

MPIA Network Session Paper

**Poverty Impacts of Increased Openness
and Fiscal Policies in a dollarized
economy: A CGE-Micro Approach for
Ecuador**

Sara Wong
Paul Herrera



*A paper presented during the 5th PEP Research Network General Meeting,
June 18-22, 2006, Addis Ababa, Ethiopia.*

**Poverty Impacts of Increased Openness and Fiscal Policies in a
dollarized economy:
A CGE-Micro Approach for Ecuador**

RESEARCH PROPOSAL 10644

Presented to
PEP Network

By
Sara Wong
&
Paul Herrera

ECUADOR

February 21, 2006

Abstract

We propose to quantify the effects of both full trade liberalization policy and a budget-neutral value added tax increase (which seeks to compensate tariff revenue losses) on poverty and income distribution in Ecuador. We stress the study of fiscal policies that the government could tap in order to compensate the tariff revenue loss. This is a very important issue for Ecuador because this country adopted the US dollar as its currency in 2000.

To study these issues we combine a reduced-form micro Household income and occupational choice model with a standard single-country computable general equilibrium model (CGE) for Ecuador. We follow a sequential approach that tries to ensure consistency between the micro model and the CGE model, and that tries to capture heterogeneity and simulate the full distributional impact of the trade and tax policies. The CGE model is based on input-output and SAM data. The microsimulation model uses data from both an urban-household's income and expenditure survey and rural household data from a life condition survey.

INTRODUCTION

Ecuador is immersed in a process of economic policy changes that started in the early 1990s, led by changes in trade policy. Trade policy changes included a tariff reform, important reductions in import restrictions, export promotion laws, the modernization of trade institutions, and the simplification of trade procedures. Policy changes have also included changes in the tax system. The ultimate goal of these policy changes is to create jobs, foster economic growth and reduce poverty in Ecuador. However, little has been done to study the impacts of fiscal and trade policies on poverty in Ecuador.

In contrast to previous decades, in the 1990s Ecuador began to put in place trade policy and practices aimed at reducing trade barriers and fostering exports. A key reform was made in tariffs. These reforms brought down the tariff range from 29 – 290 percent in 1989 to 0 – 40 percent in 1994 (the highest tariff was applied to vehicle imports). The average tariff was reduced from 29 percent in 1989 to 11 percent in 1994 (see Tamayo, 1997). Currently, Ecuador, together with Colombia and Peru, are about to sign a free trade agreement with the U.S., Ecuador's main trade partner. Negotiations for a free trade agreement with the European Union are expected to start in 2006. The changes in tariff collection that these free trade agreements will bring about could spell reduced government revenues that eventually have to be made up by increasing other taxes or reducing expenditure. Given the rigidities in the Ecuadorian government budget, it is more likely that an increase in taxes will be adopted. An increase in value added tax is a good candidate.

The analysis of fiscal policy changes is a key issue in an economy such as that of Ecuador, which has adopted the US dollar as its currency since 2000, as a way to halt a deep economic crisis. 2000 marked the beginning of a slow recovery period from the latest economic crisis that increased the levels of poverty by almost 17 points from 1998 to 1999 (see World Bank, 2004), and affected both rural and urban areas. No doubt fiscal policy changes aimed at compensating tariff revenue loss will have an impact on income distribution and poverty. However, in spite of the importance of poverty and fiscal policy impacts, little has been done to analyze the links between these subjects and how other policies may affect them.

This proposal seeks to measure the impact on income distribution and poverty of changes in fiscal policy in response to trade openness in Ecuador. Given that Ecuador is an economy that adopted the US dollar as its currency, the analysis of fiscal policies is crucial. Given that Ecuador is a country with high poverty levels, the study of the effect of changes in economic policies on poverty is a must.

Ecuador: Economic and Poverty Situation Overview

Ecuador is a small, open, middle-income, agrarian, oil-dependent economy. In 2004, Ecuadorian GDP totalled US\$ 30.3 billion, whereas GDP per capita reached US\$ 2325 (or US\$ 1460 in US dollars of 2000). This economy is characterized by high unemployment and underemployment rates, which reached 11 and 42.7 percent, respectively, in 2004. Ecuadorian exports as a share of GDP reached an annual average of 24 percent in the last five years, 2000-2004. The central government budget of Ecuador is characterized by both high dependence on oil revenues (oil revenues share in total revenues for the central government represent 34 percent annual average for the period 2000-2004) and deficits. In 2004, the central government deficit reached 1.1% of total GDP. See Tables 1, 2 and 3

Table 1.- Structural Characteristics of the Ecuadorian Economy. 2004

<i>I. Macroeconomic Characteristics</i>							
GDP (Millions of US\$)	30300	Trade Bal. Surplus/exports	4.7%				
GDP per capita (US\$)	2325	Bal. of Payments surplus/exports	3.6%				
GDP per capita (US\$ of 2000)	1460	Bal. of Payments surplus/GDP	0.9%				
Population (thousands)	13027						
Imports/Domestic Demand	28.1%						
Exports/GDP	25.3%						
<i>II. Sectoral Characteristics</i>							
	Agriculture ^{1/.}	Fishing	Mining and quarrying	Industry (excl. Oil Ref.)	Oil Refining	Services	Other
(Current) GDP share by sector	7.3	0.9	16.8	10.2	-5	59.6	11
GDP Share in Total Exports	25	4	67	40	-20	n.a.	n.a.
GDP Share in Total Imports	27	4	70	43	-21	n.a.	n.a.
<i>III. Unemployment (as a percentage of the workforce)</i>							
Urban unemployment rate	11 ^{3/.}						
Underemployment ^{2/.}	42.7						

Sources: Statistics of the Central Bank of Ecuador and the Ministry of Finance.

Notes:

1/. Includes livestock, hunting and forestry

2/. Members of the labor force working fewer than 40 hours per week or earning less than the minimum salary

3/. As November.

