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Domestic Support Policies for Agriculture in Ecuador and the U.S.-Andean Countries Free Trade Agreement: An Applied General Equilibrium Assessment

Carlos E. Ludena¹ and Sara Wong²

¹Department of Agricultural Economics
Purdue University
403 West State St.
West Lafayette, IN 47907, USA
Email: ludenac@purdue.edu

²Escuela Superior Politécnica del Litoral (ESPOL)
Malecon 100 y Loja
Guayaquil, Guayas
Ecuador
Email: sawong@espol.edu.ec

Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Long Beach, California, July 23-26, 2006

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Abstract

For the past two years the United States and Colombia, Peru and Ecuador have been negotiating a Free Trade Agreement (FTA). One of the main concerns of Ecuador's farmers is the asymmetry that exists between U.S. and Ecuador agricultural sectors. U.S. agriculture is highly subsidized in products such as rice, corn, and soybeans, products that represent an important export and subsistence products for Ecuadorian farmers. To reduce any negative effect that the FTA may have, Ecuador's government is studying land-based payments for rice, corn, soybeans and livestock producers. This program would offer direct initial support to farmers' income after the FTA enters in full effect. The objectives of this paper were twofold. First, estimate the effects on the Ecuadorian economy, and especially on Ecuador's agriculture of the FTA. And second, study the viability of the domestic support program for agriculture proposed by the Ecuadorian government, as well as some alternative domestic support policies. We use a modified version of the GTAP global general equilibrium model specific for agriculture support, called GTAP-AGR. The results show that trade liberalization will negatively affect all agricultural sectors in Ecuador, except for the exporting sectors (bananas, coffee, cocoa, and flowers). Government subsidies are estimated to disproportionately help rice and soybeans producers, but they will not be enough for corn and livestock producers. We conclude that government subsidies should be extended to other sector such as sugar cane and cotton.

JEL Classification: F13, C68, Q17, Q18

Key words: Free trade, Tariff liberalization, Ecuador, agriculture, subsidies

Introduction

In May 2004, the United States and the Andean Community nations of Colombia, Peru and Ecuador began negotiating a Free Trade Agreement (FTA). The other two Andean Community nations, Bolivia and Venezuela have not been directly participating in the negotiations, although Bolivia has observer status. By April 2006, Colombia and Peru already reached an agreement with the U.S., and only Ecuador remained in the negotiation table.

As with other FTAs, the agricultural sector is one of the most sensitive, and one of the hardest to negotiate. In Ecuador, agriculture is the most important exporting sector after oil. This sector generates employment for a third of the economic active population, and is an important part of GDP and exports. The principal agricultural export products from Ecuador are bananas, cacao, coffee, flowers, shrimp, and tuna, with a large share of these exports going to the U.S. The main concern of Ecuador's farmers is the asymmetry that exists between U.S. and Ecuador's agricultural sectors. Productivity in U.S. agriculture is higher, with farmers receiving large subsidies that amount to US \$20 billion a year.

Ecuador's government is studying a program of domestic economic support to farmers, to alleviate possible negative effects of the FTA on the Ecuadorian agricultural sector. The government has designed a support program to help sectors directly exposed to competition from subsidized American products. According to government estimates, the agricultural products that would be affected the most by the FTA are rice, corn, soybeans and livestock, which are in some cases either important export commodities (rice), or are import subsistence commodities of Ecuador's farmers (corn, wheat). For

these sectors, the program will offer direct initial support to farmers' income after the FTA enters in full effect.

These payments would be based on land in production, estimated with data from the 2000 agricultural census. The government estimates to pay farmers \$26-100 for every hectare in production, a small number if we compare to payments that U.S. farmers receive. The amount of the subsidy would decrease as the size of the production unit increases. That is, farmers with 10 hectares or less would receive 100% of the subsidy, with farmers with more than 10 hectares receiving a lesser amount. These government subsidies aim to benefit 260,000 production units, of a total of 820,000 that have been registered in the 2000 census. The program is expected as soon as the FTA enters in force. The budget assigned for this program is 100 million US dollars. However, critics argue that the amount should be larger.

The objectives of this paper are twofold. First, estimate the effects on the Ecuadorian economy of a simultaneous bilateral FTA between Ecuador, Colombia, Peru and the U.S. We also analyze what would happen if Ecuador does not sign the FTA, given that Colombia and Peru have already signed it. This possible scenario is feasible given the strong political opposition of indigenous and grass root organizations to such an agreement, and the current state of disputes between the Ecuadorian government and U.S. oil companies. Second, we study the viability of the domestic support program for agriculture proposed by the Ecuadorian government, as well as alternative domestic support policies proposed to mitigate possible negative effects of the FTA on Ecuadorian agricultural sectors.

To tackle these issues, we use a computable general equilibrium (CGE) model. We use a modified version of the GTAP general equilibrium model (Hertel, 1997) called GTAP-AGR (Keeney and Hertel, 2005). This model and database is specifically tailored for analysis of agricultural sectors and domestic support policies. We use version 6.2 of the GTAP database, which includes Ecuador as a disaggregated region in the database. We first perform tariff liberalization scenarios, and then, in a second round of simulations, apply the domestic support policy scenarios that might mitigate possible negative effects of the FTA on the Ecuadorian agricultural sectors.

The results show that trade liberalization will negatively affect all agricultural sectors in Ecuador, except for the exporting sectors (bananas, coffee, cocoa, and flowers). Government subsidies are estimated to disproportionately help rice and soybeans producers, but they will not be enough for corn and livestock producers. We conclude that government subsidies should be extended to other sector such as sugar cane and cotton.

Overview of the Ecuadorian Economy

Ecuador is a small, open, middle-income, agrarian, oil-exporting economy. Gross Domestic Product reached US\$ 30.3 billion in 2004, and GDP per capita US\$ 2,325 dollar. Exports as a share of GDP reached 25.3% in 2004, whereas imports share in domestic demand was 28.1%. Oil revenues represent an important share of total revenues for the central government (34% annual average for 2000-2004). Economic ties to the U.S. remain strong due to trade, foreign direct investment, as well as the use of the dollar as the official Ecuadorian currency.

Since the early 1990s, Ecuador has embarked upon a process of opening up its economy. This process has reverted years of import substitution policies that by the mid-1980s were thought to be curtailing growth and development opportunities. Changes in trade policies included tariff reform, reductions in import restrictions, export promotion laws, modernization of trade institutions, and simplification of trade procedures. For instance, tariff reform brought tariff rates down from a range of 29-290% in 1989 to a range of 0-40% (the upper level applying to vehicles) in 1994. The average nominal tariff rate was reduced from 29% in 1989 to 11% in 1994 (Tamayo 1997). By 1995, most of changes in tariffs aimed at reducing protectionism were finally concluded.

A single indicator of openness, the share of imports plus exports as a percentage of GDP, illustrates the increased trade openness experienced by the Ecuadorian economy since the early 1990s. As Figure 1 indicates, the degree of openness of the Ecuadorian economy went from 37% in 1993 to 49% in 2004. What seem to have contributed to this greater openness are the consolidation of agreements such as CAN, the opening-up of new markets such as Canada, Russia and China, and the continuation of trade preferences that Ecuador receives from the U.S. (ATPA and ATPDEA; see below for a more detailed discussion).

Imports grew at an annual average rate of 14% between 1994 and 2004, reaching US\$ 7,861 million by 2004, more than double of what they were in 1994 (Table 1). As imports have steadily increased, its composition has also changed. The U.S. used to have the biggest import share in total Ecuadorian imports, with a share of over 30% in 1996. By 2004 this share declined to 21%, with partner countries of the Andean Community increasing their share to 25% of total imports. Asia is another region whose import share

in total imports has increased since the late 1990s. The rest of the countries from Latin America and the world have also increased their participation as a whole, in total imports in Ecuador.

For exports, the U.S. is the most important single export market for Ecuador. It has represented more than 38% of Ecuador's total value of exports, every year, for almost a decade (see Table 2). However, the relative importance of the U.S. market has been challenged as Ecuadorian products have gained more access to Andean markets as well as the rest of the world (excluding Asia and Europe).

As for foreign direct investment (FDI), Ecuador has been recipient of growing flows at an annual average rate of 14% since 2000, increasing from US\$720 million in 2000 to US\$1,160 in 2004. Most of these flows have been directed towards the oil extraction industry. Although the share of U.S. FDI in total foreign investment in Ecuador has declined from 77.6% in 1993 to 26.7% in 2004, it still remains the primary source of FDI, ahead of Canada with 26.1% of total foreign direct investment.

Strong economic ties to the U.S. also come from two other events: dollarization and remittances. Ecuador adopted the U.S. dollar as the official currency since January 2000, as a way to halt inflation in the midst of a currency-debt-financial crisis in 1999. As a byproduct of this currency-debt-financial crisis that Ecuadorians endured in 1999, and of the lack of employment, many Ecuadorians emigrated to the U.S. and Europe (mainly Spain). The remittances that these migrants send back have become an important source of household income for the Ecuadorian economy. In 2004, Ecuador received US\$1,604 million in total remittances, accounting for 5% of GDP. Remittances are second only to

oil and ahead of bananas as a source of foreign exchange. In 2004, more than 80 percent of total remittances originated in the U.S. (43 percent) and Spain (39 percent).

