Poverty Impacts of Trade Integration with the EU: lessons for Ecuador

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Abstract

This research proposes to measure the effects of a trade agreement with the European Union on poverty in Ecuador. Both poverty and the signing of a trade agreement with the EU are issues under discussion in Ecuador. Ecuador is seeking to sign a trade agreement with the EU due to their complementary trade: the EU is a major market for Ecuadorian agricultural and fish products, and Ecuador imports mainly manufacturing goods from the EU. In particular, the EU is the main market for the main agricultural export product of Ecuador: bananas.

The transmission mechanisms to study these issues include changes in commodity prices, wages and earnings, and labor market demands. This research combines a reduced-form micro household income and occupational choice model with a standard single-country computable general equilibrium model (CGE) for Ecuador. This study highlights that a trade agreement with the EU may have a different impact on poverty depending on the degree of initial tariff reduction, on labor market considerations, and on whether better access to Ecuadorian bananas is granted by the negotiations or not. Through trade liberalization there is a significant increase in imports from the EU, particularly in protected sectors. With better access for bananas to the EU market, investment constraints may mean that increasing banana export and production can be achieved by pulling resources (namely production and labor) out of other sectors. Nearly every scenario of a trade agreement leads to a decline in extreme poverty in rural regions. In contrast, extreme poverty in urban regions may increase.

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Poverty Impacts of Trade Integration with the EU: lessons for Ecuador

1. Introduction

Ecuador is currently negotiating a trade agreement with the European Union, one of Ecuador's main trade partners. In 2007, Ecuadorian exports to the EU represented 12.7 percent of the value of its total exports –the average in the last five years (2003-2007) was 13.6 percent. In the same year, the share of Ecuador's imports from the EU in total imports reached 9 percent. Almost half of Ecuadorian exports to the EU consist of agricultural products such as banana (35%), and other fruit, vegetables and flowers (10%). In contrast, most of Ecuador's imports from the EU are manufactures such as machinery (38%), or chemicals, rubber and plastic (26%).

Under the Generalized System of Preferences Plus (GSP+) the EU provides tariff preferences to around 6,600 products of which 6,370 enter the EU with zero tariffs. A few products that are of special importance to Ecuador do not have free access to the EU market such as bananas, which pay 176 euros per Metric Ton to enter the EU market. According to the EU, GSP+ aims to contribute to poverty reduction, good governance, and sustainable development. These tariff preferences are unilaterally provided by the EU. Ecuador applies its most favorable nation tariffs to European products.

Agricultural export activities are an important economic activity for Ecuador and banana exports alone represent two thirds of total tropical exports. Furthermore, according to the Central Bank of Ecuador, depending on the degree of technological advancement, the banana sector directly employs 1 to 3 workers per hectare and indirectly generates 1.5 to 10 jobs per hectare in production (in Chang, 2000, as cited in Central Bank of Ecuador, 2004).

Therefore Ecuador expects to gain better access to the European banana market by signing a free trade agreement with the EU. The official negotiations started in July 2007, with the Andean Community (Colombia, Peru, and Bolivia) negotiating as a block, but recent developments have led to each country holding bilateral negotiations with the EU.[1] According to Ecuador's Minister of Trade, Ecuador is interested in signing the agreement because it has complementary trade with the EU (Ecuador exports mostly agricultural products to the EU and imports manufactures from the EU). (El Comercio, November 8, 2008, p.8).

Given the importance of the banana sector, where labor is an important factor of production, it may be the case that the expected changes in banana prices due to better access to the

[1] Colombia and Peru finish negotiating the trade agreement with the EU on March 2010. The agreement is to be signed in May 2010 and, according to sources from Peru it will enter into effect on 2012.

EU market have a key social impact on Ecuador (for better or worse, depending on the outcome of the trade negotiations).

However, to the extent of our knowledge, there is no study that shows impacts on key aspects of the Ecuadorian economy of a potential preferential trade agreement with the EU, in particular, impacts on urban and rural sectors, employment, and poverty. The aim of the present study is to fill this gap.

This study is part of a growing branch of empirical economics literature that tries to examine the effects on poverty in countries that have opened their markets to global competition (see literature reviews in, for example, Winters, McCulloch, and McKay 2004, Hertel 2006). The impact analysis of changes in trade policies on poverty in urban and rural (farming) sectors is a very important issue for a country such as Ecuador where rural poverty rates are high.

The channels for the poverty impacts of changes in trade policy (tariffs) addressed in this paper include the impact on prices, employment, and macroeconomic performance, differentiated by urban and rural sectors, and industry.

To perform such impact analyses, we apply a CGE model and micro-simulations. This study is based on research by Wong and Arguello (2009) that links trade and fiscal policy changes to poverty and income distribution effects, using a single-country CGE model *and* a micro simulation model. As opposed to Wong and Arguello, the present study focuses on the impacts that a trade agreement with the EU may have on Ecuador's economy, with special regard to agricultural sectors and the urban/rural effects on poverty. These are key aspects for Ecuador, given that the majority of Ecuadorian exports to the EU are bananas.

The CGE and micro models permit the documentation of changes regarding these prices and labor market effects, within different labor types according to education, region and employment and by mayor type of commodity produced in Ecuador.

The main research questions the present study tackles are: (i) What would the effects of a free trade agreement with the EU be on the main macroeconomic indicators in Ecuador?; (ii) What would the effects of this trade agreement be on poverty (headcount) in Ecuador?; and (iii) How do alternative economic and policy scenarios that seek to stimulate key features of the Ecuadorian economy (unemployment, dollarization, concentration on bananas for the exports to the EU) influence the results of the previous questions?

The trade agreement with the EU is simulated with 3 different scenarios:

- Free trade for all EU products (100 percent tariff reduction), and Ecuador keeps the GSP+ preferences
- Free trade for all EU products, Ecuador keeps the GSP+ preferences, and receives better access for bananas to the EU market
- Preferential trade, similar as the first scenario but with a 50 percent (instead of 100 percent) tariff reduction

The main results suggest that a trade agreement with the EU may have a different poverty impact depending on the degree of initial tariff reduction, and on whether better access to Ecuadorian bananas is granted by the negotiations. The adjustments to a trade agreement with the EU come through changes in prices (goods, services) and factor returns. For the scenarios that assume unemployment in the unskilled urban and rural labor, adjustments also come through changes in labor demand for these categories of wage workers. How fast trade liberalization is implemented has an impact on factor returns and prices that are reflected in poverty results and macro aggregates. For the macro aggregates, the impacts of the partial trade liberalization (50% tariff reduction) are half of those of the scenario of zero tariffs. For poverty results, the 50% tariff reduction determines that –under the assumption of unemployment in the unskilled wage worker segment– poverty reduction may not be as fast as in the zero tariff case and it may be mainly because the reduction in consumption prices is not as big as in the free trade case.

When one important sector of the economy -such as bananas- gets better access to the EU markets (given that almost all of the others are already entering the EU with zero tariffs), investment constraints may imply that increasing export and production of bananas can be achieved by pulling resources (namely labor) out of other sectors. Lower production and higher consumer prices in those sectors may preclude gains from poverty reduction, even if free trade is adopted. This result highlights the need for investment when increasing trade opportunities arise.

The remainder of this document is organized as follows. Section 2 presents an overview of the Ecuadorian economy. Section 3 discusses relevant work on CGE modeling and micro-simulation models related to trade policies and poverty. Section 4 lays out the methodology and data. Section 5 summarizes the scenarios applied. Section 6 discusses the results and policy implications, and Section 7 presents concluding remarks. The Annexes present further details on data and model issues.

2. Overview of the Ecuadorian Economy

As part of a policy to gain or increase access for Ecuadorian products, the current Government of Ecuador is seeking a trade agreement with the EU. The European Union is a key market for Ecuador, in particular for Ecuadorian bananas. Bananas are a key export product of Ecuador. Ecuador's exports to the EU represent around 12 to 16 percent of total exports. According to the Central Bank of Ecuador, banana exports represent 42 percent of total non-oil and non-manufacturing exports in Ecuador (Central Bank of Ecuador, 2008). The EU purchases half of Ecuador's total banana exports (49% in 2007) and banana exports to the EU represent more than one third of Ecuador's total exports to the EU (35% in 2007). While Ecuador exports most-

ly agricultural products to the EU, the majority of Ecuador's imports from the EU are manufacturing products. See Table 1.

Table 1.- Trade composition with the European Union

Exports	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Banana, coffee & cocoa [1]	53%	49%	41%	38%	38%	35%
Fish products	24%	25%	27%	35%	39%	39%
Other food products	6%	9%	14%	9%	8%	8%
Other agricultural products	12%	10%	12%	13%	12%	10%
Others	5%	7%	6%	5%	4%	8%
	100%	100%	100%	100%	100%	100%
Total FOB Exports to the EU						
In 000's of US dollars	794,504	1,076,638	1,048,551	1,293,082	1,487,499	1,815,803
As a % of total Exports	16%	17%	14%	13%	12%	13%
Banana Exports to the EU						
In 000's of US dollars	418,643	527,933	435,050	495,201	561,707	635,298
As a % of Ecuador's total Banana Exports	43%	48%	43%	46%	46%	49%
Imports	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Machinery	43%	43%	42%	44%	38%	38%
Chemicals, rubber and plastic	19%	21%	23%	23%	22%	26%
Manufactures [2]	26%	22%	21%	20%	19%	19%
Petroleum products	7%	9%	8%	7%	15%	11%
Others	4%	6%	7%	6%	6%	6%
	100%	100%	100%	100%	100%	100%
Total CIF Imports to the EU						
In 000's of US dollars	889,562	815,043	864,435	1,068,987	1,210,498	1,241,844
As a % of total Imports	14%	12%	11%	10%	10%	9%

Source: Own construction using data from the Central Bank of Ecuador.
Notes: 1.-The shares of banana, coffee and cocoa exports in this category are the following. 2002: banana (89%), coffee (1%) and cocoa (10%). 2003: banana (88%), coffee (1%) and cocoa (12%). 2004: banana (99%) and coffee (1%). 2005: banana (89%), coffee (1%) and cocoa (10%). 2006: banana (84%), coffee (1%) and cocoa (15%). 2007: banana (80%), coffee (1%) and cocoa (19%). 2.- Includes: textiles, wood, paper, mineral products and transport.

Ecuador is seeking to consolidate and improve the trade preferences it already receives from the EU through the Generalized System of Preferences Plus (GSP+). As mentioned above, the GSP+ allows most Ecuadorian products to enter the EU free of tariffs. There are a few exceptions, which include some key agricultural products of Ecuador. The most significant case is bananas, the main Ecuadorian export to the EU, which are subjected to a specific tariff of 176 euros per metric ton (MT).

Although Ecuador receives zero-tariff entry on almost all products under GSP+, these preferences are subject to revision every period (of about three years, and this has been the case since the EU first implemented GSP for developing countries in 1971). One of the objectives for Ecuador of a trade agreement with the EU is to make this zero-tariff entry permanent, and to extend preferences to those key Ecuadorian products that do not receive preferential treatment.

Ecuadorian producers and exporters are concerned about the market access for Ecuadorian bananas to the EU due to the EU tariff policy on bananas from Latin American countries. Ecuador hopes to obtain no less than was nearly accepted by the EU in the last negotiations between banana country producers and exporters and the EU in Geneva, July 2008. This meet-

ing failed when the EU made the success of the Doha round a condition for its implementation; and, in turn, the Doha round failed. The 2008 Doha round failed because of lack of agreement on the implementation of a mechanism of special safeguards that would allow developing countries to raise tariffs on farm imports when they reach a certain level and begin to threaten the livelihoods of poor farmers. The aforementioned agreement between the EU and banana country producers and exporters called for a slow reduction of the EU specific banana tariff from 176 euros per MT in 2008 to 114 euros per MT by 2016.[2]

The ultimate purpose of the Ecuadorian Government in setting up these agriculture and trade policies is to reduce poverty and redistribute income in favor of the poor. However, despite the importance of the analysis of poverty impacts in Ecuador, there has been little research on the impact on poverty of agricultural trade policies in this country.

As shown in Table 2, poverty is widespread in Ecuador, particularly in rural areas where –measuring poverty using aggregate income[3]– 22.7 percent of individuals are under the one-dollar-a-day poverty line (extreme poverty) and 49.6 percent are under the two-dollar-a-day poverty line (poverty). In urban areas, 10.8 percent are under extreme poverty and 27.8 percent live in poverty. Extreme-poverty and poverty rates, measured using aggregate consumption, are lower than poverty results obtained using aggregate income, but poverty rates in rural areas still present high and similar rates under both aggregate measures.[4] In rural areas, 11.6 percent of households are extremely poor and 47.1 percent are poor. In urban areas, 1.3 percent of households are extremely poor and 15 percent are poor. There are differences in poverty incidence when households are headed by males or females, and they tend to be wider under the two-dollar-a-day poverty line: when measuring poverty using aggregate income, households headed by women tend to experience a higher incidence rate.

Considering that one out of three households in Ecuador live in rural areas, these high poverty incidence rates are significant. According to the 2005-6 household survey data, there are 3,264,866 households in Ecuador (approximately 13 million inhabitants), 34 percent of which live in rural areas. Eighty one percent of rural households have some agricultural activity. In contrast (and as expected), fewer urban households work on agricultural related activities, but there is still a considerable share of urban households whose activities include agriculture (18%).

[2] This tariff may be reduced to 114 Euros per metric ton (over a seven-year period) under an agreement reached between the EU and the Latin American countries at the end of 2009. If and when the agreement is ratified, it would end a sixteen-year WTO dispute between Ecuador (and other Latin American banana exporter countries) and the EU.

[3] Aggregate income includes: wages and salaries, income from agricultural activities, income from self-employment, remittances, and aid.

[4] Aggregate consumption includes food, non-food items, durables, utilities, and rent. Expenditure on durables was calculated as the flow of services from durable goods. It was calculated using data on durable spending and age of the durable goods, as reported in the Ecuadorian household survey.

Table 2.- Ecuador: Poverty indices (headcount) at the base, 2005 [1,2,3]

Households	a. Measured by Aggregate Consumption		b. Measured by Aggregate Income	
	Below one dollar a day (extreme poverty)	Below two dollars a day (poverty)	Below one dollar a day (extreme poverty)	Below two dollars a day (poverty)
Total	4.85%	26.05%	14.87%	35.28%
Rural	11.57%	47.09%	22.72%	49.55%
Urban	1.33%	15.05%	10.78%	27.82%
Headed by male	5.19%	27.41%	13.64%	33.91%
Headed by female	3.54%	20.88%	19.57%	40.46%

Source: Ecuador's Household Survey 2005-2006, and own calculations.
Notes: 1.-Excludes households that do not show any data on income. 2.-This study uses the customary poverty measure of poverty incidence or FGT(0), which is the percentage of individuals whose consumption (or income) fall under the poverty line. 3.-The poverty lines adopted are also the customary one dollar and two dollar a day poverty lines because the study wants the reader to be able to establish comparisons between the poverty situation in Ecuador and the poverty situation in other developing countries.

Given the changes in relative prices –between tradables and nontradables– expected during periods of trade openness, it is also important to know what type of products (tradable: exportable and import-competing, or non-tradable) Ecuadorian farmers produce. The importance of tradable products on the revenue from agricultural activities of farm households varies by region (Amazon region, Coast and Sierra) and type of family agriculture[5] (subsistence and commercial). In the Coastal region, small subsistence farms produce more tradable commodities (92%) than non-tradables (8%), and more import-competing (60%) than exportables (32%). In the highlands, non-tradable products represent an important share of the agricultural income of these small farms (51%). In contrast, the agricultural revenue of the Amazon region comes mostly from export-oriented products, which make up almost three-quarters of the agricultural revenue share (Table 3).

