**Documento de proyecto**

# Trade, poverty and complementary policies in Latin America

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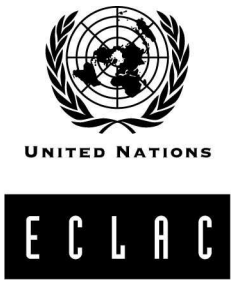



Economic Commision for Latin America and the Caribbean (ECLAC)

This document contains a selection of studies carried out for the Poverty, Trade Policy and Complementary Policies project, which was conducted between September 2008 and December 2010 with financing from the Spanish International Cooperation Agency for Development (AECID). A number of the papers were presented at country seminars during 2009 and 2010.

The project was coordinated by a team whose members were José Durán Lima, Marcelo LaFleur and Andrea Pellandra, all staff members at the Division of International Trade and Integration of the Economic Commission for Latin America and the Caribbean (ECLAC). The editors are grateful for the comments of those who participated in the country workshops. Particular thanks are due to Mariano Álvarez and Dayna Zaclicever, who assisted in preparing the chapters for this edition, and all the individual authors of the papers: Lucas Arce, Joaquím Bento de Souza, Soraya Fernández, Alfonso Finot, William Foster, Cynthia González, Veronica Kulmer, Ramón López, Carlos Ludeña, Fernando Masi, Rossana Patrón, Hugo Rojas-Romagosa, Gustavo Setrini, Roberto Tellería, María Inés Terra, Alberto Valdés and Sara Wong.

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# Index

# Foreword

There is general agreement about the importance of the role played by trade in development policies, and the governments of Latin America and the Caribbean are accordingly seeking to expand their countries' trade and improve the quality of their international specialization as an integral part of their development agendas.

Trade provides opportunities to generate economic growth, reduce inequality and increase the incomes of the poor. In particular cases, however, the effects of trade opening can be detrimental to the welfare of the poorest unless it is supported by specific investments and domestic support policies. These are particularly important where SME competitiveness and workforce training are concerned.

Furthermore, there is a complex dynamic at work in the interaction between trade policies and social variables. Relative price changes deriving from liberalization tend to alter the way resources are allocated, transforming production and employment structures and potentially causing winners and losers to emerge. While some producers may lose competitiveness and go out of business, with the consequent rise in unemployment and loss of income for the affected population, others break into new markets and are in a position to expand their operations and their workers' incomes. There is a more direct effect on consumer goods prices, which immediately impact consumers as they benefit from cheaper, higher-quality products. To the extent that trade liberalization brings this improved consumption basket within the reach of the poorest groups without any change in income, these groups will enjoy greater purchasing power and enhance their welfare.

Whether or not trade reforms benefit the poor depends not just on the ability of countries to expand their markets and procure cheaper inputs but also on access, compensation, regulation and promotion policies:

(i) measures to make it easier for lower-income producers or exporters to participate effectively in stable export flows (access);

(ii) measures to offset any negative effects of reforms on the most vulnerable groups (compensation);

(iii) measures to improve the regulatory framework with a view to correcting distortions (regulation), and

(iv) productive development measures to improve the productivity, workforce quality and networking capabilities of SMEs so that they can scale up production and capitalize on trade promotion measures while improving their access to financing (promotion).

Measures of this kind, known as complementary measures, are at the heart of the studies presented here. The recent empirical evidence shows that the distributive effects of trade opening, if unaccompanied by other policies to secure a balanced distribution of its benefits, may actually be detrimental to the welfare of the poorest segments of the population.

To address these issues, in September 2008 the Division of International Trade and Integration of ECLAC began implementing the Poverty, Trade Policy and Complementary Policies project as a component of the programme of cooperation between ECLAC and the Spanish International Cooperation Agency for Development (AECID), "Policies and Instruments for the Promotion of the Growth in Latin America and the Caribbean II".

Two regional seminars and eight country-level seminars were held under project auspices in seven different countries (Brazil, Chile, Costa Rica, Ecuador, Paraguay, the Plurinational State of Bolivia and Uruguay), involving representatives of the public and private sectors, international organizations, non-governmental organizations (NGOs) and academia. At all these events, particular recommendations for public policy measures were discussed from a technical and economic perspective, including measures to: a) use the benefits of trade to serve the interests of vulnerable groups and b) encourage local and regional dialogue on the need to apply policies that complement trade policy in areas related to human capital accumulation, the efficiency of public social spending, the promotion of public-private partnerships to form value chains oriented towards external markets, the reduction of levels of protection that generate economic inefficiency and the lessening of subnational inequalities, among others. These issues are dealt with at length in the different chapters of the book.

ECLAC aims to enhance the ability of the region's governments to develop foreign trade-related strategies that can help to relieve poverty while contributing to the formulation of complementary policies that enable the poor to benefit from opportunities arising out of regional and international trade.

We are aware of the difficulties involved in this process, given the wide spectrum across which the different public policies suggested need to be applied. Notwithstanding this, we at ECLAC are convinced that this is the way forward for growth with equality. Accordingly, we are delighted to present this volume and its wide range of studies with their concrete recommendations for policies to address a variety of specific situations affecting the poorest and most vulnerable groups. The goal is to provide governments and the academic and business worlds with empirical findings and lessons from experience and good practice that allow them to move more quickly towards policies that can forge a more advantageous link between participation in the global economy, innovation, competitiveness and the reduction of inequalities.

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# Introduction

With a view to learning lessons about the interactions between trade and poverty through their various channels, this book brings together the different studies analysing these connections from a variety of angles and with different approaches. Rather than laying down a standard methodology for evaluating the impacts of trade policy decisions on poverty, the logic followed by the group of studies presented in this volume is the discovery of common denominators for economic policy decisions intended to complement trade policy measures, setting out from the position that each country has the sovereign right to determine its own development strategy and role in the global economy.

One of the main conclusions is that while trade measures at the country level have a large potential impact on poverty reduction in vulnerable populations, complementary local and national policies have a key role to play in reducing the negative impact of trade liberalization and increasing its benefits. The project also helped to identify issues for more in-depth analysis, such as the importance of family farming and partnership in anti-poverty efforts; long-term social policies, such as education; the importance of involvement by micro, small and medium-sized enterprises in export chains and in the incomes of poorer groups; and the need for clarity about the channels through which trade policies interact with poverty at the regional and sectoral level so that complementary anti-poverty policies can be designed.

In the course of this project, detailed case studies were commissioned with a view to obtaining relevant recommendations for a pro-poor public policy orientation that takes trade policy into account. These studies have a twofold purpose: (a) to determine the effects of changes in trade policy and (b) to identify measures that have been or will be adopted to mitigate the undesirable effects of trade.

The studies presented in this volume can be grouped into three types. A first group evaluate the effects of trade policy changes on trade itself, and thence upon income distribution and poverty. A second group analyse the link between trade policy and poverty when human capital accumulation policies are applied, meaning an increase in the endowment of skilled labour. A third group focus particularly on the definition of ex post analysis methodologies, and include an evaluation of a collective initiative to bring vulnerable groups into international trade in one of the poorest regions of Paraguay (Caazapá) and an estimation of the effects of lower tariffs on household welfare in Chile. Both methods are presented as possible case studies that could be replicated for other countries.

In chapter I, Durán, LaFleur and Pellandra present an integrated executive summary for all the papers in the book, and from this they derive a set of recommendations focusing on the concrete

application of complementary policies to strengthen the link between trade, growth and poverty. Among other things, they highlight (a) inclusion of these issues in countries' national development strategies, (b) the need for prospective studies on the possible benefits and losses deriving from the establishment of trading relationships with third countries or the application of unilateral tariff reduction measures, (c) promotion of public-private partnerships, (d) the design of incentives to encourage capacity-building in organizations connecting together small farmers or vulnerable people with exporting potential, and (e) appropriate investment of social spending earmarked for human capital accumulation.

In chapter II, Wong and Kulmer analyse the poverty and income distribution effects that might ensue if a free trade agreement between Ecuador and the European Union is signed. The study concludes that trade opening by the European Union and Ecuador will generate export and import growth, although this will be very modest, given that most products exported by Ecuador to the European Union already benefit from special tariff preferences under the enhanced Generalized System of Preferences (GSP+). The main benefit obtained by Ecuador would basically be the retention of GSP+ in future, providing greater certainty for exporters. The best results arise in a scenario where the European Union offers wide-ranging preferences and better conditions of access for bananas, although this creates a major policy challenge, as the greatest benefits accrue to just three of the country's provinces (Guayas, Los Ríos and El Oro), while welfare in other agricultural sectors declines because of the resources absorbed by banana growers. This would lead to worsening poverty and inequality, calling for countervailing policy efforts to stimulate investment in the worst-affected sectors.

In chapter III, Tellería, Ludeña and Fernández evaluate some alternative and strategic policies for the Plurinational State of Bolivia following the ending of preferences under the Andean Trade Promotion and Drug Eradication Act (ATPDEA), especially the possibility of the country joining the talks on the partial agreement negotiated between the Andean Community countries and the European Union under a variety of formats (full liberalization or partial liberalization that excludes sensitive products). The study concludes that for the Plurinational State of Bolivia, being part of an Andean Community-European Union (AC-EU) agreement is a better alternative than maintaining the status quo whereby the country benefits from the enhanced generalized preferences granted to it by the EU (GSP+). However, there is a need for complementary measures to ensure that the benefits of trade are inclusive, as the gains are largely confined to higher-income segments of the population and so do not necessarily do anything to reduce the current unequal pattern of income distribution.

In chapter IV, Valdés and Foster analyse the link between agricultural trade opening and the performance of the sector in eight countries of Latin America (Argentina, Brazil, Chile, Colombia, the Dominican Republic, Ecuador, Mexico and Nicaragua) before going on to discuss some poverty impacts. The emphasis is on Latin America during the 1960-2005 period, using a database of nominal rates of assistance (NRA) and relative rates of assistance (RRA) for agricultural support, which includes information on a number of developing countries outside the region. The main question addressed is whether the trade regime influences sectoral growth. The answer to this provides the basis for some inferences regarding the influence of the sector's growth on poverty, using estimates for the impact of agricultural growth on national economic growth, which in turn affects the incomes of the poorest quintile. Among its main conclusions, the study highlights the evidence that countries which attain higher agricultural incomes (50% above trend growth) during the period are the ones that have applied lower levels of protection. As regards the link between trade and poverty, the study concludes that average annual growth in a representative country would have been some four percentage points higher, or about 9% above its average rate, if protection had been reduced. This leads on to the conclusion that the impact of agricultural growth on poverty in Latin America and the Caribbean has been important insofar as lower protection has increased the income of the poorest quintile by a quarter of a percentage point.

In chapter V, Bento de Souza combines a computable general equilibrium methodology with a microsimulations methodology employing data from a variety of Brazilian sources to evaluate the social effects of the projected increase in domestic and global ethanol demand for the Brazilian economy. In particular, the study considers the effects on demand for labour in agricultural sectors and

in the economy as a whole. This leads on to an analysis of the consequences for income distribution and poverty at the national and subregional levels. The modelling results show higher demand for ethanol in Brazil reducing poverty slightly, while increasing the poverty gap. Income distribution improves very marginally. The main reason is that, by contrast with the past, the projected expansion of the sugar cane complex has a new technological basis that relies heavily on mechanization of agriculture. The employment gains are concentrated in São Paulo and centre-west regions and among medium-wage workers, with employment falling among the lower-skilled in many states of the north-eastern region. The main policy challenge that arises concerns the regional redistribution of economic activity within Brazilian, as the effects are not evenly distributed. This means there is a need for efforts to retrain the workers who will be displaced so that they can be absorbed into other sectors of the economy.

In chapter VI, Rivera and Romagosa use a combination of different methodologies (recursive computable general equilibrium, microsimulation techniques and the calibration of a human capital accumulation model) to construct an analytical framework for evaluating the impacts on Costa Rica and Nicaragua of trade policy changes between 2004 and 2011 and the possible effects of applying human capital accumulation measures involving an increase in the endowment of labour up to 2030. The study also sets out to establish the complementarity between trade policy and education policy. Its assumptions include all the multilateral and bilateral agreements signed and under negotiation by both countries, particularly the Central American-Dominican Republic Free Trade Agreement (DR-CAFTA), plus implementation of the Association Agreement between Central America and the European Union from 2011. The results of the trade policy simulations indicate increases in trade and output, although these are modest, something that is explained by the static nature of the model. When labour efficiency shocks are simulated, however, growth rates are higher. Thence it is argued that the main driver of economic growth in both Costa Rica and Nicaragua is the formation of human capital via education policies. Human capital policies also have a greater impact on poverty than trade agreements. Consequently, the poverty reductions estimated in integrated scenarios (with both policies implemented together) are mainly the outcome of human capital accumulation in both countries. The findings of the study show that human capital investment is essential if the benefits of international trade are to be reaped.

In chapter VII, Terra and Patrón use the computable general equilibrium methodology for a country model in order to study the links between workforce skills, trade in services and growth and income distribution patterns in the particular case of the Uruguayan economy. Setting out from the basis that services trade has been the most dynamic globally and that Uruguay has considerable potential in this type of trade but also suffers from certain weaknesses, they seek to answer the question of whether Uruguay is ready to capitalize on the opportunities now opening up in the global market, and if not, what the consequences might be. This potential was analysed by means of policy simulation exercises that assumed an increase in external demand for skills-intensive services, following for this purpose the trend of global growth in services trade and an increased Uruguayan share of this trade. The results of the simulations show that, in a scenario where the education system does not raise its performance, growing external demand for services leads to a widening of the wage gap between different worker skill levels. Consequently, policies to promote human capital growth and greater skills will contribute to a better fit between demand for and supply of qualifications, thereby allowing dynamic sectors to expand and reducing inequality.

In chapter VIII, López conducts an econometric study of the relationship between poverty and income distribution in Latin America, the focus being on establishing the degree of complementarity between trade policy and public social spending. Using data on public social spending (education, health, housing, protection and transfers), non-social spending (defence, economic affairs, etc.), per capita income and the stock of social and non-social capital in eight countries (the Bolivarian Republic of Venezuela, Chile, Colombia, Ecuador, Guatemala, Honduras, Nicaragua and Panama), this author evaluates the hypothesis that social or human capital stocks provided by the State tend to result in trade liberalization benefits that are larger and better distributed among households, especially the poorest. The findings do indeed bear out this hypothesis by showing that social spending is complementary to trade

policy. The benefits of trade opening, especially for low-income household groups and the middle class, largely depend on the amount of social capital provided by the State. Conversely, non-social capital spending tends to bring greater benefits to the richest groups than to middle-income and poor households. Thence the conclusion too that there is evidence of non-complementarity between non-social spending and trade policy, given that this type of spending benefits only the richest segments of society to the detriment of the poor. Where policy implications are concerned, the study concludes that trade liberalization ought to be accompanied by progressive reallocation of public spending from non-social to social goods in a way that gives priority to efforts to build up the stock of social capital.

In chapter IX, Masi, Setrini, González, Arce and Servi propose a methodology involving surveys carried out among a group of small producers linked to a cooperative (Capiibary) to analyse the link between trade and poverty via the inclusion of small family farmers in a value chain headed by a large exporter in Paraguay, Frutika, to which they sell their output of passion fruit (mburucuyá) and other fruits. The cooperative and the firm are located in one of Paraguay's poorest regions, with a poverty coefficient of 41.8% and an even higher incidence of 46.3% in the rural part of the region. The main focus is on evaluating the impact of the linkage between small farmers and Frutika, the control being a group of family farmers in the cooperative who have no ties to it. The findings as regards the factors accounting for the different levels of poverty and the income effects of participating in the value chain indicate that belonging to the fruit farming chain has a very large influence in explaining why both the poverty gap and the severity of poverty are lower among producers who are in the chain than among those who are not. Poverty falls by much more in the group of producers within the fruit farming chain than among those outside it. Although belonging to the chain improves the relative position of the farmers concerned, it is not a sufficient condition for poor families (which a proportion of these producers are) to be lifted out of poverty. This can only happen if one or more members of these families are also employed as wage-earning agricultural or non-agricultural workers. The findings of the study yield important recommendations for the way in which a virtuous link can be developed between family farming and global value chains.

In chapter X, Durán, Finot and LaFleur propose an ex post methodology for analysing the effects of trade policy changes on poverty and income distribution on the basis of information from household surveys, family budgets and the evolution of effective tariffs. This methodology integrates several datasets in a compatible way, making it possible to evaluate trade policy changes that have already occurred. The proposed methodology is applied to analyse household welfare in Chile. The authors use different econometric techniques to estimate a set of parameters and elasticities that allow the compensating variation to be calculated for the direct and indirect effects associated with trade opening between 1999 and 2006, a period when Chile signed a number of free trade agreements. This provides the basis for counterfactual analyses involving policies that are alternatives to liberalization. The results show that, in the case of Chile, the trade policy applied in the first half of the 2000s was pro-poor, as average incomes in the households of the lowest-income quintile of the population rose by 6 percentage points more than those in the richest quintile of the population and over 5 points more than the general average. Income redistribution policies designed to favour the poorest segments of the population improve incomes in the bottom quintiles. If competition in domestic markets also increased, with the price pass-through channel being supplemented by appropriate competition regulation policies, the price gains could be greater. The benefits of liberalization cease to be marginal for the poor when social policies are targeted on the bottom quintiles, and these could improve their welfare by more than the level observed in scenarios not involving complementary measures.

The main purpose of publishing this document is to contribute to the presentation of specific analyses that are conducive to public dialogue about ideas for enhancing poverty reduction measures in the region and to increase the availability of specific information on the household surveys, input-output matrices, family expenditure data, price series, etc., that underpinned the studies presented by the different authors in this volume. Again, an increasingly focused exposition of a set of issues that are recurrent and of high priority in the work of politicians, businesses, academics and public policymakers must necessarily promote and encourage this dialogue, which is helpful for the design of public policy generally.

It is important for trade policy at the regional level to be carefully designed, as it cannot be dissociated from a country's development strategy. Analyses of the effects arising from changes in trade policy indicate that liberalization alone cannot maximize their impact or the benefits producers and exporters derive from them, and the same is true of the consequences for poverty and income distribution. These depend on additional factors more closely associated with a range of complementary public policies, and such policies are the central concern of the studies presented.

# I. Trade, poverty and complementary policies

***José Durán Lima***
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## A. The effect of trade openness on poverty

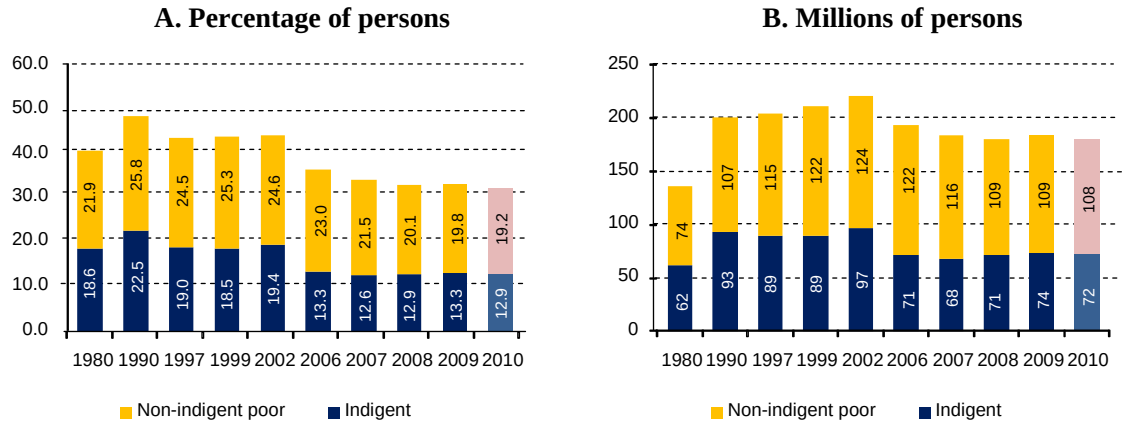
In the last two decades, the percentage of the developing world living in extreme poverty has been halved. As poverty rates have fallen, developing countries have become increasingly integrated into the global trade system. After the import-substitution development strategy was abruptly abandoned following the debt crisis of the 1980s in Latin America and the Caribbean, the region's developing countries drastically lowered their tariffs and stepped up their participation in global trade. In fact, if the percentage of exports in gross domestic product (GDP) is used as a measure of globalization, the developing countries are now more globalized than the high-income countries.

In Latin America and the Caribbean, poverty reduction has followed the global trend. Over the past decade, poverty has fallen in every country in the region except Uruguay. On average, the poverty rate shrank by 1.6 percentage points annually between 2002 and 2009 (ECLAC, 2010). Inequality has also fallen. Measured according to the Gini index, inequality in the region decreased by an average of 3% between 2002 and 2009. These social gains were made alongside economic and trade reforms. Most of the region's countries have implemented major structural reforms over the past 20 years and now count among the most open trade regimes in the world. In terms of trade policy, most countries in Latin America and the Caribbean have continued to actively negotiate free trade agreements with partners outside the region, particularly the European Union and Asian countries. Since 2002, the countries and subregions of Latin America and the Caribbean have signed 36 new free trade agreements, 4 framework agreements and 2 partial scope agreements.

Despite the good results achieved in the trade and social sectors during the past decade, the global economic crisis of 2008 and 2009 revealed the vulnerability of certain groups to the global markets. As the global economic crisis drove up commodity prices around the world, poverty levels in the region rose from 33.0% in 2008 to 33.1% in 2009, plunging three million additional people into poverty in Latin America in 2009 and predominantly affecting indigent groups. The figure would have

been higher if not for the support provided by social policy through transfers and other forms of social assistance (see the figure below).

**FIGURE I.1**
**LATIN AMERICA: POVERTY AND INDIGENCE, 1980-2009**




Source: Economic Commission for Latin America and the Caribbean (ECLAC), *Social Panorama of Latin America 2010* (LC/G.2423-P/E), Santiago, Chile, November 2010.

The poverty and indigence rates registered at the country level between 2002 and 2009 underscore the importance not only of trade openness, but also of complementary policies, for reaping the benefits of periods of economic growth. Complementary policies should include the most vulnerable groups and the poor so a greater level of international integration can be achieved that takes into account the effects of fluctuations in global markets on social variables. The challenge now facing the region is to maximize the opportunities associated with trade openness to benefit all sectors of society while minimizing the negative impacts of that openness on the most vulnerable groups.

Between 2008 and 2010, ECLAC implemented the project Poverty, Trade Policy and Complementary Policies, with financing from the Spanish International Cooperation Agency for Development (AECID), in order to deepen the current body of knowledge and provide the region's countries with policy recommendations for designing and implementing pro-poor trade strategies and complementary policies. There is little empirical evidence at the country level on the links between trade and poverty and how policy affects this relationship. Moreover, the differences in socio-economic conditions from one country to another necessitate policy recommendations that are more specific and differentiated for each case. In order to expand empirical knowledge and inform public policymakers, the analyses presented in this book introduce specific case studies of the dynamic between trade policy and poverty, based on data disaggregated to the microeconomic level (household surveys, price studies for specific products, censuses etc.). This book is a synthesis of these studies, which are presented in greater detail on the project webpage (ECLAC, 2010).

## 1. The link between trade and poverty

Although the increase in trade participation and the reduction in poverty occurred nearly simultaneously, it has been difficult to empirically establish a direct causal relationship between the two variables. There is a broad consensus that trade plays a major role in development policies by opening markets for more products and services and lowering consumer prices, and consequently the region's governments are promoting trade as an integral part of their development agendas (Reina and Zuluaga, 2008). However, taking advantage of these opportunities is not automatic. It depends on a

number of internal factors that are equally important for generating growth and reducing inequality and are complementary to the trade policy of these countries.

Studies on the link between trade and poverty stress that while in the long run it is likely that trade leads to poverty reduction (Balassa, 1971; Balassa, 1985; Krueger, 1978; Bhagwathi, 1978), in the short term there may be some different outcomes (Winters, 2000; Matusz and Tarr, 1999; Giordano, 2009). 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 analysed 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 labour markets. This literature review highlights these short-term adjustment channels and the empirical research on this topic for Latin American countries.

Trade is just one pillar of a dynamic, multifaceted process aimed at reducing poverty. The results of trade liberalization can be beneficial for the most vulnerable, which requires policies that reinforce and multiply these benefits. However, the results can also be detrimental to the well-being of the poorest sectors, without the support of domestic investments and policies for the most vulnerable groups.

In order to analyse the possible impact of trade liberalization on poverty, the clearest possible picture of actual conditions in each country is needed, specifically in terms of: local policies and practices, marketing and retail system, connectivity of domestic producers with consumers in the global marketplace, the state of infrastructure, the business climate, regulations in the labour market and factors that affect labour mobility and social conditions. The relationship between the poor and the global market, which is not obvious, must also be understood. Following Winters, McCulloch and McKay (2004) and Giordano (2009), the next sections cover the main channels of transmission of the effects of trade liberalization on poverty and income distribution: economic growth, goods and services prices, wages and employment and government revenue and spending.

## a) Economic growth and productivity

In the long run, economic growth is key to poverty reduction, because – provided inequality does not increase – the additional resources will clearly also boost the incomes of the poor and enhance government capacity to take action. The empirical evidence that links trade and growth or productivity (that is, long-term impacts) is vast and complex to summarize. According to Winters and others (2004), 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 and others, 2004, p. 83). Tybout (2000) and Epifani (2003) survey in their respective documents 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 reallocation 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 in Chile the net exit of less-efficient firms increased aggregate productivity (Tybout, 1996) and that in Colombia productivity growth can be attributed to intra-plant reallocation of resources (Roberts, 1996). In Ecuador, Wong (2009) finds that increased aggregate productivity might be due to both more output being produced by more productive establishments and a slight increase in the productivity of each plant.

Apparently, there is strong empirical evidence that trade openness generates economic growth, increases average income levels and even leads to productivity gains (Young, 1991; Helpman and Krugman, 1985; Grossmann and Helpman, 1991; López de Córdova and Moreira, 2004). However, growth does not have systematically identifiable effects on income distribution in the short

term, although it is not possible to identify undesired effects such as larger wage gaps. The population that is most vulnerable to small changes in wages and employment is precisely the population on the brink of poverty. Therefore, it cannot be definitively concluded that growth tends to benefit the poor. In fact, growth has occasionally been accompanied by a deterioration in quality of life for segments of the population and consequently by an increase in poverty.

It is well established in the literature that productivity gains are a necessary condition for sustained economic growth and development. The economies of developing countries suffer from structural heterogeneity and large productivity gaps between the different sectors of the economy as well as between companies of different sizes in each sector, which are much more pronounced than what is commonly seen in most developed countries. These wide productivity gaps in comparison with developed countries also translate into larger wage gaps since most jobs in the low-income sectors are provided by small and medium-sized enterprises (SMEs), which are typically the least productive. Lastly, this structural heterogeneity is one of the main sources of income inequality. Therefore, strengthening the competitiveness and enhancing the productivity of local SMEs is particularly important if these countries are to achieve the goal of poverty reduction.

In the case of developing countries, which generally lack the resources to innovate, one of the most important channels for acquiring new knowledge and enhancing productivity is participation in international trade. The capacity of firms to participate in global markets, increasing the value added of their export products and services while ensuring linkages between the export sectors and other sectors of the economy, is a key element of pro-poor growth.

### b) Prices of goods and services

One of the most direct links between the global market and the poorest sectors is the transmission of global prices to domestic consumers and producers. In any economy there are several steps of transmission between changes in (tariff-inclusive) border prices following external liberalization and price changes experienced by producers or consumers at local levels. The extent of transmission may be limited by a number of factors including transport costs and other costs of distribution; the extent of competition between traders and the functioning of markets more generally; and infrastructure, domestic taxes and regulations. Some of these costs, such as transport costs, are inevitable (though they may be increased by other factors such as fuel taxes or inadequate infrastructure); others represent direct economic inefficiency such as monopoly or monopsony power exercised by traders.

Border price transmission is likely to be particularly ineffective for poor people living in remote rural areas. In extreme cases, producers or consumers can be completely insulated from the changes taking place at the border, i.e. goods cease to be tradable. Even more important than price changes is whether markets exist at all: trade reform can both create and destroy markets. Adverse poverty shocks are often associated with the disappearance of a market, while strong poverty alleviation can arise when markets are created for previously untraded or unavailable goods. Lowering prices at the border will have little impact in these areas in the absence of specific public interventions to improve the dynamic of domestic markets.

### c) Wages

In addition to the impact on the prices that consumers must pay, trade liberalization has significant effects on the competitiveness and earnings of domestic firms, which affects wages, employment and ultimately poverty. For own-account workers, the main determinant of income is the price commanded by their output and inputs, but for employees commodity prices need to be translated into factor prices (wages) or previous employment opportunities. In all countries some of the poor, and in some countries most of the poor, rely on labour markets for the bulk of their income.

The Stolper-Samuelson theorem – in a simple Heckscher–Ohlin model of two countries, two goods and two factors (2x2x2) – predicts that an increase in the price of the good that is labour-

intensive will increase its production and thus increase the real wage in the sector that produces it. Therefore, if most of the poor are unskilled workers and a developing country is abundant in unskilled labour, trade liberalization will have the effect of pushing up wages, and poverty should fall.

Unfortunately, the Stolper-Samuelson theorem is much less effective in the multi-commodity, multi-country and multi-factor models that more accurately reflect the real world. A poor country in a world with many factors and many goods might cease to have a comparative advantage in the production of unskilled-labour-intensive goods. This idea is easy to understand in the context of three countries—e.g. the United States, Mexico and China. Although Mexico might have a comparative advantage in the production of unskilled-labour-intensive goods in its trade with the United States, its comparative advantage changes in relation to China. If most of the poor in Mexico are unskilled workers and the virtuous effects of deepening trade between Mexico and the United States accrue to semi-skilled workers, poverty would be unaffected and possibly worsened.

It should also be taken into consideration that empirical studies show that, in the real world, labour markets are not flexible and labour is not as mobile as assumed in the Heckscher-Ohlin trade model. In order for unskilled workers to use their comparative advantage to increase their income, they must move from shrinking to expanding sectors. Thus, in the presence of rigid labour markets, any reduction in the level of protection provided to a specific sector in a third country will lead to a drop in the income of workers who were producing goods for that sector, since they are unable to move into other sectors.

Another reason why the poor have often failed to benefit from trade reform is the protection that developing countries have historically provided for sectors that use unskilled labour, such as the textile and apparel sectors. This pattern of protection contradicts the assumptions of the Heckscher-Ohlin theory.

Trade reform can result in lower wages for unskilled workers, who are more likely to be poor. The fact that gains or losses for the poor stemming from trade reform depend crucially on labour mobility (or immobility) should be explicitly considered by policymakers, since case studies have shown that trade reforms have been associated with an increase in poverty in regions with significant labour rigidities. In order for trade reforms to benefit the poor, they need to be coupled with a reform of the labour market and all labour market institutions that could undermine labour mobility.

Unlike in most developed countries, in Latin American countries most jobs—especially among the poorest strata of the population—are concentrated in SMEs. In general, these enterprises do not have the resources needed to invest in innovation and they are also the least productive. Accordingly, strengthening the competitiveness and enhancing the productivity of SMEs are particularly crucial steps if these countries are to achieve the goal of poverty reduction.

In addition, firms often participate in local clusters, as well as in global value chains, and both forms of organization offer opportunities for enhancing competitiveness through ongoing learning and advanced training. However, the extent to which this trend effectively promotes development and helps reduce poverty remains unclear. Some see benefits such as the generation of income and jobs, but others highlight the elevated risk and vulnerability for the poorest workers and producers. The capacity of the firms to participate in the global market by increasing the value added of their products is therefore a key element for guaranteeing pro-poor growth, based on decent work and respect for labour standards.

Trade facilitation and support programmes also play a key role in integrating SMEs into the global marketplace, by developing marketing channels, increasing productivity, promoting networking and cooperation and improving infrastructure and access to information in the countries, while minimizing vulnerability to risks associated with trade. This requires an analysis of good practices in diverse countries where SMEs have joined export chains, where training activities have been successful in improving job quality and raising income and where networking and cooperation between SMEs has helped to move the agenda forward.

### d) Government revenue and spending

A key concern about trade liberalization is that it will reduce government revenue. The share of trade taxes in total revenue is negatively associated with the level of economic development, with many low-income countries earning half or more of their revenue from trade taxes. However, neither theory nor evidence suggests a simple link between trade reform and revenues. Designing revenue-neutral packages is complex and liable to error; and, eventually, as tariffs approach zero, so too must revenue. The first response to the drop in tariff revenue is to seek alternative non-trade sources of revenue. Clearly the impact of replacement taxes upon the poor depends on the choice of fiscal instrument, and in general there is no economic reason why the burden should fall on the poorest. The alternative response to a fall in revenue is to cut public expenditure, which could impact the poor through social spending cuts in particular. However, even recognizing the administrative constraints faced by poor-country governments, it is ultimately a political decision whether the new taxes necessary to make up the shortfall, or the cuts in government expenditure that result from falling revenue, impinge heavily on the poor.

To inform this decision, a clear understanding is needed of the relationship between trade policy and its impact on the poorest people. Tariff reductions have different effects depending on the products subject to the reductions, the consumer profile and the employment opportunities for the poorest sectors. Having a clear understanding of this effect will help governments make the best decisions about possible tariff reductions, spending cuts and specific social policy adjustments.

## B. The role of complementary policies

As the preceding discussion makes clear, the relationship between trade and poverty is very complex and the results defy generalization. However, what is certain is that globalization produces winners and losers among the poor. In a single country or even a single region, two groups can be affected in opposite ways, and trade reform can lead to income losses for rural agricultural producers while benefiting the rural and urban consumers of those goods. In the various countries, poor wage earners in the export sectors or sectors with foreign investment flows benefit from trade reform, while in general poverty rates rise in formerly protected sectors that are exposed to competition from imports. The fact that there are losers among the poor as a result of trade liberalization demonstrates that careful selection is needed in the design of policies to support poor people who are adversely affected by globalization.

In addition, the empirical research shows how the impacts of trade on poverty are crucially determined not only by trade openness per se but also by the interplay between trade and the larger environment. The poor are much more likely to be able to participate in the benefits of globalization when complementary policies are in place. Key complementary policies include investment in human capital and infrastructure, as well as macroeconomic stability and policies that promote access to credit and technical assistance for farmers to invest in technological improvements. The fact that other policies are needed to guarantee that the benefits of trade are shared among the entire population suggests that relying on trade reform alone to reduce poverty could be very misguided.

# C. Summary of the main conclusions of the studies presented in this book

## 1. Trade integration with the European Union and the impact on poverty in Ecuador

The Ecuador study, through the use of computable general equilibrium (CGE) techniques and microsimulations, evaluates the possible macroeconomic and social effects of a trade liberalization agreement between Ecuador and the European Union. The study concluded that opening the European Union to trade with Ecuador would boost exports and imports, although the increases would be very modest inasmuch as most of Ecuador's exports to the European Union already benefit from special tariff preferences under the enhanced Generalized System of Preferences (GSP plus). Basically, the main benefit for Ecuador would be the continuation of the GSP plus scheme into the future, which would generate greater certainty for the export sector.

In terms of the impact of full trade liberalization on income distribution and poverty, it must first be stated that under the most plausible assumption, which is unemployment, real wages would rise in the unskilled labour segment, but this would be accompanied by falling employment levels among unskilled workers in urban areas. By contrast, real wages would rise for skilled and unskilled workers alike in the rural sector. The decision not to include bananas in the negotiations makes the difference, as this will lead to higher wage and employment gains for all segments of the labour force.

This impact on poverty reduction can be explained by the increase in jobs for rural unskilled wage workers and by the rise in the real wages of urban and rural unskilled wage workers. This is a highly consequential outcome, especially because jobs for rural unskilled wage work account for around 15% of total employment. These workers come from the poorest households in the country.

The simulations conducted using the CGE model and the microsimulation approach produced declines in poverty and indigence of 4% and 9%, respectively. These large reductions in indigence ($ 1 per day) and poverty ($ 2 per day) were produced under the scenario of full liberalization. Under the scenario of partial liberalization (just 50%), poverty and indigence rates rose, albeit slightly, with a very slight drop in indigence in rural areas. It is more advantageous in terms of trade when bananas are added.

When liberalization is expanded to give bananas preferential access to the European Union market, that sector profits but at the expense of diverting resources away from other agricultural sectors. This is especially important because the output of other sectors, such as the floriculture sector, is observed to fall. Paradoxically, this clearly illustrates the need for alternative policies for investment in the other agricultural sectors.

The targeting of trade benefits in a specific region, i.e. the banana-growing region, presents a major policy challenge, since the largest pockets of poverty in Ecuador are found in the rural highland areas and in the northern coastal region of the country. These areas would not be directly benefited by liberalization of the market for bananas, which are primarily grown in Ecuador's central coastal region (Guaya, Los Ríos and El Oro), where rural poverty rates are lower,[1] although there are very poor small producers with scarce access to credit, unreliable irrigation systems and little opportunity to apply effective sanitary and phytosanitary measures.

Another important conclusion has to do with the fact that the poverty-reducing impacts of free trade can be adversely affected if the sector diverts resources away from others (sectors located in regions with higher concentrations of poverty and/or sectors that create jobs for labour-intensive

[1] Wong (2007; 2010) explains in detail how of a total of 6,000 banana producers, 71% are small producers with less than 20 hectares; 26% are medium-sized producers with between 20 and 100 hectares; and 3% are large producers (more than 100 hectares). Of total banana production, small growers produce 23% (with 24% of the total land under cultivation) and larger growers produce 38% (with 30% of the total land under cultivation).

processes). The case of the banana industry in Ecuador provides a good illustration of this effect, given that although exports are rising, poverty levels are moving in an unexpected direction, with good results concentrated only in a small geographical area consisting of three provinces and in a small percentage of households that represent just over 4,200 producers, or less than 2% of total rural households in Ecuador.

## 2. Policy alternatives and strategies for the Plurinational State of Bolivia following the end of tariff preferences under the Andean Trade Promotion and Drug Eradication Act: Evaluation of a trade agreement with the European Union

Through the use of CGE techniques and microsimulations, the authors attempt to answer a number of questions: What trade reforms and policy flexibility are needed in the Plurinational State of Bolivia to improve the performance of the national economy? How do different liberalization scenarios affect the main macroeconomic indicators? How would the economic well-being of the different household groups in the Plurinational State of Bolivia be affected? The main conclusions of this study include the following:

Joining an agreement between the Andean Community and the European Union is a better alternative for maintaining the status quo of access to generalized preferences (GSP plus). The Plurinational State of Bolivia's efforts to enter into a trade agreement with the European Union would be beneficial. However, complementary measures must be introduced to ensure that the benefits of international trade are more inclusive.

Moreover, the termination of preferences under the Andean Trade Promotion and Drug Eradication Act of the United States was a negative outcome both from a macro and a micro standpoint. The negative results, in the authors' opinion, indicate that a policy of protectionism and termination of trade relations should be avoided if economic growth and greater social well-being are to be achieved.

The various outcomes that would be expected if the Plurinational State of Bolivia were to sign a free trade agreement between the countries of the Andean Community and the European Union include an increase in total exports on the order of 3.1% to 3.6% depending on whether bilateral trade between the regions is partially or fully liberalized. By contrast, if the Plurinational State of Bolivia did not sign the agreement, it would not reap the trade creation benefits. At the sector level, the highest growth would take place in labour-intensive sectors.

The study concludes by estimating the private utility derived from the agreement with the European Union. The findings indicate that trade liberalization with the European Union would generally improve well-being as measured by private utility. However, the trade-driven increase in utility is smallest among the poorest sextile of the population. Conversely, if the Plurinational State of Bolivia does not sign the agreement with the European Union, net losses in private utility are expected. As a result of these findings, the authors recommend the adoption of complementary policies for the poorest income groups if the Plurinational State of Bolivia decides to participate in a trade agreement with the European Union.

## 3. Increased ethanol demand and poverty in Brazil

Through the combined use of a CGE methodology and a microsimulation methodology, with data from various sources in Brazil, an evaluation was conducted of the social effects that the projected increase in domestic and global ethanol demand would have on the Brazilian economy. In particular, the effects on labour demand in the agricultural sectors, as well as in the economy as a whole, were considered. The impact on income distribution and poverty at the national and subregional level was also analysed.

Model results show that the expansion in ethanol demand in Brazil would slightly reduce poverty, although it would increase the poverty gap. Income distribution improves very little. The main reason is that, unlike in the past, the projected expansion of the sugar-cane complex has a new technological basis, which relies heavily on mechanization of agricultural activities. This raises several points for policy considerations.

The first is related to the pattern of expansion of labour demand. Based on the regional findings, the job expansion would primarily occur in São Paulo and in the central-western region, and among middle-wage earners, with job losses occurring among the less skilled in many states in the north-eastern region of the country. The loss of unskilled jobs in São Paulo and the resulting adverse effects on income and poverty warrant efforts to train the labour force that will be displaced so these workers can be absorbed by other sectors of the economy.

Second, the results suggest that the food versus energy dilemma, at the heart of recent discussions about ethanol production expansion, is not really a serious problem in Brazil. Actually, there is no factual basis for the prognostications of catastrophe that became popular during the surge in international food prices observed in 2008. Even though food prices are climbing due to the decrease in land available for food production, the increase is small and could easily be counteracted by small productivity increases in food production.

The food price increase would actually raise the cost of the consumption bundles of the poorest, but this increase would be more than offset by the increase in incomes, generating a net positive effect, as the model results suggest. However, even though the ethanol demand expansion is shown here to be poverty-friendly in aggregate, it is only by a small amount. The distributional side effects are positive, but not striking. The main benefits associated with Brazil's ethanol expansion are related to diversification of the energy matrix and to reductions of greenhouse gases emissions.

The most serious imbalances associated with the increase in ethanol demand will likely be related to the regional redistribution of economic activity inside Brazil. The south-eastern and central-western regions, as well as the sugar-cane-producing states in the north-east, are the biggest winners, while the non-sugar-cane-producing states in the north-east and Rio de Janeiro in the south-east are poised, for different reasons, to lose the most. This redistribution and the potential negative effects on regional equity are the main topic that warrants the attention of policymakers in Brazil regarding the expansion of the sugar-cane complex.

## 4. Agricultural incentives, growth and poverty in Latin America and the Caribbean

This study focuses on the relationship between agricultural trade liberalization and the performance of the farm sector in order to elucidate some impacts on poverty. It places emphasis on Latin America during the period 1960-2005, using a recently constructed database of nominal rates of assistance (NRA) and relative rates of assistance (RRA) for the agricultural sector that includes information on a number of developing countries around the world. The main question addressed by the study is: does the trade regime influence sectoral growth? Based on the answer to this question, inferences are made regarding the influence that the growth of the sector has on poverty, using estimates of the impact of agricultural growth on national economic growth, which in turn has an impact on the income of the poorest quintile.

The empirical examination takes advantage of cross-country panel data from several sources, covering many developing countries in Africa, Asia and Latin America and the Caribbean. The Latin American and Caribbean countries that are considered are Argentina, Brazil, Chile, Colombia, the Dominican Republic, Ecuador, Mexico and Nicaragua. A comparison is made of groups of countries, classified by their levels of protection and the variations in those levels (using both NRA and RRA figures) to evaluate the effects of the trade regime on the growth of value added and agricultural production (based on agricultural production indices of the Food and Agriculture Organization of the United Nations (FAO)).

The study's main general conclusions include the following: (a) changes in the trade regime are more important than absolute levels of protection per se; and (b) eliminating protection (trade taxes in the 1970s and 1980s) would have led to approximately 50% higher average growth in agricultural GDP than the growth trend (at least over a five-year horizon).

In terms of the link between trade and poverty, the study evaluates the impact of reducing high levels of protection (negative or stable NRA) to neutral levels (zero NRA). The conclusion is that the average annual growth rate of a representative country would have increased by approximately one quarter of a percentage point, or around 9% above its average rate. The authors found that if the country had eliminated the implicit tax, annual agricultural growth would have increased from 2% to 2.95% in the following five-year period. The impact of agricultural growth on poverty in Latin America and the Caribbean would have also been sizeable. Reducing protection levels would have boosted the income of the poorest quintile by one quarter of a percentage point.

Lastly, the study discusses the implications for a future policy agenda, especially in light of the large number of countries in Latin America and the Caribbean that still have high levels of intervention, both positive for importables and negative for exportables, although indicators of average protection levels in the agricultural sector are relatively low.

## 5. Human capital formation and the linkage between trade and poverty: The cases of Costa Rica and Nicaragua

Through a combination of various methodologies—CGE, microsimulation techniques and the calibration of a human capital accumulation model—an analytical framework was developed to evaluate the impacts for Costa Rica and Nicaragua derived from trade policy changes made between 2004 and 2011 and the possible effects of implementing human capital accumulation measures to expand the labour force through 2030. The study also attempts to establish the complementarity between trade policy and educational policy.

The following trade policy changes are considered: (a) implementation of the 2005 Agreement on Textiles and Clothing; (b) expansion of the European Union from 25 to 27 countries; (c) the Dominican Republic-Central America-United States Free Trade Agreement (DR-CAFTA); and (d) the entry into force of the Association Agreement between the Central American Common Market and the European Union.

The results of the trade policy simulations point to an increase in trade and output, albeit small, which is explained by the static nature of the model. However, when the effects of shocks from labour efficiency gains are simulated, higher growth rates occur. Accordingly, the assertion is made that the main driver of economic growth both in Costa Rica and Nicaragua would be the upgrading of human capital through educational policies. In a first stage, workers receive lower salaries, but when the initial opportunity costs are absorbed and the human capital accumulation process begins, wages begin to grow steadily against the baseline. The long-term impact continues beyond 2030—the final year of the simulation—so poverty reduction can also be expected to continue to decline over time.

Human capital policies also have a greater impact than trade agreements on poverty. Thus, the poverty reductions estimated in the integrated scenarios (with both policies implemented together) are primarily the result of human capital accumulation in both countries. This is largely due to wage increases for unskilled workers. The wages of skilled workers as well as the price of other factors also climb but are less important for low-income families.

Finally, poverty and other macroeconomic variables do present positive but relatively small complementarity effects when both trade and educational policies are implemented jointly. The exception is the strong complementarity that occurs in Costa Rica in the case of wages of skilled workers, where educational policies completely offset the negative impact caused by the trade shocks. In a framework that assumes dynamic effects on growth, different results and greater complementarity between trade and poverty in particular would be expected.

The analysis yields two main policy recommendations. First, the study shows that human capital accumulation is crucial for growth and poverty reduction. Therefore, improvements in education should be part of an integrated approach for development policy design. Human capital investments, moreover, should be a policy priority, regardless of interactions with other public policies.

The study findings indicate that human capital investment is fundamental for taking advantage of the benefits of international trade. Costa Rica and Nicaragua will profit considerably from the trade agreements, but these benefits can be multiplied if the quality of education is improved.

## 6. Skill formation in Uruguay: What job skills are required for development?

Using the CGE country model methodology, the links between workforce skills, trade in services and patterns of income distribution and growth were studied in the specific context of the Uruguayan economy. The study is based on the understanding that trade in services has seen the most robust growth worldwide, with nearly twice the average growth rate of the goods and manufacturing sectors. The three sectors have completely different compositions in terms of type of work, with the services sector being the most skills-intensive.

In Uruguay, human capital formation has several weaknesses, which begs the following questions: Is Uruguay prepared to take advantage of the opportunities arising in the global market? If not, what will the consequences be? In order to analyse this possibility, policy simulation exercises were conducted that consisted in an increase in external demand for skills-intensive services, in line with the global trend of growth in trade in services, as well as greater participation by Uruguay in those trade flows.

For simulation of the different counterfactual scenarios of growth in the supply of labour by various skill groups, the following assumptions were made alternately: (a) improvements in higher education, in which case the supply of skilled labour is assumed to increase by 21% over a 20-year horizon; and (b) improvements in basic education, in which case the supply of semi-skilled labour is assumed to grow by 21% over 20 years. These scenarios were compared against a neutral scenario in which no policies are introduced and the supply of labour grows uniformly (10%).

The results of the simulations show that in a scenario in which the performance of the educational system does not improve, rising external demand for services would increase the wage gap between skill groups in the labour force. Accordingly, policies to promote the development of human capital and upgrade skill levels will contribute to better matching of supply and demand for skills, paving the way for growth sectors to expand and reducing inequality.

## 7. Family agriculture, direct sales, trade and poverty: The case of small fruit growers in Caazapá, Paraguay

In 2009, a survey was conducted of a group of small producers who are part of a cooperative (Capi'ibary) that has established a relationship with an export firm (Frutika) to directly sell passion fruit and other fruits. The cooperative and the export firm are located in one of Paraguay's poorest regions, where the overall poverty rate is 41.8% and the rural poverty rate in 46.3%. The specific purpose of the study was to evaluate the impact of the linkage between the small growers and Frutika. The study findings were controlled against a group of family farmers in the cooperative who did not sell to Frutika.

The most convincing finding yielded by the research into this group of small producers (linked and unlinked) is that 70% of them were living below the poverty line at the time of the survey (2009), with a larger number of poor families concentrated among the producers who were not linked to the Frutika chain. The fact that there were fewer poor families among the producers linked to Frutika may point to the favourable effects of having initiated fruit cultivation at an early point in time, and thus of the income earned from that production. However, the phenomenon could also be

interpreted to indicate that the cooperative may have selected producers for the fruit supply chain whose families were in a better economic position.

The findings on the factors that explain the different levels of poverty and the effects of value-chain participation on income indicate that participation in the value chain goes a long way towards explaining why the gap is smaller and the severity of poverty is less among the linked producers than the unlinked producers. Poverty levels fall by much larger margins in the group of producers participating in the supply chain than in the non-participating group.

Although participation in the supply chain improves the relative position of the linked growers, it is not sufficient on its own for poor families, which includes a percentage of these producers, to rise above the poverty line or, otherwise said, to escape from poverty. This is only possible if, in addition, one or more members of the family are employed as an agricultural or non-agricultural wage earner.

Another interesting conclusion is that there are indirect effects on rural growth that are generated by income earned from participation in the fruit supply chain. These effects are produced by greater spending on agricultural and non-agricultural labour in the community in the study. Although this type of expenditure is observed for both types of producers (linked and unlinked), the level of spending is higher among producers in the chain.

Among the factors driving the success of this public-private project, none are originating in the public sector, despite the project's explicit focus on strengthening public institutions and despite the relationship between these institutions and the private actors, such as Frutika and the cooperative. Both the Ministry of Agriculture and the local government have been scarcely more than mere spectators in this process. Moreover, in areas where the Ministry of Agriculture has had a direct presence through its agricultural extension service (in the case of oranges), without the involvement of a cooperative, the supply chains did not prosper as they did in the case of the passion fruit and grapefruit growers.

# 8. Poverty and income distribution in Latin America: On the complementarities between trade policy and social public spending

This chapter presents an econometric study of the relationship between poverty and income distribution in Latin America. The study focuses on establishing the degree of complementarity between trade policy and social public spending. Using data on social public spending (education, health, housing, social protection and transfers), non-social spending (defence, economic affairs and current spending), per capita income and the stock of social and non-social capital for eight countries (Chile, Colombia, Ecuador, Guatemala, Honduras, Nicaragua, Panama and Venezuela (Bolivarian Republic of)), the study evaluates the hypothesis that government-provided social or human capital stocks tend to make the benefits of trade liberalization larger and better distributed across households, especially among the poorest. This is the first analysis to consider the interdependencies between the poverty and distributional effects of trade liberalization and public spending policies simultaneously.

The findings effectively corroborate this hypothesis, in the sense that social spending is complementary with trade policy. The benefits of trade openness, especially for the low-income and middle-class household groups, greatly depend on the size of the government-provided social capital. However, non-social capital spending tends to benefit richer groups more than middle-income and poor households. These findings were not entirely promising. Conversely, the benefits of social capital for the poor depend to a large extent on the degree of openness of the trade regime. Social capital has a much smaller effect on household incomes when trade is restricted and may even have a deleterious effect if trade is sufficiently restricted. Efforts to promote trade have lower positive effects for households if the per capita social capital is low.

With respect to non-social spending, the study finds a lack of complementarity with trade policy, given that this type of spending benefits only the richer segments of society, to the detriment of the poor.

Middle-income households can only benefit from non-social capital if the trade regime is highly restricted. Thus, trade and non-social capital are not complementary policies. One reason why non-social capital primarily benefits rich households may be that the non-social component of government-supplied capital stocks tend to be directed to the rich via subsidies and other types of expenditures that are greatly motivated by rent-seeking activities based on political contacts and campaign contributions, which in Latin America are often the privilege of the richest segments of society.

As for policy implications, the study concludes that trade liberalization should be accompanied by a progressive reallocation of government spending from non-social to social goods, so that the stock of social capital is allowed to grow faster and non-social capital at a slower pace. This would have direct net positive welfare effects on middle-income and poor households and would greatly enhance the benefits of trade liberalization for the vast majority of the households. At the same time, increasing trade liberalization would magnify the beneficial effects of shifting the structure of government-provided capital from non-social to social capital. Finally, the analysis suggests that trade reform should be implemented gradually to give time to allow the fiscal spending reallocation to manifest itself into changes in capital stocks.

## 9. Analysis of trade openness on household well-being: An application in the case of Chile

This study proposes a methodology consisting of an ex post analysis of the well-being effects that derive from the adoption of liberalization policies by a country. In practice, it is a quantitative assessment of trade policy measures and their actual impact on poverty and income distribution, based on data from household surveys, family budgets and the evolution of tariffs in a given period. The methodology integrates and makes several data sets compatible so the changes that have already taken place in trade policy can be evaluated.

The proposed methodology was used to analyse the well-being of households in Chile, a country in the region that pursued a very active trade policy in the last decade of the twentieth century and the first decade of this century (2000-2009). Using various econometric techniques, a set of parameters and elasticities was estimated in order to calculate the compensatory variation for the direct and indirect effects associated with trade openness between 1999 and 2006, a period in which Chile signed myriad free trade agreements, the agreements with the United States and the European Union being the most representative.

From a public policy standpoint, the findings present sufficient evidence to assert that in the case of Chile, liberalization took the right form, generating immediate gains in well-being in the Santiago Metropolitan Region. The size of the effect that was calculated is small, but it should be taken into account that it deals with the very immediate term and does not consider changes in the consumption bundle. Households saw their consumption and income possibilities rise by about 0.18% of their total base income, determined by their preferences in the 2007 family expenditure survey. In addition, the results by groups of products were higher in the case of food and household appliances.

The results of the simulated exercises using the family expenditure survey determined that the total effect (sum of direct and indirect effects) for the period of study (1999-2006) was pro-poor inasmuch as the lowest deciles received greater benefits than the highest deciles. Breaking down the effects by income quintiles, the poorer quintiles/deciles of the population were found to have received greater relative gains than higher income groups. On average, they received 0.4% more of total income than the richest quintile of the population and over 5% more if the total calculated effect is considered.

The price effects of changes in trade policy during the period are positive, although small in magnitude in the case of Chile. The results were similar to those produced in other studies for Chile, in which the total effect resulting from changes in late-1990s trade policy was close to 1%. This included the effect on employment income, a factor that was not considered in this study. The empirical literature identifies labour markets as a major channel of transmission of the benefits of trade, and the findings presented here confirm this view.

The results in general demonstrate that the transmission of changes in trade policy has an effect on the poorest and that policies can be created that take into account this relationship. This bias has to do partly with the composition of the consumption bundle at each income level, which provides an opportunity for liberalizing trade in a way that is even more biased in favour of the poorest. For example, sharper reductions in tariffs on food products would produce an even stronger pro-poor effect.

The potential of trade liberalization to improve income distribution and reduce poverty depends on its differentiated impact. Food products account for three times more of the consumption bundle of the lowest quintile than the highest quintile, but tariffs in this category changed less between 1999 and 2007 than in most other categories (although the price transfer ratio is not high for these products).

Another conclusion of no less importance is that there is room for complementary competition policies that have the effect of transmitting lower tariffs to prices. The fact that the results are small is largely due to the low level of transmission of trade liberalization to domestic prices. Policy simulations show that, assuming full price transfer, the well-being gains would have been close to 1.3% instead of 0.2%. The study highlights the fact that transfer policies associated with measures to stimulate competition in the local markets would have significant multiplier effects on the relative improvement of income among the poor, with a much stronger impact in terms of reducing levels of inequality.

## D. Policy recommendations

At the regional level, trade policy must be carefully designed because it cannot be decoupled from a country's development strategy. The impacts derived from a potential trade agreement indicate that the productive and export sectors' ability to take advantage of it cannot be achieved on the basis of liberalization alone, but rather in conjunction with a set of complementary public policies. These include: (a) investment in infrastructure to better integrate markets, making it easier for producers to take advantage of the windows of opportunity that can arise as a result of agreements with new trade partners; (b) the promotion of sectors with future promise; (c) the inclusion of policies to mitigate undesired impacts through allowances, transfers etc.; (d) the development of institutions involved in trade promotion; (e) the promotion of selective studies on different trade policy alternatives; and (f) the development of public-private programmes. The following is a summary of some of the findings of the studies that address the multiple dimensions of public policies in the area of trade, growth and poverty.

The studies conducted by Wong and Kulmer (2010) and Tellería, Ludeña and Fernández (2010) clearly illustrate the various economic policy alternatives that Ecuador and the Plurinational State of Bolivia could adopt in anticipation of a potential deepening of trade relations with the countries of the European Union. In both cases, the inclusion of sensitive products for the countries (farm products) leads to greater trade gains (measured by the increase in exports). In the case of the Plurinational State of Bolivia, declining to join the agreement between the Andean Community and the European Union diminishes the prospects of obtaining those benefits and could eventually lead to trade diversion situations that would translate into loss of growth in trade with neighbouring countries, especially Peru and Colombia. If trade with the European Union is liberalized, in both cases the results of the microsimulations that were conducted indicate that undesired effects could be expected for rural households, as they would not fully benefit from liberalization.

A decrease in protection levels (understood as fewer taxes on agriculture) would be associated with higher growth prospects in rural sectors, and an increase in growth in agricultural areas would help reduce poverty. The study by Foster and Valdés (2010), which simulated the ex post effects of lowering protection levels and the resulting impact on growth and poverty, found evidence that a reduction in agricultural taxes would bring about income gains for households in the poorest quintiles. As taxes fall and agricultural GDP rises, income levels climb among the poorest segment of the population. This does not, however, mean that growth will automatically reduce inequality. For that, additional policies are needed to help the poorest sectors gain better access to the benefits of trade.

Along the lines of promoting projects and programmes that support particularly vulnerable sectors, public programmes and proposals or public-private partnerships should be pursued that support the formation of agribusiness value chains, especially those that are focused on the external market, in recognition of the fact that this strategy can drive the creation of new sources of competitiveness. The case study by Masi and others (2010) of small fruit growers in Caazapá, Paraguay, points up the practical importance of taking proper advantage of a value chain in which small rural producers can participate, enabling them to orient their production to the global market. Small producers raise their income levels when they are linked to export activities. In fact, belonging to the fruit supply chain (Frutika) was an important factor in reducing poverty levels. The case study also showed that indirect effects resulted from greater spending by the linked producers, in particular to hire labour for farm work.

Durán, Finot and LaFleur (2010) found that the direct effects of liberalization via free trade agreements are positive, although quite small, and have a clear pro-poor bias. They show that income redistribution policies in favour of the poorest segments of the population raise income levels among the lowest quintiles, thus improving income distribution. If, in addition, competition in the domestic markets were increased (improving the regulatory framework to correct distortions), expanding the price transmission channel with effective policies for regulating competition, price gains could be greater.

The specific policy recommendations that can be made based on the studies presented in this analysis and which, in our opinion, should be implemented in the region are as follows:

- An alternative menu of trade policies designed to meet the countries' export development needs should be developed, addressing first the problem of access to new markets, especially in sectors of strategic importance for national productive development, and in accordance with the natural comparative advantages specific to each country, precisely because it is in these sectors where the link with job creation is produced. This is the case with agribusiness in Paraguay (see Masi and others, 2010) and with professional services (Terra and Patrón, 2010).

- As part of this design process, prospective studies on the potential benefits and losses resulting from the establishment of trade relations with third countries should be included, in order to set the country's foreign agenda. It would be useful to conduct, among others, prospective studies on trade liberalization with the European Union, as well as with developing countries in Asia, especially China, India and member countries of the Association of Southeast Asian Nations (ASEAN). Selective unilateral tariff reductions in sectors of interest should also be considered.

- Institutional performance within the public sector should be enhanced, especially as concerns those institutions involved in the process of building competitiveness. Export and foreign direct investment promotion agencies, research institutes, sector ministries etc. It is very unlikely that value chains that incorporate family farms will be created on a large scale without the active participation of public institutions, for example.

- Explicit efforts should be made to promote public-private partnerships with the inclusion of interested third parties, especially producers and groups of individual donors. The case study in Caazapá, Paraguay, illustrates this type of policy, in which the local private sector (Frutika) and small farmers in the Capi'ibary Cooperative took advantage, first, of the public-private programme promoted by the German Agency for Technical Cooperation (GTZ) and subsequently of the support provided by the non-governmental organization Action against Hunger (ACF). The same study revealed problems related to the failure of public agencies to sufficiently weigh priorities.

- Incentives should be increased for building capacity in organizations that link together small farmers or vulnerable groups with export potential. The study by Masi and others (2010) suggests that the way in which farmers organize is a key variable in determining

whether they have the capacity to carry out the investments and cooperation needed to form an export chain. Because pro-poor trade depends on the direct participation of small farmers as suppliers in a global value chain, capturing trade gains (in countries like Paraguay) requires a major investment in the types of organizations that bring together small farmers, so the organizations can effectively represent the farmers' interests and acquire the capacity to forge production-based partnerships with agricultural export firms and the government.

- The State should become more involved in supporting, guiding and forming production chains, not as a direct actor, but rather as a coordinator of government programmes for inclusive economic growth, i.e. growth coupled with job creation and poverty reduction. It should also establish guidelines for the formation of these chains and corresponding incentives based on the development priorities, in order to facilitate and steer private investment towards the sectors and regions with the greatest potential for success.

- Elimination of trade distortions. The findings of the study by Foster and Valdés (2010) send a message to those countries that have not yet changed their distortionary trade policies. In all likelihood, these countries are making a major sacrifice in terms of poverty reduction, especially in rural areas. Concerning the objective of openness, there are still many pending items on the agenda. Making trade policy more neutral should translate into higher sector growth. Reducing protection levels on importables and the tax on exportables would boost the incentive to expand production of exports, since both compete for the same resources.

- The creation of more jobs and higher wages are conditions for generating new development opportunities, particularly for the poorest households. Accordingly, investment in education should be given priority in the design of policies. Although this is not the product of trade policy, trade policy could contribute to it, promoting openness in sectors where a greater comparative advantage obtains from employing higher-skilled workers.

- The complementarity of social spending should be strengthened, especially at the level of social capital spending as compared to non-social capital spending. López (2010) contends that social spending has a stronger pro-poor effect when the economy is more open than when international trade is more restricted.

- There are many challenges involved in fully exploiting the potential of trade agreements, and complementary policies are a central issue, particularly those that promote productivity growth. Education is one of the pillars of global competitiveness, on a par with infrastructure, macroeconomic stability and innovation, among other engines of growth. Schwab and Sala-i-Martin (2009) indicate that education in Costa Rica is a competitive advantage but major investment is needed for the country to attain the level of developed economies. In the case of Nicaragua, although the country has made progress in expanding primary education coverage, the quality of education in general and enrolment rates in secondary schools and universities constitute limits on growth. Trade policies can be expected to be less effective in these two countries until the state of education improves.

- It is recommended that consideration should be given to the possibility of phasing in trade policies gradually, concentrating the effects of liberalization on those sectors that most benefit people in low-income groups. However, emphasis is also placed on the need to properly weigh the opportunity cost associated with liberalization in sectors producing intermediate goods that are needed to improve the competitiveness of sectors in which there are comparative advantages for exports. In this case, combining this methodology with others such as computable partial or general equilibrium models is crucial, particularly with respect to analyses of trade policy.

- It is suggested that similar studies should be conducted for other countries that still maintain high levels of protection for some products in particular and have few free trade agreements in place but have implemented liberalization policies for capital goods and intermediate inputs, such as Ecuador and the Plurinational State of Bolivia. These studies could yield diverse findings. An analysis should be conducted in such cases in order to compare the specific examples of these types of protection structures, which are more akin to the differentiated levels of the protection structures within the Common Market of the South/Mercado Común del Sur (MERCOSUR) customs union or the Andean Community.
- It is recommended that ex post analysis methodologies that include price and wage effects should be used. Determining the overall effects during the short, medium and long terms will shed light on where the focus should be in terms of public policies that target specific segments of the most vulnerable population. The Durán, Finot and LaFleur (2010) study has broken ground in proposing lines of connection between trade policy and social policy, with the understanding that these two policy areas are more complementary than mutually substitutable.
- Increasing economic competition between the agents that control the domestic market is vital in order to prevent the benefits generated by trade from being lost or captured by just a few firms or economic groups. Policies to boost competitiveness in the domestic markets, along with initiatives to reduce transaction frictions in the commodity marketing chain, are also important for increasing the benefits of liberalization. Lowering transaction costs is an area that requires even more effort by the governments since costs result in a type of protection of domestic firms.
- It is suggested that direct transfer policies should be adopted in cases in which liberalization acts to the detriment of low-income sectors of the population. In Wong and Kulmer (2010) and Durán, Finot and LaFleur (2010), it is made clear that the direct effects of trade policy changes on social well-being could be greater if the right public intervention is taken to correct market failures.
- Lastly, governments have a central role to play in making the policy changes that the countries need to boost productivity, compete successfully and benefit from trade openness. One concern in this regard is the absence in a number of countries in the region of a comprehensive long-term development strategy, as noted in the findings of several of the studies presented here.

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# II. Poverty impacts of trade integration with the European Union: lessons for Ecuador

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## A. 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 most favored 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 star-ted in July 2007, with the Andean Community (Colombia, Peru, and the Plurinational State of Bolivia) negotiating as a block, but recent developments have led to each country holding bilateral negotiations with the EU. 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 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 (farm) 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 trade policies 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: i) free trade for all products; ii) free trade for all products and better access for bananas; and iii) preferential trade (50 percent tariff reduction).

The main results suggest that a trade agreement with the EU may have different a 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 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 may imply that increasing export and production of bananas can be achieved by pulling resources (namely labor) out from 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 B presents an overview of the Ecuadorian economy. Section C discusses relevant work on CGE modeling and micro-simulation models related to trade policies and poverty. Section D lays out the methodology and data. Section E summarizes the scenarios applied. Section F discusses the results and policy implications, and Section G presents concluding remarks.

## B. Overview of the Ecuadorian economy

The 1990s and 2000s push for trade openness by developed nations on developing countries raised concerns in developing countries about the consequences of trade liberalization on poverty. Ecuador is not a stranger to these swift trade policy changes as it also embarked upon important trade reforms aimed at opening up its economy to trade in the late 1980s and mid 1990s. Some of these reforms (which included a tariff reform, the simplification of import procedures, and the creation of institutions to promote exports) aimed at productivity gains (Comexi 2004). [2] However, there still remain sectors with high protection rates (nominal and effective). These sectors generally include agricultural sectors, where a sizeable fraction of the Ecuadorian poor is concentrated. Ecuador applies on average its highest tariffs to agricultural products especially for meat and meat products, diary products, and cereals.

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, the country's key export product. 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 of 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 mostly agricultural products to the EU, the majority of Ecuador's imports from the EU are manufacturing products. See Table II.1.

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 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). 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.

Although Ecuador receives zero tariff entry on almost all products under GSP+, Ecuador exports to the EU are concentrated in a few primary and low manufactured products, such as agricultural and fish products. Thus, one of the objectives for Ecuador of a trade agreement with the EU is to make this zero-tariff entry permanent, and not subject to revision every period (as has been the case since the EU first implemented GSP for developing countries in 1971), and to extend preferences to those key Ecuadorian products that do not receive preferential treatment.

[2] The tariff reform in Ecuador reduced the average nominal tariff from 29 percent in 1989 to 11 percent in 1994 (see Tamayo, 1997).

**TABLE II.1**
**TRADE COMPOSITION WITH THE EUROPEAN UNION**

| Exports | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|
| Banana, coffee & cocoa [a] | 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 [b] | 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.
[a] 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%).
[b] Includes: textiles, wood, paper, mineral products and transport.

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 II.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.

[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.

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 house-hold 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%).

**TABLE II.2**
**ECUADOR: POVERTY INDICES (HEADCOUNT) AT THE BASE, 2005[a, b, c]**

| 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.
[a] Excludes households that do not show any data on income.
[b] 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.
[c] 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, as well as 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%). On the contrary, the agricultural revenue of the Amazon region comes mostly from export-oriented products which make up almost three-quarters of the agricultural revenue share (Wong and Kulmer, 2010).

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.

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 II.3).

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

[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.

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 II.3**
**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: 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— enter with varying degrees of importance into 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 II.4 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 house-holds in the lowest quintile of income go 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 II.4**
**EXPENDITURE SHARES BY TYPE OF HOUSEHOLD AND INCOME QUINTILE**

| 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 II.5). 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 II.5**
**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 II.6, 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 II.6**
**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.

## C. Methodology and data[6]

The method applied includes four main stages, and has a sequential approach, given that the macro and the micro modeling 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 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 modeling stages are:

(i) Linking, in a consistent way, the micro and the CGE models (See Section IV below). This study follows the consistency rules provided by Bourguignon, Robilliard and Robinson (2003), by which changes in 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.

(ii) 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

[6] This section relies on Wong and Arguello, forthcoming.

aggregate employment variables) that are used to communicate with the micro-simulation model. An overview of the CGE model is presented below.

(iii) Estimating the coefficients in the occupational choice and wages and earnings model.

(iv) 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 modeling 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 expenditures at the household level. The unit of study of the household survey is the household and its members. That is, besides household level data, the survey also contains data for variables at the individual level.

## 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).[7]

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.

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

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.

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).

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 (uwmi if wage-worker, and usmi if self-employed). The estimated coefficients and respective residuals will be used later in the micro simulation that connects the micro model with the results from the CGE model that simulates the changes in the labor conditions (in the scenarios that assume unemployment).

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.

**TABLE II.7**
**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.

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. Table

II.7 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.[8]

## 2. Overview of the CGE model

The Ecuador CGE model is a standard neoclassical static CGE model based on Lofgren et al 2002.[9]

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 services 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.

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 re-turn-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.

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

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

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.

## a) 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 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 house-holds, 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. 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 ad-just 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).[10]

Regarding the savings-investment closure, this study assumes that it is investment driven and balanced. In this closure, both nominal absorption shares of in-vestment and government consumption are fixed at base levels (flexible quantities). The residual share for household consumption is also

[10] "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.

fixed at base levels (flexible quantities). There is a uniform marginal propensity to save (MPS) point change for selected institutions.[11]

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 ad-just 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.

### b) 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:

(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, whet-her 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.

[11] 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 ma-de 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. 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.

(v) 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).

(vi) 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.

## D. Scenarios

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

(i) Tariff elimination with the EU.
(ii) Tariff elimination with the EU plus better access for Ecuadorian banana (15-20 percent increase in export price for bananas to the EU).

(iii) Preferential trade with the EU (50 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 II.8**
**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 elaborated 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 |

(continues)

Table II.8 (conclusion)

| SAM Sector | Product | Total tariff EU (%) |
|---|---|---|
| 20 | Paper and paper products | 6.87 |
| 21 | Chemicals, rubber and plastic | 6.68 |
| 22 | Metallic mineral products and non-metallic | 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.

# E. Results

## 1. CGE model results

Preliminary results 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, and meat and meat products as well as cereals. However, total imports increase modestly, as imports from the EU currently represent around 9 to 10 percent of total imports.

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 II.9). 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 II.9**
**PERCENTAGE CHANGES IN QUANTITY IMPORTS FROM THE EU**
*(By commodity)*

| | Base | Free Trade | | 50% tariff reduction | | Free trade and + banana access | |
|---|---|---|---|---|---|---|---|
| Description | Millions of US$ | 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 |

(continues)

Table II.9 (conclusion)

| Description | Base Millions of US$ | Free Trade | | 50% tariff reduction | | Free trade and + banana access | |
|---|---|---|---|---|---|---|---|
| | | Full employment | Unemployment | Full employment | Unemployment | Full employment | Unemployment |
| Meat, meat prods. and sub-prod. | 0.4 | 16.9 | 16.9 | 7.8 | 7.8 | 18.6 | 19.6 |
| Fish canned 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-metallic 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.

**TABLE II.10**
**PERCENTAGE CHANGES IN QUANTITY EXPORTS TO THE EU**
*(By commodity)*

| | | Free trade and + banana access | | | |
|---|---|---|---|---|---|
| | | Full employment | | Unemployment | |
| Description | Base Millions of US$ | 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 | | - | - | - | - |
| Fish canned 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 example). (See Table II.11). Lower quantity production brings in an increase in the consumer price index, unlike in the previous two trade agreement scenarios in which the CPI falls (Table II.12). The increase in the CPI will in turn have an impact on poverty, as we will see later on.

**TABLE II.11**
**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 |
| Fish canned 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 II.12 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 II.12**
**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 | - | - |

(continues)

Table II.12 (conclusion)

| | | Free Trade | | | | 50% tariff reduction | | | | Free trade and better banana access | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Nominal | | Real | | Nominal | | Real | | Nominal | | Real | |
| Variable | Labor market | 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 |
| 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.
[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 II.13). 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 II.13 shows the percentage changes in factor returns. Land and rural unskilled wages experience the highest increase in real terms in all scenarios.

**TABLE II.13**
**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 |

(continues)

Table II.13 (conclusion)

| Labor market | Factor type | Free Trade | | 50% tariff reduction | | Free trade and + banana access | |
|---|---|---|---|---|---|---|---|
| | | Nominal | Real | Nominal | Real | Nominal | Real |
| LABOR | | | | | | | |
| | 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 |

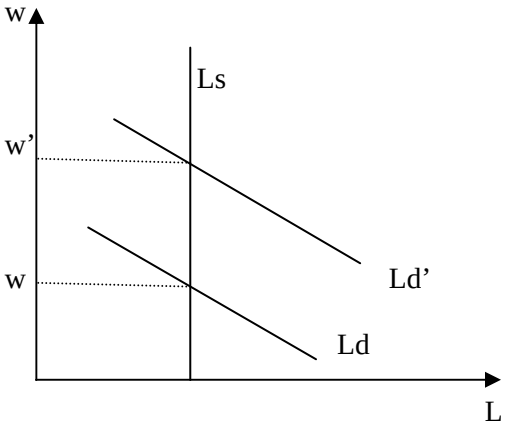
Source: Own calculations.
[1] For all the scenarios the closures include capital mobility, sector-specific land, and balanced investment point share adjustment.
[2] FE = full employment. UE = unemployment in unskilled wage workers.