Previous discussion on trade and foreign direct investment suggest that, the U.S. constitutes an important export market and source of FDI for Ecuador. In the last 15 years, important changes in trade policy oriented to open the Ecuadorian economy to foreign markets have taken place. These changes in trade policy continue today as Ecuador negotiates its first comprehensive trade agreement with its major trade partners: the U.S. and the Andean countries of Colombia and Peru. This preferential trade agreement is expected to go beyond trade. The U.S.-Ecuador free trade agreement is expected to help Ecuador eliminate sources of inefficiencies (such as problems in customs, low industrial competitiveness, poor infrastructure and outdated technology) and distortions (such as subsidies or high tariffs in some sectors and products). It is expected to demand changes in many policy matters and institutions, and give Ecuadorians opportunities to create more business and jobs.

Agricultural Sector in Ecuador

Traditionally, Ecuador has been an agricultural based economy. The importance of agricultural and farm activities in this economy has changed since the earliest 1970s when oil became the main source of government revenue and exports. However, the importance of the agricultural sector, although diminishing, still holds. For the last 10 years, agriculture has contributed on average with 10% of GDP, only considering primary level (Table 3). It has generated, on average, 42% of total exports (64% excluding oil,

Table 4), and it employs 28% of the economic active population. Its average GDP growth rate has been on average higher than that of the economy as a whole (3.9 versus 2.6%).

The main export product for Ecuador in the last 10 years has been agricultural products (bananas, shrimp and flowers), with an average share of exports of 39.6%. Oil comes in second with 36.6%. However, if we exclude crude oil, agriculture represents almost two thirds of total exports. Banana exports make up half of total agricultural exports. Shrimp has decreased in importance in the last 10 years, due to disease outbreaks. Roses, which are labor intensive, now account for almost 20% of total agricultural exports.

As for domestic production, Ecuador has three distinct production areas: the Coastal region, called *Costa*, the Andean region called *Sierra*, and the oriental region called *Oriente*. The subsidy program that the government plans to implement will be based on total area under production, based on figures from the 2000 Agriculture and Livestock census. In this section we analyze the composition of total land under production, and what sectors and regions could be more benefited by these subsidies.

In terms of area harvested, the main products are fruits (45%), sugar cane (37%), oilseeds (9%) and cereals and other grains (7%) (see Table 5). Other crops that are not extensive and require large amounts of land are coffee (2%) and potatoes and cassava (0.5%). Flowers, is not an extensive crops, and a total of less than 5,000 hectares are planted. Within fruits, we have that 91% of area harvested corresponds to bananas and plantains. Within oilseeds, 86% of area harvested is oil palm and 8% soybeans. These crops (and sugar cane) are tropical crops, and are almost entirely produced in the *Costa* region. As for grains and cereals, corn and rice are the two most important crops. Corn is

42% and rice is 34% of total area harvested in grains and cereals. For corn (grain), 74% of area under production is in the *Costa* region and 23% in the *Sierra*. For rice, 98% is produced in the *Costa* region.

Land Tenure and the FTA

According to the Ministry of Agriculture, the most affected products if Ecuador signs the FTA would be rice, corn, and soybeans. For this reason, we next focus on the total number of producers and the area planted for these crops. We look at the distribution of total number of producers, their size and the total amount of land under production that is less than 10 hectares, which is the production unit size that the government has established as the threshold for giving 100% of the subsidy.

According to the 2000 Agricultural Census, there were a total of 75,814 Agricultural Production Units (APU) producing rice, with a total area of 343,936 hectares (Table 6). Farmers with 10 hectares or less accounted for almost two thirds of total APUs, but only held one third of total land under production. Medium farmers, with farms between 10-50 hectares accounted for 28% of total APU, holding almost the same amount of land as small farmers. As for large farmers, they were only 7% of total production units, but with almost one third of total land. These numbers show that the proposed subsidy plan would help in its full form (100% of subsidy) to almost two thirds of rice producers. The total amount of subsidy for these farmers, would add up to almost US\$ 8 million.

For corn, Ecuador produces it as grain and on the cob, both for hard and soft corn. We look at grain hard corn production only, because producers that would be directly

affected by U.S. imports are the producers of dry grain quality corn. The total number of APUs with corn production was 81,943, representing 240,201 hectares. Producers with less than 10 hectares accounted for more than half of total APUs, but only held a little bit more than a quarter of total land under production. Producers with APUs between 10-50 hectares were 36% of APUs, and accounted for almost half the land under production. Large producers with more than 50 hectares accounted for 12% of APUs, but held almost the same amount of land under production as small producers.

For soybeans, there is a total of 4,226 APUs, representing 54,350 hectares. The majority (60%) are small producers, holding only 14% of land. APUs between 10-50 hectares are one third of producers and hold a proportional amount of land. Large producers with more than 50 hectares are only 10% of APUs; however, they hold more than half of the total land in production (55%).

As for livestock production, the main sectors are beef, milk, pigs and poultry. Half of beef and milk animal stock is in the *Sierra*, and a third in the coastal region. As for pigs, two thirds are produced in *Sierra*, and the rest in the other regions. Sheep are mostly produced in the *Sierra* and with 75% of goats produced in that region. As for poultry, half is in the *Sierra* and 40% in the coastal region.

As we have mentioned, the livestock sector might be one of the beneficiaries of the government subsidies. We assume in this case that they will have the same scheme as crops, and will be based on amount of land under. Table 7 shows the number of producers (APUs) by size and the amount of land under production. For bovine cattle for meat production, almost half of the land is held by only 9% of producers. Close to 70% of producers are small producers (less than 10 hectares), but they hold only 25% of total

land. For milk production, land is more equally distributed among producers, no matter what their size is. For pigs, three quarters of producers are small producers, holding 60% of land.

In poultry production we distinguish two types of producers: backyard producers and commercial producers. The first are characterized that the large majority (71%) are small producers, holding sixty percent of total poultry stock. As for commercial producers, the majority is also small producers, but they hold only a little bit more than a quarter of poultry stock. The majority of stock (73%) is held by medium and large producers, which account for only 30% of total producers. Finally, sheep and other cattle are mainly small producers, holding more than 70% of animal stock.

FTA between the U.S. and the Andean countries

In 2004, the U.S. and the Andean nations of Colombia, Ecuador and Peru began negotiations on a free trade agreement (FTA). These Andean countries wanted to ensure access for their products to the U.S. market, especially since the Andean Trade Promotion and Drug Eradication Act (ATPDEA) is scheduled to expire by the end of 2006. In 2004, Colombia accounted for about half of the U.S. trade with the region, with Peru and Ecuador almost evenly splitting the other half, and Bolivia accounting for a very small share. The main exports from the region to the U.S. were crude petroleum oil (37% of all imports) mainly from Ecuador and Colombia. Other exports to the U.S. included gold, coal, cut flowers, coffee, articles of copper, and bananas. Major imports of the Andean countries from the U.S. were mining equipment, wheat, broadcasting equipment, and maize.

The U.S. currently gives duty-free treatment to exports from the Andean countries (excluding Venezuela) under a regional and unilateral trade preference program. The ATPA granted duty-free treatment to certain products, and the Andean Trade Promotion and Drug Eradication Act (ATPDEA) reauthorized the ATPA program and added products that had been previously excluded. In 2004, over half of exports from the Andean countries to the U.S. entered under these preferences.

The ATPA program began in 1991, granting duty-free treatment to certain products that met domestic content and other requirements. The purpose of the program was to promote economic growth in the Andean region and to encourage a shift away from economic dependence on production of illegal drugs, by supporting legitimate economic activities. ATPA was originally authorized for 10 years and expired in 2001. For the period 1993-2001, exports to the U.S. that benefited from ATPA totaled an annual average of US\$1,667 millions. Agricultural, fish, and agro-industrial products constituted about 70% of total exports value for that period. The remaining value was mostly explained by oil and oil related products exports. (See Table 8).

ATPDEA was enacted in 2002, reauthorizing the ATPA preference program and expanding trade preferences. The additional products under ATPDEA include petroleum and petroleum products, certain footwear, tuna in flexible containers, and certain watches and leather products. ATPDEA also grants duty-free treatment to certain apparel articles, if the articles met domestic content rules. Duty free benefits under ATPDEA are scheduled to end December 31, 2006.

In 2004, 42% of all exports from the four Andean countries to the U.S. entered duty-free under ATPDEA, and 12% entered duty-free under ATPA (Cárate and

Fernández, 2004). Two percent entered duty-free under the U.S. Generalized System of Preferences (GSP), which applies to most developing countries, and of the remaining 44% of exports, most entered duty-free under normal trade relations. Only 10% of the value of U.S. imports from the four countries was subject to duties in 2004. Thus, compared to the status quo, only a relatively small share of exports from the Andean countries would become duty-free under an FTA. That small share, however, might include products that are very important to the Andean countries or relatively import-sensitive to the U.S.