Table 2.- The Government Sector in Ecuador. 2004

	Share in Revenues		Share in expenditures
<i>Central Government</i>			
Income taxes and transfers	13.7%	Current expenditures	74.6%
Indirect taxes (VAT)	37.1%	Interests	14.8%
Import tariffs and other import taxes	10.4%	Wages and Salaries	37.3%
Oil revenues	30.1%	Purchases	6.6%
Deficit	6.16%	Investment	25.4%
<i>Total Public Sector</i>			
Income taxes and transfers from C.Gov.	26.7%	Current expenditures	78.5%
Indirect taxes and import tariffs	32.6%	Interests	10.7%
Oil revenues	26.0%	Wages and Salaries	34.6%
Soc. Sec. Contr.	12.2%	Purchases	13.8%
Superavit	8.4%	Investment	21.5%
<i>Financing of the Deficit (Millions of US\$)</i>			
Foreign borrowing	1679	<i>As a percentage of GDP, Central Gov.</i>	
Domestic borrowing	1814	Revenue	17.1%
	-249	Expenditure	18.2%
Interest expenditures	811	Balance (deficit)	1.1%

Sources: Statistics of the Central Bank of Ecuador and the Ministry of Finance.

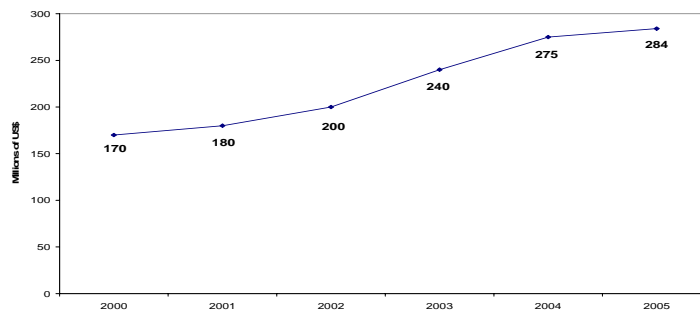
Table 3.- Central Government Budget. Deficit (-) or Surplus (+)

Transactions/ Period	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Millions of US Dollars	-289.4	-504.6	-278.1	-959.2	-475.7	19.3	-222.3	-184.6	-108.5	-319.2
As a percentage of Total Revenues	-9.2%	-15.7%	-8.1%	-29.7%	-17.7%	0.6%	-5.8%	-4.0%	-2.3%	-6.2%
As a percentage of GDP	-1.4%	-2.4%	-1.2%	-4.1%	-2.9%	0.1%	-1.1%	-0.8%	-0.4%	-1.1%

Sources: Statistics of the Central Bank of Ecuador and the Ministry of Finance

A heavy burden on the government budget is the presence of expensive and badly targeted subsidies. The case of liquefied petroleum gas for domestic use stands out. In the last five years, since the dollar was adopted as a currency in Ecuador, the government has spent US\$1.35 billion on subsidizing liquefied petroleum gas (LPG) for domestic consumption. Cuesta et. al. assert that the richest 20 percent of the population consume 21 percent of the LPG for domestic use whereas the poorest 20 percent of the population consume only 15 percent of the LPG. LPG is also used (although it is not allowed) for public transport.

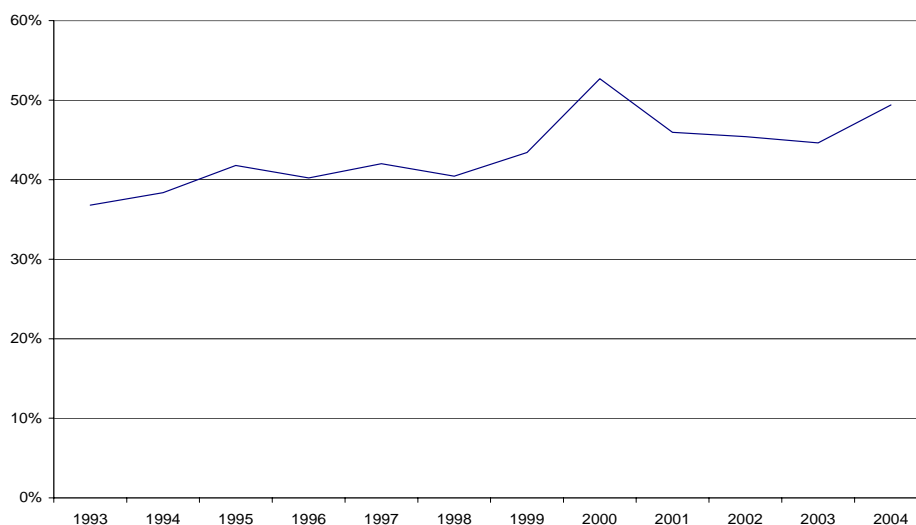
Figure 1.- Ecuador: Total subsidy for gas for domestic use



Source: World Bank (2004), Ministry of Finance.

In the early 1990s Ecuador began a turnaround in trade policy, from an import-substitution policy to an export-oriented – less protective – trade policy. As a result, Ecuador has experienced a great deal of increase in trade openness in the last decade. As figure 2 indicates, the degree of openness of the Ecuadorian economy went from 36.6% in 1993 to 49.4% in 2004. The consolidation of agreements such as CAN, the opening-up of new markets (for example Canada, Russia and China), and the continuation of trade preferences that Ecuador receives from the U.S. (ATPA and ATPDEA) seem to have also contributed to this greater openness.

Figure 2.- Ecuador: Openness, 1993-2004



Source: Central Bank of Ecuador, and own construction.

Note: Openness is measured as imports plus exports as a percentage of gross domestic product.