The increase in returns to unskilled rural labor and land may not be surprising as neoclassical theory of trade predicts that the country will specialize in the production (and export) of products that use more intensively the factor abundant, and that this factor will experience an increase in returns. Most of Ecuadorian exports to the EU consist of agricultural products (See Table II.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 II.13). 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 mobility (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 II.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 II.1.

**FIGURE II.1**
**LABOR MARKET WITH FULL EMPLOYMENT ASSUMPTION**

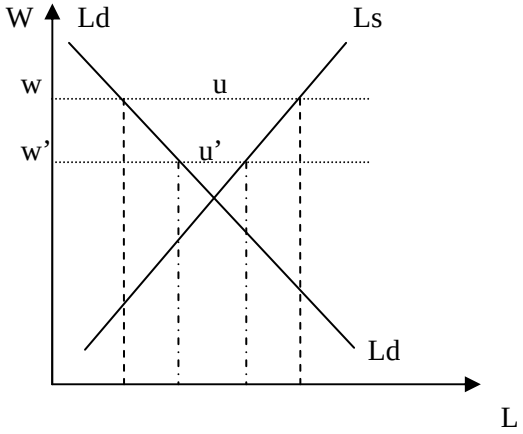



Source: Own calculations.

Similarly to the full employment scenario, under unemployment in the unskilled wage labor (urban and rural), both a 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 imply 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 II.14 and II.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 II.13 and II.14). See Figure II.2.

**FIGURE II.2**
**LABOR MARKET WITH UNEMPLOYMENT ASSUMPTION**




Source: Own calculations.

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 II.14**
**PERCENTAGE CHANGES IN EMPLOYMENT FOR UNSKILLED WAGE WORKERS**

| | Base | | Free Trade | | 50% tariff reduction | | Free trade and + banana access | |
|---|---|---|---|---|---|---|---|---|
| Labor type | Number 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.

## 2. 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 II.15). While there is a small decrease in indigence[12] in rural areas (0.11%), in urban areas indigence increases (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 specific-sector 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. Summarizing, 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 a small, 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 II.15). This reduction in poverty may be explained by the increase in employment that rural unskilled wage worker experience (Table II.14),

[12] 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.

the increase in real wages and earnings for the urban and rural workers and self-employed (Table II.13), 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 that 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 workers (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 II.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 II.15.

A trade agreement with the EU that implies only a 50 percent tariff reduction to imports from the EU, and again under the assumption of unemployment, shows modest —if any- poverty reduction effects. At the national level, indigence increases around 0.8percent, 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 per-cent 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 II.15).

**TABLE II.15**
**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% |
| 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.

To understand these results on poverty, it is important to recall the main income sources for the poor (see quintile 1 in Table II.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. 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.

## 3. 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 of 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).[13]

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).[14] 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, more easily met by big farms, 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

[13] See World Bank (2004) and Elbers at al (2002).
[14] See Wong (2007), and Baquero et al (2004).

higher export price of banana to the EU market,[15] 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.

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 can have a poverty reduction outcome to the extent that this trade opportunity creates more jobs (workers in the farms that can meet the EU standards) in these big and medium banana farms and in the indirect occupations that the banana sector generates. Small farmers could take advantage of the EU market to the extent that 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 most favored nations (MFN) (among which are 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 sets at 60 euro 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).

## F. 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 (that enter the EU market paying 176 euro per MT). The agreement is expected to have positive impacts in 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 characteristics of the Ecuadorian economy such as dollarization, capital restrictions (modeled as capital sector specific), 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.

[15] As mentioned in previous sections, the main export market for Ecuadorian bananas in the EU —and the one that usually pays 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.

The results show that impacts on Ecuadorian imports from the EU are significant, particularly in sectors that are currently the most protected (meat and meat products, cereals, beverages, textiles and apparel, wood and wood products, machinery and equipment). More so as Ecuador gets also better access to the EU market for its bananas (so 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 would consolidate its EU trade preferences. But, there would be loss in employment for the unskilled in urban areas. However, 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 II.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 poor households' expenditures (54 percent in rural areas, and 40 percent in urban areas; see Table II.9), and the main source of income for the poor are agricultural activities (33 percent of total income come from these activities in rural areas) and wages (42 percent of total in-come 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 be 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 from 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 share of the household's total consumption) but could not be included as part of the analysis for 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 non-tradable commodities (49 percent), see Table II.7, economic impacts of an FTA may vary by region (as well).

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, focused only on unskilled wage workers.

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# Annex 1

## Social Accounting Matrix (SAM) 2004

The 2004 SAM comprises 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 II.A1 below.

**TABLE II.A1**
**ECUADOR SAM 2004: BASIC STRUCTURE**
*(In millions of US dollars)*

| | | Products | Activities | Income Generation | Income Distribution | | Use of Income | | Capital | | Rest of the World | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Households | Governments | Households | Governments | Households | Governments | | |
| Products | | | 24 052.65 | | | | 21 959.90 | 3 716.27 | 6 213.62 | 1 418.79 | 8 984.94 | 66 346.16 |
| Activities | | 53 643.19 | | | | | | | | | | 53 643.19 |
| Income Generation | | | 29 590.54 | | | | | | | | 10.35 | 29 600.89 |
| Income Distribution | Households | | | 28 690.07 | | 1 465.99 | | | | | 1 935.85 | 32.091,91 |
| | Governments | 3 045.17 | | 900.32 | 3 420.45 | | | | | | 0.32 | 7.366,26 |
| Use of Income | Households | | | | 27 341.13 | | | | | | | 27.341,13 |
| | Governments | | | | | 5 264.67 | | | | | | 5.264,67 |
| Capital | Households | | | | | | 5 381.22 | | | | | 5.381,22 |
| | Governments | | | | | | | 1 548.40 | 431.37 | | 21.40 | 2.001,17 |
| Rest of the World | | 9 657.80 | | 10.50 | 1 330.33 | 635.61 | | | -1 263.76 | 582.38 | | 10 942.36 |
| Total | | 66 346.16 | 53 643.19 | 29 600.89 | 32 091.91 | 7 366.26 | 27 341.13 | 5 264.67 | 5 381.22 | 2 001.17 | 10 952.86 | |

Source: Central Bank of Ecuador.
Note: Rows represent income; columns represent expenditure.

# III. Policy alternatives and strategies for the Plurinational State of Bolivia following the end of trade preferences: evaluating an association agreement with the European Union

***Roberto Tellería***
***Carlos Ludeña***
***Soraya Fernández***

## A. Introduction

Discussions about the benefits of international free trade are not conclusive. Free trade supporters argue that exchanging goods and services is almost always to their mutual benefit (Krugman and Obstfeld, 2003). Open markets permit national resources to be employed more productively and allow sourcing non-local produced goods, giving consumers and producers a wider variety of products to choose from. Nonetheless, others perceive that free trade has not contributed to economic development, and in some cases has worsened inequality, unemployment and poverty particularly in the rural areas of developing countries (Berthelot, 2002). Jimenez et al. (2005) assert that economic gains from international trade do not guarantee in themselves gains for the poorer sectors of the economy, and that indeed more international exchange of goods might be accompanied by a rise in inequality. The 2001 *Zanzibar Declaration* reflects the concern of Least Developed Countries at their marginalization in the multilateral trading system as manifested in the insignificant 0.4 percent share of world trade (WTO, 2001).

Yet, countries around the world, developed and developing, have engaged in a trend of negotiating multilateral, regional and bilateral trade agreements. The WTO reports that at December 2008, there were up to 421 regional trade agreements that were notified. The Plurinational State of Bolivia has not avoided this trend, signing several trade agreements since the 1960s, though has not faced a hectic agenda in the last ten years. In fact, existing trade agreements for the Plurinational State of Bolivia are relatively old, such as the Andean Community (1969); Economic Complementation Agreement (ACE 22) with Chile (1994); Economic Complementation Agreement (ACE 31) with

Mexico (1994); inclusion into the WTO (1995); MERCOSUR as associated member (1996); and the Economic Complementation Agreement (ACE 47) with Cuba (1999). The latest agreement was the Bolivarian Alternative for Latin America and the Caribbean -ALBA in Spanish- (2006) that has been spearheaded by Venezuela.

In 2004 the Andean Community (CAN) tried, as a bloc, to negotiate a trade agreement with the United States. However, negotiations failed due to disagreements within the bloc and political frictions between the Plurinational State of Bolivia and Ecuador with the United States. Peru and Colombia individually signed trade agreements with the US in 2005 and 2006, respectively. The Plurinational State of Bolivia and Ecuador failed to reach any agreement, without any sign to restart negotiations for the time being. Furthermore, trade preferences that the United States grants to Andean countries called 'Andean Trade Promotion and Drug Eradication Act' (ATPDEA) was not renewed for the Plurinational State of Bolivia (expired in December 2008), though it was renewed for Ecuador until December 2010. For Colombia and Peru, these trade preferences were superseded by the more comprehensive FTA, which provides permanent duty-free status to a wider range of commodities from those two countries into the United States.

In September 2007, the Andean Community started joint negotiations with the European Union. However, the Plurinational State of Bolivia's differing views on property rights and tariff reduction schedules led to disagreements with other Andean countries. In spite of the Plurinational State of Bolivia's request to CAN members to negotiate with the EU as a group, Colombia, Ecuador and Peru expressed their preference for individual negotiations. Thus, in February 2009 these three countries started bilateral negotiations with the EU, while the Plurinational State of Bolivia has frozen any trade negotiation for the time being.

The main purpose of this study is to investigate the economic effects for the Bolivian economy that may emerge from the Plurinational State of Bolivia-EU related trade scenarios. This study assesses how convenient is for the Plurinational State of Bolivia to be taking part or be outside negotiations with the EU, and the subsequent preferential access implications for the Bolivian economy. At the current time, there is no economic assessment on how the economic wellbeing of the domestic population and macroeconomic indicators may change as a result of a the Plurinational State of Bolivia-EU trade agreement. Thus study will try to fill that void and provide with an assessment that can be used by policy makers in the Plurinational State of Bolivia to formulate trade and complementary policies.

This document is organised as follows: Section B describes the current trade situation of the Plurinational State of Bolivia, the objectives and research questions. Section C reviews the work that has been done in terms of EU- the Plurinational State of Bolivia trade agreements. Section D presents the methodology chosen to asses a prospective trade association agreement from a macro and micro viewpoints. This section also defines trade policy scenarios, criteria for grouping GTAP regions and commodity sectors, price transmission model and the micro-simulation approach used in this research. Section E discusses macro-simulation results. Section F presents micro-simulation results and corresponding discussion. Finally, Section G presents conclusions and recommendations emerging from this study. An expanded version of this work (Telleria, 2011) can be found in www.eclac.cl/comercio/comercio_pobreza

## B. Problem, objectives and research questions

After the end of trade preferences (ATPDEA) from the Unites States, the Plurinational State of Bolivia lost preferential access to the American market for some important products. The loss of these preferences to such large and important market would need to be filled by either new markets in other

regions such as Asia or the strengthening of existing ones. One of those markets where the Plurinational State of Bolivia already has commercial ties is the European Union.

The European Union could be an alternative market to replace the ATPDEA, given that the Plurinational State of Bolivia already exports to the EU (with no trade agreement involved) and because it is an attractive market niche for any country that looks for higher prices and a large consumer market (the EU is the second largest importer in the world; the first one is the US). Taking into account the potential of the EU as importer is that the Andean Community, as a group, started negotiations with the European Union in 2007. However, Andean countries have different trade policies and strategies on the implications that might emerge from that trade agreement. Given that group negotiations between the Andean Community and the EU stalled, Peru, Colombia and Ecuador reoriented their negotiation agendas toward bilateral trade agreements. Therefore it is reasonable to consider that a trade-off between having or not an agreement with the EU needs to be assessed.

Based on these developments, the Bolivian government will need to reconsider its trade policy if these policies are going to be used as economic tool to contribute improving the domestic welfare of the Bolivian people. Interests and expectations from the Bolivian production sector, policy makers, and civil society might emerge if the Plurinational State of Bolivia decides to initiate trade negotiations with the European Union. But also some concerns might emerge regarding EU's stronger export-related capacity compared to the Plurinational State of Bolivia.

There is no specific research has been carried out to estimate the economic implications that such a trade agreement would have for both the national economy and the economic wellbeing of Bolivian households. Such lack of research is an issue in terms of policy possibilities to provide estimations as to how the various economic sectors in the Plurinational State of Bolivia would be affected by the trade agreement. This lack of research prevents the development of effective trade policies oriented to benefit both the national economy and the majority of Bolivian households. We expect to fill that gap with this study.

The overall objective of this research is to estimate the effects for the Bolivian economy and its households that could emerge from different trade reform settings between the Plurinational State of Bolivia and the European Union. More specific objectives are:

- First, to investigate economic implications emerging from termination of the ATPDEA;
- Second, to assess the impact of trade policy measures with the EU (changes in tariffs) on the progress of key macroeconomic variables (e.g. exports, imports, production and GDP);
- Third, to estimate the economic effects of the trade reforms affecting households' wellbeing (in the form of changes in income and expenditures), in particular the impact over the Bolivian poor.

We expect that this research will enable us to assess how the different liberalisation scenarios affect the Plurinational State of Bolivia's main macroeconomic indicators, and how the economic wellbeing of household groups will be affected by the trade liberalisation.

## C. Bolivian economy and trade policy

The world economy in the 1980's was characterized by changes that led to the formation of economic blocs and extend the effects of the globalization to the world economy. Large groups such as the European Union were assembled and reinforced. The European Union inspired a process of world integration, as it represented one of the most important efforts governments carried out to integrate themselves in social, economic and cultural dimensions. At the end of the eighties, the Andean Community was revamped

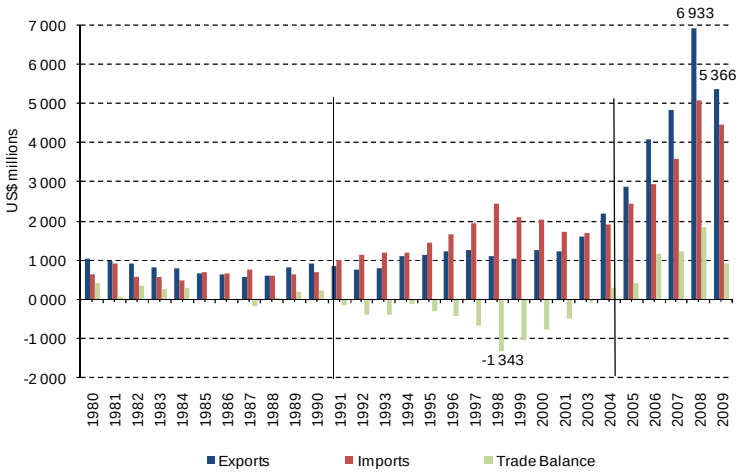
becoming an Andean free trade area. Within the framework of the Latin American Integration Association (ALADI), southern countries formed the Southern Common Market (MERCOSUR).

In the nineties, the Plurinational State of Bolivia focused on deepening integration within the Andean Community, subscribing different trade agreements, and negotiating unilateral preferential treatment like the ATPDEA to the US and the Generalized System of Preferences (SGP Plus) to Europe. Additionally, the Plurinational State of Bolivia implemented an open and free market strategy, deregulating the domestic economy and privatising state enterprises (among others) to meet IMF conditions to generate more employment, investment, economic growth, and ultimately more economic welfare. Part of the policy measures implemented in the 1990's consisted in lowering import tariffs. Such lowering is referred here as "näive de-tariffication" since the Plurinational State of Bolivia unilaterally lowered import tariffs losing negotiating capabilities in bilateral, regional and multilateral trade negotiations. Import tariff reductions started in 1987 and ended-up in 1995 establishing a general and easy tariff structure setting 10% for general products, 5% for capital goods and 2% for books.

Later between 2000 and 2004, the Plurinational State of Bolivia suffered domestic political and economic crises. While Colombia, Ecuador and Peru began trade negotiations with the United States in May 2004, the Plurinational State of Bolivia did not participated of these negotiations due to such political crises that eventually contributed to the election of Evo Morales as Bolivian president in 2005. His government prioritised policies that supported the domestic market, rejecting any possibility of trade negotiations with the United States. Instead, in 2006 the Plurinational State of Bolivia joined the so-called Bolivarian Alternative for the People of Our America (*Alternativa Bolivariana para los Pueblos de Nuestra América*, ALBA). In September 2008 the Morales administration expelled the US ambassador in La Paz. In December of the same year, the United States did not extend the ATPDEA to the Plurinational State of Bolivia, arguing that the Plurinational State of Bolivia failed to cooperate with anti-narcotic efforts.

In this context of unstable political situation in Bolivia, domestic exports grew substantially, especially from 2004 onwards, far exceeding the level of imports (Figure III.1). However, this tendency of the last four years has not prevailed in the last thirty years. Throughout the 1980's exports and imports ranged between US$500 – 1000 million, with exports usually exceeding the level of imports by small margins. During the 1990's up to 2003, the trade balance experienced permanent deficits, reaching its peak in 1998 where the trade deficit was more than US$1.3 billion, the highest deficit in the Bolivian trade balance in the last 30 years.

**FIGURE III.1**
**BOLIVIAN TRADE PERFORMANCE 1980 – 2008**



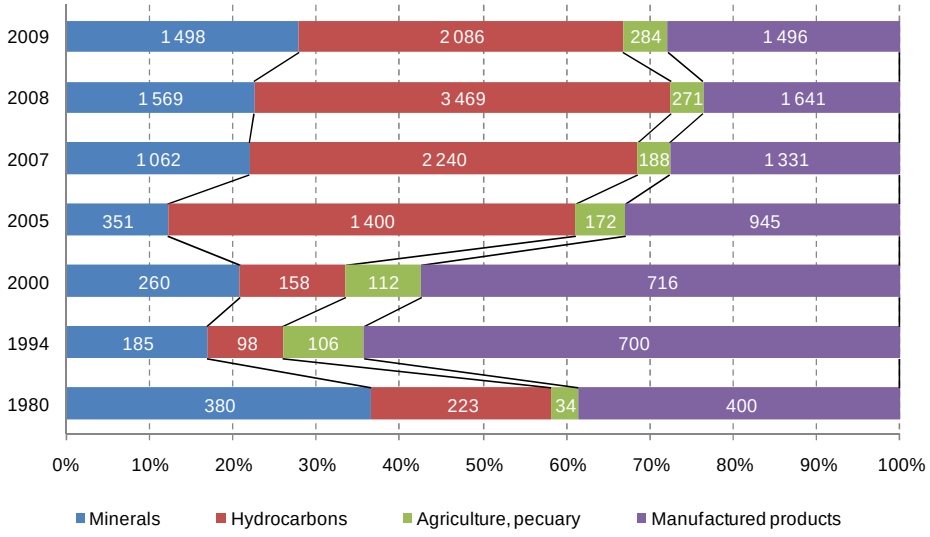

Source: Authors' elaboration based on INE data.

In the last few years, the exporting sector started to experience a favourable context due to the economic growth of neighbouring countries, mainly Brazil and Argentina. The economic growth of these two economies meant higher demand and better prices for Bolivian exports, especially natural gas. Due to these developments, for the first time in more than a decade Bolivian exports outpaced imports in 2004, and since then the trade balance has become largely positive, reaching a peak of US$1.85 billion in 2008.

Between 2008 and 2009, in light of the global economic crisis and right after the termination of the ATPDEA agreement with the United States (December 2008), exports decreased for almost a billion US dollars (Figure III.1). Imports also decreased, though by smaller amounts (about 600 hundred million dollars). This might have been due to the fact that in January 2009 the Bolivian government moderately increased tariffs for some commodity groups. Yet, the trade balance was positive, though only half of its 2008 level, when the surplus was at its highest historical level (more than one billion US$).

Figure III.2 shows that the structure of Bolivian exports has changed overtime towards hydrocarbons. In 1980 exports of manufactures and minerals lead the Bolivian exports (38 and 36 percent respectively). In 1994, manufactured products, which are products with value-added activities, dominated Bolivian exports with more than 60% of the total share. The importance of the manufacturing industry somehow prevailed for the next 10 years, when exports of hydrocarbons started to grow substantially.

**FIGURE III.2**
**BOLIVIAN EXPORTS BY ECONOMIC SECTOR**
*(Million US Dollars)*




Source: Instituto Nacional de Estadística – INE. Elaboration: Instituto Boliviano de Comercio Exterior – IBCE.

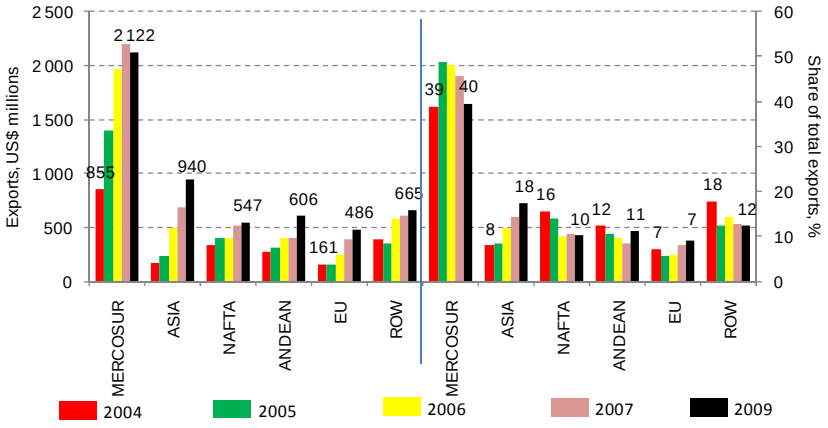
In 2009 Hydrocarbon and Minerals, which are products with a limited degree of transformation, dominated with 70% of total exports, while manufactures share decreased from about 38% in 1980 to 28% in 2009 (though in absolute values increased from 400 to 1 496 million dollars respectively.) The share of agricultural goods decreased from 9% in 1994 to 5% in 2009 though, likewise manufactures, increased in absolute terms (from 34 million in 1980 to 284 millions in 2009.) The most impressive growth corresponds, without any doubt, to exports of hydrocarbons (mainly

natural gas). Between 1980 and 2000 it fluctuated from 100 to 230 million dollars per year; however it grew from 1 400 million in 2005 to 3 469 millions in 2008 (about 50% of total Bolivian exports.) In fact, from 2005 onwards about half of domestic exports corresponded to exports of hydrocarbons.

This growth has a privatisation history behind. In 1993 Mr Gonzalo Sanchez de Lozada, Bolivian president who favoured policy measures prescribed by the IMF, decided to initiate an aggressive privatization programme. This programme (which was inspired in the well-known structural adjustment programmes) included privatisation of all hydrocarbon-related industry which until then was in public sector hands. Brazilian and Argentinean oil companies bought the majority of the shares of the industry, and invested large amounts in oil exploration. Thanks to these investments in the early 2000, it was found out that the Plurinational State of Bolivia has the second largest reserves of natural gas in Latin America (Venezuela is in the first place). In 2006, it did not come as a surprise that, given the large economic benefits exports of natural gas was yielding to the privatised oil company, the Morales administration decided to nationalize the hydrocarbon industry.

The nationalization of the oil industry did not change much the composition of exports by partner, as they have traditionally being few and located in the Americas (Figure III.3). Throughout 2004 to 2009 the Plurinational State of Bolivia exported growing values of merchandises to all economic blocs. From 2004 to 2009 MECOSUR's share increased from 39% to 40% of total Bolivian exports. This growth is explained by increased exports of natural gas to Brazil and Argentina. In fact Brazil became the most important trading partner for the Plurinational State of Bolivia accounting for about 31% of total exports in 2009 (in 2001 its share was 21%). Exports to the EU increased from 161 to 486 million dollars between 2004 and 2009, but keeping its 7% share throughout this period. Exports to Asia grew also grew substantially from about US$ 200 in 2004 to almost US$ 1200 in 2008 (500% growth in four years). This growth is mostly explained by mineral products (zinc, silver and lead) exported to South Korea. Finally exports to NAFTA decreased from 16% in 2004 to 10% in 2009.

**FIGURE III.3**
**BOLIVIAN EXPORTS BY DESTINATION, 2004 - 2009**




Source: Authors' elaboration based on INE data.

The Plurinational State of Bolivia has experienced a positive trade balance in 1989 and throughout the 1990s (except in 1998). The trade balance from 2001 onwards has been negative, except in 2007 where exports exceeded imports by US$ 57 million. The Plurinational State of Bolivia Imports from the EU in 2009 were US$ 396 million (7% of its total imports.)[16] Total imports grew at

[16] Total import value from the EU grew at an annual rate of 3.3% between 1989 and 2009, from US$ 253 million to US$ 486 million.

an annual rate of 3.3% between 1989 and 2009, and accelerated in 2002, when total trade (exports and imports) grew from less than US$ 200 million to US$ 900 million in 2009. Total EU imports in 2009 were US$ 1 679 trillion, where the Plurinational State of Bolivia had an insignificant share of just 0.0003 percent. Most of the products that the Plurinational State of Bolivia exports to the European Union are labour-intensive goods, including zinc and concentrates, tin and borate, silver, alcohol, vegetable oils, quinoa, processed coffee, nuts, wood furniture and leather products.

From 1996 to 2003 the trade balance between MERCOSUR and the Plurinational State of Bolivia had been negative. It only became largely positive from 2004 onwards when the Plurinational State of Bolivia started to sell natural gas to Brazil and Argentina. With no exports of natural gas, the Plurinational State of Bolivia would have had a permanent trade deficit with MERCOSUR, which from 1996 to 2008 would have accrued to US$ 8.433 million (IBCE - Menacho, 2009). Bolivian exports to Brazil (accounting natural gas) were US$ 3.023 million in 2008, but with no gas exports they would just be US$ 52 million. Likewise exports to Argentina with natural gas were in 2008 were US$ 493 million, but without gas they would just be US$ 42 million. While in 2009 there was a significant decrease in these values (-40%), natural gas continued as the main source for the Plurinational State of Bolivia's trade surplus.

# D. Methodology - A macro-micro simulation approach

This section presents the research approach that has been followed to estimate the changes in the Bolivian economy and household groups resulting from liberalization scenarios between the Plurinational State of Bolivia and the EU. This approach consists of a combination of a macro simulation model (in the form of a Computable General Equilibrium - CGE) and a micro-simulation approach (in form of *Laspeyres* price indices for income and expenditure), which in short can be referred to as a 'macro-micro approach'.

## 1. Introduction to macro-micro simulations

The impacts of trade reforms over rural and urban households in the developing world have become a major concern of the WTO negotiations (Hertel et al., 2005). This concern is also reflected in the 'Millennium Development Goals' which commits governments to halve poverty by 2015. According to Vandemoortele (2009), the establishment of a fair and improved international trading system is an important component in achieving this goal. To analyse such impacts, researchers have used a variety of tools, including the combined use of a CGE model with micro-simulation models, also called macro-micro simulation approach.

The macro-micro approach consists of using a CGE model to simulate policy shocks. The results, including changes in commodity prices, returns to factors of production, GDP, imports and exports and terms of trade are used by a micro-simulation approach that allows analysis of the effects of such policies at household-group level. For social and economic policy analysis this technique has the advantage of producing results that can be evaluated at the household level.

In general terms, the macro-micro simulation approach aims to answer the key question of how trade reforms affect the wellbeing of different household groups (Telleria et al., 2007). Given that the household data available for this research contains earnings and consumption data, we measure economic wellbeing by bi-featured indicators: income and expenditure. Both provide a measure of the economic wellbeing of an individual. However, we acknowledge that economic wellbeing viewed in this way is a narrower picture of a more comprehensive wellbeing concept, which would include other components such as health, education, housing, etc. Section 4.4 describes in more detail the micro-simulation approach.

The GTAP model (Hertel, 1997) has been chosen as the macro-simulation model, while the micro-simulation approach uses price indexes as defined by Ianchovichina et al. (2002). The GTAP model is a standard, static, multi-region, multi-sector general equilibrium model which includes explicitly treatment of international trade and transport margins, global savings and investment, and price and income responsiveness across countries. It assumes perfect competition, constant returns to scale, and an Armington specification for bilateral trade flows that differentiates trade by origin. It also assumes a fixed factor endowment and full factor use. In this research we use the GTAP Data Base, version 7.0, which represents a snapshot of the world economy in the year 2004. The results of this model for all variables are expressed as relative changes from the original GTAP Data Base. That is, results are percentage changes from the base case scenario. The macro-micro approach has been applied in three stages:

i) First, we set a pre-simulation (or pre-liberalisation) scenario where, based on the household database, values of the consumption basket and income levels are estimated for each household category.

ii) The second stage is the simulation of trade liberalisation scenarios using the GTAP model. The results of such simulations are then analyzed against key macroeconomic indicators of the Bolivian economy.

iii) Finally, we use the results from the general equilibrium model (percentage changes in prices of commodities and sources of income), to estimate money metric estimations of changes in households' spending and revenues using the micro-simulation approach. We use a cointegration model to analyse the degree of integration between primary and secondary markets, so estimating price transmission coefficients. Then, we compared both the pre- and post-liberalisation scenarios and analyzed the impacts of trade reforms on households' economic wellbeing.

Given the large size of the GTAP database, the amount of computational resources needed to compute the data is usually very large and, therefore, for the simulations to be solvable data aggregation is needed (Hertel et al, 2004). The 113 regions (or countries) and 57 sectors (commodity groups) available in the GTAP database version 7.0 were aggregated into 14 regions and 35 sectors (Table III.1). The regional aggregation criterion used consisted of choosing countries that are important trade partners for the Plurinational State of Bolivia. South American countries, the United States and the European Union represent between 77 and 97% of total Bolivian exports to the world between 1994 and 2006. The 57 GTAP sectors were aggregated into 35 sectors that are important commodities for trade flows (importing and exporting sectors), employment generation and food security. For purposes of presentation of results, these 35 sectors were further aggregated into five commodity sectors namely 'Agriculture', 'Mining and natural resources', 'Light manufactures', 'Heavy manufactures, and 'Services'.

**TABLE III.1**
**SECTORAL AND REGIONAL AGGREGATION OF THE GTAP DATABASE, VERSION 7.0**

| Sectors | Regions |
|---|---|
| 1. Agriculture | 1. Plurinational State of Bolivia |
| 2. Mining and Natural Resources | 2. USA |
| 3. Light Manufactures | 3. EU27 |
| 4. Heavy Manufactures | 4. Mexico |
| 5. Services | 5. Argentina |
| | 6. Brazil |
| | 7. Chile |
| | 8. Colombia |
| | 9. Ecuador |
| | 10. Paraguay |
| | 11. Peru |
| | 12. Bolivarian Republic of Venezuela |
| | 13. Rest of LAC |
| | 14. ROW |

Source: Authors' classification based on results from GTAP 7.0 simulations.

## 2. Trade scenarios and sensitive commodities

The latest development in the Plurinational State of Bolivia-US trade relationship resulted in the end of the ATPDEA for the Plurinational State of Bolivia in December 2008. In light of this new *status quo*, we formulate a series of trade scenarios that tries to reflect this new development, as well as to analyze the ex-ante economic effects of the Plurinational State of Bolivia-EU trade agreement. Thus, the definition of the trade scenarios was based on identification of sensitive commodities, updating of trade developments, and enquires to the Bolivian government as to what were the most likely trade settings in a prospective trade agreement.

We also account for sensitive commodities from both the EU and the Plurinational State of Bolivia for the simulation scenarios. From the EU trade negotiations with Peru, Colombia and Ecuador, it is evident that the EU has provided a particular protection to some commodity groups considered as sensitive. These commodities include fruits and vegetables, meat, dairy products, sugar, beverages and tobacco, and other food products. In the case of the Plurinational State of Bolivia, products to which the Plurinational State of Bolivia provides a special protection when negotiating trade agreements include rice, wheat, oilseeds, meats, dairy products, sugar, textiles and leather products. We also consider sensitive products for Colombia, Ecuador and Peru. These include rice, wheat, cereals, fruits and vegetables, plant based fibres, meat, milk, paper products, textiles, motor vehicles and chemical products. Based on this, the trade scenarios tested were:

- **Scenario 1:** No ATPDEA (termination of the ATPDEA). This scenario simulates the economic impacts of the end of the ATPDEA. In this scenario US tariffs for Bolivian products increase on all goods that previously benefited from ATPDEA trade preference (Annex 4 shows tariff changes before and after ATPDEA). The Plurinational State of Bolivia also increases tariffs to some products imported from the US.

  The results of this first scenario serve as the new baseline for the next four scenarios. That is, the GTAP database is updated to incorporate the end of the ATPDEA for the Plurinational State of Bolivia. This new baseline is used to analyze ex-ante the impacts of a trade agreement between the European Union and Andean countries. The four scenarios considered are:

- **Scenario 2:** CAN – EU Total Liberalisation. In this scenario all products from Andean countries (the Plurinational State of Bolivia, Colombia, Ecuador, and Peru) enter duty-free into the European Union, and vice-versa.

- **Scenario 3:** CAN – EU with 'sensitive products'. Sensitive products from both Andean countries and the EU are excluded from the trade liberalisation treaty. Tariffs for all other products are eliminated.

- **Scenario 4:** CAN – EU Total Liberalisation without the Plurinational State of Bolivia. All Andean countries except the Plurinational State of Bolivia sign a trade agreement with the EU. All tradable products enter duty-free into both regional blocs.

- **Scenario 5:** CAN – EU Total Liberalisation without the Plurinational State of Bolivia and with 'sensitive products'. In this scenario all Andean countries except the Plurinational State of Bolivia sign a trade agreement with the EU. All tradable products, except those considered sensitive ones', enter duty-free into both regional blocs.

The first two scenarios assume that the Plurinational State of Bolivia signs a trade agreement with the European Union along with the other Andean countries. The last two scenarios assume that the Plurinational State of Bolivia does not sign a trade agreement with the EU, but the other Andean countries do. Within each pair of scenarios, we consider total liberalization and partial liberalization, this last which accounts for sensible products.

### a) Modifications to the GTAP Data base

As the base year of the GTAP data base version 7.0 is 2004, the database does not reflect the current tariff structure. That is, it does not incorporate tariff information from trade agreements stipulated after 2004. For example, in December 2008 US tariffs to Bolivian products increased because of the end of trade preferences from the ATPDEA. Thus, we update the tariff information in the GTAP database to incorporate trade reforms up to a new base year, in this case 2008. Using this new baseline we simulate first the end of the ATPDEA, and upon this new baseline, we simulate the trade liberalization scenarios between the EU and the Andean countries (Telleria 2010 shows tariff modification before and after modifications in tariff information).

## 3. Market integration

As explained before, commodity prices change as result of trade reforms. However, those changes in international commodity prices might not affect domestic prices uniformly. Nicita (2005) and Hertel and Winters (2005) suggest that households living in urban areas are more sensible to changes in prices at the border than rural areas. For rural regions only a fraction of international prices are felt, especially in the case of agricultural products. Nicita (2005) finds that for Mexico international prices are transmitted differentially within regions, depending on the type of product and distance to the border. The price transmission or "pass-through" of international prices to domestic prices at the border was 66 percent for manufactured products, but only 25 percent for agricultural products. At the same time, that price transmission decreases as distance to the border increases.

In this study we incorporate these features of imperfect price transmission between urban and rural areas and different type of products. This would allow distributing price changes from trade liberalization to households, according to their regional location in the Plurinational State of Bolivia. For this, we analyze whether or not there is some degree of integration between domestic primary and secondary markets in the short and long term. We econometrically estimate price transmission relations and then map those relationships directly into the economic wellbeing function of households. This approach allows transmitting price changes from the GTAP global CGE model into Bolivian households living in different geographical areas. The next section outlines this methodology more in detail.

### a) Market integration approach

From the perspective of market integration, two or more markets are integrated when changes in prices in one market, are transmitted to one or more markets in equal or different degrees and at different speeds. To measure integration between two or more markets, we need to determine a causality relationship between prices in main markets (from large and well-connected cities) and prices in secondary markets (from smaller and weakly-connected cities). If there is causality, the sign and direction determines the degree of cointegration in prices in the long term. This allows estimating price elasticity of transmission between both markets, and the speed of adjustment in the short term.

To test whether markets in the Plurinational State of Bolivia are integrated or not, we use a cointegration test called the Vector Error Correction Model (VECM). The VECM is a time series regression model that is based on the behavioural assumption that two or more times series exhibit an equilibrium relationship that determines both short and long time behaviour. VECM models are common time series models for estimating and testing leading indicators of cointegration, and offer several advantages.[17] These are simple multivariate models in which a variable is explained by its own past values and past values of all other variables (leading indicators) in the system.

[17] First, it allows to study the relation that prevails between time series characterised by non-stationary pattern (non-stationarity is a very common case when analysing regressions that involve time series); Second, it is standard as allows stating a pre-determined structural model for the variables, which facilitates the estimation of causalities such as

The VECM allows identifying one or more cointegration vectors that capture the dynamics of price convergence between markets in the long term. Coefficients of each equation show an equilibrium relationship between price variables. Speed coefficients of adjustment show how fast the equilibrium is achieved in the long term. In addition, the coefficients indicate those variables (i.e. prices) that adjust in the system after the shock has occurred. However, the speed coefficients of adjustment cannot tell the time needed for prices to adjust. Engler and Nahuelhual (2003) indicate that if speed coefficients are 1, then variables would respond immediately (i.e. one month). For lower coefficient values such as 0.75 then the reaction is slower. In general, the smaller the coefficient the slower the variable reaction.

The first steps to test for cointegration is to conduct Augmented Dickey Fuller (ADF) tests on each of the price time series to determine if they are non-stationary (we hypothesize that they will not be stationary). Using the ADF, we tested if each time series (expressed in logarithms) hold or not a unitary root. Then, following Johansen (1988, 1991) we proceeded to test for cointegration. Using the VECM we estimated:[18] a) if some spatial integration and causality in the long term exists; and b) the time needed (measured in months) for prices to adjust to equilibrium.

The data used to evaluate these dynamics of transmission between markets was price information for different regions and products in the Plurinational State of Bolivia. These prices were collected by the Fundación Valles through the Sistema Integrado de Mercados Agropecuarios (Integrated System of Agricultural Markets). Since 2002 to current date, the Fundación Valles has collected daily price information in six out of the nine departments in the Plurinational State of Bolivia. These data includes 33 commodities from the consumption bundle of any standard Bolivian family. We use monthly average prices for each of those commodities, for the period from May 2002 to August 2009. To estimate price elasticities, we transform commodity prices into logarithms.

Annex 6 of Telleria (2010) shows all departments where price information for these commodities was collected. These prices correspond to markets of La Paz, Santa Cruz, Cochabamba, Sucre, Tarija and Oruro. Given that La Paz, Santa Cruz and Cochabamba are the most populated and better connected to international markets in the Plurinational State of Bolivia (where a significant share of total Bolivian exports come from), we consider these three cities as main domestic markets. Sucre, Tarija and Oruro, with low population, few companies exporting abroad and poorly connected to international markets are considered secondary markets.

## 4. Micro-simulation approach

The micro-simulation approach used in this analysis is the Laspeyres price indices for income and expenditure. The methodology consists of using the CGE model as 'price generator', and the micro-simulation approach as a bridge to transmit those changes in prices to the household level. The household survey provides the structure of households' consumption and income before the trade scenarios are simulated. This structure is set to a base-year using the Laspeyres cost of living and income indices.

Price changes of commodities and price changes of sources of income (i.e. returns to factors of production) were obtained from the GTAP model. We adjust price transmission between the macro and micro models using the results from the cointegration tests (Table III.2). This adjustment reflects the impact of international price changes in domestic prices by geographical location. Using the Laspeyres indices for expenditure and income, the modified prices are then used to obtain a post-liberalisation structure of households' consumption and income.

Granger; and Third, allows to explain the process that a group of variables follow to restore equilibrium within the system.

[18] By pair cities, one secondary market with each primary market.

**TABLE III.2**
**GTAP CHANGES IN GOODS' PRICES AND IN THE PRICE TRANSMISSION COEFFICIENTS**

| Sectors | Changes in the prices of basic products | | | | Transmission coefficients | |
|---|---|---|---|---|---|---|
| | FTA CAN-EU | FTA CAN-EU, no sensitives | FTA CAN-EU, no Bolivia (Plurinational State of) | FTA CAN-EU, no Bolivia (Plurinational State of), no sensitives | Tarija, Beni, Pando | Chuquisaca, Oruro, Potosí |
| Cooking oil | 1.59 | 0.29 | 0.62 | -0.39 | 0.68 | 0.96 |
| Chili | 1.59 | 0.29 | 0.62 | -0.39 | 0.98 | 1.11 |
| Green peas | 1.59 | 0.29 | 0.62 | -0.39 | 1.11 | 0.89 |
| Rice | 2.10 | 0.92 | 0.40 | -0.29 | 0.97 | 0.97 |
| Tuna, sardines | 7.98 | 7.95 | 0.06 | -0.09 | 0.61 | 0.68 |
| Sugar | 1.78 | 1.30 | 0.17 | -0.15 | 0.93 | 0.96 |
| Alcoholic bev. | 1.68 | 1.27 | 0.13 | -0.14 | 1.00 | 1.00 |
| Onion | 2.32 | 0.87 | 0.34 | -0.27 | 0.92 | 0.82 |
| Pork | 1.93 | 0.85 | 0.36 | -0.27 | 1.00 | 0.86 |
| Cereals | 2.19 | 1.12 | 0.36 | -0.27 | 0.97 | 0.95 |
| Corn | 1.43 | 0.45 | 0.46 | -0.30 | 0.75 | 0.80 |
| Chuño | 1.79 | 1.16 | 0.23 | -0.17 | 0.99 | 1.00 |
| Coca | 2.45 | 1.34 | 0.40 | -0.27 | 1.12 | 0.89 |
| Cocoa | 2.45 | 1.34 | 0.40 | -0.27 | 1.12 | 0.89 |
| Spices | 2.45 | 1.34 | 0.40 | -0.27 | 1.00 | 1.00 |
| Lam | 1.93 | 0.85 | 0.36 | -0.27 | 0.90 | 0.95 |
| Ham | 1.97 | 1.24 | 0.24 | -0.20 | 1.00 | 0.84 |
| Pasta | 1.59 | 0.93 | 0.26 | -0.20 | 1.00 | 1.00 |
| Soft drinks | 1.68 | 1.27 | 0.13 | -0.14 | 1.00 | 1.00 |
| Beans | 2.45 | 1.34 | 0.40 | -0.27 | 0.95 | 0.71 |
| Flour | 1.59 | 0.93 | 0.26 | -0.20 | 1.10 | 1.20 |
| Liver | 1.97 | 1.24 | 0.24 | -0.20 | 1.00 | 0.84 |
| Eggs | 1.88 | 1.35 | 0.17 | -0.16 | 0.94 | 1.02 |
| Juice | 1.68 | 1.27 | 0.13 | -0.14 | 1.00 | 1.00 |
| Milk | 1.88 | 1.35 | 0.17 | -0.16 | 1.00 | 1.00 |
| Powder milk | 1.88 | 1.35 | 0.17 | -0.16 | 1.00 | 1.00 |
| Lettuce | 2.32 | 0.87 | 0.34 | -0.27 | 0.73 | 0.93 |
| Lemon | 2.32 | 0.87 | 0.34 | -0.27 | 1.00 | 1.00 |
| Dried corn | 2.19 | 1.12 | 0.36 | -0.27 | 0.97 | 0.95 |
| Peanuts | 1.43 | 0.45 | 0.46 | -0.30 | 1.05 | 1.06 |
| Butter | 1.88 | 1.35 | 0.17 | -0.16 | 0.99 | 0.15 |
| Apple | 2.32 | 0.87 | 0.34 | -0.27 | 1.06 | 1.03 |
| Jams | 1.59 | 0.93 | 0.26 | -0.20 | 1.00 | 1.00 |
| Honey | 1.59 | 0.93 | 0.26 | -0.20 | 1.00 | 1.00 |
| Oranges | 2.32 | 0.87 | 0.34 | -0.27 | 1.00 | 1.00 |
| Goose | 1.79 | 1.16 | 0.23 | -0.17 | 0.95 | 1.02 |
| Other meats | 1.93 | 0.85 | 0.36 | -0.27 | 1.00 | 0.84 |
| Other fruits | 2.32 | 0.87 | 0.34 | -0.27 | 0.94 | 0.93 |
| Other milk pr. | 1.88 | 1.35 | 0.17 | -0.16 | 1.00 | 1.00 |
| Other fish | 7.98 | 7.95 | 0.06 | -0.09 | 0.61 | 0.68 |
| Other refresh. | 1.68 | 1.27 | 0.13 | -0.14 | 1.00 | 1.00 |
| Other tubers | 1.79 | 1.16 | 0.23 | -0.17 | 1.00 | 1.00 |
| Other veg. | 2.32 | 0.87 | 0.34 | -0.27 | 0.94 | 0.93 |
| Bread | 1.59 | 0.93 | 0.26 | -0.20 | 1.00 | 1.00 |
| Potato | 1.79 | 1.16 | 0.23 | -0.17 | 1.00 | 1.00 |
| Papaya | 2.32 | 0.87 | 0.34 | -0.27 | 1.00 | 1.00 |
| Fish | 7.98 | 7.95 | 0.06 | -0.09 | 0.61 | 0.68 |
| Banana | 2.32 | 0.87 | 0.34 | -0.27 | 1.00 | 1.00 |
| Fried banana | 2.32 | 0.87 | 0.34 | -0.27 | 1.00 | 1.00 |
| Chicken | 1.93 | 0.85 | 0.36 | -0.27 | 0.96 | 1.00 |
| Cheese | 1.88 | 1.35 | 0.17 | -0.16 | 1.00 | 1.00 |
| Quinoa | 2.19 | 1.12 | 0.36 | -0.27 | 0.95 | 0.97 |
| Refreshment | 1.68 | 1.27 | 0.13 | -0.14 | 1.00 | 0.98 |
| Salt | 1.59 | 0.93 | 0.26 | -0.20 | 1.00 | 1.00 |
| Tea, coffee | 2.45 | 1.34 | 0.40 | -0.27 | 1.00 | 1.00 |
| Tomato | 2.32 | 0.87 | 0.34 | -0.27 | 0.94 | 0.93 |
| Wheat | 1.60 | 1.06 | 0.22 | -0.18 | 1.00 | 0.93 |
| Beef | 1.97 | 1.24 | 0.24 | -0.20 | 1.00 | 0.84 |
| Cassava | 1.79 | 1.16 | 0.23 | -0.17 | 1.01 | 0.96 |
| Carrots | 2.32 | 0.87 | 0.34 | -0.27 | 0.76 | 0.99 |

Source: Authors based on econometric estimations.

Note: The first four columns are percentage changes in prices generated by the GTAP model, mapped to the products in this basket. We assume that the domestic markets most connected to international markets are La Paz, Santa Cruz and Cochabamba, while the least connected ones are Beni, Chuquisaca, Oruro, Pando, Potosí and Tarija. To this latter group we estimate the price transmission coefficient in the last two columns. Using these coefficients we modify the GTAP price estimates to show that the least connected areas are those least exposed to changes in international prices. This modification was made for each of the 5 746 families in the household survey.

The change in cost of living by segments of population provides an upper bound measurement of the increase/decrease in expenditure that would be required (for each population segment) to purchase the same quantities of goods as in the base-year (Ianchovichina et al., 2002). Also changes in households' livelihoods are estimated according to changes in returns to production factors. This approach uses economic wellbeing and price index notions, which are described next.

### *(1) Price index*

Following Ianchovichina et al. (2002), we use the Laspeyres price index to calculate the impact on the expenditure side of households emerging from the different policy simulation scenarios. Formally, this index is defined as:

$$P_L = \frac{\sum_i p_i^1 q_i^0}{\sum_i p_i^0 q_i^0} \text{ x } 100 \quad (1)$$

Where PL is the change in price level, pi and qi are the price and quantity of commodity i, respectively. Prices and quantities are indexed by time, where 0 denotes the base period, and 1 refers to the post simulation period. This price index is normalised to a value of 100 in the base year to indicate the percentage level of the price index in period 1 relative to the base year. For example, a price-index value of 110 in period 1 indicates that the price index is 10% higher in the first year compared to the base year. As mentioned by Ianchovichina et al. (2002), the Laspeyres index overstates the increase in expenditure because it does not account for substitution in consumption when prices change (zero elasticity of substitution). That is, households might respond to price changes by altering the quantities they purchase. Consequently, the Laspeyres index provides an upper bound measurement of the increase in expenditure.

### *(2) Changes in private utility*

Following Ianchovichina et al. (2002), we use of GTAP's private utility equation to measure changes in economic wellbeing. The term 'private utility' is used to refer to an individual's difference between the Laspeyres index for income and the Laspeyres index for expenditure:

$$up(r) = \frac{yp(r) - \sum_{i \in TRAD} [CONSHR(i,r) \text{ x } pp(i,r)]}{\sum_{i \in TRAD} [CONSHR(i,r) \text{ x } INCPAR(i,r)]} \quad (2)$$

Where up(r) represents the percentage change in private utility in region r; yp(r) is the percentage change in private household income in region r; CONSHR(i,r) is the share of i in total consumption in region r; pp(i,r) is the percentage change in the demand price of commodity i in region r; INCPAR(i,r) is the income expansion parameter (elasticity) of commodity i in region r. If preferences are homothetic (i.e. a change in budget will allow for proportional changes in the demand of commodities) the INCPAR(i,r) equals 1 for all commodities, and therefore equation (2) collapses into the difference between a Laspeyres price index for income and a Laspeyres price index for expenditure:

$$up(r) = yp(r) - \sum_{i \in TRAD} [CONSHR(i,r) \text{ x } pp(i,r)] \quad (3)$$

Equation (3) is the difference between the change in household income (returns from skilled labour, unskilled labour, capital, land and natural resources)[19] and the consumption share times the percentage change in prices summed over all commodities. In other words, this equation measures economic wellbeing change by computing the difference between changes in income and expenditure. A Laspeyres price index provides a fixed-weight approximation in the economic private utility emerging from a change in income sources and a change in expenditure.

### *(3) Household Data*

The data used in this study comes from the Bolivian National Institute of Statistics (BNIS, 2002), despite the availability of more recent surveys (2004 and 2007). The 2002 dataset has chose particularly because it provides expenditure data in volumes, which is needed in the methodology used in this study. The 2002 survey covers 5,746 households from the nine departments in which the country is geographically classified.[20] Out of this total number of households, 3,339 were located in urban areas, and 2,407 in rural ones. The survey contains information on household income (salaries, wages) and expenditure on food items. Given the large size of the sample and for presentation purposes, we grouped household data according to geography, income level, education level, and economic activity.

Households contained in the database were classified according to departments. A geographical dimension was critical given the disparities in income and poverty incidence across the country (Table III.3).

**TABLE III.3**
**GEOGRAPHICAL GROUPING**
*(Number of households in the survey)*

| Department | Rural | Urban | Total | % |
|---|---|---|---|---|
| 1. La Paz | 430 | 789 | 1 219 | 21.2 |
| 2. Oruro | 239 | 297 | 536 | 9.3 |
| 3. Potosí | 350 | 282 | 632 | 11.0 |
| 4. Cochabamba | 373 | 538 | 911 | 15.9 |
| 5. Chuquisaca | 262 | 215 | 477 | 8.3 |
| 6. Tarija | 199 | 277 | 476 | 8.3 |
| 7. Beni | 147 | 265 | 412 | 7.2 |
| 8. Pando | 95 | 48 | 143 | 2.5 |
| 9. Santa Cruz | 320 | 620 | 940 | 16.4 |
| Total | 2 415 | 3 331 | 5 746 | 100 |

Source: own classification based on data from the Bolivian National Institute of Statistics (2002)

Households were grouped into six sextiles of income. The first corresponds to household that earned less than or equal to 389.7 Bolivianos per month (Bs/month). Considering the average exchange rate in 2002 (1 USD = 6.9 Bolivianos), this amount corresponded to 57 USD/month (Table III.4).

[19] In turn, household income is defined as the sum of the share in the household's endowments times the percentage change in price of these endowments [ps(r)]:

$$yp(r) = \sum_{i \in Endowment} INCOMESHR(i,r) \text{ x } ps(r)$$

[20] 106 questionnaires were dropped due to a lack of data. The analisis was conducted on the remaining 5 640 responses.

**TABLE III.4**
**INCOME CATEGORY**

| Income group (Bs/month) | No. of questionnaires | % |
|---|---|---|
| 1) <= 389.7 | 956 | 16.7 |
| 2) 389.7 - 694.9 | 950 | 16.6 |
| 3) 694.9 – 1,032.9 | 953 | 16.7 |
| 4) 1 032.9 – 1 538.4 | 953 | 16.7 |
| 5) 1 538.4 – 2 546.7 | 953 | 16.7 |
| 6) 2 546.7+ | 952 | 16.7 |
| Total | 5 717 | 100 |

Source: own classification based on data from the Bolivian National Institute of Statistics (2002)

**TABLE III.5**
**EDUCATION STATUS**

| | Literate | Illiterate | Total |
|---|---|---|---|
| Total | 4 977 | 769 | 5 746 |
| Percentage | 86.6 | 13.4 | 100 |

Source: own classification based on data from the Bolivian National Institute of Statistics (2002)

Households might have many activities (e.g. get income from farming and from manufacturing) to build up his/her monthly income. In this classification households were grouped according to the economic activity that contributed the most to the households' income (Table III.6).

**TABLE III.6**
**ECONOMIC ACTIVITY**

| Activity | Total | Percentage |
|---|---|---|
| Agriculture | 2086 | 36.3 |
| Capital | 1 303 | 22.7 |
| Diversified | 623 | 10.8 |
| Natural resources | 764 | 13.3 |
| No information | 356 | 6.2 |
| Non-agriculture | 614 | 10.7 |
| Total | 5 746 | 100.0 |

Source: own classification based on data from the Bolivian National Institute of Statistics (2002)

## E. Macro-simulation results

This section is divided into two main parts. First, we discuss the impacts that the end of trade preferences (ATPDEA) would produce on the Bolivian economy. Second, as a policy alternative and strategy following the end of the ATPDEA, we then discuss the results from the different scenarios that consider a trade agreement between the European Union and the Andean Community, with and without the Plurinational State of Bolivia. The simulation scenarios were run employing the data base that sets 2008 as the new baseline year (includes all FTAs and modifications of tariffs/preferential access that happened in Latin America up this year).

## 1. Economic impacts on the Plurinational State of Bolivia from the end of trade preferences (ATPDEA)

The main results of the loss of trade preferences are presented in Table III.7. As bilateral tariffs rise for both the United States and the Plurinational State of Bolivia, the Plurinational State of Bolivia main economic indicators tend to deteriorate. GDP fells by 0.04 per cent, as well as there are welfare losses of 10 million dollars per year. As a result, household income decreases by 0.31 per cent. As trade preferences are eliminated, both exports and imports decline. Exports decrease by 0.30 per cent and imports by 0.54 per cent. The steeper decline in imports gives a very slight jump to domestic production (0.03). Terms of trade get reduced for the Plurinational State of Bolivia by 0.24 per cent.

**TABLE III.7**
**IMPACTS ON THE PLURINATIONAL STATE OF BOLIVIA ON THE END OF ATPDEA**
*(Percentage changes)*

| Economic variable | Percentage Change |
|---|---|
| GDP | -0.04 |
| Welfare (millions of US dollars) | -10.00 |
| Income | -0.31 |
| Production | 0.03 |
| Exports | -0.30 |
| Imports | -0.54 |
| Terms of trade | -0.24 |

Source: Authors based on results from GTAP 7.0 simulations. Variables used from GTAP are GDP (qgdp), welfare (EV), income (y), production (qo), exports (qxwreg), imports (qiwreg) and terms of trade (tot).

These results are consistent with Telleria et al. (2009), which also discuss the poverty effects of the end of the ATPDEA in the Plurinational State of Bolivia. Sectoral effects follow a similar pattern as in Telleria et al., and are available from the authors upon request.

## 2. A FTA between CAN and the EU: Impacts on the Plurinational State of Bolivia

As we examine the impacts from a full liberalisation between the Andean Community (the Plurinational State of Bolivia, Colombia, Ecuador and Peru) with the European Union on the Plurinational State of Bolivia, we observe that there is a slight decrease in GDP for the Plurinational State of Bolivia (first column in Table III.8). However, the welfare gains associated with this trade agreement on Bolivian society amount to US$ 33 million per year. Household income increases by almost 2 per cent, and domestic production is not affected. Exports (2.2%), imports (3.6%) and terms of trade (1.4%) all improve for the Plurinational State of Bolivia. Overall, there are positive impacts on the Plurinational State of Bolivia from full liberalisation, with a slight decrease in GDP but with a positive effect on other variables, including welfare.

As we exclude sensitive products from trade liberalisation for both the Andean Community and the European Union (second column in Table III.8), the benefits for the Plurinational State of Bolivia, although still positive, decrease slightly. Welfare increases by US$ 25 million per year, and household income increase by 1.4 percent. GDP remain unchanged, and exports and imports increase, as well as terms of trade.

**TABLE III.8**
**IMPACTS ON THE PLURINATIONAL STATE OF BOLIVIA OF A FTA BETWEEN CAN AND THE EU**
*(Percentage changes)*

| Economic Variable | With Bolivia (Plurinational State of) | | Without Bolivia (Plurinational State of) | |
|---|---|---|---|---|
| | FTA CAN-EU | FTA CAN-EU with sensitive | FTA CAN-EU | FTA CAN-EU with sensible |
| GDP | -0.01 | -0.01 | 0 | 0 |
| Welfare (millions of $US) | 33 | 25 | 3 | -3 |
| Income | 1.92 | 1.4 | 0.17 | -0.17 |
| Production | 0.0 | 0.0 | 0.0 | 0.0 |
| Exports | 2.2 | 2.0 | 0.0 | -0.0 |
| Imports | 3.6 | 3.1 | 0.2 | -0.2 |
| Terms of trade | 1.4 | 1.0 | 0.1 | -0.1 |

Source: Authors based on results from GTAP 7.0 simulations. Variables used from GTAP are GDP (qgdp), welfare (EV), income (y), production (qo), exports (qxwreg), imports (qiwreg) and terms of trade (tot).

In the case where the other members of CAN negotiate a trade agreement with the European Union, the benefits are very small (total liberalisation) or even negative (sensitive commodities excluded). With full liberalisation the change in GDP is zero and welfare and income increase slightly. However, when sensible products are considered, the impacts on the Plurinational State of Bolivia are slightly negative, probably due to trade diversion from other CAN members and the EU. These results suggest that the Plurinational State of Bolivia would benefit slightly more from a trade agreement with the EU, if it negotiates along with the other member of CAN. When the Plurinational State of Bolivia is out of the CAN-EU agreement the welfare change is slightly positive or negative.

## a) Changes in exports and imports

With full liberalisation (with the Plurinational State of Bolivia in the CAN-EU agreement), exports increase for most sectors within agriculture and light manufactures, and decrease in mining & natural resources and heavy manufactures (Table III.9). Within agriculture and light manufactures, the overall Bolivian exportable production of sugar cane, rice and wheat (in this order) and textiles, wood products and leather products all increase substantially. These increments are due to a substitution effect that impacted over prices of Bolivian products in the EU market. That is, because the EU eliminated import tariffs to Bolivian products, along with prices of the other CAN countries, consumer prices were reduced in the EU market.

Within mining and natural resources and heavy manufactures, most of them decrease somewhat in scenarios that include the Plurinational State of Bolivia in the trade agreement between CAN and the EU. This is because the price of Bolivian commodities did not become much cheaper in comparison with the prices of the same commodities exported into the EU from other CAN countries. That is, as the EU already charges low import tariffs to Bolivian mining and natural resources and heavy manufactures products, when tariff reductions were simulated actually Bolivian prices were not reduced significantly. In addition, the Plurinational State of Bolivia benefits from the SGP-Plus, which already grants duty-free status to some Bolivian commodities exported to the EU. The difference in prices between Bolivian and other EU countries provoked an incentive for EU importers to switch (i.e. substitute) towards importing more products from other than the Plurinational State of Bolivia CAN countries.

When we account for sensitive products, exports decrease for some sectors. However, for those sectors which had an increase in exports under full liberalisation, the increase in exports was even larger with sensitive products (such as rice, wheat and cereals). This may be due to factor reallocation to those sectors which have a comparative advantage in the Plurinational State of Bolivia such as agriculture and light manufactures.

**TABLE III.9**
**CHANGE IN BOLIVIAN EXPORTS**
*(Percentage change)*

| Sector | | With Bolivia (Plurinational State of) | | Without Bolivia (Plurinational State of) | |
|---|---|---|---|---|---|
| | | FTA CAN-EU | FTA CAN-EU with sensitive | FTA CAN-EU | FTA CAN-EU with sensitive |
| Agriculture | 1. Rice | 39.9 | 53.2 | -0.6 | 2.4 |
| | 2. Wheat | 38.5 | 47.0 | -2.7 | 1.7 |
| | 3. Cereals | 16.3 | 19.4 | -0.9 | 0.6 |
| | 4. Vegetables and Fruits | 9.1 | -3.0 | -3.0 | 0.9 |
| | 5. Oilseeds | 0.9 | 0.0 | 2.6 | 0.8 |
| | 6. Sugar Cane | 58.6 | 69.2 | -2.6 | 1.3 |
| | 7. Plant Based Fibres | -6.4 | -5.2 | 0.1 | 0.4 |
| | 8. Other Crops | 22.4 | 29.4 | -0.9 | 1.5 |
| | 9. Cattle | 21.5 | 24.3 | 0.9 | 0.9 |
| | 10. Forestry & Fishing | -19.3 | -19.3 | -0.3 | 0.0 |
| Mining and natural resources | 11. Oil & Coal | -2.2 | -1.8 | -0.1 | 0.2 |
| | 12. Gas | -0.8 | -0.7 | -0.1 | 0.0 |
| | 13. Mineral Extraction | -1.4 | -1.1 | -0.2 | 0.0 |
| Light manufactures | 14. Meat | 8.4 | -9.9 | -3.3 | 1.1 |
| | 15. Vegetable Oils & Fats | -2.4 | -4.4 | 1.8 | -1.2 |
| | 16. Dairy Products | -27.8 | -9.4 | -21.3 | 0.1 |
| | 17. Processed Rice | 1.9 | 4.2 | -0.6 | 0.3 |
| | 18. Sugar | 1.6 | -6.1 | 7.8 | -0.6 |
| | 19. Other Food | 9.5 | -5.0 | -1.3 | -1.0 |
| | 20. Beverages & Tobacco | 12.7 | -3.2 | -1.0 | -0.3 |
| | 21. Textiles | 99.1 | 106.4 | -4.0 | 0.5 |
| | 22. Apparel | 11.0 | 13.5 | -1.3 | 0.4 |
| | 23. Leather Products | 32.6 | 35.9 | -1.4 | 0.3 |
| | 24. Wood Products | 65.2 | 67.9 | -0.7 | 0.6 |
| | 25. Paper Products | 11.0 | 15.3 | -3.4 | 0.3 |
| Heavy manufactures | 26. Petroleum Products | -1.0 | -0.6 | -0.1 | 0.1 |
| | 27. Chemical Products | 7.5 | 10.0 | -1.3 | 0.6 |
| | 28. Mineral Products | -7.4 | -6.9 | -3.3 | -3.3 |
| | 29. Ferrous & Non Ferrous Metals | 11.1 | 12.8 | -0.7 | 0.4 |
| | 30. Metal Products | -2.9 | -0.9 | -1.4 | 0.0 |
| | 31. Motor Vehicles | -7.2 | -4.9 | -1.1 | 0.7 |
| | 32. Electric Equip. | -1.6 | 1.3 | -1.3 | 0.7 |
| | 33. Machinery & Equip. | -7.6 | -5.3 | -1.7 | -0.1 |
| | 34. Other Manufactures | -8.1 | -6.1 | -0.8 | 0.8 |

Source: Authors based on results from GTAP 7.0 simulations.

As the Plurinational State of Bolivia does not participate in a trade agreement (in both full liberalisation and liberalisation without sensitive commodities), the change in exports is small for most sectors, with most of them decreasing or increasing marginally. These reductions are probably due to a diversion effect created by the reduction import tariffs that benefited similar commodities exported from the other CAN countries.

In terms of imports, the first point of impact of the reduction in Bolivian import tariffs is increased demand for imports from EU into the Plurinational State of Bolivia at the expense of imports from the other markets (See Telleria et al., 2010 for complete results.)

### b) Production and factor use

This section addresses changes in aggregated production and factor use in the Plurinational State of Bolivia. Analysing the domestic production of commodity sectors is important in terms of understanding the general equilibrium demand response simulated in GTAP. Changes in aggregated production refer to total production increased or decreased in the Plurinational State of Bolivia as a result of CAN-EU trade reforms (with or without the Plurinational State of Bolivia). With full liberalisation the model projected the production of Bolivian commodities (which includes domestically consumed and exported commodities) decreased in most mining & extraction of natural resource and heavy manufactures, and increased in most agriculture commodities and light manufactures.

The most noticeable result is observed in the domestic production of textiles and wood products that increased 51.4 and 22.6% annually respectively. This effect is even larger under the scenario with sensitive products, where there is a larger increase in production for those sectors. The driving forces behind these growths were increments in the production of goods for the domestic and goods oriented to international markets. However, the production of some commodity groups also decreased. For example electric equipment and oil seeds decreased (10% and 2.3% per year respectively), which is explained by reductions in domestic production oriented to international markets and a drop in local production oriented to the domestic market.

In general total production of commodity sectors decreased slightly in scenario where the Plurinational State of Bolivia is out of the CAN-EU trade agreement (see Telleria et al., 2010). Yet, few sectors such as oils seeds and sugar cane increased marginally due to a small expansion in exportable production, and a modest contraction in production of domestically traded commodities. In the last scenario (FTA CAN-EU with sensible), the model projected null or minor increments in all domestic production of tradables and non-tradables ('Agriculture', 'Mining and natural resources', 'Light manufactures' and 'Heavy manufactures'), due to small expansions in both domestic production for the local and international markets. In general, for those scenarios where the Plurinational State of Bolivia does not participate in a FTA, production changes are small or negligible.

Finally, changes in factor use (land, labour and capital) are small. With full liberalisation, within agriculture there is factor reallocation between oilseeds and other sectors, as oilseeds use less land (-0.5%), while other sectors use more land, labour and capital. This is mainly due to the decline in production of oilseeds. With liberalisation with sensible products, there is a similar pattern, but with less factor use in oilseeds and sugar cane. Outside agriculture, there is a slight increase in factor use for almost all sectors.

## 3. Tariff revenues

As pointed out by an IMF (2005) report, a subject that has been frequently ignored in trade liberalisation studies is the issue of the loss in government revenues when import tariffs are eliminated. CGE models like GTAP are, for the time being, unable to account for how tariff revenues are replaced with other sources of revenue for the government. However, the tariff structure for the Plurinational State of Bolivia in the GTAP database shows that the Plurinational State of Bolivia is a fairly open economy. This reflects the process of unilateral tariff reduction that the Plurinational State of Bolivia underwent

during the structural adjustment program implemented in the late eighties and early nineties. Thus when tariff reductions were simulated under different scenarios in GTAP, the grade of modifications in the tariff structure of the Plurinational State of Bolivia was not substantial.

Additionally, Bolivian custom office collected (in 2008) about 1000 million dollars from import tariffs worldwide. Out of this amount, about US$ 300 million was collected from firms that imported goods from the European Union.[21] In 2008, these US$ 300 million represented 2.3% of the Bolivian government total expenditure. In the case of a the Plurinational State of Bolivia-EU trade agreement, the potential 2.3% loss in fiscal income for the government of the Plurinational State of Bolivia will have to be covered from domestic taxes or other sources.

Considering that the share of Bolivian imports from the EU has not been large (7% in average between 2004 and 2009 as shown in Figure III.3), we believe that the importance of the EU is in terms of tariff revenues would not be growing. In addition, the Plurinational State of Bolivia imports from the EU capital goods such as machinery (both new and second hand trucks, agricultural equipment), oils, lubricants, textiles (e.g. jerseys, cardigans), medicines, etc which in turn are used as inputs for the production of other final goods. Therefore, the production sector might actually benefit from tariff elimination. However, this is a subject that needs to be addressed more carefully, and which is out of the scope of this research.

## F. Micro-simulation results

This section presents results from the application to the macro-micro simulation approach. These results provide insights into the impact of the different trade scenarios across the various household classifications. This analysis has taken into account the fact that once domestic prices change due to an external factor (such as elimination of import tariffs), prices of commodities might not immediately be transmitted to the different rural and urban areas of a given region/country. In the case of the Plurinational State of Bolivia, we have estimated these coefficients (See Telleria 2010, annex) to allow for price adjustment in less connected markets and low populated areas. The main markets (well connected and relatively more populated) were La Paz, Santa Cruz and Cochabamba, where it was assumed a unitary price transmission; while the less connected markets were Beni, Chuquisaca, Oruro, Pando, Potosí and Tarija which had different transmission coefficients as shown in Table III.10.

**TABLE III.10**
**PRIVATE UTILITY BY DEPARTMENT AND BY RURAL AND URBAN CONDITION**
*(Percentage changes)*

| Department | Zone | Observations | FTA CAN - EU | FTA CAN - EU (no sensitives) | FTA CAN - EU (no Bolivia, Plurinational State of) | FTA CAN - EU (no Bolivia, Plurinational State of, no sensitives) |
|---|---|---|---|---|---|---|
| Beni | Rural | 138 | 0.13 | -0.95 | 0.40 | -0.22 |
| | Urban | 254 | 0.26 | 0.70 | -0.14 | 0.07 |
| Chuquisaca | Rural | 262 | 0.07 | -1.42 | 0.51 | -0.28 |
| | Urban | 211 | 0.32 | 0.79 | -0.16 | 0.07 |
| Cochabamba | Rural | 371 | -0.02 | -0.3 | 0.33 | -0.19 |
| | Urban | 528 | 0.21 | 0.71 | -0.16 | 0.08 |
| La Paz | Rural | 424 | -0.07 | -.94 | 0.30 | -0.17 |

(continues)

[21] Eduardo Rojas, personal communication. Mr. Rojas is the General Manager of the Regional Customs Administration in Cochabamba, Bolivia.

Table III.10 (conclusion)

| Department | Zone | Observations | FTA CAN - EU | FTA CAN - EU (no sensitives) | FTA CAN - EU (no Bolivia, Plurinational State of) | FTA CAN - EU (no Bolivia, Plurinational State of, no sensitives) |
|---|---|---|---|---|---|---|
| Oruro | Urban | 768 | 0.17 | 0.67 | -0.17 | 0.08 |
| | Rural | 238 | 0.19 | -.36 | 0.19 | -0.11 |
| Pando | Urban | 294 | 0.32 | 0.78 | -0.16 | 0.07 |
| | Rural | 92 | 0.00 | -0.56 | 0.21 | -0.12 |
| Potosí | Urban | 44 | 0.24 | 0.68 | -0.14 | 0.07 |
| | Rural | 343 | 0.11 | -0.54 | 0.22 | -0.13 |
| Santa Cruz | Urban | 277 | 0.31 | 0.80 | -0.17 | 0.08 |
| | Rural | 316 | 0.04 | -0.63 | 0.22 | -0.12 |
| Tarija | Urban | 604 | 0.21 | 0.72 | -0.16 | 0.08 |
| | Rural | 199 | 0.08 | -0.89 | 0.32 | -0.17 |
| Total | Urban | 277 | 0.27 | 0.75 | -0.16 | 0.08 |
| | Rural | 2383 | 0.06 | -0.78 | 0.30 | -0.16 |
| | Urban | 3257 | 0.24 | 0.73 | -0.16 | 0.08 |
| | Total | 5640 | 0.20 | 0.59 | -0.14 | 0.06 |

Source: : Authors' estimations based on results micro simulations.

The analysis of the impacts of alternative trade reforms on household economic wellbeing involves computing the private utility equation (equations 2 and 3). This equation uses the resulting price and return to factor changes (generated by GTAP), weighted by price transmission coefficients, for the computation of the difference between Laspeyres index for income and Laspeyres index for expenditure, so producing an estimation of the post-reform private utility at pre-reform quantities. The Laspeyres indices were subsequently normalised to a value of 100 in the base year, to indicate the percentage change in income and expenditure across household classifications. In this investigation we have referred to this process as 'macro-micro simulation approach'

## 1. Changes in prices

Table III.11 shows that, as expected, import prices from the EU into the Plurinational State of Bolivia would decrease as a result of a FTA CAN EU ("EU prices" column). However, domestic prices in the Plurinational State of Bolivia would actually increase in all scenarios, except the last scenario ("FTA CAN – EU, no the Plurinational State of Bolivia, no sensitives"). Why is it that domestic prices in the Plurinational State of Bolivia increase if, with trade liberalization and reduced tariffs, prices are expected to decrease? This is due to general equilibrium impacts that are captured by the model and explained below.