Ecuador's exports to the U.S. are greatly concentrated in a handful of products. In 2003, of a total of USD 2,387 millions exported to the U.S., 54% were crude oil and refined products (Cárate and Fernández, 2004). When we account the top 10 export products (oil, bananas, cut roses, frozen shrimp, and tuna), they represent 85% of total exports to the U.S. and 947 other products represent only 3%. In 2003, out of 5,861 possible products under the ATPDEA, Ecuador exported a total of 870 products duty-free. These 870 products represented 95% of total products exported, with more than half being oil related products and 23% traditional export products (like bananas, coffee, cacao). Non-traditional products represented 20% of exports under ATPDEA. From these, 44% were cut flowers, 10% wood and wood related products. Of those exports excluded by the ATPDEA, the main two products are tuna and sugar (91% of total products excluded) and in lesser amount textiles.

According to the Ecuador's Ministry of Agriculture, the objective of the agricultural negotiations is to consolidate the agro-industrial products that currently are exported through ATPDEA and GSP, representing 30% of total Ecuadorian exports to the

U.S. The remaining 70% already has duty-free status. The most important Ecuadorian agricultural products included under the ATPDEA are cut flowers, frozen shrimp, canned tuna, mangos, sugar, passion fruit, pineapples, beans, cauliflower, and broccoli. These products represent around \$300 million dollars of total exports. Bananas, coffee, cacao, tea, and other products already enter the US under duty-free status without the ATPDEA.

FTA Negotiations

In terms of negotiations, there are two important issues that are worth noticing. The first is the amount of subsidies that the U.S. government gives to their farmers. This subsidies affect specially rice, sugar, dairy, corn, wheat and soybeans, which are in some cases either important export commodities (rice), or are import subsistence commodities of Ecuador's farmers (corn, wheat). However, U.S. negotiators have refused to talk about rules for agricultural subsidies, saying that subsidies should be dealt with in the on-going multilateral trade negotiations in the WTO.

The second is a mechanism that Andean countries have to help domestic producers against changes in world commodity prices called the "price-band mechanism". Under this system, a variable tariff is imposed to keep import's price of a commodity within a specific range. If prices for wheat, corn, or rice fell below certain levels, variable tariffs of up to 100% are applied to restore domestic prices. Import tariffs fall when prices increase to certain levels. For Colombia and Ecuador, this mechanism covers over 150 items, including corn, rice, soybeans, and powdered milk. An important goal for the U.S. in the FTA talks has been the elimination of this system. However, Andean negotiators have said that the price-band mechanism is necessary to protect their

farmers, especially small farmers, against subsidized imports. So far, the U.S. has achieved his goal: Peru will eliminate this system upon entry to the FTA, with only few exceptions where the price bands mechanism will be replaced with special agricultural safeguards (El Comercio, 01/22/2006).

As this paper is written (May 2006) Peru and Colombia already finished negotiations. Peru's negotiations in agriculture can be described as short term tariff reductions, with large import volumes for U.S. products. This reflects Peru's condition as a net food importer of corn, soybeans, powdered milk, meat, etc. Ecuador is still negotiating, and agriculture has been left for last. Ecuador wants to maintain the market access gained with the ATPDEA, and expand it to the few products not already covered (such as canned tuna, sugar, and some leather and textile products), making it permanent and without conditions.

Rice production in Ecuador satisfies local consumption and surplus production is exported to neighbors such as Colombia and Peru. Ecuador's government is worried that rice, corn and soybean exports to Peru and Colombia will be harmed by cheap imports from the U.S. Ecuadorian producers don't want large import volumes, and want to limit import quotas to 3,000 annual metric tons, with extended exclusion periods of 25 years to protect local production. However, the U.S. has asked for a 28,000 annual tons import quota.

For corn, Ecuador's wants to allow no more than 200,000 annual tons. However, the U.S. wants market access of double that amount. Ecuador has allowed wheat and oats for beer production to enter duty free. In exchange, some Andean cereals such as quinoa will have zero tariffs in the U.S. For oilseeds, a special issue is the access to soybean oil,

which is a substitute of local palm oil. According to press news as of April 2006, the oil and fats sector in Ecuador reached an agreement that, according to industry representatives, would represent 120,000 jobs and investment for 800 million dollars.

For meat and milk, Ecuador wants tariff reductions within 20 years, with technical exclusions for powdered milk. For beef, livestock producers would allow a quota no larger than 170 annual tons, which represents less than 1% of local production. Powdered milk is a sensitive product for Ecuador, which is not the case for Peru or Colombia. Ecuador's position is to allow no more than 240 annual tons of powdered milk imports, which is manageable for local milk producers. In contrast, Peru and Colombia agreed to 10 times that volume. For chicken parts, Ecuador's position is to allow free market access to 7,000 tons per year, with tariff deregulation in 18 years, with the first 6 years still with old tariffs, making the FTA effective by 2013. For tuna, which is included in ATPDEA, Ecuador is looking for free market access.

Other food products such as sugar expect to export 25,000 tons (sugar exports quota currently is 11,000 metric tons). Similar to Colombia, Ecuador would like to include under this quota, products with high content of sugar, like sweets and cookies. In exchange, Ecuador would allow free market access of glucose and fructose, an important input for that industry. In the case of glucose there would be full access, and for fructose only partial access, since it competes with local sugar production.

Model and Data: GTAP-AGR - A General Equilibrium Approach

The framework of analysis of trade liberalization and agricultural subsidies is a computable general equilibrium model, with special features for the analysis of

agricultural issues. We use the Global Trade Analysis Project (GTAP) model of global trade (Hertel, 1997), version 6.2 with a base year of 2001 that includes for the first time Ecuador and Bolivia as individual countries in this database. The GTAP model is a standard, multi-region, multi-sector model which includes explicitly treatment of international trade and transport margins, global savings and investment, and price and income responsiveness across countries. It assumes perfect competition, constant returns to scale, and an Armington specification for bilateral trade flows that differentiates trade by origin.

However, critiques argue that the standard GTAP model does not capture some of the important characteristics of the agricultural economy. To include these special features there is a modified version of the GTAP model and database called GTAP-AGR (Keeney and Hertel, 2005). The GTAP-AGR model captures certain structural features of world agricultural markets that are not well reflected in the standard GTAP model.

GTAP-AGR provides a more realistic representation of the farm and food system. It explicitly identifies farm households as entities that earn income from both farm and non farm activities, pay taxes, and consume both food and non food products. The model tries to characterize the degree of factor market segmentation between agriculture and other sectors of the economy, as well as to improve the representation of input substitution possibilities in farm production.

In terms of primary factor supply and its market segmentation, the GTAP-AGR model specifies a constant elasticity of transformation (CET) function that “transforms” labor in agriculture into labor for other economic sectors. That is, increased supplies of labor to manufacturing and services must be drawn from agriculture, and vice versa. This

model specification allows for wages to diverge between agriculture and other sectors. Capital segmentation is modeled in the same way.

For factor demand, GTAP-AGR uses a nested constant elasticity of substitution (CES) production function, using two types of inputs: farm-owned and purchased inputs. The latter is a feature that distinguishes the GTAP-AGR from the standard GTAP model. Given their limited availability, the supply and substitution elasticities values for developing countries (including Ecuador and the other Andean nations) are taken from Mexico. The GTAP-AGR also accounts for the substitution possibilities among feedstuffs used in livestock production, included as a nested CES within the purchased inputs aggregate.

Consumer demand assumes separability of food and non-food commodities. It includes income and price elasticities for one (1) non-food category and eight (8) food commodity groups: breads and cereals (rice, wheat, etc.), fruits and vegetables, meats, fish, dairy, fats and oils, beverages and tobacco, and other foods (sugar, coffee, etc.). As noted by Keeney and Hertel, this specification is adequate for most agricultural liberalization scenarios, but it might present some problems when impacts of non-food liberalization are important to the analysis. We should take this into account when we analyze our results.

As described before, farm household income in GTAP-AGR accounts for on-farm and off-farm income generation and assumes that all endowments employed in primary agriculture are farm-owned endowments. Agricultural households are identified as entities that earn income from both farm and non-farm activities, pay taxes, and consume both food and non-food products.

As mentioned by Keeney and Hertel, the GTAP version that serves as the base for GTAP-AGR is version 6 of the database, is not as readily flexible with respect to commodity and region aggregation. For commodity aggregation, the database works well for us, since we have the full disaggregation of farm and food sectors. However, for regional disaggregation, we need to modify the database to fit our needs.

This version did not include Ecuador (or Bolivia) in it (later included in version 6.1). For that reason we needed to expand the parameters of GTAP-AGR from 87 to 92 regions (commodities were the same number). Due to lack of information, we were unable to supplement the parameter estimates for Ecuador. For that reason, we let the disaggregated regions inherit the parameters from parent regions; in the case of Ecuador, the aggregated “Rest of Andean Pact” from version 6, which included both Ecuador and Bolivia. These parameters are the same for all developing countries, with Mexico being the source of these parameters.