Other more recent policy changes in the Ecuadorian economy are the adoption of the US dollar as the official currency of Ecuador. The dollar was adopted in January 2000, in the midst of a currency-debt-financial crisis that was threatening the political stability of the government at that time. High inflationary pressures were halted, and the inflation rate converged, but very slowly, to levels close to those of US inflation. Thus, inflation in Ecuador was 52.2% in 1999 and reached a peak of 96.1% in 2000. Prices increased at a slower pace in 2001 (37.7 %) and in 2002 (12.5%), to finally experience one-digit inflation in 2003 with 7.9%, as well as in 2004 with only 2.7%.

In 2004, Ecuador (and the rest of the Andean Community nations, Bolivia, Colombia, Peru, and Venezuela) signed a Free Trade Agreement for goods with the MERCOSUR countries (Argentina, Brazil, Uruguay, and Paraguay). Currently, Ecuador is negotiating a free trade agreement with the US and Andean partners Colombia and Peru. The agreement is expected to

start in or after year 2006, right after the trade preferences that the U.S. gives –unilaterally– to the Andean countries end. Ecuadorian authorities, together with authorities from other Andean countries have already proposed to start negotiating for a free trade agreement with the European Union. The U.S., the Andean Community and the European Union markets purchase around 70 percent of total Ecuadorian exports. Similarly, Ecuador receives over 55 percent of its total imports from the U.S., the Andean Community and the European Union.

Table 4.- Ecuador: Exports and Imports by country

Exports as a Percentage Share of Total Exports										
	A	E	F	G	H	I	J	K	L	M
17	Country/Region	1996	1997	1998	1999	2000	2001	2002	2003	2004
18	U.S.A.	38%	39%	39%	38%	38%	38%	41%	41%	43%
19	Andean Community	9%	12%	13%	11%	14%	18%	16%	17%	13%
20	E.U.	19%	19%	21%	18%	12%	14%	16%	17%	13%
21	Asia	12%	11%	8%	11%	12%	10%	9%	6%	5%
22	Central America and Caribbean	2%	2%	2%	3%	3%	9%	8%	4%	2%
23	Rest of America and the world	20%	17%	17%	19%	21%	11%	10%	15%	24%
24	Total	100%	100%	100%	100%	100%	100%	100%	100%	100%

Imports as a Percentage Share of Total Imports										
Country/Region	1996	1997	1998	1999	2000	2001	2002	2003	2004	
U.S.A. ^{1/}	31%	31%	30%	30%	25%	25%	23%	21%	21%	
Andean Community	17%	19%	18%	20%	23%	22%	22%	23%	25%	
E.U.	18%	16%	15%	14%	11%	12%	14%	12%	10%	
Asia	11%	12%	14%	11%	15%	16%	15%	15%	16%	
Central America and Caribbean	0%	0%	0%	1%	0%	1%	0%	1%	0%	
Rest of America and the world	24%	23%	23%	24%	26%	25%	26%	28%	28%	
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	

Source: Central Bank of Ecuador, and own construction.

Note: 1/. U.S. import data include Puerto Rico.

These changes in trade policy have had and will continue to have an economic and social impact on Ecuador that in turn may trigger changes in other policies. A very likely course that the government would pursue in seeking to compensate its revenue loss due to tariff reductions/elimination is an increase in taxes. Tariff and other import taxes represented 10.4 percent of total revenues for the central government in 2004. As revenue for the non-financial public sector, tariff and other import taxes represented 1.55 percent of GDP the same year (see Tables 2 and 5). Unless the government reduces its current expenditure or generates more revenue from sources other than taxes, the government will have to decide how to compensate its tariff revenue loss. Such fiscal impacts have even more relevance in an economy like Ecuador's, which has adopted the US dollar as its currency (abandoning with it other key instruments of economic policy like those in monetary and exchange rate policies). Fiscal policies in Ecuador are a unique and key instrument in managing the economy. In fact, the press has already reported a possible increase in value added tax which currently stands at 12 percent (for final sales of

goods and services). Changes in fiscal policies will in turn affect poverty and income distribution in Ecuador. Despite the importance of the analysis of fiscal and poverty impacts in Ecuador there has been little research on the subject.

Table 5.- Non-financial Public Sector, Selected Operations
Percentage of GDP

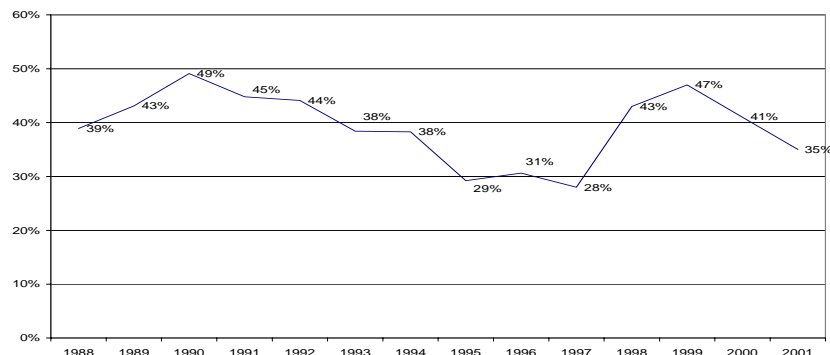
Transactions/Period	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
TOTAL REVENUES (1)	22.8	21.89	19.9	17.32	21.08	25.9	23.57	26.16	25.4	26.92
Oil	6.62	7.4	5.37	3.93	6.29	9.16	6.43	5.73	6.12	6.99
Non-oil	13.54	12.25	13.26	13.32	14	15.79	16.63	19.67	18.95	19.15
Value Added Taxes (VAT)	3.09	2.98	3.3	3.58	3.54	5.61	6.93	6.87	6.39	6.23
Income taxes	1.71	1.61	1.7	1.52	0.86	1.97	2.57	2.45	2.71	2.91
Tariff collections	1.49	1.15	1.8	2.55	1.86	1.36	1.69	1.7	1.46	1.55
Social Security contributions	2.52	2.12	1.9	1.94	1.38	1.43	2.16	3.16	3.31	3.3
Others	3.9	3.76	3.7	2.96	3.79	3.75	2.54	4.55	4.21	4.27
TOTAL EXPENDITURES (2)	23.8	24.6	22.1	22.13	24.98	24.41	23.53	25.35	24.21	24.66
Current Expenditures	17.9	17.74	16.79	17.16	18.98	19.42	16.83	18.84	18.85	19.35
Interest	3.92	3.91	4.21	4.25	7.1	6.6	4.74	3.47	3.01	2.63
Wages and salaries	7.11	6.97	6.5	7.27	5.94	4.78	6.46	8.26	8.42	8.54
Purchase of goods and services	1.52	2.5	2.5	2.45	2.38	2.57	2.76	3.71	3.49	3.41
Others	5.4	4.36	3.5	3.2	3.56	5.47	2.88	3.41	3.93	4.77
Capital Expenditures	5.92	6.81	5.3	4.97	6	4.99	6.7	6.51	5.37	5.31
BALANCE	-1.02	-2.66	-2.14	-4.81	-3.9	1.49	0.04	0.82	1.67	2.26