However, some small subsistence farmers may not get to sell their crops in the markets. According to the 2005-6 household survey data, one-third of these small farmers do not sell the majority of their crops to the markets. Instead these farmers may use their crops for consumption in the household or, in the worst case scenario, waste the crops. Later on, data on home consumption will show the importance of this item for rural households (Table 7).

[5] According to FAO (see Echenique, 2006), small subsistence farm households are defined as those farm households that do not hire any kind of labor outside the household and usually work on small extensions of land. Commercial farm households are farm households that hire labor and work on usually much larger farms than those of subsistence farm households.

Table 3. - Agricultural Revenue Share according to tradability of agricultural products.
By type of farm, crop, and region [1, 2, 3]

Region/Type of crop	Type of family agriculture		Total for all FA
	Subsistence	Commercial	
Total Coast (US$)	155,060,171	516,252,247	671,312,418
Exportable	32%	55%	50%
Importable	60%	40%	44%
Non-tradable	8%	6%	6%
Others	0%	0%	0%
Total Sierra (US$)	129,129,375	249,428,682	378,558,057
Exportable	18%	28%	25%
Importable	24%	20%	21%
Non-tradable	51%	47%	49%
Others	7%	4%	5%
Total Amazon region (US$)	20,187,747	22,600,130	42,787,877
Exportable	73%	71%	72%
Importable	14%	13%	13%
Non-tradable	9%	13%	11%
Others	4%	3%	4%
Total National (US$)	300,835,697	779,338,640	1,080,174,336
Exportable	29%	47%	42%
Importable	42%	33%	35%
Non-tradable	27%	19%	21%
Others	3%	1%	2%

Source: Own construction using data from Ecuador's Household Survey 2005-2006.
Notes: 1.-Agricultural revenue includes value of sales and self-consumption of own production. 2.-Household survey data do not include data on the production of flowers. 3.-Trade classification is based on the share of total exports or imports in total production (average data from years 2002-2004). If the share of exports of a given product is above 1%, the product is classified as exportable. Similarly for importable products. 4.-'Others' includes data on crops that cannot be classified by their trade orientation.

Agricultural activities may be only part of a household income, as households derive income also from wages, self-employment (in non-agricultural activities), remittances, and transfers. The distribution of household income among these sources of income varies by income quintile and by type of household: urban and rural (Table 4).

Agricultural income is a key income component for rural households, in particular for households in the lowest quintile of income, for which agricultural activities make up 33 percent of their income. Wages are an important income source for both rural and urban households, but more so for urban households, where wages represent between 42 to 60 percent of total income (for rural households between 22 to 48 percent), with the higher shares for households in higher income quintiles.

Transfers are an important source of income for the poor, representing 15 percent and 10 percent of income in households in the lowest income quintile of urban and rural areas, respectively. Similarly, although with lower shares, remittances contribute more to the income of urban households (3 to 7% of their total income) than to the rural households' income (3 to 4% of their total income), and more to the income of the urban households in the lowest income quintile (7%).

Table 4.- Income shares by area and income quintile [1]

Total							Total
Quintiles	**Remittances**	**Transfers**	**Self-employment**	**Wages**	**Agricultural**	**Percentage**	**Millions of US$**
1	5%	11%	32%	30%	22%	100%	350
2	5%	6%	29%	45%	15%	100%	1,057
3	4%	4%	28%	52%	11%	100%	2,044
4	4%	3%	30%	56%	7%	100%	3,875
5	3%	2%	35%	53%	6%	100%	13,541
Urban							
Quintiles	**Remittances**	**Transfers**	**Self-employment**	**Wages**	**Agricultural**	**Percentage**	**Millions of US$**
1	7%	15%	34%	42%	2%	100%	309
2	6%	7%	32%	54%	2%	100%	925
3	5%	4%	31%	58%	1%	100%	1,730
4	4%	4%	31%	60%	1%	100%	3,120
5	3%	2%	37%	55%	4%	100%	9,868
Rural							
Quintiles	**Remittances**	**Transfers**	**Self-employment**	**Wages**	**Agricultural**	**Percentage**	**Millions of US$**
1	3%	10%	32%	22%	33%	100%	110
2	4%	4%	27%	37%	28%	100%	309
3	4%	3%	24%	46%	23%	100%	570
4	3%	3%	26%	48%	20%	100%	985
5	3%	1%	31%	41%	23%	100%	2,942

Source: Own construction using data from Ecuador's Household Survey 2005-2006.
Note: 1.-Some households also obtain income from small businesses, but this source of income is not included due to measurement issues.

Income from self-employment represents a similar share of total income for households in the lowest income quintile in both urban (34%) and rural areas (32%).

Clearly, wages and agricultural income –two sources of income likely to be affected by policies of trade liberalization– add with varying degrees of importance to the income of urban and rural households in the lowest income quintile. Poor households in rural areas depend on both wages (22%) and agricultural revenues (33%), and poor households in urban areas rely heavily on wages (42%).

Finally, to understand the potential impacts of a free trade agreement with the EU, it is necessary to take into account the composition of households' expenditures, as these expenditures will be affected directly by changes in prices and indirectly by other channels (ripple effects coming from changes in employment and production) during trade liberalization.

Table 5 shows that food expenditures are an important component of households' expenditures: more for rural households than for urban households, and more for households in the lowest income quintile than for households in the higher income quintiles. Thus, for rural households 54 percent of expenditures in households in the lowest quintile of income goes towards food items, while 42 percent of household expenditures for rural households in the highest income quintile are on food. In urban areas, the lowest income quintile spends 40 percent of their total expenditure on food, and the highest income quintile just 25 percent.

Table 5.- Expenditure shares by type of household and income quintile

Total									Total
Quintiles	Food	Non food	Health	Education	Rent	Services	Durables	Percentage	Millions of US$
1	46%	16%	6%	3%	16%	6%	6%	100%	1,162
2	46%	16%	6%	3%	14%	5%	9%	100%	1,667
3	44%	18%	6%	4%	14%	5%	8%	100%	2,506
4	41%	19%	6%	5%	14%	5%	10%	100%	3,938
5	28%	25%	6%	7%	14%	5%	14%	100%	9,313
Urban									
Quintiles	**Food**	**Non food**	**Health**	**Education**	**Rent**	**Services**	**Durables**	**Percentage**	**Millions of US$**
1	40%	16%	6%	3%	18%	6%	10%	100%	1,140
2	40%	19%	6%	4%	16%	6%	9%	100%	1,508
3	39%	19%	6%	5%	15%	6%	10%	100%	2,101
4	36%	20%	6%	6%	15%	6%	12%	100%	3,161
5	25%	27%	6%	7%	15%	6%	15%	100%	6,541
Rural									
Quintiles	**Food**	**Non food**	**Health**	**Education**	**Rent**	**Services**	**Durables**	**Percentage**	**Millions of US$**
1	54%	14%	7%	2%	14%	5%	4%	100%	292
2	54%	15%	6%	3%	12%	5%	5%	100%	451
3	53%	16%	7%	3%	11%	5%	6%	100%	615
4	51%	17%	6%	4%	11%	5%	7%	100%	917
5	42%	21%	7%	5%	11%	4%	10%	100%	1,837

Source: Own construction using data from Ecuador's Household Survey 2005-2006.

As already pointed out for agricultural revenue, food consumption patterns also vary by type of product, region, and type of farm household (Table 6). The share of *importable* food products in the consumption of small subsistence farm households from the coast (41%) is bigger than the share of farm households from the other regions in Ecuador (36% in the highlands, and 29% in the Amazon). With regards to food consumption, subsistence farm households from the highlands have the biggest share in *nontradable* products (51%), whereas households of commercial farmers from the Coast have the lowest share (35%).

Table 6. - Consumption expenditure shares of food products according to tradability of products.
Family Agriculture in Ecuador, by type and region

Region/Type of crop	Type of family agriculture		Total for all FA
	Subsistence	Commercial	
Total Coast (US$)	1,128,700,000	270,719,348	1,399,419,348
Exportable	20%	22%	20%
Importable	41%	43%	41%
Non-tradable	40%	35%	39%
Total Sierra (US$)	916,400,000	257,672,692	1,174,072,692
Exportable	15%	18%	15%
Importable	35%	39%	36%
Non-tradable	51%	44%	49%
Total Amazon region (US$)	121,203,616	67,010,708	188,214,324
Exportable	23%	30%	26%
Importable	28%	30%	29%
Non-tradable	48%	39%	45%
Total National (US$)	2,166,303,616	595,402,748	2,761,706,364
Exportable	18%	21%	18%
Importable	37%	40%	81%
Non-tradable	45%	39%	40%

Source: Ecuador's Household Survey 2005-2006 collected by the National Institute of Statistics and Census, and own construction.
Notes: Food consumption includes consumption of goods produced by the households, gifts, and donations. Trade classification based on the share of total exports or imports in total production (average data from years 2002-2004). If the share of exports of a given product is above 1%, the product is classified as exportable. Similarly for importable products.

For rural households, consumption of home produced goods is an important component of consumption expenditures. According to Table 7, the consumption of home produced banana, coffee, and cocoa represents 24 percent of the total consumption expenditure of rural households; the consumption of cereals, other crops, and meat and meat products represents 13, 11, and 22 percent respectively.

Table 7. - Consumption expenditure of home produced goods

Products	Urban					Total Urban	Rural					Total Rural
	q1	q2	q3	q4	q5		q1	q2	q3	q4	q5	
Banana, coffee, and cocoa	0.47%	1.02%	0.79%	0.53%	2.22%	**1.17%**	15.1%	17.8%	18.5%	19.3%	33.9%	**23.9%**
Cereals	0.47%	1.05%	0.54%	0.50%	0.81%	**0.68%**	7.8%	9.9%	10.2%	11.8%	16.2%	**12.5%**
Other crops	0.44%	0.38%	0.41%	0.24%	0.28%	**0.32%**	10.9%	10.7%	10.5%	8.0%	13.6%	**11.2%**
Meat and meat products	1.31%	1.51%	1.68%	1.32%	1.21%	**1.36%**	20.0%	25.0%	23.5%	22.7%	19.3%	**21.5%**
Dairy	0.03%	0.02%	0.03%	0.01%	0.01%	**0.02%**	0.9%	1.6%	1.3%	0.8%	0.8%	**1.0%**
Other food products, tobacco and chocolate	3.8%	3.1%	3.7%	5.5%	4.3%	**4.2%**	14.4%	17.9%	19.6%	21.8%	33.3%	**23.7%**

Source: Own construction using home produced data from Ecuador's Household Survey 2005, and total consumption expenditures from the Social Accounting Matrix data 2004.

3. Literature Review

Studies on the link between trade and poverty stress that while in the long run it is likely that trade leads to poverty reduction, in the short term there may be some different outcomes (Winters 2000a, Matusz and Tarr 1999). The positive long-run impact of trade on poverty comes from the positive impact that trade may have on growth and the poverty reduction effects of sustained growth (that is, the effect of trade on poverty is usually analyzed in a two-step fashion, USAID 2006). In the short run, however, positive or negative poverty results from trade liberalization may arise depending on several factors such as the initial distortions in goods and service markets, the speed of trade liberalization and price transmission, and the structure and flexibility of factor markets, in particular labor markets. The present literature review highlights these short-term adjustment channels and the empirical research on this topic for Latin American countries.

It has been mentioned in the literature that ultimately the question of what are, or have been, the poverty impacts of trade openness is an empirical one. To ascertain these impacts Winters, McCullogh and McKay (2004) review the empirical evidence on four channels: growth, goods and services prices, wages and employment, and government revenue and spend-

ing. The authors consider that these four channels are the key aspects in the transmission of the poverty effects of trade.[6] Winters et al differentiate between the short-term mechanisms (shocks and adjustment processes) and the long-term ones (economic growth). The main conclusion of these authors from their empirical literature review is that "…In the long run, economic growth is the key to the alleviation of absolute poverty." (Winters et al 2004, p. 76), mainly because economic growth would raise households' income.[7]

The empirical evidence that links trade and growth or productivity (that is long-term impacts) is vast and complex to summarize. According to Winters et al, recent empirical evidence may suggest a strong influence of trade openness and liberalization on productivity and its rate of change, which in many cases will lead to a reduction in poverty, particularly in the long run (Winters et al 2004, p. 83). Tybout (2000) and Epifani (2003) survey the possible effects of trade policies on manufacturing firms in developing countries. Their conclusions suggest that scale efficiency gains are minor and not correlated with trade liberalization (Tybout and Westbrook 1995). Plant-level studies find that it is the re-allocation of resources from less to more productive plants that explains productivity gains (Pavcnik 2002, Tybout and Westbrook 1995). For Latin America, econometric studies in Roberts and Tybout (1996) on the productivity impacts of trade liberalization in the manufacturing industry suggest that net exit increased aggregate productivity in Chile (Tybout 1996), and that productivity growth can be attributed to intra-plant movements in Colombia (Roberts 1996). On the same topic, for Ecuador, Wong (2009) finds that increased aggregate productivity might be due to both more output being produced by more productive establishments and slightly increased own-plant's productivity.

The literature also stresses that the channels that link trade and poverty are case-specific (Winters 2000b). Therefore, the best approach is to examine separate country episodes of trade liberalization and learn from their experience with trade openness, growth and poverty.

Ideally, the studies should conduct *ex-post* analysis of a particular episode of trade openness, growth, and poverty, but data limitations may hinder the possibility of undertaking this approach. Just a few studies have been able to perform this type of ex-post analysis, such as Friedman (2003) for Indonesia, which finds that this economy obtained poverty reduction effects from economic growth at the national level, but with significant differences across the regions.

Studies on the poverty impacts of trade liberalization should also account for short-term adjustments, that is, what happens on impact with markets and prices and how these effects get transmitted to households. For goods markets, empirical models usually assume flexible mar-

[6] A similar structure and emphasis on these transmission channels is found in earlier works by Winters (Winters 2000a.b.c, and Winters 2001).

kets, and the perfect transmission of prices. Winters (2001) stresses that this may not be the case in developing countries, particularly in rural areas where prices may not get transmitted because poor infrastructure, missing markets, and marketing practices may keep rural markets isolated, thus preventing any effect on poverty from trade liberalization (see examples in Winters 2000a, pp. 16-21).

Assuming price changes are effectively transmitted to households, the empirical literature usually uses a measure of aggregate income or aggregate consumption, and an assessment of the households' net position –as buyers or sellers of the goods and services whose prices have changed– to ascertain how these price changes affect households. The literature stresses that the impact of price changes will affect households differently depending on their income and spending patterns: the households that gain from trade liberalization are net sellers of products whose prices rise and the households that lose out are net purchasers of such goods (Winters 2000b, Hertel 2006). For the poorest rural households, consumption should take into account home production, as it may represent a sizable portion of their overall consumption profile, which in turn would allow the poor to feel only modest impacts of any changes in relative prices.