As for the database aggregation we used FlexAGG, a GTAP utility that allows for custom aggregations of the database. We modified the parameter aggregation module, given additional parameters in GTAP-AGR and other parameters with different dimension specification, compared to the standard GTAP model. Specifically, two key parameters are now indexed also by region: the CET elasticity of transformation for sluggish factor endowments (ETRAE) and the CES elasticity of substitution between primary factors in production of value added (ESUBVA).

We aggregate the GTAP database version 6.2 into 13 regions and 24 commodities. Our regional aggregation tries to focus on the Western Hemisphere, especially on the Andean countries and its neighbors. As for our commodity aggregation,

our focus is on agricultural products, the emphasis of this paper (Tables A1 and A2 in the appendix). There are 5 factors of production: skilled labor, unskilled labor, capital, land, and natural resources.

Free Trade Agreement Simulations

We consider a total of four liberalization scenarios. The first scenario is where Ecuador signs the FTA agreement with the U.S. at the same time as Colombia and Peru. We assume that full market access is allowed for all goods across the U.S. and the Andean nations, with no exclusions from free markets access. That is, all tariff barriers are eliminated for agriculture and manufacturing sectors. Obviously, the model can also be run with sectors exempted in different degrees from full market access (such as sugar or rice), including the permanence of some tariff rate quotas.

A second scenario assumes that Ecuador does not sign a FTA with the U.S., but Peru and Colombia do. This scenario is a political possibility under the current circumstances in Ecuador. Indigenous organizations and grass roots groups oppose very strongly to any agreement between the U.S. and Ecuador. These groups have expressed concern over the impact that opening domestic markets to U.S. products might have. They point out the case of Mexico and the experience of their agricultural sector under NAFTA. They argue that employment in the agricultural sector decreased due to cheap subsidized corn imports from the U.S. that disrupted domestic markets. Another obstacle to the FTA is a host of disputes that the Ecuadorian government maintains with some U.S. oil companies.

A third scenario takes the first liberalization scenario and incorporates the free trade agreement between the Andean Community of Nations (CAN) – including all 5 Andean countries (Bolivia, Colombia, Ecuador, Peru, and Venezuela) – and MERCOSUR (Argentina Brazil and Uruguay).¹ A fourth scenario incorporates the CAN-MERCOSUR free trade agreement and combines it with our second scenario. In other words, Ecuador does not sign an FTA with the U.S., but it does sign with the MERCOSUR countries.

Although there have been worries from Ecuador producers about the level of subsidies that U.S. producers receive (especially for such products such as rice, corn, soybeans, and sugar), we have assumed that the U.S. will not eliminate support to their agricultural producers in the regional trade agreements considered here. The U.S. has already indicated that they are prepared to negotiate domestic support only within multilateral negotiations in the WTO. Therefore, the distorting effects of producer subsidies in the U.S. are not considered.

Ecuador's government expects that the FTA will allow local production to modernize for better competition in world markets. Some aspects that are expected to improve are sanitary and phytosanitary conditions, port management efficiency, etc. However, it is worth noticing that the GTAP database does not account for phytosanitary barriers, quotas, and voluntary export restraint agreements that may affect certain agricultural products (such as some fruits and vegetables). These barriers do not show up on the tariff equivalent data included in the GTAP database. For this reason, the potential impact of the full market accession may be underestimated in the model.

¹ Paraguay is included in the GTAP database as an aggregate region called Rest of South America along with Guyana, Suriname and Falklands Islands.

Domestic Support Simulations

As discussed before, the government is planning cash support payments for Ecuadorian farmers based on the amount of land in production. The government is going to target three specific crops: rice, corn and soybeans, which according to government sources are the agricultural sectors that will be most affected by the FTA with the U.S. Rice production in Ecuador satisfies local consumption and surplus production is exported to neighbors such as Colombia and Peru. Ecuador's government is worried that rice exports to Peru and Colombia, as well as local production of corn and soybean will be harmed by cheap imports from the U.S.

The government has developed a subsidy scheme where they make distinctions by size of production unit (APU). On this scheme, small farmers with less than 20 hectares receive 100% of the land-based payment, farmers with APUs between 20-50 hectares receive 70% of the subsidy and farmers with more than 50 hectares receive half of the subsidy. For example, in corn, small farmers will receive \$110/Ha., medium size farmers \$77/Ha., and large farmers \$55/Ha. Also, bovine livestock producers would receive cash payments based on APUs' size. (See Table 9).

We implement the government plan in GTAP-AGR, taking the total value of subsidy payments by sector, and transforming them to percentage shocks. The size of the shock for each sector is based on the size of the subsidy payments relative to the value of land at producer prices in each sector. That is, we assume that subsidy payments are direct subsidies to the cost of land.

For our alternative subsidy scheme, we base our subsidy payments on the results of the first scenario, the FTA between U.S and the three Andean countries. We consider

land-based subsidy payments for those sectors in Ecuador negatively affected by the FTA. These, as we later discuss, are all agricultural sectors except for fruits and vegetables (bananas), and other crops (coffee, cacao, roses). We estimate the size of the subsidy payments that would leave farm welfare unchanged for those sectors with welfare losses with the FTA. We estimate this by making farm income endogenous and land subsidies exogenous.

It is important to note that we estimate the size of the subsidies needed by the agricultural sectors, but we don't estimate how Ecuador's government is going to finance them. The government plans to finance these subsidy payments by reducing subsidies to domestic gas. They plan to provide the gas subsidy – which now is allocated to all consumers – to specific consumers that need these subsidies the most.

Results: Effects of the FTA on the Ecuadorian agricultural sector

We start our discussion with the first scenario (Scenario 1a) where the FTA is signed by all Andean countries and the U.S. This FTA would give free access to U.S. imports into Andean markets, and keep and improve the trade preferences that the U.S. gives to these countries. Andean countries already receive tariff preferential treatment from the U.S. which has set tariffs to zero or almost zero for most goods that the U.S. imports from these Andean countries (except Venezuela). Then, in practice, the FTA is a unilateral tariff concession from the Andean countries to the U.S.

Because of that unilateral liberalization the agreement would lead, on impact, to a fall in GDP in all Andean countries, with only U.S. GDP increasing by 0.05% (see Table 10). Total imports for all Andean countries would increase by more than 2%, given tariff

reduction that would bring a change in relative prices in favor of U.S. products. Exports would also increase, although less than imports (1.4% for Ecuador) which would contribute to deterioration in Andean countries' trade balance and terms of trade. Private consumption would decrease (1.5% for Ecuador), similar to the fall in GDP. Economic welfare is expected to fall in the Andean countries, and for Ecuador, this fall would be around US\$53 million.

At the sectoral level, almost all sectors in Ecuador show a negative impact on value added (Table 11). Exceptions are export oriented sectors, both traditional (fruits and vegetables, coffee, cocoa, oil, fish, processed rice) and nontraditional (roses, other food products). In contrast, both total imports and total exports increase. The biggest increase in imports would come from the meat and dairy products sectors, which are currently some of the most protected sectors in Ecuador. Imports of bovine meat products would grow by 23.8%, other meat products by 36.4%, and dairy products by 8.3% (See Table 12). On the export side, performance of traditional exports is lackluster with vegetables and fruits growing by 1.3%, other crops (cocoa, coffee, and roses) by 1.6%, and forestry by 4.5%. As feared by Ecuador's government, sectors with negative impact include paddy rice (-31.7%), cereal grains (-16.7%), soybeans (-11.1%), meat products (pork, poultry meat; -20.3%), and sugar (-10.1%).²

For farmers in Ecuador, Colombia and Peru, the FTA would imply a fall in factor income (at market prices net of depreciation) (second to last column in Table 10). However, real farm income in Ecuador would increase by 0.36% (last column in table 10). This implies that the fall in prices would more than compensate a fall in nominal farm income.

² We have not considered, in any of the FTA scenarios, an increase in the sugar annual quota that the U.S. gives to sugar imports from Andean countries. We would do so, in a later version.

A detailed analysis of the sources of farm income between ‘on’ and ‘off’ farm income, according to the origin of the farm employed endowments shows that on-farm employed endowment contributes to the rise of real farm income in Ecuador (Table 13). As we analyze the increase in farm income at the sectoral level (See Table 14), only sectors that include traditional export goods (such as banana, cocoa, coffee) and flowers (one of the sectors that benefits from ATPDEA preferences) show an increase on real farm income. These results show that for rice, corn, soybean and livestock farmers, income decreases as expected by Ecuador’s government. This supports the implementation of a subsidy program to help farmers reduce the negative impact of the FTA on their income.

Our second scenario (Scenario 1b) assumes that Ecuador does not enter the FTA (but Colombia and Peru do), losing its ATPDEA preferences, with the U.S. imposing tariffs similar as Venezuela (which is excluded from ATPDEA). Under this scenario, Ecuador’s GDP fall by -0.4% (Table 10). Falls in consumption (-0.41%) and exports (-0.36%) contribute to the decrease in GDP. The somewhat bigger fall in imports than exports (-0.46%) contributes to a slight improvement in Ecuador’s trade balance. Despite the fall in all main macroeconomic indicators, welfare rises slightly in Ecuador (US\$ 8.74 million).