**TABLE III.11**
**SIMULATION EFFECTS ON COMMODITY PRICES AND PRODUCTION FACTORS**
*(In % changes)*

| Commodity/Factors of Production | With Bolivia (Plurinational State of) | | No Bolivia (Plurinational State of) | |
|---|---|---|---|---|
| | FTA CAN-EU | FTA CAN-EU no sensitive | FTA CAN-EU | FTA CAN-EU no sensitives |
| 1. Rice | 2.1 | 0.9 | 0.4 | -0.3 |
| 2. Wheat | 1.6 | 1.1 | 0.2 | -0.2 |
| 3. Cereals | 2.2 | 1.1 | 0.4 | -0.3 |
| 4. VegFruitNuts | 2.3 | 0.9 | 0.3 | -0.3 |
| 5. Oil Seeds | 1.6 | 0.3 | 0.6 | -0.4 |
| 6. Sugar Cane | 1.8 | 0.8 | 0.4 | -0.2 |
| 7. Plants Bas Fib | 1.8 | 1.2 | 0.2 | -0.2 |
| 8. Crops | 2.5 | 1.3 | 0.4 | -0.3 |
| 9. Bov Sheep Go | 1.9 | 0.9 | 0.4 | -0.3 |
| 10. Fore&Fish | 8.0 | 8.0 | 0.1 | -0.1 |
| 11. Oil&Coal | 0.3 | 0.2 | 0.1 | 0.0 |
| 12. Gas | 0.3 | 0.3 | 0.0 | -0.1 |
| 13. Min Extrac | 2.1 | 1.9 | 0.0 | -0.1 |
| 14. BovMeat Pro | 2.0 | 1.2 | 0.2 | -0.2 |
| 15. Veg Oils Fats | 1.4 | 0.5 | 0.5 | -0.3 |
| 16. Dairy Products | 1.9 | 1.4 | 0.2 | -0.2 |
| 17. Processed Rice | 1.9 | 1.2 | 0.2 | -0.2 |
| 18. Sugar | 1.8 | 1.3 | 0.2 | -0.2 |
| 19. Other Food | 1.6 | 0.9 | 0.3 | -0.2 |
| 20. Beverages and Tobacco | 1.7 | 1.3 | 0.1 | -0.1 |
| 21. Textiles | 1.6 | 1.3 | 0.1 | -0.1 |
| 22. Apparel | 1.7 | 1.3 | 0.1 | -0.1 |
| 23. Leather Products | 1.7 | 1.3 | 0.1 | -0.1 |
| 24. Wood Products | 3.2 | 2.9 | 0.1 | -0.1 |
| 25. Paper Products | 1.4 | 1.0 | 0.1 | -0.1 |
| 26. Petroleum Coal | 0.6 | 0.5 | 0.1 | -0.1 |
| 27. Chem Rub Plast | 1.6 | 1.3 | 0.1 | -0.1 |
| 28. Miner Produ | 1.9 | 1.6 | 0.1 | -0.1 |
| 29. Ferr&NonFe | 1.9 | 1.7 | 0.0 | -0.1 |
| 30. Metal Product | 1.4 | 1.1 | 0.1 | -0.1 |
| 31. Motor Vehicle | 1.6 | 1.3 | 0.1 | -0.1 |
| 32. Elect Equipm | 1.7 | 1.3 | 0.1 | -0.1 |
| 33. Machine Equipm | 1.5 | 1.2 | 0.1 | -0.1 |
| 34. Manufact | 1.3 | 1.0 | 0.1 | -0.1 |
| 35. Services | 1.8 | 1.5 | 0.1 | -0.1 |
| Land | 1.7 | -2.9 | 1.7 | -1.0 |
| UnSkilled labour | 2.5 | 2.0 | 0.2 | -0.2 |
| Skilled labour | 2.1 | 1.8 | 0.1 | -0.1 |
| Capital | 2.4 | 2.0 | 0.1 | -0.1 |
| Natural Resources | -0.7 | 0.3 | -0.3 | 0.2 |

Source: Authors' estimations based on results from GTAP 7.0 simulations.

The EU represents for most products in the Plurinational State of Bolivia for less than 10% of total imports. Brazil, Argentina and ROW represent most of the share of imports. Exports to the EU, Ecuador and most products of Colombia increase, while for all other partners decreases. In relative terms, the prices that the Plurinational State of Bolivia pays for these imports from the EU fell relative to imports of other countries. However, relative prices of products from Andean partners, especially Colombia and Ecuador increase for the Plurinational State of Bolivia, relative to the price of other imports. Therefore, the overall impact in the Plurinational State of Bolivia in the first scenario is increased domestic prices.

Under the third and fourth scenarios ("FTA CAN – EU, no the Plurinational State of Bolivia" and "FTA CAN – EU, no the Plurinational State of Bolivia, no sensitives" respectively), percentage

changes in most commodity prices were projected to be either positive or negative, but negligible. This is because in these scenarios it is simulated that the Plurinational State of Bolivia is out of the trade agreement, while changes in prices are due to changes in import tariffs from both the EU and other than the Plurinational State of Bolivia CAN countries.

The effect of the simulations on the income side resulted in mixed results for Bolivian production factors (bottom part of Table III.11). While increments were projected in returns to unskilled labour, skilled labour and capital under the first two scenarios, reductions were projected in natural resources for the first scenario, and in land for the second scenario. In the case of the last two scenarios (where the Plurinational State of Bolivia is out of the agreement) the model projected marginal increments or reductions in all production factors, except in the case of land that increased under the third scenario.

The negative results in natural resources and land are basically explained by their sluggish feature which means that both resources are virtually fixed in the economy. Therefore, when demand for these resources decrease, their prices do so (given that their supply is almost perfectly inelastic). In the first and third scenario the model projected an increase in the demand for land, which leads to an increase in its relative price.

## 2. Changes in private utility

Table III.12 presents the impacts of the trade reforms on households' private utility by department. In general the results indicate that private utility would increase for households under the first two scenarios (FTA CAN-EU with the Plurinational State of Bolivia), and would decrease or remain changeless under the last two scenarios (FTA CAN-EU, but without the Plurinational State of Bolivia). The moderate changes in household private utility reflect the rather small changes in commodity prices and returns to production factors estimated by the CGE model (Table III.12). This outcome is not surprising given the relatively small rates of protection the Plurinational State of Bolivia has been applying to EU products and to the relatively small share EU products into Bolivian markets.

When considered the effect on private utility by region, the urban households benefit more than those the rural department and rural/urban condition shows that urban households tend to benefit more than rural ones under Scenario 1 (FTA CAN-EU). In La Paz and Cochabamba departments private utility is estimated to be negative, though small.[22]

These results indicate that the micro-simulation model has resulted in returns to production factors that overcame higher prices of commodities. i.e., values of the Laspeyres index for income were greater than values of the Laspeyres index for expenditure. With increased prices of commodities, households' expenditure on their consumption bundle became more costly. In the case of urban households, such higher costs were covered by even higher returns to production factors, resulting in a net positive benefit for them (reflected on positive private utility values). In the case of rural households higher costs of the consumption bundle were marginally covered by higher income, or were not in the case of rural households from La Paz and Cochabamba rural areas.

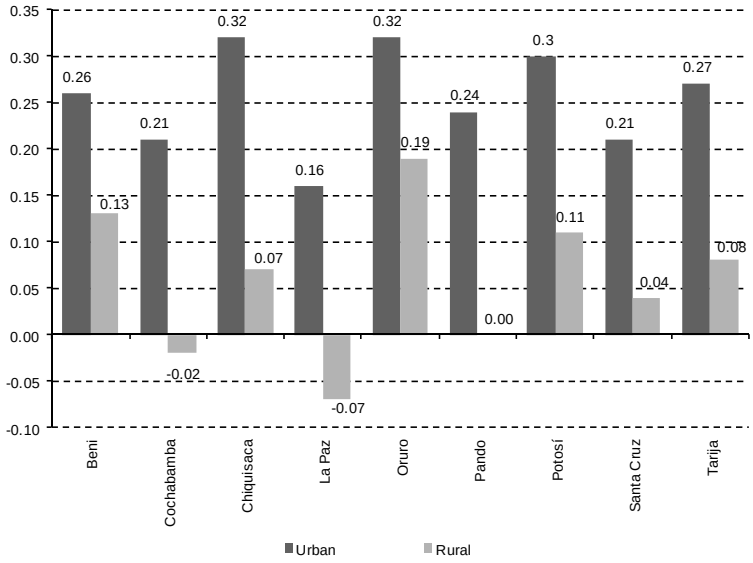
[22] See Telleria et al. (2010), annex 8 for values of private utility for the other three scenarios, where private utility tends to be positive for urban areas, and tends to be negative for most rural ones (except in the case of the third scenario, FTA CAN – EU no Bolivia, where the model predicts negative private utility for urban households).

**TABLE III.12**
**HOUSEHOLD PRIVATE UTILITY BY LIBERALISATION SCENARIO AND DEPARTMENT**
*(Changes)*

| \ | With Bolivia (Plurinational State of) | | No Bolivia (Plurinational State of) | |
|---|---|---|---|---|
| | FTA CAN-EU | FTA CAN-EU (no sensitives) | FTA CAN-EU | FTA CAN-EU (no sensitives) |
| Beni | 0.24 | 0.60 | -0.12 | 0.05 |
| Chuquisaca | 0.24 | 0.43 | -0.57 | 0.02 |
| Cochabamba | 0.16 | 0.59 | -0.14 | 0.07 |
| La Paz | 0.12 | 0.54 | -0.15 | 0.07 |
| Oruro | 0.28 | 0.69 | -0.13 | 0.06 |
| Pando | 0.11 | -0.14 | 0.04 | -0.03 |
| Potosí | 0.25 | 0.57 | -0.11 | 0.05 |
| Santa Cruz | 0.19 | 0.64 | -0.15 | 0.07 |
| Tarija | 0.24 | 0.67 | -0.14 | 0.06 |
| Total | 0.20 | 0.59 | -0.14 | 0.06 |

Source: Authors' estimations based on results from micro-simulations.
Note 1: Due to missing data on household sources of income, 106 questionnaires were excluded from the database. Therefore the analysis was based on 5640 questionnaires.
Note 2: To reduce the impact of extreme values of private utility, the median was used instead of the mean.

**FIGURE III.4**
**PRIVATE UTILITY BY DEPARTMENT AND BY RURAL AND URBAN CONDITION**
*(Percentage changes)*




Source: Authors' estimations based on results from micro-simulations.

The micro-simulation model shows a negative situation for rural households who would not benefit in general from the different CAN-EU trade agreements. At first sight this is not as dramatic as it looks like given that changes in welfare are not large. Yet, considering households in rural areas of the Plurinational State of Bolivia are the poorest in the country, minor changes in welfare might mean difficulties for the most vulnerable ones.

Another perspective is given by Table III.13, which summarises results of household private utility by income group. As a consequence of the CAN – EU liberalisation reforms with and without

sensitive commodities (first two scenarios), the private utilities of households included in the income category '389.71 – 694.95' Bs/month and above are projected to increase, while the private utility of the poorest household income group ('<= 389.7') is projected to either decrease (Scenario 2) or insignificantly increase (Scenario 1).

Under the third scenario (trade agreement without the Plurinational State of Bolivia), the private utility of all household groups (except the poorest income group) is projected to increase. Under the fourth scenario (no the Plurinational State of Bolivia, no sensitive commodities), the opposite is projected. That is, only the private utility of household heads belonging to the poorest income category ('<= 389.7') is projected to be negative, while the private utilities of the rest of the income groups are projected to negligible increase. The results show that a scenario in which the Plurinational State of Bolivia is not included in a FTA with the European Union results in the worse outcome for the country's households.

**TABLE III.12**
**PRIVATE UTILITY BY PER LIBERALISATION SCENARIO AND INCOME CATEGORY**

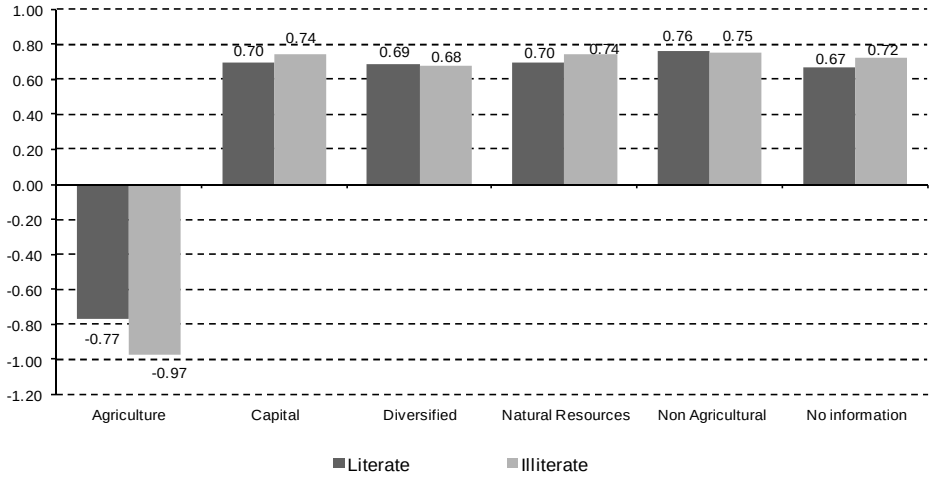
| Income category (Bs/month) | With Bolivia (Plurinational State of) | | Without Bolivia (Plurinational State of) | |
|---|---|---|---|---|
| | FTA CAN-EU | FTA CAN-EU (no sensitives) | FTA CAN-EU | FTA CAN-EU (no sensitives) |
| Sextile I: <= 390 | 0.08 | -0.69 | 0.25 | -0.14 |
| Sextile II: 390 - 695 | 0.21 | 0.56 | -0.13 | 0.05 |
| Sextile III: 695 – 1 033 | 0.22 | 0.59 | -0.14 | 0.06 |
| Sextile IV: 1 033 – 1 538 | 0.22 | 0.63 | -0.15 | 0.07 |
| Sextile V: 1 538 – 2 547 | 0.20 | 0.64 | -0.15 | 0.07 |
| Sextile VI: > 2 547 | 0.21 | 0.64 | -0.15 | 0.07 |
| Total | 0.20 | 0.59 | -0.14 | 0.06 |

Source: Authors' estimations based on results from micro-simulations.
Note 1: Due to missing data on household sources of income, 106 questionnaires were excluded from the database. Therefore analysis was done based on 5640 questionnaires.
Note 2: To reduce the impact of extreme values of private utility, the median was used instead of the mean.

The results that combine information on households' education group, production factors and private utility level for Scenario 2 (FTA CAN – EU, no sensitives) confirm that the most vulnerable households (i.e. depending mainly on agriculture for their livelihoods) would be worst-off as a result of a trade agreement with the EU (see Telleria et al., 2010). Households depending on the rest of production factor categories (capital, natural resources, non-agriculture and diversified resources) would be better-off. Generally, scenarios that simulate a trade agreement with the Plurinational State of Bolivia included are the most advantageous for Bolivian households (except in the cases of households that obtain a significant share of their income from agricultural activities). The results are irrespective of the literacy in the households as both tend to gain with the agreement, except again in the case of those households that get most of their income from agriculture.

Overall results support the conclusion that households in the Plurinational State of Bolivia would suffer from not signing into an FTA with the European Union. Nonetheless, FTAs also have unintended consequences especially for the poorest and rural households. Therefore the government should consider implementing compensatory policies if decides to engage into a trade agreement with the EU. Complementarily, Page (2008) suggests that countries should not assume that trade agreements alone will automatically generate development benefits, and that the evidence from Latin America advocates for introducing complementary policies both directly and indirectly.

**FIGURE III.5**
**PRIVATE UTILITY BY PRODUCTION FACTOR AND EDUCATION GROUP**




Source: Authors' estimations based on results from micro-simulations.

The combined macro-micro results suggest that economic growth could contribute to poverty reduction. In general, there seems to be some agreement on the positive effects of economic growth on poverty reduction. For example, Giordano (2009) reports that according to the World Development Report 2001 a value of two is observed in developing countries in the elasticity of income to poverty reduction. That is, a one percent increase in real income reduces headcount poverty by two percent. Cragg and Epelbaum (1996) suggest that, in the long-run, returns to skill labour have risen in Mexico as a result of trade liberalisation in the late 80s and early 90s. In Colombia, which reduced also drastically tariffs in early 90s, returns to skilled labour also increased due to an increase in the demand for skilled workers (Attanasio et al., 2003). Winters (2003) reports that trade liberalisation was associated with a marked acceleration in formal employment creation.

## G. Conclusions and recommendations

The core conclusion of this research is that a CAN – EU trade agreement that includes the Plurinational State of Bolivia is a superior alternative to maintaining the status quo. This conclusion draws from the most important findings the macro-micro simulations. The macro simulation supports the conclusion that an agreement with the EU is the best trade setting for the Bolivian economy as a whole. The micro simulation found that such scenarios that were the most advantageous trade setting where benefits would be distributed across most household groups of Bolivian society. The scenarios that exclude the Plurinational State of Bolivia from the CAN – EU trade agreement were repetitively projected to be the worst trading picture for both the Bolivian macroeconomic performance and the economic wellbeing of its households.

At a household level, the micro-simulation model projected that the economy-wide trade liberalisation settings resulted in higher benefits for most household groups, while the scenarios that simulate a trade agreement but without the Plurinational State of Bolivia, private utility tends to be negative or marginally positive. Yet, compensatory or complementary policies are recommended for the poorest income groups if the Plurinational State of Bolivia decides to engage into a trade agreement with the EU.

We recognise that trade reforms by themselves do not achieve substantive changes in poverty reduction. We would recommend carrying them out in association with macroeconomic stabilization

policies, deregulation, technological improvement policies, and other policies that fit better for the domestic development.

We consider that the Plurinational State of Bolivia should not remain apart from the liberalisation processes that characterise the current globalised economy. The other CAN countries (Colombia, Ecuador and Peru) already started negotiations with the EU towards a trade agreement. If the Plurinational State of Bolivia is unable to make the EU to lower its domestic tariffs for Bolivian products, it will lose competitiveness in comparison with Colombian, Ecuadorian and Peruvian goods and services as EU import tariffs for them will be reduced or eliminated. To keep its market share the Plurinational State of Bolivia has to react implementing a trade policy that will keeps open market niches for Bolivian products.

The Plurinational State of Bolivia already applies low tariffs to EU goods. Therefore, the sacrifice the government would have to do would not be huge, and there is more to gain in terms of access to the EU market than to lose in terms of tariff elimination. The Plurinational State of Bolivia already left itself out of the agreement with the US (the largest importer in the world), and now has to consider carefully if it is really convenient to be once more out of a trade agreement with an important market like the EU (the second largest importer in the world).

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# IV. The rise in global demand for ethanol and poverty in Brazil

***Joaquim Bento de Souza Ferreira Filho***

## A. Introduction

Brazil has traditionally been one of the most important sugarcane and ethanol producers. Since 1975, when the National Ethanol Program (Programa Nacional do Alcool – Proalcool) was created, the country has produced fuel ethanol on a large scale. The increase in sugar exports in the nineties, which competed with inputs to ethanol production, caused rationing in the Brazilian ethanol market and a decline in consumption, which lasted until 2003.

Since then the scenario for ethanol has again substantially changed. The development of flex-fuel engines (which can use either ethanol or gasoline) and the rise in oil prices granted new status to ethanol as a fuel in Brazil, allowing consumers to choose between both, depending on relative prices. According to a study of the Ministry of Energy and Mining (EPE, 2008a), in 2008 ethanol was already economically viable in 19 out of 26 states in Brazil. The expansion of the Brazilian economy in the last years dramatically increased the sales of new cars, most of them with flex-fuel engines. According to an EPE (2008a) study, from January to June, 2008, flex-fuel vehicles accounted for 87.4% of new sales of light vehicles in Brazil. Still according to that study, the demand for hydrated ethanol in 2017 is projected to be about 73% of total demand of liquid fuels (Otto cycle) in the country. This would represent a total demand for ethanol in 2017 of around 52.3 million liters, against the present use of 20.3 million liters in 2008.

Ethanol exports are also expected to increase greatly. From 4.2 trillion liters in 2008, total exports are projected to double by 2017, reaching around 8.3 trillion liters. And, finally, ethanol used in the chemical industry is also projected to increase substantially until 2017, with new industrial plants already under construction in Brazil (MME, 2008).

Several leading Brazilian institutions have recently produced scenarios for the ethanol and sugarcane expansions in Brazil. These scenarios comprise, in general, the increase in the sugarcane supply, land use, ethanol and energy generation, as well as projections for the demand side. A much less studied issue, however, is the social impacts to be expected with such an expansion. The

technology of sugarcane production differs significantly across Brazil's regions. The same can be said about the structure of land ownership, which suggests that the pattern of sugarcane expansion will be key to distributional outcomes.

Ferreira Filho and Cunha Filho (2008), for example, showed that the sugarcane produced in Northeast Brazil is more labor intensive than the one produced in Southeast Brazil. Moreover, those regions also differ in terms of the structure of labor demand in agriculture in general, and in sugarcane in particular, with the Northeast demanding proportionately more low-skill workers than the Southeast, which demands more high-skill workers (Ferreira Filho and Cunha Filho, 2008).

Agriculture is a key sector of Brazil's economy. With strong forward and backward linkages, agriculture accounted for 5.5% of total Brazilian GDP in 2006 (IBGE, 2008), and rural population still accounted for about 19% of total population in 2003. It is natural, then, that changes in the agricultural sector have important impacts in the economy as a whole. Due to its particular characteristics in the labor market, as a food supplier and as an energy supply source, these impacts are of complex nature, with net results depending largely on the structural characteristics of the economy. The impacts of the projected sugarcane and ethanol expansion in Brazil upon labor demand, income distribution and poverty in the country is the object of this study.

## B. Objective

The objective of this paper is to assess the social effects of the projected increase in domestic and world demand for ethanol on the Brazilian economy. Of particular interest in the analysis will be the effects on labor demand in the country, both in the agricultural sector and in the whole economy, and its consequences on household income distribution. The analysis will be conducted at the micro level, in order to allow the assessment of income distribution effects. Labor demand in agriculture will be disaggregated in order to allow the analysis of different kinds of workers. The regional dimension inside Brazil will be highlighted.

## C. Methodology

A computable general equilibrium (CGE) model of the Brazilian economy will be used to assess the economic and distributional impact of the prospective increase in ethanol production increase in Brazil. The core CGE model is linked to a micro-simulation model of Brazil, and has its theoretical structure based on previous work of Ferreira Filho and Horridge (2006), Ferreira Filho, Santos and Lima (2007) and Ferreira Filho and Horridge (2008).

The model database used in this paper, however, is a new 2005 database. It is based on the Brazilian Input Output tables for the year 2005 and the Brazilian National Household Survey (Pesquisa Nacional por Amostragens de Domicílios – PNAD), for the year 2005 (IBGE, 2005). The main features of the model are as follows.

The CGE model used here, TERM-BR, is a static inter-regional model of Brazil based on the TERME model of Australia (Horridge, Madden and Wittwer, 2005). It consists, in essence, of 27 separate CGE models (one for each Brazilian state), linked by the markets for goods and factors. For each region, each industry and final demander combines Brazilian and imported versions of each commodity to produce a user-specific constant elasticity of substitution (CES) composite good. Household consumption of these domestic/imported composites is modeled through the Linear Expenditure System, while intermediate demand has a Leontief (fixed proportions) structure. Industry demands for primary factors follow a CES pattern, while labor is itself a CES function of 10 different labor types. These different labor types are classified according to wages, as a proxy for skills. The model distinguishes 35 producing sectors (or industries) and 35 commodities. Agricultural land is

distributed among the agricultural activities through a CET frontier. Export volumes are determined by constant-elasticity foreign demand schedules.

These regional CGE models are linked by trade in goods underpinned by large arrays of inter-regional trade that record, for each commodity, source region and destination region, the values of Brazilian and foreign goods transported, as well as the associated transport or trade margins. São Paulo users of, say, vegetables substitute between vegetables produced in the 27 states according to their relative prices, under a CES demand system.

With 27 regions, 35 industries, 35 commodities, and 10 labor types, the model contains around 650 thousand non-linear equations. It is solved with GEMPACK (Harrison and Pearson, 1996). The CGE model is calibrated with data from two main sources: the 2005 Brazilian Input-Output Matrix, and some shares derived from the Pesquisa Agrícola Municipal (IBGE, 2005, available at http://ibge.gov.br).

On the income generation side of the model, workers are divided into 10 different categories (occupations), according to their wages. Together with the revenues from other endowments (capital and land rents) these wages contribute to regional household incomes. Each industry in each region uses a particular mix of the 10 different labor occupations (skills). Changes in activity level change employment by sector and region. This drives changes in poverty and income distribution. Using the expenditure survey (POF, mentioned below) data the CGE model was extended to cover 270 different expenditure patterns, composed of 10 different household income classes in 27 regions. In this way, all the expenditure-side detail of the micro-simulation dataset is incorporated within the main CGE model.

There are two main sources of information for the household micro-simulation model: the Pesquisa Nacional por Amostragem de Domicílios –PNAD (National Household Survey – IBGE, 2005), and the Pesquisa de Orçamentos Familiares- POF (Household Expenditure Survey, IBGE, 2004). The PNAD contains information about households and persons. The main data extracted from PNAD were wage by industry and region, as well as other personal characteristics such as years of schooling, sex, age, position in the family, and other socio-economic details.

The POF, on the other hand, is an expenditure survey that covers all the metropolitan regions in Brazil. It was undertaken during 2002-2003, and covered 48,470 households in all states, with the purpose of updating the consumption bundle structure. The main information drawn from this survey was the expenditure patterns of 10 different income classes, for each state. One such pattern was assigned to each individual PNAD household, according to region and income class. After preparation, the micro-simulation database comprises 293,048 persons (older than 15 years old) and 126,007 households.

The CGE and the micro-simulation (MS) models are run sequentially, with consistency between the two models assured by constraining the micro-simulation model to agree with the CGE model. The CGE model is sufficiently detailed, and its categories and data are close enough to those of the MS model that the CGE model predicts MS aggregate behavior (that is also included in the CGE model, such as household demands or labor supplies) very closely. The role of the MS model is to provide extra information about the variance of income within income groups, or about the incidence of price and wage changes upon groups not identified by the CGE model, such as groups identified by ethnic type, educational level, or family status. Note that each household in the micro data set has one of the 270 expenditure patterns identified in the main CGE model. There is very little scope for the MS to disagree with the CGE model.

The simulation starts with a set of shocks to the model. The shocks are applied, and the results calculated for 35 commodities, 35 industries, 10 households and 10 labor occupations, all of which vary by 27 regions. Next, the results from the CGE model are used to update the MS model. At first, this update consists basically in updating wages and hours worked for the 293,048 workers in the sample. These changes have a regional (27 regions) as well as sector (42 industries) dimension.

The model then relocates jobs according to changes in labor demand. This is done by changing the PNAD weight of each worker in order to mimic the change in employment. In this

approach, then, there is a true job relocation process going on. Although the job relocation has very little effect on the distribution of wage income between the 270 household groups identified by the CGE model, it may have considerable impact on the variance of income within a group.

One final point about the procedure used in this paper should be stressed. Although the changes in the labor market are simulated for each adult in the labor force, the changes in incomes and expenditures are tracked back to the household dimension. A PNAD key links persons to households, which contain one or more adults, either working in a particular sector and occupation, or unemployed, as well as dependents. Thus the model can compute changes in household incomes from the changes in individuals' employment and wages. This is a very important aspect of the model, since it is likely that family income variations are cushioned, in general, by this procedure. If, for example, one person in some household loses his job but another in the same household gets a new job, household income may change little (or even increase). Since households are the expenditure units in the model, we would expect household spending variations to be smoothed by this income pooling effect. On the other hand, the loss of a job will increase poverty more if the displaced worker is the sole earner in a household.

## D. Poverty and income distribution in Brazil in the 2005 reference year

Despite recent improvement, income in Brazil is still very concentrated. If household income is split in ten groups, as displayed in Table IV.1, it can be seen that the first five income household groups (POF 1 to POF 5), while accounting for 67.8% of population, get only 29.3% of total household income. The two richest groups, on the other hand, while accounting for just 9.9% of the population, get 41.6% of total household income.

The poverty line used in this study was set at one third of the average household income.[23] Based on this poverty line about 28% of the Brazilian households would be poor in 2005. [24]

The figures in Table IV.1 also show how each POF group contributes to the Foster-Greer-Thorbecke (1984) (FGT, for short) overall measures of poverty: FGT0 —the proportion of poor households (i.e., below the poverty line) and FGT1— the average poverty gap ratio (proportion by which household income falls below the poverty line). It can be seen from Table IV.1 that the share below poverty line is very high until the third household income group, and that the poverty gap is very high among the poorest household group, around 50%. Actually, this household group contributes to around 66% of the national poverty gap.

**TABLE IV.1**
**BRAZIL: POVERTY AND INCOME DISTRIBUTION, 2005**

| Household income group | Proportion of population | Proportion of income | Share below poverty line (FGT0) | Household contribution to FGT0 | Average poverty gap (FGT1) | Household contribution toFGT1 |
|---|---|---|---|---|---|---|
| 1 POF[1] (poorest) | 14.1 | 2.3 | 0.85 | 0.14 | 0.50 | 0.08 |
| 2 POF[2] | 14.0 | 4.2 | 0.62 | 0.09 | 0.18 | 0.02 |
| 3 POF[3] | 21.0 | 10.1 | 0.20 | 0.04 | 0.03 | 0.01 |
| 4 POF[4] | 7.7 | 4.7 | 0.05 | 0.00 | 0.01 | 0.00 |

(continues)

[23] Rocha (2006), working with a set of regional poverty lines, obtained a 0.332 headcount ratio for 2004, which would amount to 57,698,000 poor people.

[24] Rocha (2006), working with a set of regional poverty lines, obtained a 0.332 headcount ratio for 2004, which would amount to 57,698,000 poor people.

Table IV.1 (conclusion)

| Household income group | Proportion of population | Proportion of income | Share below poverty line (FGT0) | Household contribution to FGT0 | Average poverty gap (FGT1) | Household contribution toFGT1 |
|---|---|---|---|---|---|---|
| 5 POF[5] | 10.9 | 8.4 | 0.01 | 0.00 | 0.00 | 0.00 |
| 6 POF[6] | 7.2 | 7.0 | 0.00 | 0.00 | 0.00 | 0.00 |
| 7 POF[7] | 9.9 | 12.6 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8 POF[8] | 5.3 | 9.2 | 0 | 0 | 0 | 0 |
| 9 POF[9] | 4.8 | 11.8 | 0 | 0 | 0 | 0 |
| 10 POF[10] (richest) | 5.2 | 29.7 | 0 | 0 | 0 | 0 |
| National Values | 100.00 | 100.00 | 0.28 | Sum = 0.28 | 0.12 | Sum = 0.12 |
| GINI | 0.55 | | | | | |

Source: Authors calculations based on “Pesquisa de Orçamentos Familiares”, IBGE.

Brazil is a large, heterogeneous country, with important regional differences in poverty and income distribution. These differences are shown in Table IV.2.

The most densely populated regions are the Northeast region (NE), with 27.83% of total population, and the SE region, with 42.51% of Brazil's population. The Northeast and North regions present the higher relative poverty levels, or share of regional population below the poverty line. When one takes into account the size of the population, however, São Paulo and Minas Gerais (both in the Southeast region of Brazil) are, with Bahia, the most important contributors to the national headcount ratio (FGT0),[25] , as can be seen from the fifth column in Table IV.2. São Paulo is also the most important regional contributor to the poverty gap.

**TABLE IV.2**
**BRAZIL: REGIONAL POVERTY AND INCOME INEQUALITY FIGURES, 2005**

| Regions | Macro-regions [a] | Regional population share in total population | Proportion of poor households in regional population (FGT0) | Regional contribution to total FGT0 | Regional Average Poverty Gap (FGT1) | Regional Contribution to total Poverty Gap |
|---|---|---|---|---|---|---|
| 1 Rondonia | N | 0.80 | 0.29 | 0.00 | 0.10 | 0.00 |
| 2 Acre | N | 0.30 | 0.43 | 0.00 | 0.17 | 0.00 |
| 3 Amazonas | N | 1.58 | 0.33 | 0.01 | 0.13 | 0.00 |
| 4 Roraima | N | 0.19 | 0.41 | 0.00 | 0.18 | 0.00 |
| 5 Pará | N | 3.41 | 0.41 | 0.01 | 0.17 | 0.01 |
| 6 Amapá | N | 0.29 | 0.30 | 0.00 | 0.11 | 0.00 |
| 7 Tocantins | N | 0.67 | 0.37 | 0.00 | 0.14 | 0.00 |
| 8 Maranhão | NE | 3.03 | 0.58 | 0.02 | 0.28 | 0.01 |
| 9 Piauí | NE | 1.57 | 0.54 | 0.01 | 0.28 | 0.00 |
| 10 Ceará | NE | 4.20 | 0.50 | 0.02 | 0.23 | 0.01 |
| 11 RGNorte | NE | 1.60 | 0.45 | 0.01 | 0.19 | 0.00 |
| 12 Paraíba | NE | 1.91 | 0.46 | 0.01 | 0.20 | 0.00 |
| 13 Pernambuco | NE | 4.43 | 0.48 | 0.02 | 0.22 | 0.01 |
| 14 Alagoas | NE | 1.52 | 0.56 | 0.01 | 0.25 | 0.00 |
| 15 Sergipe | NE | 1.07 | 0.43 | 0.00 | 0.18 | 0.00 |
| 16 Bahia | NE | 7.27 | 0.46 | 0.03 | 0.20 | 0.01 |

(continues)

[25] São Paulo and Minas Gerais are two of the most industrialized states in Brazil.

Table IV.2 (conclusion)

| Regions | Macro-regions [a] | Regional population share in total population | Proportion of poor households in regional population (FGT0) | Regional contribution to total FGT0 | Regional Average Poverty Gap (FGT1) | Regional Contribution to total Poverty Gap |
|---|---|---|---|---|---|---|
| 17 MinasG | SE | 10.67 | 0.24 | 0.03 | 0.09 | 0.01 |
| 18 EspSanto | SE | 1.87 | 0.25 | 0.00 | 0.10 | 0.00 |
| 19 RioJaneiro | SE | 8.75 | 0.19 | 0.02 | 0.08 | 0.01 |
| 20 São Paulo | SE | 22.78 | 0.15 | 0.03 | 0.06 | 0.01 |
| 21 Paraná | S | 5.65 | 0.18 | 0.01 | 0.07 | 0.00 |
| 22 StaCatari | S | 3.25 | 0.10 | 0.00 | 0.04 | 0.00 |
| 23 RGSul | S | 6.14 | 0.15 | 0.01 | 0.06 | 0.00 |
| 24 MtGrSul | CW | 1.23 | 0.24 | 0.00 | 0.09 | 0.00 |
| 25 MtGrosso | CW | 1.50 | 0.23 | 0.00 | 0.08 | 0.00 |
| 26 Goiás | CW | 3.06 | 0.24 | 0.01 | 0.09 | 0.00 |
| 27 DF | CW | 1.25 | 0.19 | 0.00 | 0.09 | 0.00 |
| Total | Brazil | 100 | - | 0.28 | - | 0.12 |

Source: Authors calculations based on "Pesquisa de Orçamentos Familiares", IBGE.
[a] Macro-Regions: N = North; NE = North-East; SE = South-East; S = South; CW = Centerwest.

The joint analysis of Table IV.3 and Table IV.4 brings important information for the problem at hand. Table IV.3 shows the structure of labor use by production sector in Brazil. The 35 industries have been aggregated to 5 for reporting purposes. The first line shows the upper limit, in year 2005 Reais, of the value of each wage class. For example, the wage class OCC2 includes monthly wages ranging from R$150 to R$250, and so on. The last wage class, OCC10, includes all monthly wages higher than R$2,000.00 in 2005 values.[26]

The table shows that Agriculture accounts for about 50.2% and 47.8% of total use (wages) of the less skilled (lowest wages) workers in Brazil, respectively wage classes OCC1 and OCC2, while the other sectors account for a larger share of workers in the higher wage classes. The Service sector is also an important employer of poorer workers.

**TABLE IV.3**
**BRAZIL: USE OF LABOR BY EACH AGGREGATED ACTIVITY, SHARES, 2005**

| | Wage classes | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sectors | OCC1 | OCC2 | OCC3 | OCC4 | OCC5 | OCC6 | OCC7 | OCC8 | OCC9 | OCC10 |
| Limit (R$) | 150 | 250 | 300 | 350 | 400 | 500 | 620 | 900 | 1500 | open |
| Agropec | 0.50 | 0.44 | 0.17 | 0.19 | 0.13 | 0.10 | 0.08 | 0.05 | 0.04 | 0.06 |
| ExtratMin | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 |
| Manufact | 0.06 | 0.06 | 0.10 | 0.13 | 0.13 | 0.15 | 0.16 | 0.17 | 0.15 | 0.15 |
| FoodInd | 0.02 | 0.03 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 | 0.01 |
| Services | 0.41 | 0.47 | 0.71 | 0.65 | 0.70 | 0.71 | 0.73 | 0.74 | 0.78 | 0.78 |
| Total | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Source: Authors calculations based on "Pesquisa de Orçamentos Familiares", IBGE.

Table IV.4 brings information about the income composition of household classes in Brazil (POF1 to POF10, after the Pesquisa de Orçamentos Familiares – POF, the expenditure survey), the expenditure units in the model. Unsurprisingly, the income of the poorest households is mostly composed of wages coming from the worst-paid workers. The income of the poorest household

[26] For the sake of reference, the monthly weighted average value of the minimum wage in Brazil in 2005 was R$286.66 (4 months at R$260.0 and 8 months at R$300). Roughly speaking, then, OCC3 is around the limit of the minimum wage value.

(POF1), for example, is almost entirely composed of wages coming from the three lowest wage groups (OCC1 to OCC3), the less skilled workers in the economy.

**TABLE IV.4**
**BRAZIL: HOUSEHOLD INCOME COMPOSITION ACCORDING TO WORKER'S WAGE CLASS, 2005**

| | OCC1 | OCC2 | OCC3 | OCC4 | OCC5 | OCC6 | OCC7 | OCC8 | OCC9 | OCC10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| POF[1][a] | 0.243 | 0.242 | 0.516 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| POF[2] | 0.107 | 0.118 | 0.165 | 0.121 | 0.207 | 0.282 | 0 | 0 | 0 | 0 | 1 |
| POF[3] | 0.056 | 0.083 | 0.179 | 0.058 | 0.105 | 0.138 | 0.194 | 0.186 | 0 | 0 | 1 |
| POF[4] | 0.040 | 0.066 | 0.144 | 0.051 | 0.088 | 0.162 | 0.192 | 0.222 | 0.036 | 0 | 1 |
| POF[5] | 0.020 | 0.042 | 0.089 | 0.034 | 0.075 | 0.134 | 0.148 | 0.216 | 0.242 | 0 | 1 |
| POF[6] | 0.012 | 0.026 | 0.067 | 0.024 | 0.055 | 0.105 | 0.112 | 0.235 | 0.362 | 0.002 | 1 |
| POF[7] | 0.006 | 0.016 | 0.038 | 0.018 | 0.039 | 0.075 | 0.086 | 0.175 | 0.340 | 0.206 | 1 |
| POF[8] | 0.002 | 0.008 | 0.022 | 0.009 | 0.023 | 0.048 | 0.051 | 0.126 | 0.297 | 0.414 | 1 |
| POF[9] | 0.001 | 0.004 | 0.010 | 0.004 | 0.011 | 0.023 | 0.026 | 0.063 | 0.205 | 0.652 | 1 |
| POF[10] | 0.000 | 0.001 | 0.003 | 0.001 | 0.002 | 0.005 | 0.006 | 0.014 | 0.060 | 0.907 | 1 |

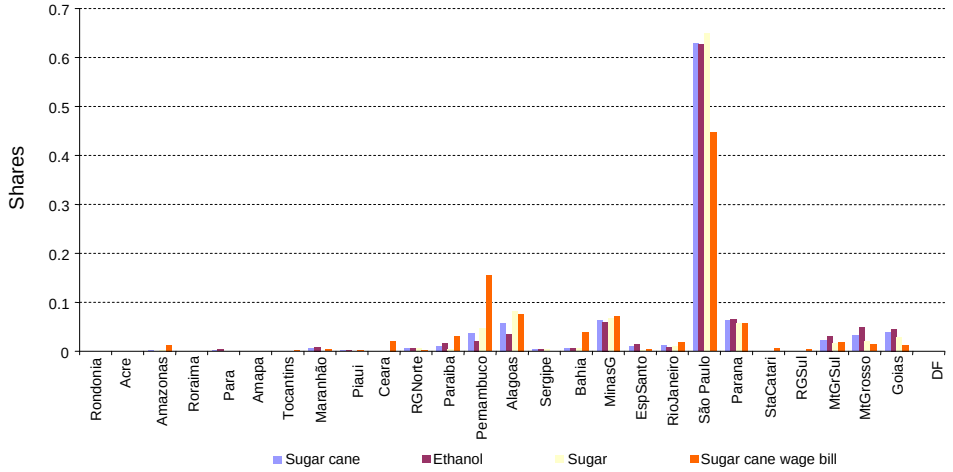
Source: Authors calculations based on "Pesquisa de Orçamentos Familiares", IBGE.
[a] POF1 is the poorest, POF10 the richest.

## E. Labor demand composition in the sugarcane production complex in Brazil

Throughout the text the term "sugarcane complex" will be used to refer to sugarcane, ethanol and sugar production. Information obtained from PNAD shows the structure of labor demand, distinguished by sector, labor type, and region. This is important for this study. There are technological differences in the ethanol production chain inside Brazil; particularly in the labor composition of cane growing. According to PNAD, in 2005 there were 597,532 workers in sugarcane production, 79,901 in ethanol production and 119,746 in sugar production. Primary sugarcane, then, has a prominent role in labor income composition of the sugarcane complex in Brazil.

The first thing to take into account in this discussion is the regional distribution of sugarcane production in Brazil, shown in Figure IV.1, which also shows the regional wage bill share in sugarcane production and the regional shares of labor force in the sugarcane production activity.

**FIGURE IV.1**
**SUGARCANE COMPLEX GEOGRAPHICAL DISTRIBUTION IN BRAZIL (SHARES), 2005**




Source: Authors calculations based on "Pesquisa de Orçamentos Familiares", IBGE.

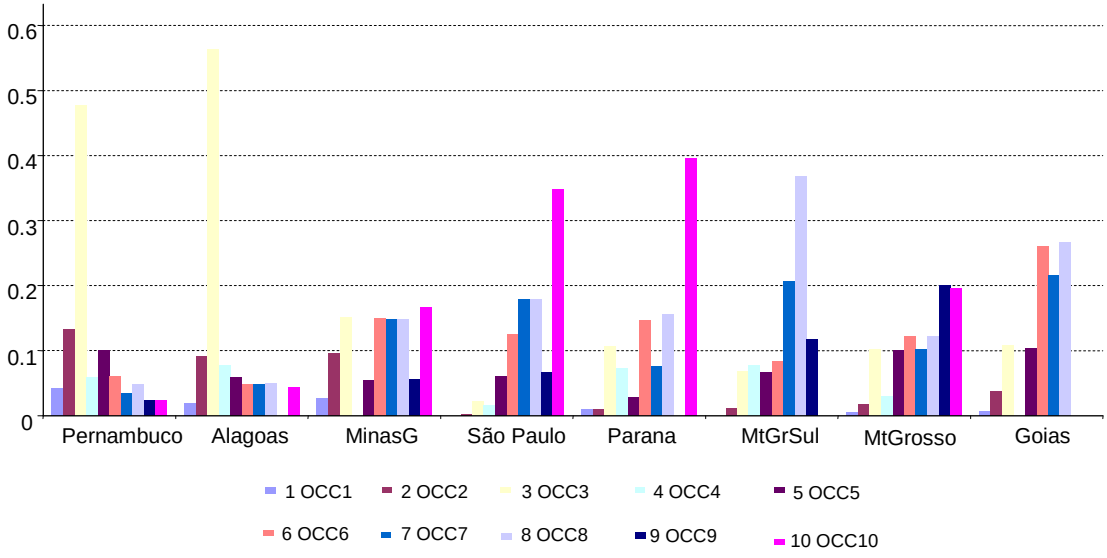
The figure shows that production is concentrated in São Paulo, the most industrialized state, which in 2005 still produced more sugar than ethanol. Another point to note is the almost perfect correlation of production of the three products (sugarcane, ethanol plus sugar) in the same regions. Sugarcane is bulky and cannot be transported far —forcing processing to occur close to growing. The sugar/ethanol ratio, however, varies between regions.

Note also the contrast between the total wage bill shares and the regional production shares. In Figure IV.1, the Northeast states (Maranhão, Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe and Bahia), though responsible for just 12.6% of total sugarcane production, account for 32.7% of wages in the sector. The NE states (of which Pernambuco and Alagoas are the most important) are much more labor intensive in sugar cane production than São Paulo, the most important producer. São Paulo, on the other hand, while accounting for 26.3% of the total labor force in sugarcane production, pays 44.7% of the total labor bill in the activity, pointing to an above-average wage in this state, in contrast to lower wages in Pernambuco, Alagoas and Minas Gerais.

Two states in Northeast Brazil, Pernambuco and Alagoas deserve special attention for this study. They are the most important states in the sugarcane complex production in Northeast Brazil. As can be seen in Figure IV.1, Pernambuco (a larger state with a larger population, see Table IV.2) produces less of both ethanol and sugar than Alagoas, a smaller state. Pernambuco has a more diversified economic structure, which implies that the sugarcane complex value of production has a smaller share in the state's total value of production. Indeed, database values show that the sugarcane complex (sugarcane, ethanol and sugar) account for 2.7% of total value of production (all producing activities) in Pernambuco, against 15.1% in Alagoas. The ratio of the value of production of sugar/ethanol is almost the same in both states, being 3.55 in Pernambuco against 3.71 in Alagoas.

Notice too that the states in the Centerwest region (Mato Grosso do Sul, Mato Grosso and Goiás), in which the sugarcane expansion is much more recent, produce more ethanol, rather than sugar. The wage bill shares of those regions are much smaller than the ethanol production shares, pointing to a more capital-intensive sugarcane production. Indeed, the flat lands and sparse populations of these regions favor mechanization, including mechanical harvesting, in contrast to the NE regions, where the bulk of the sugarcane is still manually harvested. The distribution of labor bill in sugar cane production by region, according to occupational wages can be seen in Figure IV.2.

**FIGURE IV.2**
**SHARE OF LABOR BILL IN SUGAR CANE PRODUCTION, BY OCCUPATIONAL WAGES AND BY REGION. 2005**

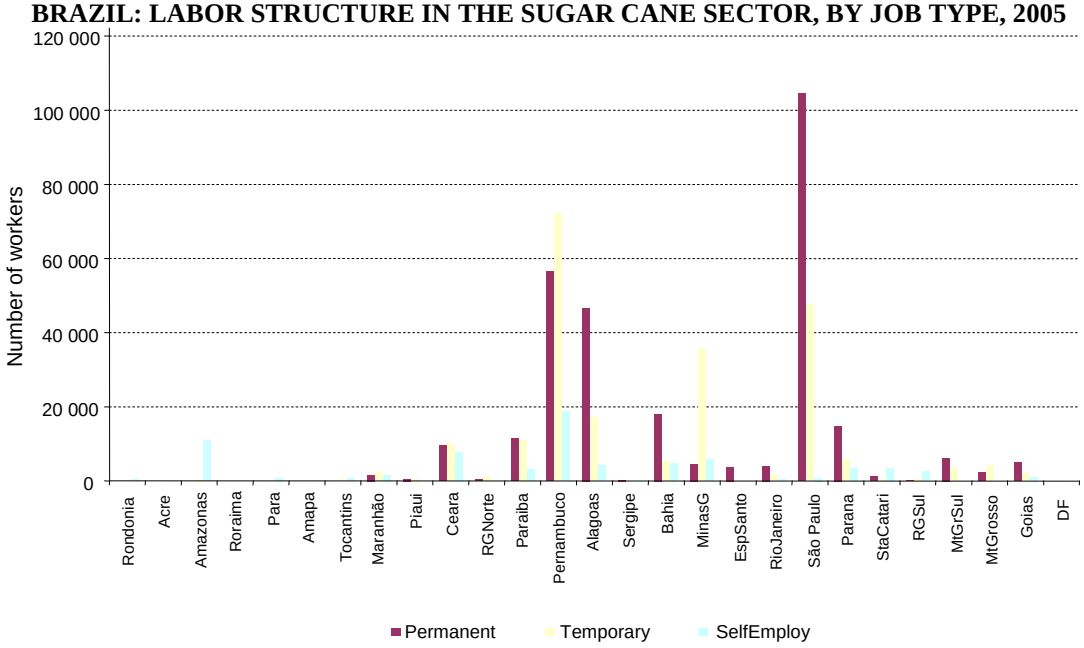



Source: Authors calculations based on "Pesquisa de Orçamentos Familiares", IBGE.

In Figure IV.2 only the most important states in sugarcane production are listed, to avoid clutter. The Northeast states (Pernambuco and Alagoas) specialize in employing the less skilled workers (OCC1 to OCC3), while São Paulo (the most important producing state) concentrates in the middle to upper range. The first three occupational groups account for 65.2% and 67.4% respectively in Pernambuco and Alagoas, and only 2.4% in São Paulo. Goiás, which is representative of the new expansion area (together with Mato Grosso do Sul and Mato Grosso), has a labor demand pattern strongly concentrated on the upper wage groups, or more skilled workers. This seems to be the pattern of labor demand in the new areas, bringing important consequences for income distribution.

Another informative way of looking at the structure of labor demand in the sugar cane complex is by analyzing the type of worker in the agricultural sector according to its contractual status, that is, if the worker is a permanent worker, temporary worker of a self employed worker. This information is largely gathered from the PNAD 2005 survey, since the microdata of the Brazilian Agricultural Census is not yet available, and can be seen in Figure IV.3.

**FIGURE IV.3**
**BRAZIL: LABOR STRUCTURE IN THE SUGAR CANE SECTOR, BY JOB TYPE, 2005**




Source: Authors calculations based on "Pesquisa de Orçamentos Familiares", IBGE.

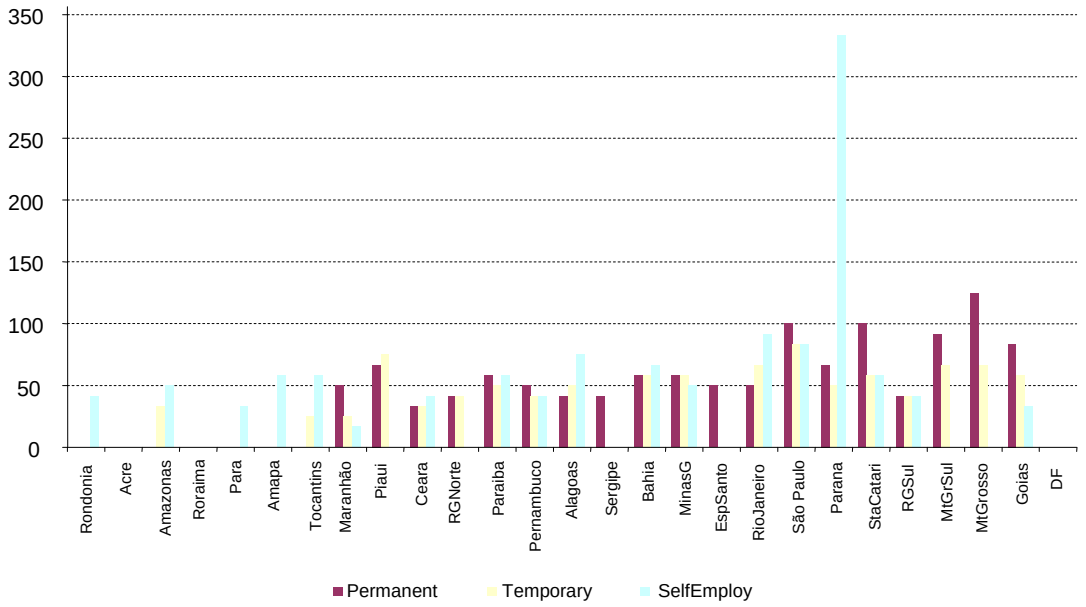
The total number of workers (temporary, permanent and self employed) in the sugar cane production sector in Brazil in 2005 was 597,532 workers[27]. This total is subdivided in 222,518 temporary workers, 292,767 permanent workers, and 70,998 self employed workers (IBGE, 2005). [28] The regional distribution of these types of workers can be seen in Figure IV.3. As it can be seen, São Paulo, the most important producer state, concentrates the bulk of workers in the sector, followed by Pernambuco and Alagoas. In São Paulo the number of temporary workers (47,504) is smaller than the number of permanent workers (104,499), contrary to what can be observed in Pernambuco and Minas Gerais, where the number of temporary workers is higher.

It should be noted, however, that São Paulo, even though concentrating the larger number of workers in the sugar cane sector has a share in total employment (0.263) in the sector that is smaller

[27] Older than 15 years.
[28] Besides those workers the PNAD identifies an extra 11,949 who are employers.

than the state's sugar cane production share (0.632), another indication of the relatively more capital extensive nature of production in São Paulo. Indeed, the average wage index in the sugar cane sector in Brazil in 2005 can be seen in Figure IV.4.

**FIGURE IV.4**
**BRAZIL: AVERAGE WAGE INDEX IN SUGAR CANE PRODUCTION, 2005**
*Average wage index (Permanent worker in SP=100)*




Source: Authors calculations based on "Pesquisa de Orçamentos Familiares", IBGE.

The numbers in Figure IV.4 are average wages index numbers in reference to the average wage of the permanent worker in São Paulo (which is taken as 100). As it can be seen, in São Paulo the wage of the permanent worker is about 20% higher than the wage of the temporary worker. The wage of a permanent worker in Pernambuco, on the other hand, is around 50% less than the reference permanent worker in São Paulo. [29]

## F. The scenarios to be simulated

The scenarios of this study are based on the projections of EPE (2008a,b). Even though these scenarios were originally designed in October 2008 (during the first signals of the current world financial crisis), they are long-run scenarios, and should be regarded as upper-bound scenarios.

The simulated scenario entails projections for the year 2016, and takes into account a large number of variables. In what follows the main points of this scenario are presented:

- About 73% of the cars will be "flex-fuel" in Brazil in 2017.
- The blend of ethanol and gasoline in gasohol will be around the present level (25% of ethanol in the blend).

[29] The values for states where sugar cane production is small, as is the case of Amazon, Paraiba and Santa Catarina, should be regarded with care, due to possible survey problems.

- A 0.7% a year increase in the fuel use efficiency of new cars.
- The consumer price of gasoline must be above US$1.47/litre for the whole period.
- Exports for the USA based on the forecast of the Energy International Administration (EIA).[30] For Europe, estimates from F.O.Licht.[31] Exports to other markets are 15% of those for the main markets.

The EPE study brings several different production scenarios, including one from UNICA, the sugarcane industry producers association. The UNICA scenario is somewhat more conservative than the EPE original one, and was adopted here. The final scenario, however, gets some elements from the EPE scenario, namely the intermediate demand increase, and adapts it to the UNICA scenario. Table IV.5 shows the projected production and use of ethanol as for the 2016 year.

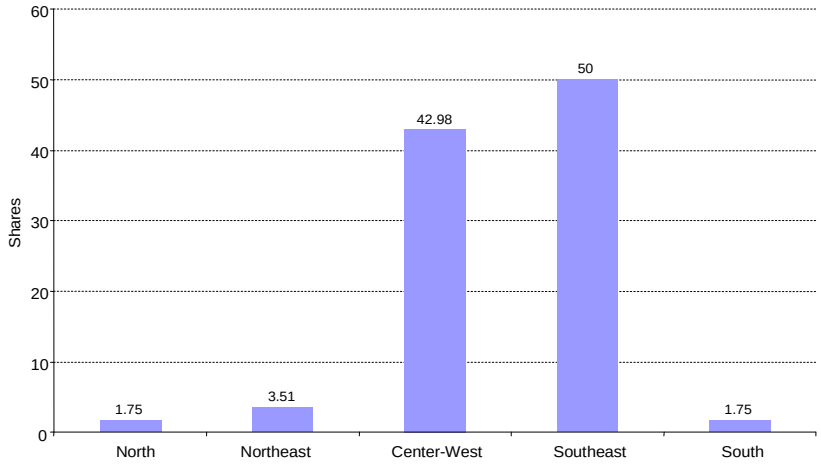
**TABLE IV.5**
**ETHANOL DEMAND PROJECTIONS FOR BRAZIL. BILLIONS OF LITERS**

| Ethanol use projections | 2006/2007 | 2015/2016 | % variation |
|---|---|---|---|
| Domestic fuel use | 13.55 | 32.65 | 141.0 |
| Chemical industry use | 0.65 | 1.95 | 200.0 |
| Exports | 3.7 | 12.3 | 232.4 |
| Total | 17.9 | 46.9 | 162.0 |

Source: EPE (2008a).

The projections in Table IV.5 are the UNICA projections, adapted from EPE (2008a) to include intermediate demand projections not included in the original UNICA data. These intermediate demands refer to new chemical industries using ethanol instead of petroleum products. As can be seen, the scenario entails a strong demand in ethanol in Brazil, to be matched by increases in local ethanol production.

**FIGURE IV.5**
**REGIONAL DISTRIBUTION OF PROJECTED NEW MILLS IN BRAZIL, 2010**



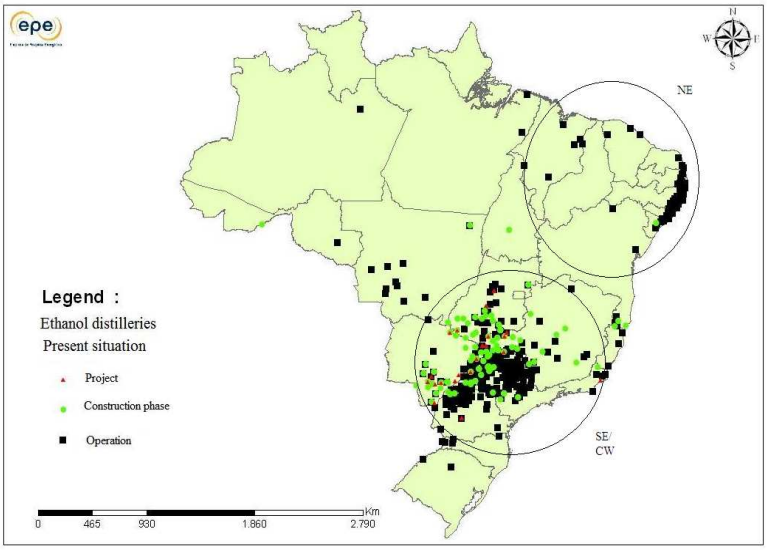

Source: EPE (2008a).

[30] EIA/DOE, 2007. Anual Energy Outlook 2007 with Projections to 2030. Available at: http://www.eia.doe.gov/oiaf/archive/aeo07/pdf/0383(2007).pdf.
[31] F.O.LICHT, 2006. World Ethanol Markets – The Outlook to 2015.

Ethanol production is expected to increase unevenly in the Brazilian regions. EPE (2008b) forecasts that 114 new sugarcane mills will be built by 2010 (mostly for ethanol production only). About 90% of those new plants will be located in the states of Mato Grosso do Sul and Goiás, in the Centerwest region, and in Minas Gerais and São Paulo, in the Southeast. Mato Grosso do Sul and São Paulo together account for 51% of the projected new mills. The regional distribution of the new mills (according to EPE, 2008a), can be seen in Figure IV.5, [32] while map 1 shows the location of mills and distilleries in Brazil, both existing and projected (EPE, 2008a).

This regional pattern of expansion of ethanol production is taken into account in the simulations, and is one of the main differences between this study and that of Giesecke, Horridge and Scaramucci (2007). As seen before, there are important regional differences in labor demand compositions in the sugarcane production in Brazil. As seen in Map IV.1, the Centerwest and the Southeast regions in Brazil will likely increase their share in ethanol production in the country, while the northeast region, currently the second most important, will reduce its share.

**MAP IV.1**
**LOCATION OF ETHANOL DISTILLERIES IN BRAZIL**




Source: EPE (2008a).
[a] The boundaries and names shown on this map do not imply official endorsement or acceptance by the United Nations.

## G. Simulation design

The sources of increase in demand for ethanol in the simulation are:

- Growth in household demands, generated by the increase in the flex-fuel fleet in Brazil. This growth also implies a fall in gasohol[33] use by households;
- Growth in exports of ethanol; and
- Growth in intermediate demands caused by a shift from petroleum products towards ethanol by parts of the chemical industry.

[32] The total projected demand increase would require, according to EPE (2008) 132 new mills, but it is not yet possible to determine their location.
[33] Gasohol is the blend of pure gasoline (75%) and ethanol (25%) which is used regularly in Brazil.

The simulation starts with an adjustment in the model database —as stated above this is based on 2005. The baseline projections, however, start in 2006, and depart from a level of exports and household demand larger than in 2005. That is, the exported share and household demand share in 2006, which was used to calculate the shocks, are larger than the one observed in the 2005 database. The solution for this problem was to do a preliminary simulation to adjust the database to the shares observed in 2006. With this procedure the share of exports in total use in the original database, which is 9.2% in 2005, was updated to about 20%, in line with the EPE estimates for 2006. This adjusted database was used for subsequent simulations.

The main simulation was done by imposing the demand-side projections on the model and letting supply adjust accordingly. This was done under a standard long-run closure, of which the main aspects are:

- National employment rate, national unemployment rate, participation rate and hours worked per worker are assumed not to be affected by the shocks, and hence are exogenous. Labor moves between regions driven by changes in regional real wages. Initial inter-regional wage differentials are not eliminated.
- Sectoral investment in the model is linked to sectoral profits. However, this affects only the aggregate demand profile, since the model is static.
- The trade balance is fixed (as a fraction of GDP) and total household consumption is endogenous. Government consumption follows household consumption.
- Industry-specific capital stocks are free to adjust in general, at given rates of return. The ethanol production industry, however, gets a different treatment.
- Considering that the ethanol expansion is expected to happen almost entirely in the Centerwest and Southeast regions, capital stocks in ethanol production are free to adjust in some states in these regions, and kept fixed in all other regions. This means that the expansion in demand will be mostly met by capital expansion (and ethanol supply) in ethanol production in the Centerwest and Southeast states, which comprise the states of Minas Gerais, São Paulo, Paraná, Mato Grosso do Sul, Mato Grosso, and Goiás. These regions will be referred throughout this text as the "target regions". In these states, then, capital stocks adjust to meet the demand targets.
- Total stock of agricultural land is fixed by state, and mobile between agricultural activities through a CET mechanism.
- The increase in ethanol demand by households will substitute gasohol (which in Brazil is a blend of 75% of gasoline and 25% of ethanol, as stated before) in household use. This is endogenously done in the model through a shift in household preferences from gasoline towards ethanol, representing the increase in the flex-fuel vehicle fleet.
- The intermediate demand increase in ethanol use is implemented through a global intermediate cost-neutral shift (twist) from Basic Petrochemicals products towards ethanol. The increase in ethanol demand for intermediate consumption, then, reduces the demand for Basic Petrochemicals products.
- The increase in capital stock in the Centerwest states was accompanied by a 5% reduction in ethanol transportation costs from that region to the other regions.
- The consumer price index (CPI) is the model's numeraire.

The shocks assume that the use of ethanol by households in Brazil would increase at a 3.5% a year rate due only to the baseline growth in the Brazilian economy in the EPE (2008) scenario, a

procedure also used by Giesecke, Horridge and Scaramucci (2007). The final shocks applied in the model can be seen in Table IV.6. [34]

**TABLE IV.6**
**ETHANOL DEMAND SHOCKS TO THE MODEL**

| Shocks | % variation |
|---|---|
| Domestic household demand for fuel use | 135.0 |
| Chemical industry use | 112.0 |
| Exports | 232.4 |

Source: Authors' calculations.

The shocks are applied to the core CGE model, and the results are transmitted to the micro-simulation model, which calculates the changes in income distribution caused by the shocks. The results are discussed in the next sections.

# H. Results

## 1. General results

The production of ethanol represented, in the adjusted database, about 0.5% of total value of production in Brazil —so the shocks generate only small changes in macroeconomic variables. This can be seen in Table IV.7.

**TABLE IV.7**
**MODEL RESULTS. SELECTED MACROECONOMIC VARIABLES**

| Macro variable | % variation |
|---|---|
| Real Household Consumption | 0.15 |
| Real Investment | 0.21 |
| Real Government Expenditure | 0.17 |
| Real Exports | -0.46 |
| Real Imports | -0.77 |
| Real GDP | 0.13 |
| Aggregate Employment | -0.00 |
| Average real wage | 0.25 |
| Aggregated Capital Stock | 0.45 |
| GDP Price Index | 0.08 |
| Consumer Price Index (CPI) | 0 |
| Exports Price Index | -0.06 |
| Imports Price Index | -0.87 |
| Nominal GDP | 0.21 |
| Land price | 2.61 |

Source: Authors' calculations.

[34] Notice that the difference between the percent variations in table 5 and table 6 is due to the baseline increase in the case of households demand, and to the need to transform the projected intermediate consumption use change in the EPE projections in the corresponding variation in intermediate use in the database.

The total shocks in ethanol demand generate a 0.13% increase in real GDP. This is accompanied by a slight appreciation of the currency (a 0.95% appreciation, measured by the difference between the variation of the imports price index and the GDP deflator percentage changes), and a 0.81% increase in the terms of trade. As a result of the shock there is a 0.45% increase in total capital stock in the economy.

Table IV.8 shows variations in production, exports and employment, by commodity and region; the sectors most directly linked to the ethanol production increase are shaded.

As a result of the shocks to the model, a 50.39% increase in sugarcane production is required, and a 51.25% increase in the sector's employment. Ethanol production expands by 103.5%, to meet the demand targets.[35] Ethanol exports increase by the value imposed by the shock, and the same is true for household use (shown in Table IV.6). Due to substitution, gasohol production must fall by 17.73%, driving the fall in Gasoline production by 5.50%. The production of Petrochemicals also falls (-7.9%) due to the change in intermediate use towards ethanol.

**TABLE IV.8**
**MODEL RESULTS. PRODUCTION, PRICES, EXPORTS AND EMPLOYMENT, PERCENTAGE CHANGES**

| Commodity | Production | Consumer prices | Exports | Employment |
|---|---|---|---|---|
| Rice | -0.53 | -0.20 | 0 | -0.56 |
| Corn | -0.56 | 0.04 | -2.75 | -0.53 |
| Wheat and Cereals | -2.20 | -0.17 | -1.94 | -2.23 |
| Sugar Cane | 39.07 | 0 | 0 | 38.13 |
| Soybeans | -2.36 | 0.29 | -4.94 | -2.43 |
| Cassava | -0.60 | -0.11 | -3.14 | -0.59 |
| Tobacco | 0.17 | 0 | -2.15 | 0.15 |
| Cotton | -0.83 | 0 | -8.08 | -1.03 |
| Oranges | -0.47 | 0.36 | -6.05 | -0.19 |
| Coffee | -2.53 | 0 | -3.80 | -2.52 |
| Forestry | -0.79 | -0.09 | -3.87 | -0.78 |
| Live Animals | -0.33 | -0.01 | -4.72 | -0.37 |
| Raw Milk | -0.31 | 0.02 | 0 | -0.38 |
| Other Agriculture | -0.45 | 0.03 | -4.18 | -0.40 |
| Mining, Oil, Gas | -2.88 | -1.08 | 0.72 | -4.54 |
| Meats | -0.99 | 0.15 | -3.81 | -1.32 |
| Edible Oils | -0.10 | 0.13 | -3.71 | -0.52 |
| Dairy | 0.12 | 0.17 | -4.37 | -0.23 |
| Processed Rice | -0.19 | 0.18 | -2.80 | -0.49 |
| Sugar | -0.38 | 0.40 | -6.06 | -1.13 |
| Processed Coffee | -0.69 | 0.18 | -6.85 | -1.04 |
| Other Food | -0.30 | 0.08 | -3.85 | -0.64 |
| Textiles and Apparel | -0.97 | 0.09 | -6.17 | -1.13 |
| Paper and Graphic | -0.35 | -0.01 | -2.84 | -0.58 |
| Gasoline | -5.50 | 0 | -0.76 | -5.61 |
| Gasohol | -16.73 | -0.42 | 0 | -16.71 |
| Ethanol | 103.50 | 1.31 | 232.40 | 112.67 |
| Combustible Oils | -0.03 | -0.51 | -1.18 | -0.13 |

(continues)

[35] With the baseline expansion considered, the UNICA forecast for 2015 would require a 107% increase in production. The small difference with that target and the results here presented is due to differences in database shares of household consumption.

Table IV.8 (conclusion)

| Commodity | Production | Consumer prices | Exports | Employment |
|---|---|---|---|---|
| Petrochemicals | -7.90 | -0.39 | -1.80 | -8.01 |
| Other Manufacturing | -0.62 | -0.16 | -3.97 | -0.84 |
| Automobiles, Buses, Trucks | -2.43 | -0.15 | -7.80 | -2.56 |
| Metal Products | -1.44 | -0.24 | -3.43 | -1.82 |
| Trade | -0.90 | 0 | -3.40 | -1.03 |
| Transport | -0.54 | -0.11 | -2.82 | -0.70 |
| Services | -0.06 | 0.02 | -3.09 | -0.17 |

Source: Authors' calculations.

The fall in production of Gasoline and Petrochemicals harm in particular the states of Bahia and Rio de Janeiro. These states have a high share in production of those products, just like São Paulo, but unlike this state Rio de Janeiro and Bahia are not important ethanol producers. The expansion in ethanol, then, will transfer part of those states' economic activity to São Paulo, which is already the economic centre of gravity of Brazil. This result also point to a possible growth in idle capacity in the contracting sectors, something for planners to take into account.

Sugar production shows a small reduction, 0.38%, mainly due to the 6.06% fall in sugar exports. This is due to the real appreciation (the "Dutch Disease" effect, a result also obtained by Giesecke, Horridge and Scaramucci, 2007), and an unchanged use of sugar by households. Even though sugar is also an ethanol input in the 2005 database, the ethanol sector expansion is not strong enough to compensate for the decrease in sugar exports. This result has consequences for the regional income distribution impacts, as it will be seen. The abovementioned results, however, vary across regions, as seen in Table IV.9.

**TABLE IV.9**
**MODEL RESULTS. SELECTED REGIONAL MACROECONOMIC VARIABLES**
*Percent variation*

| State (Region)[a] | Real GDP | Aggregate employment | Aggregate Capital Stock | Ethanol production | Sugar production |
|---|---|---|---|---|---|
| Rondonia (N) | -0.13 | -0.24 | -0.13 | 21.43 | 1.68 |
| Acre (N) | -0.25 | -0.35 | -0.26 | 21.52 | 1.01 |
| Amazonas (N) | -0.61 | -0.56 | -0.71 | 20.44 | 1.31 |
| Roraima (N) | -0.64 | -0.61 | -0.65 | 19.80 | 2.06 |
| Pará (N) | -0.91 | -0.72 | -1.08 | 24.09 | 2.43 |
| Amapá (N) | -0.58 | -0.56 | -0.62 | 26.36 | 2.04 |
| Tocantins (N) | -0.10 | -0.25 | 0.12 | 23.74 | 1.55 |
| Maranhão (NE) | -0.72 | -0.53 | -0.96 | 34.95 | 2.22 |
| Piauí (NE) | -0.42 | -0.37 | -0.49 | 33.45 | 2.00 |
| Ceará (NE) | -0.66 | -0.56 | -0.75 | 37.17 | 2.72 |
| RGNorte (NE) | -0.73 | -0.47 | -1.12 | 44.00 | 0.85 |
| Paraíba (NE) | 1.15 | 1.08 | 1.19 | 36.63 | 1.30 |
| Pernambuco(NE) | 0.28 | 0.26 | 0.31 | 50.72 | -2.22 |
| Alagoas (NE) | 2.81 | 2.91 | 2.67 | 37.96 | -6.32 |
| Sergipe (NE) | -0.90 | -0.59 | -1.37 | 43.30 | 2.72 |
| Bahia (NE) | -0.51 | -0.55 | -1.04 | 40.33 | 2.62 |
| MinasG (SE) | 0.04 | -0.09 | 0.21 | 104.88 | 1.90 |

(continues)

Table IV.9 (conclusion)

| State (Region)a | Real GDP | Aggregate employment | Aggregate Capital Stock | Ethanol production | Sugar production |
|---|---|---|---|---|---|
| EspSanto (SE) | -0.90 | -0.65 | -1.16 | 31.06 | 1.44 |
| RioJaneiro (SE) | -0.98 | -0.75 | -1.44 | 24.83 | 1.92 |
| São Paulo (SE) | 0.76 | 0.43 | 1.49 | 113.10 | -0.29 |
| Paraná (S) | -0.24 | -0.28 | 0.05 | 83.82 | 0.69 |
| StaCatari (S) | -0.42 | -0.39 | -0.40 | 17.77 | 1.65 |
| RGSul (S) | -0.62 | -0.49 | -0.74 | 21.01 | 1.93 |
| MtGrSul (CW) | 2.56 | 1.25 | 5.03 | 135.66 | 1.41 |
| MtGrosso (CW) | 2.43 | 0.99 | 5.56 | 154.78 | 4.96 |
| Goiás (CW) | 1.61 | 0.77 | 2.94 | 129.48 | 2.40 |
| DF (CW) | 0.13 | 0.05 | 0.19 | 29.52 | 1.06 |

Source: Authors' calculations.
[a] Individual states in Brazil according to macro regions: North (N), Northeast (NE), Southeast (SE), South (S), Centerwest (CW).

In Table IV.9, the regions where the capital stock is free to adjust (the target regions) are shaded. As can be seen, as a result of the economic regional stimulus generated by the increase in ethanol demand, capital stock increases in all those target regions, and decrease elsewhere. The same can be said about real GDP, which increases in the target regions due to the primary factor attraction caused by capital accumulation. The only exception is Parana state, where the capital stock increase is not enough to counteract the larger increase in the other target regions. Notice that there is a fall in labor employment in Parana, which, in terms of model's closure means that part of Parana labor force has moved elsewhere, attracted by higher real wages increases in other states. Actually, the states in the new Center-west producing regions show the larger increase in real wages.

For the important sugarcane producers of the Northeast (Pernambuco and Alagoas), in which capital stock in ethanol production was fixed in the simulation, model results points to an expansion of ethanol and a fall in sugar production in both states. Real GDP increases more in Alagoas than in Pernambuco. As seen before, Pernambuco is relatively more specialized in sugar than ethanol, compared to Alagoas. The strong increase in ethanol production, which crowds out sugar production in both states, is more beneficial to Alagoas than Pernambuco, an effect strong enough to increase Alagoas' GDP. And, finally, notice that aggregate employment also increases more in Alagoas than in Pernambuco, following the aggregate capital stock in those states. As seen before, Pernambuco has a more diversified economy than Alagoas, with a larger share in manufacturing and other agricultural activities.

Model results show, then, a movement of employment towards São Paulo and the Center-west states in the target regions. Pernambuco and Alagoas also increase employment, as well as Paraiba. This last state, although not an important sugar cane producer, accounts for about 1% of total sugar cane production in the base year, and gets some benefit of its expansion too. Employment changes in the model between regions are driven by real wages, and can be seen in Table IV.10. Real wages, employment and labor bills increase most in the Center-west states of Mato Grosso do Sul and Mato Grosso, where a large share of the new supply is expected to come from. The shares of these states in total ethanol production increase, as expected, increasing the share of Center-west in total, from 9.2% of total production in the original database to 9.8% in the updated (after simulation) database. The Northeast region, on the other hand, reduces its share in ethanol production from 12.9% to 10.9%, even though actual output increases. The South region also decreases its share slightly, from 6.1% to 5.0%, while the Southeast's share increases from 71.5% to 74%.