As for factor markets, the effects on labor markets (employment and wages) provide another key channel for the analysis of the poverty effects of trade liberalization (in both the short and long term). If Heckscher-Olin holds, countries should specialize in the production and export of goods and services that use the relatively more abundant factor, which in the case of developing countries is expected to be unskilled labor. Aside from frictional effects, as production responds to changes in relative prices and firms hire unskilled labor, wages of this labor market segment may reflect an upward pressure. This in turn should have a poverty reducing effect, if the former wages are below the poverty line or if the newly hired workers were unemployed. However, this scenario assumes a fixed supply of labor and wage flexibility which may not be the case in some developing countries. As Winters (2000b) points out, labor supply may be infinitely elastic at the prevailing wage rate (which may be set by minimum wage laws) so that an increase in labor demand increases employment, but not wages. In this case, depending on what the former unemployed were doing (e.g. subsistence activities that earned them less than or the same amount as the minimum wage), the results may or may not have a poverty reducing impact.

With regard to the short-term unemployment effects of trade liberalization in Latin America, a literature review by Reina and Zuluaga (2008) concludes that frictional unemployment has been mild and lower than expected, but again, the short-term impacts on employment and wages depend on the labor market structure and its regulatory framework (Reina and Zulu-

[7] Note that Winters et al (2004) –and the empirical literature in general– use an absolute income or con-

aga 2008, p. 35). For the long-term employment effects, the ex-post empirical evidence analyzed by Reina and Zuluaga in the cases of Chile and Mexico points to a positive effect of trade liberalization on employment. Nonetheless, in the case of NAFTA and Mexico, these authors mention that the labor markets' lack of flexibility and barriers to credit market access prevented NAFTA from having great positive social impacts in Mexico.

Given the data difficulties faced when trying to undertake ex-post analysis, the empirical evidence on the poverty impacts of trade liberalization using *ex-ante* analysis (simulations) has flourished. However, for Latin America there are not many studies, and only a few of these studies distinguish poverty results by urban and rural areas. Thus, for instance, Gurgel (2007) applies the GTAP model to the analysis of different trade agreements in Brazil, modifying it to account for different household categories in Brazil (urban, rural, and small and commercial farmers). This author finds that while the income differential between urban and rural households diminishes, the income differential between rural households deteriorates.

Taylor (2002) uses a macro-micro econometric approach to study the impacts of several policies of increased trade openness and market shock scenarios on rural production, income and poverty in Mexico and Central America. Taylor stresses the role of rural market structures, transaction costs, and imperfect markets in determining the economic results from trade liberalization. His main findings with respect to rural poverty are that the effect on rural income depends upon the type of crop affected (cash or staple). If trade reduces staple prices, the impact on rural income may be small, as rural households have a high level of product diversification. According to Taylor, price effects on non-staple production and migration should also help to mitigate effects on rural household income. Taylor stresses that some rural households may benefit from staple price reduction as their food price declines as well (given that food makes up a sizable portion of rural household consumption). If trade reduces cash crop prices, rural income results would depend on whether the production is labor or capital intensive: if trade in the cash crop is labor intensive, the results should be large (whether positive or negative); and if it is capital intensive, impacts on rural household income may be of low intensity.

Morley and Diaz-Bonilla (2003) develop a computable general equilibrium and micro model to study the poverty impacts of several scenarios of greater trade openness in Mexico. These authors find that although overall poverty falls after trade liberalization, rural poverty and extreme poverty increase. These authors explain that these mixed poverty results happen because increased trade in Mexico expands skilled labor-intensive sectors which leads to a larger gap between skilled and unskilled wages in urban areas and between rural agricultural wages and the rest of the wages in Mexico.

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sumption measure of poverty.

Wong and Arguello (2009) find similar results for Ecuador, in terms of the differentiated impact on rural and urban poverty, when applying a CGE and micro models to simulate a combined policy of a free trade agreement with the US and a VAT rate increase (eliminating current food exemptions) to compensate for tariff revenue losses. In Wong and Arguello, national poverty falls, but rural poverty increases, although the effects are small. According to these authors, the effects on employment and on real wages and earnings (with respect to the poverty line) could explain this result on poverty: there is a fall in self-employed earnings and an increase in the real wages of unskilled workers and urban skilled workers. As the real wage of unskilled and urban skilled workers rises, some workers may lose their employment, and the results worsen poverty. The VAT rate increase may compound this effect as the rural self-employed (mostly farmers) have a bigger share of food consumption (originally VAT exempted) which –under the worst poverty outcome scenario- would be subject to VAT. Also for Ecuador, Vos and DeJong (2003) analyze poverty impacts with a CGE-micro framework, but of a Free Trade Agreement of the Americas (FTAA) scenario, as opposed to just an FTA between Ecuador and the US. The CGE-micro model of Vos and De Jong predicts that with a FTAA type of trade liberalization (that adjusts for changes in world prices using GTAP results), the welfare of Ecuadorians would slightly increase, although there would be an increase in the wage differential between skilled and unskilled workers, and no poverty-reducing effects. However, in this study there is no emphasis on urban/rural poverty effects, and the micro modeling is approached as a random process (that is, the micro model does not use real household data for the analysis of poverty changes, but it generates a distribution and uses it to explain poverty changes).

Ganuza, Morley, Robinson, Pineiro, and Vos (2004), applying a CGE-micro simulation framework for several Latin American countries, find that different scenarios of trade liberalization (tariff reduction, a free trade agreement of the Americas, and a world wide WTO rules enforcement) lead to poverty reduction effects. Again, the effects on poverty are small.

Most of the studies mentioned above apply computable general equilibrium models and micro models to study the poverty impacts of trade liberalization because these studies try to capture the direct (price effects on commodity markets from lower tariffs) and indirect channels (for instance, factor market effects arising from higher/lower production resulting from trade liberalization) through which trade can impact poverty. A general equilibrium model, unlike a partial equilibrium model, should capture such direct and indirect effects.

There are several ways to approach the analysis of the impact on poverty and income distribution of changes in economic policies within a combined CGE-micro-simulation framework. These approaches can be classified according to the interrelation between the CGE and the micro model or data they apply: top-down, bottom-up, both top-down and bottom-up; layered, fully integrated; representative, extended representative or real household data. Bour-

guignon, Pereira, and Stern (2002), and Davies (2004) highlight the main characteristics, applications, and advantages and disadvantages of these approaches. Lofgren, Robinson, and El-Said (2003) explain the representative household approach.

Cockburn (2005) is an example of a fully integrated CGE-micro-simulation model. Fully integrated CGE micro simulation models have as many households in the CGE model as in the micro model with the aim to account for the full distributional changes in household data (inter- and intra-household) as a result of policy changes. The gain in income variation comes at the cost of high computational demands and a highly complex model set up. Savard (2003) designed a top-down/bottom-up approach, where the CGE and the micro model connect in a two-way fashion to capture household responses to policy changes (given in the CGE model) as well as responses in the economy to feedback from the household reactions to policies. Bourguignon, Robilliard and Robinson (2003) follow a top-down layered or sequential approach.[8]

The top-down approach has been widely applied as it makes it easy to follow the chain of events from changes in commodity and factor prices, and employment –stemming from the CGE model– to the effects in households' real income and consumption, and poverty –obtained in the micro model (once the CGE price and employment changes are passed into the micro model). The main criticism against the top-down approach is that this approach ignores feedback mechanisms from households' responses in the micro-model simulations to the CGE economy-wide model.

The present study adopts a top-down sequential approach with a CGE and a micro model along the lines of Bourguignon, Robilliard and Robinson (2003), connecting a CGE model and a micro model of earnings and occupational choice by households through changes in wages, earnings, prices, and employment. A key contribution of the present study is the modeling of agricultural trade policies and the analysis of impacts on Ecuadorian urban and rural poverty with *real* household data of a free trade agreement between Ecuador and the EU.

4. Methodology[9] and Data

The method applied includes four main stages, and has a sequential approach, given that the macro and the micro-modelling part are developed separately. A key step is to ensure consistency between the CGE and the micro model data. This is an insightful approach as it allows us to transmit to the household level, domestic price and resource reallocation changes expected from trade liberalization and agricultural trade policies that may have a key influence on household poverty and income distribution. It also allows us to analyze the full distribution of real

[8] See also Robilliard, Bourguignon and Robinson (2005), Robilliard, Bourguignon and Robinson (2008), and Bussolo and Lay (2005).
[9] This section relies on Wong and Arguello, forthcoming.

household income *within* households and not just *between* households, which is the traditional weakness of models which use a representative household approach.

As mentioned above, the top-down approach using a CGE and micro models is not free of criticism either. Main criticisms against this approach are the lack of feedback from households' results to the CGE model, and the ad-hoc nature of the micro-model equations.

The four main modelling stages are:

1) Linking, in a consistent way, the micro and the CGE models (See Section 4.2.2 below). This study follows the *consistency rules* provided by Bourguignon, Robilliard and Robinson (2003), by which changes in the variables (aggregate employment, wages, earnings, and prices) of the micro-model data equations are set to be equal to changes in similar variables of the CGE model.
2) Solving the trade policy changes in the CGE country model for Ecuador, and getting a new set of variables (a vector of appropriate prices, aggregate wages and earnings, and aggregate employment variables) that are used to communicate with the micro-simulation model. An overview of the CGE model is presented below.
3) Estimating the coefficients in the occupational choice, and wages and earnings regressions.
4) Evaluating the impacts of the policy changes on poverty using the changes in employment, wages and earnings from the CGE into the micro model estimations so that the results are consistent with the post-policy-change macro variables generated by the CGE model.

An issue, addressed prior to the macro-micro links issue, is the modelling of both the single-country CGE model for Ecuador and the micro model so that the models take into account key features of the Ecuadorian economy and households (such as the agricultural sector, household characteristics, and labor market). To deal with unemployment, this study adopts a proper closure that keeps wages fixed and allows for adjustment in labor quantities. Whether or not unemployment in Ecuador (9 to 11% on average annually in the last 5 years) is really a problem (of rationing) worth dealing with in a more detailed fashion, within the framework proposed, is an issue that remains to be discussed.

This research utilizes an input-output table and a social accounting matrix (SAM) for Ecuador for the year 2004, both developed by the Central Bank of Ecuador. This SAM was modified to suit the needs of the present study (Annex 1 provides a further description of the SAM). The study also uses the 2005-2006 survey of urban and rural households' life conditions, collected by the National Institute of Statistics and Censuses (INEC). This survey follows the same methodology and format as the World Bank's Living Standards Measurement Study (LSMS) household surveys. The survey includes data on income and occupational choices at the individual level, as well as income on agricultural and business activities and expenditure at the household level. The unit of study of the household survey is the household and its mem-

bers. That is, besides household level data, the survey also contains data for variables at the individual level.

4.1 The Micro Model

The micro model is based on a set of reduced form equations that describe individual wages, individual and household self-employment income, and the occupational choices of individuals in the household survey, as in Bourguignon, Robilliard and Robinson (2003).[10]

The wage equation is a semi-logarithmic equation of the logarithm of the wages of individual *i* in household *m* with independent variables: a constant, age, years of schooling, years of schooling squared (to account for non-linearity in income generation), number of children under 18 years of age, and dummies for gender, marital status, and head of household. There are four labor market segments: urban skilled, urban unskilled, rural skilled and rural unskilled.

The earnings or self-employment income equation is a semi-logarithmic equation of the logarithm of self-employment income of household *m*, with independent variables: a constant, age of head of household, years of schooling and years of schooling squared of the head of household, land size of the farm field of those households that have farm income, and dummies for gender and marital status of the head of the household. This self-employment income equation includes also a variable for the number of household members actually involved in self-employment.

Both total wages and earnings equations are estimated by OLS and by Heckman two-stage, the latter to control for sample selection bias. Sample selection bias may arise given that the wage and income is observed by those who actually participate in the labor market, although this is less of a problem with large samples such as the data used here. The regressions for wages and earnings show, in general, expected signs and significant effects. Working-age male household members command higher wages than female ones. Age has a positive and significant effect on wages and earnings (except in the equation for urban self-employment income, where age is not significant). Married members show higher wages than unmarried members (except in the equation for rural unskilled wage workers, and the urban self-employed, where marital status is not significant). The heads of household have a higher wage than the rest of working-age household members. Education leads to a higher wage for urban-skilled, urban-unskilled, and rural unskilled wage workers. The effect of formal education on wages of rural-skilled workers is negative, although not significant.

For self-employed individuals, higher education also has a positive and significant effect on earnings.

[10] For details on the micro model see Wong and Arguello, forthcoming.

The Heckman two-step estimates present similar effects to those in the OLS regressions, for both the wage and earnings equations. That is, it appears that the household samples are large enough, so we can use the OLS estimates. The OLS estimates for the wages and earnings regressions will later be used in the micro simulation that links the survey data (from the micro model) with the SAM data (from the CGE model).

The occupational choice equation is a multinomial logit of three occupational alternatives for individual *i*: (i) inactive or unemployed (benchmark, not estimated), (ii) wage earner, and (iii) self-employed (farm and non-farm activities for the household).

Table 8 shows data on the number of workers and their wages and earnings. There are fewer self-employed (41 percent) than wage earners (59 percent), and the latter have a bigger share of total wages and earnings (55 percent) than the self-employed people. These differences hold for urban and rural areas, although in rural areas the wage-worker earnings' share (44 percent) is lower than the self-employed earnings' share (56 percent) in total wages and earnings.[11]

In the occupational choice model, individuals decide whether to be inactive, self-employed, or wage worker, based on the utility associated to each choice. This equation states that an individual will be wage-employed if the utility associated with wage employment is higher than the utility of being self-employed or inactive. The base category is "inactive", and its associated utility is zero. For the wage-worker category, the occupational choice equation applies the set of independent variables: years of schooling, years of schooling squared, number of children under 18 years of age in the household, exogenous income (such as aid and remittances), and dummies for gender, marital status, and for somebody in the household who owns a family business. There is, of course, an error term (u^{w}_{mi} if wage worker, and u^{s}_{mi} if self-employed). The coefficient estimates and their correspondent residuals will later be applied to the micro simulation that connects the micro model with the CGE model results when simulating changes in employment status (under the scenarios that assume unemployment).

Table 8.- Number of workers, wages, and earnings, 2005

	Total		Urban		Rural	
Description	**Value**	**%**	**Value**	**%**	**Value**	**%**
Number of wage workers	3,270,907	59%	2,254,662	62%	1,016,245	54%
Number of self-employed	2,279,231	41%	1,401,028	38%	878,203	46%
Total	5,550,138	100%	3,655,690	100%	1,894,448	100%
Wages, Annual Millions of US$	10,800	55%	8,750	52%	2,050	44%
Earnings, Annual Millions of US$*	8,830	45%	6,260	48%	2,570	56%
Total	19,630	100%	15,010	100%	4,620	100%

Source: Own calculations using Ecuador's Household Survey 2005-2006.

[11] Data on total wages and earnings should be regarded with care as these data may be subject to problems of under-reporting and omission.

For the category self-employed, the choice equation has as the dependent variable the number of household members working in self-employment activities, and as the set of independent variables the same set defined above. This equation states that an individual *i* of household *m* will prefer self-employment if its associated utility is higher than the utility of inactivity or wage employment.

An income accounting equation complements the earnings and occupational choice model. The total household income will be adjusted using the consumer price index resulting from the CGE simulations.

4.2 Overview of the CGE Model

The Ecuador CGE model is a standard neoclassical static CGE model based on Lofgren et al 2002.[12]

The basic structure of the model is the following. Technology is modeled at the top by a Leontieff function of value added and aggregate intermediate input. The value added equation is a CES function of primary factors (labor, capital, and land) and the aggregate intermediate input is a Leontieff function of disaggregated intermediate inputs. Each activity can produce more than one commodity following fixed yield coefficients. A commodity can also be produced by more than one activity. There are 27 sectors: nine primary or extractive (six agricultural, two fisheries, and mining and oil), eight food industries, seven non-food manufacturing industries, and three service sectors. These sectors or industries produce 27 goods or services, 17 of which are produced by more than one industry.