Imports in all sectors fall (except wheat and sugar), as well as exports of sectors that would lose the ATPDEA preferences (Table 12). That is the case of the sector that includes flower (-0.4%), but also of sectors that seek protection from an FTA such as rice and dairy products (-6%). For paddy rice (-34%), processed rice (-5.2%), cereal grains (-17%), soybeans (-12%), and meat products (-23%), exports decrease is larger than with the FTA. For other crops (flowers, coffee, and cocoa) and dairy products exports actually

decrease compared to increased exports in the FTA scenario. For traditional exports such as bananas, exports increase (0.4%), but less than when the FTA is signed. These export losses are important, because sectors like roses are labor intensive and represent 75% of all new jobs (or 15,600 jobs) generated under ATPA preferences. (See Andean Community, 2001)

As sectors that benefit from the ATPDEA lose these preferences, real farm income falls (-0.01%), as opposed to the increase experienced when Ecuador joins the FTA (Table 13). The main source of this fall on real farm income comes from off-farm employed endowments. As we analyze by sector, this negative impact on farm income comes from losses in exporting sectors that benefited before with the FTA (Table 14). However, it is worth noticing that for some sectors, real farm income decreases less compared to the FTA scenario (rice, cereal grains, soybeans and livestock).

As we account for the foreign trade agreement between MERCOSUR and Andean countries at the same time that we include the FTA between Andean countries and the U.S. (Scenario 2a), the impacts on GDP are similar to those when the US-CAN FTA alone (Table 10). However, Ecuadorian exports and imports experience a bigger percentage increase, imports grow more than exports, and thus contribute to terms of trade deterioration. Under this scenario, Ecuador shows the biggest fall in welfare among the four scenarios of trade liberalization (US\$73 million).

Just few sectors show a fall in imports (See Table 12). These sectors include: paddy rice (-0.25), sugar cane (-1.5%), raw milk (-3.2%), and processed rice (-2.3%). Again, the biggest increments in imports are for sectors that have been traditionally well protected (bovine meat products, other meat products, dairy, cereal grains). Imports of

vegetable oils and fats increase by 30% only when we include the CAN-MERCOSUR trade agreement. As with the first scenario (U.S.-Andean FTA), paddy rice (-34%), cereal grains (-18%), soybeans (-15%), meat products (-23%), and sugar (-11%) experience a big fall in exports. Due to increased imports, exports of vegetable oils and fats decrease by 17%.

Factor income in Ecuador falls, but by less than in the first FTA scenario. However, real factor income increases. This growth comes from the increase in real farm income of on-farm employed endowment that surpasses a fall in real farm income that includes off-farm employed endowments (Table 13). The sectors that show an increase in real farm income include fruits and vegetables (2.4%), other crops (coffee, cocoa, and roses, with 1.1%), and wheat (1.1%). (Table 14)

In the final trade liberalization scenario analyzed, Ecuador enters the FTA with MERCOSUR (as well as the other four Andean countries), but does not sign the FTA with the U.S. (although Colombia and Peru do). As in the second scenario, Ecuador loses ATPDEA preferences and receives similar tariff regime as Venezuela. Ecuadorian GDP falls (-0.6%), with private consumption contributing to this fall (-0.6%), but exports do not, as they increase (0.5%). Imports increase slightly (0.7%). Welfare falls, but less than when Ecuador signs FTA with U.S. and MERCOSUR, and even less when it signs FTA with U.S. Under this scenario, only the vegetable oils and fats sector has a large increase in imports (28%). Other sectors show a modest increase in imports or a fall (Table 12). On the export side, sectors with big fall in exports include: paddy rice, cereal grains, soybeans, meat products, vegetable oils and fats, sugar, and wool.

Factor income falls in Ecuador (-0.21%), but real farm income rises (0.52%). As with other scenarios, on farm income is the main source of this increase in real farm income. The sectors that show an increase in real farm income include (as in previous scenarios): wheat (2.2%), fruits and vegetables (1.8%), and plant based fibers (cotton; 0.65%). (Tables 13, and 14).

Support Scenarios Results

The effect of the FTA and the help that government subsidies give to farmers' income are shown in table 15. As discussed previously, the FTA has negative effects on all agricultural sectors, except for the export sectors (bananas, coffee, cacao and flowers). As discussed before, government subsidies are only directed to three crop production sectors (rice, corn and soybeans) and four livestock sectors.

Table 16 shows the size of land subsidy payments for each agricultural sector in Ecuador under the FTA between U.S. and the Andean countries relative to the value of land. The first two columns show subsidies under the assumption that all livestock sectors (including pigs and poultry production) receive land based subsidies. The last two columns show the size of subsidies, with pigs and poultry excluded from subsidies to the livestock sector.

The sector that receives the largest subsidy is rice with a subsidy that amounts 215% the cost of land in the GTAP database. Corn receives a 176% subsidy, soybeans 59%, and all four livestock sectors 35%. For the scenario where we exclude pigs and poultry, the subsidy increases to 54% the value of land in livestock production (Table 16). These government subsidies are estimated to disproportionally help rice and

soybeans producers, but they will not be enough for corn and livestock producers (second column in table 15).

Farmers' income for rice and soybeans producers increases by 149% and 14%, respectively. For corn and other grain producers, farmers' income decreases by 126%. For livestock producers, income decreases between 2 and 6%. Subsidies do help livestock producers, when we eliminate pigs and poultry producers from the subsidy plan. Livestock producers increase their income by 1 to 5 percent. As noted by Keeney and Hertel (2005), the factor supply elasticities in the GTAP-AGR model are less than one. This means that commodity supply will be less price responsive, and most of the benefits of farm subsidies will accrue to farm households, as opposed to consumers of the farm products.

As a result of the FTA, and with subsidies at hand, rice farmers decrease their production by 0.36%. As production decreases, the rice sector starts demanding fewer resources (especially land). This drives up the price of land under rice production by 250%. One of the reasons that rice farmers benefit so much by the program is that the price of land – which is a cost of production, but also part of farmers' income – increases. Rice farmers benefit from this relative increase in land prices of land under rice production. For comparison, price of land in all other agricultural sectors fall between 40 and 200%. As we eliminate pigs and poultry producers from subsidies, livestock, but also corn producers benefit. Rice producers' income increases from 149% to 156%. Corn producers, on the other hand, lose more than before (income decreases 128% vs. 126%). Soybean producers remain the same.

As explained before, we estimated the amount of land subsidy payments that would leave farmers income unchanged. These subsidies are shown in the second and fourth columns of table 16. According to our results, Ecuador's government should extend these subsidies payments to other sectors such as sugar cane and cotton. Also, the size of subsidy payments should be less than the government's plan. These values denote an optimal plan that would have leave farmers as well off as they were before the FTA.

Conclusion

As Ecuador enters a FTA with the U.S., and given that the U.S. has already opened its markets to Andean countries through unilateral trade preferences, an FTA with the U.S. would imply a unilateral tariff reduction by Ecuador. As a result, the FTA will mean, on impact, welfare loses for Ecuador (as well as for Colombia and Peru). But an FTA with the U.S. does not necessarily imply a fall in income for Ecuadorian farmers. In fact, the only scenario in which real farm income falls is where Ecuador does not sign the FTA. Sectors that win from an FTA in term of effects on exports, factor income, and real farm income include both those sectors that benefit from current ATPDEA preferences such as roses, and traditional export sectors such as bananas, cocoa, and coffee. These same sectors would be harmed if the FTA is not signed by Ecuador.

We conclude that subsidies that the government plans to give to rice, corn, soybean and livestock farmers are justified, given the negative effects that the FTA has on these sectors in terms of exports and farm income. However, these subsidies should be extended to other sectors such as sugar cane and cotton which also receive negative impacts from the FTA. Government subsidies are also estimated to disproportionately help

rice and soybeans producers, but they will not be enough for corn and livestock producers.

Limitations and Future Research

A limitation of this study is that the parameters used are not specific for Ecuador. As noted by Keeney and Hertel, all parameters for developing countries in GTAP-AGR were borrowed from Mexico. Another limitation is that it does not include phytosanitary barriers, quotas, and voluntary export restraint agreements that may affect certain agricultural products (such as some fruits and vegetables). As for our subsidy estimates, we have pointed out that we do not estimate how this would be financed. We assume that they come directly from Ecuador's government and add up to its deficit.

Future Research

The government expects to attract direct foreign investments for agricultural production with more value added and technological innovation, and generate market opportunities for new agricultural exports. As some authors have noted (see Diao et al., 2002), trade liberalization affects country productivity through the access to new technology, scale effects of increased exports, and better efficiency due to increased competition in previously protected domestic markets. In future research, we plan to introduce these technological spillovers from developed countries (in this case the U.S.) to better reflect the improvements that Ecuador's government expects from the FTA. We also expect to introduce increased sugar quotas for Andean exports to the U.S.