**TABLE IV.10**
**MODEL RESULTS. EMPLOYMENT, REAL WAGE AND WAGE BILL, BY REGION**
*Percent variation*

| State (Region)[a] | Aggregate employment | Real wages | Labor bills |
|---|---|---|---|
| Rondonia (N) | -0.24 | 0.00 | -0.40 |
| Acre (N) | -0.35 | 0.01 | -0.49 |
| Amazonas (N) | -0.56 | -0.06 | -0.82 |
| Roraima (N) | -0.61 | -0.15 | -0.98 |
| Pará (N) | -0.72 | -0.28 | -1.17 |
| Amapá (N) | -0.56 | -0.14 | -0.88 |
| Tocantins (N) | -0.25 | 0.16 | -0.13 |
| Maranhão (NE) | -0.53 | -0.16 | -0.76 |
| Piauí (NE) | -0.37 | -0.10 | -0.51 |
| Ceará (NE) | -0.56 | -0.27 | -1.02 |
| RGNorte (NE) | -0.47 | -0.18 | -0.54 |
| Paraíba (NE) | 1.08 | 1.23 | 3.00 |
| Pernambuco (NE) | 0.26 | 0.49 | 1.35 |
| Alagoas (NE) | 2.91 | 2.99 | 7.39 |
| Sergipe (NE) | -0.59 | -0.26 | -0.87 |
| Bahia (NE) | -0.55 | -0.22 | -0.91 |
| MinasG (SE) | -0.09 | 0.23 | 0.02 |
| EspSanto (SE) | -0.65 | -0.27 | -1.03 |
| RioJaneiro (SE) | -0.75 | -0.49 | -1.63 |
| São Paulo (SE) | 0.43 | 0.60 | 1.32 |
| Paraná (S) | -0.28 | 0.00 | -0.50 |
| StaCatari (S) | -0.39 | -0.04 | -0.76 |
| RGSul (S) | -0.49 | -0.17 | -1.08 |
| MtGrSul (CW) | 1.25 | 1.46 | 3.35 |
| MtGrosso (CW) | 0.99 | 1.34 | 2.78 |
| Goiás (CW) | 0.77 | 1.04 | 2.18 |
| DF (CW) | 0.05 | 0.08 | 0.06 |

Source: Authors' calculations.
[a] Individual states in Brazil according to macro regions: North (N), Northeast (NE), Southeast (SE), South (S), Center-west (CW).

With different labor demand composition, the demand for labor by type varies by region, as shown in Table IV.11. In this table, regions are aggregated according to Brazil's macro region classification. In the Southeast region, however, the São Paulo state is presented separately from the Rest of Southeast (Espírito Santo, Minas Gerais and Rio de Janeiro), due to the importance of that state in sugarcane complex production.

**TABLE IV.11**
**MODEL RESULTS. LABOR DEMAND VARIATION, BY TYPE OF OCCUPATION AND AGGREGATED REGION**
*Percent variation*

| | Aggregated regions[a] | | | | | |
|---|---|---|---|---|---|---|
| Type of labor | N | NE | São Paulo | RSE | S | CW |
| OCC1 | -0.28 | 0.14 | -0.30 | 0.07 | -0.17 | -0.15 |
| OCC2 | -0.37 | 0.37 | -0.16 | -0.08 | -0.22 | 0.00 |

(continues)

Table IV.11 (conclusion)

| | Aggregated regions[a] | | | | | |
|---|---|---|---|---|---|---|
| Type of labor | N | NE | São Paulo | RSE | S | CW |
| OCC3 | -0.57 | 0.53 | -0.07 | -0.40 | -0.37 | 0.27 |
| OCC4 | -0.55 | 0.15 | 0.41 | -0.41 | -0.35 | 1.09 |
| OCC5 | -0.76 | 0.20 | 0.35 | -0.37 | -0.58 | 1.69 |
| OCC6 | -0.62 | -0.32 | 0.50 | -0.28 | -0.35 | 0.80 |
| OCC7 | -0.87 | -0.60 | 0.63 | -0.68 | -0.69 | 1.66 |
| OCC8 | -0.76 | -0.50 | 0.54 | -0.70 | -0.53 | 1.84 |
| OCC9 | -0.57 | -0.35 | 0.45 | -0.32 | -0.35 | 0.22 |
| OCC10 | -0.35 | -0.32 | 0.41 | -0.48 | -0.32 | 0.39 |

Source: Authors' calculations.
[a] North (N), Northeast (NE), São Paulo state, Rest of Southeast (RSE), South (S), Center-west (CW).

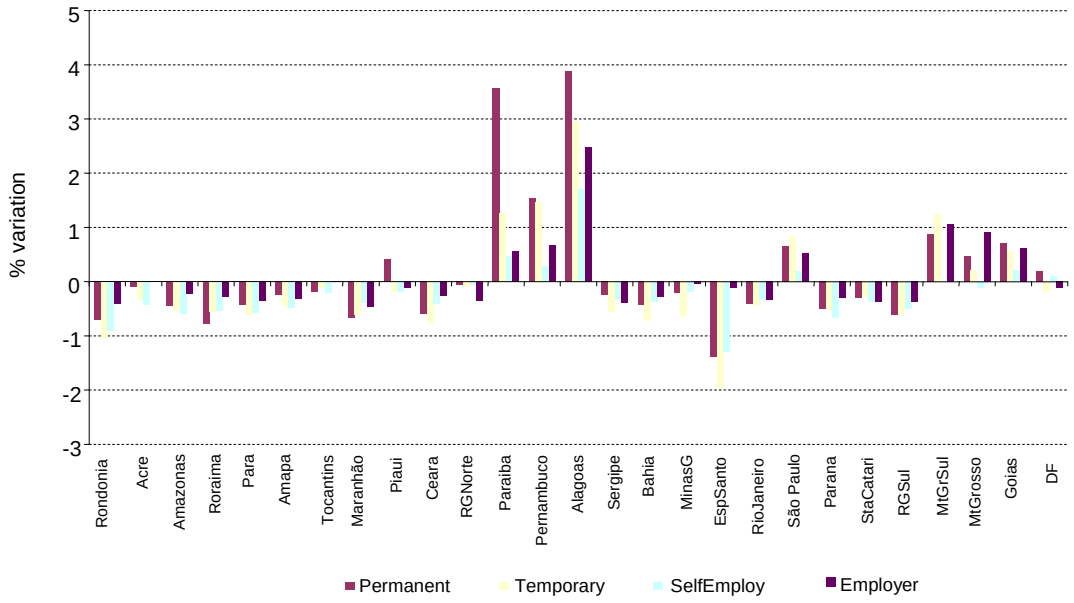
In Table IV.11 labor demand is shown by occupational group, which, as said before, is a proxy for skills. In the table, occupation 1 (OCC1) is the lowest wage (less skilled) worker, and occupation 10 the highest. OCC1 employment tends to decrease slightly in São Paulo, in the North, in the South region (which includes Paraná state) and in the Center-west. Lower-paid employment increases, however, in the Northeast region, following the sugar cane expansion in that region, which, as seen before, is relatively more intensive in low skills workers. As it can be seen, the first 5 occupational groups (OCC1 to OCC5) increase employment in Northeast Brazil, and the contrary happens to the highest wage occupations.

The above result can be better understood taking into account what happens to different agricultural activities in each state. The sugar cane expansion in São Paulo and in the Center-west states attracts land from other agricultural activities more intensive in less skilled workers. That's why employment for the less skilled falls in those regions. In the Northeast states, however, the contrary happens, since sugar cane is relatively more labor intensive in those states. In this case, the expansion of sugar cane has a positive effect on the employment of the less skilled workers. This is an important result, since the Northeast region is the poorest region in Brazil. The sugar cane expansion, then, along the actual forecasted patterns, will probably imply a fall in employment of the less skilled in the agricultural sector.[36]

Apart from the occupations classification, which is a proxy for skills, it's also possible to analyze the change in income in the agricultural sector according to the type of the labor status of the worker, that is, if the worker is a temporary worker, a permanent worker, a self employed worker or an employer. The wage of each of those workers can be classified in any of the ten occupations groups described before. Except for the employers, the first three groups (temporary, permanent or self employed worker) have their income updated in the model by the change in wages, what assumes that this is their main income source. Employers, however, have their income updated in the simulation by the change in the price of the primary composite factor, which is a composite of the price of capital, land and wages. The results can be seen in Figure IV.6.

[36] We will get back to this point later on this text.

**FIGURE IV.6**
**MODEL RESULTS. AVERAGE INCOME VARIATION IN AGRICULTURE**
*Percent variation*




Source: Authors' calculations.

As it can be seen, the average income of those working in agriculture tends to increase in the expansion regions. Notice again that Paraiba, a small state in Northeast which is not an important sugar cane producer also tend to benefit from the ethanol and sugar cane expansion. As for the most important producer states we can see that the income of workers in agriculture experience the greatest increase in Alagoas, a small state, where permanent workers average income increases by about 3.9% and temporary workers income increase by 3.0%. In São Paulo, on the other hand, the increase in workers income is relatively smaller and greater for temporary workers.

The income of temporary workers experience also a relatively high increase in the new expansion areas of Mato Grosso do Sul (MtGSul) and Mato Grosso (MtGrosso), indicating the relative scarcity of workers in those regions in comparison to the strong sugar cane expected expansion. This is also related to the more capital intensive production system to be settled there compared to what has been observed so far. As mentioned before, the region's flat topography is favorable to mechanization, what would facilitate the substitution between labor and capital indicated by relative factors prices. And, finally, the income of employers increases in most expansion regions, influenced by the increase in the price of land, which drives an increase in land returns.[37]

The projected sugarcane production requires, in the model, a 21.48% increase in land use for the culture. This increase in land demand for sugarcane is accommodated by a fall in agricultural land for other uses, as shown in Table IV.12.

[37] The income of the employer in the model is updated by the composite price of primary factors (capital, land and labor), which is driven down by the fall in labor wages and land prices in the non-expansion states.

**TABLE IV.12**
**MODEL RESULTS. AGRICULTURAL LAND USE CHANGE**

| Commodity production | % variation |
|---|---|
| Rice | -0.42 |
| Corn | -1.98 |
| Wheat and Cereals | -2.09 |
| Sugar Cane | 21.47 |
| Soybeans | -2.36 |
| Cassava | -1.17 |
| Tobaco | 0.39 |
| Cotton | -0.26 |
| Oranges | -7.89 |
| Coffee | -3.59 |
| Forestry | -1.81 |
| Live Animals | -1.22 |
| Raw Milk | 0 |
| Other Agriculture | -1.88 |

Source: Authors' calculations.

In 2006, 6.18 million hectares were planted with sugarcane, according to the Brazilian Ministry of Agriculture and Livestock (MAPA), accounting for about 10% of total land used for agriculture (not pastures) in the same year, around 60 million hectares. The required increase in land for sugarcane production would represent around 1.4 million hectares. The total of land allocated for pastures in Brazil, however, according to 2006 Brazilian Agricultural Census (IBGE, available at http://www.sidra.ibge.gov.br ) amounts to 172 million hectares. This is a point which has raised a lot of concern in the discussions about the ethanol expansion in Brazil, the ethanol versus food issue. As we can see, however, land availability will certainly not be a problem in Brazil, especially if one takes into account that the new expansion regions are exactly where livestock pasturing is concentrated.

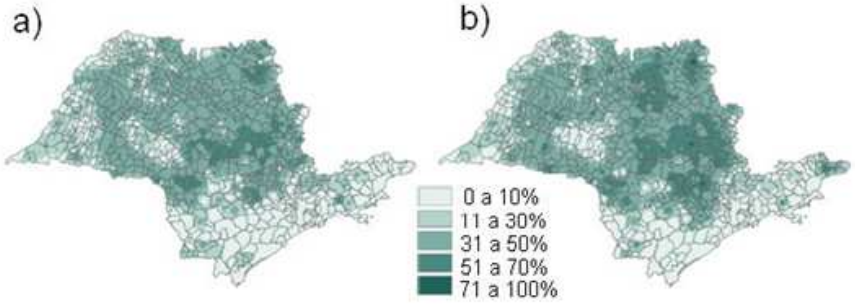
Besides that, it should also be noticed that, despite the increase in sugar cane productivity observed in the last years, there is apparently still a strong potential for further productivity increases, depending on the economic conditions. In the 2005/06 harvest year, for example, São Paulo produced 243 millions tons out of about 387 million tons of total sugarcane production in Brazil. Marin et al. (2008), in a study about the potential sugar cane productivity in São Paulo concluded that only about 15% of cultivated sugar cane land in the state had productivity higher than 70% of the potential productivity in the 2002/2003 harvest year. This information can be seen in Table IV.13 and Map IV.2, below.

**TABLE IV.13**
**AREA OF EFFICIENCY CLASSES OF SUGARCANE CROP PRODUCTION, DURING TWO GROWING SEASONS, IN THE STATE OF SÃO PAULO, BRAZIL**

| Crop Efficiency | Growing season 1995 - 1996 | | Growing season 2002 - 2003 | |
|---|---|---|---|---|
| | Km2 | % | Km2 | % |
| 0-10% | 59 285 | 24 | 55 855 | 22 |
| 11-30% | 40 634 | 16 | 33 985 | 14 |
| 31-50% | 42 648 | 17 | 35 185 | 14 |
| 50-70% | 89 275 | 36 | 85 269 | 34 |
| >70% | 16 965 | 7 | 38 513 | 15 |

Source: Marin et al., 2008.

**MAP IV.2**
**SPATIAL VARIATION OF SUGARCANE PRODUCTION EFFICIENCY, IN THE STATE OF SÃO PAULO, BRAZIL, DURING THE GROWING SEASONS OF 1995/1996 (A) AND 2002/2003 (B)**




Source: Marin et al. (2008)
[a] The boundaries and names shown on this map do not imply official endorsement or acceptance by the United Nations.

The model used here, of course, does not take into account productivity gains, which makes the land projections described above an upper limit projection. As it can be seen in Table IV.13, about 50% of the cultivated land area in the state of São Paulo, the most important producer in Brazil still had, in 2003, production bellow 50% of the agronomic estimated potential. Fertilizer use is found to be one of the most important determinants associated to the actual productivity, a factor that can be increased depending on economic conditions. But managerial practices were also found to be important for the results.

Model results, however, show a fall in food production accompanied by an increase in the consumers' price of food. But this should not be regarded as a general welfare indicator, since there are important regional differences in employment and income changes. The income distribution and poverty impacts are evaluated in the next section.

**TABLE IV.14**
**MODEL RESULTS. HOUSEHOLD POVERTY AND INCOME DISTRIBUTION RESULTS**
*Percent variation*

| Household Income class | Average nominal income | Consumer Price Index | Average real income | Headcount ratio (FGT0)[a] | Average poverty gap (FGT1) |
|---|---|---|---|---|---|
| 1 POF[1] | 3.21 | 0.04 | 3.17 | -0.67 | -0.83 |
| 2 POF[2] | 1.09 | 0.02 | 1.07 | -1.08 | 0.85 |
| 3 POF[3] | 0.62 | 0.01 | 0.61 | 0.79 | 9.60 |
| 4 POF[4] | 0.53 | -0.01 | 0.54 | 12.43 | 48.67 |
| 5 POF[5] | 0.37 | 0.01 | 0.36 | 45.77 | 157.73 |
| 6 POF[6] | 0.22 | 0.01 | 0.21 | 138.01 | 681.39 |
| 7 POF[7] | -0.11 | 0.01 | -0.12 | 370.87 | 2012.78 |
| 8 POF[8] | -0.29 | 0.02 | -0.31 | 0 | 0 |
| 9 POF[9] | -0.61 | -0.00 | -0.61 | 0 | 0 |
| 10 POF[10] | -0.77 | -0.04 | -0.73 | 0 | 0 |
| Original values (base year) | - | - | - | 0.28 | 0.12 |
| Percentage change | - | - | - | -0.02 | 0.83 |
| GINI (percentage change) | | | | | -0.01 |

Source: Authors'calculations.
[a] FGT0: Foster-Greer-Torbecke proportion of poor households' index, or headcount ratio. FGT1: poverty gap. The large numbers for FGT0 and FGT1 for POF groups 4 and above have no meaning, since they represent large percentage variations on tiny base values.

Model results in Table IV.14 suggest that the ethanol demand increase would benefit the poorest the most, with the higher reduction in the headcount ratio appearing in POF[1], the poorest households. In aggregate, however, the net effect is only a tiny positive impact on income distribution, as can be seen by the 0.01% fall in the GINI index. This slight fall in inequality, however, is accompanied by a 0.83% increase in the average poverty gap. Poverty gap also increases for household groups 2 and 3 (POF2 and POF3) which, as seen in Table IV.1, accounted for about 35% of population in 2005, and had respectively 62% and 20% of families below the poverty line. The ethanol expansion, then, even though reducing slightly the number of poor people in Brazil (a 0.02% fall poverty measured by the headcount ratio), increases the average gap between poor incomes and the poverty line.

The increase in poverty gap in aggregate can be better understood taking into account what happens to the occupational wages in the simulation. Wages of the lower skilled workers increase in some regions (Northeast and the Rest of Southeast) and falls elsewhere. The total employment of workers is fixed by the closure by occupational type. The change in demand, then, changes wages and the labor bill. When the totals are computed for the whole country, the result is a fall in the aggregated labor bill of the lower skilled workers, as can be seen in Table IV.15. As it can be seen there, the total wage bills of the two lowest wage groups fall in the simulation, increasing the average poverty gap even though the headcount falls slightly.

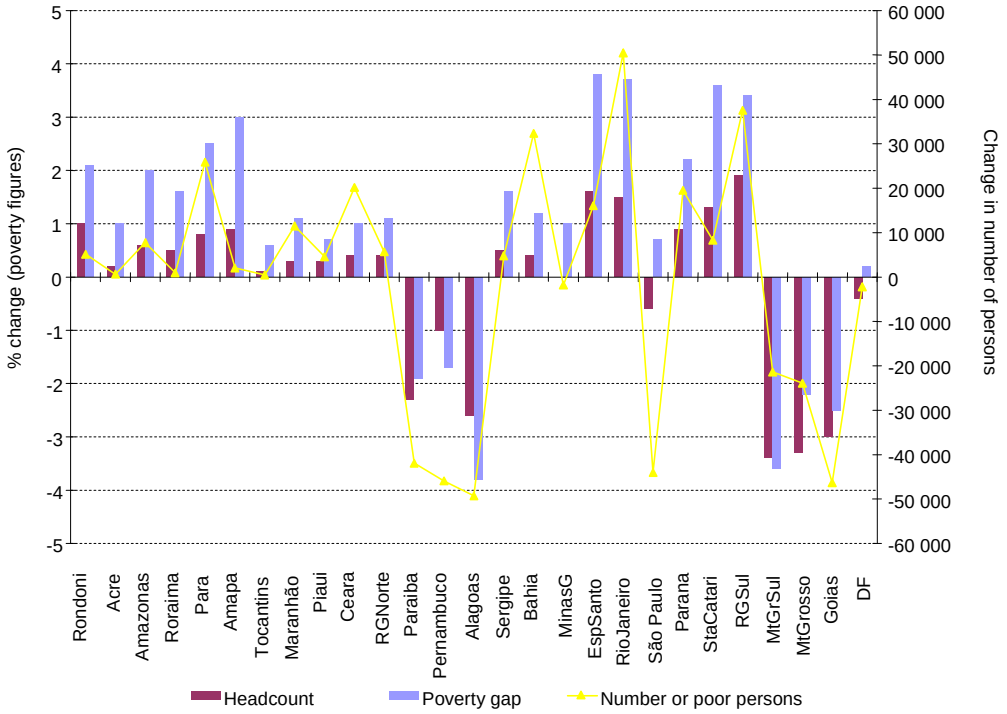
**TABLE IV.15**
**AGGREGATED LABOR BILL, BY WAGE CLASS**
*Percentage change*

| Wage class | Percentage change |
|---|---|
| OCC1 | -0.50 |
| OCC2 | -0.26 |
| OCC3 | 0.60 |
| OCC4 | 0.45 |
| OCC5 | 1.10 |
| OCC6 | 0.65 |
| OCC7 | 1.63 |
| OCC8 | 1.15 |
| OCC9 | 0.30 |
| OCC10 | -0.31 |

Source: Authors'calculations.

In regional terms, Figure IV.8 shows that the number of poor persons falls mostly in the states of São Paulo and in the Northeast states of Paraiba, Pernambuco and Alagoas, as well as in the Center-western states of Mato Grosso do Sul, Mato Grosso and Goiás. All the other states show an increase in the number or poor persons.

**FIGURE IV.7**
**REGIONAL RESULTS: PERCENTAGE CHANGES IN THE HEADCOUNT RATIO AND POVERTY GAP, AND CHANGE IN THE NUMBER OF POOR PERSONS**
*In percentages*




Source: Authors'calculations.

Rio de Janeiro and Bahia also show a relatively large increase in poverty, which is related to the fall in activity of Petrochemicals (and related industries), which are substituted in demand by ethanol. Sugar cane is not important in these states' economies, and so they don't get the benefit of its expansion. Those states are densely populated states, and model results suggest that it will certainly require attention during the adjustment process.

The fall in the headcount ratio showed by the model corresponds to a reduction of 3,126 poor households, or 23,261 poor persons in Brazil, due to the increase in ethanol demand projected in this simulation.

It was seen before that the sugarcane expansion in Brazil is projected to happen in regions (Southeast and Center-west) where the technology in sugarcane production is more capital intensive, and in which relatively more skilled labor is demanded in the sugarcane production complex. Indeed, this seems to be the pattern that can be expected. Recent developments, especially environmental and labor regulations point to more capital intensive activity. The São Paulo state, for example, passed a law banning sugar field burning after 2012. This will have severe consequences for labor demand since non-burnt sugarcane cannot be harvested manually.

Figure IV.7 shows that São Paulo, already the richest state in Brazil and where relative poverty figures are one of the lowest, will be one of the most benefited with the sugar cane expansion. The same can be said about the Center-west states, where the regional headcount ratio is about half the value observed in the poorest Northeast states (Table IV.2). As shown by Liboni (2009), this is also the region which shows the highest educational profile for workers in the sugarcane complex, either in agriculture or in the industrial stages, in contrast to the Northeast region. But some very poor states in Northeast

regions, namely Paraiba, Pernambuco and Alagoas will also be benefited by the process. Even though new industrial plants are not expected in those regions, the existing units will tend to increase their production (ethanol and sugar cane). Given the labor demand structure of sugar cane in those regions this will cause a positive effect on employment of the poorest and, consequently, on poverty.

# I. Final remarks

Model results show that the expansion in ethanol demand in Brazil would slightly reduce poverty, although increasing the poverty gap. Income distribution improves very little. The main reason is that, unlike in the past, the projected expansion of the sugarcane complex has a new technological basis, which relies heavily on mechanization of agricultural activities. This raises several points for policy considerations.

The first is related to the pattern of expansion in labor demand. As shown in this paper, the increase in labor will happen mostly in São Paulo and in the Center-west regions, and among middle-waged workers, with a decrease in employment of the less skilled in many states in the Northeast region. UNICA (2008), according to Liboni (2009), estimates a loss of around 420 thousand jobs in sugarcane production in São Paulo state due only to the expansion of mechanization in harvesting. Results here presented suggest a slowing down of that movement, due to the expansion of cane-growing in São Paulo. This effect, of course, will be lost after the 2012 year, if the complete ban of manual harvest is really enforced.[38] Hence labor force training arises as a key policy problem.

[38] The extent to which the regulation will actually be enforced is uncertain. Some important producing regions in São Paulo have hilly lands, unsuitable for mechanized harvesters. Besides, these regions are the ones with a higher share of small to medium-sized producers.

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# V. Agricultural incentives, growth and poverty in Latin America and the Caribbean

***William Foster***
***Alberto Valdés***

## A. Introduction

This study investigates the relationship between trade policy interventions that affect agricultural incentives and their influence on farm sector growth and poverty alleviation. The study places emphasis on Latin America during 1960-2005, although much of the analysis will make use of information for several countries, developing and developed, throughout the world. The first question to address is, Does the trade regime influence sectoral growth? And if it does so, the second question is, does the trade sectoral growth influence national or rural poverty levels? The quantitative analysis focuses on an empirical examination of the relationship between agricultural protection and agricultural sector growth in Latin America and the Caribbean. The empirical examination takes advantage of cross-country panel data from several sources, covering many developing countries in Africa, Asia and the LAC region. The LAC countries are Argentina, Brazil, Chile, Colombia, Dominican Republic, Ecuador, Mexico, and Nicaragua.

What are the channels by which interventions affect agricultural incentives and thereby impact poverty? Based on previous studies on these issues, we present below a discussion of the conceptual links and a synthesis of the results from the few empirical investigations available. There is a body of literature that links the growth of the agricultural sector to poverty alleviation, especially in rural areas, but there is less evidence for the link between the incentive structures, particularly as determined by trade policy, and agricultural growth.[39] A recent study by Hertel and Reimer (2005) discuss the various approaches currently being is used to estimate the poverty impacts of trade liberalization. One can distinguish between the estimation of impacts using historical data and the projection of impacts using simulation approaches, such as the use of general equilibrium models

[39] Pioneering work on structural modeling of the impact of the incentive framework on agricultural growth by Y. Mundlak and associates for Argentina and Chile in the late 1980s unfortunately has not been updated or extended to other countries.

(CGEs) or household models, where trade policy changes enter in the form of shocks to input and output prices. (In some recent and innovative studies, general equilibrium mechanisms are integrated with household survey information.) In terms of empirical evidence, these policy-growth-poverty links are under-researched. The World Development Report, 2008,[40] does present much evidence regarding the links between agricultural growth and poverty reduction. Examples of previous empirical analysis for Latin America and the Caribbean is found in Valdes and Foster (2005) and the World Bank's Beyond the City.[41] Bresciani and Valdes (2007) summarize the evidence for six countries in Latin America and Asia. And as the World Development Report 2008 notes (p. 6): "For China, aggregate growth originating in agriculture is estimated to have been 3.5 times more effective in reducing poverty growth than outside agriculture – and for Latin America 2.7 times more."

More generally, with respect to the economy as a whole, there exists much debate regarding whether or not greater openness to trade is an important factor in achieving poverty reduction. Does trade help poor families more than it hurts? While most economists would accept the assertion that open economies produce better outcomes than closed economies,[42] especially for small and medium sized countries, there is a problem of defining openness and outcomes. (See Giordano, 2009, especially Chapter 3 by Giordano and Florez.) A fairly large literature, where one finds Dollar and Kray (2001), Bhagwati and Srinivasan (2002), Sachs and Warner (1995) and other has supported the hypothesis that openness spurs growth, and growth spurs poverty reduction.

The impact of growth per se on poverty reduction is not a matter of much disagreement, but because the cross-country evidence is incomplete linking the partial effects of liberalization to growth, some economists, notably Rodrik (2000), emphasize investment and macroeconomic stability as the more important factors, implying, in effect, that liberalization has been oversold. For example, Harrison (2005) notes that export growth is generally associated with poverty reduction more so than the removal of protection, which could be associated with increasing poverty for some groups. One does have confidence, however, in the broad conclusion stated by Winters, McCulloch and McKay (2004): "The key to sustained poverty alleviation is economic growth, as is widely accepted by economists and development practitioners. Although growth can be unequalizing, it has to be very strongly so if it is to increase absolute poverty. This appears not to be the case either in general or for growth associated with freer trade. The link that has seen the most sustained debate among economists, however, is that between greater openness and growth." This openness-growth link will be the focus of this paper in the context of agriculture.

As discussed in Giordano and Florez (in Giordano, ed., 2009, Chapter 3), there is an unsettled debate over the operational definition of trade openness, as well as the measures of poverty. To capture non-tariff barriers to trade, most economists would recommend ad valorem equivalent tariffs, as being more accurate measures of openness than nominal tariffs. But in practice often economists have at hand only nominal tariffs and ex post measures of openness, such as trade volume (exports plus imports) relative to GDP, perhaps adjusted for country size and other controls.

With regard to the practical quantification of agricultural trade regimes, there have been few analytical efforts to estimate, in a form comparable across countries, policy-induced distortions to incentives in developing countries, including Latin America and the Caribbean. For Latin America, the principle cross-country comparative studies have been Krueger, Schiff and Valdes (1992), Valdes

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40 World Bank, 2008. World Development Report: Agriculture for Development.

41 de Farranti, D., G.E. Perry, W. Foster, D. Lederman, and A. Valdes. 2005. Beyond the City: The Rural Contribution to Development. World Bank Latin American and Caribbean Studies.

42 As Winters, McCulloch and McKay conclude, "[A]lthough trade liberalization may not be the most powerful or direct mechanism for addressing poverty in a country, it is one of the easiest to change. While many pro-poor policies are administratively complex and expensive to implement, the most important bits of trade reform—tariff reductions and uniformity, and the abolition of nontariff barriers—are easy to do and will frequently save resources. Thus trade reform may be one of the most cost effective anti-poverty policies available to governments. Certainly the evidence suggests that, with care, trade liberalization can be an important component of a "pro-poor" development strategy."

(1996), Anderson and Valdes (2008), the series of OECD analyses of producer subsidy equivalents (PSEs) for Mexico, Brazil and Chile, and the recent work by the IDB for Central America. In this present study, we present the historical patterns of agricultural price interventions in various regions, including the eight countries in the LAC region. The quantitative evidence presented regarding the evolution of the level of price-related interventions for exportables, importables and agricultural sectoral averages are based mainly on the recent Anderson and Valdes (2008) study. Special attention is focused on the period 1985 to 2005, but detailed information is also available from previous studies for 1960 to 1985 (Krueger, Schiff and Valdes, 1992) and for 1985 to 1995 (Valdes, 1996). Although the focus of the study will be on the LAC region, econometric analysis will also make use of a broader sample of developing countries. Data are available for eight countries in the region and about 30 non-LAC countries.

One contribution of this study is the pulling together and comparison of data on protection measure from three sources. It is interesting to observe that differing methodologies, although each defensible in practical terms, yield different conclusions with regard to the level of protection given to agriculture, especially for the period 1960-1980, due in large part to the treatment of economy-wide policies in estimating the protection measures. Exchange rate misalignment and industrial protection prior to economic reforms of the 1990s induced a substantial difference in the analysis of relative rates of assistance between agriculture and non-agriculture.

A specific purpose of this study is to establish a better basis for deriving lessons for future policy development and for offering general implications of pro-growth policy options to governments in Latin America and the Caribbean in their formulation of trade-related strategies. Several countries in the region have much to gain from a more-neutral trade regime, because their agricultural exports are still taxed (e.g., Argentina, Nicaragua, Dominican Republic and Mexico, during 2000-2004). On the other hand, there are several countries with significant agricultural sectors oriented toward import-competing products, and with high levels of support (e.g., Mexico, Nicaragua, Ecuador, and Colombia). With trade policy adjustments toward a more-neutral trade regime, the consequences for losers raise the importance of complementary social policies (safety nets, training, reducing friction in labor markets). For example, the impact of FTA implementation (e.g., CAFTA) on import-competing sectors (especially small farmers) will have to be addressed by complementary policies to ease the transition of sectors currently enjoying high levels of support.

This paper is structured in the following manner. The following section addresses in the context of Latin America the state of rural poverty in the region, the importance of agricultural trade, and the historical patterns of agricultural price intervention. In the course of presenting the data on trade-related interventions, the section also discusses briefly the conceptual and practical differences in some recent protection measures. The third section then presents the results of our analysis of the effects of trade regime on agricultural growth, where growth rates are in terms of farm sector value added (from national accounts) and aggregate production value (as compiled by the FAO STAT). The fourth section discusses the link between agricultural trade interventions, agricultural growth and the alleviation of poverty, using that which has been emphasized in a fairly wide conceptual literature but documented only in very few studies. We present our results from the correlation of protection measures and growth and poverty. Finally, in the fifth section we present some concluding comments.

# B. Rural poverty, agricultural trade, and the historical patterns of protection in LAC

## 1. Rural poverty in the region

As is discussed at some length in World Bank (2005), the various official definitions of “rural” in LAC countries tend to underestimate the size of the population living in areas that can be reasonably called rural in terms of population density and remoteness. Nevertheless, using the official statistics, one can note a significant heterogeneity of the rural economy across countries in the region in terms of

the contribution of agricultural production to national GDP, the importance and composition of agricultural trade, the number of persons in rural areas, their income sources, and the incidence of poverty. With some exceptions, poverty in the LAC region still affects the rural population more than the urban. Despite the high incidence of rural poverty, many countries tend to focus on urban poverty, and some countries – notably Argentina – lack good data on poverty in rural areas. Table V.1 presents the official data that we have from available household surveys (from CEPAL). The Plurinational State of Bolivia, Honduras, Nicaragua, Paraguay and Peru have at least 70% or more of their rural populations living in poverty. The World Bank (2005) reports that more than a third of the rural population lives in extreme poverty in the Plurinational State of Bolivia, Colombia, El Salvador, Guatemala Honduras, Nicaragua, Paraguay and Peru.

## 2. The importance of agriculture in exports

Agriculture products contribute significantly to trade flows in the LAC region, and the net trade position varies widely across countries. Not only are the levels of total national exports and imports of crop, livestock, and forestry products important, but one should distinguish between the net overall agricultural trade position and the net food trade position. The net food trade position is often the most important factor in domestic agricultural policy debates, entering considerations of national food security and food import dependence. Agricultural trade in a wider sense involves not only primary agriculture – the size of which is reflected in sectoral value added found in national accounts – but also agro-processing, which is not included in agricultural value added but in other sectors. The growth in agro-processing sectors – especially linked to exports – has been notable in the region, and adds greater emphasis to farm policy because the performance of agro-processing depends ultimately on the performance of primary agriculture. Moreover, from the perspective of poverty, paying some greater attention to processed agricultural exports is warranted by the growing importance of non-farm employment and income in rural areas. Much of this non-farm employment is linked to agro-processing and attendant up- and down-stream services. While much of agro-processing is not accounted for in agricultural GDPs, the importance of international trade to determining the contribution of these agricultural-linked industries to both rural and national households should not be overlooked. This is especially important in a region that is relatively land abundant and where the growth of agriculture is constrained by domestic demand, leaving export markets as an avenue both for sectoral growth and, more generally, for growth in the rural economy.

**TABLE V.1**
**RURAL AND URBAN POVERTY IN LATIN AMERICA AND THE CARIBBEAN, SELECTED COUNTRIES AND AVAILABLE HOUSEHOLD SURVEY DATA**
*(Population living below the poverty line, by urban and rural areas, selected Latin American countries, 1979-2007)*

| Country | National | | | | | Urban | | | | | Rural | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1979-85 | 1986-90 | 1991-95 | 1996-00 | 2001-07 | 1979-85 | 1986-90 | 1991-95 | 1996-00 | 2001-07 | 1979-85 | 1986-90 | 1991-95 | 1996-00 | 2001-07 |
| Argentina | 10,4 | - | - | - | | 8,5 | - | 16,1 | 23,7 | 30,5 | 19,0 | - | - | - | |
| Bolivia (Plurinational State of) | - | - | - | 61,4 | 61,1 | - | 52,6 | 51,6 | 50,5 | 50,5 | - | - | - | 79,6 | 79,1 |
| Brazil | 45,1 | 48,0 | 45,3 | 36,7 | 35,6 | 33,5 | 41,2 | 40,3 | 31,8 | 32,3 | 68,2 | 70,6 | 63,0 | 55,5 | 52,1 |
| Chile | - | 41,9 | 27,6 | 21,7 | 16,2 | - | 41,1 | 27,0 | 20,8 | 16,2 | - | 45,2 | 31,1 | 27,2 | 16,2 |
| Colombia | 42,3 | - | 54,3 | 52,9 | 49,7 | 39,7 | - | 49,1 | 47,8 | 48,6 | 47,7 | - | 61,6 | 61,0 | 52,4 |
| Costa Rica | 23,6 | 26,3 | 23,1 | 21,4 | 19,9 | 18,2 | 24,9 | 20,7 | 18,7 | 18,4 | 28,4 | 27,3 | 25,0 | 23,6 | 22,0 |
| Dominican Republic | - | - | - | 46,9 | 47,6 | - | - | - | 42,3 | 44,9 | - | - | - | 55,2 | 52,6 |
| Ecuador | - | - | - | - | 46,3 | - | 62,1 | 57,9 | 59,9 | 44,1 | - | - | - | - | 53,0 |
| El Salvador | - | - | 54,2 | 52,7 | 48,2 | - | - | 45,8 | 41,6 | 40,3 | - | - | 64,4 | 67,1 | 59,6 |
| Guatemala | 71,1 | 69,4 | - | 61,1 | 57,5 | 47,0 | 53,6 | - | 49,1 | 43,7 | 83,7 | 77,7 | - | 69,0 | 67,3 |
| Honduras | - | 78,5 | 77,9 | 79,4 | 73,1 | - | 64,1 | 74,5 | 72,1 | 62,2 | - | 86,5 | 80,5 | 85,3 | 82,8 |
| Mexico | 42,5 | 47,7 | 45,1 | 47,0 | 35,9 | 36,1 | 42,1 | 36,8 | 39,1 | 30,0 | 53,5 | 56,7 | 56,5 | 58,7 | 45,7 |
| Nicaragua | - | - | 73,6 | 69,9 | 65,6 | - | - | 66,3 | 64,0 | 59,1 | - | - | 82,7 | 77,0 | 74,3 |
| Panama | 42,0 | 41,0 | - | - | 31,5 | 36,1 | 38,5 | 29,0 | 22,8 | 22,1 | - | - | - | - | 47,7 |
| Paraguay | - | - | - | 60,6 | 62,0 | - | - | 49,9 | 47,7 | 54,9 | - | - | - | 73,9 | 71,1 |
| Peru | 52,9 | 59,9 | - | 48,1 | 50,3 | 38,4 | 52,3 | - | 34,9 | 38,0 | 79,7 | 72,1 | - | 72,6 | 72,9 |
| Uruguay | 14,6 | 20,4 | - | - | | 12,8 | 18,6 | 10,9 | 9,5 | 18,3 | 26,7 | 28,7 | - | - | |
| Venezuela, (Bol. Rep. of) | 25,0 | 36,0 | 42,9 | 48,7 | 38,0 | 19,5 | 34,2 | 41,6 | - | | 43,0 | 44,1 | 55,6 | - | |
| LAC | 40,5 | 45,8 | 45,7 | 43,3 | 40,5 | 29,8 | 38,5 | 38,7 | 36,5 | 35,1 | 59,9 | 62,7 | 65,1 | 63,1 | 58,5 |

Source: CEPALSTAT (http://www.cepal.org/estadisticas/bases/default.asp?idioma=IN).

Table V.2 reports agriculture and processed food as a share in total merchandise exports and imports for various five-year sub-periods between 1961 and 2005. Agricultural exports represent more than 25% of total export revenue for nine countries, reaching as high as 40% for Argentina, Cuba, Guatemala, Honduras, Paraguay and Uruguay. Countries for which the share is relatively small are the oil-exporting countries of Mexico, Trinidad and Tobago, and Venezuela, and the Caribbean. On the import side, the shares of agricultural and forestry products are generally smaller, ranging between 8 to 20%. The only country with an import share greater than 20% is Haiti (34%). Crop and livestock products clearly predominate. In terms of totals for crop, livestock and forestry, export products deriving from crops and livestock average more than 75% of total agro-forestry exports. Chile is notable for the size of share of exports due to forestry products (35%). The share of crop and livestock products averages around 80% for agro-forestry imports for the three sub regions. Unlike exports, forestry's share of imports is high for many countries. The highest shares for forestry imports are found in Argentina (40%), Costa Rica (33%), Ecuador (20%), the Dominican Republic (23%), and Trinidad and Tobago (22%).

One notable resultof countries' net food trade position[43] is that only five of the 22 countries considered are net exporters of food, and all are in MERCOSUR or are associated members see de Farranti et al. (2005), pg. 41).[44] At odds with the common perception of Latin America as an agricultural continent, 16 of the 22 countries are net food importers, nine of which are also net importers of all agricultural products. But in contrast to food products only, for all agricultural products there are ten net importers and twelve net agricultural exporters compared to five net food exporters. Notably, there are seven countries that are both net agricultural exporters and net food importers: Chile, Colombia, Ecuador, Costa Rica, Guatemala, Honduras, and Nicaragua. Finally note that, despite the high growth rate for agricultural exports, Table V.2 shows that the share of agricultural products in total merchandise exports has declined, and in some countries, such as Brazil, this decline has been large. Chile is an exception, where agricultural exports began with a low base and where economic reforms created a "vent for surplus."

These data regarding the importance of agriculture and food are relevant for trade negotiations. The common perception is that there exists a high cost of agricultural protection in OECD countries for Latin America, based on the presumption that most countries in the region are net exporters. Only five countries are net food exporters, and they are losers with current OECD protectionism – and subsidy-induced lower world prices. But the increase in world prices due to a reduction in the protection and subsidies in the OECD would be beneficial for nonfood agricultural exports, affecting many more countries (12). While it is clear why most LAC countries – seeking to expand their exports – would be enthusiastic for trade liberalization and subsidy reduction in the OECD, the case of net-food and net-agriculture importers is ambiguous. It is, however, important to note that there is hypothetical possibility that today's net food import position in some products could decline due to trade reversals arising from higher world prices that would result from trade liberalization in the OECD.

**TABLE V.2**
**SHARE OF AGRICULTURE, RAW AND PROCESSED, IN MERCHANDISE EXPORTS AND MERCHANDISE IMPORTS, SELECTED LATIN AMERICAN COUNTRIES, 1961–2005**

| Country | | 1961-65 | 1966-70 | 1971-75 | 1976-80 | 1981-85 | 1986-90 | 1991-95 | 1996-00 | 2001-05 |
|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | X | 93,0 | 87,5 | 75,5 | 70,7 | 70,1 | 58,7 | 52,4 | 44,4 | 44,4 |
| | M | 7,6 | 8,5 | 7,6 | 6,8 | 5,7 | 6,2 | 5,9 | 5,4 | 4,5 |
| Brazil | X | 82,3 | 75,9 | 62,1 | 52,1 | 39,4 | 29,3 | 26,9 | 28,3 | 27,5 |

[43] The food group includes cereals, dairy products, eggs, vegetable oils, meats, and sugar. The concept of food here is broader than that used by some international agencies, such as FAO, which often excludes sugar and vegetable oils, based on a definition of "essential foods."

[44] Two countries, Bolivia and Guatemala are borderline cases of net food importation. Bolivia particularly in the Santa Cruz area produces soybeans, rice and other grains.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | M | 18,0 | 14,7 | 7,9 | 9,7 | 9,1 | 10,5 | 11,8 | 9,2 | 5,6 |

(continues)

Table V.2 (conclusion)

| Country | | 1961-65 | 1966-70 | 1971-75 | 1976-80 | 1981-85 | 1986-90 | 1991-95 | 1996-00 | 2001-05 |
|---|---|---|---|---|---|---|---|---|---|---|
| Chile | X | 5,4 | 3,2 | 4,7 | 8,4 | 11,4 | 13,8 | 15,1 | 16,2 | 14,7 |
| | M | 24,7 | 20,1 | 26,6 | 17,0 | 14,0 | 5,6 | 6,9 | 7,1 | 6,8 |
| Colombia | X | 80,3 | 79,0 | 71,7 | 77,3 | 67,0 | 46,8 | 35,9 | 29,7 | 21,3 |
| | M | 12,0 | 11,2 | 12,3 | 11,1 | 10,1 | 7,8 | 9,0 | 12,1 | 11,1 |
| Dominican Republic | X | 90,7 | 90,2 | 79,4 | 66,5 | 66,8 | 53,0 | 51,8 | 66,0 | 58,6 |
| | M | 17,1 | 17,8 | 19,4 | 16,2 | 14,1 | 15,0 | 15,6 | 11,8 | 12,9 |
| Ecuador | X | 91,5 | 86,6 | 41,8 | 35,4 | 20,8 | 31,3 | 32,7 | 34,0 | 28,2 |
| | M | 13,1 | 12,6 | 9,5 | 8,1 | 9,7 | 8,2 | 7,8 | 11,1 | 9,1 |
| Mexico | X | 59,3 | 56,5 | 40,4 | 22,2 | 6,9 | 12,0 | 11,6 | 9,5 | 9,5 |
| | M | 8,5 | 7,4 | 13,9 | 13,4 | 15,3 | 15,3 | 11,8 | 10,0 | 10,2 |
| Nicaragua | X | 86,7 | 78,9 | 74,4 | 80,3 | 83,5 | 73,5 | 62,5 | 54,1 | 66,6 |
| | M | 10,3 | 10,2 | 9,9 | 11,3 | 13,9 | 14,7 | 21,1 | 16,2 | 15,7 |
| Paraguay | X | 70,5 | 65,3 | 76,9 | 81,0 | 73,7 | 78,3 | 76,3 | 75,3 | 66,9 |
| | M | 19,4 | 17,4 | 14,7 | 14,7 | 10,8 | 9,6 | 16,5 | 18,5 | 9,3 |
| Uruguay | X | 77,5 | 71,1 | 64,3 | 46,9 | 52,7 | 44,8 | 42,0 | 47,2 | 52,8 |
| | M | 15,8 | 17,2 | 15,6 | 10,9 | 9,1 | 9,2 | 11,0 | 11,8 | 11,9 |
| Total selected countries | X | 73,7 | 69,4 | 59,1 | 54,1 | 49,2 | 44,1 | 40,7 | 40,5 | 39,0 |
| | M | 14,7 | 13,7 | 13,7 | 11,9 | 11,2 | 10,2 | 11,7 | 11,3 | 9,7 |

Source: FAOSTAT.
Notes: Nota: X = value of agricultural exports (including agro-process goods) relative to total de merchandise exports. M = value of agricultural imports (including agro-process goods) relative to total de merchandise imports.

What are the lessons from the importance of agricultural trade in the region? First, the primary sector contributes significantly to overall national trade: more than a third of export revenues in recent years are in agro-forestry exports, although this share has been declining. There is considerable interest in obtaining market access in world markets to expand these agro-forestry exports. But the share of agro-forestry export trade to total trade is quite heterogeneous across LAC countries. Second, this high degree of heterogeneity carries over to countries' net trade positions in both food and all agro-forestry products. In terms of the number of countries, there is a high degree of food import dependence, relevant for future WTO negotiations. Third, exports of agro-processed products are increasing rapidly in this region, in spite of the pronounced degree of tariff escalation encountered in most countries.

## 3. Protection indicators 1960-2005, method and data sources

We first consolidate and process time-series data from previous multi-country studies measuring policy-induced distortions to agricultural incentives in Latin America and the Caribbean. These studies include Schiff and Valdes[45] (1992), Valdes (1996), and Anderson and Valdes (2008). The principle indicators for measuring price-related agricultural support at the farm level are the Nominal and Effective Protection Rates (NPR and EPR), which have become standard measures in trade policy discussions. The NPR measures the output price interventions alone and typically is expressed as a tariff equivalent of tariff and non-tariff barriers. The EPR measures how the value added of particular activities is altered by trade barriers and price interventions that affect jointly the product and its

[45] Volume 4 of Krueger, Schiff and Valdés.

tradable inputs. The Producer Subsidy Equivalent (PSE), which has been used by the OECD for monitoring the agricultural support of member countries, incorporates price interventions and adds domestic income payments and input subsidies. The Effective Rate of Assistance (ERA) is conceptually close to the PSE, because it includes both price and non-price subsidies (and taxes), but instead of measuring the effect on gross output value (as in the PSE) it measures the effect on value added (see, for example, Valdes's 1996 Surveillance report).

One measure of importance in what follows is the Nominal Rate of Assistance (NRA). NRAs are defined for individual tradable outputs and tradable farm inputs in the same way as the NPRs are defined using outputs only. Because tariffs are not the only trade barriers, measure of NPRs and NRAs are estimated by direct price comparison between prices received or paid by farms (adjusted for transport and marketing costs and quality differences) and border prices (see Anderson and Valdes, 2008, Appendix A). The NRA for an individual product is the ad valorum tariff equivalent, $t_E$. For an individual output or input, i, one finds the percent deviation of the domestic price, $P_i^d$, from the border price in the domestic currency (world price, $P_i^w$, in dollars adjusted by the exchange rate, E):

$$NRA_i = \frac{P_i^d - E \cdot P_i^w}{E \cdot P_i^w} = \frac{E \cdot P_i^w \cdot (1 + t_E) - E \cdot P_i^w}{E \cdot P_i^w} = t_E$$

An NRA for an activity and for the sector as a whole is defined as the sum of the individual NRAs for all tradable outputs and inputs: $NRA_{outputs} + NRA_{inputs} = NRA_{total}$.

Another important measure is the Relative Rate of Assistance (RRA) to agriculture, which is defined as the NRA for agriculture relative to the NRA for non agriculture:

$$RRA_A = \frac{NRA_A + 1}{NRA_{NA} + 1} - 1$$

Assuming no distortions in the markets for non-tradables, and that the value shares of agricultural and non-agricultural non-tradable remain constant, "then the economy wide effects of the distortions to agricultural incentive may be captured by the extent to which the tradable parts of agricultural production are assisted or taxed relative to producers of other tradables" (pp. 19-20, Anderson and Valdes).

With respect to the RRA measure, the reader should note that, although NRAs in both agriculture and non-agriculture could be positive (i.e., domestic prices greater than world prices), the RRA measure could be negative, indicating that agriculture is being "taxed" relative to the non-agriculture sector.

For the period 1960 to 1985 and 18 developing countries, Schiff and Valdes (1992) report NPRs, with and without for adjustment for what they refer to as "indirect" interventions. Direct interventions are sector specific, and indirect interventions reflect macroeconomic and industrial policies, manifested by measures of the tariff equivalent of import protection of industrial products and the exchange rate misalignment. For the period 1985 to 1995 and 8 Latin American countries, Valdes (1996) reports NPRs (only direct), ERAs and PSEs. The estimates of NRAs and RRAs used below also do not adjust for the indirect effects of economy wide policies, including exchange rate misalignment.

The various protection measures from the three sources mentioned above for the original set of LAC countries found in Schiff and Valdes are presented in Table V.3. The NPR direct measure reported by Schiff and Valdes is conceptually closest to the NRA measure of the recent Anderson World Bank project, differences arising due to the inclusion of inputs in the NRA measure and to differences in databases. The two measures are notably correlated, as seen in Figure V.1. It is understandable that the NPR direct would differ from the NPR total, because the latter include distortions beyond the agricultural sector. When the direct NPR is dominated by exportables, such as in the case of Argentina,

the indirect reinforces the negative protection. But the direct and positive NPR for import-competing products is offset by the indirect interventions, and the total NPR tends to be compressed for this group of products. During the period 1960-1985, the NPR total falls below that of the NPR direct, and sometimes significantly below, emphasizing the implicit taxation on agriculture of economy-wide policies.

Turning to RRAs, the first thing to note is that they tend to be highly persistent over time (autocorrelated), as shown in Figure V.1 using five-year averages of RRAs starting with the 1961-1965 quinquennium. Considering that the RRA is relative measure of protection to two sectors, one expects dispersion across countries and time. Nevertheless, the data reveal that countries that have taxed agriculture in the past tend to continue to do so through time; and countries that have protected agriculture similarly tend to continue protection. The RRA, as calculated in the Anderson project, tends also to be highly correlated with the NRA, using five-year averages. This high correlation may present a problem with respect to the measurements of protection in non-agricultural sectors. As mentioned above, and for very practical difficulties of addressing the question, the RRA measure excludes the home-goods sector in non-agriculture (the largest sector of the economy). Also note that the denominator of the RRA – the NRAs for non-farm tradables – dealt only with importables and then in terms of official tariffs only. For agriculture, by contrast, tariff-equivalent price comparisons were made at the level of individual products. As an empirical matter, therefore, variability of the RRA measures tends to be dominated by the variability of the numerator – the NRAs of agriculture.

Regarding trends in protection data on the average changes in RRAs by country in relation to average RRAs during the period 1986-2005, which includes the period of economic reforms shows that most countries that were "taxing" their agricultural sectors during 1986-2005 and were also reducing their taxation (average NRAs less than zero and average changes in NRAs greater than zero). Of the few countries that were, on average, supporting agriculture relative to non-agriculture, most reduced support, except for Colombia and Mexico. There are a few countries that both tax agriculture and increased taxes during the period, most prominently Zimbabwe.

With respect to lessons for future policy development, the evolution of protection indicators shows that there has been significant policy adjustment since the mid-1980s in reducing the degree of anti-export bias, that is, a move toward a more-neutral trade regime. This reduction of the anti-export bias is due primarily to the reduction of taxes on exportables.

**TABLE V.3**
**INDICATORS OF AGRICULTURAL SECTOR PROTECTION, SELECTED LATIN AMERICAN COUNTRIES, 1960 – 2005**

| Country | 1960-84 | | | 1985 - 1995 | | | | | | | 1996 - 2005 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SV Study | | | Anderson Study | | | Surveillance study | | | | Anderson Study | | | Anderson Study | | |
| | Direct | Indirect | Total | NRA Cov. | NRA Total | RRA | NPR | EPR | PSE | ERA | NRA Cov. | NRA Total | RRA | NRA Cov. | NRA Total | RRA |
| Argentina | -18.5 | -21.3 | -39.7 | -25.9 | -22.1 | -42.3 | -10.0 | -19.7 | -14.7 | -16.9 | -12.6 | -10.7 | -21.0 | -12.4 | -11.4 | -17.7 |
| Brazil | 10.4 | -18.4 | -8.1 | -24.3 | -23.6 | -44.4 | 3.7 | -10.4 | -4.0 | . | -20.9 | -14.3 | -26.1 | 2.3 | 6.0 | -0.3 |
| Chile | -0.7 | -20.4 | -21.1 | -0.5 | 13.0 | -13.2 | 21.9 | 38.7 | 13.7 | 43.6 | 17.1 | 10.4 | 3.2 | 7.8 | 6.5 | 1.2 |
| Colombia | -5.1 | -25.2 | -30.3 | -7.5 | -6.0 | -23.8 | 15.2 | 24.1 | 8.6 | 30.4 | 2.4 | 4.4 | -7.8 | 21.4 | 20.9 | 18.3 |
| Dominican Republic | -19.0 | -21.3 | -40.3 | -18.1 | -18.1 | -25.9 | 34.9 | 45.9 | -22.6 | 44.9 | -19.2 | -19.2 | -26.6 | 7.8 | 7.8 | 3.5 |
| Ecuador | - | - | - | -14.2 | -10.3 | -17.4 | -21.5 | -22.6 | -54.4 | -20.9 | -4.5 | -3.7 | -8.9 | 4.2 | 3.2 | -3.7 |
| Mexico | - | - | - | 0.7 | 2.9 | -4.2 | - | - | - | - | 11.8 | 14.0 | 8.9 | 7.3 | 10.4 | 4.9 |
| Nicaragua | - | - | - | - | - | - | - | - | - | - | -8.5 | -4.3 | -10.5 | -13.0 | -7.7 | -12.7 |
| Paraguay | - | - | - | - | - | - | -5.4 | -18.6 | -18.4 | -5.9 | - | - | - | - | - | - |
| Uruguay | - | - | - | - | - | - | -8.2 | -22.6 | -15.2 | -29.0 | - | - | - | - | - | - |
| Total | -6.6 | -21.3 | -27.9 | -12.8 | -9.2 | -24.5 | 3.8 | 1.8 | -13.4 | 6.6 | -4.3 | -2.9 | -11.1 | 3.2 | 4.5 | -0.8 |

Source: Authors' elaboration.

**FIGURE V.1**
**PERSISTENCE OF RELATIVE RATES OF ASSISTANCE: RRA VERSUS LAGGED RRA (FIVE YEAR AVERAGES). LATIN AMERICA, 1960 - 2005**


Source: Authors' calculations.

As seen in Table V.4, however, except for Argentina, Brazil and Chile all other countries maintain fairly high levels of support for import-competing activities, most notably Colombia and the Dominican Republic. And several other countries that still tax exportables: Argentina, Dominican Republic, Mexico and Nicaragua. In these countries there is both the protection of importables and taxation of exportables (except for Argentina, where importables were not studied). Evidently, there is much room remaining for adjusting trade policy as it affects agriculture, particularly in terms of reducing the protection of import-competing crops.

**TABLE V.4**
**NRAS (%) ACROSS PRODUCTS BY COUNTRY, EXPORTABLES AND IMPORTABLES, AVERAGES 1980-1984 AND 2000-2004**

| Country | Exportables | | Importables | | Anti-export bias | |
|---|---|---|---|---|---|---|
| | 1980-84[a] | 2000-04 | 1980-84[a] | 2000-04 | 1980-84[a] | 2000-04 |
| Argentina | -19.3 | -14.9 | ----- | ----- | ----- | ----- |
| Brazil | -31.5 | 1.2 | -6.8 | 11.6 | -0.26 | -0.09 |
| Chile | -2.0 | -0.3 | 10.1 | 6.3 | -0.11 | -0.06 |
| Colombia | -9.2 | 26.0 | 52.7 | 46.2 | -0.40 | -0.13 |
| Dominican Republic | -51.7 | -29.4 | 20.2 | 43.7 | -0.59 | -0.51 |
| Ecuador | -31.1 | -3.2 | 53.8 | 22.2 | -0.55 | -0.20 |
| Mexico | -35.1 | -19.9 | 21.4 | 21.4 | -0.47 | -0.34 |
| Nicaragua* | -14.9 | -18.1 | 12.5 | 24.9 | -0.24 | -0.33 |
| Unweighted average | -25.7 | -7.5 | 25.2 | 25.1 | -0.41 | -0.26 |

Source: Anderson and Valdes, 2008.
[a] The first observations for Nicaragua are during the period 1990-1994. The unweighted average for 1980-84 does not contain Nicaragua. Anti-export bias is defined as the (NRAEx – NRAIm)/(100+ NRAIm).

# C. The effects of the trade regime on agricultural growth

## 1. Comparing growth rate averages across all countries in the data base: counterintuitive results when mixing high-income and Eastern and Central Asian countries with other developing countries

This section presents some results of our analysis of the relationship between agricultural growth and the trade regime, using the data discussed in the previous section. The first approach is to make a comparison of sectoral growth rates and levels of support by examining value added growth and agricultural production growth in relation to both levels of support as defined by the RRA and the NRA and to changes in levels of support. We distinguish between the pre-reform period, 1960-1985, and the post-reform period, 1986-2005. During the mid-1980s many countries began significant reforms, both in terms of economy-wide policy changes as well as reforms to specific policies related to agricultural production and trade.

We classify a country as a low-protection country (or high sectoral tax country) if its protection measure (RRA or NRA) averaged over a sub-period was below the median of annual average for all countries. It is classified as a high-protection country, if its average annual protection measure falls above this median. Furthermore, we distinguish between countries according to whether they were increasing or decreasing their protection measures. A country is classified as a decreasing protector (or increasing taxer) if the average annual change of the RRA or NRA during the sub-period falls below the median of these averages based on all countries. And it is an increasing protector (or a decreasing taxer) if the contrary.

As an initial starting point, Tables V.5A and V.5B present the average rates of growth in agricultural value added for low protection countries and for high protection countries using RRAs (Table V.5A) and NRAs (Table V.5B) for the sub periods 1960-1985 and 1986-2005, and for the entire period 1960-2005. To assess the sensitivity of the results to the definition of sectoral growth, Tables V.5 report average growth rates using the value added measures for each country deflated by the country's consumer price index and by the countries wholesale price index. Also average growth rates are calculated using value added in purchasing-power-parity terms. The final column of Tables V.5 also report the average relative growth rate of agriculture: average percent changes in the value added of agriculture relative to the average percent change in national GDP. Note that Tables V.5 show that countries in the low-protection group (the group that on average taxes agriculture) appear to have, on average, higher average annual growth rates of their farm sectors. These higher growth rates for low-protection countries are consistent across growth measures and for the three time periods.

One source of this apparently counterintuitive result is found in the selection of countries in the database, which comprises countries ranging in level of development. First, high-income countries are likely both to subsidize their farmers and to have more-slowly-growing agricultural sectors. Standard growth theory holds that national economic growth rates should decline with national income due to the declining marginal product of capital investments; and given a declining number of farmers relative to non-farm taxpayers and a rising level of national wealth, the logic of political economy explains subsidies for agriculture as a consequence of rent-seeking (concentrated benefits paid for by spreading the costs over many households). Second, the database includes countries of eastern and central Europe, the national economies and agricultural sectors of which suffered severe disruptions following the collapse of the Soviet block.

**TABLE V.5A**
**AGRICULTURAL PROTECTION (RRAS) AND AVERAGE SECTORAL GDP GROWTH (WDI) ACROSS HIGH PROTECTION AND LOW PROTECTION COUNTRIES**

| RRA and Ag. Growth, 1960 - 1985 | | | | | |
|---|---|---|---|---|---|
| | RRA | Ag GDP Growth (CPI, %) | Ag GDP Growth (WPI, %) | Ag GDP Growth (PPP, %) | Relative Growth |
| Low protection | -30,5 | 3,1 | 2,7 | 2,1 | 0,6 |
| High protection | 77,2 | 0,0 | 1,8 | -0,3 | -0,4 |
| Average | 7,6 | 2,2 | 2,3 | 1,1 | 0,3 |
| Note: 54 countries. | | | | | |
| RRA and Ag. Growth, 1986 – 2005 | | | | | |
| | RRA | Ag GDP Growth (CPI, %) | Ag GDP Growth (WPI, %) | Ag GDP Growth (PPP, %) | Relative Growth |
| Low protection | -14,0 | 1,5 | 1,6 | 1,8 | -0,1 |
| High protection | 81,8 | -1,0 | 0,2 | -1,1 | -0,3 |
| Average | 19,9 | 0,6 | 1,0 | 0,7 | -0,1 |
| Note: 69 countries. | | | | | |
| RRA and Ag. Growth, 1960 – 2005 | | | | | |
| | RRA | Ag GDP Growth (CPI, %) | Ag GDP Growth (WPI, %) | Ag GDP Growth (PPP, %) | Relative Growth |
| Low protection | -22,4 | 2,2 | 2,3 | 1,9 | -0,1 |
| High protection | 79,5 | -0,7 | 0,4 | -1,0 | 0,3 |
| Average | 13,8 | 1,2 | 1,4 | 0,8 | 0,0 |

Source: Authors' calculations from Anderson project data for RRA and from WDI for agricultural GDP and price deflators. Note CPI = consumer price index, and WPI = wholesale price index.

**TABLE V.5B**
**AGRICULTURAL PROTECTION (NRAS) AND AVERAGE SECTORAL GDP GROWTH (WDI) ACROSS HIGH PROTECTION AND LOW PROTECTION COUNTRIES**

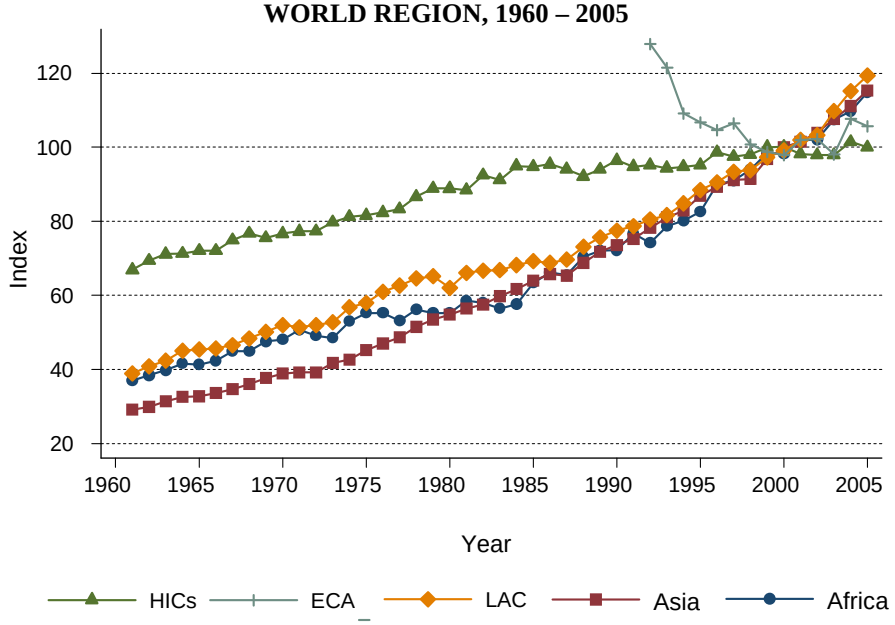
| NRA Total and Ag. Growth, 1960 - 1985 | | | | | |
|---|---|---|---|---|---|
| | NRA Tot. | Ag GDP Growth (CPI, %) | Ag GDP Growth (WPI, %) | Ag GDP Growth (PPP, %) | Relative Growth |
| Low protection | -8,7 | 2,8 | 2,3 | 2,1 | 0,2 |
| High protection | 87,0 | 0,6 | 2,3 | -0,1 | 0,5 |
| Average | 20,5 | 2,2 | 2,3 | 1,4 | 0,3 |
| Note: 59 paises | | | | | |
| NRA Total and Ag. Growth, 1986 – 2005 | | | | | |
| | NRA Tot. | Ag GDP Growth (CPI, %) | Ag GDP Growth (WPI, %) | Ag GDP Growth (PPP, %) | Relative Growth |
| Low protection | -1,2 | 1,6 | 3,1 | 1,7 | 1,0 |
| High protection | 84,4 | -1,1 | 0,2 | -1,2 | -0,2 |
| Average | 25,2 | 0,7 | 1,8 | 0,7 | 0,7 |
| Note: 74 paises | | | | | |
| NRA Total and Ag. Growth, 1960 – 2005 | | | | | |
| | NRA Tot. | Ag GDP Growth (CPI, %) | Ag GDP Growth (WPI, %) | Ag GDP Growth (PPP, %) | Relative Growth |
| Low protection | -5,0 | 2,1 | 2,9 | 1,7 | 0,7 |
| High protection | 85,0 | -0,6 | 0,7 | -0,9 | 0,1 |
| Average | 22,9 | 1,3 | 2,0 | 0,9 | 0,5 |

Source: Authors' calculations from Anderson project data for NRA and from WDI for agricultural GDP and price deflators. Note CPI = consumer price index, and WPI = wholesale price index.

To illustrate very clearly the heterogeneity – between regions and periods – of the agriculture sector growth rates of the countries in the basic database, consider Figure V.6, which shows the evolution of FAO's gross agriculture production indices for five groups of countries, Africa, Asia, high income countries, Latin America and the Caribbean, and eastern and central Europe.[46] Note that the production index is set to a common reference value of 100 using average production values during the period 1999 to 2001; absolute levels of production (measured in dollars, say) will differ. The relatively (much) slower rate of growth of HICs is demonstrated in Figure V.6 by the relatively lower slope of the path of the HIC index over time, compared to the paths of the indices of Africa, Asia and Latin America. (Protection levels in HICs are the highest.) The problems of the agricultural sectors in ECA countries are revealed by the steep decline in the average production index for this group.

What is also striking is that the slopes of the paths of the production indices for Africa, Asia and Latin America are nearly identical after 1986. The growth rates by region for the two sub-periods are presented in Table V.6, which distills the graphical information into simple averages. The reader should take careful note of the increases in average production growth rates in Table V.6 for Africa, Asia and Latin America when moving from the pre-reform period to the reform period. Corresponding to these economically significant increases in the developing world was a significant decrease in the production growth rates in high income countries.

**FIGURE V.2**
**EVOLUTION OF GROSS AGRICULTURE PRODUCTION INDICES (BASE 1999-2001), BY WORLD REGION, 1960 – 2005**




Source: FAOSTAT. Note that each point corresponds to a simple average of the observations of countries that fall in each regional group. The countries in each grouping are those in the Anderson World Bank project. With the exception of Turkey (for which data exist since 1961), data for countries in the eastern and central Europe group (ECA) exist only since 1992. The inclusion of Turkey in the ECA group is a World Bank administrative decision rather than the result of economic, cultural or geographic commonalities.

[46] The countries falling into the Africa, Asia and Latin America groups are developing countries (i.e., not high income), and so Japan, although geographically Asian, is classified as HIC.

## 2. Comparing growth rate averages across developing countries: Africa, Asia and Latin America

As Table V.7 shows, among developing countries in Africa, Asia and Latin America, high-protection countries as measured by RRAs during the period 1960-1985 tended to have higher average annual growth rates in agricultural production and in sectoral value added. (For the growth rates by individual countries that make up each country grouping. And increasing-protection countries also had higher average growth rates. Table V.7 also shows these production growth rates for the period 1986-2005, but in this latter period the trend in protection seems to be more influential than the level, although the relationship between growth and levels of protection are not contrary to the hypothesis of a positive aggregate supply elasticity. Although from an economy-wide perspective the relative measures of support would tend to reflect better the incentives for resource movement between sectors, thereby affecting aggregate sectoral growth, we have more confidence in the NRA measures.

**TABLE V.7**
**AVERAGE ANNUAL RATE OF GROWTH (%) IN AGRICULTURAL PRODUCTION ACCORDING TO AVERAGE LEVELS OF PROTECTION AND AVERAGE CHANGES IN LEVELS OF PROTECTION (RRA), AFRICA, ASIA AND LATIN AMERICA, 1960-1985**

| Simple medians of both protection levels and changes | | |
|---|---|---|
| 1960-1985 | Low RRA growth | High RRA growth |
| Low RRA | 3.1 | 3.2 |
| High RRA | 2.8 | 3.4 |
| Simple medians of protection levels but median of changes conditional on average protection level | | |
| 1960-1985 | Low RRA growth | High RRA growth |
| Low RRA | 2.9 | 3.4 |
| High RRA | 3.0 | 3.4 |
| Simple medians of both protection levels and changes | | |
| 1986-2005 | Low RRA growth | High RRA growth |
| Low RRA | 1.6 | 3.3 |
| High RRA | 3.2 | 3.6 |
| Simple medians of protection levels but median of changes conditional on average protection level | | |
| 1986-2005 | Low RRA growth | High RRA growth |
| Low RRA | 2.4 | 3.4 |
| High RRA | 3.5 | 3.2 |

Source: Authors'elaboration.

Table V.8 shows that high protection countries – as measured by NRAs – and increasing protection countries again have average growth rates.

**TABLE V.8**
**AVERAGE ANNUAL RATE OF GROWTH (%) IN AGRICULTURAL PRODUCTION ACCORDING TO AVERAGE LEVELS OF PROTECTION AND AVERAGE CHANGES IN LEVELS OF PROTECTION (NRA), AFRICA, ASIA AND LATIN AMERICA**

| Simple medians of both protection levels and changes | | |
|---|---|---|
| 1960-1985 | Low NRA growth | High NRA growth |
| Low NRA | 2.7 | 3.4 |
| High NRA | 3.0 | 3.3 |
| Simple medians of protection levels but median of changes conditional on average protection level | | |
| 1960-1985 | Low NRA growth | High NRA growth |
| Low NRA | 2.7 | 3.4 |
| High NRA | 3.0 | 3.3 |

(continues)

Table V.8 (conclusion)

| Simple medians of both protection levels and changes | | |
|---|---|---|
| 1986-2005 | Low NRA growth | High NRA growth |
| Low NRA | 2.9 | 3.5 |
| High NRA | 3.2 | 3.4 |
| Simple medians of protection levels but median of changes conditional on average protection level | | |
| 1986-2005 | Low NRA growth | High NRA growth |
| Low NRA | 3.0 | 3.6 |
| High NRA | 3.1 | 3.4 |

Source: Authors'elaboration.

Finally, Tables V.9A and V.9B show the average annual rate of growth (%) in agricultural value added according to average levels of protection and average changes in levels of protection as measured by RRA for Africa, Asia and Latin America in the two periods 1960-1985 and 1986-2005. The same patterns hold, and one conclusion is clear: It is not merely the average level of protection, but the trend in protection – particularly the lowering of taxation – that was important in stimulating private investments in the sector.

**TABLE V.9A**
**AVERAGE ANNUAL RATE OF GROWTH (%) IN AGRICULTURAL VALUE ADDED ACCORDING TO AVERAGE LEVELS OF PROTECTION AND AVERAGE CHANGES IN LEVELS OF PROTECTION (RRA), AFRICA, ASIA AND LATIN AMERICA, 1960-1985. SIMPLE MEDIANS OF PROTECTION LEVELS AND CHANGES**

| | | Ag. Growth (%) | | | Number of observations | | |
|---|---|---|---|---|---|---|---|
| Average RRA over period | | Low RRA growth | High RRA growth | Total | Low RRA growth | High RRA growth | Total |
| Low RRA | WDI | 2.5 | 3.1 | 2.8 | 144 | 140 | 284 |
| | CPI | 3.2 | 3.5 | 3.3 | 116 | 115 | 231 |
| | WPI | 2.7 | 3.5 | 3.2 | 44 | 81 | 125 |
| | PPP | 0.6 | 5.8 | 2.7 | 42 | 30 | 72 |
| High RRA | WDI | 3.1 | 3.3 | 3.2 | 111 | 225 | 336 |
| | CPI | 2.4 | 3.7 | 3.2 | 113 | 209 | 322 |
| | WPI | -0.1 | 4.4 | 4.3 | 5 | 130 | 135 |
| | PPP | 1.0 | 2.2 | 1.8 | 25 | 50 | 75 |
| Total | WDI | 2.8 | 3.2 | 3.0 | 255 | 365 | 620 |
| | CPI | 2.8 | 3.6 | 3.3 | 229 | 324 | 553 |
| | WPI | 2.4 | 4.1 | 3.8 | 49 | 211 | 260 |
| | PPP | 0.7 | 3.6 | 2.3 | 67 | 80 | 147 |

Source: Authors'elaboration.

**TABLE V.9B**
**AVERAGE ANNUAL RATE OF GROWTH (%) IN AGRICULTURAL VALUE ADDED ACCORDING TO AVERAGE LEVELS OF PROTECTION AND AVERAGE CHANGES IN LEVELS OF PROTECTION (RRA), AFRICA, ASIA AND LATIN AMERICA, 1986-2005. SIMPLE MEDIANS OF PROTECTION LEVELS AND CHANGES**

| | | Ag. Growth (%) | | | Number of observations | | |
|---|---|---|---|---|---|---|---|
| Average RRA over period | | Low RRA growth | High RRA growth | Total | Low RRA growth | High RRA growth | Total |
| Low RRA | WDI | 2.0 | 3.8 | 3.3 | 80 | 255 | 335 |
| | CPI | 1.6 | 3.6 | 3.1 | 80 | 242 | 322 |
| | WPI | 4.8 | 2.8 | 3.6 | 43 | 70 | 113 |
| | PPP | 2.2 | 3.2 | 3.0 | 60 | 246 | 306 |

(continues)

Table V.9B (conclusion)

| Average RRA over period | | Ag. Growth (%) | | | Number of observations | | |
|---|---|---|---|---|---|---|---|
| | | Low RRA growth | High RRA growth | Total | Low RRA growth | High RRA growth | Total |
| High RRA | WDI | 2.6 | 2.6 | 2.6 | 234 | 100 | 334 |
| | CPI | 0.0 | 3.8 | 1.1 | 227 | 90 | 317 |
| | WPI | 1.6 | 4.2 | 1.9 | 179 | 20 | 199 |
| | PPP | 1.5 | 3.3 | 2.1 | 234 | 100 | 334 |
| Total | WDI | 2.5 | 3.4 | 3.0 | 314 | 355 | 669 |
| | CPI | 0.4 | 3.7 | 2.1 | 307 | 332 | 639 |
| | WPI | 2.2 | 3.1 | 2.5 | 222 | 90 | 312 |
| | PPP | 1.7 | 3.2 | 2.5 | 294 | 346 | 640 |

Source: Authors'elaboration.
Note: WDI = real sector GDP from World Development Indicators (Real Ag Value Added); CPI = Nominal Ag. GDP Ag deflated by the country's CPI; WPI = Nominal GDP deflated by the wholesale price index CPI; PPP = purchasing power GDP from World Development Indicators. Note that an observation is for one year and one country.