Households, split between rural and urban, receive income from factors and transfers from other institutions (government, the rest of the world, and other households) and consume. Consumption is the residual after paying taxes, savings, and transfers to other institutions, and is spent according to LES demand functions derived from a Stone-Geary utility function. Self-employment also generates income for households, but no attempt is made to distinguish between labor and capital from self-employment income due to the lack of reliable data to do so. Commodities may be marketed or consumed directly by the household producer, valued at producer prices.

Enterprises may receive factor income (only from capital) and transfers from other institutions. Their activities are assumed to maximize profits, subject to technology and taking prices as given. Their total income can be allocated between direct taxes, savings, and transfers to other institutions.

[12] Löfgren, H., R. L. Harris, and S. Robinson (2002), "A Standard Computable General Equilibrium (CGE) Model in GAMS," International Food Policy Research Institute.

The government collects taxes and gets transfers from other institutions and spends this income on purchases (basically services), transfers to households, payments to other regions, and savings. Government consumption is fixed in real terms while transfers to domestic institutions are CPI-indexed, and savings is a residual

As for factor markets, there are six labor types: four wage-labor types and two self-employed types. Wage workers are organized by educational level and area of residence. Educational levels comprise of (i) unskilled: no formal education and primary, and (ii) skilled: secondary (whether complete or not) and higher. Each of these wage-worker types is split into rural and urban, according to their area of residence. Self-employed labor is divided into urban and rural, according to the location of the household's residence. The other factors included are capital and land. There is no distinction as to land or capital types.

To incorporate land in this model, part of the return to capital (included in the mixed income or self-employment income) was apportioned to land using return-to-land shares from the GTAP-AGR database 6.2 (base year 2001). This procedure affects only the six agricultural sectors in the Ecuador SAM.

As this study looks at impact effects, capital is assumed to be sector specific or immobile (although an alternative closure allows for capital mobility). Land is also assumed to be immobile.

Marketed outputs are imperfectly substitutable under a CES function. Aggregated domestic output is allocated between domestic consumption and export through a CET function. Domestic demand comes from households and government consumption, investment, and intermediate input consumption. Export demands and supplies are infinitely elastic.

There are four foreign regions in the model: the US, the EU, the Andean Community, and the Rest of the World. The export data are incorporated in a nested structure that includes the regions mentioned above.

Aggregate composite imported commodities and domestic output are imperfect substitutes in demand using a CES function (Armington assumption). Imports are differentiated by region of origin using a single nest structure that includes the four import markets.

Household direct taxes are defined as fixed shares of household income. The rest of taxes are at fixed ad valorem rates, as are tariff rates. The treatment of taxes varies according to the closure rule adopted. Given that this study is not focused on compensating for government revenue losses that may arise due to tariff reduction or elimination, throughout this study it is assumed that the government savings are flexible, and that taxes are at fixed rates. Government consumption is assumed to be fixed.

Annex 3 lists the equations that embody the main changes included in the basic Lofgren model.

4.2.1 Calibration of CGE model and Closures

The Ecuador CGE model is calibrated to a modified SAM that includes the European Union as a trade region, while the original SAM from the Central Bank of Ecuador includes only the US, Andean Communities and Rest of the World as trade regions. A new SAM with the EU as a fourth trade region was built by using trade data from the Central Bank of Ecuador. Export and Import data by sector for the EU was taken out of the corresponding data of the Rest of the World.

The CGE is calibrated in such a way that its data is consistent with data coming from the household survey employed. In particular, total household income is consistent in the SAM and in the micro model database, the sectoral division of income comes from the original SAM, and the split between urban and rural households, both in terms of factor income and from self-employment, is consistent with that in the household survey.

This study follows standard procedures for calibrating parameters and elasticities of a CGE model. To the extent that they are available, this study uses econometric estimates of elasticities for Ecuador (See tables A4.1 and A4.2 in Annex 4). The calibration procedures include checks such as tests for data replication, tests for parameter weights, Walras' Law, etc.

The following closures reflect both the relevant conditions in the Ecuadorian economy before the shocks and the expected mechanisms by which trade may have an impact on poverty. First, and concerning the external balance, as the Ecuadorian economy uses the US dollar as its official currency, the nominal exchange rate is fixed. The current account is assumed fixed too, so as to avoid the "free lunch" effect that arises (in a static model) if the foreign savings were allowed to adjust to fill the current account gap. The nominal exchange rate is used as the numeraire and the consumer price index is allowed to vary so that the real exchange rate can adjust too.

Secondly, for the government closure, all the tax rates (for households and enterprises) are fixed and government savings vary. Government consumption is fixed in real terms (or as a share of total absorption).[13]

Regarding the savings-investment closure, this study assumes that it is investment driven and balanced. In this closure, both nominal absorption shares of investment and government consumption are fixed at base levels (flexible quantities). The residual share for household consumption is also fixed at base levels (flexible quantities). There is a uniform marginal propensity to save (MPS) point change for selected institutions.[14]

[13] "With regard to government consumption, the (single-period) model does not capture its direct and indirect welfare contributions; to avoid misleading results, it is also preferable in welfare analysis to keep this variable fixed." Lofgren et al (2002), p.16.

[14] Alternatively, the assumption for the change in MPS could be that this is done as a scaled (not point) change for selected institutions. This is just to highlight the point made by Lofgren et al (2002) by which the impacts may vary according to the way the MPS adjusts, either as a point change or in a scale fashion.

As per factors markets, this study assumes that land is not mobile to capture the notion that crops can only be cultivated in land with some agro-ecological requirements, unique for each type of crop (for instance, land that is used to cultivate bananas cannot be used to cultivate flowers). There are two scenarios for capital mobility: (i) sector-specific capital, to highlight the notion that in Ecuador there are capital rigidities or restrictions, and (ii) capital mobility between sectors. To simplify the analysis for the reader and because the results of capital mobility and sector-specific capital do not show many differences in most scenarios, we analyze predominantly the case of capital being mobile. In the case that striking differences occur, we highlight the results of capital being sector specific too.

The closure rules vary according to the two types of additional assumptions regarding factor markets: (i) full employment of all factors and factor returns adjust to clear the markets (the classical trade model closure), and (ii) unemployment in the unskilled salaried labor market segment, both rural and urban, a feature expected to be common in most of the Latin American economies (the classical development theory closure, pointed out by Winters 2000), while the rest of factor markets clear through changes in returns.

4.2.2 Linking micro model and CGE model

In order to analyze whether consistency between the aggregate income and consumption data in the micro model and the data in the CGE model at the benchmark equilibrium exists or not, we compare these two sets of data. These two data sets are said to be consistent if discrepancies between the survey and SAM data for each of the two aggregates are equal or lower than 10 percent. According to the data comparison between the 2005 household survey data and the 2004 Social Accounting Matrix of Ecuador, there are no significant differences between aggregate total incomes in the two data sets (the difference between aggregate income data amounts to 2 percent). Differences in aggregate consumption are higher (15 percent), so we keep income data fixed and re-balance consumption data in the SAM.

To ensure consistency in the model simulations, percentage changes in household data should match percentage changes in the CGE model data after performing changes in policy in the CGE. In particular, the percentage changes in aggregate wages, earnings, and employment that link the CGE model with the micro model should be equal in both data sets. The changes in some or all of these aggregates are triggered by a policy change or shock that hits the economy (in the CGE model). These changes are then incorporated into the household behavior through the micro-simulation for wages, income, and employment, so that consistency requirements are met. More specifically, the general post-simulation consistency rules imply:

This comparison could be interesting if there were changes in taxes, for instance, if the study were focused on exploring the effects of a tax replacement policy.

(i) For the number of wage earners: the percentage change in the number of all wage earners from the household survey (the sum over each individual, whether heads, or other members in a household and then sum over all households) equates the percentage change of total wage employment for each labor market segment arising from the CGE simulations. This consistency rule applies in the case of unemployment, where adjustments are expected in the number of unskilled wage workers. To choose which wage worker moves into (out of) wage employment, wage workers are ordered according to their probability of being wage worker (inactive) given by the multinomial logit occupational choice model regressions, individuals with the highest probability being chosen first.

(ii) For wages: the percentage change of total wages based on household survey data should be equal to the percentage change in the total wage bill arising from the CGE model simulations (for each labor market category).

(iii) For self-employment income: the percentage change in total income from household data should equal the percentage change in self-employed earnings from the CGE model (for each category, rural and urban).

To ensure consistency with income data in the baseline from the Ecuadorian household survey, this study follows recent literature and it adds back estimated residuals into the estimated household behavior equations. This study simulates changes in wages and earnings via changes in intercepts. That is, it does not re-estimate micro equations behavior. Consistency checks are performed in each simulation result.

5. Scenarios

This section summarizes the alternative scenarios applied to analyze the poverty effects of the free trade agreement with the EU in Ecuador.

(i) Free trade for all EU products (100 percent tariff reduction), and Ecuador keeps the GSP+ preferences

(ii) Free trade for all EU products, Ecuador keeps the GSP+ preferences, and receives better access for bananas to the EU market

(iii) Preferential trade, similar as the first scenario but with a 50 percent (instead of 100 percent) tariff reduction

Tariff elimination implies zero tariffs after the trade agreement is in place for all goods and services imported from the EU, starting from the original effective tariffs, shown in the next table. The bandwidth of the applied tariffs lies between 0.1% and 23%. Most tariffs are in the range of 13% to 17%. Commodities of the sectors' transportation equipment, alcoholic and non alcoholic beverages and telecommunication and small services are subjected to the highest effective tariffs.

Table 9.- Ecuador's Effective Tariff rates with the European Union

SAM Sector	Product	Total tariff EU (%)
1	Banana, coffee, and cocoa	15.00
2	Cereals	15.15
3	Flowers	0.07
4	Other agricultural products	8.15
5	Livestock	5.63
6	Forestry products	13.54
7	Shrimps	-
8	Raw fish	8.09
9	Crude oil, mineral products and fuel oils, and other oil products	1.60
10	Meat, meat products and sub products	18.67
11	Canned fish and other manufactured aquatic products	17.83
12	Oil and fats	17.25
13	Dairy products	17.43
14	Milling and bakery products	17.23
15	Sugar products	16.44
16	Alcoholic and non-alcoholic beverages	20.00
17	Other miscellaneous food products, chocolate and tobacco	12.98
18	Textiles and apparel, leather, leather products and footwear	13.54
19	Wood and wooden products	17.09
20	Paper and paper products	6.87
21	Chemicals, rubber and plastic	6.68
22	Metallic and non-metallic mineral products	10.34
23	Transportation equipment	23.11
24	Machinery and equipment, other non-food manufactured goods	4.93
25	Transportation services and storage	-
26	Telecommunication and mail services	18.81
27	Other services	-

Source: Social Accounting Matrix of Ecuador 2004 from the Central Bank of Ecuador and own calculations.

6. Results

Preliminary results from the CGE model show that imports from the EU would increase after a trade agreement with this region. Sectors with the highest increase in import quantities in all three scenarios are beverages, wood and wooden products, canned fish and other seafood products, textiles and apparel, meat and meat products, and cereals. However, total imports increase modestly, as imports from the EU currently represent around 9 to 10 percent of total imports.

Table 10.- Percentage changes in the quantity of imports from the EU
By commodity

Description	Base Millions of US$	Free Trade		50% tariff reduction		Free trade and + banana access	
		Full employment	Unemployment	Full employment	Unemployment	Full employment	Unemployment
Cereals	0.0	14.6	14.6	6.8	6.8	16.1	16.5
Flowers	3.1	0.3	0.3	0.1	0.1	8.2	7.3
Other agricultural	8.1	3.1	3.1	1.5	1.5	3.6	4.3
Livestock	0.5	11.6	11.6	5.5	5.5	13.7	14.8
Forestry	3.3	10.7	10.7	5.0	5.0	12.7	13.9
Raw fish	0.7	-0.1	-0.1	-0.1	-0.1	0.7	1.4
Fuel oils and other oil prod.	66.9	0.6	0.6	0.3	0.3	0.6	1.0
Meat, meat prods. and sub-prod.	0.4	16.9	16.9	7.8	7.8	18.6	19.6
Canned fish and other aquatic	0.1	18.6	18.6	8.5	8.5	21.5	22.7
Oil and fats	2.9	13.1	13.1	6.1	6.1	14.0	14.6
Dairy	1.4	13.6	13.6	6.3	6.3	15.0	15.7
Milling and bakery	6.0	10.8	10.8	5.1	5.1	12.9	13.6
Sugar	0.4	0.2	0.2	0.1	0.1	1.5	2.1
Alcoholic and non-alcoh. beverages	25.0	25.5	25.5	11.5	11.5	27.2	28.2
Other miscellaneous food	11.7	11.2	11.2	5.3	5.3	11.2	11.6
Textiles, apparel and leather	23.0	17.0	17.0	7.8	7.8	18.3	19.3
Wood and wooden products	6.3	13.1	13.1	6.3	6.3	19.6	23.6
Paper and paper products	37.9	8.8	8.8	4.2	4.2	9.3	10.1
Chemicals, rubber and plastic	218.2	3.0	3.0	1.5	1.5	5.0	6.0
Metallic and non-met. mineral prod.	93.5	6.4	6.4	3.1	3.1	6.9	7.5
Transportation equipment	41.1	6.0	6.0	2.9	2.9	6.2	6.9
Machinery and equipment	396.2	4.2	4.2	2.0	2.0	4.8	5.6
Telecom. and mail services	0.0	-0.2	-0.2	-0.1	-0.1	0.4	1.3

Source: Own calculation
Note: For all the scenarios the closures include: capital mobility, sector-specific land, and balanced investment point share adjustment.

In terms of exports, no noticeable impacts occur in the scenarios of free trade and partial trade liberalization because most of Ecuador's exports are already free and these two scenarios do not include a better access to any export products, just the permanence of SGP+.

Nonetheless, in the third scenario, when in exchange for zero tariffs to EU products Ecuador not only keeps current trade preferences from the EU, but also obtains better access for its banana exports to the EU, banana exports show a considerable increase, both under the full employment (21 percent) and the unemployment (25 percent) assumptions (Table 11). In both cases, the increase in banana exports is higher when capital is mobile than when capital is assumed sector specific. In other words, capital restrictions imply that not all export opportunities can be fully materialized.