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FIGURES

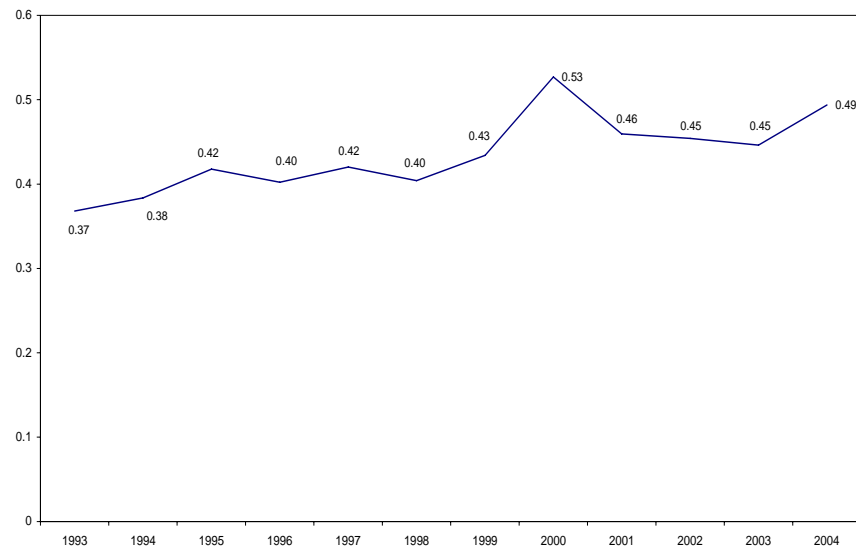


Figure 1. Ecuador: Trade Openness Index, 1993 - 2004

Source: Trade Statistics, Central Bank of Ecuador. Authors' construction.

TABLES

Table 1. Total Imports by region in Ecuador (Millions of U.S. Dollars, CIF)

Region	1996	1997	1998	1999	2000	2001	2002	2003 ¹	2004 ¹
U.S.A ²	1222	1516	1680	919	932	1326	1481	1401	1623
Andean Community	653	918	976	611	847	1173	1416	1490	1929
European Union	700	807	820	427	412	665	890	812	814
Asia	413	572	804	329	545	835	967	985	1221
Rest of the World	944	1141	1295	732	986	1364	1678	1846	2272
Total Imports	3932	4955	5576	3017	3721	5363	6431	6534	7861
<hr/>									
Share of Imports (%)									
U.S.A	31	31	30	30	25	25	23	21	21
Andean Community	17	19	18	20	23	22	22	23	25
European Union	18	16	15	14	11	12	14	12	10
Asia	11	12	14	11	15	16	15	15	16
Rest of the World	24	23	23	25	26	26	26	29	28
Total	100	100	100	100	100	100	100	100	100

Source: Trade Statistics, Central Bank of Ecuador, and own construction.

1/. For years 2003-2004, figures are provisional. 2/. U.S. import data includes Puerto Rico.

Table 2. Total Exports by region of destination in Ecuador (Millions of U.S. Dollars, FOB)

Region	1996	1997	1998	1999	2000	2001	2002	2003	2004
U.S.A	1859	2032	1637	1708	1875	1790	2052	2452	3286
Andean Community	428	636	548	483	687	837	805	1055	1026
European Union	943	1017	872	818	611	665	793	1037	1012
Asia	603	575	345	492	579	446	545	384	374
Rest of the World	1067	1004	741	951	1176	941	938	1111	1959
Total Imports	4873	5264	4203	4451	4927	4678	5036	6039	7655
Share of Exports (%)									
U.S.A	38	39	39	38	38	38	41	41	43
Andean Community	9	12	13	11	14	18	16	17	13
European Union	19	19	21	18	12	14	16	17	13
Asia	12	11	8	11	12	10	9	6	5
Rest of the World	22	19	19	22	24	20	18	19	26
Total	100	100	100	100	100	100	100	100	100

Source: Trade Statistics, Central Bank of Ecuador, and own construction.

Table 3. Ecuador: Gross Domestic Product, 1994-2005

Year	Total GDP		Agriculture, livestock and forestry GDP		
	Millions of U.S. dollars	Annual growth rate (%)	Millions of U.S. dollars	Annual growth rate (%)	Share in Total GDP (%)
1994	18,573		2,460		13.2
1995	20,196	1.7	2,597	2.6	12.9
1996	21,268	2.4	2,606	8.3	12.3
1997	23,636	4.1	2,802	9.1	11.9
1998	23,255	2.1	2,307	-5.0	9.9
1999	16,674	-6.3	1,653	13.0	9.9
2000	15,934	2.8	1,466	4.3	9.2
2001*	21,024	5.1	1,647	0.4	7.8
2002*	24,311	3.4	1,917	7.5	7.9
2003*	27,201	2.7	1,829	0.9	6.7
2004*	30,282	6.6	1,935	0.3	6.4
2005**	31,722	3.9	2,020	1.6	6.4
Average 1995-2005		2.6		3.9	

Source: Central Bank of Ecuador

* = Provisional, ** = Projected

Table 4. Exports Shares (%) by Main Export Product in Ecuador, 1993-2005.

Year	Bananas and Plantains	Shrimp	Tuna	Flowers	Other Agriculture ¹	Total Agriculture	Crude Oil	Other Industrial ²
1994	18	14	1	2	17	52	31	18
1995	20	15	2	2	11	50	32	19
1996	20	13	1	2	11	47	31	22
1997	25	17	1	2	8	53	27	19
1998	25	21	1	4	6	56	19	24
1999	21	14	1	4	7	47	29	24
2000	17	6	1	4	4	32	44	25
2001	18	6	1	5	6	36	37	27
2002	19	5	1	6	6	37	37	26
2003	18	5	1	5	6	34	39	26
2004	13	4	1	5	5	27	51	22
2005	13	5	0	5	4	27	52	22
Average 1995-2005						39.6	36.6	23.7

Source: Central Bank of Ecuador

1/ Other Agriculture exports include: coffee, cocoa, abaca, wood, fish, and others non-industrial.

2/ Other Industrial exports include: coffee products, cocoa products, fish flour, other sea products, chemicals and pharmaceuticals, manufactured metal, hats, apparel, and other industrial.

Table 5. Total Area Harvested (hectares) and Shares by Product and Region (2004)

Product	Total Area (Share in total area)	Sierra	Costa	Oriente/ Galapagos	Total
	979,448				
1. Cereal Grains	(6.5)				
Rice	34	2	98	0	100
Corn	42	23	74	3	100
Other grains	24	91	8	1	100
	72,782				
2. Roots and Tubers	(0.5)	76	12	12	100
	32,153				
3. Vegetables	(0.2)	68	32	0	100
	6,720,080				
4. Fruits	(44.8)				
Bananas/plantains	91	1	98	1	100
Other Fruits	9	6	91	3	100
	1,406,340				
5. Oil Seeds	(9.4)				
Oil palm	86	4	66	30	100
Soybeans	8	0	100	0	100
Other oil crops	6	19	52	29	100
	34,436				
6. Fibers	(0.2)	27	73	0	100
	288,557				
7. Beverages	(1.9)	36	60	4	100
	5,481,578				
8. Other Crops	(36.5)				
Sugar Cane	99	1	95	4	100
TOTAL	15,015,374	895,050	13,362,469	757,855	

Source: Ministry of Agriculture, SICA Project

Table 6. Land tenure for Selected Crops in Ecuador (2000)

Crop		Less than 10 Ha (Share, %)	10-50 Ha (Share, %)	More than 50 Ha (Share, %)	Total
Rice	APUs	49,595 (65)	21,164 (28)	5,054 (7)	75,814
	Hectares	113,868 (33)	120,094 (35)	109,974 (32)	343,936
Corn	APUs	42,313 (52)	29,587 (36)	10,044 (12)	81,943
	Hectares	64,777 (27)	111,426 (46)	63,998 (27)	240,201
Soybeans	APUs	2,496 (59)	1,296 (31)	433 (10)	4,226
	Hectares	7,724 (14)	16,749 (31)	29,877 (55)	54,350

Source: 2000 Agricultural Census

Table 7. Livestock Ownership Distribution by Type of Cattle in Ecuador (2000)

Type of Cattle		Less than 10 Ha (Share, %)	10-50 Ha (Share, %)	More than 50 Ha (Share, %)	Total
Bovine (Meat)	APUs	291,598 (68)	96,227 (23)	39,690 (9)	427,514
	Heads	1,132,184 (25)	1,293,048 (29)	2,060,787 (46)	4,486,020
Bovine (Milk)	APUs	272,116 (34)	239,018 (30)	297,722 (37)	808,856
	Heads	1,131,274 (32)	989,936 (28)	1,403,816 (40)	3,525,027
Pigs	APUs	332,171 (75)	81,616 (19)	26,687 (6)	440,475
	Heads	898,111 (59)	405,860 (27)	223,142 (15)	1,527,114
Poultry (backyard)	APUs	489,648 (71)	147,110 (21)	50,973 (7)	687,732
	Number	5,711,340 (59)	2,780,822 (29)	1,202,462 (12)	9,694,623
Poultry (commercial)	APUs	3,548 (70)	1,000 (20)	496 (10)	5,066
	Number	8,633,048 (27)	11,976,316 (37)	11,288,673 (35)	32,305,495
Sheep	APUs	157,399 (88)	18,102 (10)	3,494 (2)	178,995
	Heads	816,141 (72)	172,520 (15)	138,807 (12)	1,127,468
Other Cattle	APUs	579,825 (70)	176,062 (21)	68,479 (8)	824,384
	Number	5,120,937 (79)	883,578 (14)	462,605 (7)	6,467,152