Sources: Statistics of the Central Bank of Ecuador and of the Ministry of Finance.

Notes: 1/. Other small revenues, excluded from this table, are: special consumption taxes, taxes on exits from the country, and taxes no longer applied after 2000 (like the tax on purchases and sales of foreign currency, and on circulation of capital). 2/. In this table government expenditures are expenditures already accrued.

According to a recent World Bank poverty note (see Sanchez-Paramo, 2005), forty percent of the population in Ecuador lives in rural areas and sixty percent of this population is poor. On the other hand, figure 3 below shows that urban poverty hit a low level of 28 percent of urban population in 1997, increased to 47 percent in 1999 (as a consequence of a deep economic crisis), and recovered twelve points up to 2001 to reach 35 percent.

Figure 3.- Ecuador: Urban Poverty, 1988-2001
Percent of Population



Source: Leon and Vos (2000), and as published in World Bank (2004).

Note: Based on surveys of Employment, Unemployment, and Underemployment.

Sanchez-Paramo points out two key problems with social expenditure in Ecuador: they are highly volatile and poorly targeted. Some social expenditures are progressive – primary and secondary education, for instance. But others are regressive, such as the case of the subsidy for cooking gas, as discussed above. On several occasions the elimination of the gas subsidy has been recommended (see for instance, World Bank 2004). Several governments have tried to reform or eliminate the gas subsidy, but it has proven a very hard political issue to deal with. The elimination of this subsidy could be a way to compensate tariff revenue loss, but the high political cost makes the adoption of this expenditure-reduction measure unlikely.

**Table 6.- Ecuador: Social expenditure, Selected years
As percentage of GDP**

	1973	1979	1981	1984	1988	1992	1996	1998	2000	2002
Total	3.8	4.6	6.3	4.9	4.7	5.2	3.8	3.4	3.6	4.5
Education	3.2	3.5	4.8	3.7	3.2	3.8	2.5	2.4	1.7	2.4
Health	0.5	1.0	1.3	1.1	1.3	1.1	0.8	0.7	0.6	1.2
Social Assistance	0.1	0.1	0.2	0.1	0.2	0.3	0.5	0.2	1.3	1.0
Bono Solidario									0.8	0.4
Other	0.1	0.1	0.2	0.1	0.2	0.3	0.5	0.2	0.5	0.6

Source: Sanchez-Paramo (2005).

1. Main research questions and core research objectives

The ultimate goal of this proposal is to contribute to the availability of tools to perform income distribution and poverty impact studies of changes in fiscal and trade policies in Ecuador. We believe that two key tools to perform such impact analyses are CGE models and microsimulations. Through this study we also aim to expand the knowledge of Ecuadorian people and of the international community regarding fiscal and trade policies in Ecuador, and their effects on poverty and income distribution in Ecuador. We take as an illustration the study of poverty and income distribution effects of a combined policy of full trade liberalization with changes in value added tax –designed to compensate for government’s tariff revenue loss- in Ecuador.¹

¹ We believe that this scenario of full trade liberalization can be seen as a benchmark for trade liberalization policies pursued by Ecuador in recent years. Ecuador has complementary economic agreements with several Latin American countries (these agreements grant trade preferences to signatory trade partners). Ecuador recently signed a Free Trade Agreement for goods with MERCOSUR, is negotiating an expected broader Free Trade Agreement with its main trade partners –U.S., Colombia, Peru-, is already in a free trade zone with Andean partners, and is expecting to soon negotiate Free Trade Agreements with the European Union and Chile. Ecuador (and fellow Andean countries) already receives tariff preferences from its main trade partners (the U.S. and the EU). We take this proposed study as an upper benchmark of poverty effects of recent trade liberalization policies pursued in Ecuador because we are studying a full liberalization scenario. We, for sake of modeling simplicity, do not include a multi-region CGE model (again, Ecuador already enjoys zero- or very small tariff access in most of its trade with its most important trade partners).

The main research questions we pose in this study are:

- What would be the effects on income distribution and poverty of a policy of full liberalization (zero tariff rates) and an increase in the value added tax rate designed to keep the government budget neutral?
- How many households would fall below the poverty line after free trade and changes in the value added tax rates are implemented?
- Are there any other possible tax/trade scenarios that could have less negative impacts on the poor?

The core research objectives include:

- To document the main domestic prices and labor market effects of trade liberalization policies in Ecuador and establish the links between the CGE and micro-model regarding these price and labor market effects.
- To document the changes in income distribution and poverty, resulting from combined free trade and increase in value added tax policies.
- To establish the main links and mechanisms by which these trade and fiscal policies affect income distribution and poverty across and within different labor types (wage, self-employment; rural, urban; and, by education level), in Ecuador. The types of factor incomes to be considered are constrained by data availability.