Table 11.- Percentage changes in the quantity of exports to the EU
By commodity

Description	Base Millions of US$	Free trade and + banana access			
		Full employment		Unemployment	
		Capital mobility	Capital sector specific	Capital mobility	Capital sector specific
Banana, coffee, and cocoa	435,0	21,0	16,4	25,4	20,6
Cereals	0,0	-3,2	-3,1	-2,2	-2,2
Flowers	62,0	-13,2	-10,7	-10,0	-7,6
Other agricultural products	30,8	-2,3	-2,6	-1,9	-2,2
Livestock	0,0	-1,1	-2,1	-1,0	-2,0
Forestry products	7,6	-2,3	-2,8	-2,7	-3,4
Shrimps		-	-	-	-
Raw fish	0,7	-0,8	-0,9	-0,6	-0,7
Fuel oils and other oil products	0,0	-1,7	-0,2	-1,8	-0,3
Meat, meat products and sub products		-	-	-	-
Canned fish and other aquatic products	122,7	-1,8	-1,9	-1,8	-1,8
Oil and fats	0,8	-2,0	-2,6	-1,9	-2,9
Dairy products		-	-	-	-
Milling and bakery products	0,1	-2,7	-2,7	-2,2	-2,2
Sugar products	0,2	-0,7	-2,2	0,1	-1,7
Alcoholic and non-alcoholic beverages	0,1	-1,0	-1,6	-0,7	-1,8
Other miscellaneous food products	147,9	1,8	-0,5	2,9	0,3
Textiles, apparel and leather products	12,5	-1,0	-1,7	-0,5	-1,4
Wood and wooden products	0,2	-1,9	-2,0	-2,4	-2,4
Paper and paper products	0,3	-0,6	-1,2	-0,3	-1,1
Chemicals, rubber and plastic	1,0	1,2	-0,7	2,0	-0,5
Metallic and non-metallic mineral products	10,3	-0,5	-0,9	0,1	-0,4
Transportation equipment	0,0	-0,2	-0,6	0,3	-0,3
Machinery and equipment	7,1	-1,1	-2,0	-0,7	-1,9
Transportation services and storage	78,5	-0,8	-1,8	-0,7	-1,7
Telecommunication and mail services	23,1	-0,2	-1,7	0,5	-2,6
Other services	134,2	-0,1	-0,6	0,2	-0,4

Source: Own calculations.
Note: For all the scenarios the closures include capital mobility, sector-specific land, and balanced investment point share adjustment.

Better access to the EU banana market gives the incentive for an increase in banana production that in the model (with no intertemporal growth) implies a reduction in production in other sectors, particularly agricultural sectors, such as flowers, cereals, and other agricultural products. As expected, this decrease in production is higher under the full employment assumption (for instance, 13 percent reduction in flower production) than it is under the unemployment scenario (10 percent reduction in flower production, to continue with the same example). Table 12 shows the results. Lower production in real terms brings with it an increase in the consumer price index, unlike in the previous two trade agreement scenarios in which the CPI falls (Table 13). The increase in the CPI will in turn have an impact on poverty, as we will see later on.

Table 12.- Percentage changes in production at market value
By commodity

Description	Base Millions of US$	Free trade and + banana access			
		Full employment		Unemployment	
		Capital mobility	Capital sector specific	Capital mobility	Capital sector specific
Banana, coffee, and cocoa	1.488,0	15,2	11,2	19,1	14,8
Cereals	447,2	-1,6	-1,3	-0,9	-0,6
Flowers	448,0	-11,1	-9,0	-8,3	-6,2
Other agricultural products	1.178,0	-0,7	-0,7	-0,2	-0,3
Livestock	1.190,3	0,1	0,0	0,5	0,4
Forestry products	439,5	-0,7	-0,9	-0,6	-0,8
Shrimps	785,1	-7,8	-2,0	-8,0	-2,0
Raw fish	538,3	-0,6	-0,5	-0,3	-0,2
Fuel oils and other oil products	8.451,4	-1,2	-0,1	-1,1	-0,1
Meat, meat products and sub products	1.143,3	0,1	0,0	0,5	0,3
Canned fish and other aquatic products	705,6	-1,6	-1,6	-1,5	-1,5
Oil and fats	550,8	-0,6	-0,6	-0,2	-0,4
Dairy products	417,0	-0,1	-0,2	0,5	0,2
Milling and bakery products	1.020,7	-0,6	-0,3	-0,1	0,2
Sugar products	237,0	0,2	-0,2	0,9	0,3
Alcoholic and non-alcoholic beverages	531,0	-0,5	-0,5	0,0	-0,2
Other miscellaneous food products	996,1	1,0	0,0	1,8	0,6
Textiles, apparel and leather products	1.373,8	-0,4	-0,6	0,2	-0,2
Wood and wooden products	721,9	-0,9	-1,0	-0,9	-1,0
Paper and paper products	750,3	-0,4	-0,7	0,1	-0,3
Chemicals, rubber and plastic	1.409,2	1,5	0,5	2,4	1,1
Metallic and non-metallic mineral products	1.438,9	-0,3	-0,5	0,3	0,0
Transportation equipment	523,7	-0,1	-0,2	0,5	0,3
Machinery and equipment	1.227,2	-0,4	-0,6	0,2	-0,3
Transportation services and storage	4.610,1	0,5	0,2	1,0	0,7
Telecommunication and mail services	1.388,6	0,1	-0,1	0,9	0,0
Other services	19.744,7	0,1	-0,1	0,5	0,3

Source: Own calculations.
Note: For all the scenarios the closures include capital mobility, sector-specific land, and balanced investment point share adjustment.

Table 13 shows that real impacts on GDP are negligible (given that the model is static), in particular under the full employment assumption.

Regarding partial trade liberalization, the results go in the same directions as those of free trade, but with half the magnitude. Therefore we concentrate our interpretation of the model results on free trade and free trade with better banana access to the EU.

Table 13.- Percentage change in GDP and components, including CPI [1, 2]

Nominal and real

Variable	Labor market	Free Trade				50% tariff reduction				Free trade and better banana access			
		Nominal		Real		Nominal		Real		Nominal		Real	
		Capital mobility	Capital sector specific	Capital mobility	Capital sector specific	Capital mobility	Capital sector specific	Capital mobility	Capital sector specific	Capital mobility	Capital sector specific	Capital mobility	Capital sector specific
Absorption	FE	-0.30	-0.47	0.01	0.00	-0.15	-0.23	0.00	0.00	1.06	2.07	0.22	0.23
	UE	-0.29	-0.48	0.01	0.00	-0.14	-0.23	0.00	0.00	1.90	2.86	0.73	0.62
Private consumption	FE	-0.30	-0.47	0.00	0.00	-0.15	-0.23	0.00	0.00	1.06	2.07	0.22	0.29
	UE	-0.29	-0.48	0.00	-0.01	-0.14	-0.23	0.00	0.00	1.90	2.86	0.76	0.69
Fixed investment	FE	-0.27	-0.45	0.14	0.11	-0.13	-0.22	0.07	0.05	1.17	2.19	0.47	0.49
	UE	-0.26	-0.46	0.14	0.09	-0.13	-0.22	0.07	0.05	2.09	3.03	1.04	0.96
Stock change	FE	-0.68	-0.72	-	-	-0.34	-0.36	-	-	-0.36	0.66	-	-
	UE	-0.68	-0.71	-	-	-0.34	-0.35	-	-	-0.36	0.84	-	-
Exports	FE	0.30	0.23	0.30	0.23	0.15	0.11	0.15	0.11	1.13	1.41	0.28	0.59
	UE	0.31	0.23	0.31	0.23	0.15	0.11	0.15	0.11	1.89	2.06	1.01	1.21
Imports	FE	0.28	0.22	0.28	0.22	0.14	0.11	0.14	0.11	1.05	1.31	1.05	1.31
	UE	0.29	0.21	0.29	0.21	0.14	0.10	0.14	0.10	1.75	1.91	1.75	1.91
GDP (value added)	FE	-0.31	-0.48	0.01	0.00	-0.15	-0.23	0.00	0.00	1.08	2.12	-0.01	0.01
	UE	-0.30	-0.49	0.01	0.00	-0.14	-0.23	0.00	0.00	1.94	2.92	0.51	0.40
GDP (factor cost)	FE	-0.05	-0.23	0.00	0.00	-0.02	-0.11	0.00	0.00	1.40	2.47	0.00	0.00
	UE	-0.04	-0.23	0.00	-0.01	-0.02	-0.11	0.00	0.00	2.27	3.29	0.51	0.39
CPI change	FE	-0.30	-0.48			-0.15	-0.23			0.83	1.77		
	UE	-0.30	-0.47			-0.14	-0.23			1.12	2.15		

Source: Own calculations.

Notes: 1.- For all the scenarios the closures include: sector-specific land, and balanced investment, point share adjustment. **2.-** FE = full employment. UE = unemployment in unskilled wage workers.

Next, we analyze the effects of a trade agreement with the EU on factor remunerations. Under the assumption of *full employment*, a *zero-tariff agreement with the EU* results in a fall in nominal wages and earnings, except in the case of wages for rural unskilled wage workers (see Table 14). Land and capital show a small increase in returns. Real returns to factors go up – although modestly– for all factors of production, given that cheaper access to imports from the EU would bring about a fall in the consumer price index. Under full employment and a 50 percent tariff reduction, results for factor returns go in the same direction, but with a lower magnitude. Table 14 shows the percentage changes in factor returns. Land and rural unskilled wages experience the highest increase in real terms in all scenarios.

Table 14.- Percentage change in Labor factor returns [1,2]

Nominal and real

Labor market	Factor type	Free Trade		50% tariff reduction		Free trade and + banana access	
		Nominal	Real	Nominal	Real	Nominal	Real
LABOR							
	Urban						
FE	Unskilled wage labor	-0,05	0,25	-0,02	0,12	1,89	1,06
	Skilled wage labor	-0,09	0,21	-0,04	0,10	1,49	0,66
	Self-employment	-0,11	0,19	-0,05	0,09	1,66	0,83
UE	Unskilled wage labor	-	0,30	-	0,14	-	-1,12
	Skilled wage labor	-0,08	0,22	-0,04	0,11	2,52	1,39
	Self-employment	-0,10	0,19	-0,05	0,09	2,68	1,56
	Rural						
FE	Unskilled wage labor	0,17	0,47	0,08	0,23	5,63	4,81
	Skilled wage labor	-0,06	0,24	-0,03	0,12	2,25	1,43
	Self-employment	-0,09	0,21	-0,04	0,11	2,01	1,18
UE	Unskilled wage labor	-	0,30	-	0,14	-	-1,12
	Skilled wage labor	-0,05	0,25	-0,02	0,12	3,44	2,32
	Self-employment	-0,07	0,22	-0,04	0,11	3,13	2,01
CAPITAL							
FE	-	0,02	0,32	0,02	0,16	-0,01	-0,84
UE	-	0,03	0,32	0,01	0,16	0,53	-0,60
LAND							
FE	-	0,23	0,53	0,11	0,26	7,10	6,27
UE	-	0,27	0,56	0,13	0,28	9,80	8,68

Source: Own calculations.
Notes: **1.-** For all the scenarios the closures include capital mobility, sector-specific land, and balanced investment point share adjustment. **2.-** FE = full employment. UE = unemployment in unskilled wage workers.

The fact that both unskilled rural labor and land receive higher returns may not be surprising as neoclassical theory of trade predicts that a country will specialize in the production (and export) of products that use more intensively the abundant factor, and that this factor will experience an increase in returns. Most of Ecuadorian exports to the EU consist of agricultural products (See Table 1), so it is expected that permanent free access to the European market would consolidate market access to this type of products. Agricultural export products to the EU in Ecuador are banana, flowers, and other vegetables and fruits, which are labor intensive. Thus, the results show that consolidation of access to the EU market brings a higher return to unskilled rural workers, which in turn may have a positive implication for poverty reduction, as we will see later on.

Compared to the previous two scenarios, *full employment* and *free trade with better access to the EU banana market* implies a higher increase in real wages and earnings. Rural wages increase more than urban wages (see Table 14). Unskilled wage workers experience a higher wage increase than skilled wage workers (in both rural and urban areas). If capital is assumed sector specific, increments in nominal wages are higher than in the case of capital mo-

bility (except for the increment in wages of rural unskilled wage workers –not shown in the table). Income from self-employment also increases and so do returns for land. In fact, land experiences the highest nominal and real percentage increase of all factor returns (6 percent in real terms). Capital returns decline slightly (0.84 percent).

The increase in urban wages, and the even bigger increase in rural wages (particularly for the unskilled wage workers) can be explained by the increase in banana exports which comes hand in hand with an increase in banana production –a sector that, as mentioned in the introduction, employs 1 to 3 workers per hectare and indirectly generates 1.5 to 10 jobs per hectare in production. As the assumptions also include full employment and a static model, an increase in banana production implies a reduction in the production of the other sectors, in particular other agricultural sectors –as already shown in Table 12. Given the assumption of full employment, higher banana production can be reached with an increase in real wages for the factor used intensively in this sector: unskilled labor, in particular rural unskilled labor. See Figure 1.

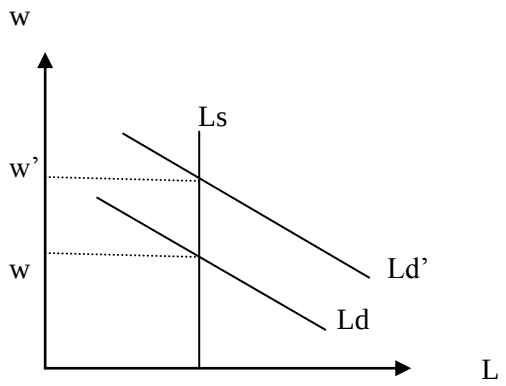

Figure 1.- Labor Market with full employment assumption

In a similar way to the full employment scenario, under *unemployment* in the unskilled wage labor (urban and rural), both zero-tariff and 50-percent tariff reduction scenarios lead to an increase in real factor returns, in particular for the unskilled wage workers. Under the assumption of unemployment, the adjustment in this labor market segment comes through changes in quantities (number of workers) and not through changes in nominal wages. Thus, an increase in real wages in turn implies decreased employment in the *urban* unskilled wage worker segment (-0.03 and -0.19 percent for the cases of capital mobility and sector-specific capital, respectively). On the contrary, for *rural* unskilled wage workers employment would increase in these two scenarios as well as their real wages –more so in the case of a zero-tariff agreement with the EU. For further details see Tables 14 and 15. Both an increase in employment and real wages for the *rural* unskilled workers should have an important poverty reducing effect.

A different situation may arise in terms of real return to factors under the scenario of *free trade with the EU and better access for bananas to the EU market* if there is *unemployment* in unskilled wage workers. In this case, an increase in banana production, implies an increase in unskilled labor demand (that reduces unemployment) met with lower real wages for unskilled wage workers both in rural and urban areas (1.12 percent, see Tables 13 and 14). See Figure 2.

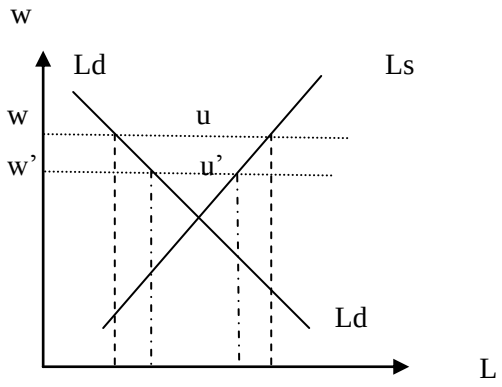

Figure 2.- Labor Market with unemployment assumption

The next section shows the poverty effects of the price increases, and both a fall in real wages and the increased labor demand of a free trade agreement with the EU with better market access to Ecuadorian bananas.

Table 15.- Percentage changes in employment for unskilled wage workers

	Base		Free Trade		50% tariff reduction		Free trade and + banana access	
Labor type	Numbers of workers	Percent	Capital mobility	Capital sector specific	Capital mobility	Capital sector specific	Capital mobility	Capital sector specific
Urban								
Unskilled wage worker	1,108,361	20%	-0.03	-0.19	-0.01	-0.09	2.69	3.46
Rural								
Unskilled wage worker	842,572	15%	0.15	0.07	0.08	0.04	5.86	5.67
Total	5,550,134	100%	-	-	-	-	-	-

Source: Own calculations.
Note: For all the scenarios the closures include sector-specific land and balanced investment point share adjustment.