Source: 2000 Agricultural Census

Table 8. Ecuador: Tariff Structure of Main Agricultural and Agro-Industry Exports to the U.S., 1993-2001

Categories		Agricultural Products included	Farm Sector Average 1993-2001	
			Thousands of Dollars	Percent of Total
Free Import (0% Tariff)		Bananas, coffee, cocoa, albacores, prawns, tea, pepper, ricin oil, extracts, essences and concentrates, tobacco, fish flour, etc.	875,543	75%
Tariff Preference "Andean Trade Promotion Act" (ATPA)	and also GSP	Broccoli, other flowers (except roses), beans, other vegetables, yucca roots, mangoes, melons, watermelon and other fruits, strawberries, meat preparations and conserves, other fruits, passion fruit juice, shrimp, sardines, sharks, other 'salmónidos', fresh and frozen fish (cuts), species and condiments, etc.	173,498	15%
	No included in GSP	Roses, pineapples, chocolats, candies, purée, pastas, other fruit preserves, etc.		
Tariff Preference Generalized System of Preferences (GSP)			98,759	8%
Exports without benefits			14,508	1%
Total Agricultural Exports			1,162,308	100%
Total Exports to the U.S. (50 products or 95%)			1,666,977	
Main Farm Exports (% of Total Main Exports)			70%	

Source: Project SICA-World Bank, Central Bank of Ecuador; own construction.

Table 9. Government Transfers by size of APU for Crops and Livestock

Commodity	APUs < 20 Ha.	APUs 20-50 Ha.	APUs > 50 Ha.	Total Transfers
		(\$/Ha.)		(\$US Millions)
Corn	110	77	55	24
Soybean	53	37	26	2
Rice	162	113	81	44
Livestock (by size of APU)		Percent of Transfers		
Small (1-10 Ha.)		68		17
Medium (10-50 Ha.)		23		6
Large (> 50 Ha.)		9		2
Total		100		25

Source: Ministry of Agriculture, El Comercio

Table 10. FTA Impacts on Production, Consumption, Trade, Welfare, and Farm Income

Countries	GDP	Exports	Imports	Terms of Trade	Consumption	Welfare ⁴	Factor income (net of depreciation)	Real farm income
	(Percentage Change)					(million US\$)	(Percentage Change)	
Scenario 1a. FTA for all Andean countries considered ¹ .								
Ecuador	-1.53	1.41	2.03	-0.52	-1.52	-53	-0.45	0.36
Colombia	-1.55	3.20	3.79	-0.87	-1.55	-240	-0.81	-0.63
Peru	-1.26	4.35	4.93	-0.93	-1.29	-109	-0.66	-0.58
U.S.	0.05	0.16	0.13	0.07	0.05	802	0.05	0.02
MERCOSUR	-0.08	-0.09	-0.14	-0.05	-0.08	-79		
Scenario 1b. FTA for all Andean countries considered, except Ecuador ² .								
Ecuador	-0.40	-0.36	-0.46	-0.11	-0.41	9	-0.38	-0.01
Colombia	-1.39	3.45	4.09	-0.79	-1.39	-115	-0.64	-0.71
Peru	-1.22	4.39	4.99	-0.92	-1.25	-57	-0.63	-0.60
U.S.	0.04	0.13	0.11	0.05	0.04	-264	0.04	0.01
MERCOSUR	-0.07	-0.08	-0.12	-0.05	-0.07	44		
Scenario 2a. FTA for all Andean countries considered, plus FTA CAN-MERCOSUR ³ .								
Ecuador	-1.60	2.12	3.01	-0.47	-1.58	-73	-0.23	0.88
Colombia	-1.86	4.52	5.28	-1.07	-1.87	-140	-0.91	-0.90
Peru	-1.44	7.08	8.02	-1.13	-1.50	-89	-0.59	-1.60
U.S.	0.02	0.12	0.08	0.05	0.02	66	0.02	0.01
MERCOSUR	0.77	1.32	1.83	0.52	0.78	-552		
Scenario 2b. FTA U.S. with Colombia and Peru (no Ecuador), plus FTA CAN-MERCOSUR ³ .								
Ecuador	-0.60	0.49	0.70	-0.10	-0.60	-15	-0.21	0.52
Colombia	-1.71	4.76	5.56	-1.00	-1.72	-256	-0.76	-0.98
Peru	-1.41	7.12	8.07	-1.12	-1.47	-104	-0.56	-1.61
U.S.	0.01	0.09	0.06	0.04	0.01	411	0.01	0.01
MERCOSUR	0.79	1.34	1.87	0.53	0.81	788		

Source: Authors' construction.

Notes: 1. Ecuador, Colombia, and Peru sign a FTA with the U.S. All current trade preferences that these Andean countries receive from the U.S.

become permanent. Colombia, Peru, and Ecuador grant free market access to U.S. goods.

2. All current trade preferences that Colombia and Peru receive from the U.S. become permanent. Colombia and Peru grant the U.S. free market access. Ecuador loses ATPDEA preferences and U.S. imposes similar tariffs as Venezuela.

3. It assumes that all bilateral tariffs between CAN (Bolivia, Colombia, Ecuador, Peru, and Venezuela) and MERCOSUR countries (Brazil, Argentina, Uruguay. Paraguay does appear in the GTAP database as a separate region) are set to zero.

4. Measured as Equivalent Variation (EV) which is a measure of the change in income needed to bring people back to their original utility level.

Table11. FTA Impacts on Ecuador's Value Added, by Sector (Percentage Change)¹.

Sector	FTA Scenario 1a	No FTA Scenario 1b	FTA + MERCOSUR Scenario 2a	No FTA + MERCOSUR Scenario 2b
1 Paddy rice	-0.3	-0.2	-0.4	-0.3
2 Wheat	-0.5	0.4	0.4	1.3
3 Cereal grains	-1.3	-0.9	-0.8	-0.3
4 Vegetables, fruits and nuts (bananas)	0.8	0.4	1.4	1.1
5 Oil Seeds (soybeans)	-3.8	-3.2	-5.9	-5.4
6 Sugar Cane	-0.6	-0.1	-0.8	-0.4
7 Plant-based fibers (cotton)	-1.6	0.4	-1.7	0.2
8 Crops nec. (coffee, cocoa, roses)	0.8	0.0	0.4	-0.3
9 Bovine Cattle, sheep, goat, horses	-0.7	0.0	-0.9	-0.3
10 Animal Products Nec (Pigs/poultry)	-1.8	-0.9	-2.2	-1.3
11 Raw milk	-0.5	-0.1	-0.7	-0.2
12 Wool, silk-worm cocoons	-1.5	-0.3	-3.3	-2.1
13 Forestry	-1.3	-0.2	-1.9	-0.8
14 Fish (Shrimp, Tuna)	0.3	0.1	0.7	0.5
15 Oil and Mining	0.3	0.2	0.2	0.1
16 Bovine meat products	-0.5	0.0	-0.6	-0.1
17 Meat products nec (pork & poultry)	-2.0	-1.2	-2.3	-1.5
18 Vegetable oils and fats	-0.8	-0.1	-5.8	-5.5
19 Dairy products (milk, cheese, etc.)	-0.5	-0.1	-0.8	-0.5
20 Processed rice	0.0	-0.3	0.2	0.0
21 Sugar	-1.2	-1.2	-1.2	-1.2
22 Food Products Nec	1.1	0.3	3.0	2.2
23 Beverages and tobacco products	-0.3	-0.1	-0.2	-0.1
24 Manufacturing	-2.1	-0.4	-3.1	-1.4

Source: Authors' construction.

Table 12. FTA Impacts on Total Imports and Exports, by Sector (Percentage Change) ¹.