2. Knowledge gaps and scientific contribution of the research

This study is part of a growing branch of the empirical economic literature that tries to examine the effects on poverty and income distribution in countries that have opened their markets to global competition. We add to it the study of fiscal policies that the government could tap in order to compensate tariff revenue loss. The impact analysis of changes in fiscal policies on poverty and income distribution is a very important issue for a country such as Ecuador where poverty rates are high and where the US dollar has been the official currency since 2000 (and thus authorities have lost monetary and exchange rate policy instruments to face any economic imbalance). However, there has been no systematic evaluation of the extent to which fiscal and trade policies affect poverty and income distribution in Ecuador.

We propose to use micro and computable general equilibrium models of the Ecuadorian economy. There are various ways to approach the analysis of the impact on poverty and income distribution of changes in economic policies within a combined CGE-microsimulation framework. These approaches are 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). Two recent surveys (Bourguignon, 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 (2001) is an example of a fully-integrated CGE-microsimulation model. Bourguignon, Robilliard and Robinson (2003) follow a top-down layered or sequential approach. Savard (2003) designed a top-down/bottom-up approach. In our study we propose the application of a sequential approach with a CGE and a micro model along the lines of Bourguignon, Robilliard and Robinson (2003).

One main technical contribution will be the analysis of impacts on poverty and income distribution of fiscal policies using a CGE for the Ecuadorian economy and microsimulation analysis with *real* household data. A recent study on the impact of trade liberalization on poverty in Ecuador using the CGE microsimulation framework is Vos and De Jong (2003). But in this study there is no fiscal policy change involved, and the micro modeling is approached as a random process. We depart from this approach and try to model earnings and occupational choice households' decisions by building a system of equations as in Bourguignon, Robilliard and Robinson (2003). (See also Robilliard and Robinson (2005), and Robilliard, Bourguignon and Robinson (2001)). A key contribution will be to identify key links between the CGE and micro models.

This research will contribute to the development in Ecuador of both CGE modelling and micro modelling. And very importantly, it will build tools for the analysis of impacts of fiscal and trade policies. At the same time this study will focus attention on a key aspect of fiscal and trade policy changes usually ignored in the public debate in Ecuador: their effects on income distribution and poverty.

Key points of this study.-

This study differs from previous CGE studies of Ecuador because:

- 1.- It links fiscal and trade policy changes to poverty and income distribution effects, using own single-country CGE model *and* a micro simulation model.

2.- It links macroeconomic variables to income distribution across different labor groups (according to area –rural and urban, and education level –primary and higher than primary; for wage earners and the self-employed).

3.- The CGE and micro models designed and used in this proposal are intended to be kept and further applied in Ecuador as an analysis tool of the poverty impacts of other policy changes.

3. Policy relevance

Ecuador is a dollarized economy immersed in a trade openness process which will likely trigger changes in fiscal policies. These policy changes in turn will affect income distribution and poverty rates in a country with already high poverty rates in rural areas and rising poverty in urban areas (see World Bank, 2004). There has been a lack of funds and own analysis tools in Ecuador to study poverty and fiscal impacts.

Our emphasis on both fiscal policies and the use of CGE and microsimulation models as basic analysis tools is necessary. In a country such as Ecuador, which is a dollarized economy pursuing trade liberalization policies, with high poverty rates, and lacking research tools for impact analyses of changes in economic policies, the availability of analysis tools should contribute to the adoption of better-informed policy decisions concerning the poverty effects of fiscal and trade policies.

It is time to draw the attention of Ecuadorian authorities and the Ecuadorian community and public in general to key topics such as fiscal and poverty impacts. We hope that the analysis of poverty and income distribution impacts will become common practice in the discussion of the effects of policy changes. This study would be a first step in that direction.

4. Methodology

The method we plan to follow to address the impacts on poverty of a combined policy of full liberalization and an increase in VAT to keep the budget neutral is to combine a CGE model with a micro model. The method will include four main stages, and will have a sequential approach, given that the macro and the micro modelling part will be developed separately, but we will try to ensure consistency between the CGE and the micro model results. We believe this is an insightful approach as it will allow us to transmit domestic price changes and resource reallocation expected from the trade liberalization policy that may have a key influence on households' poverty and income distribution. It will also allow us to analyze the full distribution of real household income within households and not just between households, which is a criticism received by models which use a representative household approach with a few groups. The

approach with real household data we follow is not free of criticism either. Main criticisms against this approach are the lack of feedback from households' results to the main macro model (the CGE country model, in our case), and the ad-hoc nature of the micro-model equations. Our microsimulation work follows the spirit of the work in Bourguignon, Robilliard and Robinson (2003) and Robilliard, A., F. Bourguignon, and S. Robinson (2001).

The four main modelling stages proposed are:

- 1) Linking, in a consistent way, the micro and the CGE model. This step in turns implies, broadly speaking, two steps: (i) estimating the equations in the micro model and obtaining a set of coefficients and household characteristics that will be used to calibrate the CGE model, and (ii) running a benchmark simulation in the CGE model so that the model is calibrated, in a consistent way to the set of coefficients and household characteristics from the micro model. We expect to follow the consistency rules provided by Bourguignon, Robilliard and Robinson (2003). In a nutshell, according to Bourguignon et. al., consistency requires changes in variables of micro-model equations to be equal to changes in similar variables of the CGE model.
- 2) Solving the trade and fiscal policy changes in the CGE country model for Ecuador (which seek to raise revenues in response to the revenue lost due to tariff elimination, so to keep the government budget neutral), and get a new set of variables (a vector of appropriate prices, wages, and aggregate employment variables) that will be used to communicate with the micro-simulation model. An overview of the CGE model is presented below.
- 3) Using the micro-simulation model to generate changes in variables that account for heterogeneity in the household data (individual wages, self-employment income, and employment) so that the results are consistent with the post-policy-change macro variables generated by the CGE model.
- 4) Evaluating the impact of the policy changes on poverty and income distribution.