During the pre-reform period 1960 to 1985, agricultural trade policy was more or less stable, and so the division of countries into the four categories is even in terms of the number of countries in each category. During the second period, 1986-2005, however, many countries that had been taxing their agricultural sectors (low protection), reduced their taxation, principally of their exportables, and so their NRA and RRA levels increased. Similarly, many countries that had protected their sectors, reduced their protection. Therefore, during this second period the division of countries into the four categories is unbalanced in terms of numbers. Because we observe so few countries in the two categories high-level-and-high-change in protection and low-level-and-low-change in protection, the differences in sectoral growth rates might be sensitive to the inclusion or exclusion of specific countries. For example, Sri Lanka and Zimbabwe are two countries where civil unrest and insecurity would likely have prevented high production growth after 1986, regardless of the level of protection, which was low and which changed little. They, however represent two of the four countries in the category, of low-average protection and low change in protection using unconditional medians. Therefore, Tables V.7 and V.8 also report the sectoral growth rates using categories based on the median of protection change conditional on the protection level. That is, for those countries with low protection averaged over the period ("low" based on the median of protection level for all countries), we divide this group into two subgroups of roughly equal size base on this particular group's median for changes in protection levels. And for those countries with high average protection, we divide this group into two subgroups of roughly equal size base on this group's median for changes in protection levels. The results are less stark in the case of conditional medians, but nevertheless hold.

Finally, Table V.10 presents a panel-data regression analysis of the rate of growth of agricultural value added using as explanatory variables lagged NRAs and lagged changes in NRAs, in addition to a number of other variables used in explaining national GDP growth rates. For this latter set of variables we make use of Norman Loayza's data set used in Loayza and Soto (2002). The model here is a simple growth model, where the rate of change of agricultural value added depends on its lagged value, plus additional control variables. The data are averages for 5-year periods. We use lagged values of NRAs and changes in NRAs due to the likely endogeneity of the NRAs. There are at least two reasons that the NRAs are endogenous. First, from a political economy standpoint, when agriculture is doing poorly, politicians have incentives either to increase protection (i.e., to give more subsidies), or to reduce taxation. And vice versa. Second, various authors have noted that as countries get richer they tend to support more (or tax less) their agricultural sectors (e.g., Hayami, 2007). To the extent that growth rates decline with income levels (ceteris paribus, as predicted by standard growth

theory) then one might expect a negative correlation between NRAs and growth rates, regardless of the existence or not of a cause-effect relation between them.

**TABLE V.10**
**PANEL DATA REGRESSION (FIXED EFFECTS) EXPLAINING THE GROWTH RATE OF AGRICULTURAL VALUE ADDED: CROSS-COUNTRY, 1960-2000, 5-YEAR AVERAGES**

| Dependent variable: average % change in agricultural value added over 5 year intervals. | Estimated coefficient | Standard error | p-value |
|---|---|---|---|
| Lagged NRA averaged over 5 years | -0.301 | 1.113 | 0.787 |
| Lagged average change in NRA | **7.228** | **3.477** | **0.039** |
| Lagged average ag value added. | **-7.081** | **1.790** | **0.000** |
| Income per capita | -1.879 | 1.429 | 0.190 |
| Initial output gap (log[actual GDP/potential GDP]) | 2.096 | 8.099 | 0.796 |
| Education - log of secondary enrollment rate | -0.127 | 1.116 | 0.909 |
| Financial depth (log of credit to the private sector over GDP) | -0.396 | 0.651 | 0.544 |
| Trade openness index (residual of regression of trade over GDP on several variables) | -0.731 | 1.019 | 0.474 |
| Government burden (log of government consumption over GDP) | 0.832 | 1.072 | 0.439 |
| Public infrastructure (log of phone lines per 1000 population) | **1.429** | **0.861** | **0.099** |
| Governance index (first principal component of ICRG indicators) | 0.052 | 0.329 | 0.875 |
| Lack of price stability (log of inflation rate+100) | -0.203 | 0.798 | 0.800 |
| Cyclical volatility (standard deviation of output gap) | -1.894 | 15.724 | 0.904 |
| Real exchange rate overvaluation (log of real exchange rate over-valuation index) | -1.029 | 0.718 | 0.154 |
| Systemic banking crises (fraction of period during which the country had a systemic crisis) | -0.437 | 0.743 | 0.558 |
| Terms-of-trade shocks (terms of trade growth) | 0.004 | 0.003 | 0.224 |
| Period dummies (reference 1996-2000): | | | |
| 1966-1970 | -3.314 | 1.587 | 0.038 |
| 1971-1975 | -2.752 | 1.386 | 0.049 |
| 1976-1980 | -2.263 | 1.156 | 0.052 |
| 1981-1985 | -1.832 | 0.974 | 0.062 |
| 1986-1990 | -1.558 | 0.756 | 0.041 |
| 1991-1995 | -1.713 | 0.581 | 0.004 |
| _Constant | 178.417 | 39.185 | 0.000 |

Source: Authors'elaboration.
Note: unbalanced panel, fixed-effects (within) regression, number of observation = 245, number of groups = 5 0, R-sq: within = 0.2208, between = 0.1208, overall = 0.0468, F(22,173)= 2.23( p-value = 0.0022).

The results indicate that, in addition to an expected (and strong) rate of convergence (as indicated by the negative coefficient on lagged agricultural value added), lagged average changes in NRAs are significantly positively correlated with value added growth, but lagged average levels of NRAs are not. This result is highly consistent with the comparisons of simple averages found in Tables V.7 and V.8, and Tables V.9A and V.9B. Note that this regression model makes use of five-year averages and a simple lag of levels and changes. The interpretation of the coefficient on lagged change in NRA is as follows: an increase in the NRA from taxation (a negative) to trade-regime neutrality would produce an increase in the average rate of agricultural growth in the subsequent five-year period of (7.228 times the change in NRA). Due to the limited number of observations for many countries, and to the use of lagging to eliminate endogeneity, only one lag was employed. Therefore,

the influence of changes in NRAs on growth rates in periods beyond the next five-year horizon are not estimated; and so the model cannot say anything about more lasting changes in rates of growth, merely the increase in the average rate in the period immediately following. What we can say is that, controlling for changes in NRAs, the average level itself during the previous five-year period does not have a significant impact on agricultural growth rates. Of the other variables, usually important for national GDP growth rates, only infrastructure (the per capita availability of telephones) appears to have a statistically significant positive relation with agricultural value added growth.

# D. Connecting the impacts of agricultural protection on poverty reduction via agricultural growth

## 1. The relationship between agricultural growth and poverty reduction: what do we know?

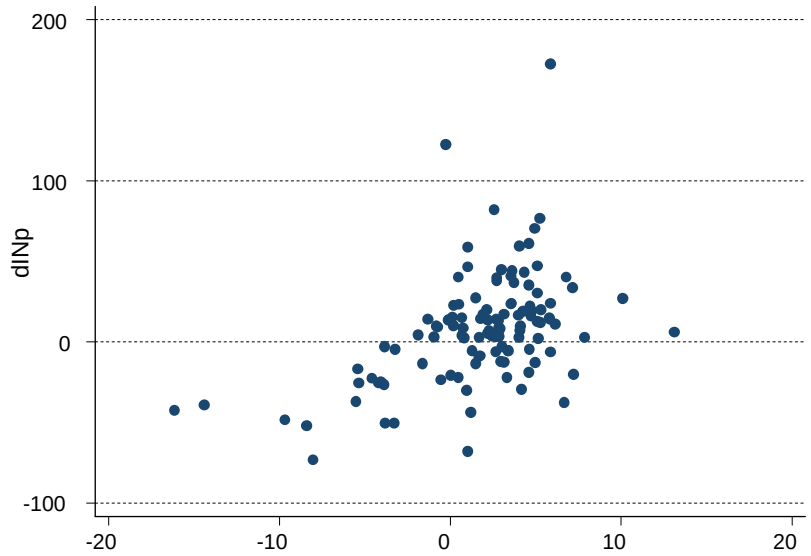
In this section we summarize some important findings regarding the link between agricultural growth and poverty reduction. In the next section we analyze the link between the trade regime to agricultural growth. Many of the econometric studies showing the importance of the agriculture sector's growth for poverty reduction make use of cross-country data to estimate the partial correlation of growth measures with income levels or poverty incidence rates, controlling for other determinants. The basic statistical problem is to make sense of the scatter diagrams as shown in Figures V.3A and V.3B, which show a positive relationship between agricultural sector growth, whether measured in terms of production or value added, and the rate of increase of per capita income of the poorest decile. In the Figures the rates of growth are five-year averages for each country in our sample (discussed in the previous section) over a series of five-year periods beginning in 1980. In Figures V.3A and V.3B, the simple correlation between the average rate of growth in production and the average rate of growth in per capita income of the first decile is 0.47, and the simple correlation with the average rate of growth in value added is 0.34. But of course there are other factors determining the income growth of the poorest and changes in poverty rates. What is the evidence we have that agricultural growth is important to economic development and poverty reduction?

Timmer (2002) notes that agriculture's contribution to national economic development is an "old and honorable question, dating back to the Physiocrats." From a longer-term perspective, the most fundamental and obvious contribution has been the direct contribution of agricultural growth to lower food prices, and therefore higher living standards. In a closed economy, with agricultural growth the non-farm sector enjoys lower real wage costs, which yields rents that stimulate investments and structural changes (this is the classic model of Lewis, 1954; Johnson, 1957). From the perspective of an individual country open to trade, however, the benefits of lower food prices can be accessed by imports, and so the spillovers from the dynamism of the domestic agriculture sector are of much less importance.

The 2002 review article by Timmer is a useful starting point for assessing the econometric evidence linking agriculture and economic development. Timmer presents an analysis of the relationship between the rate of economic growth and the growth of agriculture, expanding upon the panel data approach to the estimation of endogenous growth models,[47] finding that a contemporaneous increase of 1 percent in the agricultural sector growth rate contributes about a 0.2 percent increase in the non-agricultural growth rate. This does not show causality, however, because both sectors could have grown in response to other factors, such as macroeconomic policies. More to the point of inferring causality, Timmer finds that a 1 percent increase in the five-year lagged agricultural growth rate contributes to about a 0.14 percent increase in the non-agricultural growth rate.

[47] Timmer uses 65 developing countries for 1960-1985.

**FIGURE V.3A**
**PERCENT CHANGE IN THE AVERAGE INCOME OF THE FIRST DECILE VERSUS PERCENT CHANGE IN FAO'S GROSS AGRICULTURE PRODUCTION INDEX, SELECTED COUNTRIES 1981 - 2005**



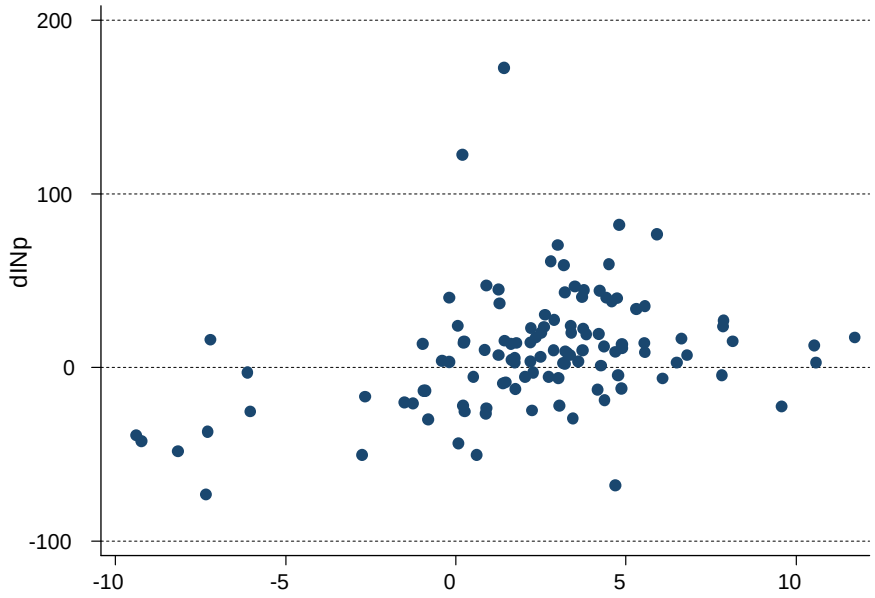

Source: Authors' calculations.
Note: Simple correlation = 0.4694.

Bravo-Ortega and Lederman (2005) also examine econometrically the links between agricultural growth and the growth of the non-agriculture sector using panel data of over 120 countries for the period 1960-2000. Non-agricultural sector value added was regressed on the one-year lag of agricultural sector value added, controlling for lagged non-agricultural value added,[48] and a Granger style "causality" test was done to resolve the question of which sector leads the other in predictive terms. The results are that in developing countries historically a 1 percent increase in agricultural growth leads to between a 0.12 percent (for Latin America) to 0.15 percent (other developing countries) increase in non-agricultural growth.[49] For high income countries, however, agricultural growth is associated with a subsequent decline (–0.09 percent) in non-agricultural growth, perhaps through a resource-pull effect. Also there is a reverse growth effect: a 1 percent increase in the non-agricultural growth rate leads to a decrease in agricultural growth in non-LAC developing countries. In LAC and in developed countries non-agricultural growth appears unrelated to subsequent agricultural growth. Looking at individual countries, there is a substantial heterogeneity, which can be illustrated in the case of Latin America. In all LAC countries except for Uruguay, agricultural is positively related to subsequent non-agricultural growth, and this relationship for 10 of the 20 other LAC countries is considerably above the regional average cross-sector growth elasticity of 0.12, with some countries having very high elasticities of cross-sector growth impacts (e.g., Chile, Jamaica, Guatemala, Argentina and Brazil).

[48] This control was not included in Timmer's analysis. Using lagged non-agricultural GDP also is a way to control for the level of development: one expects faster non-agricultural growth at lower levels of development.

[49] Although statistically different from zero, these regional averages are not statistically different from each other.

**FIGURE V.3B**
**PERCENT CHANGE IN THE AVERAGE INCOME OF THE FIRST DECILE VERSUS PERCENT CHANGE IN AGRICULTURE SECTOR VALUE ADDED, SELECTED COUNTRIES 1981 - 2005**




Source: Authors' calculations.
Note: Simple correlation = 0.3367.

The Bravo-Lederman World Bank study also extended the definition of agriculture to include the food processing sectors. Using the same breakdown of country groups, the results indicate that the LAC average cross-sector growth elasticity from agriculture to non-agriculture increases from 0.12 when excluding food processing to 0.18 when including processing. In the case of LAC, this strongly suggests that the positive spillovers of agriculture are stronger when the sector's downstream industries are included in the "rural" economy. By contrast, adding the food processing industries to non-LAC developing countries' agricultural sectors reduces the average cross-sector growth elasticity. This suggests that, in non-LAC developing countries, much of the subsequent growth in non-agriculture that is related to current primary agricultural growth is found in processing industries more closely related to agriculture. That is, a substantial part of what is measured as the non-agricultural growth correlated with agriculture is in the food processing sector.

In LAC countries it appears that forward links have a longer reach into industries beyond food processing, probably due to the region having better articulation between markets domestically and between domestic and international markets. If one considers both the direct contribution of agriculture (its share in GDP) plus its indirect contribution on other sectors for non-LAC developing countries one finds that agriculture "contributes" about 1.5 times the size of the sector to growth. For LAC countries agriculture contributes about 1.8 times its size. In the case of non-LAC countries, non-agriculture contributes slightly less its share to GDP growth. In LAC and developed countries the non-agricultural contribution is approximately equal to its share in GDP. The results suggest significant spillover effects of agriculture to non-agriculture in developing countries. Along with the lower income elasticity of demand for primary products, the above results imply all the more strongly that agricultural growth would lead over time to a lower share of agriculture in total GDP, which corresponds to historical trends.

Lengthening the period of analysis to 1960-2004, Christiaensen, Demery, and Kuhl (2006) perform a similar econometric analysis, focusing on Africa,[50] finding a small impact of past agricultural growth on non-agricultural growth (though only in low income countries outside Sub-Saharan Africa), but finding no evidence of an impact from nonagriculture growth to agriculture growth. Tiffen and Irz (2006) use a VAR approach and find that, for most developing countries, value added per worker in agriculture "causes" national GDP per capita growth, but for developed countries the evidence is ambiguous.

Finding indirect effects of agriculture on non-agriculture is not an argument for subsidizing agricultural production, because "causality" tests show predictive links, not the mechanisms by which agricultural growth would lead to non-agricultural growth. Such mechanisms would have to be clear for practical policy applications. The results do, however, reinforce the argument against taxing agriculture relative to other sectors (as in Schiff and Valdes, 1992), and they imply that, in assigning public expenditures to public goods, one should take into account this documented historical relationship between agricultural growth and subsequent non-agricultural growth.

Another important question addressed in the literature concerns the role of the sectoral composition of growth in linking overall growth to poverty. Timmer's (2002) econometric analysis of the impact of agriculture on poverty makes use of countries where agriculture represents at least 5% of total GDP[51] and estimates the relationthsip between average income of persons living in each quintile to the sectoral labor productivities of agriculture and non-agriculture. This estimated relationship yields an "elasticity of connection" (see Roemer and Gugerty, 1997) for each quintile, representing the marginal impact of a sector's growth on per capita incomes. Of special interest is the elasticity of connection for the poorest quintile. The Bravo-Lederman World Bank study goes further than Timmer and estimates an elasticity of connection that includes both the direct effects of sectoral composition and the indirect effects on poverty through sectoral growth on the growth of the other sector (discussed above).[52]

Timmer finds that for countries where the disparity between the richest and poorest is relatively small, growth in agricultural labor productivity is "slightly but consistently" more important in generating per capita income in every quintile. But in countries where the income gap is large, the elasticities of connection of both sectors for the poorest quintile are small, but rise sharply by income class. Timmer thus concludes that, for high income gap countries, the poorest quintile is "nearly left out of the growth process altogether." Furthermore, in this case agricultural growth is less successful than non-agricultural growth at raising the incomes of the poorest. Timmer notes that, because over the period of analysis the income gap tended to increase with growth, agriculture has had a declining influence in reducing poverty relative to non-agriculture, although there is an exception: the fastest growing countries during the decade 1985-1995 showed on average a narrowing of the income gap.

The Bravo and Lederman study similarly examines the per capita average incomes of quintiles, expanding the number of countries to 84 and updating the data to 2002. Their estimates show that the elasticities of connection are higher for non-agricultural than for agricultural growth across quintile groups. In the case of non-LAC developing countries, for example, the elasticities of connection for the poorest quintile are 0.36 for agriculture and 0.64 for non-agriculture. In terms of absolute impact, in both LAC and non-LAC developing countries, generally growth of the non-agriculture sector is more important than growth of agriculture. The relative impact of agricultural growth is least for the lowest

[50] Their specification for agriculture includes yearly deviations from long-run average rainfall.

[51] Timmer uses data from 27 countries for the period 1960-1995. The average agricultural share of GDP in his data set is 25% and the average share of agricultural workers of the total workforce is 51%. His data are therefore very much representative of least developed countries.

[52] Note that the elasticity of connection between growth and income is not the same as a growth elasticity of poverty measured by a change in the poverty level relative to a given poverty threshold (where the location of the poverty line varies across countries). Heltberg (2004) demonstrates, the headcount ratio of poverty has drawbacks, relying on a proportion of people who cross a poverty line if all incomes increase, and ignoring what happens to those who might benefit but remain below the poverty. In contrast, the elasticity of connection measures the impact of growth on the mean income of poorest. There will always be a first quintile, but the mean income of this 20% is changing.

quintile compared to higher income quintiles, as also in Timmer's high inequality scenario. The elasticities of connection for agriculture compared to non-agriculture are even less in the case of Latin America. And the agriculture elasticities fall relative to non-LAC developing countries and the non-agriculture elasticities increase.

But the indirect effects of agriculture on poverty reduction, through the influence of agricultural growth on non-agricultural growth, also aids in poverty reduction. For LAC countries the total elasticity is 0.28 for agriculture and 0.77 for non-agriculture, but for other developing countries the elasticities are 0.48 and 0.58. But the indirect effect of agriculture's growth on poverty reduction is a large proportion of its total effect both in LAC (a third) and non-LAC developing countries (a fifth). Compared to LAC countries, in non-LAC developing countries agricultural growth has slightly higher impact on non-agricultural growth, but that non-agricultural growth has a smaller impact on poverty reduction. In non-LAC developing countries the direct effect of agricultural growth is relatively more important than in LAC countries for poverty reduction. More interestingly, relative to its GDP share agriculture has a greater impact on poverty reduction than non-agriculture. Agriculture's GDP share averages 0.12 for LAC and 0.22 for non-LAC developing countries. Relative to their shares in GDP, on average, agriculture's contribution to raising the incomes of the poorest is at least 2.5 times that of non-agriculture (2.5 for LAC, 2.9 for non-LAC developing countries).

Recently, the 2008 World Development Report, entitled Agriculture for Development, notes that, due to resource endowments and a difficult investment climate for the near future, many developing countries will continue to find their comparative advantages in the primary activities of agriculture and mining, and in agro-processing. Realistically, in at least the next several decades, countries with agriculture-based economies must design a growth strategy based on spurring the farm sector. The WDR finds that agricultural growth can aid in reducing poverty across all country types (p.7). Again using cross-country estimates, it appears that agriculture-based GDP is at least twice as effective in reducing poverty as non-agricultural-based GDP growth (see the report's Figure V.3, p. 6). For example, in the case of China, estimates suggest that agriculture-based growth has been 3.5 times more effective in poverty reduction than non-agriculture-based growth. In the case of Latin America the estimate is 2.7 times more effective (p. 6). The WDR 2008 also cites the significant declines in rural poverty due to rapid agricultural growth in India linked to the introduction of high yielding varieties and other technologies. Ghana is a more recent example of a notable fall in poverty being due in large part to raising the incomes of rural households linked to agricultural growth.

## 2. Some estimates of the impact of growth on the income of the poorest

The previous section sets out the evidence that the taxation or protection of agriculture – or, more accurately, the reduction of taxation or increase in protection – affects agricultural growth. This present section first discusses the contribution of agricultural growth to economic growth, and then the connection from growth to poverty reduction.

As noted in the preceding section, the key question here is with respect to the role of the sectoral composition of growth: Does the sectoral composition of national economic activities influence the strength of the link between overall economic growth and poverty? One approach (e.g., Timmer, 2002) to answer this question is to relate the average income of persons living in each income quintile (j = 1,…,5) to the sectoral labor productivities ($g_i = G_i/L_i$ , where $L_i$ is the labor force in sector i) of agriculture and non-agriculture:

$$\ln y_j = f(\ln g_A, \ln g_{NA}) \quad j = 1,...,5$$

The estimation of this relationship produces the "elasticity of connection" (Roemer and Gugerty, 1997) for each quintile, which represents the marginal impact of a sector's growth on per capita incomes. Of most interest is the elasticity of connection for the first quintile, the poorest:

$$\frac{\partial \ln y_1}{\partial \ln g_A} \text{ and } \frac{\partial \ln y_1}{\partial \ln g_{NA}}$$

The Bravo-Lederman World Bank study goes further by estimating an elasticity of connection that includes both the direct effects of sectoral composition and the indirect effects on poverty – as measured by the average income of the first quintile – through sectoral growth on the growth of the other sector:

$$\frac{d \ln y_1}{d \ln g_A} = \left.\frac{\partial \ln y_1}{\partial \ln g_A}\right|_{\Delta g_{NA}=0} + \frac{\partial \ln y_1}{\partial \ln g_{NA}} \cdot \frac{\partial \ln g_{NA}}{\partial \ln g_A}$$

$$\frac{d \ln y_1}{d \ln G_{NA}} = \left.\frac{\partial \ln y_1}{\partial \ln G_{NA}}\right|_{\Delta g_A=0} + \frac{\partial \ln y_1}{\partial \ln G_A} \cdot \frac{\partial \ln g_A}{\partial \ln g_{NA}}$$

If the sectoral labor force is exogenous (valid in the short and medium term, when migration is less significant), then the elasticity of per-capita income in one sector with respect to the other is well-approximated by the elasticity of total income of one sector with respect to the other: $\partial \ln g_{NA} / \partial \ln g_A = \partial \ln G_{NA} / \partial \ln G_A$ (this latter elasticity is discussed in the previous section.)

Table V.11 shows both the direct and indirect effects and the total effect of agricultural and non-agricultural growth on income of the poorest (taken from Beyond the City).[53] For the LAC countries the total elasticity with respect to agricultural growth is 0.28 and with respect to non-agriculture, 0.77. For non-LAC developing countries the values are 0.48 and 0.58 respectively. Note is that the indirect effect of agricultural growth on poverty reduction represents a large proportion of its total effect. This is the case in LAC countries, where the indirect effect is one-third of the total, and in non-LAC countries, where it make up one fifth. In comparison to LAC countries, agricultural growth in non-LAC countries effects non-agricultural growth to a greater degree, although non-agricultural growth has smaller effects on poverty reduction. In short, the direct effect of agricultural growth is more important for poverty alleviation in non-LAC countries than in LAC countries. In all cases the growth of the non-agricultural sector is more important for poverty reduction in absolute terms. But relative to its GDP share, agriculture has a greater impact on poverty reduction than non-agriculture. For the LAC countries, agriculture's GDP share averages 0.12 (0.22 for non-LAC developing countries), and so, on average, agriculture's contribution to raising the incomes of the poorest is at least 2.5 times that of non-agriculture (2.5 for LAC, 2.9 for non-LAC developing countries).

## 3. Pulling these results together using regional averages

Suppose that we begin from a base period of agricultural GDP growth of 2%, which is the average growth rate corresponding to high taxation countries (low RRAs) that did not vary their level of intervention during the period 1986-2005 (see Table V.9B). The average NRAs for countries in the period 1985-2005 with high sectoral taxation was -0.132. What would have been the impact on agricultural growth if a representative country removed the relative taxation of agriculture, changing its NRA from -0.132 to zero, a neutral trade regime? Using the coefficient of 7.228 linking the average percent change in agricultural value added (over five-year periods) to the average change in NRA (in the

[53] The reader should note that the estimates of indirect growth effects from agriculture to non-agriculture and vice versa might be sensitive to the grouping of countries in the econometric specifications. For example, Bravo-Ortega and Lederman grouped countries by first high income and low income, and then within low income by Latin America and non-LAC. Christiaensen, Demery and Kuhl grouped countries by high, middle and low income, and also grouped by Sub-Saharan African countries and non-SSA countries. (Their specification also differed slightly in other respects from the Bravo-Ortega and Lederman approach.) Our emphasis in this paper is the LAC region, and so we use the Bravo-Ortega and Lederman results. Christiaensen, Demery and Kuhl do not separate middle and low income country groups by regions other than SSA.

previous five-year period) from Table V.10, one can calculate an increase in agricultural growth due to the policy change. As Table V.12 shows agricultural growth rates would have almost increased 50% from 2% to 2.95% annual growth (2.0% + 0.132*7.228% = 2.95%). This is the direct effect on the acceleration of agricultural growth due to the change from the average taxation regime (during 1986-2005) to a neutral regime.

Furthermore, there is heterogeneity with respect to the indirect effects of taxing the sector through the spillover of slower agricultural growth on the rest of the economy ($\partial lnG_{NA}/\partial lnG_A$).We do have estimates of the indirect effects of agriculture on non-agriculture for LAC countries (Beyond the City, p. 73), which are summarized for some LAC countries in Table V.13. Although the spillover effects are not statistically significantly different from the regional average for several countries, there are some countries with notably higher indirect effects. For example, in the cases of Chile and Panama, the percent change in non-agricultural GDP with respect to a one percent rise in agricultural GDP is at least one, if not higher. In these two cases the multiplier effects or positive externalities of agricultural activities are extremely high (likely due to stronger linkages with downstream industries) and one would expect therefore that the final impact on incomes of the poor from taxing the sector would be greater. Many countries with large agricultural sectors in the region also have higher indirect elasticities than the regional average – approximately 0.5, such Brazil and Argentina. It is an interesting question for future research why it should be that these indirect effects differ so widely across countries: Is it due to the structure of agricultural production and processing, the degree of trade openness and its implications for exchange along the value chain, or the extent of "dualism" in the economy that might tend to isolate agriculture?

Table V.13 presents another simulation of the impacts on the income of poorest quintile due to reducing the NRA from the average of -0.132 to neutrality. The income sensitivity of eliminating this representative tax on agriculture depends on the country-specific indirect effect of agricultural growth on non-agriculture. Table V.13 again supposes that non-agriculture grows at 3% annually and agriculture prior to relaxing the tax grows at 2%. With these reference growth rates the average income in the poorest quintile would increase at approximately 2.95% annually. Taking Chile as an example, the country's indirect elasticity of agricultural growth on non-agricultural growth is so high (1.29) that annual income growth rates of the poorest quintile would have risen to 4% if Chile were to have reduced the NRA from -0.132 to neutrality. Looking at this result from a slightly different perspective, it illustrates what would have been the cost in terms of poverty reduction of not opening the economy and maintaining implicit taxation on agriculture. One is tempted to speculate, given Argentina's fairly large estimate of the indirect growth elasticity of 0.5, that the country's policy of taxing agriculture could be causing significant foregone income gains of the poorest.[54]

[54] In Argentina's case, that agricultural exports are wage goods to a significant degree (grains and meat) would complicate the analysis of the net effect on the poor of taxing agriculture.

**TABLE V.12**
**SIMULATED CHANGES IN AGRICULTURAL VALUE-ADDED GROWTH RATES AS A FUNCTION OF DECREASES IN SECTORAL TAXATION AS MEASURED BY NRAS AND THE CONSEQUENTIAL EFFECT ON THE GROWTH RATE OF PER CAPITA INCOME OF THE LOWEST QUINTILE**
*(In percentages)*

| | | | | Change in growth rate of income of lowest quintile | | |
|---|---|---|---|---|---|---|
| Change in NRA | Initial ag GDP growth rate | Ag growth after change in NRA | Impact on ag growth rate | Direct effect | Indirect effect | Total effect |
| 0.05 | 2.00 | 2.36 | 0.36 | 0.07 | 0.03 | 0.10 |
| 0.1 | 2.00 | 2.72 | 0.72 | 0.14 | 0.07 | 0.21 |
| **0.132** | **2.00** | **2.95** | **0.95** | **0.18** | **0.09** | **0.27** |
| 0.15 | 2.00 | 3.08 | 1.08 | 0.21 | 0.10 | 0.31 |
| 0.2 | 2.00 | 3.45 | 1.45 | 0.28 | 0.13 | 0.41 |
| 0.25 | 2.00 | 3.81 | 1.81 | 0.35 | 0.17 | 0.51 |
| 0.3 | 2.00 | 4.17 | 2.17 | 0.41 | 0.20 | 0.62 |

Source: Authors'elaboration.
Note: Initial agriculture growth of 2% and non-agricultural growth of 3%.

**TABLE V.13**
**SENSITIVITY OF THE IMPACTS ON INCOME OF THE POOREST QUINTILE FROM TAXING AGRICULTURE TO THE COUNTRY-SPECIFIC INDIRECT EFFECT OF AGRICULTURAL GROWTH ON NON-AGRICULTURE: MOVING FROM AN NRA OF -0.132 TO NEUTRALITY BASED ON INITIAL AGRICULTURE GROWTH OF 2% AND NON-AGRICULTURAL GROWTH OF 3%**

| Reference country for the indirect effect of ag growth on rest of economy | Indirect elasticity Ag growth on nonAG GDP growth | Income elasticity of poorest quintile: indirect effect | Income elasticity of poorest quintile: total effect | Total effect of an increase in NRA of 0.132 on income of poorest quintile % | Rate of annual growth average income poorest quintile (base 2.89%) |
|---|---|---|---|---|---|
| LAC Regional Average | 0.12 | 0.093 | 0.284 | 0.27 | 3.16 |
| Argentina | 0.53 | 0.409 | 0.600 | 0.57 | 3.46 |
| Chile | 1.29 | 0.996 | 1.187 | 1.13 | 4.02 |
| Brazil | 0.57 | 0.440 | 0.631 | 0.60 | 3.49 |
| Mexico | 0.79 | 0.610 | 0.801 | 0.76 | 3.65 |
| Panama | 1.07 | 0.826 | 1.017 | 0.97 | 3.86 |
| Peru | 0.24 | 0.185 | 0.376 | 0.36 | 3.25 |

Source: Authors'elaboration.

# E. Conclusions

This study has focused on the link between agricultural openness and the sector's performance, an improvement in which could have significant impacts on poverty reduction. We have emphasized Latin America, during 1960 to 2005, using a recently-constructed data base of agricultural support that includes information for several developing countries beyond the region. The principal question addressed is, does the trade regime influence sectoral growth? With the answer to this question we then make some inferences regarding the influence of sectoral growth on poverty, using estimates of

the impact of economic growth on the incomes of the poorest quintile. The empirical analysis takes advantage of cross-country panel data from several sources, covering many developing countries in Africa, Asia and the LAC region. The LAC countries are Argentina, Brazil, Chile, Colombia, Dominican Republic, Ecuador, Mexico, and Nicaragua.

There is an unsettled debate in the literature regarding the definitions of some basic concepts, How to define the openness of the trade regime? How to measure the outcome in terms of agricultural growth? And, how to define the most important outcome: poverty reduction? In the case of trade openness, we make use of NRAs and RRAs, as indicators of effective levels of supports, although these measures of intervention have their drawbacks. Indicators of agricultural growth are the sector's value added and production levels; we have examined both here.

Using simple comparisons of averages we find that among developing countries in Africa, Asia and LAC, those with high-protection (which in many cases corresponds to less negative protection – i.e., taxation) during the period 1960-1985 tended to have higher average growth rates in agriculture production and in sectoral value added; and countries that were increasing protection (i.e., reducing taxation) during this period also had higher average growth rates. For the period 1986-2005, the trend in protection seems to be even more influential than the level, although the relationship between growth and levels of protection is not contrary to the hypothesis of a positive aggregate supply elasticity. We interpret these results as saying that it is not merely the average level of protection, but the trend in protection – particularly the lowering of taxation – that was important in stimulating private investments in the sector. A panel data analysis using five-year averages of the data supports the contention that changes in agricultural support – as measured by NRAs – are more important that levels. Investors generally look to the future, and potential investors in agriculture would look to possible future effects of protection or taxation of the sector on returns in the medium and longer term. It is not surprising, therefore, that trends in the trade regime, being more accurate than levels as predictors of the future environment for returns on investment, would correlate more closely with sectoral performance associated with changes in investments, positive or negative.

Using the panel data regression estimate of the effect of changes in NRAs on agricultural growth rates, we simulate what would have been the impact on average agricultural growth in the subsequent five-year period if a representative country removed the relative taxation of agriculture, changing its NRA from an average for countries in the period 1985-2005 with high sectoral taxation (-0.132) to zero, a neutral trade regime. As a point of reference we use a sectoral growth rate of 2% (the average rate corresponding to high taxation countries that did not vary their level of intervention during the period 1986-2005). The response in growth to this reduction in taxation shows that growth rates would have increased almost 50% from 2% to an average of 2.95% in the subsequent five year period. This is the direct effect on the acceleration of agricultural growth due to the change from the average taxation regime (during 1986-2005) to a neutral regime. For several countries in the LAC region, the level of taxation was considerably higher, prior to the economic reforms of the 1980s, and so the effect of moving to a neutral trade regime on agricultural GDP would have been all the greater.

With respect to poverty, while we do not empirically test the final impact of protection on poverty, we discuss the large body of evidence the supports the hypothesis that economic growth, especially agricultural growth in the case of developing countries, alleviates poverty, particularly when measured in terms of the average income of the lowest decile or quintile (this does not imply that growth automatically reduces inequality.) Then, using our own estimation of the effects of the trade regime on sectoral growth, and taking previously-estimated links between growth and income of the poorest, and between agricultural growth and national growth, we simulate the effects on the average income of the first quintile due to a reduction in taxation on agriculture. Using averages for the LAC region, a reduction in taxation on the sector from an NRA of –0.132 to neutrality (NRA = 0) would have increased the sector's growth (in the next five-year period) by about a percentage point, which would have led to an increase in the income growth rate of the poorest of slightly over a quarter percentage point (0.27). Assuming that without the removal of taxation, agricultural would have grown at 2% yearly and non-agriculture at 3%, and income of the poorest would have grown at about 2.9%; while without taxation

growth would have been about 3.2% (i.e., an increase of slightly more than 9% in the income growth rate).

These estimates of the impact of reducing the taxation on agriculture likely give a lower bound for rural areas and poor countries, because the direct impact of an increase in agricultural growth would be felt significantly among those in farm-related activities (concentrated in rural areas); and in some countries the poorest quintile likely is more rural, having a greater proportion of rural people than is representative in the total population. One can think of this simulation in terms of what would have otherwise been forgone if reforms had not taken place and reduced taxation on agriculture. It also provides a cautionary tale for countries that have yet to reduce fully their taxation of agriculture (e.g., Argentina, Nicaragua); they may be foregoing significant gains in incomes received by the poorest.

The empirical discussion above is bases on sectoral average NRAs, which combines all tradables. Nevertheless, as can be observed in Figure V.3 above, distinguishing the patterns of protection of importables and exportables shows that there still remains much that might be done in the LAC region to reduce the protection of import-competing crops and the taxation of the export-oriented sector. For the agriculture sector as a whole, the latest data for 2000-2004 might indicate misleadingly that governments are not intervening in price signals. But looking at importables and exportables separately would reveal that there is yet much to be done to remove a still strong anti-export bias. Our results above likely underestimate the benefits of trade liberalization, because we are working with aggregate NRAs, an indicator that conflates importables and exportables under one category of "tradables." Unfortunately the data are not available to separate the two sectors in terms of their value-added growth patterns and perhaps their distinct impacts on poverty.

With respect to lessons for future policy development, the evolution of protection indicators shows that there has been significant policy adjustment since the mid-1980s in reducing the degree of anti-export bias. There has been a movement toward a more-neutral trade regime, but this reduction in anti-export bias has been due mainly to the reduction of taxes on exportables. Notably in the region, Argentina, Dominican Republic, Mexico and Nicaragua still tax exportables, and (except for Argentina, where we have no information) they offer high levels of protection to importables. Evidently, there is much room remaining for adjusting trade policy as it affects agriculture, particularly in terms of reducing the protection of import-competing crops. For example, there are very high positive protection rates for importables in the cases of Colombia, Dominican Republic, Ecuador, Mexico, and Nicaragua.

From our analysis, a result from moving toward a neutral regime by reducing taxation on agriculture is to increase the sector's growth rate. Reducing taxation on exports and reducing protection for imports would raise the incentives to expand the production of exports even further, which – to the extent the two subsectors compete for domestic resources – would lead to faster growth of the agricultural sector as a whole. What would be the precise effect on poverty of this faster growth cannot be determined a priori, because the nature of pro-poor growth depends on the labor intensity – especially the unskilled labor intensity – of importables to exportables throughout the value chain. These labor intensities vary by activity, but as a general rule, they are higher in the case of fruits and vegetables and lower for field crops such as soy and wheat.

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# VI. Human capital formation and the linkage between trade and poverty: the cases of Costa Rica and Nicaragua

***Luis Rivera***
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## A. Introduction

Costa Rica and Nicaragua have engaged in important trade negotiations in the past 15 years. After negotiating several Free Trade Agreements (FTAs) with minor commercial partners (e.g. Mexico, Canada, Chile), Nicaragua ratified a FTA with the United States (US) in 2006 and Costa Rica in 2008 (DR-CAFTA). Moreover, both countries together with El Salvador, Guatemala and Honduras started negotiations with the European Union on an EU-Central America Association Agreement (EU-CAAA) in 2007. Combined, the US and EU represent the highest share of trade flows for both countries and thus, both FTAs are expected to have a significant economic impacts. In addition to trade reforms, both countries have been actively attracting Foreign Direct Investment (FDI) and pursuing competitiveness reforms to strengthen their integration with global markets. The main challenge of these policy efforts is to foster economic growth, improve living standards and reduce poverty.

Central America is characterized by widespread poverty and high levels of income inequality. Although Costa Rica has lower poverty levels, in the last two decades these have remained almost unaltered while income distribution has worsened. In the case of Nicaragua, poverty rates are among the highest in Latin America, while income distribution is highly unequal (Francois et al., 2008). Thus, it is important to estimate the poverty effects of trade policy in both Central American countries. The main feature of FTAs is the change in relative prices of final goods and factors, associated with the reduction or elimination of tariffs and other trade barriers. It has been widely acknowledged that trade reform is in aggregate beneficial for households (the country's aggregate welfare). Notwithstanding, it is also asserted that particular groups can be negatively affected by increased trade openness. The final outcome of an FTA depends on the general equilibrium adjustments and resource reallocations resulting from relative price changes. As well as the dynamic effects created by FDI inflows, increased productivity and innovation derived from higher exposure to international markets and ideas.

Human capital formation has long been regarded as an important source of economic growth (Lucas, 1988; Barro and Sala-i-Martin, 1995). In their recent survey, Hanushek and Woessman (2008) find that there are strong empirical links between human capital formation and economic growth, particularly when the quality of education is accounted for. Thus, it is expected that educational policies that increase the quantity and quality of schooling can foster growth in both Central American countries. In turn, higher growth rates have a large potential to reduce poverty rates. Moreover, a labor force with higher human capital can act as a positive complementary effect to enhance the benefits of the recent trade liberalization process in Costa Rica and Nicaragua.

The main objective of this study is to estimate the impact of trade and human capital formation on poverty, and assess the complementarities between both sets of policies. To achieve this goal we use several methodologies. First, we build a dynamic Computable General Equilibrium (CGE) model and use it to analyze the macroeconomic effects of two FTAs (DR-CAFTA and EU-CAAA). Secondly, using a "top-down" approach, we assess the microeconomic effects on households when the macro policies are implemented. Finally, we implement a human capital satellite model and use it to assess the effects of human capital policies on labor efficiency and labor supply by different skill types. We then interlink the satellite model with the CGE model to interact trade and human capital policies at the macro level. The combination of these methodologies enables use to conduct a rich analysis of each policy (education and trade), their interactions and complementarities.

With respect to the macro component, this paper builds on previous studies that estimated the macroeconomic effects of both FTAs. In Francois et al. (2008) the economic implications of DR-CAFTA were assessed, while Rivera and Rojas-Romagosa (2007) studied the effects associated with different prospective scenarios for EU-CAAA.

The "top-down" methodology takes a two-step approach where changes in factors and final goods prices and quantities are first estimated through a Computable General Equilibrium (CGE) model and then mapped into the welfare function of each household using detailed household income and expenditure data.[55] With this methodology we can assess the poverty effects of both DR-CAFTA and the forthcoming EU-CAAA on two Central American countries: Costa Rica and Nicaragua.

Recent household surveys for Costa Rica and Nicaragua provide detailed micro information on the income sources and expenditures of a representative sample of households.[56] When this micro data is adequately organized, we can map changes in final goods and factor prices to the real income of each household. Using this real income information and the existing poverty line estimations published by national statistics agencies, we can estimate the changes in headcount poverty ratios, the poverty gap and the Foster-Greer-Thorbecke index for each country:

To address the issue of human capital formation a satellite model is constructed following a revised version of the model by Jacobs (2005). In this model, improvements in school attainment are linked to changes in labor efficiency and labor supplies of different skill groups. The revised version includes the use of qualitative measures of schooling —by means of test scores— to assess the impact of educational policies. This allows us to incorporate into the model the latest findings by Hanushek and Woessman (2008), who show the importance of cognitive skills (i.e. the quality dimension of schooling) to assess the impact of human capital on growth and productivity.

Given the relative abundance of low-skill labor in both countries, it is expected that better export market access to the US and the EU increases the production and trade in low-skill intensive activities. The expansion of these sectors will increase the demand for low-skill workers and this is reflected in higher wages and better employment opportunities. Since the region is also characterized by a large informal sector which consists mainly of low-skill workers, a larger labor demand related to

[55] This methodology is now a standard feature of trade and poverty analysis. See for instance Cogneau and Robilliard (2000); Bourguignon and da Silva (2003); Löfgren et al. (2003); Winters et al. (2004).

[56] More precisely, the most recent expenditure and income surveys will be used for this study. These surveys are more comprehensive and capture more information than the (annual) household surveys.

higher trade volumes can also facilitate the inclusion of these low-skill workers into the formal sector.[57] Moreover, human capital investments in both countries are far behind international standards. This situation constrains the possibilities to create skill improvements that can take advantage of higher value added productive activities linked to international trade and foreign direct investment.

Our CGE results show that Costa Rica and Nicaragua can expect production and consumption increases from DR-CAFTA. These benefits are also present after the implementation of an Association Agreement with the European Union, although at a lower level. The CGE framework, however, only simulates static efficiency changes as a result of lower trade barriers. Thus, the positive changes from the trade policies we report can be regarded as a lower-bound for the potential benefits of the trade agreements. If dynamic efficiency gains are considered, then the benefits can be higher.[58]

The main driver of economic growth in the analysis is provided by the upgrading of human capital through educational policies. The results from the satellite model show that these policies create significant dynamic efficiency gains. For instance, the baseline growth rate is increased by around 0:6% in Costa Rica and 1% in Nicaragua when we link the labor supply and efficiency changes from the satellite model into the CGE model. Thus, both Costa Rica and Nicaragua experience higher growth and welfare effects when labor efficiency improves through human capital policies. However, there are significant short-term costs associated with the educational policies. In a first stage, the supply of low and high-skill workers is reduced (since students stay longer in school) but later on the human capital accumulation process starts and labor efficiency and wages begin to grow steadily over time. This process yields significant medium and long-term returns from education.

As a consequence of the different growth patterns produced by both policies, poverty impacts of FTAs are positive, but small. Human capital policies, on the other hand, yield stronger poverty reductions. Therefore, the poverty reduction we observe in our integrated scenario —where both trade and educational policies interact— is a direct outcome of human capital improvements in both countries. Our microsimulation results using the household surveys show that the most important income source for poor families in both countries is low-skill wages. Therefore, much of the poverty reduction after the implementation of education policies derives from the significant growth in low-skill wages. Finally, poverty and other macroeconomic variables do present positive but relatively small complementarity effects when both trade and educational policies are jointly implemented.

# B. Initial economic conditions in Costa Rica and Nicaragua

## 1. Trade and development in Costa Rica and Nicaragua

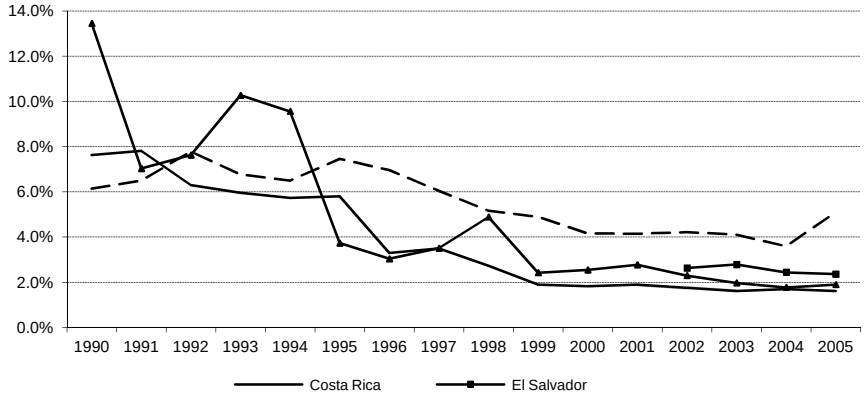
One of the most meaningful changes experienced by Costa Rica, Nicaragua, and Central America in general during the last two decades has been the consolidation of market liberalization policies and trade openness. The countries have been deliberate in opening their economies, establishing measures to accelerate it through unilateral import tariff cuts, policies to attract Foreign Direct Investment (FDI), and the implementation of Free Trade Agreements (FTAs).

For instance, trade-weighted average tariffs in both countries have been steadily declining since the 1980s (Figure VI.1). During the last decade, in particular, trade policy in Costa Rica and Nicaragua has been based on FTAs. Currently, both countries have signed FTAs with Canada, Mexico, Chile, the Dominican Republic, United Sates and some Caribbean countries. In addition, investment agreements have been ratified with an important group of countries, European as well as Latin American.

[57] For instance, Sauma and Sánchez (2003) indicate that in the case of Costa Rica, trade liberalization helped to create more "formal" jobs and thus reduce poverty rates. Evidence suggests an inverse relationship between formal work and poverty in Costa Rica.

[58] Francois et al. (2008) and Rivera and Rojas-Romagosa (2007) estimate some of these dynamic efficiency gains.

**FIGURE VI.1**
**CENTRAL AMERICA, EFFECTIVE AVERAGE NOMINAL TARIFF RATES[a], 1990-2005**




Source: World Development Indicators, The World Bank
[a] Defined as the ratio of collected import duties to total imports.

Costa Rica experienced an important structural change in its productive and trade sectors since the middle of the 90s, driven by FDI growth (Monge-González et al., 2009). The country has a trade structure with a higher level of technological sophistication. Exports and imports of industrial goods represent the highest share of trade, particularly medium and high technology intensive goods. On the other hand, Nicaragua's exports depend mainly on primary and natural resource based goods, while its imports are less technology intensive. The trade structure of the country has not changed, with the exception of other products like mining, which have increased their participation (Table VI.1).

**TABLE VI.1**
**TRADE STRUCTURE BY INDUSTRY AND TECHNOLOGY CLASSIFICATION, 1995 AND 2007/2008**

| | Costa Rica | | | | Nicaragua | | | |
|---|---|---|---|---|---|---|---|---|
| | Exports | | Imports | | Exports | | Imports | |
| | 1995 | 2008 | 1995 | 2008 | 1995 | 2007 | 1995 | 2007 |
| Primary Goods | 58.3% | 23.9% | 10.7% | 9.9% | 64.0% | 62.6% | 23.9% | 19.1% |
| Industrial Goods | 36.4% | 75.5% | 87.4% | 89.5% | 34.0% | 31.8% | 75.2% | 79.8% |
| Based on Natural Resources | 15.6% | 16.3% | 23.6% | 22.7% | 14.2% | 23.4% | 19.4% | 25.1% |
| Low Technology | 10.8% | 14.1% | 16.1% | 14.9% | 12.0% | 2.8% | 13.2% | 15.7% |
| Medium Technology | 7.1% | 17.6% | 36.3% | 29.7% | 2.9% | 4.8% | 30.5% | 25.0% |
| High Technology | 2.9% | 27.6% | 11.6% | 22.2% | 4.8% | 0.8% | 12.1% | 14.1% |
| Others | 5.3% | 0.6% | 1.9% | 0.6% | 2.0% | 5.6% | 0.9% | 1.1% |
| Total | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

Source: Own elaboration with data from CEPAL (2009).

The United States and the European Union are the most important trade partners of Costa Rica. Table VI.2 shows which goods are the main source of trade between Costa Rica and these regions. Industrial goods exports are the largest to the US market, with a higher share of products classified as diffusers of technical progress.[59] These same industrial goods account for around 60% of Costa Rican exports to other markets. On the other hand, primary agricultural goods represent almost 60% of external sales to the European Union, and around 30% of exports to the USA. Industrial

[59] This is mainly related to the operations of Intel Corporation in Costa Rica beginning in the late 1990s.

imports from all trading partners are significant, whereas more technology advanced goods are imported from the EU and other markets. The United States is the main import source of traditional industrial goods and products with economies of scale.

**TABLE VI.2**
**COSTA RICA: TRADE BY MAIN PARTNERS AND PRODUCT CATEGORIES, 2008**

| | United States | | European Union | | Others | |
|---|---|---|---|---|---|---|
| | US$ 000 | % of total | US$ 000 | % of total | US$ 000 | % of total |
| Exports | | | | | | |
| Agriculture | 1 077 692 | 29.1 | 952 022 | 56.1 | 190 449 | 4.4 |
| Mining | 395 | 0.0 | 0 | 0.0 | 6 277 | 0.1 |
| Energy | 644 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Traditional industrial goods | 821 495 | 22.2 | 199 800 | 11.8 | 1 413 642 | 32.7 |
| With economies of scale | 300 827 | 8.1 | 72 785 | 4.3 | 754 290 | 17.4 |
| Durable goods | 13 788 | 0.4 | 5 056 | 0.3 | 76 921 | 1.8 |
| Diffusers of technical progress | 1 492 051 | 40.2 | 465 762 | 27.5 | 1 886 965 | 43.6 |
| Others | 860 | 0.0 | 1 109 | 0.1 | 644 | 0.0 |
| Total | 3 707 752 | 100.0 | 1 696 534 | 100.0 | 4 329 188 | 100.0 |
| Imports | | | | | | |
| Agriculture | 496 321 | 8.5 | 18 428 | 1.1 | 221 521 | 2.9 |
| Mining | 10 771 | 0.2 | 588 | 0.0 | 42 387 | 0.5 |
| Energy | 4 841 | 0.1 | 537 | 0.0 | 580 562 | 7.5 |
| Traditional industrial goods | 904 850 | 15.5 | 209 822 | 12.2 | 1 613 189 | 20.9 |
| With economies of scale | 1 648 528 | 28.3 | 453 130 | 26.4 | 2 791 887 | 36.1 |
| Durable goods | 233 624 | 4.0 | 79 302 | 4.6 | 816 891 | 10.6 |
| Diffusers of technical progress | 2 440 826 | 41.8 | 942 437 | 55.0 | 1 607 620 | 20.8 |
| Others | 92 974 | 1.6 | 9 823 | 0.6 | 54 859 | 0.7 |
| Total | 5 832 735 | 100.0 | 1 714 067 | 100.0 | 7 728 916 | 100.0 |

Source: CEPAL (2009).

Nicaragua's trade with the US and the EU is more balanced in terms of industrial and primary goods (Table VI.3). Exports to other markets (especially to the Central American region) are more concentrated on primary goods. As indicated before, the trade structure of Nicaragua is composed of low technology intensity goods, especially in terms of its exports. More advanced goods are imported from the EU and other regions.

It is important to highlight that Costa Rica and Nicaragua have distinct economic and social characteristics, as shown by their different production and trade patterns. Costa Rica has a medium-income GDP per capita level, and a more dynamic and diversified economy. This difference can be better understood by observing the education and human development indicators. As shown in Table VI.4, Nicaragua has low literacy rates, education expenditures, and lower enrollment rates. Costa Rica shows better performance indicators. This differentiation introduces comparative issues that would help understand from two different perspectives the role played by trade on growth and poverty.

The Central America region has low-income country characteristics, while poverty rates are relatively lower for Costa Rica, and significantly high for Nicaragua. In addition, poverty rates are higher for people without a formal occupation. Even when unemployment is around 5% in both countries and expected to increase between 0.6% and 0.7% in year 2009 (ECLAC, 2009), there are relatively high under-employment conditions tied to a significant informal sector economy, particularly in Nicaragua (Table VI.5).

**TABLE VI.3**
**NICARAGUA: TRADE BY MAIN PARTNERS AND PRODUCT CATEGORIES, 2007**

| | United States | | European Union | | Others | |
|---|---|---|---|---|---|---|
| | US$ | % of total | US$ | % of total | US$ | % of total |
| Exports | | | | | | |
| Agriculture | 59 313 | 34.0 | 171 111 | 53.1 | 165 735 | 81.4 |
| Mining | 3 119 | 1.8 | 0 | 0.0 | 8 | 0.0 |
| Energy | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Traditional industrial goods | 82 922 | 47.5 | 131 073 | 40.7 | 31 472 | 15.5 |
| With economies of scale | 17 881 | 10.2 | 16 742 | 5.2 | 5 490 | 2.7 |
| Durable goods | 692 | 0.4 | 135 | 0.0 | 147 | 0.1 |
| Diffusers of technical progress | 10 314 | 5.9 | 2 899 | 0.9 | 699 | 0.3 |
| Others | 287 | 0.2 | 195 | 0.1 | 106 | 0.1 |
| Total | 174 529 | 100.0 | 322 155 | 100.0 | 203 655 | 100.0 |
| Imports | | | | | | |
| Agriculture | 20 054 | 1.6 | 75 008 | 12.0 | 6 735 | 0.8 |
| Mining | 1 598 | 0.1 | 528 | 0.1 | 74 | 0.0 |
| Energy | 353 419 | 27.7 | 3 108 | 0.5 | 29 620 | 3.5 |
| Traditional industrial goods | 304 541 | 23.9 | 121 478 | 19.4 | 166 966 | 19.9 |
| With economies of scale | 354 308 | 27.8 | 173 734 | 27.8 | 217 199 | 25.9 |
| Durable goods | 56 851 | 4.5 | 28 038 | 4.5 | 166 499 | 19.8 |
| Diffusers of technical progress | 184 962 | 14.5 | 187 279 | 30.0 | 247 358 | 29.4 |
| Others | 235 | 0.0 | 35 571 | 5.7 | 5 498 | 0.7 |
| Total | 1 275 968 | 100.0 | 624 744 | 100.0 | 839 949 | 100.0 |

Source: CEPAL (2009).

**TABLE VI.4**
**EDUCATION AND HUMAN DEVELOPMENT**

| | HDI Rank* | Adult Literacy Rate (% aged 15 and above) | Net Primary Enrollment Rate (%) | Net Secondary Enrollment Rate (%) | Public Expenditure in Education (% of GDP) | Researchers in R&D (per million people) |
|---|---|---|---|---|---|---|
| | 2008 | 2008 | 2005 | 2005 | 2005 | 2005 |
| Costa Rica | 50 | 95.8 | 99.7 | 67.6 | 4.9 | 533 |
| Nicaragua | 120 | 80.1 | 84.1 | 43.0 | 3.1 | 73 |

Source: Human Development Report, UNDP and World Development Indicators, The World Bank.
* Human Development Index, among 179 countries.

These characteristics imply that with this low human capital profile —together with the absence of major natural resource endowments— low-skill labor is a relatively abundant factor in Nicaragua, and less in Costa Rica. The subsequent high sub-utilization rates of labor imply that workers could be drawn to the formal sector with the improved labor opportunities expected from DR-CAFTA and EU-CAAA.

**TABLE VI.5**
**FUNCTIONAL ANALYST SENIORPOVERTY AND LABOR CONDITIONS**

| | Poverty headcount | Poverty headcount* | Poverty non-employed | Worker Sub-Utilization** | Gini Coefficient |
|---|---|---|---|---|---|
| | 1990-2003 | 2008 | 2008 | 2008 | 2008 |
| Costa Rica | 22.0% | 18.6% | 20.0% | 13.4% | 0.51 |
| Nicaragua | 47.9% | 46.0% | 62.0% | 33.7% | 0.57 |
| Central America | 44.5% | 52.8% | 51.9% | 30.7% | 0.57 |

Source: UNDP (2006), ECLAC (2009), Rivera and Rojas-Romagosa (2007).
*2005 for Nicaragua.
**Unemployment plus Under-Employment.

## 2. Trade policy in Central America

Both DR-CAFTA and EU-CAAA are steps forward in the global integration process of Costa Rica and Nicaragua. The agreements will not only consolidate trade and investments with the US and EU, but create a business platform in the region, to attract more companies and investors interested in entering both markets. Most importantly, there would be a more solid integration of a regional Central American market of almost 40 million people.

Depending on the final outcome of a Free Trade Agreement (resulting basically from the political bargaining of interest and pressure groups), a group of "winners" and "losers" will emerge. These groups, however, might not be the expected winners and losers, in terms of their success or failure to influence the FTA agreement. Instead, the impact of an FTA will depend significantly on the starting point of an economy, and the particular characteristics of its productive sectors. The ensuing results will then depend on the structure, level of development, stage of competitiveness and dynamics of the different sectors within the economic system of a country (Condo et al., 2005).

However, there are political, economic and social risks that must be recognized and mitigated. Basically, the difficulties lie in the ability of the countries to manage the transformation process. Upgrading competitive capacity and shifting factors of production into other areas is time and resource consuming and requires much investment. Fiscal and institutional constraints in the countries could limit the ability to invest in many critical areas that would help facilitate and smooth the transformation.

Under the US Caribbean Basin Trade Partnership Act (CBTPA)[60] and the Generalized System of Preferences (GSP), many exports from Costa Rica and Nicaragua already enter the United States duty-free. DR-CAFTA consolidated these benefits and made them permanent.[61] More than 80 percent of US tariff codes (consumer and industrial products) exported to Central America enter duty-free immediately since the ratification of the agreement, while 85 percent will be duty free within five years. All remaining tariffs will be eliminated within ten years.

Close to 98 percent of all goods produced in Central America enter the US market duty-free. The Central American countries also accorded substantial market access across their entire services regime (i.e. banking, insurance, telecommunications), subject to very few exceptions. Regarding agriculture, DR-CAFTA opened the market widely, with the elimination of almost 100 percent of import tariffs. The only excluded products are sugar in the US, white corn in all Central American countries, potatoes and onions in Costa Rica. The sensitive agricultural products of Central America (rice, beans, poultry, beef and pork meat, dairy products) obtained protection with long tariff phase-out periods.

The European Union (EU) and five Central American countries, El Salvador, Guatemala, Honduras, Nicaragua and Costa Rica, started negotiations of an EU-Central America Association Agreement (EU- CAAA) in June 2007.[62] Under the Generalized System of Preferences (GSP plus), many exports from Central America already enter the European Union duty-free. Notwithstanding, many agricultural goods face important tariff and non-tariff barriers in the EU market, particularly bananas and sugar, two export commodities with significant comparative advantages in Central America.

The Association Agreement could consolidate GSP plus benefits and make them permanent, so that an important amount of products made in Central America could enter the EU market duty-free

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60 Enacted in May 2000 as part of the Trade and Development Act. The CBTPA enhanced the 1984 Caribbean Basin Initiative (CBI) benefits.

61 The United States and five Central American countries, El Salvador, Guatemala, Honduras, Nicaragua and Costa Rica, concluded negotiations on the US-Central American Free Trade Agreement (DR-CAFTA) in January 2004. The agreement was signed on May 2004, and ratified by the US House of Representatives on July 27, 2005. The agreement has been ratified by all country partners. The Dominican Republic was included into the Agreement on August 2004, named afterwards DR-CAFTA.

62 An Association Agreement goes beyond the standard Free Trade Agreement approach. It incorporates political and institutional agreements between the Parties, and a development aid component. The EU-CAAA is expected to be ratified in 2010.

immediately upon ratification of the agreement. However, the recent experience with EU negotiated FTAs (with Chile, Mexico, and South Africa, for instance) suggests that many "sensitive" sectors, mainly EU agricultural goods with high protection, would be excluded from any agreement.

## 3. Education quality in Nicaragua and Costa Rica

Improving the quality of education is still the major challenge confronted by the education systems of Latin America and the Caribbean (UNESCO and LLECCE, 2008b). In the case of Nicaragua, the task is more stressing, since limited access to education and low completion rates (quantity) are still important barriers to development. According to World Bank (2008), lack of education constitutes one of the main determinants of poverty in Nicaragua. It is estimated that less than 70% of population between 15 and 19 years attained complete primary education (UNESCO and LLECCE, 2008a). The Ministry of Education (MINED) reports an 80.3% primary school completion rate (*Ministerio de Educación de Nicaragua*, 2007). However, less than 40% of students complete primary education without repetition.

Despite some progress in recent years, Nicaragua is likely to meet less than half of the Millennium Development Goals (MDGs) set for 2015. In the case of MDG-2 (a net primary enrollment rate of 100% for year 2015), the country is on track, but unlikely to achieve the goal, notwithstanding the advances reported by Ministerio de Educación de Nicaragua (2008). Currently, the net enrollment rate in primary education is 84.1%. The forecast for 2015 is 87% (World Bank, 2008).

Regarding secondary education, Ministerio de Educación de Nicaragua (2007) reports a 65.7% approval rate, while 43.12% of students complete it without repetition. In year 2007, only 32% of the population aged between 20 and 29 year graduated from high school (UNESCO and LLECCE, 2008a). Therefore, there is also broad space for improvements in secondary education.

Recent estimations indicate that a worker in Nicaragua earns 10% more for each additional year of schooling received. Returns to primary and secondary education have been increasing in the last decade. It is estimated that workers require at least 11 years of education to achieve an income level above the poverty line (World Bank, 2008). Trejos and Gindling (2004) argue that one of the most important determinants of income inequality in Nicaragua, relative to other Central American countries, is the limited access to education. Quality is a central issue, as well. The possibility of increasing labor productivity depends on education quality improvements (World Bank, 2008; Guevara, 2004). For instance, using household survey data, Gutierrez et al. (2008) report a decrease of -26% in labor productivity (output per worker) between 2001 and 2005. In presence of more average years of education of the labor force, and a negative Total Factor Productivity (TFP) rate for the same period, the quality of education appears as a possible explanation for this outcome.

From a policy perspective, it seems clear that the improvement of education coverage and quality are key objectives of the Ministry of Education (MINED, 2007b). The final policy outcome in terms of a more productive labor force appears as a key performance indicator for the medium and long term.

Compared to Latin American standards, Costa Rica has made important advances regarding education access in the last decades. Literacy rate is almost 100% while more than 93% of population between 15 and 19 years has completed primary education (UNESCO and LLECCE, 2008a). According to the Ministry of Planning (MIDEPLAN), the net enrollment rate in primary education is 100.7% and 68.9% in secondary education, with completion rates of 89.3% and 79.4%, respectively (SIDES, 2009). However, in recent years secondary school attendance has decreased significantly. Close to 12.5% of secondary students leave high school before completion (Programa Estado de la Nación, 2008). Moreover, it is estimated that only 69% of enrolled students complete secondary studies without repetition (SIDES, 2009).

Secondary education is a central concern of current policy. Indeed, government officials included secondary education promotion as a key component of the National Development Plan for

year 2006-2010 (MIDEPLAN, 2006). The main instrument of education promotion has been Avancemos, a conditional cash transfer program that aims to support low income students and thus help them complete secondary education. The main objective is to increase the completion rate by 4.2% of 2006 level, in year 2010.

According to Gindling and Trejos (2005), one of the most important determinants of rising inequality in Costa Rica during the 1990s (the period of major trade liberalization measures) was the presence of increasing returns of education, that is, the earning differences between more —and less— educated workers. Driven by trade liberalization and foreign direct investments attraction, the productive structure of Costa Rica has changed significantly in the last two decades. The demand for high skilled workers has increased, as well as their relative wages compared to low skilled workers (Sánchez, 2004). Multinational companies (MNCs) and exporting firms have created a labor demand for more qualified workers, therefore increasing education returns (Monge-González et al., 2009). Gindling (2007) indicates that 90% of household income inequality is explained by labor income, while inequality in education access accounts for an important part of wage dispersion.

Table VI.6 describes the education level of the labor force for both countries. In terms of education quantity, the Costa Rican labor force is generally more skilled than in Nicaragua. In spite of this, Nicaragua has made advances in recent years to reduce the non-educated workers share and increase all education levels of the employed people. Projections for year 2015 suggest a similar tendency.

**TABLE VI.6**
**EDUCATION LEVEL OF THE LABOR FORCE: PROJECTIONS FOR 2015**

| | Costa Rica | | Nicaragua | |
|---|---|---|---|---|
| | 2006 | 2015 | 2006 | 2015 |
| No Education | 2.5 | 1.8 | 14.4 | 8.4 |
| Incomplete Primary | 12.5 | 8.7 | 23.1 | 15.4 |
| Primary | 28.6 | 22.8 | 14.7 | 12.2 |
| Incomplete Secondary | 20.7 | 24.7 | 23.4 | 28.4 |
| Secondary | 13.9 | 15.1 | 11.1 | 16.7 |
| University | 21.8 | 26.9 | 13.2 | 19.0 |

Source: Trejos (2008).

Table VI.7 describes data from the Second Regional Comparative and Explanatory Study (SERCE). These data evaluates student performance in Latin America, following a similar methodology to the PISA (Programme for International Student Assessment) report by OECD (2007). The SERCE gives insight into the learning acquired by Latin American and Caribbean Third and Sixth Grade Primary Students in the areas of Mathematics, Language (Reading and Writing) and Natural Science during their school trajectory. The assessment is based on test scores with a scale of 500 (mean) and 100 (standard deviation) points (UNESCO and LLECCE, 2008a).

**TABLE VI.7**
**SERCE TESTS: STUDENT PERFORMANCE IN MATHEMATICS AND READING TESTS**

| | Mathematics | | Reading | |
|---|---|---|---|---|
| | Mean Score | Standard deviation. | Mean score | Standard deviation |
| Argentina | 513,0 | 7,7 | 506,5 | 9,6 |
| Brazil | 499,4 | 11,6 | 520,3 | 11,4 |
| Chile | 517,3 | 8,1 | 546,1 | 8,4 |
| Colombia | 492,7 | 9,4 | 514,9 | 10,9 |
| Costa Rica | 549,3 | 7,4 | 563,2 | 6,2 |
| Cuba | 637,5 | 21,7 | 595,9 | 13,0 |
| Ecuador | 459,5 | 9,9 | 447,4 | 9,2 |

(continues)

Table VI.7 (conclusion)

| | Mathematics | | Reading | |
|---|---|---|---|---|
| | Mean Score | Standard deviation. | Mean score | Standard deviation |
| El Salvador | 471,9 | 7,4 | 484,2 | 7,8 |
| Guatemala | 455,8 | 5,7 | 451,5 | 6,6 |
| Mexico | 541,6 | 10,3 | 529,9 | 9,4 |
| Nicaragua | 457,9 | 5,0 | 472,9 | 5,3 |
| Panamá | 451,6 | 6,3 | 472,1 | 7,2 |
| Paraguay | 468,3 | 8,4 | 455,2 | 8,7 |
| Peru | 490,0 | 10,6 | 479,3 | 5,2 |
| Dominican Republic | 415,6 | 4,0 | 421,5 | 6,4 |
| Uruguay | 578,4 | 7,9 | 542,2 | 7,2 |
| Latin America | 506,7 | 5,3 | 513,0 | 5,2 |

Source: UNESCO and LLECCE, 2008b.

With regard to changes in the quality of education —as measured by standardized test scores— Costa Rica shows scores above the Latin American averages, while Nicaragua ranks below regional average both in mathematics and reading skills tests. It is noticeable the dispersion of test scores from the highest and lowest percentiles.

The SERCE report found a positive correlation between the average scores of a given country and its per capita Gross Domestic Product (GDP). Another relevant finding is that the higher the income distribution inequality, the lower the average student performance in Latin American countries. Therefore, SERCE scores change offer a good picture of how the improvement of education quality could impact growth in the region.

SERCE reports scores for sixth grade students, while PISA evaluates 15-year old students' skills. In spite of this difference, both reports are helpful for comparisons of Latin American countries included in both studies. A clear result is that PISA's standards are more rigorous than SERCE's. Latin American countries are far from developed countries standards reported by PISA and obtained much lower scores compared to those of SERCE (in all cases more than 100 score points less). Furthermore, Hanushek and Woessman (2009b) argue that the average achievement of Latin American students on international cognitive skills tests is substantially lower than in East Asia and close to Sub-Saharan Africa.

# C. Analytical instruments and methodology

## 1. Trade and poverty evaluation using a top-down approach

The first analysis takes a two-step approach for which changes in factors and goods prices are estimated through a recursively dynamic multi-country CGE model and then mapped into the income and expenditure disaggregations of individual households using recent household survey data for Costa Rica and Nicaragua. In this way, the macroeconomic effects of FTAs are used to assess the potential impacts on poverty and income distribution from trade agreements alone. The methodology to assess the household-specific impact of trade reforms has been developed in Bourguignon et al. (2003).

### a) Dynamic CGE model

To obtain the macroeconomic effects of both trade agreements we construct our own multi-country recursive dynamic CGE model. This model is written in GAMS using the MPSGE application

developed by Rutherford (1995; 1999).This application translates the GTAP database and standard model into a GAMS version, i.e. GTAPinGAMS. Furthermore, Rutherford uses the MPSGE programming language, which allows handling CGE models in a consistent and compact format.

The characteristics of our recursive-dynamic CGE model and the calibration assumptions are provided in detail in Rivera and Rojas-Romagosa (2010).[63]

### b) Microsimulations using household-level data

For the top-down microsimulations, we use the most recent expenditure/income surveys for Costa Rica in 2004 (INEC-CR, 2006) and for Nicaragua in 2005 (INEC-Nicaragua, 2005).

The second step in the macro-micro top-down approach consists in translating the macro results from the CGE model to the disaggregated household data available from national surveys. In this study we use economy-wide price changes in final goods and factors, to link the macro CGE model with the survey micro data. As a starting point, it is assumed that the labor market adjustments are made via changes in wages and not through changes in existing employment levels. When the economy is not in full employment it can be expected that wages will not vary much, but employment levels will increase in response to a rise in the labor demand.

In the CGE model it is assumed that the governmental budget is adjusted to compensate for potential tariff revenue losses and therefore, transfers to households are also assumed to remain constant. Using this approach, therefore, the main effect of the FTAs on individual households is represented by the change in the price of the goods consumed and the variation in the factor prices (i.e. wages, capital and land rents). The overall welfare effects for an individual household are then a combination of both price effects. For example, if the price of the bundle of goods consumed by a specific household increases more than the price of its factor endowments, it is likely that its real income diminishes.[64]

Combining the five factor classification of GTAP with the household survey data we obtain the composition of income by percentile. The income composition of the low-income families consists mainly of low-skill labor, and to a lesser extent capital and transfers. On the contrary, for the high-income households' high-skill labor, capital rents, and financial gains are the most significant.

This decomposition provides important information to evaluate the potential poverty impacts. First, capital represents a constant fraction of household income, irrespective of the income level.[65] It is important to notice that the constant share of capital among income levels does not mean that the absolute levels of capital are equal among different household, only the relative fraction. Thus, high-income households will have higher capital gains compared to poorer households, but it will represent the same fraction of their total income.

