84	96	4	
MIN	1	84	88	12	55
NRI	1	63	31	67	53
FFH	1	81	87	13	
THR	0	32	34	65	76

Key:
%-Y: Percentage of Gross Output - Industry Size
%-VA: Value added as a percentage of total product value.
%-L/VA: Labor's share in total value-added.
%-K/VA: Capital's share in total value-added.
%-SKL/L: Skilled labor as a share of total labor for a given industry.