Poverty results

Under the assumption of *full employment*, a *free trade agreement with the EU* (100 percent tariff reduction) shows small and mixed impacts on poverty, and results at the national level mask the different direction of impacts in rural and urban areas (Table 16). While there is a small decrease in indigence[15] in rural areas (0.11%), in urban areas indigence increases

[15] The poverty lines for extreme poverty (or indigence) and poverty, 1-dollar-a-day and 2-dollar-a-day, respectively, have been adjusted for the change in consumer prices resulting in the simulations.

(0.14%). On the other hand, rural poverty headcount increases (0.18 percent) while urban poverty falls (0.08 percent). In the end, both extreme poverty and poverty rates increase slightly at the national level. If the assumption of sector-specific capital is added, the fall in both rural indigence and urban poverty rates results in a fall in both indigence and poverty rates at the national level. In summary, the results suggest that in the case of full employment a free trade agreement with the EU leads to a redistribution of income to the benefit of the rural indigent and the urban poor.

With full employment and a preferential trade agreement that only reduces all tariffs charged to the EU by 50 percent , reductions in indigence and poverty are of smaller magnitude, while increases in poverty are bigger, resulting in a slight poverty and extreme poverty increase at the national level. It seems that the smaller fall in consumer prices and the smaller real wage raise produce lesser poverty impacts in this scenario.

Under full employment, an FTA with the EU that includes better access to Ecuadorian banana exports also shows mixed results on poverty. Both indigence and poverty rates fall at the national level if capital is assumed fully mobile (0.17 percent and -0.06 percent, respectively), but they increase if capital is assumed sector specific (0.04 percent and 0.32 percent, respectively).

So far a trade agreement with the EU has little, if any, poverty impact –given the small fall in goods' prices and factor returns. Nevertheless, if *unemployment* amongst unskilled wage workers is assumed, which may be a reasonable assumption in the Ecuadorian labor market, a *free trade scenario* leads to strong poverty reduction effects (Table 16). This reduction in poverty may be explained by the increase in employment that rural unskilled wage worker experience (Table 15), the increase in real wages and earnings for the urban and rural workers and self-employed (Table 14), and the fall in the consumer price index.

Rural unskilled wage labor accounts for about 15 percent of total employment and these workers belong to households that are amongst the poorest, so the gain in employment (amongst those currently unemployed –with the assumption that the newly employed will receive the average wage of the rural unskilled wage workers currently employed) may lead to a positive effect in poverty reduction. Urban unskilled wage workers represent 20 percent of total employment, and they also belong to households that are amongst the poorest. The increase in the real wage of this type of worker (an increase that is bigger than the one observed in the simulations under full employment) may also contribute to poverty reduction.

Under the two alternative closures (capital mobility and sector-specific capital) and the free trade and unemployment scenario, indigence rates as well as poverty rates fall (-4% and -9%, respectively). That is, there is a significant decline in poverty rates. As Table 16 reports, urban households show a higher decline of indigence and poverty rate than rural households. In

contrast to free trade and full employment, with free trade and unemployment rural and urban households are both winners, poverty and indigence decline in both areas. See Table 16.

Table 16.- Percentage changes in poverty indices (headcount) for each scenario

Scenario i.a: Free Trade, Capital Mobility	**Full employment**		**Unemployment**	
	Below one dollar a day	Below two dollars a day	Below one dollar a day	Below two dollars a day
Total Households	0.06%	0.01%	-4.30%	-9.22%
Rural Households	-0.11%	0.18%	-3.39%	-6.17%
Urban Households	0.14%	-0.08%	-4.79%	-10.81%
Hhd. headed by male	0.02%	0.03%	-3.55%	-7.94%
Hhd. headed by female	0.18%	-0.04%	-7.19%	-14.06%
Scenario i.c: Free Trade, Capital Sector Specific	**Full employment**		**Unemployment**	
	Below one dollar a day	Below two dollars a day	Below one dollar a day	Below two dollars a day
Total Households	-0.03%	-0.08%	-4.35%	-9.26%
Rural Households	-0.26%	0.01%	-3.43%	-6.26%
Urban Households	0.08%	-0.13%	-4.83%	-10.83%
Hhd. headed by male	-0.09%	-0.09%	-3.60%	-7.99%
Hhd. headed by female	0.16%	-0.04%	-7.21%	-14.08%
Scenario ii.a.: Preferential Trade, Capital Mobility	**Full employment**		**Unemployment**	
	Below one dollar a day	Below two dollars a day	Below one dollar a day	Below two dollars a day
Total Households	0.08%	0.09%	0.08%	0.11%
Rural Households	-0.07%	0.23%	-0.06%	0.26%
Urban Households	0.15%	0.03%	0.15%	0.03%
Hhd. headed by male	0.04%	0.11%	0.04%	0.12%
Hhd. headed by female	0.21%	0.09%	0.21%	0.09%
Scenario ii.c.: Preferential Trade, Capital Sector Specific	**Full employment**		**Unemployment**	
	Below one dollar a day	Below two dollars a day	Below one dollar a day	Below two dollars a day
Total Households	0.07%	0.04%	0.07%	0.04%
Rural Households	-0.09%	0.19%	-0.09%	0.19%
Urban Households	0.14%	-0.03%	0.14%	-0.03%
Hhd. headed by male	0.03%	0.06%	0.03%	0.06%
Hhd. headed by female	0.18%	0.02%	0.18%	0.02%
Scenario i.a: Free Trade Banana, Capital Mobility	**Full employment**		**Unemployment**	
	Below one dollar a day	Below two dollars a day	Below one dollar a day	Below two dollars a day
Total Households	-0.16%	-0.07%	0.08%	0.32%
Rural Households	-0.87%	-0.37%	-0.43%	0.13%
Urban Households	0.20%	0.09%	0.33%	0.42%
Hhd. headed by male	-0.22%	-0.04%	-0.07%	0.14%
Hhd. headed by female	0.04%	-0.13%	0.61%	1.01%
Scenario i.c: Free Trade Banana, Capital Sector Specific	**Full employment**		**Unemployment**	
	Below one dollar a day	Below two dollars a day	Below one dollar a day	Below two dollars a day
Total Households	0.04%	0.32%	0.32%	0.92%
Rural Households	-0.42%	0.20%	-0.02%	0.81%
Urban Households	0.27%	0.38%	0.48%	0.98%
Hhd. headed by male	0.00%	0.30%	0.14%	0.77%
Hhd. headed by female	0.18%	0.43%	0.98%	1.50%

Source: Own calculations.

A trade agreement with the EU that implies only a 50 percent tariff reduction to imports from the EU, again under the assumption of unemployment, shows modest, if any, poverty reduction effects. At the national level, indigence increases around 0.8 percent, while rural indigence falls by -0.06 percent, and urban indigence increases by 0.15 percent (under the assumption of capital mobility, but similar results are obtained if capital is assumed to be sector specific). Poverty rates increase 0.11 percent, which comes about from an increase in poverty of 0.27 percent in rural areas and of 0.03 percent in urban areas. If capital is sector specific, poverty is slightly reduced in urban areas (-0.03 percent). These results are in striking contrast with the bigger magnitude in poverty reduction obtained with a free trade (zero tariffs) trade agreement with the EU. It seems that the bigger reduction in prices obtained with a zero-tariff trade agreement (as opposed to only a 50 percent tariff reduction) has a greater impact on the poor's income (and thus their spending). A zero tariff agreement also creates more job opportunities for unskilled wage workers in both urban and rural areas and has a bigger poverty reduction impact than a 50 percent tariff agreement (see Table 15).

To understand these results on poverty, it is important to recall the main income sources for the poor (see quintile 1 in Table 4). For households living in rural areas, their main income source comes from agricultural activities and for those in urban areas, it comes from wages. It is also important to recall that a sizable share of the poor's spending is on food (approximately 40 percent for those in urban areas, and 54 percent for those in rural areas).

If the assumption of unemployment in unskilled wage workers is in place, and a free trade agreement with the EU with improved access to the EU banana market is reached, both indigence and poverty increase at the national level, with or without capital mobility (Table 16). Interestingly, in this scenario, there is the biggest increase in indigence and poverty rates of all the scenarios, and this happens in the households headed by females. In this type of household, indigence and poverty rates increase by 0.61 percent and 1 percent if capital is assumed fully mobile, and they increase by 1 percent and 1.5 percent if capital is assumed sector specific.

The increase in poverty rates with a free trade agreement and better access to Ecuadorian banana, if there is unemployment, can be explained by the developments in the banana sector and their impacts on production and wages in other sectors. As the economy is being affected by the lack of increasing capital accumulation and labor supply (the model is static), the increase in banana production can only be met by pulling resources out of other (agricultural) sectors which reduces production in those sectors where resources are being drained and increases prices for consumers. Price increases have a poverty increase effect. This result highlights the need for more investment as an economy opens up for increasing trade. It also highlights the impacts on poverty of consumer price increases.

Poverty impacts on farmers in the banana sector and complementary policies

Given the importance of the banana sector –it contributes to 24% of agricultural GDP, its exports represent 4% of total GDP, and approximately 12% of the Ecuadorian population depends on this activity (see Baquero et al 2004) – we ask what poverty impacts a trade agreement with the EU may have in the sector. To answer this question, it is important to identify who the banana producers are, where they are located, and how important the access to the EU market is for them.

Most banana producers are located in the Coastal provinces of El Oro (51%), Guayas (34%), and Los Ríos (15%) (See Wong 2007). As documented in several studies, these provinces have the lowest incidence of poverty in Ecuador (the highest poverty incidence is in the rural highlands and northern part of the Coast).[16]

Several studies identify banana farmers in three groups by farm size: small (less than 20 hectares), medium (20 to 100 hectares), and big farmers (over 100 hectares).[17] There are approximately 6,282 banana farmers, 71% of which are small, 26% are medium, and only 3% are big farmers. However, big farmers have 30% of the total crop area, while small farmers have only 24% of the banana crop area (Wong 2007). Banana farmers also differ in the productivity of their farms, which in turn depends on factors such as technology, access to credit, and cultural practices. In contrast to big (and medium) farms, small banana farms have, in general, low productivity, more difficult access to credit, and poor cultural practices.

The EU has tough sanitary and phytosanitary (SPS) requirements and technical standards which are more easily met by big farms, and less so by medium farms. Small farmers (given the credit constraints they face) find it difficult to meet EU standards, as they require investment in facilities and cultural practices that imply higher costs (See Wong 2007). Alternative markets for small banana farmer's production are non-EU markets, such as Russia.

So, how would an Ecuador-EU trade agreement affect farmers in the banana sector? In the scenario that assumes that the EU gives better access for the banana market, which is translated as a higher export price of banana to the EU market,[18] the results suggest that there is more production and exports –although they come at a price, reducing production in other sectors. The model is static and cannot account for increased investment, nor have we modeled productivity improvements.

[16] See World Bank (2004) and Elbers at al (2002).
[17] See Wong (2007), and Baquero et al (2004).
[18] As mentioned in previous sections, the main export market for Ecuadorian bananas is the EU. It is also the one that usually pays the highest prices, although international banana prices have strong seasonal variations (see Baquero et al 2004). As it is known in Ecuador, the international banana price does not necessarily get transmitted to the local farmers –the oligopsonistic structure of the local market is blamed for this lack of price transmission. Local authorities set a price floor for banana farmers. There is also a spot market depending on local supply and demand conditions. In this study, we assume that the price set in the EU gets transmitted to banana producers, as the modeling of the price setting mechanisms in the Ecuadorian banana market is beyond the scope of the present study.

This better access to the EU market will probably be taken advantage of by big farmers –and perhaps medium farmers. For small farmers, this is not necessarily the case. As mentioned above, big farms can meet the stringent SPS and technical requirements imposed by the EU on banana imports, but medium farmers may meet these requirements with difficulty, and small farmers may not be able to meet the requirements at all. Still better access to the EU market may have a poverty reduction outcome if this trade opportunity creates more jobs for workers on the big and medium banana farms that can meet the EU standards, and in other occupations indirectly generated by the banana sector. Small farmers could take advantage of the EU market if they receive technical and financial support to meet EU standards for bananas.

There are a host of other issues for the poverty analysis, one of which is the possibility that Colombia and Peru sign a trade agreement with the EU, and Ecuador does not. Tied to this question is whether or not signing an agreement would imply that Ecuador loses GSP+ preferences from the EU. A related unresolved issue is the outcome of the banana dispute between Ecuador and other Latin American countries with the EU in the WTO. The aim of the present study and tools required to address these issues are beyond the realm of the present research. However, it may be interesting to mention some results by Anania (2009) on the WTO dispute and its possible effects in Latin American economies (among others). According to Anania, the EU banana trade policy sets a tariff of 176 euro per ton of banana to the most favored nations (MFN) (which include Ecuador and other Latin American countries). At the same time, the EU has in place Economic Partnership Agreements (EPAs) with African, Caribbean and Pacific (ACP) countries. Anania mentions that these EPAs (together with the EU banana trade policy for MFN) should have a significant negative impact on MFN banana exports to the EU, which should decline 5% by 2016. This author establishes at 60 euros per ton the MFN tariff (ceteris paribus) if the objective is to leave MFN exports without change "*with respect to the scenario in which the EPAs are not implemented*." (Anania, p. viii).

7. Concluding remarks

Ecuador expects to sign a trade agreement with the EU to make permanent the trade preferences it receives from the EU (zero tariffs for most of Ecuadorian products) and to open the EU market for the main agricultural export product of Ecuador: bananas (which currently enter the EU market paying 176 euros per MT). The agreement is expected to have positive impacts on the Ecuadorian economy given the complementarities of these two economies in trade –Ecuador exports mostly agricultural goods to the EU and imports manufactures from the EU. This study highlights that a trade agreement with the EU may have different poverty impact depending on the degree of initial tariff reduction, and on whether better access to Ecuadorian bananas is granted by the negotiations. These scenarios try to take into account key charac-

teristics of the Ecuadorian economy such as dollarization, capital restrictions (modeled as sector- specific capital), and unemployment (expected to be in the unskilled wage labor).

The adjustments to a trade agreement with the EU come through changes in prices and factor returns. For the scenarios that assume unemployment in the unskilled urban and rural labor, adjustments also come through changes in labor demand for these categories of wage workers.

The results show that impacts on Ecuadorian imports from the EU are significant, particularly in the sectors that are currently the most protected (meat and meat products, cereals, beverages, textiles and apparel, wood and wood products, machinery and equipment). These impacts become even more significant as Ecuador also gets better access to the EU market for its bananas (Ecuador can finance more purchases from the EU –given the assumptions of no free lunch and that the model is static).

In the scenarios of free trade, real wages for unskilled labor increase (as the consumer price index decrease). If unemployment in this labor market segment is taken into account, there is an increase in employment for unskilled wage workers in rural areas –as expected if Ecuador consolidates its EU trade preferences. However, there would be a fall in employment for the unskilled in urban areas. Nevertheless, in this scenario there is a considerable poverty reduction. Poverty reduction seems to come about by increases in real wages and employment in the labor market segments where households are among the poorest and where poverty rates are the highest: rural and agricultural households. As Table 5 shows it is estimated that 50 percent of households are poor in rural areas (measured using aggregate income). For poor households food represents the majority share of the households' expenditure (54 percent in rural areas, and 40 percent in urban areas; see Table 9), and the main source of income is through agricultural activity (33 percent of total income comes from these activities in rural areas) and wages (42 percent of total income in urban areas and 22 percent of total income in rural areas).