With respect to poverty, the changes in low-skill labor earnings are a key issue. This follows from the fact that for the lowest two quintiles of the population, low-skill labor represents more than half of its income. Moreover, given the relative importance of food consumption for the poorest household, the relative price of food is also a key factor that affects poverty.

For the case of Nicaragua, the income composition is heavily skewed toward low-skill labor earnings. Low-skill labor represents around 70% of income for all families up to the last quintile were its relative importance diminishes. On the other hand, high-skill labor income is only significant for

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63 The full project report.

64 An alternative is to assume a different macroeconomic closure, where wages are fixed and employment levels change. In this case, the assignment of new jobs to specific households can be done using logistic regressions. These regressions provide the probability of each household to have an employed member.

65 This follows the way the household divides own-activity income, assigning part of the revenues to capital gains and the rest to labor income. Thus, for the low-income individuals that work in independent activities, part of their income will be reported as capital rents and the rest as unskilled labor income.

the richest families. As with Costa Rica, capital rents represent a similar share of total income for all the population. However, land rents are more significant in Nicaragua, and contribute to almost 10% of total income of the poorest families. Finally, transfers are significant for all income levels.

Under these conditions, increases in inequality can be expected if the wages for high-skill wages increase relative to other income sources. However, the main concern for Nicaragua is the reduction of its high poverty levels and this can be achieved by an increase in the low-skill labor earnings, which is the main income source for most households. Moreover, the share of food consumption in total expenditure is also relatively high for most income levels, and therefore, changes in the relative prices of food are key to changes in poverty.

## 2. Assessing the impact of human capital policies

### a) The human capital satellite model

The implementation of human capital formation is evaluated through a satellite model based on Jacobs (2005) and Rojas-Romagosa (2009). Using five different skill-levels this model estimates the opportunity costs of increased years of schooling and the expected labor productivity increases by skill that are expected from higher school attainment. Both outcomes are then linked to the main CGE model to estimate the effect of higher school attainment on labor supply of different skills, wages, sectoral production and other relevant macroeconomic variables. In turn, these macroeconomic results are linked using the top-down approach to the micro model to evaluate the impact of the human capital policies on poverty.

For this paper, a revised version of the satellite model by Rojas-Romagosa (2009) is constructed. In particular, to adapt the model to developing countries, we change the skill classifications to have more detailed information for low skilled workers, which are relatively more important in countries like Costa Rica and Nicaragua. Thus, we use three low skilled and two high skilled sub-groups. In addition, the satellite model incorporates cognitive skills into the analysis. Using test score information for Costa Rica and Nicaragua, the impact of these quality indicators are incorporated to obtain a more robust indicator of the role of human capital on poverty. The results from the human capital satellite model are incorporated into the core CGE model using two linkage variables: labor supply volume changes and labor efficiency changes.[66]

As surveyed by Hanushek and Woessman (2008), there are strong empirical links between human capital and economic growth. Thus, it is expected that increasing the quantity and/or quality of schooling in both Central American countries can positively impact economic growth and facilitate poverty reduction. Moreover, improving the human capital stock can also act as a complementary policy to recent trade liberalization processes in the region. Improving the skills of workers can enhance the potential benefits of increased trade openness.

### b) Human capital policy simulations

In this section we explain the policy simulations that are conducted for each country and the changes in labor efficiency that are derived from the application of these policies.

Simulation exercises based on the state of education in Costa Rica and Nicaragua described in section II.D, three simulation exercises are developed. In all cases, a what if policy scenario is formulated. The main data sources are the household survey of year 2008 in the case of Costa Rica INEC CR (2008), the eight population census of Nicaragua, published in year 2005 INEC Nicaragua (2005), and the SERCE report. The three exercises for Nicaragua are based on the following assumptions:

[66] A detailed description of the human capital satellite model is presented in Rivera and Rojas-Romagosa (2010).

(i) We do not think the achievement of the MDG-2 target is plausible. However, we simulate a significant progress by assuming that there is an 80% completion rate in primary education by 2015 and 90% by 2020.

(ii) The second target is another what-if scenario when —on top of the increase in primary completion— secondary graduation rates[67] increase to 5 percentage points to reach 37% in 2010, with an additional 5% increase to reach 42% in 2015.

(iii) The final target for Nicaragua is an improvement in student performance measured by a half standard deviation increase in the SERCE scores (50 points).

In the case of Costa Rica, the three counterfactual exercises are based on the following assumptions:

(i) The achievement of a 95% graduation rate of primary education by 2015 and 97.5% by 2020.

(ii) In addition to the primary graduation rates, the increase of the secondary graduation rates by 5% in 2010 reaching 55% and then another 5% increase to reach 60% in 2015. This requires an increase in all low-skill type graduation rates to produce a balanced increase in schooling attainment.

(iii) The final target is an improvement in student performance measured by a half standard deviation increase in the SERCE scores (50 points).

### *(1) Labor efficiency and labor supply results*

The results are divided between the school attainment goals, i.e., more years of schooling, and the quality of schooling goals as measured by standardized test scores. To simulate the school attainment goals (primary and secondary education) we change the graduation rates in the human capital satellite model. To assess the impact of quality improvements in education, as measured by standardized test-scores we use the SERCE data. We estimate the effects of an increase of half standard deviation (50 points) in the test scores. This is translated, in turn, into a labor productivity increase of 10%. As explained above we take that one standard deviation increase in standardized test scores translates into a 20% increase in wages. Thus, a half standard deviation increase is equivalent to a 6% labor productivity increase.

To achieve this quality increase, however, requires monetary investments and time. There is a huge literature that tries to link education expenditures with the quality of education. In the influential paper by Hanushek (1986), he concluded that there was no empirical relation between school expenditures and student performance. However, it is recognized that the majority of the studies he surveyed suffered endogeneity bias. A more recent literature uses exogenous variation from controlled or natural experiments. These new papers are surveyed by Webbink (2005) and he finds that resources and incentives can matter for achievements of students. However, the results vary by expenditure and incentives, making it extremely difficult to establish a clear relationship between concrete policy interventions and schooling achievements. For example, the cost-effectiveness of the policies is not yet established and it probably varies much between countries and educational systems. This lack of clear policy instruments that can be directly modeled to achieve the increase in schooling quality limits is a limiting factor in our analysis. Thus, for illustrative reasons we conduct a what-if experiment where the quality increase has already been reached in 2015. We show the changes in labor efficiency of this quality improvement in Figure VI.6.

Comparing these results with those of increased schooling attainment, it is clear that the economic benefits of improved schooling quality are much more significant. Labor efficiency increases by around 20% when test scores are improved. While the increase in labor efficiency is half

[67] Graduation rates are defined as the percentage of the population with ages between 20 and 29 that graduated from a specific educational level.

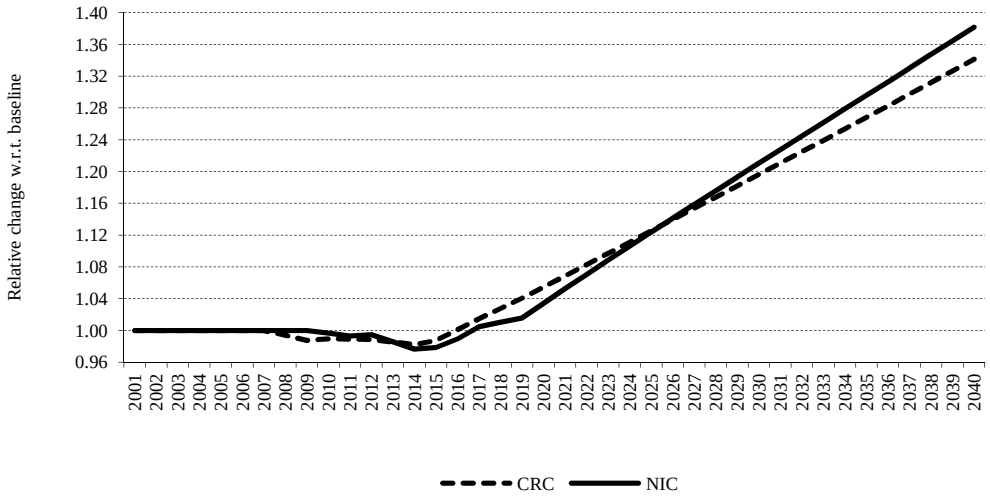
that amount (around 10%) when there is an increase in secondary school attainment. Therefore, these significant results are in line with the empirical findings by Hanushek and Woessman (2008) that cognitive skills have a significant impact on economic growth.

To put these results in perspective, it is useful to compare the SERCE results with those of the PISA study. As indicated before, PISA tests are more rigorous than SERCE's. The sample of Latin American countries included in both studies reveals a wide gap in the test results between developing and developed countries. Comparing the results of both tests we can also have an idea of the meaning of a half standard deviation increase. Taking into account that Costa Rica's scores reported by SERCE are higher than those of Latin American countries in the PISA study, an increase of half a standard deviation (50 points) of test scores would rank the country close to the level of European countries like Greece and Turkey. For the case of Nicaragua, such an improvement of 50 points would rank the country close to the test score levels of Brazil and Peru.

### *(2) Cumulative results*

We run a simulation of the satellite model where all policy education goals are achieved. Thus, both primary and secondary school attainment and improved schooling quality are included in the overall labor efficiency gains. The results are shown in Figure VI.2: The end-result is a staggering 34% increase in labor efficiency in Costa Rica and 38% in Nicaragua by 2040. Although the educational goals we have modeled are ambitious, these results show the expected payoffs in terms of labor efficiency, which are translated into higher labor productivity and wages. The level of such increases can become a significant force to increase overall growth rates and significantly decrease poverty.

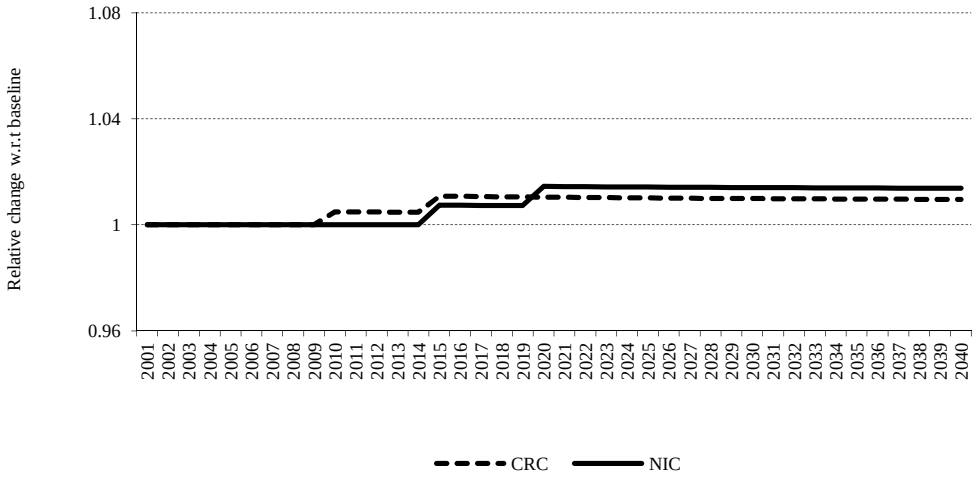
**FIGURE VI.2**
**COSTA RICA AND NICARAGUA, ACCUMULATIVE CHANGES IN AGGREGATE LABOUR EFFICIENCY WHEN REACHING BOTH SCHOOL ATTAINMENT AND QUALITY GOALS**




Source: Own elaboration.

Figure VI.3 shows the changes in labor supply for the high-skill category H: We see that the supply of H is increasing in two steps and the change becomes permanent after 2020. This corresponds to the increase in high-school graduates in both countries.

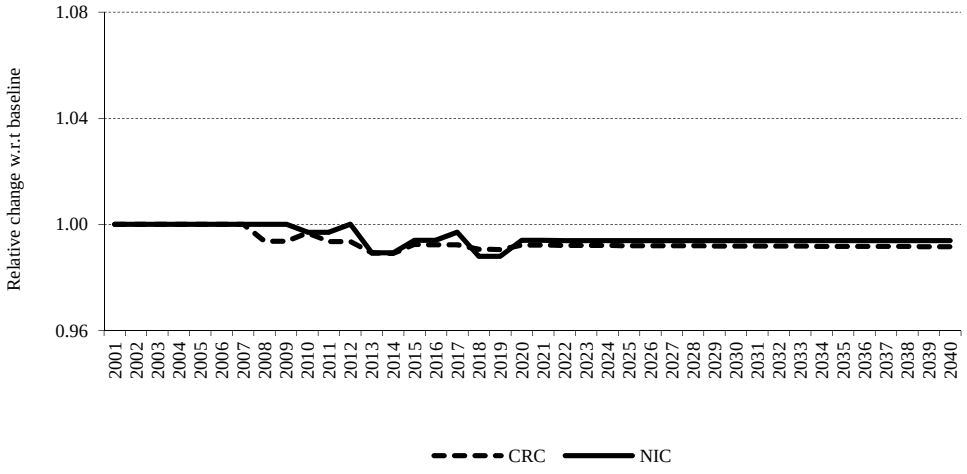
**FIGURE VI.3**
**COSTA RICA AND NICARAGUA, HIGH-SKILL LABOUR SUPPLY CHANGES WITH RESPECT TO BASELINE, SIMULATION WITH ALL EDUCATION POLICIES**




Source: Own elaboration.

On the other hand, Figure VI.4 gives the same information but for the low-skill workers. The supply of *L* is increasing with the primary school goals, which increase the level of schooling within the low skill aggregate *L*. But this effect is counteracted by the movement of students from the *L* aggregate unto the *H* aggregate as more students are completing their secondary education. At the end, this second effect is stronger and after 2020 there is a permanent decrease in the supply of low-skill workers.

**FIGURE VI.4**
**COSTA RICA AND NICARAGUA, LOW-SKILL LABOUR SUPPLY CHANGES WITH RESPECT TO BASELINE, SIMULATION WITH ALL EDUCATION POLICIES**




Source: Own elaboration.

# D. Economic and poverty impact of trade and human capital policies in Costa Rica and Nicaragua

## 1. Macroeconomic effects of the trade scenarios

In this study we aggregate the GTAP7 database in 40 sectors and 9 regions: Costa Rica (CRC), Guatemala (GUA), Nicaragua (NIC), Panama (PAN), Rest of Central America (RCA), United States (USA), European Union (EU27), China (CHN), and Rest of the World (ROW). The sector aggregation was done considering the relevant exporting and importing sectors for Costa Rica, Nicaragua and Central America.[68] The baseline case takes 2004 as the starting point and it then applies the different growth rates explained in Rivera and Rojas-Romagosa (2010). This simulation represents the business as usual scenario, which does not include the trade or the human capital policy shocks. For both countries, GDP growth is around 3% by year. In what follows, the results from the different scenarios are presented in a sequential way. First the ATC-protocol is implemented in 2005, together with the expansion of the EU from 25 to 27 members. Then DR-CAFTA is implemented starting in 2006 and 2008 in Nicaragua and Costa Rica, respectively. Finally, EU-CAAA is implemented in 2011 in both countries. We analyze each scenario below using sectoral production changes to see disaggregated effects and relative changes in private consumption. Changes in factor prices and final goods prices are analyzed when we discuss the poverty impacts of each scenario. While aggregated production (GDP) is analyzed in the next section when we simulate the human capital polices.[69]

### a) ATC-protocol scenario

The global liberalization of textile and clothing quotas at the beginning of 2005 under the Agreement on Textiles and Clothing (ATC-protocol) has already opened the US and EU markets for Chinese exports. This fact is very relevant for Central American textile and apparel (T&A) products and has already produced a significant increase of Chinese exports to the US and Europe. Hence, to assess the current international setting in the T&A sector, we eliminate the textile quotas for Chinese imports to the US and EU in 2005, as a pre-experiment condition in our baseline estimations. Given the highly significant participation of China in the world market, we consider it necessary to include this event prior to our FTAs estimations. With the implementation of the ATC- protocol, the T&A sector shrinks in Costa Rica and Nicaragua, evidencing an important market share loss of Central American countries. From Figure VI.5 we observe that the impact of the ATC-protocol implementation on consumption is significantly negative for Nicaragua with a reduction of more than 2% with respect to the baseline values. In the case of Costa Rica the impact is also negative but close to zero. This reflects the small proportion of Costa Rican exports in the T&A sector.[70]

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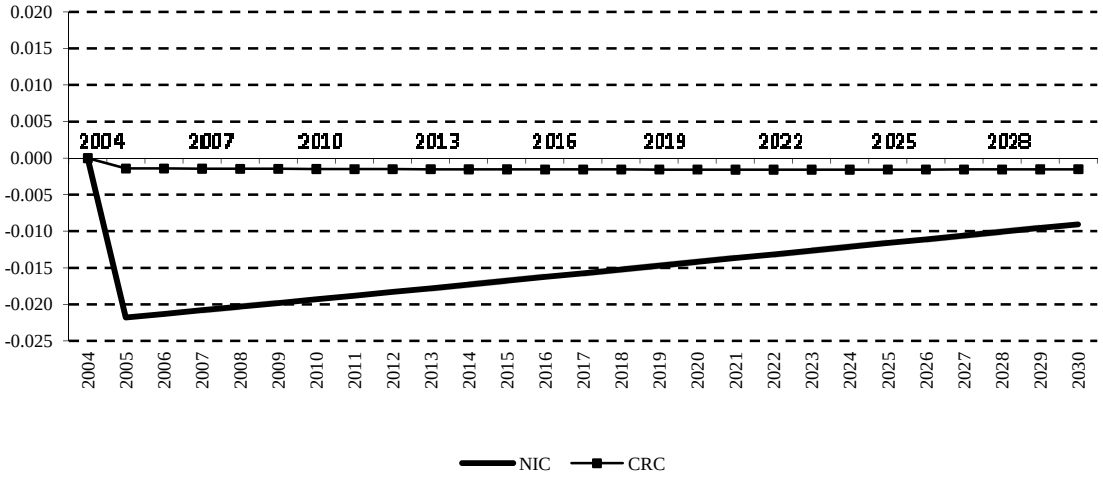
68 Sectoral definitions and groupings can be found in Rivera and Rojas-Romagosa (2010).

69 In our recursive dynamic model, there is no inter-temporal optimization of consumption and investments, and thus, we cannot construct a strict welfare indicator. However, the changes in private consumption in real terms, is an indirect measure of the increase in household utility over time. In what follows, we use consumption as our main indicator of welfare improvements.

70 In the case of Guatemala and the other Central American countries (El Salvador and Honduras), the impact of the ATC protocol on T&A production is very important. The impact of China's competition on these countries is stronger than in Nicaragua. These results are not presented here, but are available on request.

**FIGURE VI.5**
**ATC SCENARIO, CONSUMPTION CHANGES W.R.T. BASELINE**




Source: Own elaboration.

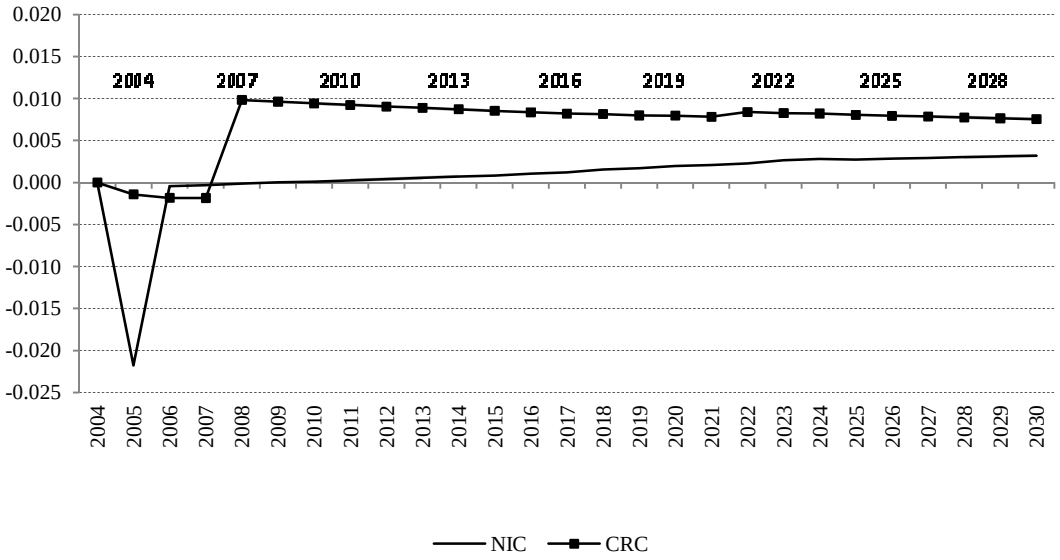
## b) DR-CAFTA Scenario

Once we ran the scenario with the quota reduction to Chinese exports of T&A, we proceeded to estimate the impact of DR-CAFTA. This calculation is done by assuming a full liberalization of trade between the US and Central America in 2006 (for the case of Costa Rica in 2008), as well as free trade within CA. Thus, we reduce all tariffs between both regions to zero and eliminate all tariffs within CA; but keep the original tariffs with the other 7 regions. In accordance with the agricultural exclusions made in the agreement we do not remove the tariffs for sugar from CA to the US, and implement a phase-out period for sensitive goods from the US to CA using a GTAP7 classification adaptation. In addition, some minor quotas across both regions and within CA were also eliminated.

Regarding sectoral production changes for the DR-CAFTA scenario, first, we observe that most agriculture sectors are either slightly decreasing or remaining the same as in the baseline levels, for both Costa Rica and Nicaragua. However, there are some exceptions like raw milk and dairy products in both countries and oilseeds in Nicaragua. The production of the apparel sector falls significantly compared to the baseline, but less than in the previous scenario for the ATC-protocol, while the textile sector is experiencing a strong expansion. Since each scenario builds upon the last, this means that DR-CAFTA is partly compensating for the negative effects of the stronger Chinese competition in T&A markets. But it is also creating a specialization in the textile sector away from the apparel sector. On the other hand, many industrial sectors experience an increase in production with respect to baseline values, in both countries. In the case of the US (not reported), the only relevant result is a reduction in the production of the T&A sector, but for the rest of sectors there are no significant changes.

The impact of DR-CAFTA on the GDP and consumption for the United States is negligible. In Figure VI.6 we show the consumption effects for Costa Rica and Nicaragua. For Costa Rica we see a significant increase of 1% after the implementation of the agreement, which gradually is reduced over time. For Nicaragua, the ATC protocol impacts are still observed before 2007. However, when DR-CAFTA is implemented consumption jumps 2% to offset the negative impact of the ATC protocol. Later on consumption continues growing to reach almost 0.5% in 2030.

**FIGURE VI.6**
**DR-CAFTA SCENARIO, CONSUMPTION CHANGES W.R.T. BASELINE**



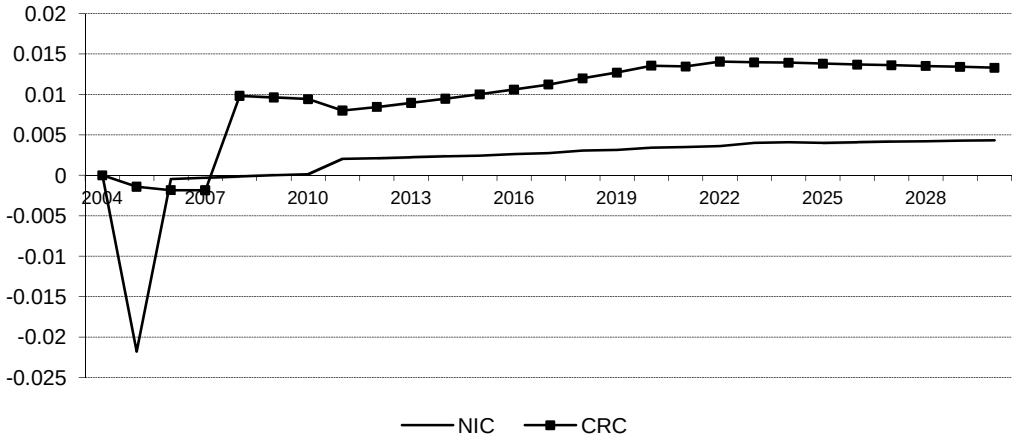

Source: Own elaboration.

## c) EU-CAAA Scenario

The EU-CAAA scenario is sequential with the other two trade policy shocks. Thus, we first include the application of the Agreement on Textiles and Clothing (ATC) protocol in 2005, which expands China's exports of apparel and textile products to the US and the EU, and increases competition with Central American products. In the second sequential adjustment we apply the DR-CAFTA base case scenario implementation. The implementation of the EU-CAAA is assumed to begin in 2011.

The sectoral production changes resulting from EU-CAAA are different between Costa Rica and Nicaragua. For Costa Rica we observe a decrease in most agricultural production. However, the vegetable and fruits sector —where bananas are included— experiences a 5% increase by 2030. For Nicaragua we observe that some agricultural sectors are expanding, most prominently oil seeds. For both countries we observe an increase in many agro-industrial and industrial sectors. The exceptions are textiles and apparel in both countries as a result of the ATC protocol. There is no significant impact of EU-CAAA on the EU macroeconomic indicators. We observe that the broad pattern of consumption is maintained, however, there is an increase of around 0.5% in consumption for Costa Rica —when compared to the DR-CAFTA scenario. For Nicaragua, there are almost no consumption changes.

**FIGURE VI.7**
**EU-CAAA SCENARIO, CONSUMPTION CHANGES W.R.T. BASELINE**




Source: Own elaboration.

### d) Final remarks on the CGE simulations of trade policies

Costa Rica and Nicaragua can expect significant and lasting benefits from both FTAs. However, we are only considering here the static adjustments related to these agreements. We do not account for dynamic effects such as increased FDI inflows, trade facilitation mechanisms that can reduce international transportation costs nor productivity changes associated with increased trade flows. There is a large literature that relates trade with economic growth. Yet, there is a large debate about how to isolate the effect of trade liberalization from other economic policies that are usually carried out together. Thus, there is no empirical link between trade flows and TFP changes. Moreover, FDI inflows are extremely difficult to model in a dynamic recursive framework where investment is not optimally decided over time. To construct such a framework is beyond the scope of this study and therefore, we remain with our static effects. These can be considered to be a lower bound of the potential benefits of these FTAs.

## 2. Poverty effects of the trade scenarios

This section presents the simulation results using the top-down approach, which combines the dynamic CGE model with the microsimulations using household survey data. The impact of FTAs on poverty depends on how factor and food products prices change as a result of trade agreements implementation. For poorer households, wages and food prices are the most relevant variables. Both in Costa Rica and Nicaragua, income of the poorest household depends significantly on low-skill workers wages, while food goods represent and important share of total consumption.

Following this methodology, we first analyze how wages for both skill types —high and low skill— change for each scenario.

The wages of low-skill workers in Costa Rica experience an expected decrease after the implementation of the ATC-protocol, which represents more competitions from low-skill intensive goods from China. This initial decrease, however, is reversed after the DR-CAFTA agreement, where wages in- crease by 0.5%. The implementation of the EU-CAAA agreement also has a positive impact on low-skill wages, but it is about only 0.1%.

On the other hand, in all three trade scenarios there is a decrease in the wages of high-skill workers. These are less intuitive results. The ATC-protocol is decreasing high-skill wages, while DR-CAFTA increases them by more than 0.5% but with the EU-CAAA returns wages to their ATC-

protocol levels. In general, following standard trade theory, more competition with relatively skill abundant regions such as the EU and the USA is expected to hurt the wages of high-skill workers. However, in the case of Costa Rica, it seems that the T&A sector had an important component of high-skill factor content. This can be a consequence of Costa Rica competing in a specialized niche of the T&A market that does not rely entirely on cheap labor to be competitive.

The wage results from our trade scenarios are very different for Nicaragua. For both types of wages we observe the same pattern. Wages decrease significantly with the ATC-protocol implementation in 2005 as the T&A sector contracts. In the medium term, wages increase for both high-skill workers as the economy adjusts its production to other sectors. When the DR-CAFTA is implemented we observe a one-time increase in the wages of more than 2% for low-skill workers and of less than 2% for high-skill workers. The EU-CAAA has a positive but small impact on wages for both for skill types. Thus, the reallocation of productive resources to different sectors after the trade shocks increases the demand for all workers irrespective of skill levels. This has a positive impact on wages. In this case, contrary to Costa Rica, the wage gap between skill levels is not changing.

We analyze now the changes in final goods prices of the two trade agreements. In the case of DR- CAFTA, the decrease of general prices (CPI) compared to baseline values indicates an improvement in real incomes for both countries. On the other hand, the changes in food prices are diverse. In Costa Rica, the prices of some agricultural products decrease, while others grow. In both our FTA scenarios and in both countries, CPI is declining mainly because of changes in manufactured goods, which are imported at lower prices after the implementation of the agreements. There are similar price effects for Nicaragua. Consumer prices fall below baseline levels for all the analyzed period, while in the case of food products most prices grow although others fall. The decrease is significant in the case of rice, which is an important consumption good for poor families.

Summing up on the changes on prices and wages, we can expect poverty to fall given the increase in low-skill wages in both countries. As mentioned before, the most important impact on poverty resulting from FTAs implementation would be the changes in wages, particularly those of low-skill workers. The results from the simulations indicate that both agreements (DR-CAFTA and EU-CAAA) have a positive impact on low-skill workers wages in Costa Rica. Whether small in magnitude, the agreements help to compensate for the decrease in low-skill workers demand resulting from ATC and China's impact on T&A markets. However, the changes in relative food prices can have mixed effects on poverty. We observe that many agricultural goods have a relative price increase and this can have a negative impact on the expenditures —in real terms— of poor households, where food has a high percentage of their consumption basket.

We now can analyze how poverty is changing. We integrate these price and wage changes into the income and expenditure values of each household using the survey information. This allows us to translate the CGE macroeconomic shocks into the real income values of each household. For instance, real income increases with higher wages, but it decreases when the prices of final goods rise. The extent of the impact of final goods depends on the weight of each specific product on the consumption basket of that particular household. Then we divide the real income of the household by the number of household members to obtain the real income by person. Finally, we compare this real income value with the specific poverty line to asses which people are considered to be relatively poor (if their income is below the $2 a day poverty line) and absolute poor (when income are below the $1 a day threshold).

The impact of all changes aforementioned on poverty in Costa Rica is described in Table VI.8. Our main indicator is the headcount poverty index. The poverty values for 2004 are those obtained directly from the households surveys and do not include any policy shock.

**TABLE VI.8**
**COSTA RICA, HEADCOUNT POVERTY VALUES FOR TRADE SCENARIOS**

| | 2004 | 2010 | 2020 | 2030 |
|---|---|---|---|---|
| Baseline | | | | |
| Relative poverty | 19,6% | 17,4% | 16,2% | 15,4% |
| Absolute poverty | 4,0% | 6,0% | 5,7% | 5,7% |
| ATC-Protocol | | | | |
| Relative poverty | | 17,6% | 16,3% | 15,7% |
| Absolute poverty | | 6,0% | 5,7% | 5,7% |
| DR-CAFTA | | | | |
| Relative poverty | | 17,4% | 16,1% | 15,3% |
| Absolute poverty | | 6,0% | 5,7% | 5,7% |
| EU-CAAA | | | | |
| Relative poverty | | 17,4% | 16,4% | 15,5% |
| Absolute poverty | | 6,0% | 5,8% | 5,8% |

Source: Own elaboration.
Notes: Relative poverty is estimated with the $2 a day poverty line, while absolute poverty uses $1 a day. The trade scenarios are sequential: DR-CAFTA includes ATC protocol and EU-CAAA includes all.

The most significant poverty reduction is achieved in the baseline scenario. This is a direct consequence of the 3% growth rate that is obtained after the increases in TFP, land efficiency and the capital stock. These changes result in sustained labor demand increases to cope with the production expansion and this yields higher wages, while food prices are growing moderately.

Regarding our trade scenarios we observe only small deviations from this baseline poverty decrease. In particular, the impact of the ATC-protocol on poverty is slightly negative, but it is compensated with a poverty reduction of DR-CAFTA of about 0.4%. On the other hand, poverty rates increase slightly with EU-CAAA. The increase in some food prices is the main force driving this outcome. However, the impacts on poverty (positive and negative) are of a very small magnitude for both trade agreements.

For the case of Nicaragua, Table VI.9 shows again a general decrease in headcount poverty in the baseline case. This follows from the same reasons explained in the case of Costa Rica. However, in Nicaragua the negative impact of the ATC-protocol implementation is much higher, with poverty increasing by almost 2% in 2010. DR-CAFTA mitigates these effects and in 2030 the percentage of poor households returns to the baseline values. The EU-CAAA has a very small impact on poverty.

As mentioned before, the impact of Chinese competition in the T&A global market negatively affected the country's welfare. Both FTAs compensate these effects by increasing promote growth and consumption, which helps to reduce poverty. Wage increases and key food products price falls are reinforcing this outcome. Finally, we observed that the changes in both relative and absolute poverty are following the same pattern in each country.

**TABLE VI.9**
**NICARAGUA, HEADCOUNT POVERTY VALUES FOR TRADE SCENARIOS**

| | 2004 | 2010 | 2020 | 2030 |
|---|---|---|---|---|
| Baseline | | | | |
| Relative poverty | 39,4% | 35,6% | 32,5% | 30,2% |
| Absolute poverty | 16,9% | 17,5% | 15,2% | 13,0% |
| ATC-Protocol | | | | |
| Relative poverty | | 37,4% | 33,7% | 30,7% |
| Absolute poverty | | 18,7% | 16,1% | 13,8% |
| DR-CAFTA | | | | |
| Relative poverty | | 36,3% | 32,7% | 30,0% |
| Absolute poverty | | 17,6% | 15,5% | 13,0% |
| EU-CAAA | | | | |
| Relative poverty | | 36,3% | 32,7% | 29,9% |
| Absolute poverty | | 17,6% | 15,5% | 13,0% |

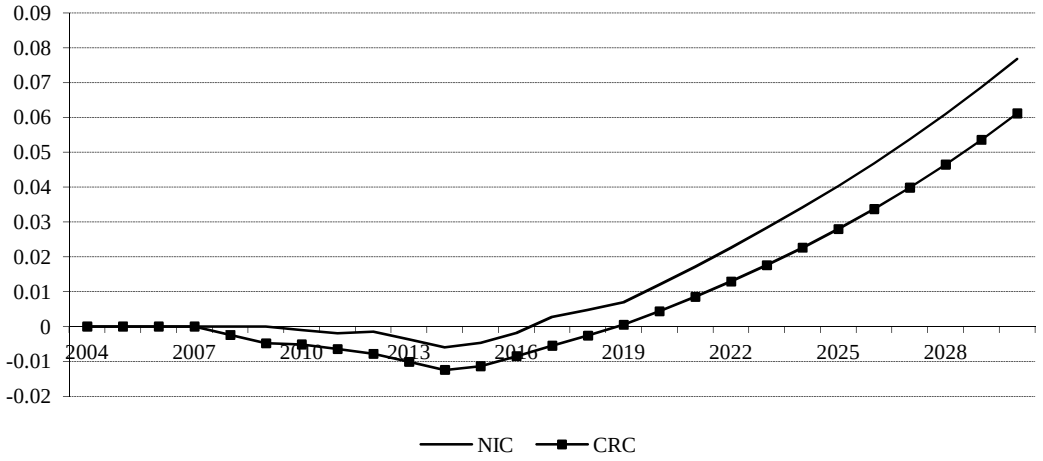
Source: Own elaboration.
Notes: Relative poverty is estimated with the $2 a day poverty line, while absolute poverty uses $1 a day. The trade scenarios are sequential: DR-CAFTA includes ATC protocol and EU-CAAA includes all.

## 3. Macroeconomic effects of human capital policies

This section links the human capital satellite model with the dynamic CGE model. Figure VI.20 depicts the impact of the human capital policies on consumption. In both countries consumption decreases with respect to their baseline levels until 2018, but then it starts increasing with rates superior not only to baseline but to all other simulation scenarios presented so far. The decrease of consumption is a direct consequence of the opportunity cost effect in education. This is, to increase the level of school attainment a fraction of the population has to stay longer at school and thus, the labor supply of workers is decreasing during this period. Yet, when these students with higher education enter into the labor market not only is labor supply increasing, but also labor efficiency is rising because the new worker cohorts have higher school attainment, but also higher quality of education. The remarkable effect is that consumption and growth levels have not only a positive effect but also experience a change in the growth rate.

In a broad sense, the human capital satellite model is creating an endogenous growth process, where shifts in the stock of human capital yield changes in the baseline growth rates. These results are in stark contrast with the more static —i.e. one-time— impact of the trade scenarios. Due to the differences in human capital in Costa Rica and Nicaragua, the impact of education policies is stronger for the Nicaraguan economy. The higher impact is determined by the lower initial levels in Nicaragua and therefore the scope for improvement is wider. It is worth mentioning that human capital policies outcomes are realized in the medium and long term. Therefore, the impact on production and other variables would be sustained as far as a continuous policy effort is institutionalized. In other words, the short-term costs outweigh the benefits, but on a broader perspective, these benefits impacts from human capital investments depend on its level of policy priority.

**FIGURE VI.8**
**HUMAN CAPITAL SCENARIO, CONSUMPTION CHANGES W.R.T. BASELINE**



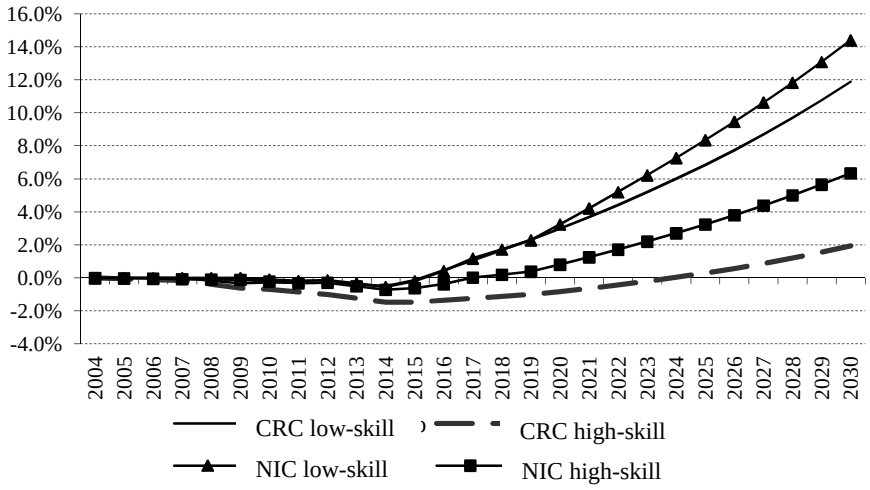

Source: Own elaboration.

## 4. Poverty effects or human capital policies

Once again we follow the top-down approach and we plug the price and wage changes into the household budgets. As expected from the high growth rates produced by the human capital policies, we have a positive and very significant impact on wages in Costa Rica and Nicaragua. Figure VI.9 plots the wage changes for Costa Rica and Nicaragua for both skill types.

A first observation is that the wages of low-skill workers is increasing more than that for high-skill workers. This is a direct consequence of the skill upgrading of the labor force, which means that low-skill labor supply is decreasing relative to high-skill supply. This supply effects produce a positive impact on the wages of low-skill relative to high-skill workers. In addition, both labor types are more efficient after the implementation of the human capital policies, and this creates the general increase in both wage types.

**FIGURE VI.9**
**COSTA RICA AND NICARAGUA, HUMAN CAPITAL SCENARIO, CHANGES IN WAGES W.R.T. BASELINE**




Source: Own elaboration.

As mentioned before, the effects on production and consumption are present the medium term, when education levels and labor efficiency of the workforce improve. In the case of wages, a similar path is followed. In Costa Rica, low-skill workers start earning higher wages after a shorter period of time, compared to high-skill workers. Low-skill workers take advantage of better education and start working on better paid jobs, at the same time that labor demand is increasing due to economic growth.

In Table VI.10 we present the poverty results for the human capital scenario for Costa Rica. Here we observe that relative poverty is initially increasing in 2010, it is equal to the baseline value in 2020 and it decreases by 2030. Although the poverty reduction is less than 1%, it is expected that the increasing growth pattern of the human capital policies assures a steady decline of poverty over time, relative to the baseline scenario. In the case of absolute poverty, we see no changes until 2030 where there is a small reduction. The last scenario is analyzed in the following section.

**TABLE VI.10**
**COSTA RICA, HEADCOUNT POVERTY VALUES FOR HUMAN CAPITAL AND INTEGRATED SCENARIOS**

| | 2004 | 2010 | 2020 | 2030 |
|---|---|---|---|---|
| Baseline | | | | |
| Relative poverty | 19,6% | 17,4% | 16,2% | 15,4% |
| Absolute poverty | 4,0% | 6,0% | 5,7% | 5,7% |
| Human capital policies | | | | |
| Relative poverty | | 17,6% | 16,2% | 14,6% |
| Absolute poverty | | 6,0% | 5,7% | 5,6% |
| Integrated: Trade and HK policies | | | | |
| Relative poverty | | 17,5% | 16,3% | 14,7% |
| Absolute poverty | | 6,0% | 5,8% | 5,7% |

Source: Own elaboration.
Note: Relative poverty is estimated with the $2 a day poverty line, while absolute poverty uses $1 a day.

Table VI.11 shows the poverty results for Nicaragua. In this case we observe that relative poverty experiences a slight increase in 2010 but then begins to decrease steadily after 2020. By 2030 relative poverty decreases more than 2% with respect to its baseline values. This decrease reflects the large wage rise produced by the skill upgrading of the working force. Moreover, these positive effects are also translated into changes in the absolute poverty level, which is reduced by more than 1%.

**TABLE VI.11**
**NICARAGUA, HEADCOUNT POVERTY VALUES FOR HUMAN CAPITAL AND INTEGRATED SCENARIOS**

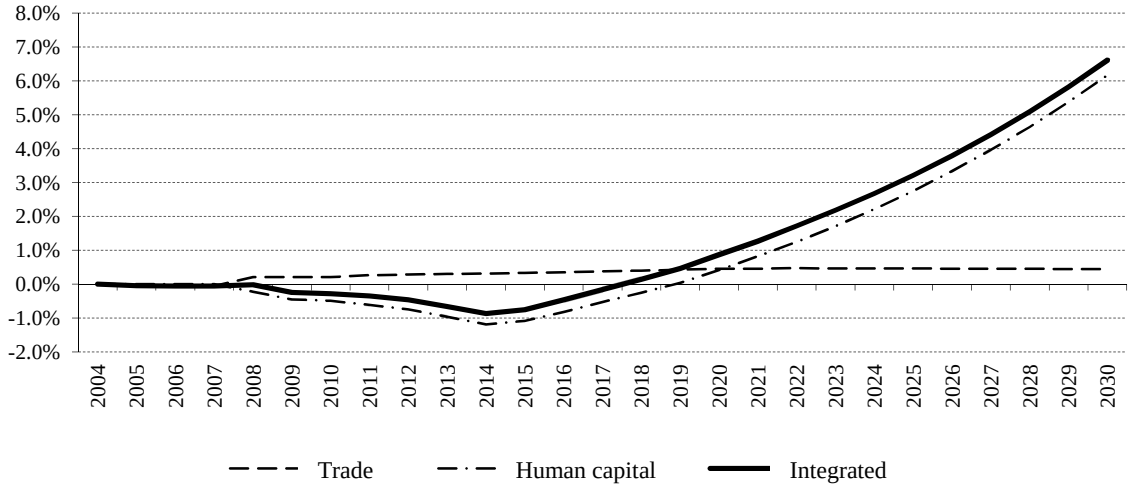
| | 2004 | 2010 | 2020 | 2030 |
|---|---|---|---|---|
| Baseline | | | | |
| Relative poverty | 39,4% | 35,6% | 32,5% | 30,2% |
| Absolute poverty | 16,9% | 17,5% | 15,2% | 13,0% |
| Human capital policies | | | | |
| Relative poverty | | 35,7% | 32,1% | 27,9% |
| Absolute poverty | | 17,5% | 15,1% | 11,7% |
| Integrated: Trade and HK policies | | | | |
| Relative poverty | | 36,4% | 32,4% | 27,8% |
| Absolute poverty | | 17,6% | 15,3% | 11,7% |

Source: Own elaboration.
Note: Relative poverty is estimated with the $2 a day poverty line, while absolute poverty uses $1 a day.

# 5. Integrated approach: Complementary effects of trade and human capital policies

The main question we want to answer is: Does implementing both sets of policies jointly have a larger effect than applying them separately? We already know from the previous sections that consumption, production and wages are increasing when trade liberalization policies and human capital policies are implemented. With respect to poverty, we have that poverty is decreasing after upgrading human capital, but remains almost unchanged after the trade shocks. In what follows we analyze these variables again when both policies are simulated.

**FIGURE VI.10**
**COSTA RICA, GDP CHANGES W.R.T. BASELINE FOR SELECTED SCENARIOS**



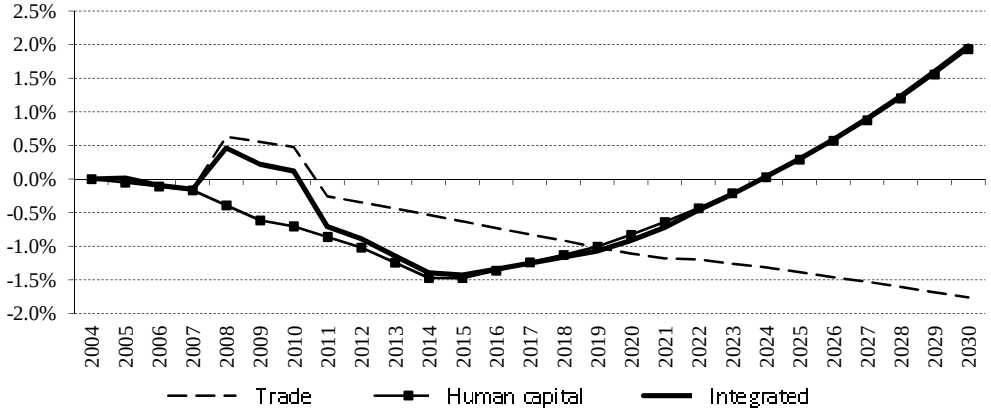

Source: Own elaboration.

We start with production. Figure VI.10 plots the changes in production (GDP) with respect to the baseline for three scenarios for Costa Rica. A first observation is that the impact of human capital policies are far more important that the effect from FTAs. This is determined by the labor efficiency increases in human capital, which produce an endogenous growth process that is changing the baseline growth rates in about 6%. On the other hand, trade liberalization is associated with the reduction in import tariffs and quotas, which produce only a one time efficiency shock, but are not associated with any changes in efficiency growth rates. Thus, we see that the trade shocks produce a scale increase in baseline production of about 0.5%. This does not mean that trade policies are less important in increasing GDP growth than human capital policies. In particular, our results are a reflection of the modeling strategy we used, where we do not have dynamic effects associated with trade shocks. Regarding human capital policies, the results for Costa Rica are consistent with recent studies that find a strong correlation between human capital investments, productivity and economic growth (Jiménez et al., 2009).

Turning back to our main question, there are no complementary effects in production between trade and human capital policies. In other words, the increases in GDP attained separately with both sets of policies are the same as when both policies are jointly implemented. For the case of consumption we do observe some positive complementarity effects, but they are small and represent an increase of 0.1%. Finally, for the case of poverty we do not observe any complementarity effects either (see Table VI.10).

When we analyze wages we find that there are no complementarity effects for low-skill wages, but we do observe a large complementarity effect for high-skill wages. In Figure VI.11 we observe that high-skill wages are declining for the trade scenario and increasing in the human capital scenario, but in the integrated scenario wages are even slightly higher than in the human capital scenario, reflecting a complementarity effect of almost 2 percentage points. This means that the implementation of human capital policies completely offsets the wage losses associated with the trade shocks and even have a higher effect than when only the education changes are simulated. This is a remarkable result and points to an important interaction of both policy sets for high-skill workers and those productive sectors that use relatively more of this factor.

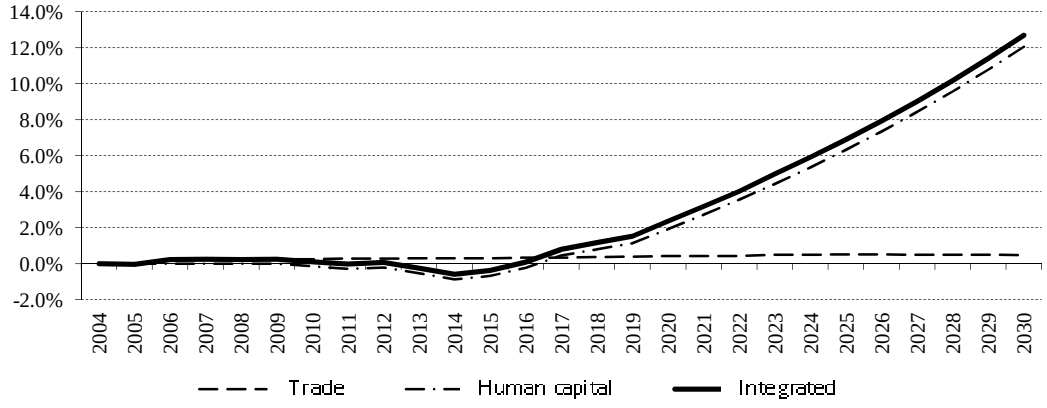
**FIGURE VI.11**
**COSTA RICA, HIGH-SKILL WAGE CHANGE W.R.T. BASELINE FOR SELECTED SCENARIOS**




Source: Own elaboration.

For Nicaragua we observe some complementarity effects, though of low magnitude. In the case of production we observe an increase of 1% relative to the baseline (Figure VI.12). Consumption, on the other hand, does not show any significant complementarity effects. Regarding wages, in Nicaragua we find very small complementarity effects for both low and high-skill workers. Relative poverty shows a complementarity effect, but not extreme poverty (Table VI.11).

**FIGURE VI.12**
**NICARAGUA, GDP CHANGES W.R.T. BASELINE FOR SELECTED SCENARIOS**




Source: Own elaboration.

To sum up this section, we find that the answer to our main question is that there are positive but small complementarity effects. The only exception is the positive and large complementarity effect for high-skill wages for Costa Rica. The lack of strong complementarity effects in most of our main variables can be a result of comparing two different policy shocks. Human capital policies have a dynamic efficiency effect, while trade policies only a static efficiency impact. Another explanation can be related to the setup of the CGE model. The initial input-output coefficients in the economy are set fixed in the base year and thus, the production technology in each sector is also fixed. This means that changes in the quantity and quality of the production factors are reflected in sectoral production and trade changes, but not in how each sectors combines the different factors. In a setting where the production technology is changing a human capital upgrade can result in different input-output coefficients that alter the patterns of production and trade. These effects are not present in CGE models.

## E. Conclusions and policy recommendations

The impact on poverty is given by three different mechanisms: a) changes in goods and factor prices through the FTAs, which affect the income and expenditure of households; b) direct changes of education policy on employment and wages; and c) the complementarities between trade and education policies.

With respect to the trade liberalization policies, the general results from our simulations show that DR-CAFTA has stronger effects on production, consumption, and poverty than EU-CAAA. In addition, the EU-CAAA results in more significant macroeconomic improvements for Costa Rica, since this country has higher trade flows with the European Union than Nicaragua. However, the impact of both FTAs yields only a static efficiency improvement that translates into a one-off increase in the baseline levels of consumption and production.

The main driver of economic growth in the analysis is provided by the upgrading of human capital through educational policies. These policies result in an endogenous growth process where the growth rate is increased by around 0:6% in Costa Rica and 1% in Nicaragua when compared to the baseline growth rates for both countries. Thus, both Costa Rica and Nicaragua experience higher growth and welfare effects when labor efficiency improves through human capital policies. In a first stage, low and high-skill workers receive lower salaries (compared to baseline levels) but when these initial opportunity costs are taken and the human capital accumulation process starts, wages begin to grow steadily. Under these circumstances, the long run impact of human capital policies continues beyond 2030 —our simulations final year— and we can expect that poverty reduction also follow a steady decline over time.

As a consequence of the different growth patterns produced by both policies, poverty impacts of FTAs are positive, but small. Human capital policies, on the other hand, yield stronger poverty reductions. Therefore, the poverty reduction we observe in our integrated scenario —where both trade and educational policies interact— is a direct outcome of human capital improvements in both countries. Much of this outcome derives from low-skill wages growth. High-skill labor and other production factors also experience a sizeable increase, but these factors are much less important as an income source for poor households.

Finally, poverty and other macroeconomic variables do present positive but relatively small complementarity effects when both trade and educational policies are implemented jointly. The only exception being the high-skill wages in Costa Rica, where educational policies completely offset the negative impact caused by the trade shocks. A possible explanation for this lack of stronger policy complementarity is that the magnitude of the human capital shocks are completely dominating the much lower trade effects. In a framework where both sets of policies have dynamic effects on growth rates we expect the results to be different.

Two main policy implications result from our analysis. First, in our study, we show that human capital accumulation is crucial in the process of economic growth and poverty reduction.

Therefore, improvements in education should be part of an integrated approach for development policy design. Human capital investments, moreover, should be a policy priority, irrespective of its interactions with other public policies. However, the downturn from human capital policies is that they are a long-term investment. The initial opportunity costs associated with students staying longer in school outweigh the economic benefits in the short run. This can create problems in a political economy setting where the policymaker is confronted with several investment choices with different short and long term returns, but worries only for her short-term electoral performance.

For instance, Jiménez et al. (2009) argue that human capital formation in Costa Rica was severely affected from the economic crises of 1980-82. The recovery of human capital investments levels took almost two decades after that negative shock. They conclude that economic growth in the following years depends on more investments in education, since total factor productivity growth in the last two decades has been mainly driven more by capital and labor accumulation (growth of labor units) than human capital accumulation.

In the case of Nicaragua, the World Bank (2008) argues that education investments are a key condition to improve labor productivity and enhance growth. They find that job creation and higher wages can improve living conditions and development opportunities, particularly for the poorest households. These potential medium and long term impacts of education investments on economic returns imply that policy efforts should be prioritized. Guevara (2004) argues that education investments require a sustained effort, if the current state of human capital in Nicaragua is to be effectively improved. Therefore, Costa Rica and Nicaragua should strengthen education policies in order to create conditions for growth and poverty reduction. Education policies should be one of the highest priorities in both countries. The results from our satellite model and CGE model clearly state that the quantity and (most importantly) the quality of education matters crucially for economic growth.

Secondly, we find that FTAs are having a positive impact on production and consumption, and on a lower extent, on poverty reduction. These positive results can be considered as a lower-bound of possible trade effects, since we are not considering the dynamic effects from trade that can foster economic growth in the lung run. In this context, the attraction of FDI, for instance, and competitiveness enhancing policies (i.e. through technology improvements and infrastructure modernization) are a critical condition to achieve these dynamic efficiency benefits.

For Costa Rica and Nicaragua, FTAs represents a series of opportunities that can be exploited, but also a series of critical challenges. Given the importance of US and EU trade and investment in the region, in addition to the huge size differences between countries and regions, the agreements will have significant sectoral and economy-wide effects.

A key factor will be the scope and depth of the complementary policies associated with FTAs implementation. For instance, after analyzing the Mexican experience with NAFTA, Lederman et al. (2005) conclude that FTAs offer great opportunities for Latin American countries, but without complementary policies, there is no guarantee that the agreements can increase growth. Thus, the full potential of trade liberalization depends on complementary policies, when we take complementary policies in a broad sense and define them as productivity enhancing policies. Competitiveness is built upon the productivity of the leading firms and industries within the economy.

Education is regarded by the World Economic Forum as one of the pillars of competitiveness, together with infrastructure, macroeconomic stability, technological readiness, and innovation, among other drivers of growth. These pillars are key determinants of productivity growth. Trade policy effectiveness depends on the country conditions in those areas. Education is certainly a key component of the growth equation. Schwab and i Martin (2009) indicate that education in Costa Rica is a competitive advantage, but requires more educational investments in order to catch up with leading innovation- driven economies. Meanwhile Nicaragua has made advances with primary education coverage, but the quality of education and enrollment rates in secondary and tertiary education represent competitive disadvantages that limit growth.

The governments of both countries have a role in adjusting policy to improve the countries' ability to compete and benefit from trade liberalization. The main concern in this respect, is the absence of long-term development strategies in Costa Rica and Nicaragua. In some way, FTAs have been seen as "substitutes" of such strategies. The key point is how governments create and implement a competitiveness enhancing long term strategy. This requires more investment in human capital. Integrated with FTAs, human capital accumulation are both growth engines that can create new development opportunities. Costa Rica and Nicaragua can expect positive and lasting benefits from both FTAs, but these benefits can be multiplied if both countries can put in place the infrastructure, human capital, and institutional capacity necessary to participate successfully in world markets.

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# VII. Skill formation in Uruguay: what are the required labour qualifications for development?

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## A. Introduction

Education, as a producer of human resources, has a crucial role to play in development as it determines growth possibilities. There seems to be an obvious question to ask: is the education system generating the right mix of workers according to what is required for long-term development? Taking into consideration the heavy early dropouts in developing countries and the increasing demand for skills, the answer is not obvious, though we suspect that we are in trouble. Early dropouts reduce the average qualifications of the labour force, whereas worldwide, the demand for certain qualifications is increasing. The aim of the paper is to analyse the economy-wide effects of a mismatch between generation and demand for skills, in particular, the long-term consequences of an inefficient educational system and its distributional effects on a small developing economy such as that of Uruguay.

In most developing countries, educational systems are inefficient. On one hand, the presence of high repetition rates increases the cost of the process of skill formation. On the other hand, the presence of high rates of early dropouts reduces the qualifications of individuals entering the labour market, in contrast to what is actually being demanded, thereby producing external inefficiency. The rate of growth of skills is directly related to schooling level, so if the efficiency of the education system is enhanced, thus improving completion rates and higher studies, the ratio of skill to unskilled labour will increase. The external efficiency will also be improved as the educational system will be delivering workers with qualifications required in the labour market.

The unsatisfactory system performance of the education sector has economy-wide repercussions: an inefficient production of capabilities has direct effects on social and economic development. For instance, while it has been noted that demand for skills is rising in Latin American countries, Paus (2003) and De Ferranti et al. (2003), among others, suggest that failure to develop the human capital base has been a major drawback to the development of the region. Besides, distributional effects are also expected from underperforming educational systems, and several papers have discussed the role of demand and/or supply of skills in explaining the rise in wage inequality

(Razzak and Timmings, 2008; Sanchez and Shady, 2003; Avalos and Savvides, 2003; Birdsall et al, 1995, among others).

This article investigates the economy-wide effects of a deficient skill formation process, in particular, on growth and income distribution. A Computable General Equilibrium (CGE) application based on the recently updated Social Accounting Matrix 2005 for Uruguay (Terra et al, 2009), using a close to standard Heckscher–Ohlin (HO) model, is used to investigate the long-term effects. The simulation results for alternative patterns of endowment growth highlight the relevance of skill formation policies for income distribution and growth patterns.

This paper has the following structure. Section II describes the general settings of the model. Section III describes the Uruguayan situation in the education sector, labour market, trade, and growth. Section IV describes the scenarios and the assumptions. Section V presents the simulation results.

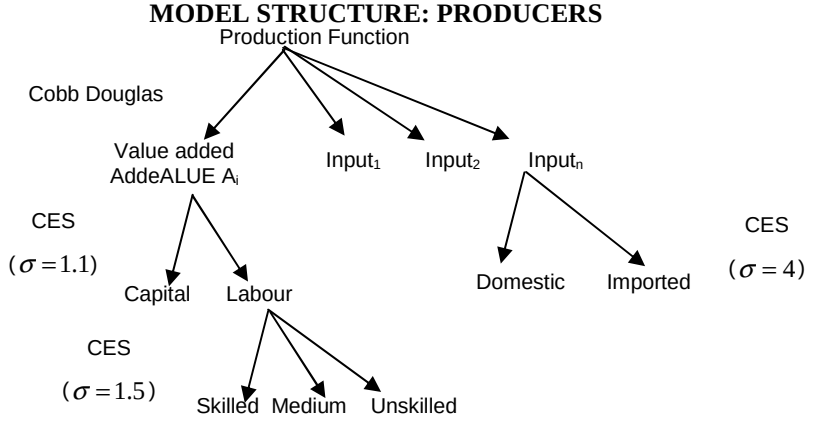
# B. The model

## 1. General description

The model used in the document is relatively standard but it distances from the Heckscher-Ohlin paradigm by introducing product differentiation and informal labour that is an imperfect substitute of formal labour but only used in non-traded activities, besides it considers an education sector that it is publicly provided. Along the lines of this model, changes in local conditions, e.g. in the relative supply of qualifications, affect good and factor prices.

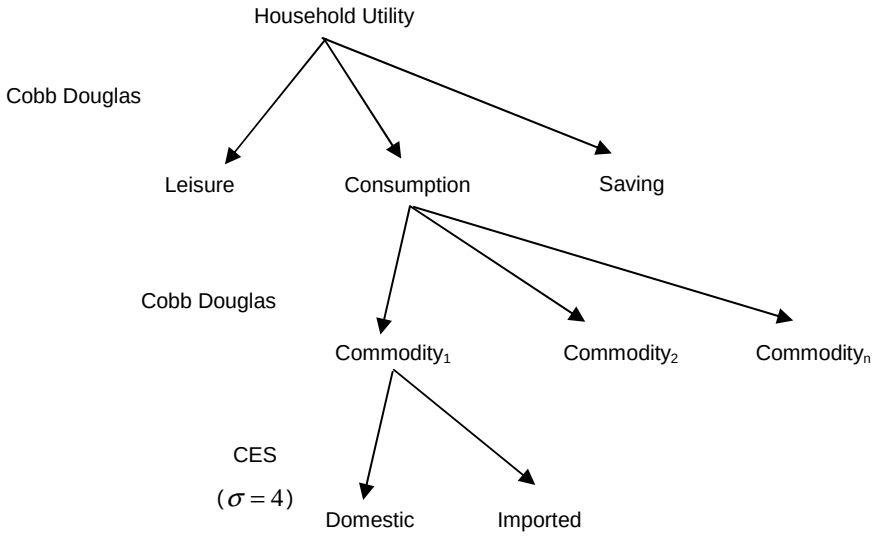
The households make a consumption-leisure choice, so that the labour supply is endogenous. The households also make the choice between working formally or informally. Households allocate their post-tax income between consumption goods: A (agriculture), B (manufacturing) and C (services). There are three tradable sectors (A, B and CT), a non-traded sector CNT and the public sector. Sector A and B are unskilled-intensive exporting activity, and sector C is a skilled-intensive activity with a low export orientation, partly of which is non traded. Traded sectors charge different prices in domestic and foreign markets (product differentiation by country). All production functions are subject to constant returns to scale. There are competitive markets for goods and factors.

**FIGURE VII.1**
**MODEL STRUCTURE: PRODUCERS**




Source: Own elaboration.

**FIGURE VII.2**
**MODEL STRUCTURE: CONSUMERS**




Source: Own elaboration.

This model is relatively standard but it deviates from the HO paradigm by introducing product differentiation by country. Whereas in the standard model, endowment growth in a small open economy has no effect on prices and factor returns and changes in international prices are fully transmitted to domestic prices, in this model that introduces product differentiation by country, product and factor prices are affected by changes in local conditions (i.e., in the domestic supply and demand of skills). In a context where both local and international conditions determine relative wages, a (relatively) greater supply of skilled labour may drive the wages of that labour down, reducing the wage gap and favouring the substitution of unskilled for skilled labour. The starting point is that educational policies have a role in determining the outcome of the accumulation process by altering quantity, quality, and composition of the public supply of educational services. Then, the standard Rybczynski effect applies, with a shift in the production possibility frontier biased towards the sector intensive in the factor which grows relatively.

## 2. Education sector and labour market

The theoretical aspects of the education sector are described to ease the interpretation of the simulation exercises, but the effects of changes in education policy will be taken as exogenous; this is a simple modelling strategy, which, nevertheless, is enough to make the point on the economy-wide effects of inefficient education sectors and their policy implications.

Education is publicly provided; the demand side is implicit in the assumption that students exit the system when the quality of education they receive is poor. The output of education activities results from the combination of resources and students for a given technology, $Q_j = F_j (G_j, E_j)$, where subindex $j = B, H$ indicates the level (basic or higher education); $G_j$ are resources; $E_j$ are students; $Q_j$ is the output of the activity, and $F_j$ is a constant returns-to-scale function. The output per student $q_j = Q_j / E_j = f (g_j)$, where $g_j$ is the resource intensity per student, measures "school quality," which is an output measure of quality (embodied knowledge per student) following Hanushek (1979). Student attainment, which reflects school quality, is taken as the determinant of dropouts, so the dropout rate is defined as $\theta_j = \theta_j (q_j)$ where $\partial\theta_j / \partial q_j < 0$. So, poor school quality leads to students' poor performance and early exit. This also leads to inefficiencies in the expenditure of education measured by completion rates.

So, the timing of exit from the educational system determines the composition of new workers into the labour market: it is assumed that those who drop out from basic education enter the market as unskilled labour, those with complete basic education or incomplete higher education enter the labour market as semi-skilled labour, while those who complete higher education enter the labour market as skilled workers. The central point here is that efficiency of the education system (completion rates) determines the pattern of endowment growth.

Thus, the composition of the inflow of new workers is given by

$$dLT_U = \theta_B E_B$$
$$dLT_M = \theta_H E_H$$
$$dLT_S = (1-\theta_H) E_H$$

where $\theta_B$ and $\theta_H$ are the exit rates at basic and higher level respectively. So, $dLT_s$, $dLT_M$, and $dLT_U$ represent the inflow of skilled, medium skilled, and unskilled workers, respectively, which determines the pattern of endowment growth. Thus, the rate of endowment growth in the economy is given by

$$\hat{L}_S = dL_S / L_S$$
$$\hat{L}_M = dL_M / L_M$$
$$\hat{L}_U = dL_U / L_U$$

where $L_S$, $L_M$, and $L_U$ are the stocks of skilled, medium-skilled, and unskilled labour, respectively, and a hut (^) placed over the variables denotes rate of growth.

So, in the model, higher education quality is associated with lower rates of early dropouts, which improves the systemic performance of educational systems and increases the productivity of the expenditure in education measured by completion rates. As the rates of early dropouts are lowered, the composition of the inflow of new workers will shift towards the higher qualified types. The approach followed in the modelling of the education sector considers that quality is the determinant of the time of exit, but it does not consider explicitly the quality of education received once the individual is in the labour market. This is not necessary to make the point, which is to show that considering the current situation of the education sector and the demand from productive activities, the mismatch between creation and demand of types of labour (measured by years of schooling) is likely to worsen; however, the long-term results may drastically vary according to alternative education policies aimed at reducing dropouts, which change the composition of the inflow of new workers. Thus, the focus will be made on the hypothesis that improving the matching between creation of and demand for skills, by enhancing skills formation, will favour the expansion of dynamic sectors, allowing them to take advantage of the opportunities open in the global economy.

# C. The Uruguay situation

## 1. The education sector

The “Education For All (EFA) by 2015” goal, set by UNESCO in 2000, focuses on the expansion of early childhood education, the achievement of universal primary schooling, the development of learning opportunities for youth and adults, the expansion of literacy, the achievement of gender parity in education, and improvements in the quality of education. In the global context, the situation of Uruguay is not bad: many years ago, it had already achieved universal primary education and gender parity, and a more recent achievement is expansion of early childhood education, reaching universal coverage of 5-year-old children (pre-schooling level) in 1999. However, there are other problematic areas in Uruguay’s educational system, for which the authorities are still trying to find a solution, for example, the low performance at the secondary education level.

In Uruguay, the dominant provider at all levels of education is the public sector, as it is shown in Table VII.1. This ensures that students have equal opportunities of having access to the whole education cycle, which is not restricted in any way, either by charging fees or by selection processes, even at the tertiary level. But, according to the data of the Ministry of Education (MEC, 2008), coverage is very different across levels. The coverage at the primary level is high, 93.2% (among population aged 14-15), but the coverage at higher levels is much lower. At lower secondary, only 64.3% complete the level (among population aged 17-18), and at higher secondary, completion rate is as low as 34.8% (among population aged 21-22). Actually the problematic situation starts at the lower secondary level where not only 64.3% of students complete the level, even when it is compulsory, but also where the gap with developed countries starts to widen from this level upwards.

**TABLE VII.1**
**PUBLIC-PRIVATE PARTICIPATION, BY EDUCATION LEVEL**
*(In percentage)*

| | Public | Private | Total |
|---|---|---|---|
| Pre-primary | 67.5 | 32.5 | 100 |
| Primary | 74.6 | 25.4 | 100 |
| Lower secondary | 85.1 | 14.9 | 100 |
| Upper secondary | 86.1 | 13.9 | 100 |
| Tertiary non-university | 99.4 | 0.6 | 100 |
| University | 85.0 | 15.0 | 100 |

Source: MEC (2008).

Moreover, the coverage is very unequal across socioeconomic groups. Table VII.2 shows, for selected ages, that coverage does not differ much across socioeconomic groups at the primary level, but it does differ much at the higher levels. For instance, for lower secondary, while almost all in the highest quintile complete this level (95.9%), less than half do so in the lowest quintile (42.8%). The situation is even more unequal for the upper secondary education: whereas 76.5% of the richest people complete the level, only 10.7% of the poorest achieve that. Unequal distribution of coverage adds another dimension to the problem of early dropouts from the educational system.

This leads to a different composition of income groups by educational attainment. Table VII.3 shows that, whereas the major part of the lowest quintile (53.3%) has only primary education, the major part of the highest quintile (55%) has tertiary education.

**TABLE VII.2**
**EDUCATIONAL ATTAINMENT, BY INCOME QUINTILES AND SELECTED AGES, URUGUAY**

| Quintile | Aged 14-15 with complete primary | Aged 17-18 with complete lower secondary | Aged 21-22 with complete higher secondary |
|---|---|---|---|
| 1 | 88.5 | 42.8 | 10.7 |
| 2 | 95.5 | 64.4 | 25.6 |
| 3 | 97.8 | 79.0 | 35.5 |
| 4 | 98.6 | 84.7 | 52.9 |
| 5 | 99.7 | 95.9 | 76.5 |
| Total | 93.4 | 64.3 | 34.8 |

Source: MEC (2008).

**TABLE VII.3**
**COMPOSITION BY EDUCATIONAL ATTAINMENT (COMPLETE OR INCOMPLETE) IN EXTREME INCOME QUINTILES, URUGUAY**

| Quintile | Lowest quintile | Highest quintile |
|---|---|---|
| Primary | 53.3 | 6.7 |
| Secondary | 43.2 | 38.2 |
| Tertiary | 2.0 | 55.0 |
| Total | 98.5 | 99.9 |

Source: MEC (2008).

The above information shows important shortcomings in the Uruguay's educational system. The focus of this paper is to discuss how these shortcomings could/would affect the long-term Uruguayan economic performance.

## 2. Education, labour market, trade and production

This section describes productive sectors in Uruguay in order to link the analysis of education, skills, and trade. For this purpose, some basic indicators are computed using 2005 data. To start with, workers are classified according to schooling level: a) unskilled: incomplete basic education (less than 9 years of schooling); b) medium-skilled: complete basic education and higher education incomplete (9 to 15 years); and c) skilled: 16 years or more, corresponding to a university degree (with a degree of an average length of 4 years) or further studies.

At the aggregate level, as can be seen in Table VII.4 panel a, the services sector is the main employer in the Uruguayan economy: almost all skilled workers are employed in this sector (93%). Panel b of Table VII.4 shows that unskilled workers account for 40% of the employment, but the composition of the sectors, by type of labour, differs: whereas the participation of skilled labour is 16% in the services sector, it is only 4% in the goods sector. The table shows that a consideration of more than two skill levels is relevant to better describe the characteristics of employment across sectors; in particular, it shows that the participation of medium-skilled labour is high and similar across sectors.

**TABLE VII.4**
**COMPOSITION OF EMPLOYMENT, BY LABOUR TYPE AND SECTOR**
*(In percentage)*

| Panel a | | | | |
|---|---|---|---|---|
| | Unskilled | Semi-skilled | Skilled | Total |
| Goods | 31 | 20 | 7 | 23 |
| Services | 69 | 80 | 93 | 77 |
| Total | 100 | 100 | 100 | 100 |
| **Panel b** | | | | |
| | Unskilled | Semi-skilled | Skilled | Total |
| Goods | 54 | 42 | 4 | 100 |
| Services | 35 | 49 | 16 | 100 |
| Total | 40 | 47 | 13 | 100 |

Source: Own elaboration on processed data from INE.

As Table VII.5 shows, the services sector is mainly oriented to the domestic market, accounting for only 18% of the country's exports, about half of which correspond to transport and travel, which is 16th in the ranking of sectors by skill content. Thus, as goods account for 82% of the exports, the Table VII.4 panel b data reveal that the most important pressure coming from external demand is on intermediate qualified workers rather than on the most skilled.

**TABLE VII.5**
**EMPLOYMENT, PRODUCTION, AND EXPORT, BY SECTOR**
*(In percentage)*

| | Employment | GDP | Export |
|---|---|---|---|
| Goods | 23 | 25 | 82 |
| Services | 77 | 75 | 18 |
| Total | 100 | 100 | 100 |

Source: Own elaboration with data from BCU and processed data from INE.

At a more disaggregated level, we can refine the analysis. Table VII.6 shows the 15 major contributors to total exports, ranked by share of each sector in total exports, and also the corresponding ranking position for several other variables. The first column of the table is the ranking by exports, the second is the position in the ranking of shares in total employment, the third shows the position in the ranking according to the sector content of skilled labour (15 or more years of education), and the last one shows the position in the ranking of contributors (shares) to GDP.

The table shows that, among the 15 top exporting sectors, 1) there are three sectors from the services group: transport and travel, information technologies (IT) and research and development (R&D)-related activities, and financial services; and that 2) there are three of the top five skilled labour- intensive sectors: IT and R&D-related activities, financial services, and oil refinery.

The general picture will be more complete with a table presenting a different selection of sectors. Table VII.7 selects the 15 sectors with more skill content, which ranking is shown in the first column. In the rest of the columns, as in the previous table, the rankings in GDP, exports, and employment are given. The ranking of the sectors with more skill content shows that 1) eight (out of 15) sectors included are services; 2) the sectors with more skill content are almost non-traded: teaching activities and health and social services; 3) seven out of the top 10 contributors to the GDP are included in the list; 4) only two of the top 10 contributors to exports (financial services and oil refinery) are included in the list.