Key issues in this research project that need to be addressed with care are how to make the proper links between the CGE country model and the micro-simulation model to ensure consistency between them. Another issue that will need to be 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 dollarization and unemployment).

One step prior to the modelling stages will be a good deal of data work. The data work includes (i) updating the rural household survey from year 1999 to year 2004, (ii) ensuring comparability of both rural and urban household survey data, (iii) constructing income distribution and poverty indicators using the (initial) rural and urban household survey data, and, (iv) updating the Social Accounting Matrix to be used in the CGE model from 2001 to 2004.

In what follows we present a preliminary outline of the micro model and an overview of the CGE model proposed.

The Micro Model: A preliminary outline

As in Bourguignon, Robilliard and Robinson (2003), the micro model will be based on a set of reduced form equations that describe individual earnings, household self-employment income, and the occupational choice of the head of the household.

Overview of the CGE Model

The CGE model goes along the lines of the ORANIG model. ORANIG is a static CGE model. (For a detailed description of ORANIG and its equations see Horridge (2000)). It follows the standard neoclassical CGE structure with equations that describe producers' production and input decisions, households' behaviour, government demands, export demands, market clearing conditions for commodities and factors markets, and numerous macroeconomic variables and price indices. Demand and supply equations for private-sector agents are derived from the solutions to optimization problems, where agents are assumed to be price-takers and markets are assumed to be competitive. Table 7 summarizes some of the features of the CGE model. There still remains work to be done with the CGE model, in particular regarding the labor market structure.

Table 7.- Main Features of the Ecuador CGE Model (*)

Sections	Description
1. Production	Each industry may produce several commodities, using as input domestic and imported commodities, labor, capital, and land. ^{1/} Commodity composites, a primary-factor composite and other costs are combined in a Leontief function. Each commodity composite is a CES (constant elasticity of substitution) function of the domestic and imported goods. Primary-factor composites are a CES aggregate of land, capital and composite labor. Composite labor is a CES aggregate of occupational labor types. Input proportions and behavioral parameters may vary between industries.
2. Household demands	These also follow also a nesting structure, where commodity composites are aggregated by a Klein-Rubin, which results in a linear expenditure system (LES). The choice between domestic and imported commodities is a CES. This structure determines the composition of household demands but not total consumption. Total consumption can be determined in several ways: (i) exogenously, (ii) by a consumption function, or (iii) via a balance of trade constraint.
3. Investment demands	The production of new units of fixed capital shows a similar structure to that of the nesting structure for production of commodities. But no primary factors are used directly as inputs to capital formation. At the top level the total cost of commodities composites is minimized subject to a Leontief; at the bottom level, the total cost of imported and domestic good I is minimized subject to a CES. The total amount of investment in each industry is exogenous and is determined by other equations.
4. Export demands	For an individual export commodity, foreign demand is inversely related to its commodity price. For collective export commodities, foreign demand is inversely related to the average price of all collective export commodities.
5. Government demand	The level and composition of government consumption can be set exogenously. Alternatively, aggregate government consumption can be assumed to move with real aggregate household consumption.
6. Market-clearing equations	The model includes standard equations to show that markets are in equilibrium.
7. Taxes	The model includes rules for setting sales-tax rates for producers, investors, households, and government. Sales taxes are ad valorem on basic values (that is, the price received by producers; it excludes sales taxes and margins involved in the transfer of the good from producers to users). Changes in the relevant tax rates can be commodity- or user-specific.
8. Primary factors aggregates	These measures indicate the aggregate productive capacities of labor, land, and capital. For instance, if needed and if data is available, the model can compute aggregate employment measures, using wage-bill weights that reflects the relative marginal products of different workers.
9. The labor market	ORANIG, the model which the Ecuador model is based on, has no theory of labor supply. The model allows for different settings, according to the desired assumptions. Employment can be set exogenously, with market-clearing wage rates determined endogenously, or wage rates (real or nominal) can be set exogenously, allowing employment to be demand-determined. Labor market modelling decisions are usually made at the economy-wide level, but could be applied individually and differentially to different industries or different types of labor.
10. Some Key assumptions	In production: input-output separability. Armington assumption in the sourcing of intermediate inputs, so that imports are considered imperfect substitutes for domestic supplies. Capital is produced with inputs of domestically produced and imported commodities. No financial markets, the model focuses on the real side of the economy. ^{2/}

(*) This overview is based on the ORANIG description found in Horridge (2000).

Notes:

1/. The input-output table of Ecuador originally has 60 commodities and 47 industries.

2/. A note related to Closures: Shifts variables can be turned on and off, reflecting the switch between the endogenous and exogenous status of shift variables. This is a nice feature of the ORANIG model set up, on which the CGE model for Ecuador is based.

5. Data requirements and sources

The data we expect to use in this study include an input-output table and a social accounting matrix (SAM) for Ecuador for year 2001, both developed by the Central Bank of Ecuador. We expect to also use the latest household data available for Ecuador. These data come from a) the 2003-2004 survey of urban households' income and expenditures (ENIGHU), and b) the 1998-1999 Encuesta de Condiciones de Vida (ECV) that includes rural households' data. Both surveys are carried out by the Ecuadorian Institute of Statistics and Census (INEC). The World Bank also has Ecuador household survey data which are based on the data collected by INEC (the so-called Living Standards Measurement Study (LSMS) household surveys for Ecuador).