How fast trade liberalization is implemented has an impact on factor returns and prices that are reflected in poverty results and macro aggregates. For the macro aggregates, the impacts of the partial trade liberalization (50% tariff reduction) are half of those in the scenario of zero tariffs. For poverty results, the 50% tariff reduction determines that –under the assumption of unemployment in the unskilled wage worker segment– poverty reduction may not be as fast as in the zero tariff case, and it may be mainly because reduction in consumption prices are not as big as in the latter case.

When one important sector for the economy -such as bananas- gets better access to the EU markets (given that almost all of the others are already entering the EU with zero tariffs), investment constraints (given that the model is static) may imply that increasing export and production of bananas can be achieved by pulling resources (namely production) out of other sectors. Lower production and higher consumer prices in those sectors may preclude gains from

poverty reduction, even if free trade is adopted. This result highlights the need for investment when increasing trade opportunities arise.

Capital restrictions may imply that increasing production opportunities cannot be materialized or that they are, but in an inefficient way. When capital is assumed to be sector specific, impacts on production and trade are not as big as when capital is assumed freely mobile.

There are several limitations and caveats of the present study. Consumption of own agricultural production in rural households can be very important (in terms of the share of the household's total consumption), but could not be included as part of the analysis for the lack of data. Another interesting aspect that could not be analyzed is the regional impact of the trade scenarios. Given the trade orientation of agricultural production in different regions –in the Coastal region of Ecuador agricultural production is concentrated on exportables (50 percent), while in the Highlands it comprises more of non-tradable commodities (49 percent) (See Table 7) – the economic impacts of an FTA may vary by region.

Among the caveats, it is important to recall that the model is static –no investment (like FDI, expected from an FTA) can be analyzed. Unemployment is assumed, focusing only on unskilled wage workers.

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ANNEXES

Annex 1. Social Accounting Matrix (SAM) 2004

The 2004 SAM comprises of 27 commodities and 27 activities. Households are broken down into urban and rural, and by quintile for each location. Factor income is assigned to each household type according to labor type (no education, primary, secondary, and college for urban and rural labor), gross surplus from enterprises, and "mixed income" (income from self-employment split according to "firm" size –family, small, and big in urban and rural settings). The SAM is organized according to the scheme presented in Table A1.1 below.

Table A1.1. - Ecuador SAM 2004: Basic Structure

Values in millions of US dollars

	Commodities	Activities	Income generation	Income distribution	Income use	Capital	ROW
Commodities		Intermediate inputs 22,446.8			Final consumption 25,676.2	Investment 7,632.4	Exports 8,984.9
Activities	Production matrix 53,643.2						
Income generation		Value added 27,654.2					Income from ROW 10,350
Income distribution	Taxes on commodities 969.8		Income 29,590.4	Transfers, property rents, other income 4,886.4			Transfers from ROW 1,935.8
Income use				Disposable income 32,605.8	In kind transfers 1,751		
Capital					Savings/Credit 6,929.6		Capital transfers from ROW 702.8
ROW	Imports 9,657.8		Factor income to ROW 10.5	Other payments to ROW 1,965.9		S/I balance 681.4	

Source: Central Bank of Ecuador

Note: Rows represent income; columns represent expenditure

Annex 2.- Additional Tables

Table A2.1.- Wage-worker Regressions
OLS

Dependent variable is log of annual wage income for wage earners

Variables	Labor market categories			
	Urban skilled	Urban un-skilled	Rural skilled	Rural unskilled
Gender	0.19926 **	0.32284 **	0.24373 *	0.38142 **
	[4.59]	[6.65]	[2.17]	[7.82]
Schooling (years)	0.25296 **	0.12832 **	-0.13948	0.07368 **
	[2.8]	[4.25]	[-0.81]	[4.02]
Schooling squared	-0.00408	-0.00619 **	0.01075	-0.00347
	[-1.34]	[-2.61]	[1.78]	[-1.93]
Head	0.26063 **	0.31975 **	0.27353 *	0.20495 **
	[5.84]	[6.84]	[2.53]	[4.36]
Marital status	0.26798 **	0.17500 **	0.16093	0.20488 **
	[6.45]	[3.96]	[1.32]	[4.82]
Nchild18	-0.03864 *	-0.03791 **	-0.00618	-0.00963
	[-2.47]	[-3.07]	[-0.24]	[-1.19]
Age (years)	0.02379 **	0.01286 **	0.02920 **	0.00515 **
	[13.42]	[8.50]	[5.28]	[3.55]
Constant	4.17123 **	5.96836 **	6.25778 **	6.14757 **
	[6.29]	[47.46]	[5.41]	[68.25]
Sample size	4,101	3,630	913	4353
R-square	0.30	0.14	0.29	0.11

Source: Wong and Arguello, forthcoming.
Notes: Values of t statistics in brackets. * Significant at 5%, ** significant at 1%.

Table A2.2.- Earnings regression for Self-Employment
OLS

Dependent variable is log of annual earnings (profits) for self-employed income earners, by household

Variables	Labor market categories	
	Urban	Rural
Gender, head	0.50307 **	0.24877 **
	[6.11]	[3.29]
Age, head (years)	0.00348	0.00656 **
	[1.77]	[4.1]
Schooling, head (years)	0.07465 **	0.06534 **
	[3.77]	[3.92]
Schooling squared, head	0.00150	-0.00061
	[1.52]	[-0.53]
Marital status, head	-0.07593	0.31457 **
	[-0.98]	[4.31]
landsize	0.00413	0.00023
	[1.59]	[0.68]
N_m (1)	1.24003 **	1.09157 **
	[30.07]	[34.55]
Constant	4.66665 **	4.87521 **
	[30.12]	[39.7]
Sample size	4,617	5,330
R-square	0.31	0.29

Source: Wong and Arguello, forthcoming.
Notes: Values of t statistics in brackets. * Significant at 5%, ** significant at 1%.
N_m is the number of household members who work as self-employed.

Table A2.3.- Wage-worker Regressions
Two-Stage Heckman

Variables	Labor market categories							
	Urban skilled				Urban unskilled			
	log wage		dummy wage (1)		log wage		dummy wage (1)	
Gender	-0.1559	**	0.3874	**	0.3444	**	0.7536	**
	[-3.33]		[16.68]		[7.15]		[31.18]	
Schooling (years)	0.1073		0.0840	**	0.1282	**	-0.0035	
	[1.25]		[16.63]		[4.25]		[-0.7]	
Schooling squared	-0.0018				-0.0062	**		
	[-0.62]				[-2.61]			
Head	0.2630	**			0.3193	**		
	[6.33]				[6.82]			
Marital status	0.2389	**	-0.0181		0.1838	**	0.3140	**
	[5.4]		[-0.7]		[4.18]		[11.57]	
Nchild18	-0.0385	**			-0.0379	**		
	[-2.66]				[-3.07]			
Age (years)	0.0251	**	-0.0048	**	0.0126	**	-0.0078	**
	[13.49]		[-4.96]		[8.37]		[-11.6]	
Constant	6.9323	**	-1.2126	**	5.9152	**	-0.8018	**
	[10.96]		[-16.45]		[46.81]		[-16.6]	
Sample size	8,348				12,646			
	Rural skilled				Rural unskilled			
	log wage		dummy wage (1)		log wage		dummy wage (1)	
Gender	-0.4332	**	0.5454	**	0.3809	**	1.0600	**
	[-4.35]		[10.36]		[7.65]		[43.74]	
Schooling (years)	-0.2744	*	0.0743	**	0.0737	**	-0.0222	**
	[-1.99]		[6.72]		[4.03]		[-4.53]	
Schooling squared	0.0120	*			-0.0035			
	[2.49]				[-1.93]			
Head	0.2508	**			0.2050	**		
	[2.81]				[4.37]			
Marital status	0.2044		-0.0785		0.2048	**	0.2462	**
	[1.8]		[-1.36]		[4.85]		[9.17]	
Nchild18	-0.0428	*			-0.0096			
	[-2.35]				[-1.19]			
Age (years)	0.0263	**	0.0039		0.0052	**	-0.0134	**
	[4.96]		[1.58]		[3.63]		[-17.87]	
Constant	9.6066	**	-1.4384	**	6.1484	**	-0.6845	**
	[10.22]		[-9.55]		[65.27]		[-15.27]	
Sample size	1,989				15,334			

Source: Wong and Arguello, forthcoming.
Notes: Values of t statistics in brackets. * Significant at 5%, ** significant at 1%. Dummy variable that takes the value of 1 if the individual is a wage earner, 0 otherwise.

Table A2.4.- Earnings functions for Self-Employment
Two-Stage Heckman

Variables	Labor market categories			
	Urban		Rural	
	log earnings	dummy earnings (1)	log earnings	dummy earnings (1)
Gender, head	0.4235 **	0.0694	0.3849 **	-0.2249 **
	[4.93]	[1.85]	[5.04]	[-5.06]
Age, head (years)	-0.0083 **	0.0116 **	0.0025	0.0116 **
	[-4.09]	[16.69]	[1.55]	[14.2]
Schooling, head (years)	0.0808 **	-0.0142 **	0.0718 **	-0.0346 **
	[4.33]	[-5.97]	[4.38]	[-9.27]
Schooling squared, head	0.0021 *		0.0004	
	[2.3]		[0.39]	
Marital status, head	-0.4077 **	0.3392 **	0.0080	0.5918 **
	[-5.11]	[9.62]	[0.11]	[13.3]
landsize	0.0060 *		0.0003	
	[2.43]		[0.81]	
N_m (1)	1.1101 **		1.0624 **	
	[26.54]		[33.11]	
Constant	6.5991 **	-0.3974 **	5.4234 **	0.5240 **
	[39.03]	[-7.73]	[44.67]	[9.4]
Sample size	7,422		6,017	

Source: Wong and Arguello, forthcoming.
Notes: Values of t statistics in brackets. * Significant at 5%, ** significant at 1%.
Dummy variable that takes the value of 1 if the individual is self-employed, 0 otherwise.

Table A2.5.- Occupational Choice Model

Variables	Demographic groups					
	Head		Spouse		Others	
	Occupational Choices		Occupational Choices		Occupational Choices	
	1	2	1	2	1	2
Gender	0.7616 **	1.3424 **	1.2646 **	2.3497 **	0.6939 **	0.9937 **
	[6.45]	[12.16]	[4.35]	[9.13]	[9.27]	[22.37]
Schooling (years)	0.0913 **	0.1141 **	0.0872 **	-0.0209	-0.1832 **	-0.1007 **
	[3.56]	[4.56]	[4.09]	[-0.84]	[-6.35]	[-5.21]
Schooling squared	-0.0002	0.0009	-0.0018	0.0101 **	0.0145 **	0.0114 **
	[-0.10]	[0.61]	[-1.42]	[7.42]	[9.16]	[10.59]
Marital status	0.0378	0.4368 **	12.4342 **	11.3028 **	1.2646 **	0.6937 **
	[0.32]	[3.96]	[70.14]	[87.76]	[13.77]	[11.06]
Nchild18	0.2002 **	0.3388 **	0.0439 *	0.0242	-0.1883 **	-0.0361 **
	[6.40]	[11.13]	[2.48]	[1.05]	[-7.54]	[-2.9]
Own family business	5.3063 **	-0.2306 **	3.1131 **	-0.4223 **	3.7471 **	-0.3080 **
	[29.68]	[-2.82]	[20.63]	[-5.76]	[11.34]	[-6.09]
Aid and remittances	0.0000	-0.0004 **	0.0000	-0.0005 **	0.0000	-0.0006 **
	[-1.15]	[-6.55]	[0.34]	[-3.65]	[0.19]	[-4.36]
Constant	-4.5476 **	1.0185 **	16.3870	12.8799	-5.2893 **	-0.9523 **
	[-22.18]	[-9.18]			[-15.03]	[-9.70]
Sample size	13,438	13,438	9,428	9,428	15,451	15,451

Source: Wong and Arguello, forthcoming.
Notes: Values of t statistics in brackets. * Significant at 5%, ** significant at 1%. Choices:
0 inactive or unemployed, 1 self-employed, 2 wage earners.

Annex 3. – CGE Model: Key Equations

Price block

Import prices

$$+\frac{QMROW_C}{QM_C} * PMROW_C \Big] + \Sigma_C PQ_C * icm_C$$

$$PMUSA_C = pwmusa_C * (1 + TIMPUSA_C) * EXR$$

$$PMCAN_C = pwmcan_C * (1 + TIMPCAN_C) * EXR$$

$$PMEU_C = pwmeu_C * (1 + TIMPEU_C) * EXR$$

$$PMROW_C = pwrow_C * (1 + TIMPROW_C) * EXR$$

NOTE: EXR = 1, as Ecuador is a dollarized economy.

Export prices

$$PE = \left[\frac{QEUSA_C}{QE_C} * PEUSA_C + \frac{QECAN_C}{QE_C} * PECAN_C + \frac{QEEU_C}{QE_C} * PEEU_C \right.$$

$$\left. + \frac{QEROW_C}{QE_C} * PEROW_C \right] - \Sigma_C PQ_C * ice_C$$

$$PEUSA_C = pweusa_C * (1 - TEXP_C) * EXR$$

$$PECAN_C = pwecan_C * (1 - TEXP_C) * EXR$$

$$PEEU_C = pweeu_C * (1 - TEXP_C) * EXR$$

$$PEROW_C = pwerow_C * (1 - TEXP_C) * EXR$$

NOTE: In Ecuador there are no taxes on exports (TEXP).