**TABLE VII.6**
**RANKING POSITIONS BY SEVERAL VARIABLES OF TOP 15 EXPORTING SECTORS**

| | | Exports | Employment | Skill content | GDP |
|---|---|---|---|---|---|
| D.1511.0 | Meat production and processing | 1 | 19 | 39 | 21 |
| I.RRTT.0 | Transport and travel | 2 | 17 | 15 | 17 |
| D.23TT.0 | Oil refinery | 3 | 40 | 5 | 20 |
| D.19TT.0 | Leather products | 4 | 24 | 41 | 37 |
| D.1520.0 | Dairy products | 5 | 26 | 24 | 24 |
| D.154S.0 | Sugar, cocoa, and confectionary | 6 | 39 | 23 | 14 |
| A.011T.0 | Crops and related services | 7 | 10 | 36 | 15 |
| J.TTTT.0 | Financial services | 8 | 14 | 4 | 3 |

(continues)

Table VII.6 (conclusion)

| | | Exports | Employment | Skill content | GDP |
|---|---|---|---|---|---|
| D.17TT.0 | Textile production | 9 | 22 | 30 | 26 |
| D.153T.0 | Mill production | 10 | 33 | 40 | 35 |
| D.151R.0 | Processing of fish, fruits, vegetables, etc. | 11 | 32 | 34 | 38 |
| D.25TT.0 | Rubber and plastic products | 12 | 31 | 26 | 31 |
| D.RRTT.0 | Metals, machinery, and equipment | 13 | 15 | 18 | 18 |
| D.24UT.0 | Other chemicals | 14 | 35 | 14 | 29 |
| K.RRTT.0 | Rental equipment, IT, R&D, and others | 15 | 7 | 3 | 9 |

Source: Own elaboration with data from BCU and processed data from INE.

**TABLE VII.7**
**RANKING POSITIONS BY SEVERAL VARIABLES, SELECTING TOP 15 SECTORS BY SKILL CONTENT**

| | | Skill content | GDP | Exports | Employment |
|---|---|---|---|---|---|
| M.80TT.0 | Teaching activities | 1 | 10 | 40 | 5 |
| N.85TT.0 | Health and social services | 2 | 6 | 41 | 3 |
| K.RRTT.0 | Rental equipment, IT, R&D, and others | 3 | 9 | 15 | 7 |
| J.TTTT.0 | Financial services | 4 | 3 | 8 | 15 |
| D.23TT.0 | Oil refinery | 5 | 20 | 3 | 40 |
| D.24ST.0 | Pharmacy | 6 | 36 | 20 | 29 |
| L.75TT.0 | Public administration and defence; administration of retirement funds | 7 | 4 | 37 | 4 |
| I.64TT.0 | Telecommunications and postal services | 8 | 7 | 25 | 19 |
| E.TTTT.0 | Electricity, water, gas | 9 | 11 | 29 | 21 |
| D.22TT.0 | Printing and editing services | 10 | 30 | 30 | 24 |
| O.TTTT.0 | Other community services | 11 | 13 | 38 | 9 |
| D.24RT.0 | Fertilizers and chemicals for agriculture | 12 | 43 | 31 | 43 |
| K.70TT.0 | Real estate | 13 | 1 | 35 | 28 |
| D.24UT.0 | Other chemicals | 14 | 29 | 14 | 34 |
| I.RRTT.0 | Transport and travel | 15 | 17 | 2 | 18 |

Source: Own elaboration with data from BCU and processed data from INE.

Table VII.8 shows the 15 major contributors to total GDP ranked and also the ranking positions for other several variables. Among the 15 major contributors to the GDP, there are six sectors listed in the top 10 of higher skill content (financial services, public administration and administration of retirement funds, health and social services, telecommunications and postal services, IT and R&D-related activities, and teaching activities), but only three top 10 exporters (financial services, sugar and confectionery, and crops and related services).

**TABLE VII.8**
**RANKING POSITIONS BY SEVERAL VARIABLES, SELECTING TOP 15 CONTRIBUTORS TO GDP**

| | | GDP | Employment | Skill content | Exports |
|---|---|---|---|---|---|
| K.70TT.0 | Real state | 1 | 29 | 13 | 35 |
| G.TTTT.0 | Retailers, car servicing and similar services | 2 | 1 | 19 | 39 |
| J.TTTT.0 | Financial services | 3 | 14 | 4 | 8 |
| L.75TT.0 | Public administration and defence; administration of retirement funds | 4 | 4 | 7 | 37 |
| F.45TT.0 | Building sector | 5 | 6 | 32 | 40 |
| N.85TT.0 | Health and social services | 6 | 3 | 2 | 41 |
| I.64TT.0 | Telecommunications and postal services | 7 | 18 | 8 | 25 |
| A.012T.0 | Livestock and related services | 8 | 28 | 21 | 24 |
| K.RRTT.0 | Rental equipment, IT, R&D, and others | 9 | 7 | 3 | 15 |
| M.80TT.0 | Teaching activities | 10 | 5 | 1 | 42 |
| E.TTTT.0 | Electricity, water, gas | 11 | 20 | 9 | 29 |
| I.60TT.0 | Ground transport | 12 | 9 | 31 | 28 |
| O.TTTT.0 | Other community services | 13 | 8 | 11 | 38 |
| D.154S.0 | Sugar, cocoa, and confectionery | 14 | 39 | 23 | 6 |
| A.011T.0 | Crops and related services | 15 | 10 | 36 | 7 |

Source: Own elaboration with data from BCU and processed data from INE.

Finally, Table VII.9 lists the 15 fastest growing sectors during the period 1997-2005, measured by the annual accumulative rate of growth of GDP during the period. The table shows that, among the fastest growing sectors in the recent period, a) there are 5 of the top 10 major contributors to GDP (telecommunications and postal services, IT and R&D-related activities, livestock and related services, real estate, and teaching activities); b) there are 5 of the top 10 contributors to exports (sugar and confectionery, meat processing, dairy products, crops and related services, and oil refinery); and c) there are 4 of the top 10 sectors with higher skill content (telecommunications and postal services, IT and R&D-related activities, oil refinery, and teaching activities).

**TABLE VII.9**
**RANKING POSITIONS BY SEVERAL VARIABLES, SELECTING TOP 15 SECTORS, BY GDP GROWTH, 1997-2005**

| | | GDP growth | Employment | Skill content | GDP | Exports |
|---|---|---|---|---|---|---|
| D.154S.0 | Sugar, cocoa, and confectionery | 1 | 39 | 23 | 14 | 6 |
| I.64TT.0 | Telecommunications and postal services | 2 | 18 | 8 | 7 | 25 |
| D.25TT.0 | Rubber and plastic products | 3 | 31 | 26 | 31 | 12 |
| D.20TT.0 | Production of wood and wood products, except furniture | 4 | 27 | 42 | 32 | 16 |
| D.1511.0 | Meat production and processing | 5 | 19 | 39 | 21 | 1 |
| D.24RT.0 | Fertilizers and chemicals for agriculture | 6 | 43 | 12 | 43 | 31 |
| D.SSTT.0 | Vehicles and transport equipment | 7 | 37 | 25 | 34 | 18 |
| K.RRTT.0 | Rental equipment, IT, R&D, and others | 8 | 7 | 3 | 9 | 15 |
| D.1520.0 | Dairy products | 9 | 26 | 24 | 24 | 5 |
| A.011T.0 | Crops and related services | 10 | 10 | 36 | 15 | 7 |
| D.23TT.0 | Oil refinery | 11 | 40 | 5 | 20 | 3 |
| A.012T.0 | Livestock and related services | 12 | 28 | 21 | 8 | 24 |
| M.80TT.0 | Teaching activities | 13 | 5 | 1 | 10 | 42 |
| D.151R.0 | Processing of fish, fruits, vegetables, etc. | 14 | 32 | 34 | 38 | 11 |
| K.70TT.0 | Real estate | 15 | 29 | 13 | 1 | 35 |

Source: Own elaboration with data from BCU and processed data from INE.

The previous tables allow us to draw an initial general picture of the link between skill formation, trade, and growth. This can be summarized as follows:

(i) In the Uruguayan economy, the services sector is the main employer, and almost all skilled workers are employed in this sector (93%).

(ii) The services sector is mainly oriented to the domestic market, accounting for only 8% of the country's exports, about half of which correspond to transport and travel, which is 15th in the ranking of skill-intensive sectors.

(iii) However, among the 15 top exporting sectors, there are three of the top five skill-intensive sectors: rental equipment, IT, R&D and-related services, financial services, and oil refinery.

(iv) In the list of the 15 major contributors to GDP, there are six of the top 10 skill-intensive sectors; between the faster growing sectors in the 1997-2005 period, measured by the annual accumulative rate of GDP growth, there are four out of the top 10 sectors with higher skill content.

All these then show that the skills are relevant to both exporting and non-exporting enterprises, with an important role to induce growth, given the performance of the dynamic sectors. Finally, to draw a stylized picture of the Uruguayan economy, based on which the simulations will be better analysed, Tables VII.10 and VII.11 present data in the main sectors: primary, manufacturing and services traded and non-traded. Table VII.10 shows the scarce participation of skilled labour in the primary and manufacturing sectors but the highest involvement in the traded services sector.

**TABLE VII.10**
**EMPLOYMENT COMPOSITION OF AGGREGATED SECTORS**
*(Percentage)*

| | Unskilled | Semi-skilled | Skilled | Total |
|---|---|---|---|---|
| Primary | 69 | 27 | 4 | 100 |
| Manufacturing | 44 | 52 | 5 | 100 |
| Services traded | 28 | 53 | 20 | 100 |
| Services non-traded | 37 | 48 | 15 | 100 |
| Total | 40 | 47 | 13 | 100 |

Source: Own elaboration based on SAM 2005 (see Terra et al. 2009).

**TABLE VII.11**
**PROFILE OF AGGREGATED SECTORS**
*(Percentage)*

| | Employment | Skill content | GDP | Exports |
|---|---|---|---|---|
| Primary | 9 | 5 | 8 | 7 |
| Manufacturing | 13 | 8 | 17 | 74 |
| Services traded | 15 | 25 | 22 | 18 |
| Services non-traded | 63 | 20 | 54 | 1 |

Source: Own elaboration based on data form: SAM 2005 (see Terra et al. 2009), Uruguayan Central Bank (BCU) and National Census Bureau (INE).

Finally, Table VII.11 highlights the relevance of non-traded services to employment (almost two-thirds) and GDP (more than a half), while the participation of manufacturing in exports is dominant (three-fourths).

# D. Scenarios and assumptions

The simulation exercise aims to highlight the relevance of educational policies to mediate the effects of trade policy or global trends on productive activities. There follows a hypothetical experiment where the economy follows different patterns of endowment growth in order to investigate the way in which these affect the results. The exercise simulates changes in the composition of the inflow of workers delivered to the market; the underlying assumption is that differences in the patterns of endowment growth are explained by different educational performances/policies.

The benchmark for this simulation is a skill-scarce country with skill-intensive services sectors producing mainly for the domestic market. However, skill- intensive services have become increasingly traded globally and Uruguayan exports have followed that trend. The sector is under a liberalization process after the Uruguay Round; the potential of economy-wide effects of trade liberalization on services are reviewed, for instance, by Hoekman (2006). The novelty of this non-traditional export in developing countries is that, in general, it involves skill- intensive activities (e.g., banking, insurance). Thus, the increasing trend in external demand for services from developed countries is simulated for an alternative pattern of endowment growth. The exercise consists of a simulation of external demand for services in alternative scenarios of endowment growth, which is described below.

## 1. Increase in the external demand for services

According to WTO (2008) data, growth rates of aggregate sectors during the period 2000-2007 are:

**TABLE VII.12**
**WORLD EXPORT GROWTH RATES**
*(In percentages)*

| | 2000-2007 |
|---|---|
| Agriculture | 4 |
| Oil and mining | 3.5 |
| Manufacturing | 6.5 |
| Services traded | 12 |

Source: International Trade Statistics, 2008, World Trade Organization.

So, we projected growth rates for a time horizon of 20 years as follows:

**TABLE VII.13**
**PROJECTED RATES OF GROWTH FOR NEXT 20 YEARS**

| | 2005-2025 |
|---|---|
| Primary | 119 |
| Manufacturing | 221 |
| Services traded | 865 |

Source: Own elaboration.

In the group of traded services are included the following activities:

**TABLE VII.14**
**LIST OF TRADED SERVICES**

| | |
|---|---|
| H55TT0 | Hotels and restaurants |
| I60TT0 | Ground transport |
| I64TT0 | Telecommunications and postal services |
| IRRTT0 | Transport (air and maritime) and travel |
| JTTTT0 | Financial services |
| KRRTT0 | Rental equipment, IT, R&D, and others |

Source: Own elaboration based on export orientation.

## 2. Exogenous endowment growth

For labour, we assumed a projected growth of the active population at 10% based on projections for 2005-2025 from INE. The increment for capital was projected taking the average rate of growth in the last 20 years, which is a conservative estimate, given that, based on the average gross investment growth rate in the last 10 years (1998-2008, data from BCU), the projected growth would be higher.

Three alternative scenarios of endowment growth are considered according to the mix of workers produced by the educational system (the total increase of labour is the same in all the alternatives). For a time horizon of 20 years, the following values for the different scenarios are considered:

**TABLE VII.15**
**ENDOWMENT GROWTH: TIME HORIZON OF 20 YEARS**

| | ESC0 | ESC1 | ESC2 |
|---|---|---|---|
| Skilled | 10% | 21% | 10% |
| Semi-skilled | 10% | 5% | 21% |
| Unskilled | 10% | 10% | 3% |
| Capital | 20% | 20% | 20% |

Source: Own elaboration.

In the base scenario (Escenario 0, ESC0), we assumed that the projected increase in all types of labour is the same as that in the population; the other scenarios assume alternative patterns. The basic assumption is that alternative patterns of labour growth are policy-induced: a policy of enhancing higher education (so, reducing dropouts and consequently favouring the formation of skilled labour-ESC1) and a policy of enhancing basic education (thus reducing dropouts at the basic level and consequently reducing unskilled labour and increasing medium-skilled labour-ESC2) are the basic policies underlying Scenarios 1 and 2.

**TABLE VII.16**
**COMPOSITION OF THE INFLOW OF WORKERS**
*(In percentage)*

| | ESC0 | ESC1 | ESC2 |
|---|---|---|---|
| Skilled | 16 | 35 | 16 |
| Semi-skilled | 33 | 15 | 70 |
| Unskilled | 50 | 50 | 14 |

Source: Own elaboration.

# E. Simulation results

The focus of the comments on the simulation results will be on the effects of the shock on the labour market and the productive sector, and these results will be compared with those obtained for alternative (assumed to be policy-induced) patterns of endowment growth.

Table VII.17 shows the effects of the shock on wages, with and without education policy. Column 3 displays the marginal effect between a situation with and without an external shock, which reveals that it will rise the relative return of medium-skilled and skilled wages, increasing the wage gap with the unskilled. Columns 4 and 5 of the same table compare the results of the shock under alternative patterns of endowment growth compared with those if the economy follows today's trend

(status quo), presenting the resulting marginal effects with respect to ESC0 (column 2). These results show that, if the production of skills is enhanced, this will reduce the wage gap, both in the alternative where the skilled labour is favoured (column 4 ESC1, enhancing higher education, thus reducing dropouts) as its return declines, and also in the alternative where medium-skilled labour is favoured (column 5 ESC2, enhancing basic education, thus reducing dropouts and unskilled labour) as the return of unskilled labour rises.

**TABLE VII.17**
**RISE IN EXTERNAL DEMAND FOR SERVICES – EFFECT ON WAGES**

| | (1) ESC0 without shock | (2) ESC0 with shock | (3) Marginal (2)-(1) | (4) ESC1 Growth skilled biased | (5) ESC2 Growth medium skilled biased |
|---|---|---|---|---|---|
| $w_u$ | 3.0 | 17.1 | 14.1 | 0.1 | 7.2 |
| $w_m$ | 2.5 | 20.2 | 17.7 | 4.4 | -7.8 |
| $w_s$ | 1.7 | 19.1 | 17.3 | -8.3 | 0.6 |

Source: Own elaboration based on simulation results.

Notation: w are wages. u, m, and s refer to unskilled, medium-skilled, and skilled labour, respectively.

Table VII.18 shows the effects of the shock on the output of productive sectors, also with and without education policy. Column 3 shows that the projected expansion of the external demand will bias growth mainly towards traded services, against the primary sector. Columns 4 and 5 display the marginal effects if the patterns of endowment growth were to change: as expected, growth in skilled or medium-skilled will favour the expansion of services, which use those factors more intensively. This shows that any alternative pattern of endowment growth different from the status quo will ease the expansion of the production of services, in particular those traded, allowing them to take advantage of the global trends in growth of trade. On the contrary, it can be deduced that a pattern of endowment growth along the lines of the country's comparative advantage ("the status quo mode") promotes the expansion of traditional competitive sectors but with more inequality as seen in Table VII.17.

**TABLE VII.18**
**RISE IN EXPORT OF SERVICES – EFFECT ON OUTPUT OF PRODUCTIVE SECTORS**

| | (1) ESC0 without shock | (2) ESC0 with shock | (3) Marginal (2)-(1) | (4) ESC1 Growth skilled biased | (5) ESC2 Growth medium skilled biased |
|---|---|---|---|---|---|
| Primary | 15.1 | 1.0 | -14.2 | -0.5 | -1.2 |
| Manufacturing | 15.2 | 19.7 | 4.5 | -0.7 | 1.0 |
| Services traded | 14.2 | 55.4 | 41.2 | 0.5 | 5.0 |
| Services non-traded | 14.1 | 22.9 | 8.9 | 0.0 | 2.2 |

Source: Own elaboration based on simulation results.

Table VII.19 shows the effect of the shock on exports, with and without education policy. Column 3 of shows that the shock results in a dramatic growth of services exports. This is even reinforced when alternative patterns of endowment growth are more skill-intensive than the status quo, as can be seen in columns 4 and 5, in particular, when the production of medium-skilled labour is enhanced (ESC2) as these activities are mainly intensive in medium-skilled labour (53% on average, see Table VII.10).

**TABLE VII.19**
**RISE IN EXTERNAL DEMAND OF SERVICES – EFFECT ON EXPORTS**

| | (1) ESC0 without shock | (2) ESC0 with shock | (3) Marginal (2)-(1) | (4) ESC1 Growth skilled biased | (5) ESC2 Growth medium skilled biased |
|---|---|---|---|---|---|
| Primary | 14.3 | -17.8 | -32.2 | -0.3 | -2.5 |
| Manufacturing | 13.0 | 38.1 | 25.1 | -0.9 | -0.3 |
| Services traded | 13.5 | 291.0 | 277.5 | 1.4 | 16.4 |

Source: Own elaboration based on simulation results.

At a more aggregated level, the effects of the shock on GDP are presented in Table VII.20, which shows a marginal effect of the shock on GDP of around 5%. However, this effect can vary substantially according to alternative policies. While the policy under scenario 1 will have an almost negligible effect on GDP, the policy of enhancing the production of semi-skilled labour will produce a significant marginal expansion of GDP by an additional 2 percentage points due to a broad use in the economy of that factor.

**TABLE VII.20**
**RISE IN EXTERNAL DEMAND OF SERVICES – EFFECT ON GDP**

| | (1) ESC0 without shock | (2) ESC0 with shock | (3) Marginal (2)-(1) | (4) ESC1 Growth skilled biased | (5) ESC2 Growth medium skilled biased |
|---|---|---|---|---|---|
| GDP | 14.3 | 19.7 | 5.3 | 0.1 | 2.1 |

Source: Own elaboration Own elaboration based on simulation results.

The analysis at the disaggregated level will provide more insights on the effects of the shock on the activities in the traded services sector. Table VII.21 presents the effects on output with and without the shock and the marginal effects in column 3 displayed ranking in descending order. The table shows the greatest impact of the rise in external demand for traded services on transport-related activities, especially those by air and sea, followed by financial services and IT and R&D- related activities.

**TABLE VII.21**
**RISE IN EXTERNAL DEMAND OF SERVICES – EFFECTS ON OUTPUT**
*(Disaggregated results)*

| | | (1) ESC0 without shock | (2) ESC0 with shock | (3) Marginal (2)-(1) | (4) ESC1 Growth skilled biased | (5) ESC2 Growth medium skilled biased |
|---|---|---|---|---|---|---|
| IRRTT0 | Transport (air and maritime) and travel | 15.8 | 197.9 | 182.1 | -3.0 | 10.4 |
| I60TT0 | Ground transport | 12.5 | 40.2 | 27.6 | -2.0 | 3.2 |
| JTTTT0 | Financial services | 15.1 | 39.5 | 24.4 | 1.2 | 5.8 |
| KRRTT0 | Rental equipment, IT, R&D, and others | 14.8 | 28.2 | 13.4 | 6.9 | 6.2 |
| H55TT0 | Hotels and restaurants | 12.1 | 21.3 | 9.2 | -0.9 | 2.1 |
| I64TT0 | Telecommunications and postal services | 14.8 | 20.9 | 6.1 | 0.2 | 2.2 |

Source: Own elaboration Own elaboration based on simulation results.

Columns 4 and 5 of Table VII.21 show the effect of the shocks under policies different from the status quo. It implies that any policy aimed at upgrading the quality of the labour force will enable a greater expansion of IT and R&D-related activities and financial services, both of them skill-intensive activities among the traded services. However, a policy oriented to enhancing the production of medium-skilled labour (ESC2) will favour the expansion of all the activities, as this type of labour is used heavily in all sectors.

# F. Conclusions

At the global level, trade in services has been the most dynamic sector, with an average growth rate about double that in the primary and manufacturing sectors. However, the three activities have a completely different composition in terms of type of labour, services being the most skill-intensive. In Uruguay, the formation of human resources shows several weaknesses; which leads one to ask: Is Uruguay prepared to take advantage of the opportunities open in the global market? If not, what are the consequences?

The situation of the Uruguayan education sector and the characteristics of the labour market were described in the paper. On one hand, a problem at the secondary level of the education sector was identified, where only two-thirds of individuals complete a compulsory level. On the other hand, the description of the labour market shows a very different composition of the goods and services sector by labour type: on average, services are more skill-intensive than the goods-producing sectors, but pressure on the demand for medium-skilled labour is similar in both groups.

The analysis of the Uruguayan data on skills, trade, and growth shows some important facts. First, even when the main exporting sectors have a high content of unskilled labour, there are some skill-intensive sectors with a high exporting profile, for which the development of human resources is a key element in the context of increasing external demand. Second, as all sectors demand a significant share of semi-skilled labour, it seems that there is a great pressure coming from the external demand for intermediate qualified workers. Third, some of the skill-intensive sectors have shown dynamism in recent years and are included in the list of the fastest growing sectors, which is independent of external demand. So, the analysis of the data shows that both skilled and medium-skilled labour are key factors for growth, resources that are deficient in Uruguay as the paper has described.

A simulation exercise was tried consisting of an increase in external demand for skill-intensive services, following the global trend of trade in services and the increasing participation of Uruguay in such trade. The pressure on relative wages and factor allocation was the focus of the simple exercise. It is shown that, in this scenario, the wage gap would widen should the pattern of endowment growth follow the current trend; however, changes in such a pattern towards more participation of skilled or semi-skilled labour would favour a reduction in the wage gap. The simulation may well represent episodes of rises in demand not met by increases in supply, often cited as the cause of the increase in the skill premium in many Latin American countries.

The results of the exercise suggest several lines for a deeper analysis. The results show that, in a context where the educational system does not improve its performance, the scenario of increasing external demand for services leads to an increase in the wage gap across qualifications. But this is not a necessary result. Educational policies aiming at improving the efficiency of the education sector will contribute to a better matching between demand and supply of qualifications, allowing the expansion of dynamic sectors with a reduction in inequality. The logic of the exercise is to provide some insights on the economy-wide effects of a novel global phenomenon such as the expansion of trade in services; however, the scenarios may be relevant to other external shocks (e.g., changes in commodity prices) or other domestic policies such as the promotion of ("somehow defined") strategic sectors.

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# VIII. Poverty and income distribution in Latin America: on the complementarities between trade policy and social public spending

***Ramón López***

## A. Introduction

Trade liberalization often implies important changes in the composition of production as well as in output and factor prices with significant impact on both the level of aggregate income and its distribution. These changes may induce negative consequences for the poor and for income distribution (Goldberg and Pavcnik, 2004 and 2007). A policy issue is how to mitigate the potentially negative effects on the poor and on equity that increasing trade openness may entail.

Studies have focused on the role of social policies and emergency anti-poverty programs to limit the social costs associated with major restructuring of economic activity. In fact, some countries in Latin America have implemented large social transfer programs to mitigate the negative consequences of such economic restructuring.[71] However, the welfare of the poor and other low income classes depends more on stocks of social or human capital rather than on flows of social spending.[72] While social spending contributes to build social capital it often takes time to achieve its impact; one of the main effects of these programs is their contribution to gradually building up stocks of social or human capital while the instantaneous direct effects on household welfare are likely to be of second order of importance and also mainly short-lived.

If the financing of the new social programs is through a reallocation of public spending an important question is what other spending items are cut. Recent studies have shown that certain countries in Latin America devote more than 50% of their revenues to providing subsidies to small

[71] Throughout this paper we use an extended definition of social spending to include not only direct social transfers but also social security, spending in education, health care, social housing, and related items.

[72] Even direct social transfer programs can be regarded as building units in constructing the necessary social infrastructure to "reach" the poor and allowing the poor to get better nourishment and education both of which involve stock effects that take years of consistent flow spending policies to build. Spending on other social goods such as education and health are obviously contributions to build human capital stocks.

economic elites to the detriment of spending in social and other public goods that generally are pro-growth and tend to benefit the majority of the population, not merely the wealthy (López and Galinato, 2007). So, one may speculate that cutting non-social subsidies to finance the build-up of social capital may be an effective way of promoting equity and reducing poverty.

In addition, there is the issue of the effectiveness of social spending to raise household income, especially of the poor. An important question is whether or not social spending is in fact targeted to the development of social capital stocks that benefit the poorest segments of society and whether social capital stocks are effective in reducing poverty and income disparities. There is a suspicion that many social programs in Latin America, including expenditures in public education, health care and others, are in fact poorly targeted and create social capital that end up benefiting more the middle and even upper classes rather than the poor (Goñi et al. 2008).

The conventional approach in the literature has been to examine the poverty and distribution effects of trade policies and fiscal policies separately. A common feature of the vast trade policy evaluation literature summarized by Goldberg and Pavcnik's (2004) comprehensive survey article is that the connections between trade liberalization and inequality and poverty are established making abstraction of the fiscal spending environment which may nonetheless affect the size and even direction of the impact of trade policy. This piecemeal approach continues to prevail in more recent analyses of trade policy as shown by the more recent survey by Goldberg and Pavcnik (2007) and by Perry and Olarreaga (2006).

Similarly, the literature examining the effects of fiscal policy on poverty and inequality has largely made abstraction of the role of the trade regime in affecting the consequences of trade policy (van de Walle, 1998; Chu et.al., 2000; Wodon et.al., 2003; Goñi et.al., 2008; López and Torero, 2010; López and Islam, 2008). This piecemeal evaluation approach is likely to contribute to explain the often contradictory findings encountered in these literatures. If for example there are important complementarities between fiscal spending in social goods and trade policy, the partial evaluation of each of these policies may yield highly unstable results; when the author uses data for countries that spend a lot in social goods the effect of trade liberalization may be large, pro-poor and pro-equity, but authors analyzing countries where social spending is low would reach opposite conclusions.[73]

In this paper we break with this traditional piecemeal approach. We evaluate the poverty and distributional effects of fiscal spending and trade policies within a simultaneous framework. We provide the first systematic analysis testing for the existence of complementarities between trade and fiscal spending policies using data from Latin America. Fiscal expenditures often lead to the creation of capital stocks that over time impinge on the income of the various household groups.[74] We focus on the complementarities and substitutions that may arise between these government-provided capital stocks and trade policies for household incomes. We distinguish between government-provided social or human capital stocks created over time mostly through government expenditures in social goods and government-provided non-social capital stocks created over time by government spending in non-social goods.

A hypothesis that we test is that government-provided social or human capital stocks tend to make the benefits of trade liberalization larger and better distributed across the households and that a more open trade regime increases the pay-off of social capital especially for the poorest households. In addition, we test the hypothesis that the effect of social capital is enhanced by a more open trade regime.

To test the above hypotheses we use existing data for Latin American and Caribbean countries on public spending over the period 1987-2006. We use government spending in social programs series to construct stocks of government-provided social capital and series of spending in non-social goods to construct series of non-social capital stocks. In addition, we use measures of the degree of trade openness

[73] Even the few studies of fiscal policies that "control" for the trade regime or studies of trade liberalization that control for certain aspects of fiscal policies do not really deal with the issue of interaction among policies; that is, merely controlling for the other policies does not by itself allow one to measure and test how the effectiveness of one set of policies affect that of the other one.

[74] Government spending rarely has merely instantaneous effects; expenditures create capital in the form of social or human capital and non-social capital including infrastructure and others.

available in the literature that are computed annually for each country in the region. These data is combined with data from periodical household surveys implemented in many countries that allow computing various measures of poverty and income distribution. We examine how the size of the effect of trade openness on poverty and, more generally income distribution, is affected by the social and non-social government-provided capital stocks. If the hypothesis that trade liberalization and government-provided social capital is correct we would expect that the estimated elasticity of poverty with respect to trade openness be lower in countries that have greater per capita social capital stocks than those that have a lower stock. If trade openness (ceteris paribus) increases poverty the size of such effect would be lower in countries exhibiting a higher social capital stock and if the effect is to decrease poverty this effect would be magnified in countries lower stocks of social capital.

# B. Econometric model

## 1. The basic specification

We divide the total household population of a country into M social groups to reflect the income distribution. We assume that the per capita household income of a particular group $i$ at time $t$ in country $j$, $y_{ijt}$, is determined by the per capita stock of government-provided social goods, $S^s_{jt}$, per capita stock of government-provided non-social goods, $S^n_{jt}$, which in turn are related to past allocations of government expenditures in social and non-social goods, respectively. In addition, we hypothesize that income distribution is associated with the country's per capita GDP, $Y_{jt}$ by characteristics of the trade regime, $Z_{jt}$, by unobserved random or fixed effects specific to the social group in each country, $\tilde{\psi}_{ij}$, by country-specific time-varying effects, $\tilde{v}_{jt}$, and a random disturbance, $\tilde{\varepsilon}_{ijt}$.

Thus, if there are M household groups, we have a system of M equations such as,

$$(1) \qquad y_{ijt} = \tilde{\psi}_{ij} + \alpha_{1i} S^s_{jt} + \alpha_{2i} Y_{jt} + \alpha_{3i} Z_{jt} + \alpha_{4i} S^n_{jt} + \tilde{v}_{jt} + \tilde{\varepsilon}_{ijt}, \qquad i = 1,2,.....M$$

Importantly, the time-varying effects $\tilde{v}_{jt}$, which are a generalization of the standard fixed effects, control for a myriad of possibly unobserved (or at least hard to measure with precision) and hence omitted time-varying country variables that may affect the income of the various groups including macro and microeconomic policies, external shocks, institutional changes and so forth.[75] That is, the specification postulated in Equation (1) controls for both group specific effects, $\tilde{\psi}_{ij}$, allowing them to be different within and across countries as well as for non-random country-specific effects that change over time in a different way for each country ($\tilde{v}_{jt}$). Also we note that the parameter vectors, $\alpha_{1i}$, $\alpha_{2i}$, $\alpha_{3i}$, and $\alpha_{4i}$ are all allowed being different for each of the M household income groups considered in order to allow for differential effects of the respective variables on the per capita income of each particular group. The flexibility to estimate such a large number of parameters is possible because we jointly estimate the $M$ group income equations.

The system estimation of the complete income distribution used here is more flexible and more general than most other specifications popular in the existing literature which use isolated

[75] Data on some important economy-wide variables (i.e., taxes, subsidies, various components of private capital stocks, and so forth) can often be estimated from existing statistics but with a low degree of precision. Thus, one could use these estimated variables but at a high cost associated with increased measurement errors biases caused by the use of explanatory variables that are gauged with little precision. We choose instead to use a more parsimonious model specification that relies on few conventional explanatory variables but that rely on country time-varying effects to control for the possible omitted variable biases associated with such a parsimonious model.

measures of income distribution or poverty (such as Gini coefficients, proportion of the population below the poverty threshold, per capita income of the poorest quintile, and so forth). This flexibility is due to the large number of degrees of freedom which, in turn, permits us to use methods such as the country time-varying effects which demand a great deal of observations.

The above model postulates that group per capita incomes are associated to the stocks of government-provided capital accumulated through government spending over many years, not directly to the current flows of government expenditures. While we have data on the flows of government expenditures for various key components we do not have direct measures of their respective stock levels. We use a perpetual inventory model to construct capital stocks series for social and non-social goods using the government-provided expenditures in social and non-social goods, respectively (Griliches, 1979). The stock of publicly-provided social goods at time $t$ in country j ($S^s_{jt}$) is,

$$(2) \qquad S^s_{jt} = gs_{jt} + (1-\delta_s)S^s_{jt-1},$$

where $gs_{jt}$ are real government expenditures in social goods at time $t$ and $\delta_s$ is the rate of depreciation of social public goods. In addition the perpetual inventory method derives the initial stock of capital ($S^s_{j0}$) as follows,

$$(3) \qquad S^s_{j0} = \frac{gs_{j0}}{\eta_{js} + \delta_s},$$

where $\eta_{js}$ is the rate of growth of the government expenditure in social goods. Using (3) and (2) we can construct a series of government-provided social capital stock over the sample time. A similar approach is used to estimate the stock of non-social government-provided capital ($S^n_{jt}$). A problem with this approach is that one needs to assume the rates of depreciation that apply to each capital stock. We use depreciation rates often used in the literature but we check the sensitivity of the results to varying the depreciation rates within reasonable ranges.

We estimate equation system (1) log differences. Expressed in changes over time the system of $M$ equations become,

$$(4) \qquad g_{ijt} = \alpha_{1i}e^s_{jt} + \alpha_{2i}g^Y_{jt} + \alpha_{3i}z_{jt} + \alpha_{4i}e^n_{jt} + v_{jt} + \varepsilon_{ijt}, \qquad i = 1,....,M$$

where, $g_{ijt} \equiv y_{ijt} - y_{ijt-1}$ ; $g^Y_{jt} \equiv Y_{jt} - Y_{jt-1}$ ; $e^s_{jt} \equiv S^s_{jt} - S^s_{jt-1}$ ; $e^n_{jt} \equiv S^n_{jt} - S^n_{jt-1}$ ; $z_{jt} \equiv Z_{jt} - Z_{jt-1}$ ; $v_{jt} \equiv \tilde{v}_{jt} - \tilde{v}_{jt-1}$

It is important to note that while the fixed group effects ($\tilde{\psi}_{ij}$ in (1)) vanish in (4) due to the specification in differences the time-varying country effects ($v_{jt}$) do not disappear and in fact play a vital role in mitigating biases due to omission of country-wide unobserved variables. Alternatively, we may assume that $\tilde{\psi}_{ij}$ is random in which case Equation (4) can be enhanced to include a random effect factor.

The change of the government stock variables from period *t–1* to $t$ is equal to the government spending at time *t–1* in the respective stock, less the depreciation of the stock. Thus, an additional advantage of using differences is that effectively using lagged instead of current government expenditures implicit in the stocks of government-provided capitals mitigates possible biases in the estimation of the coefficients due to reverse causality between government spending patterns and household income groups. Under certain assumptions we could also justify the use of lagged trade regime indicators instead of current ones. It is likely that changes in the trade regime may not have an

instantaneous effect on the income distribution across groups. Under this assumption we could use lagged values of both the government spending variables and trade openness indicators which may mitigate reverse causality biases.

However, even if we use lagged values for the government spending and trade indicators we could still have biases and inconsistencies if the lagged values of these variables are correlated with unobserved or omitted variables that in turn affect current group household incomes. But the fact that we control for country-specific time-varying effects ( $v_{jt}$ ) prevents these biases as long as the omitted variables in each country are economy-wide and not group-specific.

In the benchmark estimation we disaggregate the households into four income groups: the poor, defined as the households in the bottom two quintiles of the income distribution, the middle class encompassing the households in the 41% to 70% of the income distribution, the upper middle class including households in the 71 to 90%, and the rich which include the households in richest 10% of the distribution. Alternatively, we divide the households into the ten income deciles. Apart from providing richer measures the use of all ten deciles instead of four groups contributes to shed light into the effects of the variables of interest into the poorest segments of society. We estimate the four or ten equations as a SUR system.

## 2. Generalizations of the basic model

### a) Trade openness and government-provided capital stocks: interactions

Given our purposes we need to generalize (1) and (4) to allow for interactions between the government-provided capital stocks and the trade openness indicators. These interactions measure how the effect of trade openness on the income distribution profile is affected by the government capital stocks and vice-versa. Thus, Equation (1) is generalized to allow for such interactions as follows:

$$(1') \qquad y_{ijt} = \tilde{\psi}_{ij} + \alpha_{1i} S^s_{jt} + \alpha_{2i} Y_{jt} + \alpha_{3i} Z_{jt} + \alpha_{4i} S^n_{jt} + \beta_{1i} S^s_{jt} Z_{jt} + \beta_{2i} S^n_{jt} Z_{jt} + \tilde{v}_{jt} + \tilde{\varepsilon}_{ijt}; \qquad i = 1,2,....M$$

where the group-specific coefficients $\beta_{1i}$ and $\beta_{2i}$ measure the interactions between the trade regime and the effectiveness of government-provided social and non-social stocks. This specification in differences becomes,

$$(4') \qquad g_{ijt} = \alpha_{1i} e^s_{jt} + \alpha_{2i} g^Y_{jt} + \alpha_{3i} z_{jt} + \alpha_{4i} e^n_{jt} + \beta_{1i} I^s_{jt} + \beta_{2i} I^n_{jt} + v_{jt} + \varepsilon_{ijt}$$

where $I^s_{tj} \equiv (S^s_t - S^s_{t-1})(Z_t - Z_{t-1})$ and $I^n_{tj} \equiv (S^n_t - S^n_{t-1})(Z_t - Z_{t-1})$

### b) Joint estimation of trade openness

In addition we extend the system to M+1 equations by estimating a trade openness relationship jointly with the group income functions. We postulate that trade openness as measured by a "structure trade intensity" (SATI) index (to be defined below) is determined by per capita income, the stocks of government-provided social and non-social capital stocks, by trade policies including import tariff levels, tariff dispersion and the existence of free trade agreements and by the country-specific time-varying effects.[76] The fact that we estimate this equation jointly with the group income equations give us the degrees of freedom needed control for time-varying country effects in this equation as well. Thus, the trade openness equation estimated in difference form is the following:

[76] The SATI index normalizes the trade flows of a country by its size, geographic location, population and several other natural structural factors that are likely to affect trade openness. In this way SATI captures mainly the relative degree of openness of the countries that are associated with factors such as trade policy that are often endogenous to the country in question.

$$(5) \qquad z_{jt} = \gamma_1 e^s_{jt} + \gamma_2 g^Y_{jt} + \gamma_3 e^n_{jt} + \Omega_1 m_{jt} + \Omega_2 d_{jt} + \Omega_3 tr_{jt} + \Lambda_{jt} + \mu_{jt}$$

where $m_{jt}$, $d_{jt}$, and $tr_{jt}$ are the annual change in average tariff, in tariff dispersion and in the number of free trade agreements, respectively, $\Lambda_{jt}$ are the time-varying country effects, and $\mu_{jt}$ is a random disturbance.

It is expected that the average tariff level lowers trade openness. Free trade agreements may increase or reduced the volume of trade; as is well known, trade agreements have trade creation and trade destruction effects, so the net effect is in general ambiguous. Tariff dispersion is also likely to have an ambiguous effect on trade openness. Thus, the effects of free trade treaties and of tariff dispersion on trade openness are mainly an empirical matter.

## C. The data

The average annual group per capita income is obtained from household surveys in the different countries considered; the data was converted to purchase power parity in constant 2005 US dollars. We combine the data obtained from the Chen and Ravallion income inequality data set available at the World Bank's PovcalNet, and the Socio-Economic Database for Latin America and the Caribbean (CEDLAS and World Bank). Table VIII.1 shows a description of the data used in the main regressions and their respective sources. In the appendix we provide a summary statistics of these data.

The stocks of social capital have been created applying the "perpetual inventory method" using the data on government expenditures for social and non-social items using expressions (2) and (3). We have created the series of social and non-social government-provided capital stocks assuming a 3% annual rate of depreciation for social capital and 6% for the non-social capital stocks.

The SATI was calculated following the methodology developed by Lant Pritchett (1996), in which the SATI is the residual of the following regression, using the 18 countries included in the sample of analysis:

$$\ln(Trade)_{ijt} = \alpha_{0i} + \alpha_{1i} \ln(population)_{jt} + \alpha_{2i} \ln(area)_{jt} + \alpha_{3i} \ln(areasq)_{jt} + \alpha_{4i} \ln(GDPpercapita)_{jt}$$
$$+\alpha_{5i} \ln(GDPpercapita\_sq)_{jt} + \alpha_{6i} OilExporter + \alpha_{7i} IndEconomy + \varepsilon_{ijt}$$

The definitions and sources of each variable used in the SATI regression are described in Table VIII.A2 in the appendix.

**TABLE VIII.1**
**DESCRIPTION AND SOURCES OF THE VARIABLES USED IN THE REGRESSIONS**

| Variable | Description | Source |
|---|---|---|
| Per capita income of group 1 | Average yearly per capita income in Group 1 (0 - 40%) | Chen & Ravallion income inequality dataset available at the World Bank's PovcalNet <http://iresearch.worldbank.org/PovcalNet/jsp/index.jsp> & Socio-Economic Database for Latin America and the Caribbean (CEDLAS and World Bank) <http://www.depeco.econo.unlp.edu.ar/sedlac/esp/estadisticas.php> |
| Per capita income of group 2 | Average yearly per capita income in Group 2 (41 - 70%) | |
| Per capita income of group 3 | Average yearly per capita income in Group 3 (71 -90%) | |
| Per capita income of group 4 | Average yearly per capita income in Group 1 (91-100%) | |

(continues)

Table VIII.1 (conclusion)

| Variable | Description | Source |
|---|---|---|
| Social Expenditure | Per Capita Government Expenditures in the following COFOG categories:<br>Education<br>Health<br>Housing<br>Social Protection and transfers | ECLAC Statistics |
| Non Social Expenditure | Per Capita Government Expenditures in the following COFOG categories:<br>Non-social transfers<br>Defense<br>Economic Affairs<br>Public Order &Safety<br>Transport & Communications | ECLAC Statistics |
| Per capita GDP | Self explanatory | World Development Indicators |
| Per capita stock social capital | Per capita stock of government provided social capital, calculated using the inventory method, with 3% of depreciation and using the rate of growth of social expenditure to estimate the initial stock | Own calculations |
| Per capita stock of non-social capital | Per capita stock of government provided non social capital, calculated using the inventory method, with 6% of depreciation and using the rate of growth of non-social expenditure to estimate the initial stock | Own calculations |
| Tariff | Weighted average tariff | International Trade and Integration Division, ECLAC, taken from WITS |
| Treaties | Index that represents the number of treaties active in each year for each country | International Trade and Integration Division, ECLAC, taken from WITS |
| Tariff dispersion | Standard deviation of the tariff divided by its weighted average | International Trade and Integration Division, ECLAC, taken from WITS |
| Polity2 | Score ranges from -10 to 10, with the more democratic a nation, the higher the score. | Polity IV<br>www.cidcm.umd.edu |
| Years of duration of the last political regime | Number of years since the most recent regime change | Polity IV<br>www.cidcm.umd.edu |
| Political Competition | Score that indicates how competitive is the Political System | Polity IV<br>www.cidcm.umd.edu |

Source: Author's elaboration.

# D. The results

## 1. Specification tests

Table VIII.2 shows the joint estimates of the four per capita group income equations and the trade openness equation allowing for interactions between the effects of trade openness and government-provided social and non-social capital. We now implement various specification tests.

### *(1) Trade/capital stocks interactions*

We tested for the joint significance of the trade/capital stocks interactive effects finding that these interactive terms are jointly significant. That is, we tested the hypothesis that $\beta_{1i} = \beta_{2i} = 0$ for all $i = 1,...,4$. As can be seen in Table VIII.2 the likelihood ratio test rejects the restricted model by a significant margin. What this test shows is that the level and composition of government-provided

capital stocks are important determinants of the impact of trade on the per capita income of the household groups and that the effects of trade openness should not be evaluated ignoring the level and composition of publicly-provided capital.

### *(2) Country specific time-varying effects*

We also tested for the validity of the country time-varying effects against the restriction that all country effects are fixed. That is, we tested the null hypothesis that $\nu_{jt} = \nu_j$ and $\Lambda_{jt} = \Lambda_j$ for all $j$. As can be seen in the table the restricted fixed country effect model is rejected by a wide margin in favor of the time-varying effect model.

Thus, the above two specification tests corroborate the key tenets of this paper: that the effects of trade policy and of government spending policies on income distribution should not be evaluated independently to each other, and that merely controlling for fixed effects is an inadequate procedure.

### *(3) Biases due to endogenous capital stocks and trade policy index*

Despite that the capital stocks are derived by accumulating lagged government expenditures to the previous stocks it is possible that such lagged expenditures be correlated with omitted concurrent variables which could bias the estimates. We argued in the previous section that the fact that we used time-varying effects largely minimizes such risk. We nonetheless use instrumental variables for both capital stocks and trade to see whether or not the key qualitative results are affected by the use of instrumental variables.

We use several political and institutional variables as identifying instruments including measures of political competition, years of democratic stability and the so-called Polity2 index, in addition to the lagged trade policy indicators (average tariff, tariff dispersion and treaties, all lagged one period).[77] The description of the politico-institutional variables can be found in Table VIII.1. We postulate that the politico-institutional variables are correlated with the stocks of social and non-social capital because when institutions are more democratic and transparent politicians are likely to be more responsive to social concerns. One of the main social issues in Latin America is the concentration of income and poverty. So we can reasonably expect that more democratic societies will tend to spend a greater fraction of public spending in social goods as opposed to subsidies that are often captured by small elites. Thus, we expect a positive correlation between the quality of politico-institutional variables and social capital stocks and a negative one with non-social stocks.

The politico-institutional identifying instrumental variables are also likely to satisfy the exclusion restriction in the context of our model. The exclusion restriction requires that the instruments be uncorrelated with the errors of the main regressions. That is, in our case should be uncorrelated with the disturbances of the group income equations (all the effects of the instruments should take place via the variables that are instrumented, in this case the stocks of social and non-social capitals and trade index). The fact that we control for time varying country effects makes it plausible that the exclusion restriction is in fact satisfied. The time varying effects control for all omitted economy-wide factors that may affect the distribution of income. Hence, they should also control for any direct effects of the politico-institutional that are not channeled through the capital stocks or trade index. That is, the often elusive exclusion restriction is likely to be satisfied.

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[77] Political Competition is a key instrumental variable used. It combines information regarding Regulation of Participation and Competitiveness of Participation. Regulation of Participation measures the extent that there are binding rules on when, whether, and how political preferences are expressed. One-party states and Western democracies both regulate participation but they do so in different ways, the former by channeling participation through a single party structure, with sharp limits on diversity of opinion; the latter by allowing relatively stable and enduring groups to compete nonviolently for political influence. The polar opposite is unregulated participation, in which there are no enduring national political organizations and no effective regime controls on political activity. In such situations political competition is fluid and often characterized by recurring coercion among shifting coalitions of partisan groups. Competitiveness of participation refers to the extent to which alternative preferences for policy and leadership can be pursued in the political arena.

Table VIII.A1 in Annex II shows the results using Three Stage Least Square (3SLS) estimators instead of the usual single equation IV estimators in order to allow for the disturbances across equations to remain correlated. In this case we do not use interactive terms so the estimated coefficients directly show net effects (that is, this model uses the specification shown by equation (4)). Below we compare these results to the net effects estimated using our benchmark estimates (based on Equation (5)) and show that in general the use of 3SLS did not affect the fundamental qualitative results concerning the net effects of social and non-social capital stocks and of trade openness on the group incomes. Thus it appears that the use of country time-varying effects in conjunction with lagged fiscal spending variables to construct the capital stocks is an effective mechanism by itself to prevent biases of the key coefficients.

## 2. Analysis of the estimates

We now turn to the analysis of the coefficient estimates. The net impact of the social and non-social capital stocks on income distribution is the result of two effects: a direct effect and an indirect one that occurs via the interaction with the trade openness variable. The direct effect of per capita government-provided social capital stock is positive and highly significant for all four groups while the direct effect of the per capita non-social government stocks is negative and significant for the poor and lower middle classes, non-significant for the upper middle class but positive and significant for the richest group. We first consider the net effects evaluated using average values of the variables (that is, as if we consider a "representative" country of the region) and then we look at the net effects going beyond the average by considering the variability of the key variables over time and across countries.

**TABLE VIII.2**
**JOINT ESTIMATES OF THE GROUP PER CAPITA INCOME AND TRADE OPENNESS: SUR-TIME-VARYING COUNTRY EFFECTS METHOD**

| | Log Diff Per capita income of group 1 | | Log Diff Per capita income of group 2 | | Log Diff Per capita income of group 3 | | Log Diff Per capita income of group 4 | | Log Diff SATI | |
|---|---|---|---|---|---|---|---|---|---|---|
| Log Diff Per capita stock of social capital | 0.316 | *** | 0.387 | *** | 0.390 | *** | 0.714 | *** | 0.436 | *** |
| | 0.105 | | 0.0844 | | 0.0815 | | 0.128 | | 0.0657 | |
| Log Diff Per capita stock of non-social capital | -0.751 | *** | -0.340 | *** | -0.0312 | | 0.482 | *** | -0.0380 | |
| | 0.113 | | 0.0909 | | 0.088 | | 0.139 | | 0.0718 | |
| Log Diff SATI | 0.0112 | | 1.23 | | 3.826 | ** | 3.247 | | | |
| | 2.15 | | 1.72 | | 1.654 | | 2.605 | | | |
| Log Diff (Per capita stock social capital*SATI) | 0.865 | *** | 0.561 | *** | 0.387 | ** | 0.321 | | | |
| | 0.213 | | 0.17 | | 0.163 | | 0.256 | | | |
| Log Diff (Per capita stock non-social capital *SATI) | -0.881 | ** | -0.664 | ** | -0.775 | ** | -0.613 | | | |
| | 0.411 | | 0.328 | | 0.314 | | 0.495 | | | |
| Log Diff Per capita GDP | 1.142 | *** | 0.683 | *** | 0.603 | *** | 0.0228 | | -0.474 | *** |
| | 0.262 | | 0.21 | | 0.203 | | 0.32 | | 0.147 | |
| Number of active free trade agreements lagged | | | | | | | | | 0.0308 | ** |
| | | | | | | | | | 0.0141 | |
| Tariff dispersion lagged | | | | | | | | | -0.0690 | *** |
| | | | | | | | | | 0.0105 | |
| Log Diff tariff | | | | | | | | | -0.182 | *** |
| | | | | | | | | | 0.0309 | |
| R-squared | 0.885 | | 0.888 | | 0.894 | | 0.872 | | 0.897 | |

| | |
|---|---|
| LR test: restricted model without interactions, unrestricted model including interactions: 106 | LR test: restricted model country fixed effects, unrestricted model time varying country effects: 1485.2 |

Source: Author's elaboration.
Note: (i) The total number of observations for the equation system is 720.
(ii) All explanatory variables with the exception of tariffs, trade agreements and tariff dispersion are per capita.
(iii) Standard errors are shown below the coefficients: ** significant at 5%; *** significant at 1%.
(iv) Estimation includes 124 coefficients to capture the time-varying country effects, which are not shown in the table.
(v) Critical values for the LR tests at 1% level of significance are (2)=9.21 and for (107)=143.94.

### *(1) Analysis for the average or representative case*

Table VIII.3 shows the net effects of the two stock variables and trade index on the per capita income of the various household groups, measured in terms of elasticity, and calculated using the coefficients in Table VIII.2 with all net effects evaluated at mean values of the variables.

**TABLE VIII.3**
**NET ELASTICITIES OF GROUP INCOMES WITH RESPECT TO SOCIAL CAPITAL, NON-SOCIAL CAPITAL, AND TRADE OPENNESS**

| | Group 1 | | Group 2 | | Group 3 | | Group 4 | |
|---|---|---|---|---|---|---|---|---|
| Net effect of Per Capita Stock of Social Capital | 0.31 | *** | 0.38 | *** | 0.39 | *** | 0.71 | *** |
| | 0.105 | | 0.084 | | 0.081 | | 0.128 | |
| Net effect of Per Capita Stock of Non Social Capital | -0.75 | *** | -0.34 | *** | -0.03 | | 0.48 | *** |
| | 0.11 | | 0.09 | | 0.09 | | 0.14 | |
| Net effect of SATI | -0.08 | | 0.32 | ** | 0.29 | ** | 0.58 | *** |
| | 0.17 | | 0.14 | | 0.13 | | 0.21 | |

Source: Author's elaboration.
Note: * significant at 10%.
*** significant at 5%.
*** significant at 1%.
Standard errors are shown below the estimates.

The net effect of social capital on per capita income is positive and significant for all income groups but the net effect of non-social capital is positive and significant only for the richest group, is insignificant for the upper middle class and negative and significant for the poorest two groups. These results imply that the effect of non-social government spending is not only bad for equity but that it may be absolutely deleterious for the poorest segments of society. Social capital on the other hand has a positive and significant impact on the per capita income of all groups. It benefits most of the population more or less equally except for the top group that seems to derive even greater benefits than the rest of the household population. That is, while social spending appears to promote higher household income for all groups, it is not pro-distribution.

Thus, governments in Latin America appear on average to gear non-social capital mainly to benefit the rich but surprisingly non-social capital is deleterious to the poor and lower middle income classes. A possible explanation for this is that government provided non-social goods tends to make the economy more capital-intensive thus hurting the unskilled which are among the poorest groups in society. Expansion of non-social capital may crowd out more labor-intensive investments that would benefit the poorest segments of the labor force.

Social capital provided by the government is genuinely complementary with private investments as shown by the fact that it increases income of all households significantly, but it is not pro-distribution. However, as shown in Table VIII.3, the net effects the social capital evaluated at mean values of the variables has an almost identical net proportional effect on three of the four income groups but has a greater net effect on the richest group. This suggests that for the average country in the Region, social expenditures, and hence the resulting social capital, are not well targeted to the poorest segments of society. It appears that the upper income classes are able to capture a sizable portion of the government-provided social capital. This is consistent with several studies that have shown that the upper middle and upper classes tend to benefit much from publicly-provided often free education, specially tertiary education, from subsidized health care, public pensions, and even certain social transfers (van de Walle, 1998; Cisse et al., 2007; Goni et.al., 2010).

Turning now into the trade effects: The results in Table VIII.2 suggest that direct impact of trade openness on household income of the poor is basically negligible but for the higher income groups the direct impact is positive (positive and significant for the upper middle income group and positive and nearly significant for the rich). Table VIII.3 shows the net effects of trade openness once the trade-capital stocks interactive effects are accounted for, all evaluated at mean values of the variables. The net impacts of trade openness are positive and significant for the top three income groups while are insignificant for the bottom group. Moreover, the elasticity of increasing trade openness on the income of the wealthiest households is almost twice as large as that for the two middle income groups. Thus, the results suggest that while trade openness does not on average have a net deleterious effect on the poor it does tend to worsen income distribution by offering benefits mainly to the richest households.

It is important to note the contrasting effects of government-provided social and non-social capital. Social capital enhances positive direct income impacts or reduces the size of negative direct income effects of trade openness. That is, despite that social capital is not well targeted to the poorest segments of society it does increase the benefits of increasing trade openness. By contrast, as reflected in the negative signs of the trade/capital stocks interactive coefficients, non-social government-provided capital stocks worsen any possible negative effect of trade openness on the income of the three lowest income groups and has no significant effect on the effect of trade on the income of the richest households.

The last column of Table VIII.2 shows the estimates of the determinants of trade openness. The sign pattern of the trade policy variables is quite reasonable. The effects of both average tariff levels and their dispersion as measured by their coefficient of variability are highly significant and negative. The average tariff elasticity suggests that reducing tariff by 10% may increase trade openness by almost 2 % while reducing tariff dispersion by a similar magnitude may increase trade by about 0.7%. The effect of free trade agreement turned out to be positive although this effect is not as significant and robust as that of the tariff. This latter result would suggest that in Latin America the increasing number of free trade agreements has resulted in more trade creation than destruction.

Comparing the net effects calculated using the coefficient estimated using the benchmark regression model in Table VIII.3 with the estimates obtained using IV methods in Table VIII.A1 in Annex 2 shows a remarkable degree of similarity. While the actual values of the estimated coefficients are of course different the sign structure and significance of the coefficients are identical. In addition the relative values of the estimates are mostly preserved. For example both estimates yield the result that the stock of social capital has a similar positive and significant effects on all three lower income groups but a much higher also significant effect on the per capita income of the richest group. This high degree of consistency between the IV and non-IV estimates gives us confidence that the results using the benchmark model are free of simultaneous equation biases.

### *(2) Analysis of net effects using key aspects of the distribution of the variables*

The previous analysis focuses on net effects evaluated at the average values of the capital stocks and of the trade index. We now look at the net effects considering certain key aspects of the distribution of

the relevant variables (the two social capitals and the index of trade openness) across countries and time. Table VIII.4 shows the critical values of these variables that lead to a reversal of the sign of the net effects. This table shows the sensitivity of the net effects to changes in these three variables. The first row of the table shows that the net effect of social capital on the poorest group income reverses when the log of the value of the trade openness index is below -0.37. The trade index is below -0.37 in about 12 % of the observations. That is, the net impact of the stock of social capital becomes detrimental for the poorest group in countries or periods in which the trade regime is highly restrictive. For the other three groups the critical values of the SATI index are lower than any value for the index observed in the sample. That is, for the other three groups the stock of social capital exerts a positive effect in the upper three income groups even under the most restricted trade regimes in the sample.

The case of non-social government-provided capital is different: It has a detrimental effect for the poorest group regardless of the degree of openness observed but it causes the income of the second poorest group to increase when the economy is so closed that only occurs in 6% of the observations. It induces positive income effects in the lowest 45% of SATI for the middles class and is positive at all levels of SATI for the wealthiest group. Thus the first two rows of Table VIII.4 show that social capital and trade tend to be complements while non-social capital can only have positive welfare effects among the poor only under very restrictive trade regimes.

The net effects of trade openness, in turn, are also heavily dependent on the stocks of social and non-social capitals. A positive net impact of trade on the income of the poorest group requires a high level of social capital stock (a log value of 9.36) that is only satisfied by 49% of the observations. That is trade can be pro-poor only if the stock of social capital is so high that less than 50% of the observations satisfy. For the countries that have lower per capita social capital stocks the net effect of trade openness on the income of the poor is negative. Attaining a net effect of trade on the income of the higher income groups is much less demanding in terms of social capital: in most observations the net effect of trade is positive for the two middle class groups and is positive in practically all cases for the richest group. That is, unless the availability of social capital is extremely low, the rich always benefit out of trade liberalization but for lower income groups attaining positive effects of trade are increasingly more demanding in terms of social capital.

**TABLE VIII.4**
**CRITICAL VALUES FOR SIGN REVERSAL OF THE NET EFFECT OF SOCIAL CAPITAL, NON-SOCIAL CAPITAL AND SATI ON GROUP INCOME**

| | | Group 1 | Group 2 | Group 3 | Group 4 |
|---|---|---|---|---|---|
| Minimum value of log SATI for *positive* net effect of Social Capital on group income | Critical value for log SATI | -0.37 | -0.69 | -1.01 | -2.22 |
| | % in the sample of SATI below critical value | 12% | 0 | 0 | 0 |
| Minimum value of log SATI for *positive* net effect of non Social Capital on group income | Critical value for log SATI | -0.85 | -0.51 | -0.04 | 0.79 |
| | % in the sample of SATI below critical value | 0 | 6% | 45% | 100% |
| Minimum value of log social capital for *positive* net SATI effect (non-social capital evaluated at the mean) | Critical value for log of social capital | 9.36 | 8.70 | 8.54 | 7.46 |
| | % in the sample of social capital above critical value | 49% | 68% | 71% | 98% |
| Maximum value of log non social capital for *positive* net SATI effect (social capital evaluated at the mean) | Critical value for log of non social capital | 9.12 | 9.69 | 9.57 | 10.15 |
| | % in the sample of non social capital below critical value | 45% | 76% | 70% | 98% |

Source: Author's elaboration.

### *(3) Economic growth and income distribution*

An important finding shown in Table VIII.2 is the high responsiveness of most household income groups to changes in per capita GDP growth. Increasing the rate of economic growth tends to benefit the poorest income group more than proportionally and improves the income of the other groups less than proportionally. That is, accelerating economic growth appears to be pro-distribution. These results provide support and in fact strengthen findings in the literature concerning the effects of economic growth on household income. Dollar and Kraay (2002, 2004) and others have shown that economic growth causes the income of the poor to increase significantly. We show here that economic growth is not only pro-poor but that it is also a powerful factor of equity, by benefiting the poor more than the upper middle income groups and the rich. Economic growth appears to be a much more powerful and effective pro-distribution factor than social policies themselves.

It might seem surprising that the income of the rich is not significantly responsive to variations in the rate of economic growth. One possible explanation may be associated to the fact that the income sources of the rich are highly diversified both within the country and internationally. In addition the rich are likely to have much more flexibility to respond to macroeconomic fluctuations including their capacity to invest in the countries that grow the fastest and to move their investments into particular activities that grow in periods of general growth slowdown. What happens is that even in periods of slow average growth there are always sectors that are either not affected or that even prosper in such times. The rich have a much greater ability to identify activities not affected by the economic slowdown and move into such sectors. All this makes the income of the rich to be much less dependent on the fluctuations of the aggregate level of per capita income growth.

## 3. Sensitivity analyses

We perform a series of sensitivity analyses to ascertain the robustness of the estimators provided in Table VIII.2. In addition to the specification tests reported earlier, we further alter or generalize the specification of the equations, we check for extreme data points that may dominate the sign and significance of the key estimates and for individual country dominance.

### a) Allowing for convergence (or divergence)

Table VIII.5 reports the results obtained when the specification of the equations is changed to incorporate the initial per capita income of each group as explanatory variables. That is, these estimates allow for convergence or divergence of the group incomes over the period. We find that the initial income levels do add explanatory power to the regressions with the coefficients of these variables being highly significant. The fact that the coefficient of the initial per capita income is positive and significant for the bottom income group and negative and significant for the other three richer groups suggests a degree of per capita income convergence among the groups. However, allowing for convergence factors does not alter the basic sign structure of the coefficients associated with the government capital stocks and trade. All conclusions obtained using the benchmark regressions reported in Table VIII.2 are in fact confirmed qualitatively.

**TABLE VIII.5**
**GROUP PER CAPITA INCOME ESTIMATES USING SUR-TIME VARYING COUNTRY EFFECTS METHOD CONTROLLING FOR GROUP-INCOME CONVERGENCE (LOG DIFFERENCES WITH TIME COUNTRY VARYING EFFECTS)**

| | Log Diff Per capita income of group 1 | | Log Diff Per capita income of group 2 | | Log Diff Per capita income of group 3 | | Log Diff Per capita income of group 4 | | Log Diff SATI | |
|---|---|---|---|---|---|---|---|---|---|---|
| Log Diff Per capita stock of social capital | 0.164 | | 0.501 | *** | 0.594 | *** | 1.041 | *** | 0.400 | *** |
| | 0.121 | | 0.0974 | | 0.0915 | | 0.145 | | 0.0668 | |
| Log Diff Per capita stock of non-social capital | -0.823 | *** | -0.287 | *** | 0.0633 | | 0.635 | *** | -0.0297 | |
| | 0.116 | | 0.0931 | | 0.0874 | | 0.138 | | 0.0722 | |
| Log Diff SATI | 1.48 | | 0.19 | | 1.95 | | 0.186 | | | |
| | 2.208 | | 1.767 | | 1.657 | | 2.623 | | | |
| Log Diff (Per capita stock social capital*SATI) | 0.845 | *** | 0.578 | *** | 0.418 | *** | 0.368 | | | |
| | 0.211 | | 0.169 | | 0.158 | | 0.249 | | | |
| Log Diff (Per capita stock non-social capital *SATI) | -1.013 | ** | -0.574 | * | -0.612 | ** | -0.343 | | | |
| | 0.41 | | 0.328 | | 0.307 | | 0.485 | | | |
| Log Diff Per capita GDP | 1.104 | *** | 0.705 | *** | 0.643 | *** | 0.0891 | | -0.582 | *** |
| | 0.263 | | 0.211 | | 0.197 | | 0.312 | | 0.148 | |
| Number of active free trade agreements lagged | | | | | | | | | 0.0387 | ** |
| | | | | | | | | | 0.0146 | |
| Tariff dispersion lagged | | | | | | | | | -0.0499 | *** |
| | | | | | | | | | 0.0111 | |
| Log Diff tariff | | | | | | | | | -0.170 | *** |
| | | | | | | | | | 0.0321 | |
| Log Initial per capita income | 0.00580 | ** | -0.00374 | * | -0.00613 | *** | -0.00870 | *** | | |
| | 0.00282 | | 0.00199 | | 0.00173 | | 0.00243 | | | |
| R-squared | 0.888 | | 0.892 | | 0.905 | | 0.885 | | 0.901 | |

Source: Author's elaboration.
Note: * significant at 10%.
** significant at 5%.
*** significant at 1%. The total number of observations for the equation system is 720. Standard errors are shown below the coefficients. Estimation includes 124 coefficients that capture the time-varying country effects, which are not shown in the table.

## b) Further disaggregating the income groups

We further disaggregate the households into ten groups instead of four. Table VIII.6 shows these estimates. The qualitative findings are very similar to those using the more aggregated group structure. They do provide a few more details about the differential effects of social capital on group income. For example they show that that social spending appears to have the smallest impact on the income of

the poorest 10% of the households. This is consistent with findings in the literature suggesting that government social programs have their greatest difficulties in reaching the extreme poor, which are the bottom 10% of the income distribution.

### c) Sample dominance

Table VIII.A2 in Annex 2 shows the results of the dominance test. We sequentially re-estimate the model withdrawing the top and bottom 2.5% of the observations for each of the capital stocks. As can be seen in this Table the qualitative effects and statistical significance of the net effects of the capital stocks on group per capita income is not affected by these procedures. That is, the key findings are not the result of freak observations that may dominate the estimation.

We also perform dominance checks to verify whether the inclusion of specific countries dominate the results. We sequentially eliminate the observations from countries that contribute to less than 5 % of the total data points. Figures VIII.A1 to VIII.A4 show how the significance of the coefficients of the capital stock variables changes for each group when we implement these procedures. As can be seen in these figures the only coefficient that falls outside the margin of significance when we omit the observations of at least one country is the direct effect of social capital on the poorest group. In fact when the observations for Nicaragua are excluded this coefficient becomes marginally insignificant although still positive. Excluding the observations of any other country does not affect the sign and significance of the coefficients. This apparent weakness of the direct effect of the social capital stock on the poorest group was already apparent in the estimation allowing for group convergence (see Table VIII.4). However, the fact that the coefficient of the trade/social capital interaction remains positive and highly significant implies that the net effect of social capital is still robust.

**TABLE VIII.6**
**GROUP INCOME ESTIMATES USING 10 INCOME GROUPS. SUR-TIME VARYING COUNTRY EFFECTS METHOD**

| | Log Diff Per capita income of decile 1 | Log Diff Per capita income of decile 2 | Log Diff Per capita income of decile 3 | Log Diff Per capita income of decile 4 | Log Diff Per capita income of decile 5 | Log Diff Per capita income of decile 6 | Log Diff Per capita income of decile 7 | Log Diff Per capita income of decile 8 | Log Diff Per capita income of decile 9 | Log Diff Per capita income of decile 10 | Log Diff SATI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Log Diff Per capita stock of social capital | -0.0322 | 0.284** | 0.375*** | 0.400*** | 0.397*** | 0.386*** | 0.386*** | 0.382*** | 0.400*** | 0.715*** | 0.399*** |
| | 0.188 | 0.128 | 0.102 | 0.0934 | 0.0885 | 0.0843 | 0.0829 | 0.0819 | 0.0829 | 0.128 | 0.0649 |
| Log Diff Per capita stock of non-social capital | -1.499*** | -0.952*** | -0.663*** | -0.521*** | -0.427*** | -0.357*** | -0.270*** | -0.137 | 0.0459 | 0.483*** | -0.0409 |
| | 0.203 | 0.137 | 0.109 | 0.1 | 0.0952 | 0.0908 | 0.0894 | 0.0884 | 0.0896 | 0.139 | 0.0716 |
| Log Diff SATI | 1.878 | 0.305 | -0.559 | -0.228 | 0.354 | 1.33 | 1.788 | 2.642 | 4.762*** | 3.375 | |
| | 3.824 | 2.611 | 2.084 | 1.91 | 1.808 | 1.717 | 1.686 | 1.662 | 1.682 | 2.604 | |
| Log Diff (Per capita stock social capital*SATI) | 1.208*** | 1.055*** | 0.813*** | 0.714*** | 0.641*** | 0.586*** | 0.475*** | 0.383** | 0.373** | 0.307 | |
| | 0.378 | 0.259 | 0.207 | 0.189 | 0.179 | 0.17 | 0.166 | 0.164 | 0.166 | 0.256 | |
| Log Diff (Per capita stock non-social capital *SATI) | -1.468** | -1.129** | -0.764* | -0.682* | -0.657* | -0.701** | -0.634** | -0.635** | -0.869*** | -0.616 | |
| | 0.729 | 0.499 | 0.398 | 0.365 | 0.345 | 0.327 | 0.321 | 0.316 | 0.32 | 0.495 | |
| Log Diff Per capita GDP | 1.521*** | 1.457*** | 1.071*** | 0.864*** | 0.753*** | 0.686*** | 0.625*** | 0.597*** | 0.596*** | 0.0177 | -0.419*** |
| | 0.468 | 0.318 | 0.254 | 0.233 | 0.221 | 0.21 | 0.207 | 0.204 | 0.207 | 0.32 | 0.147 |
| Number of active free trade agreements lagged | | | | | | | | | | | 0.0307** |
| | | | | | | | | | | | 0.0138 |
| Tariff dispersion lagged | | | | | | | | | | | -0.0681*** |
| | | | | | | | | | | | 0.0101 |
| Log Diff tariff | | | | | | | | | | | -0.230*** |
| | | | | | | | | | | | 0.03 |
| R-squared | 0.874 | 0.883 | 0.887 | 0.884 | 0.886 | 0.888 | 0.890 | 0.891 | 0.895 | 0.873 | 0.892 |

Source: Author's elaboration.
Note: * significant at 10%.
** significant at 5%.
*** significant at 1%. The total number of observations for the equation system is 1584. Standard errors are shown below the coefficients. Estimation includes 124 coefficients that capture the time-varying country effects, which are not shown in the table

# E. Conclusion

To the best of our knowledge this is the first analysis that considers the interdependences between the consequences of trade liberalization and fiscal expenditure policies for poverty and income distribution. We have shown that this approach is very fruitful providing several important policy relevant insights that were not systematically examined in previous studies.

The main finding of this paper is that government-provided social capital goods are complementary with policies that promote trade openness. The benefits of trade openness especially for the low income and middle class household groups greatly depend on the size of the government-provided social capital. Conversely, the benefits of social capital for the poor depend to a large extent on the degree of openness of the trade regime. Social capital has a much smaller effect on household incomes when trade is restricted and may even have a deleterious effect if trade is sufficiently restricted. Efforts to promote trade have lower positive effects for households if the per capita social capital is low.

While government social capital stocks have positive effects for all household groups at least when trade is sufficiently open their effects are not pro-distribution. Social capital goods tend to benefit more the richest income groups than the middle income and poor households. A surprising finding is that government-provided non-social capital stocks only benefit the richest segments of society and is detrimental for the poor. Middle income households can only benefit out of non-social capital if the trade regime is highly restricted. Thus, trade and non-social capital are not complementary policies. A reason for non-social capital to be mostly beneficial to rich households may be that the non-social component of the government-supplied capital stocks tend to be directed to the rich via subsidies and other types of expenditures that are greatly motivated by rent-seeking activities based on political contacts and campaign contribution which in Latin America are often the privilege of the richest segments of society.

These results may have important implications for policy design. They suggests that the process of trade liberalization should be accompanied by a progressive reallocation of government spending from non-social to social goods, so that the stock of social capital is allowed to grow faster and non-social capital at a slower pace. This would have direct net positive welfare effects on the middle income and poor households and at the same time it would greatly enhance the benefits of trade liberalization for the vast majority of the households. At the same time increasing trade liberalization would magnify the beneficial effects of shifting the structure of government-provided capital from non-social to social capital. Finally, the analysis suggests that trade reform should be implemented gradually to give time to allow the fiscal spending reallocation to manifest itself into changes in capital stocks.

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# Annex 1

**TABLE VIII.A1**
**SUMMARY STATISTICS OF THE DATA USED IN REGRESSIONS**

| Variable | Mean | Standard Deviation | Min | Max |
|---|---|---|---|---|
| Per capita income of group 1 | 882 | 362 | 343 | 2 089 |
| Per capita income of group 2 | 2 253 | 757 | 1 092 | 4 806 |
| Per capita income of group 3 | 4 380 | 1 339 | 2 063 | 8 578 |
| Per capita income of group 4 | 12 767 | 3 424 | 5 608 | 22 526 |
| Per capita Social Expenditure | 1 023 | 653 | 150 | 2 573 |
| Per capita Non Social Expenditure | 936 | 533 | 254 | 2 802 |
| Natural Log of SATI | -0.006 | 0.3 | -0.6 | 0.7 |
| Per capita GDP | 7 168 | 2 654 | 1 963 | 13 025 |
| Per capita stock of social capital | 14 539 | 10 520 | 1 472 | 38 633 |
| Per capita stock of non-social capital | 11 724 | 6 540 | 2 790 | 27 666 |
| Polity2 | 7.9 | 1.5 | 1.0 | 10.0 |
| Durable | 18.9 | 18.2 | 0 | 86.0 |
| Polcomp | 8.0 | 8.1 | -88 | 10.0 |

Source: Author's elaboration.
Note: All economic variables are in Purchasing Power Parity constant 2005 International Dollars.