Sector	FTA Scenario 1a		No FTA Scenario 1b		FTA + MERCOSUR Scenario 2a		No FTA + MERCOSUR Scenario 2b	
	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
1 Paddy rice	-0.6	-31.7	-1.9	-33.8	-0.2	-34.1	-1.7	-35.9
2 Wheat	1.3	33.0	0.1	0.3	2.2	38.5	1.2	5.7
3 Cereal grains	7.1	-16.7	-0.4	-17.3	9.1	-18.3	2.7	-18.8
4 Vegetables, fruits and nuts (bananas)	2.1	1.3	-0.5	0.4	2.4	2.7	-0.4	1.9
5 Oil Seeds (soybeans)	2.9	-11.1	-1.1	-12.1	2.9	-14.8	-0.9	-15.6
6 Sugar Cane	-2.0	3.5	-1.1	1.5	-1.5	2.9	-0.7	1.1
7 Plant-based fibers (cotton)	4.6	3.2	-0.6	1.0	4.9	3.9	-0.4	1.9
8 Crops nec. (coffee, cocoa, roses)	0.4	1.6	-1.0	-0.4	1.9	1.5	0.5	-0.4
9 Bovine Cattle, sheep, goat, horses	-1.6	-0.4	-0.4	-1.7	1.2	-3.2	2.3	-4.3
10 Animal Products Nec (Pigs/poultry)	-0.2	-1.1	-0.8	-1.9	0.0	-2.3	-0.7	-3.1
11 Raw milk	-3.8	5.7	-1.5	2.1	-3.2	4.8	-1.1	1.5
12 Wool, silk-worm cocoons	-2.2	4.0	-0.7	-2.5	3.2	-5.3	4.9	-10.9
13 Forestry	6.4	4.5	-1.5	1.6	5.4	4.9	-2.6	2.3
14 Fish (Shrimp, Tuna)	0.9	0.2	-0.1	0.1	3.1	-1.1	2.0	-1.1
15 Oil and Mining	5.3	2.1	-0.7	0.4	5.0	2.5	-0.8	1.0
16 Bovine meat products	23.8	5.4	-1.4	1.9	24.7	4.8	-0.5	1.7
17 Meat products nec (pork & poultry)	36.4	-20.3	-0.9	-23.1	39.8	-22.5	3.8	-24.9
18 Vegetable oils and fats	4.5	-2.0	-0.5	-5.4	30.1	-16.6	28.0	-19.2
19 Dairy products (milk, cheese, etc.)	8.3	4.5	-0.5	-5.9	17.5	1.1	9.8	-8.9
20 Processed rice	-2.2	-3.4	-0.8	-5.2	-2.3	-4.6	-1.2	-6.2
21 Sugar	1.5	-10.1	0.6	-11.4	2.1	-10.7	1.0	-11.9
22 Food Products Nec	3.6	1.8	-0.3	0.2	4.9	5.2	1.1	3.7
23 Beverages and tobacco products	0.0	1.1	-0.4	-7.3	1.0	1.6	0.6	-6.6
24 Manufacturing	2.6	1.0	-0.4	-3.0	3.5	0.2	0.7	-3.5

Source: Authors' construction.

Table 13. Ecuador: FTA Impacts on real farm income ¹.

Scenarios	Real farm income	Off farm income (off-farm employed endowments)	On farm income (on-farm employed endowments)
FTA Scenario 1a	0.36	-0.51	0.40
No FTA Scenario 1b	-0.01	-0.16	0.00
FTA + MERCOSUR Scenario 2a	0.88	-0.48	0.94
No FTA + MERCOSUR Scenario 2b	0.52	-0.22	0.55

Source: Authors' construction.

Table 14. Ecuador: FTA Impacts on Real Farm Income (Percentage Change) ¹

Sector	FTA Scenario 1a	No FTA Scenario 1b	FTA + MERCOSUR Scenario 2a	No FTA + MERCOSUR Scenario 2b
Paddy rice	-0.32	-0.29	-0.06	-0.08
Wheat	-0.63	0.46	1.05	2.19
Cereal grains	-1.74	-1.30	-0.59	-0.16
Vegetables, fruits and nuts (bananas)	1.24	0.55	2.44	1.80
Oil Seeds (soybeans)	-5.20	-4.53	-7.76	-7.18
Sugar Cane	-0.80	-0.22	-0.70	-0.20
Plant-based fibers (cotton)	-2.09	0.49	-1.94	0.65
Crops nec. (coffee, cocoa, roses)	1.17	-0.10	1.07	-0.16
Bovine Cattle, sheep, goat, horses	-0.90	-0.06	-0.83	-0.07
Animal Products Nec (Pigs/poultry)	-2.43	-1.27	-2.60	-1.53
Raw milk	-0.67	-0.12	-0.46	0.00
Wool, silk-worm cocoons	-1.98	-0.41	-4.07	-2.60

Source: Authors' construction.

Table 15. Change in Farmers Income by Sector (Percent)

Sector	FTA	Government	Estimated	Government (excludes pigs and poultry)	Estimated
Rice	-0.3	149.0	0	155.6	0
Wheat	-0.6	-10.1	0	-10.1	0
Other Grains (corn)	-1.7	-126.1	0	-128.9	0
Fruits/Vegetables	1.2	0.9	1.2	0.9	1.2
Oilseeds	-5.2	14.2	0	14.1	0
Sugar Cane	-0.8	-8.4	0	-8.5	0
Plant based fibers	-2.1	-7.5	0	-7.6	0
Other Crops	1.2	7.6	1.1	7.6	1.1
Bovine Cattle	-0.9	-4.0	0	2.9	0
Pigs and Poultry	-2.4	-3.6	0	-10.6	-2.4
Dairy Cattle	-0.7	-2.8	0	4.4	0
Wool Production	-2.0	-5.7	0	1.4	0

Table 16. Size of Subsidy Relative to the Value of Land in each Agricultural Sector (Percent)

Sector	Government	Estimated	Government (excludes pigs and poultry)	Estimated
Rice	215	1.0	215	1.2
Wheat	0	2.3	0	2.3
Other Grains (corn)	176	7.2	176	7.3
Fruits/Vegetables	0	0	0	0
Oilseeds	59	17.1	59	17.1
Sugar Cane	0	3.3	0	3.4
Plant based fibers	0	7.6	0	7.6
Other Crops	0	0	0	0
Bovine Cattle	35	3.8	54	4.0
Pigs and Poultry	35	9.9	0	0
Dairy Cattle	35	2.7	54	2.8
Wool Production	35	8.2	54	8.3

ANNEX 1

Table A1. Commodity Aggregation

No.	Sector	Description
1	pdr	Paddy Rice
2	wht	Wheat
3	gro	Cereal Grains Nec. (corn, rye)
4	v_f	Vegetables, fruits and nuts (bananas)
5	osd	Oil Seeds (soybeans)
6	c_b	Sugar Cane
7	pfb	Plant-based fibers (cotton)
8	ocr	Crops nec. (coffee, cacao, roses)
9	ctl	Bovine Cattle, sheeps, goats horses
10	oap	Animal Products Nec (Pigs, poultry)
11	rmk	Raw Milk
12	wol	Wool, silk-worm cocoons
13	for	Forestry
14	fsh	Fishing (Shrimp, Tuna)
15	Oil and Mining	Oil and Mining
16	cmt	Bovine meat products
17	omt	Meat products nec (pork, poultry meat)
18	vol	Vegetable oils and fats
19	mil	Dairy products (milk, cheese, etc.)
20	pcr	Processed rice
21	sgr	Sugar
22	ofd	Food Products Nec
23	b_t	Beverages and tobacco products
24	Manufacturing	Manufacturing
25	Services	Services

Table A2. Regional Aggregation

No.	Region	Description
1	USA	U.S.
2	ECU	Ecuador
3	COL	Colombia
4	PER	Peru
5	BOL	Bolivia
6	VEN	Venezuela
7	MERCOSUR	Brazil, Argentina, Uruguay
8	CAFTA	Central America
9	ROA	Rest of FTAA
10	EU	European Union
11	CHN	China
12	ANZ	Australia and New Zealand
13	ROW	Rest of the World

Table A3. GTAP-AGR Parameters for Ecuador

No.	Sector	CDE Substitution Parameter SUBPAR	CDE Expansion Parameter INCPAR	CES Top Level Intermediates ESUBT	CES between Primary Factors – Value Added ESUBVA	CES Purchased Inputs ESUBT2
1	pdr	0.7	0.2	0.5	0.5	0.2
2	wht	0.7	0.2	0.5	0.5	0.2
3	gro	0.7	0.2	0.5	0.5	0.2
4	v_f	0.6	0.3	0.5	0.5	0.2
5	osd	0.7	0.3	0.5	0.5	0.2
6	c_b	0.5	0.4	0.5	0.5	0.2
7	pfb	0.6	0.3	0.5	0.5	0.2
8	ocr	0.7	0.2	0.5	0.5	0.2
9	ctl	0.5	0.4	0.5	0.5	0.2
10	oap	0.5	0.4	0.5	0.5	0.2
11	rmk	0.5	0.5	0.5	0.5	0.2
12	wol	1.0	1.2	0.5	0.5	0.2
13	frs	1.0	1.2	0	0.2	0
14	fsh	0.5	0.5	0	0.2	0
15	oil	1.0	1.2	0	0.2	0
16	cmt	0.5	0.4	0	1.1	0
17	omt	0.5	0.4	0	1.1	0
18	vol	0.7	0.3	0	1.1	0
19	mil	0.5	0.5	0	1.1	0
20	pcr	0.7	0.2	0	1.1	0
21	sgr	0.5	0.4	0	1.1	0
22	ofd	0.5	0.4	0	1.1	0
23	b_t	0.4	0.6	0	1.1	0
24	Mnfcs	1.0	1.2	0	1.3	0
25	Svces	1.0	1.2	0	1.5	0