Production and trade block

Output transformation and export supply

$$QE_C = QD_C * \left[\frac{PE_C}{PDS_C} * \frac{(1 - \delta_c^t)}{\delta_c^t} \right]^{\frac{1}{\rho_c^t - 1}}$$

$$QEUSA_C = \alpha_{USA_C}^t * (\delta_{USA_C}^t) * \left[\frac{PEUSA_C}{PE_C} \right]^{\frac{1}{\rho_c^t - 1}}$$

$$QECAN_C = \alpha^t_{CAN_C} * (\delta^t_{CAN_C}) * \left[\frac{PECAN_C}{PE_C} \right]^{\frac{1}{\rho^t_c - 1}}$$

$$QEEU_C = \alpha^t_{EU_C} * (\delta^t_{EU_C}) * \left[\frac{PEEU_C}{PE_C} \right]^{\frac{1}{\rho^t_c - 1}}$$

$$QEROW_C = \alpha^t_{ROW_C} * (\delta^t_{ROW_C}) * \left[\frac{PEROW_C}{PE_C} \right]^{\frac{1}{\rho^t_c - 1}}$$

Armington and cost minimization

$$QM_C = QD_C * \left[\frac{PDD_C}{PM_C} * \frac{\delta^q_c}{1 - \delta^q_c} \right]^{\frac{1}{1+\rho^q_c}}$$

$$QMUSA_C = \alpha^q_{USA_C} * \delta^q_{USA_C} * \left[\frac{PM_C}{PMUSA_C} \right]^{\frac{1}{1+\rho^q_c}}$$

$$QMCAN_C = \alpha^q_{CAN_C} * \delta^q_{CAN_C} * \left[\frac{PM_C}{PMCAN_C} \right]^{\frac{1}{1+\rho^q_c}}$$

$$QMEU_C = \alpha^q_{EU_C} * \delta^q_{EU_C} * \left[\frac{PM_C}{PMEU_C} \right]^{\frac{1}{1+\rho^q_c}}$$

$$QMROW_C = \alpha^q_{ROW_C} * \delta^q_{ROW_C} * \left[\frac{PM_C}{PMROW_C} \right]^{\frac{1}{1+\rho^q_c}}$$

Institution block

Institutional factor incomes

$$YIF_{i,f} = shif_{i,f} * \left[(1 - TFAC_f) * YF_f - (trnsf_{USA,f} + trnsf_{CAN,f} + trnsf_{EU,f} \right.$$

$$\left. + trnsf_{ROW,f}) * EXR \right] + (trnsf_{f,USA} + trnsf_{f,CAN} + trnsf_{f,EU} + trnsf_{f,ROW}) * EXR$$

Income of domestic non-governmental institutions

$$YI_{i,f} = \sum_f YIF_{i,f} + \sum_i TRII_{i,f} + trnsf_{i,gov} * CPI + (trnsf_{i,USA} + trnsf_{i,CAN}$$
$$+ trnsf_{i,EU} + trnsf_{i,ROW}) * EXR$$

Government revenue

$$YG = YGINSDNG + YGFACT + YGVADD + YGACT + YGTIMP + YGTEXP + YGCOM + YGIF + YGTRNS$$

$$YGINSDNG = \sum_i TINS_i * YI_i$$

$$YGFACT = \sum_f TFAC_f * YF_f$$

$$YGVADD = \sum_a TVAD_a * PVA_a * QVA_a$$

$$YGACT = \sum_a TAC_a * PA_a * QA_a$$

$$YGTIMP = \sum_C (TIMPUSA_C * PWMUSA_C * QMUSA_C + TIMPCAN_C * PWMCAN_C * QMCAN_C + TIMPEU_C * PWMEU_C * QMEU_C + TIMPROW_C * PWMROW_C * QMROW_C) * EXR$$

$$YGTEXP = \sum_C TEXP_C * pwe_C * QE_C * EXR$$

$$YGCOM = \sum_C TCOM_C * PQ_C * QQ_C$$

$$YGIF = \sum_f YIF_{gov,f}$$

$$YGTRNS = (trnsf_{gov,USA} + trnsf_{gov,CAN} + trnsf_{gov,EU} + trnsf_{gov,ROW}) * EXR$$

System constraint block

Current account balance of foreign regions

$$\sum_C pwm_C * QM_C + \sum_f (trnsf_{USA,f} + trnsf_{CAN,f} + trnsf_{EU,f} + trnsf_{ROW,f}) - \Sigma_i (trnsf_{i,USA} + trnsf_{i,CAN} + trnsf_{i,EU} + trnsf_{i,ROW})$$

Variables and parameters in equations

Price block

VARIABLES

EXR	exchange rate
PE(C)	price of exports
PEUSA(C)	USA domestic price of exports
PECAN(C)	CAN domestic price of exports
PEEU(C)	EU domestic price of exports
PEROW(C)	RDM domestic price of exports
PM(C)	price of imports
PMUSA(C)	price of imports from USA
PMCAN(C)	price of imports from CAN
PMEU(C)	price of imports from EU
PMROW(C)	price of imports from ROW
PQ(C)	price of composite good C
PWEUSA(C)	USA price of exports
PWECAN(C)	CAN price of exports
PWEEU(C)	EU price of exports
PWEROW(C)	ROW price of export
PWMUSA(C)	world price of imports from USA
PWMCAN(C)	world price of imports from CAN
PWMEU(C)	world price of imports from EU
PWMROW(C)	world price of imports from ROW
QE(C)	quantity of exports
QEUSA(C)	quantity of exports to USA
QECAN(C)	quantity of exports to CAN
QEEU(C)	quantity of exports to EU
QEROW(C)	quantity of exports to ROW
QM(C)	quantity of imports
QMUSA(C)	quantity of imports from USA
QMCAN(C)	quantity of imports from CAN
QMEU(C)	quantity of imports from EU
QMROW(C)	quantity of imports from ROW
TEXP(C)	Effective export tax rate for commodity C
TIMPUSA(C)	Effective USA import tax rate for commodity C
TIMPCAN(C)	Effective CAN import tax rate for commodity C
TIMPEU(C)	Effective EU import tax rate for commodity C
TIMPROW(C)	Effective ROW import tax rate for commodity C

PARAMETERS

ice(C,CP)	trade input of c per unit of comm'y cp exported
icm(C,CP)	trade input of c per unit of comm'y cp imported

Production and trade block

VARIABLES

PDD(C)	demand price for com'y c produced & sold domestically
PDS(C)	supply price for com'y c produced & sold domestically
PE(C)	price of exports
PEUSA(C)	USA domestic price of exports
PECAN(C)	CAN domestic price of exports
PEEU(C)	EU domestic price of exports
PEROW(C)	ROW domestic price of exports
PM(C)	price of imports
PMUSA(C)	price of imports from USA
PMCAN(C)	price of imports from CAN
PMEU(C)	price of imports from EU
PMROW(C)	price of imports from ROW
QD(C)	quantity of domestic sales
QE(C)	quantity of exports
QEUSA(C)	quantity of exports to USA
QECAN(C)	quantity of exports to CAN
QEEU(C)	quantity of exports to EU
QEROW(C)	quantity of exports to ROW
QM(C)	quantity of imports
QMUSA(C)	quantity of imports from USA
QMCAN(C)	quantity of imports from CAN
QMEU(C)	quantity of imports from EU
QMROW(C)	quantity of imports from ROW

PARAMETERS

alphatusa(C)	shift parameter for the USA in CET function
alphatcan(C)	shift parameter for the CAN in CET function
alphateu(C)	shift parameter for the EU in CET function
alphatrow(C)	shift parameter for the ROW in CET function
alphaq(C)	shift parameter for Armington function
alphaqusa(C)	shift parameter for the USA in Armington function
alphaqcan(C)	shift parameter for the CAN in Armington function
alphaqeu(C)	shift parameter for the EU in Armington function

alphaqrow(C)	shift parameter for the ROW in the Armington function
deltaq(C)	share parameter for Armington function
deltaqusa(C)	share parameter for USA in Armington nest function
deltaqcan(C)	share parameter for CAN in Armington nest function
deltaqeu(C)	share parameter for EU in Armington nest function
deltaqrow(C)	share parameter for ROW in Armington nest function
deltat(C)	share parameter for CET function
deltatusa(C)	share parameter for USA in CET nest function
deltatcan(C)	share parameter for CAN in CET nest function
deltateu(C)	share parameter for EU in CET nest function
deltatrow(C)	share parameter for ROW in CET nest function
rhoq(C)	Armington function exponent
rhot(C)	CET function exponent

Institution block

VARIABLES

CPI	consumer price index (PQ-based)
EXR	exchange rate
PA(A)	output price of activity A
PQ(C)	price of composite good C
PVA(A)	value added price
PWE(C)	world price of exports
PWMUSA(C)	world price of imports from USA
PWMCAN(C)	world price of imports from CAN
PWMEU(C)	world price of imports from EU
PWMROW(C)	world price of imports from ROW
QA(A)	level of domestic activity
QE(C)	quantity of exports
QMUSA(C)	quantity of imports from USA
QMCAN(C)	quantity of imports from CAN
QMEU(C)	quantity of imports from EU
QMROW(C)	quantity of imports from ROW
QQ(C)	quantity of composite goods supply
QVA(A)	quantity of aggregate value added
TCOM(C)	Effective excise tax rate for commodity C
TEXP(C)	Effective export tax rate for commodity C

TIMPUSA(C)	Effective USA import tax rate for commodity C
TIMPCAN(C)	Effective CAN import tax rate for commodity C
TIMPEU(C)	Effective EU import tax rate for commodity C
TIMPROW(C)	Effective ROW import tax rate for commodity C
TFAC(F)	Effective factor tax rate for factor F
TINS(INS)	rate of direct tax on domestic institutions ins
TRII(INS,INSP)	transfers to dom. inst. insdng from insdngp
TVAD(A)	Effective value - added tax rate for activity A
YF(F)	factor income
YG	total current government income
YGACT	total current government income from activity taxes
YGCOM	total current government income from commodity taxes
YGFACT	total current government income from factor income taxes
YGIF	total current government income from government's factor income
YGINSDNG	total current government income from direct taxes to institutions
YGTEXP	total current government income from export tariffs
YGTIMP	total current government income form import tariffs
YGTRNS	total current government income from transfers
YGVADD	total current government income from value added taxes
YI(INS)	income of (domestic non-governmental) institution ins
YIF(INS,F)	income of institution ins from factor F
YF(F)	factor income

PARAMETERS

shif(INS,F)	share of dom. institution i in income of factor F
trnsf(region,F)	transfers from factors to regions
trnsf(F,region)	transfers from regions to factors
trnsf(INS,GOV)	transfers from government to institutions
trnsf(INS,region)	transfers from regions to institutions
trnsf(GOV,region)	transfers from regions to government

System constraint block

VARIABLES

PWM(C)	world price of imports
QM(C)	quantity of imports

PARAMETERS

trnsf(region,F)	transfers from factors to regions
trnsf(INS,region)	transfers from regions to institutions

Annex 4.- Elasticities used in the CGE model

Table A4.1.- Ecuador: CET, CES, and Production Elasticities

No.	Product	Export Supply Elasticities - CET [1,2]	Armington Elasticities - CES [3,4,5,6]	Production Elasticities [7,8]
1	Banana, coffee, and cocoa	0.40	0.80	0.60
2	Cereals	0.60	0.99	0.8
3	Flowers	0.80	0.80	0.80
4	Other agricultural products	0.60	0.317	0.8
5	Livestock	1.00	1.349	0.8
6	Forestry products	0.60	0.80	0.8
7	Shrimps	1.50	1.2	0.80
8	Raw fish	0.20	1.001	0.8
9	Crude oil, mineral products and fuel oils and other oil products	1.30	0.80	0.20
10	Meat, meat products and sub products	0.60	1.001	0.80
11	Canned fish and other manufactured aquatic products	0.20	1.001	0.8
12	Oil and fats	1.30	0.8	0.8
13	Dairy products	0.90	0.782	0.8
14	Milling and bakery products	0.90	0.99	0.8
15	Sugar products	0.90	0.782	0.8
16	Alcoholic and non-alcoholic beverages	0.90	1.319	0.8
17	Other miscellaneous food products, chocolate and tobacco	0.90	0.782	0.90
18	Textiles and apparel, leather, leather products and footwear	0.50	0.93	0.9
19	Wood and wooden products	0.50	2.383	0.8
20	Paper and paper products	0.50	0.763	0.8
21	Chemicals, rubber and plastic	0.50	0.371	0.8
22	Metallic mineral products and non-metallic	0.50	0.612	0.8
23	Transportation equipment	0.50	0.482	0.8
24	Machinery and equipment, other non-food manufactured goods	0.60	0.482	0.60
25	Transportation services and storage	1.00	0.534	0.90
26	Telecommunication and mail services	1.00	0.825	0.95
27	Other services	0.20	0.2	0.90

Source: Cho, S, and J. Díaz (2006) "Trade Liberalization in Latin America and Eastern Europe: The Cases of Ecuador and Slovenia". Table 4.5, p. 13. Vos, R., and N. DeJong (2003), "Trade Liberalization and Poverty in Ecuador: a CGE Macro-Microsimulation Analysis". Economic Systems Research, Vol. 15, No. 2, June 2003. Table A.1, p. 230. Wong, S., and M. González (2005) "Elasticidades de Substitución de Importaciones para Ecuador", Revista Tecnológica ESPOL, Vol 18, No. 1, October 2005. Table No. A3, p. 180.

Notes: 1.-Data for products number 1, 3, 7, 10, 17, 24-27 from Vos and DeJong (2003). 2.-Data for the rest of products are assumptions for Ecuador using reference data from other countries. 3.-Data for products number 1, 3, 6, 9 and 18 from Cho and Díaz (2006). 4.- Data for products number 7 and 27 from Vos and DeJong (2003). 5.-Data for product number 12 is an assumption for Ecuador using reference data from other countries. 6.-Data for the rest of the products from Wong and González (2005). 7.-Data for products number 1, 3, 7, 9, 10, 17, 24-27 from Vos and DeJong (2003). 8.-Data for the rest of products are assumptions for Ecuador using reference data from other countries.

Table A4.2.- Ecuador: Household Consumption Elasticities [1, 2, 3]

No.	Product	Rural		Urban		
		Agriculture	Non-agriculture	High education	Medium level education	Low education
1	Banana, coffee, and cocoa	0.87	0.84	0.81	0.83	0.88
2	Cereals	0.87	0.84	0.81	0.83	0.88
3	Flowers	1.50	1.50	1.20	1.20	1.20
4	Other agricultural products	0.87	0.84	0.81	0.83	0.88
5	Livestock	0.87	0.84	0.81	0.83	0.88
6	Forestry products	1.50	1.50	1.20	1.20	1.20
7	Shrimps	0.87	0.84	0.81	0.83	0.88
8	Raw fish	0.87	0.84	0.81	0.83	0.88
9	Crude oil, mineral products and fuel oils and other oil products	1.02	0.98	0.72	0.74	0.78
10	Meat, meat products and sub products	0.87	0.84	0.71	0.73	0.77
11	Canned fish and other manufactured aquatic products	0.87	0.84	0.71	0.73	0.77
12	Oil and fats	0.87	0.84	0.71	0.73	0.77
13	Dairy products	0.87	0.84	0.71	0.73	0.77
14	Milling and bakery products	0.87	0.84	0.71	0.73	0.77
15	Sugar products	0.87	0.84	0.71	0.73	0.77
16	Alcoholic and non-alcoholic beverages	0.87	0.84	0.71	0.73	0.77
17	Other miscellaneous food products, chocolate and tobacco	0.85	0.81	0.66	0.74	0.78
18	Textiles and apparel, leather, leather products and footwear	1.27	1.22	1.12	1.15	1.22
19	Wood and wooden products	1.27	1.22	1.12	1.15	1.22
20	Paper and paper products	1.27	1.22	1.12	1.15	1.22
21	Chemicals, rubber and plastic	1.27	1.22	1.12	1.15	1.22
22	Metallic mineral products and non-metallic	1.27	1.22	1.12	1.15	1.22
23	Transportation equipment	1.27	1.22	1.12	1.15	1.22
24	Machinery and equipment, other non-food manufac-tured goods	1.27	1.22	1.12	1.15	1.22
25	Transportation services and storage	1.02	0.98	0.72	0.74	0.78
26	Telecommunication and mail services	1.11	1.07	1.13	1.17	1.23
27	Other services	1.02	0.98	0.72	0.74	0.78

Source: Vos, R., and De Jong, N., (2003), "Trade Liberalization and Poverty in Ecuador: a CGE Macro-Microsimulation Analysis". Economic Systems Research, Vol. 15, No. 2, June 2003, Table A.1, p. 230.

Notes: 1.-Data for products number 1, 3, 7, 9, 10, 17, 24-27 from Vos and DeJong (2003). 2.-Data for the rest of products are assumptions for Ecuador using reference data for other countries. 3.-In the Ecuador CGE model rural and urban households are each divided by income quintile. For rural household the elasticities for agriculture are applied to households in the last four income quintile categories, and elasticities for non-agriculture are applied to households in the highest income quintile. For urban households, the elasticities for low education are applied to households in the last two income quintile categories, the elasticities for medium level education are applied to the third and fourth income quintile categories, and the elasticities for high education are applied to the households in the highest income quintile.