6. Dissemination strategy

We plan to hold CICYT-organized seminars at ESPOL to present work-in-progress and final results of this research (CICYT is a department at ESPOL which is in charge of publishing research results as well as organizing seminars for big audiences, where researchers, professors, and students from across all disciplines at ESPOL and other universities can attend). Around the time we organize a seminar to present final results we expect to hold press conferences in the cities of Quito and Guayaquil. We also plan to present results at the School of Management, where the targeted audience will be private constituency, businessmen, and graduate students. We expect to attract the attention of the government and national institutions and organize seminars where government officials will be invited to attend. Working papers will also be submitted to suitable regional meetings for presentation during 2006 and 2007. We would also like to have the opportunity to attend PEP general meetings and the MPIA workshops. This will certainly be an excellent opportunity to discuss this proposal and the research in progress, and exchange ideas with other scholars and policy makers. We expect the results of this study to be the basis of future journal publications, in Ecuador and abroad.

7. Shortlist of key references

Bourguignon, F., A. Robilliard, and S. Robinson (2003), "Representative versus real households in the macro-economic modeling of inequality," DELTA working paper 2003-05.

Bourguignon, F., L. Pereira da Silva, and N. Stern (2002), "Evaluating the Poverty Impact of Economic Policies: Some Analytical Challenges," World Bank, March 2002.

Cockburn, J. (2001), "Trade Liberalisation and Poverty in Nepal: A Computable General Equilibrium Micro Simulation Analysis," Discussion Paper 01-18, CREFA, Universitat Laval, October.

- Cuesta, J. , M. León, and J. Ponce, “Simulando el paso de subsidios regresivos a transferencias progresivas: el subsidio al gas y el bono solidario en el Ecuador,” Frente Social, Sistema Integrado de Indicadores Sociales del Ecuador (SIISE), mimeo, undated.
- Davies, J. B. (2004), “Microsimulation, CGE and Macro Modelling for Transition and Developing Economies,” University of Western Ontario, April 2004.
- Horridge, M. (2000), “ORANI-G: A Generic Single-Country Computable General Equilibrium Model,” CoPS/IMPACT Working Paper Number OP-93, October 2000.
- Leon, M., and R. Vos (2000), “La Pobreza Urbana en el Ecuador, 1988-1998, Mitos y realidades,” Frente Social, Sistema Integrado de Indicadores Sociales del Ecuador (SIISE), Abya-Yala eds., Quito.
- Lofgren, H., S. Robinson, and M. El-Said (2003), “Poverty and Inequality Analysis in a General Equilibrium Framework: The Representative Household Approach,” in *The Impact of Economic Policies on Poverty and Income Distribution: Evaluation Techniques and Tools*, François Bourguignon and Luiz A. Pereira da Silva (eds.), World Bank and Oxford University Press, August 2003.
- Robilliard, A., F. Bourguignon, and S. Robinson (2005), “The Social Impact of a WTO Agreement in Indonesia,” World Bank Policy Research Paper 3747, October 2005.
- Robilliard, A., F. Bourguignon, and S. Robinson (2001), “Crisis and Income Distribution: A Micro-Macro Model for Indonesia,” mimeo.
- Sanchez-Paramo, Carolina (2005), “Poverty in Ecuador,” *En Breve*, No. 71, World Bank, May 2005.
- Savard, Luc (2003), “Poverty and Income Distribution in a CGE-Household Micro-Simulation Model: Top-Down/Bottom Up Approach,” mimeo, International Development Research Centre.
- Tamayo (1997), “La Evolución del Arancel en el Ecuador: 1990-1996,” Central Bank of Ecuador Working Paper No.115, May 1997.
- Vos, Rob, and N. De Jong (2003), “Trade Liberalization and Poverty in Ecuador: a CGE Macro-Microsimulation Analysis,” *Economic Systems Research*, Vol. 15, No. 2, June 2003.
- World Bank (2004) , "Ecuador: An Economic and Social Agenda in the New Millennium", edited by Vicente Fretes-Cibils, Marcelo M. Giugale and José Roberto López-Cálix, Washington, D.C., World Bank, available in English online at http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&id=000094946_03071204032842.

8. List of team members' prior training and experience in the issues and techniques involved.

- Paul Herrera, male, 30, has a PhD in Agricultural Economics from the Department of Agricultural Economics at Gent University (Gent-Belgium). Although he has no direct experience in the research topic of this project, he has worked in research with primary data (surveys), in topics relating to rural development, farm systems, the measurement of social capital, the economics of property rights and transaction costs. Parts of his research articles have been published in international journals.
- Sara Wong, female, 36, has a PhD in Economics with specialization in International Economics, Public Finance and Economic Development from the Economics Department at the University of California, Los Angeles (UCLA). She has received training in CGE models. She attended both the Trade Policy Modeling and the Database Construction courses for applied General Equilibrium models at the Center of Policy Studies, Monash University, in Melbourne, Australia. She has also attended the Annual Short Course at the Global Trade Analysis Project (GTAP), Purdue University, in West Lafayette, Indiana, U.S.A. She recently attended the Dynamic CGE Modelling course offered by Monash University at the US International Trade Center in Washington, DC. She has applied her CGE training to the study of the economic impacts of the foreign trade agreement that Ecuador is about to sign with the U.S.A., Colombia, and Peru. Sara contributed to the inclusion of input-output tables of both Ecuador and Bolivia in the GTAP database. As a result, these two countries are for the first time included in that database. She has worked with income and expenditure household micro-data in previous consultancy jobs in the U.S.A., applying both STATA and SAS programs.

9. Expected capacity building

Our university, ESPOL, has a mission to “undertake research, technology transfer and quality outreach programs to serve society.” To contribute to the process of trade openness that Ecuador is committed to, ESPOL has given support to projects oriented towards the study of economic impacts using a computable general equilibrium framework. The impact studies have so far focused on macro issues. We would like to deepen our experience and knowledge of CGE macro modeling while focusing on key microeconomic issues for Ecuador, such as the study of poverty impacts. In Ecuador, poverty analysis is a field where there is a pressing need for tools and theoretical frameworks in order to carry out studies.

This is why we would like to have this opportunity to work on developing and implementing a framework and tools that could help us tackle poverty issues and the poverty impacts of policy changes in Ecuador. We refer to the proposed sequential CGE-microsimulation framework. We have worked on a Computable General Equilibrium Model for Ecuador, we expect to work on a micro model of earnings and occupational choice, and we propose to apply these models to a poverty impact study of trade and fiscal policy changes.

In summary, we want to strengthen the CGE macro modelling capacities of the team members and to learn and deepen the knowledge of micro-simulation techniques that professors at ESPOL have. Some members of the team have knowledge and experience in the modelling and application of CGE models. Other team members have knowledge and experience in poverty issues. All members have a great deal of experience using statistical and econometric software and techniques. The corresponding curriculum vitae can provide more details on the background of each team member. This project may give team members the opportunity to participate in events that could enhance their capacity to teach and train others (undergraduate and graduate students) in issues and techniques in applied macro and microeconomics.

Prof. Wong will be in charge of CGE modelling and policy simulations. She will also contribute to the development of the micro model. Prof. Herrera will develop and present seminars on the results to academics, businesspeople, and government officials. He will work on poverty indicators and the micro model.

Prof. Herrera would like to stress the importance of linking micro and macro models in order to be able to derive macro-policies that could be enforced at institutional level, which in turn could support the effectiveness of micro-policies at local levels. This last point is of extreme importance in Ecuador given the weak institutional structure and the great potential of local initiatives to improve the welfare of rural populations, which are the ones that are mostly living in extreme poverty conditions. It is clear, however, that any effort at the micro local level will lose effectiveness if no enforcement is achieved at institutional level.

In addition, we will hire research assistants to work on data issues. All team members expect to apply the new knowledge and techniques learned through this project in their respective economics and management classes. For instance, we expect to design and teach a seminar with the main techniques used to foster/motivate the interest of undergraduate and graduate students in economics and management in the study of poverty issues and the CGE-micro framework. This will certainly be a great extra benefit of the project, because, as far as we know, no school in Ecuador teaches these subjects.

10. Any ethical, social, gender or environmental issues or risks which should be noted.

At this stage of the proposal, and considering the data available, we do not foresee any ethical, social, gender or environmental issues or risks that should be noted or that we could analyze.

11. List of past, current or pending projects in related areas involving team members (name of funding institution, title of project, list of team members involved)

Sara Wong

- Economic Impacts on Ecuador of the Foreign Trade Agreement with the U.S.: A CGE Approach. Funding institution: ESPOL. Role: Principal Researcher.
- Estimation of Armington Elasticities for Ecuador. Funding institution: ESPOL. Role: Project leader and researcher.
- Inclusion of an Input-Output Table of Ecuador in the GTAP database. Funding institution: ESPOL. Role: Project leader and researcher.
- Inclusion of an Input-Output Table of Bolivia in the GTAP database. Role: Adjunct researcher.
- Productivity and Trade Openness: Micro-level Evidence from Ecuador 1997-2003. Funding Institution: Andean Development Corporation. Role: Project leader and principal researcher.
- Pro-competitive effects of trade openness in Ecuador: micro-level evidence. Funding Institution: Graduate Management School (ESPAE). Role: Project leader and principal researcher.

Paul Herrera

- Measurement of Social Capital in five Irrigation Associations in the Low Daule River Basin. Funding institution: VLIR-ESPOL competitive funds for research. In progress. Role: Adjunct researcher.
- Institutional Economics of Pollution in the Chaguana River Basin. Funding institution: VLIR-ESPOL competitive funds for research. Role: Project Leader.
- Agro Industrial Opportunities for the Peninsula of Santa Elena. Funding institution: Ministry of Agriculture of Ecuador. Participants: ESPOL, University of Florida (Gainesville-USA), CEDEGE. Role: in charge of coordinating all extension activities.
- Andean Competitiveness Project (PAC-ESPOL). Funding institution: Andean Development Corporation. Role: participated in the team of researchers that developed the proposal and the final studies.

12. Appendix: Answer to PEP Comments on this Proposal received on February 7, 2006

In this section we address the way in which we have taken into account the comments we received from PEP concerning this proposal. We are grateful for these comments as we believe they have helped us to improve several sections of this proposal.

1. PEP stated that the issues we intend to address in this study are clear, namely, the analysis of impacts of fiscal policy changes in a dollarized economy. Our study proposes the poverty impact analysis of full trade liberalization and an increase in value added tax to compensate the government for lost tariff revenue.

2. PEP has questioned the proposed use of GTAP to evaluate the changes in world prices. We have reconsidered the relevance of the GTAP model for this study. Ecuador is indeed a small economy, which takes world prices as given. We have decided the GTAP model is not necessary to tackle the issues we plan to address and we will not propose to include this model in this study.

3. Ecuador is an economy that has already signed several trade agreements (with Latin American trade partners), maintains a free trade zone (with fellow Andean countries), and which already receives trade preferences from main trade partners (the U.S., and the European Union). Ecuadorian exports to these countries represented over 70 percent of total exports in 2004. Imports from those countries reached around two thirds of total imports the same year. Given that a full liberalization would imply reductions of Ecuadorian tariffs with no necessary counterpart from their trade partners (since Ecuador already receives trade preferences from its main trade partners) we have considered that a single-country model would be suitable for the analysis of the issues at hand.

4. We propose to use a reduced form micro model of income generation and occupational choices from which we would estimate parameters and coefficients using rural and urban household survey data. The estimates of parameters and coefficients would be used to calibrate the CGE model. In the link between the micro model and the CGE model we will characterize households by their factor income sources, such as different labor types (wage earners, self-employed; by area –rural, urban; by education level –primary, more than primary), and capital. The policy simulations in the CGE model will in turn provide a new set of aggregates that will be used in the micro model to calculate new micro-level results for wages, self-employment income, and employment status. The links between the micro and the CGE model should be carefully modelled and implemented so that there is consistency between them. Finally, changes in income distribution and poverty will be calculated using the (initial and) new post-policy simulation micro-level data.