**TABLE VIII.A2**
**DEFINITION OF VARIABLES USED TO CALCULATE SATI**

| Variable Name | Definition | Source |
|---|---|---|
| Trade | Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product | World Development Indicators |
| Population | Population of the country, Millions of persons | World Development Indicators |
| Area | Geographical area of the country, Millions of square kilometers | World Development Indicators |
| GDP_percapita | GDP per capita in constant 2000 US$ | World Development Indicators |
| Oild70s | Dummy with a value of one when the oil exports of a country represent at least 30% of their total exports for each year in the 70's | UNCTAD Handbook of Statistics 2001 |
| Oild80s | Dummy with a value of one when the oil exports of a country represent at least 30% of their total exports for each year in the 80's | UNCTAD Handbook of Statistics 2001 |
| Oild90s | Dummy with a value of one when the oil exports of a country represent at least 30% of their total exports for each year in the 90's | UNCTAD Handbook of Statistics 2001 |
| IndEconomy | Industrial Market Economy: dummy variable which assigns the value of one to countries that are considered industrialized. | OECD |

Source: Author's elaboration.

# Annex 2
# IV estimates and dominance checks

**TABLE VIII.A3**
**3SLS ESTIMATES OF PER CAPITA INCOME WITH INSTRUMENTAL VARIABLES (LOG DIFFERENCES WITH TIME COUNTRY VARYING EFFECTS)**

| | Log Diff Per capita income of group 1 | Log Diff Per capita income of group 2 | Log Diff Per capita income of group 3 | Log Diff Per capita income of group 4 |
|---|---|---|---|---|
| Log Diff Per capita stock of social capital | 0.409*** | 0.409*** | 0.394*** | 0.601*** |
| | 0.138 | 0.115 | 0.101 | 0.156 |
| Log Diff Per capita stock of non-social capital | -0.864*** | -0.404*** | 0.0323 | 0.760*** |
| | 0.145 | 0.120 | 0.105 | 0.163 |
| Log Diff SATI | 0.243 | 0.773*** | 0.734*** | 1.076*** |
| | 0.197 | 0.164 | 0.143 | 0.222 |
| Log Diff Per capita GDP | 1.158*** | 0.770*** | 0.556** | -0.0612 |
| | 0.317 | 0.263 | 0.230 | 0.357 |
| R-squared | 0.835 | 0.831 | 0.871 | 0.850 |

Source: Author's elaboration.
Note: * significant at 10%.
** significant at 5%.
*** significant at 1%. The total number of observations for the equation system is 576. Standard errors are shown below the coefficients. Estimations include country*year dummies. Log diff social capital, log diff non-social capital and log diff SATI are instrumented using lag of social capital, lag of non-social capital, political competition, years of duration of the last political regime, polity 2, number of active free trade agreements lagged, tariff dispersion lagged and log diff tariff. First stage R2 are about 0.78 for social capital, 0.90 for non social capital and 0.88 for SATI.

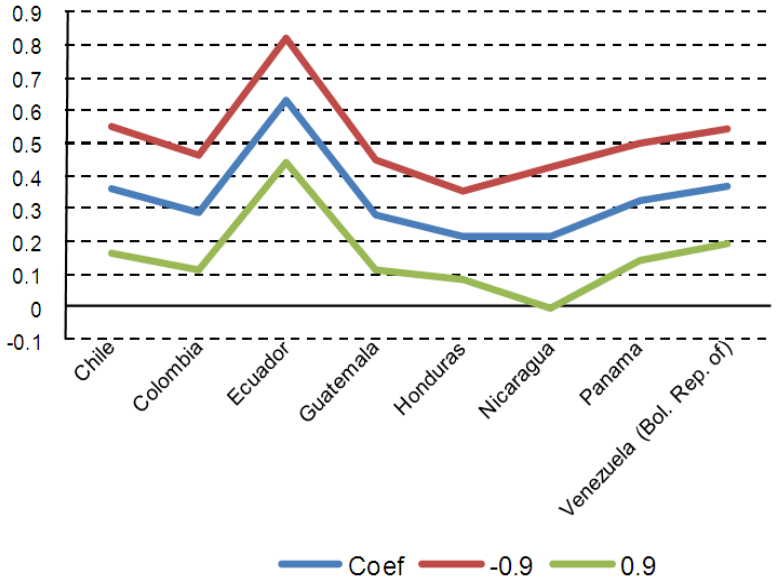
**TABLE VIII.A4**
**DOMINANCE TESTS OF THE EFFECT OF THE STOCK OF SOCIAL CAPITAL ON PER CAPITA INCOME OF EACH GROUP**

| | Coefficient of the Per capita stock of social capital in the regression of Group 1 | Coefficient of the Per capita stock of social capital in the regression of Group 2 | Coefficient of the Per capita stock of social capital in the regression of Group 3 | Coefficient of the Per capita stock of social capital in the regression of Group 4 |
|---|---|---|---|---|
| Dropping top 2.5% of per capita income | 0.32*** | 0.39*** | 0.39*** | 0.71*** |
| | 0.11 | 0.09 | 0.08 | 0.13 |
| Dropping bottom 2.5% of per capita income | 0.31*** | 0.23** | 0.28*** | 0.71*** |
| | 0.11 | 0.10 | 0.10 | 0.13 |
| Dropping top 2.5% of stock social | 0.32*** | 0.38*** | 0.39*** | 0.71*** |
| | 0.11 | 0.09 | 0.08 | 0.13 |
| Dropping bottom 2.5% of stock social | 0.24* | 0.30*** | 0.35*** | 0.67*** |
| | 0.14 | 0.11 | 0.10 | 0.16 |

Source: Author's elaboration.
Note: * significant at 10%.
** significant at 5%.
*** significant at 1%.

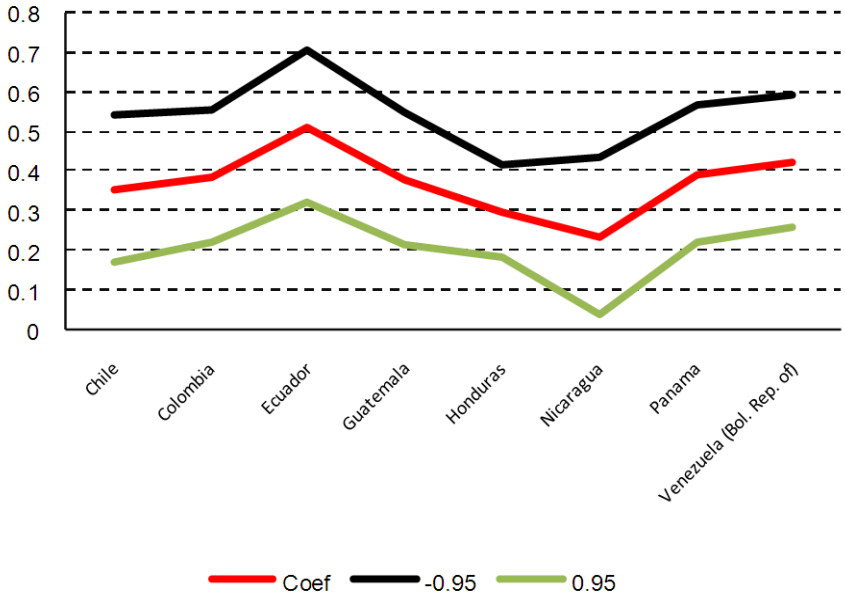
## Country dominance checks

**FIGURE VIII.A1**
**SUR ESTIMATES, NET EFFECT OF SOCIAL CAPITAL IN GROUP 1**
**ONE COUNTRY EXCLUDED FROM EACH ESTIMATION, 90% CONFIDENCE INTERVAL**



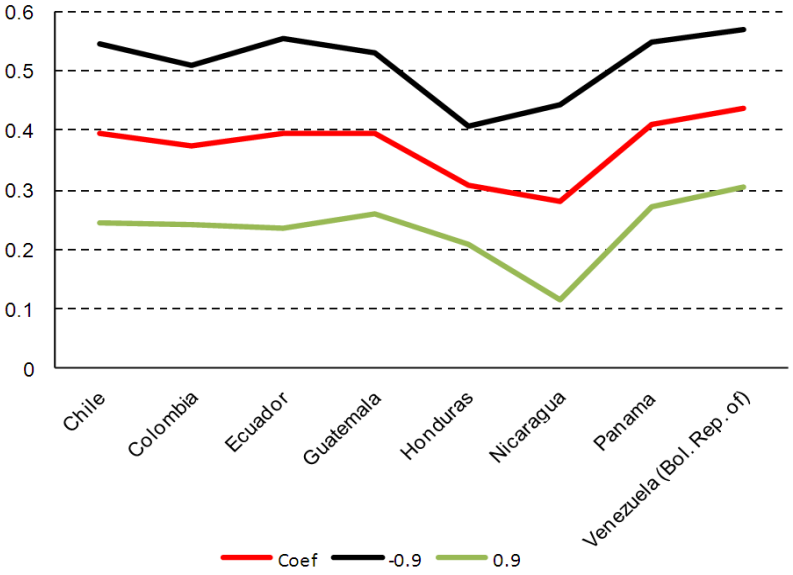

Source: Author's elaboration.
Note: Excluded countries represent less than 5% of the total number of observations.

**FIGURE VIII.A2**
**SUR ESTIMATES, NET EFFECT OF SOCIAL CAPITAL IN GROUP 2**
**ONE COUNTRY EXCLUDED FROM EACH ESTIMATION, 95% CONFIDENCE INTERVAL**




Source: Author's elaboration.
Note: Excluded countries represent less than 5% of the total number of observations.

**FIGURE VIII.A3**
**SUR ESTIMATES, NET EFFECT OF SOCIAL CAPITAL IN GROUP 3**
**ONE COUNTRY EXCLUDED FROM EACH ESTIMATION, 95% CONFIDENCE INTERVAL**




Source: Author's elaboration.
Note: Excluded countries represent less than 5% of the total number of observations.

**FIGURE VIII.A4**
**SUR ESTIMATES, NET EFFECT OF SOCIAL CAPITAL IN GROUP 4**
**ONE COUNTRY EXCLUDED FROM EACH ESTIMATION, 95% CONFIDENCE INTERVAL**


Source: Author's elaboration.
Note: Excluded countries represent less than 5% of the total number of observations.

# IX. Trade and poverty in Paraguay: the case of an agribusiness value chain

***Fernando Masi***
***Gustavo Setrini***
***Cynthia González***
***Lucas Arce***
***Belén Servin***

## A. Introduction

In Latin America and the world, the face of poverty is predominantly rural. Worldwide, 82% of the poor live in rural areas and the vast majority (86%) of these rural dwellers are farmers (World Bank, 2007). At the same time, according to data from the Corporate Database for Substantive Statistical Data of the Food and Agriculture Organization of the United Nations (FAOSTAT), global trade in agricultural goods grew by over 100% between 1991 and 2006, to US$ 721 billion. Apparently, there are ample opportunities for alleviating poverty through foreign trade, if trade were based on the industries and activities in which the poorest segments of the population participate heavily, such as in the case of the agriculture and food industries. Although the academic understanding of trade and growth is that trade liberalization can be an important tool in fighting poverty, few studies have been conducted that specifically look at the effects that the integration of small farmers into global production chains has on rural poverty.

This study seeks to evaluate such effects by examining a successful case in which a juice supply chain was created in Paraguay, with the participation of an export firm. The first section of the study reviews the literature on the trade and poverty debate, briefly analyses Paraguay's productive structure and poverty levels, and presents the main hypotheses of the study. The second section provides a brief account of the creation of the agribusiness value chain and the factors that contributed to its successful establishment. The third section discusses the principal findings concerning the effects that value chain participation by small farmers has on their household incomes and poverty levels, and the indirect effects on income levels in the rural community. Lastly, conclusions and policy recommendations are presented.

## B. The debate on trade and poverty

Currently, there is broad consensus that international trade is an important tool for economic growth and poverty reduction in developing countries.

Although some authors highlight the possible risks to which countries are exposed when they pursue trade liberalization, such as a global "levelling down" (Goodman and Pauly, 1993; Edwards, 1999) or a massive loss of jobs without the creation of new sources (cf. Schultze, 2004), the vast majority of authors concur that trade liberalization spurs economic growth and that growth ultimately reduces poverty (Balassa, 1971; Balassa, 1985; Krueger, 1978; Bhagwati, 1978; World Bank, 1987; Feder, 1983; Tyler, 1981; Edwards, 1998; Dollar, 1992). According to these studies, trade barriers distort the relative prices of the basic factors of production, which leads to poor allocation of these factors (capital, labour and land), a situation that is eventually corrected by greater trade liberalization (Reina and Zuluaga, 2008). In addition, some authors believe that trade would have a permanent impact on the ability of countries to boost their productivity (Young, 1991; Helpman and Krugman, 1985; Grossman and Helpman, 1991; Lopez Cordova and Moreira, 2004).

However, these studies provide little evidence on the mechanisms that would actually link export based growth and poverty reduction. In order to develop specific hypotheses regarding the circumstances under which new export activities have a positive effect on poverty reduction, a fuller understanding of who the poor are and what types of links exist between them and export activities is needed.

Given that most of Latin America's poor are still farmers and that non-farm workers have relatively higher income levels than farmers in rural areas, two known mechanisms for reducing rural poverty can be considered: (1) boost agricultural productivity and growth, thus raising the income levels of households that depend on this source of income; and (2) increase non-agricultural job and income generating opportunities.

These two mechanisms are strongly linked, especially in the initial phases of development, when non-agricultural activity has very little weight in the economy (Haggblade and others, 2007). First, the increase in agricultural productivity can have direct effects in terms of raising the income levels of poor farmers. Second, growth in the farm sector can, in turn, spark growth in the rural non farm sector, creating more opportunities for the poor to capture a larger share of the benefits of this growth (Mellor, 1976). This phenomenon is the result of growth linkages between the agriculture sector and other productive sectors, both of which are labour-intensive and provide goods and services for local consumption.

These observations have generated an extensive body of literature focused primarily on estimating the size of the multiplier effect of agricultural growth. The term "linkage" is understood to be a type of connection established between different productive sectors that brings about economic growth in a specific geographical area.[78]

This means that the expansion of the rural non-farm sector depends on growth among small farmers, which poses two problems. First, the consumption and input linkages are scarce because many large landholders live and consume in urban areas (Haggblade and others, 2007). Second, recent research on agricultural value chains has yielded results that are consistent with a dynamic of exclusion. The commercial actors in value chains increasingly work with a few large suppliers of commodities, seeking economies of scale and attempting to lower the transaction costs associated with ever-higher standards of quality. The concentration produced in one link of the chain, as can occur at

[78] The concept of linkage has been used in different ways in economic development theory. Most economic linkages are mainly financial transactions involving the purchase and sale of goods, services and production factors. Demand stimulates supply, and vice versa, and as a result the expansion of one production sector or market segment creates a multiplier effect in the economy (Davis and others, 2002).

the point of sale to the consumer, of processing, or of input supply, is propagated to the rest of the chain. The authors suggest that this has created new barriers that prevent small farmers from increasing their participation in and reaping greater benefits from international agricultural trade. These barriers end up limiting linkages with the rural agricultural economy (Humphrey, 2006).

Therefore, it is imperative to learn, first, how the small-scale farming sector can increase its competitiveness in open economies and, second, how foreign trade can play a relevant role in reducing rural poverty.

## 1. Paraguay: Productive structure and rural poverty

In the context of theories on trade and poverty, the case of Paraguay presents an empirical puzzle. Despite having the most open economy in the region, due to its porous borders and low degree of tariff protection (Masi, 2008), Paraguay has a high rate of poverty and has experienced very low growth in recent decades: average GDP growth was 2.2% between 1991 and 2009, and average per capita GDP growth was just 0.1% in the same period. Meanwhile, a full 38% of the population were living in poverty in 2008, compared with 35% in 1998, and 19% were living in extreme poverty. The poverty rate in Paraguay continues to be determined by rural poverty (48.8%) and rural extreme poverty (30.8%).[79] In Paraguay, despite the relative decline in population in the countryside, the rural sector continues to carry real weight within the national demographic distribution (42%).

Since 1990, Paraguay's economic structure, based on unskilled-labour-intensive activities (cotton), has been rapidly replaced by a different structure based on capital- and land-intensive activities (soybeans, wheat and beef). Although these generate economic growth, they require little labour. Meanwhile, agricultural diversification (especially on family farms) and the agro-industrialization process have been slow to materialize. Global trade openness and regional integration have caught Paraguay without the capacity to immediately increase its supply of exportables, especially alternative agricultural products that are more processed (Masi, 2008).

The economic recovery propelled by soybean and beef exports in recent years (based on active participation in international trade and higher global commodity prices) has not substantially improved the living conditions of Paraguay's campesinos. On the contrary, the export boom has driven the expansion of a particular type of agriculture that has the effect of locking campesinos out of the land market, due to rising prices and/or the sale of their lots. These changes in the productive structure, which have occurred as certain regions of Paraguay have entered the new global trade flows, have made a clear mark on the country's economic geography.

The region of Caazapá[80] (home to the producers profiled in this study), which has a poverty rate that is higher than the national average, has recently entered the world of international trade. Vázquez (2006) describes a confrontation of two productive models in this region: the model in the western region, which is less dynamic in terms of production and trade; and the model in the eastern region, restructured by the continuous expansion of the agro-export region. The productive restructuring of Caazapá finds its origins in the shift from campesino agriculture based on production for own consumption (mainly cotton) to corporate agriculture and the arrival of new actors (Vázquez, 2006). This process has led to a sudden increase in output and appreciating land values in the area. This transition threatens to exclude small farmers, who have limited capital, land and expertise.

The characterization of these two territorial economies as dynamic economies (corporate agriculture) and stagnant economies (campesino agriculture) started to change in 2000 when in the aforementioned rural regions, a large segment of the campesino family agriculture sector was revitalized by a model that diverged from the traditional campesino economy based on subsistence

[79] Statistical data from economic reports issued by the Central Bank of Paraguay and household surveys conducted by the Directorate of Statistics, Surveys and Censuses.

[80] According to the 1998 Household Survey, the poverty rate in the region of Caazapá was 37%, compared with the nationwide average of 35.8% (DGEEC, 1998).

and local market-oriented production. This transformation was based on the cultivation of new export crops that were labour-intensive but did not require much land. "This involved (…) the integration of family agriculture into the model of commercial agriculture supported by a dozen small and large companies that buy and process the products, the vast majority of which are marketed"[81] to the Common Market of the South/Mercado Común del Sur (MERCOSUR) and the Asian market. This type of "globalized family agriculture" took root in regions with high poverty rates and sharply declining population bases, such as Caazapá (Vázquez, 2009).

Clearly, the case of Paraguay demonstrates in various ways that trade openness does not immediately bring about growth and poverty reduction. Therefore, it is necessary to look at "successful" cases in which small rural producers have joined value chains, such as the case of the juice industry profiled in this study, that is, cases that indicate the conditions, aside from the elimination of tariff barriers, that are required in order to generate competitive export industries that make beneficial use of land and labour resources and support a process of rural growth and poverty alleviation.

## C. Questions, theory and methodology

This brief review of the literature on trade and poverty reduction and considerations in the case of Paraguay suggests that there is much to learn from conducting an in-depth examination of the new trade activities and how the poor are getting involved, directly or indirectly, in international trade networks. By examining the successful formation of a value chain in a Paraguayan juice industry, this study has made the following inquiries:

- What conditions contributed to the participation of small farmers in this chain?
- What has been the effect on income generation and poverty levels among the producers involved in this value chain?
- What type of rural growth linkages do these export activities create? Would existing linkages lead to poverty reduction?

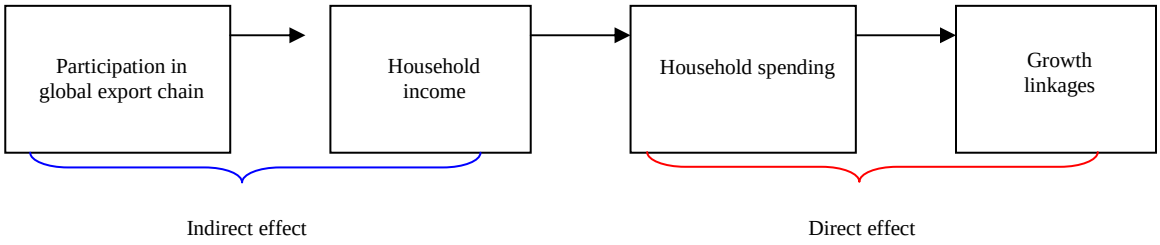
Based on the aforementioned literature on agricultural value chains and rural growth linkages, the following hypotheses were formulated:

- In order to successfully supply products to global value chains, small farmers need some type of mechanism to coordinate investment, production and harvesting activities and learning among numerous production units, thus lowering the transaction costs associated with the fragmented production structure. Extension services, in particular, play a crucial role in this coordination effort; these services are typically provided by the government, producer associations and cooperatives or by the export firm itself.
- As a result of their participation in a global value chain, the small farmers should see income gains and experience falling poverty and rising consumption levels.
- The consumption patterns of the small farmers involved in the chain are concentrated in goods and services that are highly likely to generate more growth linkages within the rural economy, especially in the area of labour-intensive activities.

These hypotheses are represented in the figure below. The figure shows the theoretical effects of the formation of a value chain: first, the direct effect of additional household income generated by the integration of small farmers into an export chain, and second, the indirect effect of the rural growth linkages generated by additional spending by these households.

[81] The new export crops from campesino family farms are sesame, stevia, organic sugar, fruits and vegetables.

**FIGURE IX.1**
**TRANSMISSION MECHANISM OF THE EFFECTS OF PARTICIPATION IN GLOBAL VALUE CHAINS**




Source: Prepared by the authors.

To answer these research questions, the study uses a hybrid methodology based on the collection and analysis of qualitative and quantitative data. The purpose of the qualitative component is to identify the principal factors that contributed to the successful integration of the small-scale passion fruit and grapefruit growers into the juice chain. The data come from a series of semi-structured interviews that were conducted between March and July 2009 with the key actors in the chain and the institutions that supported the formation of the chain.[82]

The purpose of the quantitative component is to measure the economic benefits that resulted from the integration of the small farmers from the Capi'ibary Cooperative into the Frutika juice chain. For this component, a model was developed to determine income and estimate the income-expenditure elasticities using original data from a census of the producers from the Capi'ibary Cooperative, for the purpose of determining whether additional household income and spending among the small producers linked to the Frutika chain had the effect of reducing poverty in the local economy and whether labour-intensive agricultural growth linkages were created.

For the work presented here, the principal findings of the qualitative component are summarized, instead of presenting a full description of the component.[83]

## 1. Research methodology

To obtain the quantitative data, producers in the Capi'ibary Cooperative were surveyed. The census was conducted in October and November 2009 by individuals from the area who visited the farms to collect the information solicited on the questionnaire.

The Capi'ibary Cooperative provided a list of 574 rural member producers (universe) living in five districts in the region of Caazapá. The total coverage rate of the census was 77.7%. Information was gathered from 73.2% of the producers not participating in the Frutika value chain and from 100% of the producers participating in the chain.

Of the 446 farms that were surveyed, those that did not carry out agricultural activities during the period of study and/or those with more than 53 available hectares of land were excluded, for the purpose of maintaining similar farm sizes and economic activities across both study groups and for ensuring the

[82] Interviews were conducted with groups of small producers, technical and management personnel at the Capi'ibary Cooperative, Frutika managers involved in the project, officials from the Agricultural Extension Directorate of the Ministry of Agriculture in Caazapá, representatives from a non-governmental organization that works with producers in the area and the individuals responsible for the public-private project with the German Agency for Technical Cooperation (GTZ). A total of about 30 interviews were conducted.

[83] A detailed presentation of the quantitative component can be found in the full version of this study: Masi and others, 2010.

representativeness of the survey participants in relation to the universe.[84] The study group ultimately encompassed 425 farms, with each farm corresponding to a producer in the Capi'ibary Cooperative.

The producers linked to Frutika were considered to be those who had grown passion fruit, grapefruit or oranges over the previous 12 months. According to the census data, 22.4% were participating in the Frutika value chain and 77.6% were not.

The data collected were related to the farms, as the production unit, and the members. Data were gathered on income, household spending and assets (human and productive capital) of the farms and the members.

As part of household income, data were collected on income from non-agricultural dependent and independent employment and non employment income related to remittances or transfers, agricultural income from the sale of farm products, income from own consumption[85] (farm products and by-products or processed products), income from the sale of animals, the sale of animal by-products and processed products, and income from commercial activities and the sale or leasing of lots.

In addition, data were collected on human capital and access to or ownership of production related assets. For human capital assets on the farms, typical data such as education, age, work experience, gender and other personal information were gathered. For production-related assets on the farms, data were collected on the total available land and its designation for crops, livestock and other uses, the legal status of landholding (own, with title, without title, with land-use rights), production and social linkages, access to credit and production-related technical assistance.

With these data, it is possible to estimate the direct effect that the participation of small farm producers from Caazapá in the Frutika global production chain has on the well-being of these producers' families. To this end, several linear econometric models were developed that correlate family well-being, as a dependent variable represented by per capita family income, and participation in the Frutika chain, as an independent variable, controlling those variables that show greater correlation with income, specifically those related to variables of human capital and production assets that the household possesses or has access to.

Formally, the general model, estimated using the ordinary least squares method, is as follows:

$$Y = f(X * \beta + \mu) \quad (1)$$

where:

Y represents the logarithmic vector of per capita family income; $X$ represents the matrix of independent and control variables for income, with $X_1$ specifically representing a dummy variable for the participation of the farmers in the Frutika value chain, in which the variations corresponded to the Frutika crops. In model 1, participation in the value chain is linked to the cultivation of three crops: passion fruit, grapefruit or oranges; in model 2, it is associated with the cultivation of passion fruit and grapefruit; and in model 3, with the cultivation of passion fruit. $X_2$ to $X_n$ are the control variables associated with human capital and production assets. $\beta$ is the vector of marginal effects or the direct effect of the independent and control variables on $Y$, and $\mu$ is the vector of errors.

In order to minimize specification biases and isolate the direct effect of the producers' participation in the value chain, control variables were established for access to or possession of productive or physical assets on the farm: the total availability of land, the amount of land used for crops and livestock, the tenure and number of owned lots, the amount of available labour, the members of the farm who are wage earners and who are engaged in agricultural activities, access to credit, the amount of credit and agricultural diversification, in terms of the number of crops grown in the previous crop year.

[84] See Annex 2.

[85] By multiplying the quantity of the product destined for own consumption by the price of the same product in the marketplace (price reported by the producers surveyed).

Because investment in personal assets by members of the farm can influence the farm's productivity and thus the generation of family income, variables were included such as the number of people on the farm or in the household, the education and age of the head of household and the average education of the members of the household.

## 2. Brief description of the producers and farms

The producers who participate in the Frutika value chain (passion fruit, grapefruit and/or orange growers) and those who do not participate in the chain have similar demographic and human capital characteristics. In terms of the amount of available land, the producers linked to Frutika have more hectares in crop and livestock production and have more diversified output than producers not linked to the agribusiness chain. There are no differences between the two groups in terms of ease of access to credit. The distribution of income by source is the same for both groups of producers, although per capita income levels are higher in the case of the producers linked to Frutika.

### a) Demographic characteristics

Household size, based on the number of members or residents on the farm, is similar in both groups. There are approximately five people per farm, with the number ranging from 1 to 14 people for the group linked to Frutika and from 1 to 12 people for the unlinked group. Both groups have an average of three people as available family labour, defined as the number of people 15 years and older (see Annex 3). However, the number of family labourers working as wage earners or employees is higher in the group of producers linked to Frutika (17%, compared with 9.4%).

### b) Human capital

The average age of the heads of farms in both groups is between 45 and 47 years, with 24 years of work experience in their principal occupation. In general, primary school is the highest level completed by most of the heads of farms, i.e. most have between six and seven years of education. However, the households linked to Frutika have more years of education, both on average and in terms of the highest education completed by a member of the household.

### c) Land availability and use

The amount of available land is the sum of owned lots, owned lots leased to third parties, lots leased from others, borrowed lots and municipal lots. A total of 80% of the Frutika producers and 95% of the producers not linked to the Frutika chain have up to 20 hectares of land, with an average of 14 and 10 hectares of land available, respectively. The Frutika producers have, on average, more hectares in agricultural production (6.3 hectares) than the producers not participating in the chain (5.5 hectares).

### d) Crops

Although a variety of crops are grown by the producers, the most common ones are cotton, cassava, beans, maize, soybeans, sugar cane and maté, which are both for sale and for own consumption. In addition, there are non-traditional crops: passion fruit and grapefruit in the case of the producers in the Frutika chain. For the amount of available land, these producers have more diversified production.

### e) Financial resources

Nearly all members of the cooperative have had access to credit: 99% of the producers not linked to Frutika and 97% of the producers linked to the chain. Most loans (70%) are for between 1 million and 3 million guaraníes for both groups.

\

## f) Income

Family income and per capita income incorporate income from non agricultural dependent and independent employment and non employment income related to remittances or transfers. Also considered are income from the sale of farm products, income from own consumption (farm products and by-products or processed products), income from the sale of animals, the sale of animal by-products and processed products, and income from commercial activities and the sale or leasing of lots.

The average income of the producers participating in the chain is about 22.4 million guaraníes per year and the average income of the producers not participating in the chain is about 13.4 million guaraníes per year (see Annex 4). Analogously, the average annual per capita income of the Frutika producers is 5.4 million guaraníes, compared with 3.3 million guaraníes for the producers not linked to Frutika. Most of the producers not participating in the Frutika chain have annual per capita income somewhere between 1 million and 5 million guaraníes, whereas for the Frutika producers, the upper limit of the range is higher, at 10 million guaraníes.

The two groups of producers are quite comparable inasmuch as their income distribution by source is nearly identical. The sale of agricultural products provides the main source of income for both groups, representing an average of 35% of their total average income, or 5.4 million guaraníes. The second largest source is income from non farm employment and non employment income such as family assistance, remittances, transfers etc., which accounts for up to 25% of their total income (see Table IX.1). The sale of animal by products, own consumption of farm products and income from the sale of animals represent approximately another 30% of income.

**TABLE IX.1**
**DISTRIBUTION OF TOTAL FAMILY INCOME OF PRODUCERS IN THE CAPI'IBARY COOPERATIVE**
*(Millions of guaraníes)*

| Description of variable | Non-participants | | Participants | | Group total | |
|---|---|---|---|---|---|---|
| | Annual average | % | Annual average | % | Annual average | % |
| Income from personal sources, employment and non-employment | 2.83 | 21 | 5.63 | 25 | 3.45 | 22 |
| Income from sale of crop products | 4.67 | 35 | 7.97 | 36 | 5.40 | 35 |
| Income from own consumption of crop products | 1.46 | 11 | 2.65 | 12 | 1.73 | 11 |
| Income from sale of animals | 1.0 | 7 | 2.28 | 10 | 1.29 | 8 |
| Income from own consumption of animal by-products or processed products | 0.60 | 5 | 1.28 | 6 | 0.76 | 5 |
| Income from sale of animal by-products or processed products | 2.41 | 18 | 2.33 | 10 | 2.39 | 15 |
| Income from commercial activities | 0.21 | 2 | 0.21 | 1 | 0.21 | 1 |
| Income from sale and/or leasing of lots | 0.25 | 2 | 0.051 | 0 | 0.21 | 1 |
| Total family income | 13.43 | 100 | 22.42 | 100 | 15.44 | 100 |

Source: Censo a Pequeños Productores Agrícolas de Caazapá, 2009.

In terms of the composition of agricultural income, both groups of producers are observed to grow, on average, the same crops for sale (excluding passion fruit, grapefruit and oranges) and for own consumption, although the producers linked to Frutika have higher annual per capita income (5.4 million guaraníes compared with 4.6 million guaraníes) (see Table IX.2). If income from the sale of passion fruit and grapefruit is considered, the gap in annual income between the two groups is even larger, in favour of the Frutika producers.

**TABLE IX.2**
**DISTRIBUTION OF AGRICULTURAL INCOME OF PRODUCERS IN THE CAPI'IBARY COOPERATIVE**
*(Millions of guaraníes, per capita and percentage)*

| Type of income | Non-participants | | Participants | | Total | |
|---|---|---|---|---|---|---|
| | Annual average | % | Annual average | % | Annual average | % |
| Income from passion fruit and grapefruit, related to Frutika | 0 | 0 | 2.57 | 32.2 | 0.58 | 10.7 |
| Income from other products | 4.66 | 100 | 5.40 | 68.0 | 4.83 | 89.4 |
| Total crop-related income (from the sale of crop products) | 4.66 | 100 | 7.97 | 100 | 5.40 | 100 |

Source: Censo de Pequeños Productores Agrícolas de Caazapá, 2009.

## 3. Poverty levels and effects of value chain participation on income

In order to understand the effects of participation by the producers from the Capi'ibary Cooperative in the Frutika juice value chain as well as other effects on these producers' income levels, the producers were first placed in different income groups around the national and regional poverty line. In addition, conclusions were drawn regarding the behaviour of poverty at the regional level and at the level of the producers themselves, regardless of whether they were linked to the Frutika chain.

A high poverty rate (70%) was found for the producers surveyed from the Capi'ibary Cooperative, regardless of whether they were linked to Frutika. The high rate of extreme poverty in the countryside explains the large percentage of poor among the surveyed producers.

A closer look at the poverty measure points to the conclusion that the poverty incidence, intensity (or gap) and severity rates are lower among the Frutika producers than among the producers not linked to the agribusiness company. This observation might be an indication that Frutika is making a significant contribution to poverty reduction among the producers.

### a) Poverty by geographical area and region

Using data from the 2008 Household Survey, the country's total and extreme poverty rates were studied by geographical area (urban/rural) and by region. In this study, the average annual per capita income equivalent for the total poverty line[86] was determined to be 4.4 million guaraníes, and the corresponding equivalent for the extreme poverty line was determined to be 2.7 million guaraníes.[87] In rural areas, the annual per capita income equivalent for the total poverty line is 3.5 million guaraníes and the income equivalent for the extreme poverty line is 2.4 million guaraníes.

Still at the level of the country and its geographical areas, in 2008, 48.8% of rural dwellers and 31.8% of urban dwellers were living below the poverty line (see Table IX.3). Of the rural poor, 30.8% were extremely poor, compared with just 11.2% of their urban counterparts. It is important to note that half of Paraguay's poor are living in extreme poverty.

[86] The extreme poverty line is the cost of the basic food basket, which is a bundle of products that cover the minimum nutritional needs of the population. The total poverty line reflects the cost of the extreme poverty line plus an additional cost for non-food consumption (clothing, housing etc.). Its composition, in addition to meeting the aforesaid needs, should reflect the prevailing food habits and preferences in the country, along with the supply of food products and relative prices (Robles, 2000).

[87] In the case of the total and extreme poverty lines for the country, the per capita income value that was used is a benchmark average calculated based on the value of the poverty lines constructed at the level of domain (geographical areas).

**TABLE IX.3**
**PARAGUAY: POVERTY RATE BY AREA OF RESIDENCE**
*(Percentage)*

| Area | Extreme poverty | Non-extreme poverty | Total poverty | Non-poor |
|---|---|---|---|---|
| Urban | 11.2 | 20.6 | 31.8 | 68.2 |
| Rural | 30.8 | 17.9 | 48.8 | 51.2 |
| Total | 19.4 | 19.5 | 38.8 | 61.2 |

Source: Government of Paraguay, Directorate of Statistics, Surveys and Censuses, Household Survey, 2008.

In 2008, the poverty rate in the region of Caazapá, where the cooperative's producers reside, was slightly above the national average (41.8%), and the region's extreme poverty rate was somewhat higher (25%) than the national average. That same year, rural poverty stood at 46% and urban poverty at 23% in Caazapá. Meanwhile, 28.7% of rural dwellers were living in extreme poverty.

The poverty rate in the region of Caazapá, where the cooperative's producers reside, is slightly above the national average (41.8%) but below the rate in other regions such as San Pedro (53.9%), Canindeyú (53.7%), Caaguazú (52%), Itapúa (47,8%) and Misiones (46.1%) (see Table IX.4). The region's extreme poverty rate is somewhat higher (25%) than the national average, although not as high as in Canindeyú (41.7%), San Pedro (35%), Caaguazú (33%) and Concepción (30%).

**TABLE IX.4**
**PARAGUAY: POVERTY RATE BY REGION**

| Region | Extreme poverty (*Percentage*) | Non-extreme poverty (*Percentage*) | Poor (*Percentage*) | Population | Population density |
|---|---|---|---|---|---|
| Asunción | 7.1 | 15.8 | 22.9 | 518 945 | 8.4 |
| Concepción | 30.0 | 12.3 | 42.4 | 207 201 | 3.4 |
| San Pedro | 35.1 | 18.8 | 53.9 | 353 064 | 5.7 |
| Cordillera | 17.2 | 20.3 | 37.5 | 284 256 | 4.6 |
| Guairá | 18.4 | 18.7 | 37.1 | 213 635 | 3.5 |
| Caaguazú | 33.3 | 18.8 | 52.0 | 476 225 | 7.7 |
| Caazapá | 25.0 | 16.9 | 41.8 | 138 365 | 2.2 |
| Itapúa | 28.3 | 19.5 | 47.8 | 523 161 | 8.5 |
| Misiones | 27.1 | 19.0 | 46.1 | 120 848 | 2.0 |
| Paraguarí | 22.0 | 18.4 | 40.4 | 245 097 | 4.0 |
| Alto Paraná | 16.2 | 13.0 | 29.1 | 720 293 | 11.7 |
| Central | 11.6 | 25.7 | 37.3 | 1 929 834 | 31.3 |
| Ñeembucú | 23.2 | 18.2 | 41.4 | 80 130 | 1.3 |
| Amambay | 12.8 | 17.2 | 30.0 | 98 569 | 1.6 |
| Canindeyú | 41.7 | 12.0 | 53.7 | 168 325 | 2.7 |
| Presidente Hayes | 13.9 | 6.3 | 20.3 | 85 965 | 1.4 |
| Total | 19.4 | 19.5 | 38.8 | 6 163 913 | 100.0 |

Source: Government of Paraguay, Directorate of Statistics, Surveys and Censuses, Household Survey, 2008.

It is equally important to mention that Paraguay's population is distributed more or less homogeneously among the regions and that concentrations of population occur in regions with poverty rates that are less than or equal to the national poverty rate. Therefore, although Caazapá's poverty rate is higher than the national average, it refers to less than one half of 2% of the country's total population.

In 2008, rural poverty stood at 46% in Caazapá, which was very near the national average (see Table IX.5). Urban poverty was 23%, below the national average. The extreme poverty rate in Caazapá was 28.7% among rural dwellers (near the national average) and 9.3% among urban dwellers (also near the national average).

**TABLE IX.5**
**CAAZAPÁ: POVERTY RATE BY AREA OF RESIDENCE**
*(Percentage)*

| | Non-poor | Poor |
|---|---|---|
| Urban | 76.7 | 23.3 |
| Rural | 53.7 | 46.3 |
| Total | 58.2 | 41.8 |

Source: Government of Paraguay, Directorate of Statistics, Surveys and Censuses, Household Survey, 2008.
Note: Benchmark data, not a representative sample.

## b) Poverty status of producers in the cooperative

Using data obtained from the survey of producers in the Capi'ibary Cooperative, it was observed that the producers not participating in the Frutika production chain have average annual per capita income equal to 3.3 million guaraníes, which is below the annual per capita income equivalent for the national poverty line (4.4 million guaraníes)[88] (see Table IX.6) and even below the annual per capita income equivalent for the rural poverty line (3.5 million guaraníes). In contrast, average annual per capita income among the producers participating in the Frutika chain is equal to 5.4 million guaraníes, which is above the total poverty line for the country and the rural poverty line in particular.

**TABLE IX.6**
**AVERAGE PER CAPITA INCOME BY POVERTY STATUS AND VALUE CHAIN PARTICIPATION**
*(Millions of guaraníes per year)*

| | Non-poor | Poor | Total |
|---|---|---|---|
| Non-participants | 9.61 | 1.22 | 3.38 |
| Participants | 10.37 | 1.61 | 5.40 |
| Total | 9.86 | 1.29 | 3.83 |

Source: Censo a Pequeños Productores Agrícolas de Caazapá, 2009.

Based on the rural poverty lines and corresponding annual per capita income equivalents that were calculated for this study, the percentage of producers living below and above this poverty line could be determined.[89] In the case of the producers participating in the production chain, 56.8% were found to live below the poverty line, compared with 74% of the producers not linked to the chain. For all producers combined, the average poverty rate was 70%, which was significantly high (Table IX.7).

[88] Benchmark value in the case of the national poverty line (not calculated using official statistics).

[89] Method used to obtain the poverty rate of the surveyed producers: The questionnaire design and construction of the income levels of the producers made it possible to compare producer income against the official rural poverty line to obtain the poverty levels and indicators for the study group. The questionnaire administered to the producers in Caazapá was modelled after the questionnaire used by the Directorate of Statistics, Surveys and Censuses for its household surveys. As in those surveys, there were sections that gathered information on different sources of income, a section on employment among the members of the farm or household and other sections or questions at the farm level on income from crop and livestock activities, commercial activities and income from own consumption of farm products.

Another way of measuring the poverty of these producers is through what is known as the poverty intensity or poverty gap: the difference between the average income level of the poor and the poverty line. The producers not linked to Frutika were found to have average incomes that were 48% lower than the income level equivalent to the poverty line, whereas the incomes of the producers linked to Frutika were just 31% lower. In other words, the Frutika producers are closer to rising above the poverty line than their non-Frutika counterparts. Lastly, the poverty severity indicator measures the degree of distribution of the poor across population segments, i.e. the level of concentration of the poor in these segments. In the case of the producers in Caazapá, poverty levels were found to be more concentrated among the producers not linked to Frutika.

**TABLE IX.7**
**POVERTY INDICATORS OF AGRICULTURAL PRODUCERS BY PARTICIPATION IN THE JUICE VALUE CHAIN**
*(Percentage)*

| | Total number of producers | Incidence of poverty | | | Non-poverty | Poverty gap [a] | Poverty severity [b] |
|---|---|---|---|---|---|---|---|
| | | Extreme poverty | Non-extreme poverty | Total poverty | | | |
| Non-participants | 330 | 64.85 | 9.39 | 74.24 | 25.76 | 48.0 | 36.0 |
| Participants | 95 | 43.16 | 13.68 | 56.84 | 43.16 | 31.0 | 20.0 |
| Total | 425 | 60.00 | 10.35 | 70.35 | 29.65 | 44.0 | 33.0 |

Source: Censo a Pequeños Productores Agrícolas de Caazapá, 2009.
[a] The poverty gap is the monetary difference between the poverty line and per capita income, i.e. the per capita monetary amount that the poor need to reach the poverty line. In this case, the producers classified as poor need 2,220,000 guaraníes to make up the difference. Those not participating in the chain need 2,290,000 guaraníes, and those participating in the chain need 1,890,000 guaraníes.
[b] Poverty severity measures the degree of distribution of the poor across population segments.

## 4. Direct effects on income and poverty

Following the analysis of poverty levels among the producers in the cooperative, the findings of the quantitative component are presented. This component estimates the direct effect that participation by the small farmers in the value chain has on income. The analytical method proposed at the beginning of this chapter is used, with the data considered as a representative sample of the producers.

The results show that the income levels of the producers in the Capi'ibary Cooperative are positively and significantly associated with the amount of available land, the amount of land in agricultural production, the number of crops grown (only in model 1), the amount of land in livestock production, the number of people in the household who are wage earners or employees, and the level of access to financial resources and participation in the Frutika chain through cultivation of passion fruit and grapefruit (see Table IX.8, models 3 and 4).

**TABLE IX.8**
**ESTIMATE OF THE DIRECT EFFECT OF PARTICIPATION IN THE JUICE EXPORT CHAIN**

| Dependent variable: lyfper (Ln per capita family income) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Independent control variables (IV) | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
| Household and human capital characteristics | | | | | | | | |
| Total number of household members | -0.152 | *** | -0.151 | *** | -0.149 | *** | -0.149 | *** |
| Average years of education of head of household | -0.013 | | -0.014 | | -0.013 | | -0.011 | |
| Age of head of household | -0.005 | | -0.005 | | -0.005 | | -0.005 | |
| Average years of education of the household members | 0.051 | | 0.049 | | 0.047 | | 0.045 | |
| Productive assets: land and family labour | | | | | | | | |
| Natural logarithm of the amount of available land | 0.342 | ** | 0.341 | ** | 0.359 | *** | 0.350 | ** |
| Amount of land available for crops (hectares) | 0.05 | *** | 0.051 | *** | 0.052 | *** | 0.052 | *** |
| Number of crops grown in the previous crop year | 0.066 | ** | 0.042 | | 0.043 | | 0.029 | |
| Number of owned lots (hectares) | -0.013 | | -0.013 | | -0.013 | | -0.012 | |
| Amount of land for livestock or pasture (hectares) | 0.039 | ** | 0.034 | * | 0.033 | * | 0.032 | * |
| Availability of labour [a] | 0.013 | | 0.013 | | 0.014 | | 0.012 | |
| Number of persons dependently employed | 0.661 | *** | 0.65 | *** | 0.646 | *** | 0.629 | *** |
| Number of persons engaged in agricultural activities | -0.057 | | -0.058 | | -0.061 | | -0.059 | |
| Access to financial resources | | | | | | | | |
| Range of loan amounts | 0.107 | ** | 0.106 | ** | 0.106 | ** | 0.109 | *** |
| Participation in the chain (IV) | | | | | | | | |
| Frutika 1: passion fruit, grapefruit or oranges | | | 0.186 | | | | | |
| Frutika 2: passion fruit and grapefruit | | | | | 0.270 | * | | |
| Frutika 3: passion fruit | | | | | | | 0.434 | *** |
| _cons | 13 778 | *** | 13.86 | *** | 13 820 | *** | 13 860 | *** |
| Number of observations | 403 | | 403 | | 403 | | 403 | |
| | F (13.389)=18.07 | | F (14.388)=16.89 | | F( 14.388) =16.89 | | F (14.388)=17.46 | |
| | Prob > F=0.000 | | Prob > F=0.000 | | Prob > F= 0.0000 | | Prob > F=0.000 | |
| | R-squared =0.3741 | | R-squared =0.3771 | | R-squared =0.3795 | | R-squared=0.3862 | |

Source: Censo a Pequeños Productores Agrícolas de Caazapá, 2009.
Note: *** = significance 1%; ** = significance 5%; * = significance 10%.
[a] Total number of household members 15 years or older.

By analysing the coefficients, the independent effects of each determining variable of per capita income can be observed. In general, a 1% increase in the amount of available land raises per capita income by only 0.34%. One additional hectare of land in crop production means a 5% increase in per capita income. One additional crop has a similar effect on income (6%) but is insignificant when producer participation in the juice chain is considered. One additional hectare of land for

livestock production boosts per capita income by 3%. Increasing the total number of wage earners in the family by one person is associated with a significant increase—over 60%—in per capita income. In terms of financial resources, for every additional 2 million guaraníes in credit, per capita income rises by 10%.

Lastly, when the three crops (passion fruit, grapefruit and oranges) with which the producers can participate in the Frutika chain are considered, a positive but insignificant effect is observed on per capita income (model 2). However, the results improve in the subsequent models when oranges and then grapefruit are excluded, because these crops were not at peak productivity when the producer survey was administered. Consequently, income from passion fruit represented a larger share of the farm-related income of the producers linked to Frutika when the data were collected. When the producers are participating in the juice chain with passion fruit and grapefruit (model 3) or with passion fruit only (model 4), the positive effect of their participation is significant, with an increase in per capita income of 27% in model 3 (sig=10%) and of 43% in model 4 (sig=1%). In short, participation in the Frutika chain has a significant positive effect on producer income, above all when the producers are participating with passion fruit.

The large effect of wage-earning labour on the income levels of the Capi'ibary producer farms suggests that family agriculture in this zone is not the main lever of poverty reduction and would therefore not necessarily become a source of income gains for the producers. However, the presence of the Frutika production chain contributes an interesting percentage to the income that campesino families earn from cash crops. Moreover, the magnitude of the effect of wage-earning family members on farm income levels could shrink over time as the grapefruit and orange crops reach their maximum productivity and require more labour, in which case family members might be the first to be recruited.

Model 4 predicts (see Table IX.9) average annual per capita income of 2.8 million guaraníes for the producers linked to Frutika and 1.9 million guaraníes for the producers not linked to Frutika. Both levels are below the rural poverty line, with a poverty gap of 20% for the Frutika producers and of 47% for the producers not participating in the chain. These percentages are equivalent to the income that each group would need to earn in order to reach or surpass the rural poverty line.

**TABLE IX.9**
**INCOME LEVEL ESTIMATES AND RURAL POVERTY LINE SCENARIOS FOR PRODUCERS IN THE CAPI'IBARY COOPERATIVE**

| | Per capita income (Millions of guaraníes per year) | | Per capita income gap (%) | |
|---|---|---|---|---|
| | Participants | Non-participants | Participants | Non-participants |
| Overall average | 2.8 | 1.9 | 20 | 47 |
| Scenario 1 | 2.5 | 1.6 | 29 | 54 |
| Scenario 2 | 2.9 | 1.9 | 18 | 46 |
| Scenario 3 | 4.6 | 3.2 | -33 | 8 |
| Scenario 4 | 5.4 | 3.6 | -54 | -3 |
| Rural poverty line (guaraníes per year) | | | | 3 503 372 |

Source: Censo a Pequeños Productores Agrícolas de Caazapá, 2009.
Note: Exercise performed using the model 4 coefficients.

In order to analyse the weight of the variables on the capacity and potential for reducing poverty gaps among the producers in the cooperative, scenarios have been constructed to approximate the different combinations of factors having greater or lesser possibilities of reducing and even overcoming poverty. The various scenarios make it possible to estimate different per capita income levels, which – when compared with the rural poverty line – reveal variations in the poverty gaps.

In the first scenario, the farms are assumed to have no wage-earning members, five hectares of crop land and four crops. With these characteristics, the poverty gap observed for the producers participating in the chain is 29%, whereas the gap for the producers not linked to the chain is 54%.

In the second scenario, the same conditions as in the first scenario are maintained, but, in addition, the households are assumed to have an average of seven years of education and access to between 3 million and 5 million guaraníes in credit. For this scenario, the poverty gap falls to 18% for the producers in the chain and to 46% for the producers not linked to the chain. This is a significant reduction that is most likely explained by ease of access to credit, due to the specific weight of that variable, already observed, as an income determinant.

The third scenario was constructed with the same conditions as the first scenario, with the addition of one wage-earning member. In this case, a substantial variation is observed in the poverty reduction effect, with the income levels of the Frutika producers surpassing the poverty line by 33%; and although the producers not linked to Frutika remain below the poverty line, they would only need an additional 8% of income to rise above the line.

In the fourth scenario, the farms also have wage-earning members, as well as the full complement of the other variables mentioned in the second scenario. In this case, the income levels of the Frutika producers easily surpass the poverty line (54%); the income levels of their non Frutika counterparts are also above the poverty line, though only by 3%.

In terms of increasing income and reducing the poverty gap, belonging or being linked to the Frutika production chain is a significant determinant for family agriculture in the Capi'ibary Cooperative. The assertion could be made that participation in the chain is a condition for reducing poverty levels, although not for rising above the poverty line.

Furthermore, the existence of a wage earner among the family members on the farms is a key factor in substantially raising income levels and rising above the poverty line, mainly in the case of the Frutika producers. The income brought in by these wage earners may come from agricultural activities or services but is earned off the farm.

If participation in the Frutika chain is understood to largely explain the increase in income, it could be assumed that this increase would enable the Frutika farms to hire more agricultural and non-agricultural paid labour. In this case, participation in the Frutika chain could be having an indirect effect through the hiring of paid labour, which has a high relative weight in terms of enabling rural families to increase their income and eventually rise out of poverty.

## 5. Effects of spending and creation of growth linkages

In accordance with the aforementioned literature on the participation of small agricultural producers in production chains, the effects consist not only of the direct effects resulting from income gains, but also of what are known as linkage effects. These are the effects linking agricultural growth to the factor market, production and consumption. Each of these linkages generates, respectively, greater demand for labour in agricultural and rural non-agricultural activities (primarily), greater development of activities related to the supply of inputs and increases in family spending on goods and services.

This section will attempt to demonstrate the consumption patterns of the small producers involved in the Frutika chain and their counterparts who are not involved in the chain. An attempt will also be made to demonstrate the relative extent to which these consumption patterns promote the creation of linkages at the local rural level, i.e. the relative likelihood of these patterns to generate labour intensive goods and services and, consequently, income gains in the community.

First, the family spending structure of the producers participating and not participating in the chain is presented, by type of rural linkage.

Total annual family spending among the farmers surveyed consists of production spending and consumer spending on goods and services. Production spending includes spending on farm labour,

spending on inputs for crops and livestock, as well as the purchase of equipment, machinery and implements for crops and livestock production and other expenses. Consumer spending on goods and services includes spending on food, non food items and services. Spending on non food items includes household items, clothing, school supplies and other expenses (home maintenance and health-care goods). Spending on services includes education, health care, entertainment, transportation, fuel and communications.

Table IX.10 shows the family spending structure of the producers in the Capi'ibary Cooperative. Of total family spending, 60.9% corresponds to consumer spending on goods and services and 38.8% is production spending. The concentration of spending on the consumption of goods and services is primarily explained by spending on food (43.1%), which is consistent with a typical family spending structure in the country.[90] It is important to note that the production spending percentage is not small, especially in terms of spending on agricultural inputs (24%). However, spending on these types of products does not necessarily generate new or higher income for rural communities,[91] unlike spending on agricultural labour (11%).

**TABLE IX.10**
**DISTRIBUTION OF TOTAL FAMILY SPENDING AMONG PRODUCERS IN THE CAPI'IBARY COOPERATIVE**
*(Percentage)*

| Type of spending/linkage | Non-participants | Participants | Total |
|---|---|---|---|
| A. Production spending | 38.1 | 40.5 | 38.8 |
| a. Agricultural labour | 11.4 | 11.9 | 11.5 |
| b. Inputs for crops and livestock | 24.3 | 24.7 | 24.4 |
| c. Other production expenses | 2.4 | 4.0 | 2.8 |
| B. Consumer spending on goods and services | 61.5 | 59.3 | 60.9 |
| a. Food | 43.9 | 41.3 | 43.2 |
| b. Non-food items | 12.9 | 12.9 | 12.9 |
| c. Services (non-agricultural) | 4.7 | 5.1 | 4.8 |
| C. Total | 100.0 | 100.0 | 100.0 |
| Average total family spending (thousands of 2008 guaraníes) | 9 485 | 12 812 | 10 229 |

Source: Censo a Pequeños Productores Agrícolas de Caazapá, 2009.

It is important to note that between the two types of spending (production spending and consumer spending on goods and services), the two categories that generate the linkages with the most intensive use of labour are agricultural labour (production spending) and education, health-care, transportation and communications services (non-agricultural labour). Consumer spending on food and non food items also creates employment but to a lesser extent because it is limited to the area of sales and marketing.

However, the categories that generate the most employment in the spending structure of producers participating and producers not participating in the production chain account on average for only 16.3% of total spending, with agricultural labour being the larger spending category (11.5%). In other words, the indirect effect of these spending categories with higher employment generation rates has a smaller relative weight than the categories with lower employment generation rates. To put it another way, the income levels of both types of producers do not have much weight in terms of the (indirect) generation of income in the rural communities where they operate. Nevertheless, considering only the

[90] In Paraguay, 40% of family spending nationwide and 54.2% of family spending in rural areas is on food (DGEEC, 2000).
[91] Medium-sized sellers are generally from middle-income groups and do not necessarily live in the area of production.

spending categories that create agricultural and non-agricultural labour, it is the Frutika producers who have greater purchasing power to hire these two types of labour. Therefore, these are the producers who could potentially become indirect promoters of poverty reduction, when further consolidation of the production and marketing chain translates into higher income levels for them.

In addition, these findings are substantiated by an exercise to estimate spending elasticities and determine the sensitivity of the linkages to changes in income levels among the small agricultural producers. This exercise attempts to demonstrate how spending on labour-intensive goods and services is affected by income fluctuations in the two groups of small producers.

Table IX.11 presents the estimates of spending elasticities to changes in income. In general, production spending and spending on services are highly elastic. In terms of elasticities by participation in the chain, spending on labour and on services is more elastic among the producers linked to Frutika than among the group of producers not linked to the chain. By contrast, spending on crop and livestock inputs is more elastic among the producers not linked to Frutika than among the producers linked to Frutika.

**TABLE IX.11**
**ESTIMATE OF INCOME ELASTICITY FOR SPENDING CATEGORIES AMONG PRODUCERS IN THE CAPI'IBARY COOPERATIVE**

| Type of spending/linkage | Non-participants | Participants | Total producers |
|---|---|---|---|
| A. Production spending | 1.71 | 1.20 | 1.50 |
| a. Agricultural labour | 1.62 | 1.75 | 1.66 |
| b. Inputs for crops and livestock | 1.23 | 1.02 | 1.11 |
| B. Consumer spending on goods and services | 0.54 | 0.86 | 0.66 |
| a. Food | 0.41 | 0.69 | 0.54 |
| b. Non-food items | 0.92 | 0.83 | 0.84 |
| c. Services[a] | 0.71 | 2.27 | 1.27 |

Source: "Censo a Pequeños Productores Agrícolas de Caazapá", 2009.
Note: A variable is said to be inelastic at zero, as unitary when it is at one, and as elastic when it is greater than one.
[a] Includes spending on education, health care, entertainment, transportation, fuel and communications.

By analysing the income elasticities for the spending categories with the highest employment generation rates, it can be observed that for both types of producers, income gains have a very strong effect on spending on agricultural labour, and the effect is strongest for the group of producers linked to Frutika. The elasticities are likewise very positive in the case of non-agricultural labour (services) but only for the producers participating in the chain.

This exercise also shows that the elasticities are large in the case of spending on production inputs and spending on non-food items, although not as large as in the case of spending on labour.

This elasticity exercise demonstrates that in the event of a possible increase in income among the small producers in the Capi'ibary Cooperative, the effect on spending will be greater in those categories that are more labour-intensive, and that the effect produced in this regard will be stronger in the case of income gains among the small producers participating in the Frutika chain.

This conclusion confirms the earlier results obtained from studying the participation and distribution of family spending among the Capi'ibary Cooperative producers and by comparing the amounts of money used by each group of producers (participants and non-participants in the chain). In other words, it is the Frutika producers, as opposed to the other producers, who are potentially positioned to trigger or generate more employment and thus contribute to rural poverty reduction.

# D. Conclusions and recommendations

The most resounding finding yielded by the study of this group of small producers (linked and unlinked) is that 70% of them were living below the poverty line at the time of the survey (2009), with a larger number of poor families concentrated among the producers who were not linked to the Frutika chain. The fact that there were fewer poor families among the producers linked to Frutika may point to the favourable effects of having initiated fruit cultivation at an early point in time, and thus of the income earned from that production. However, the phenomenon could also be interpreted to indicate that the cooperative may have selected producers for the fruit supply chain whose families were in a better economic position.

The model used to measure the effects on income in the two groups indicates that participation in the fruit chain must have a very significant specific weight given the fact that both the gap and severity of poverty are less among the linked producers than among their unlinked counterparts. In other words, based on the findings with respect to income levels for the two groups, poverty levels fall by much larger margins for the group of producers participating in the fruit chain than for the group of non participating producers. That is the second main conclusion: participation in the fruit chain is an important factor in reducing poverty levels.

However, participation in the chain and the income generated as a result (which is added to the income generated by other cash crops grown by these producers) are not sufficient on their own for poor families, which include a percentage of these producers, to rise above the poverty line or, otherwise said, to escape from poverty. That is only possible if, additionally, one or more members of the family are employed as agricultural or non-agricultural wage earners.

In any case, it has also been possible to confirm that income generated through participation in the fruit chain has rural growth linkage effects, i.e. the income is spent to hire agricultural and non agricultural labour in the community. Although this spending is observed for both groups of producers, spending levels are higher in the case of the linked producers.

The percentage of this spending in relation to other production and consumption spending is relatively large. However, a potential significant increase in the income levels of the fruit producers has a very strong impact on spending categories that make intensive use of labour in the community. Accordingly, the indirect or linkage effects of the production chain become complementary forces for reducing household poverty levels in the community of producers.

In conclusion, the following assertions can be made: the percentage of poor among the producers in the fruit chain is smaller than among the other producers; the income generated by the linked producers allows for a steeper reduction in poverty levels than in the case of the unlinked producers; and spending trends among the linked producers suggest that they have greater potential to contribute indirectly to reducing poverty levels in the rural community by hiring labour.

Among the factors that drove the success of this public-private project, none originated in the public sector, despite the project's explicit focus on strengthening public institutions and despite the relationship between these institutions and the private actors, such as Frutika and the cooperative. Both the Ministry of Agriculture and the local government have been scarcely more than mere spectators in this process. Moreover, in areas where the Ministry of Agriculture has had a direct presence through its agriculture extension service (in the case of oranges), without the involvement of a cooperative, the value chains did not prosper as they did in the case of the passion fruit and grapefruit growers.

For a decade, proposals have been presented in the country to establish agribusiness value chains (mainly for the foreign market) as an engine of competitiveness. These production chains, as

defined, were oriented toward traditional and non-traditional crops, as well as large-scale agriculture and family agriculture.[92]

Several public-sector initiatives were translated into programmes and projects that attempted to advance the implementation of these production chains, using new and existing instruments. However, the efforts of the government's line ministries (Industry, Agriculture, and Planning) have never been coordinated to establish plans, prioritize sectors and pursue tasks to effectively establish these chains. Nevertheless, international cooperation projects in this area have been implemented, although with uneven results and uneven support capacity by the public sector.

Private initiatives and the market have primarily been responsible for driving the creation of competitive production chains, with the participation of medium-sized producers, but increasingly with family farms or small scale producers.[93]

State involvement in supporting, guiding and forming production chains is important for three basic reasons. First, these production chains should be part of governmental programmes aimed at promoting inclusive economic growth, i.e. growth coupled with job creation and poverty reduction. Second, it is up to the State to establish guidelines for the formation of these chains and corresponding incentives based on the development priorities, in order to facilitate and steer private investment towards the sectors and regions with the greatest potential for success. Third, although market impetus is important for investments, there are market failures that should be addressed by the State.

Clearly, a deeper industrialization process is a fundamental condition for inclusive growth in Paraguay, but this process must be primarily based on agriculture. There are three reasons for this. First, Paraguay's identified comparative advantages lie in agribusiness. Second, a large percentage of the population still lives in the countryside, where poverty levels are higher. Third and last, agribusiness is the country's largest job engine, particularly when based on production chains.

Enhancing the performance of the government institutions involved in boosting competitiveness remains an important objective for the consideration of public policies. It is very unlikely that value chains that incorporate family farms can be created on a large scale without the active participation of public institutions.

This study has proposed a theoretical framework for evaluating the extent to which value chain formation in the agriculture sector has a pro-poor effect. Evidence was found linking the participation of small farmers in the juice export chain with lower levels of poverty and higher levels of spending on labour. The study also suggests that the way in which farmers organize is a key variable in determining whether they have the capacity to carry out the investments and cooperation needed to form an export chain. Because pro-poor trade depends on the direct participation of small farmers as suppliers in a global value chain, capturing trade gains (in countries like Paraguay) requires a major investment in the types of organization that bring together small farmers, so these organizations can effectively represent the farmers' interests and so they have the capacity to forge production-based partnerships with agribusiness export firms and the government.

[92] The most complete study on competitiveness in Paraguay was carried out with support from the Japan International Cooperation Agency ("Estudio sobre el desarrollo económico de la República del Paraguay"). The study identified six production chains: (i) soybean-oil-feed; (ii) beef and beef processing; (iii) cotton-textiles; (iv) leather and leather goods; (v) lumber and lumber products; and (vi) metalworking.

[93] The dairy chain and the pork chain established by medium-sized producers or family farms; the fruit and juice, organic sugar, stevia, medicinal herbs, cassava-starch chains, with high levels of participation from family farms.

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# Annex 1
# Census coverage and representativeness of the respondents

The census conducted in October and November 2009 of the producers in the Capi'ibary Cooperative had a total coverage rate of 77.7% (446 of a universe of 574 producers were surveyed), a coverage rate of 73.2% for the group of producers not linked to the Frutika chain and a coverage rate of 100% for the group of producers linked to Frutika. For reasons related primarily to adverse weather conditions, data could not be collected from all of the producers not linked to Frutika.

However, since data were collected from 446 producers, a decision was made to conduct the analysis of the quantitative component based on a total of 425 producers, a number equivalent to 95% of the survey respondents and 74% of the universe of producers, ensuring the representativeness of the respondents (the sample) with respect to the universe. In all, 21 cases were excluded because either the respondents were not engaged in agricultural activities during the census period (8 cases) or the producers were atypical in size, in terms of the amount of available land, for the purposes of this study (12 cases). In addition, an analysis was done of the mean differences in the amount of available land of the producers in the sample and in the universe, and it was concluded with a significance level of 5% that the producers surveyed and screened for the quantitative analysis are representative of the universe of producers. This can be observed in the following results of the test of mean differences:

**TABLE IX.A1**
**TEST OF MEAN DIFFERENCES IN THE AMOUNT OF AVAILABLE LAND (HECTARES) BETWEEN THE UNIVERSE OF PRODUCERS IN THE CAPI'IBARY COOPERATIVE AND THE RESPONDENTS**

| Group of producers | Number of observations | Average hectares of available land | Confidence intervals (95%) | |
|---|---|---|---|---|
| Universe | 553 | 10.75949 | 10.31823 | 11.20076 |
| Respondents | 425 | 11.14353 | 10.39771 | 11.88935 |
| Total | 978 | 10.92638 | 10.51798 | 11.33478 |
| Mean difference | | -0.3840357 | -1.208 | 0.4399285 |
| Null hypothesis: mean difference = 0 | | | | |
| Alternate hypothesis: mean difference ≠ 0 | | | | |
| Result of the test of mean differences: Pr(\|T\| > \|t\|) = 0.3606 | | | | |

Source: Prepared by the authors using data provided by the Capi'ibary Cooperative and "Censo a Pequeños Productores Agrícolas de Caazapá", 2009.

With a significance level of 5%, the null hypothesis that the average hectares of available land for the universe and for the respondents are equal is not rejected, so it can be assumed that the respondents are representative of the universe.

**TABLE IX.A2**
**TEST OF MEAN DIFFERENCES IN THE AMOUNT OF AVAILABLE LAND (HECTARES) BETWEEN THE UNIVERSE OF PRODUCERS LINKED TO FRUTIKA AND THE RESPONDENTS**

| Group of producers | Number of observations | Average hectares of available land | Confidence intervals (95%) | |
|---|---|---|---|---|
| Universe | 93 | 11.87097 | 10.50142 | 13.24052 |
| Respondents | 95 | 14.01053 | 12.06487 | 15.95618 |
| Total | 188 | 12.95213 | 11.75906 | 14.14519 |

(continues)

Table IX.A2 (conclusion)

| Group of producers | Number of observations | Average hectares of available land | Confidence intervals (95%) | |
|---|---|---|---|---|
| Mean difference | | -2.139559 | -4.512215 | 0.2330981 |
| Null hypothesis: mean difference = 0 | | | | |
| Alternate hypothesis: mean difference ≠ 0 | | | | |
| Result of the test of mean differences: Pr(\|T\| > \|t\|) = 0.0769 | | | | |

Source: Prepared by the authors using data provided by the Capi'ibary Cooperative and "Censo a Pequeños Productores Agrícolas de Caazapá", 2009.

Even though the census coverage rate for the producers linked to Frutika is 100%, the corresponding filter and test of mean differences of the amount of available land were applied. With a significance level of 5%, the null hypothesis that the average hectares of available land for the universe linked to Frutika and for the respondents linked to Frutika are equal is not rejected, so it can be assumed that the respondents linked to Frutika are representative of the universe of producers linked to Frutika.

**TABLE IX.A3**
**TEST OF MEAN DIFFERENCES IN THE AMOUNT OF AVAILABLE LAND (HECTARES) BETWEEN THE UNIVERSE OF PRODUCERS NOT LINKED TO FRUTIKA AND THE RESPONDENTS**

| Group of producers | Number of observations | Average hectares of available land | Confidence intervals (95%) | |
|---|---|---|---|---|
| Universe | 460 | 10.53478 | 10.08221 | 10.98736 |
| Respondents | 330 | 10.31818 | 9.554464 | 11.0819 |
| Total | 790 | 10.4443 | 10.03146 | 10.85715 |
| Mean difference | | 0.2166008 | -0.6209012 | 1.054103 |
| Null hypothesis: mean difference = 0 | | | | |
| Alternate hypothesis: mean difference ≠ 0 | | | | |
| Result of the test of mean differences: Pr(\|T\| > \|t\|) = 0.6118 | | | | |

Source: Prepared by the authors using data provided by the Capi'ibary Cooperative and "Censo a Pequeños Productores Agrícolas de Caazapá", 2009.

With a significance level of 5%, the null hypothesis that the average hectares of available land for the universe of producers not linked to Frutika and for the respondents not linked to Frutika are equal is not rejected, so it can be assumed that the respondents not linked to Frutika are representative of the universe of producers not linked to Frutika.

# Annex 2

## TABLE IX.A4
## DESCRIPTIVE STATISTICS OF THE VARIABLES BY PARTICIPATION IN THE FRUTIKA JUICE CHAIN

| Variables | Non-participants | | | | | Participants | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Obs | Average/% | Std. Dev. | Min | Max | Obs | Average/% | Std. Dev. | Min | Max |
| Total annual family income (Current guaraníes) | 330 | 13 400 000 | 27 700 000 | 0 | 398 000 000 | 95 | 22 400 000 | 27 800 000 | 500 000 | 202 000 000 |
| Annual per capita income (Current guaraníes) | 330 | 3 379 276 | 5 629 888 | 0 | 66 400 000 | 95 | 5 393 782 | 11 000 000 | 100 000 | 101 000 000 |
| Annual agricultural income from sales (Current guaraníes) | 330 | 4 664 506 | 7 643 121 | 0 | 66 000 000 | 95 | 7 972 220 | 8 335 501 | 0 | 52 900 000 |
| Annual income from passion fruit (Current guaraníes) | 330 | 0 | 0 | 0 | 0 | 95 | 2 339 074 | 3 673 954 | 0 | 19 000 000 |
| Annual income from grapefruit (Current guaraníes) | 330 | 0 | 0 | 0 | 0 | 95 | 77 095 | 447 138 | 0 | 4 160 000 |
| Annual income from oranges (Current guaraníes) | 330 | 0 | 0 | 0 | 0 | 95 | 157 790 | 561 166 | 0 | 3 500 000 |
| Total annual income from Frutika products (Current guaraníes) | 330 | 0 | 0 | 0 | 0 | 95 | 2 573 958 | 3 756 945 | 0 | 19 000 000 |
| Annual agricultural income excluding Frutika products (Current guaraníes) | 330 | 4 581 036 | 7 645 347 | 0 | 66 000 000 | 95 | 4 740 605 | 6 082 460 | 0 | 33 900 000 |
| Amount of available land (hectares) | 330 | 10 | 7 | 2 | 52 | 95 | 14 | 10 | 1 | 53 |
| Number of hectares available for crops | 330 | 5 | 4 | 0 | 40 | 95 | 6 | 5 | 1 | 33 |
| Number of hectares available for livestock | 330 | 1 | 3 | 0 | 35 | 95 | 3 | 5 | 0 | 25 |
| Number of crops grown | 330 | 4 | 1 | 0 | 8 | 95 | 5 | 2 | 1 | 10 |
| Access to credit (*Dummy*) | 330 | 99% | | | | 95 | 97% | | | |
| Amount of credit (ranges) | 325 | 2 | 1 | 1 | 7 | 92 | 2 | 1 | 1 | 7 |
| Number of members on the farm (persons) | 330 | 5 | 2 | 1 | 12 | 95 | 5 | 2 | 1 | 14 |
| Available family labour (persons) | 330 | 3 | 1 | 1 | 9 | 95 | 3 | 2 | 1 | 8 |

(continues)

Table IX.A4 (conclusion)

| Variables | Non-participants | | | | | Participants | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Obs | Average/% | Std. Dev. | Min | Max | Obs | Average/% | Std. Dev. | Min | Max |
| Female head of households (*Dummy*) | 300 | 9,3% | | 0 | 1 | 91 | 11% | | 0 | 1 |
| Years of education among heads of household | 330 | 6 | 3 | 0 | 17 | 95 | 7 | 4 | 0 | 17 |
| Age of head of household | 330 | 45 | 13 | 21 | 105 | 95 | 47 | 11 | 25 | 73 |
| Years of work experience of head of household | 324 | 25 | 13 | 1 | 65 | 92 | 24 | 11 | 5 | 52 |
| Years of education of spouse | 283 | 6 | 3 | 0 | 16 | 84 | 7 | 4 | 0 | 16 |
| Amount of dependent family labour (persons) | 330 | 9,4% | | 0 | 2 | 95 | 17% | | 0 | 6 |
| Number of agricultural workers | 330 | 3 | 2 | 0 | 11 | 95 | 3 | 2 | 0 | 8 |
| Average years of education of members of the farm | 330 | 6 | 2 | 1 | 16 | 95 | 7 | 3 | 2 | 14 |
| Maximum years of education on the farm | 330 | 9 | 3 | 1 | 17 | 95 | 10 | 3 | 2 | 18 |

Source: Censo a Pequeños Productores Agrícolas de Caazapá, 2009.

# Annex 3

**TABLE IX.A5**
**ANNUAL FAMILY INCOME OF THE PRODUCERS IN CURRENT GUARANÍES**

| Quintile | Non-participants | | | | Participants | | | |
|---|---|---|---|---|---|---|---|---|
| | Obs | Average | Minimum | Maximum | Obs | Average | Minimum | Maximum |
| 1 | 66 | 1 597 309 | 0 | 7 100 000 | 19 | 3 672 421 | 500 000 | 6 150 000 |
| 2 | 66 | 4 627 303 | 1 380 000 | 10 040 000 | 19 | 8 644 600 | 3 000 000 | 19 142 500 |
| 3 | 67 | 7 787 082 | 1 200 000 | 23 076 004 | 19 | 17 692 716 | 6 640 000 | 44 804 000 |
| 4 | 65 | 13 422 506 | 2 300 000 | 35 624 000 | 19 | 27 352 045 | 8 284 000 | 48 740 000 |
| 5 | 66 | 39 806 118 | 6 500 000 | 398 144 000 | 19 | 54 717 973 | 7 900 000 | 202 200 000 |
| Total | 330 | 13 430 987 | 0 | 398 144 000 | 95 | 22 415 951 | 500 000 | 202 200 000 |

Source: Censo a Pequeños Productores Agrícolas de Caazapá, 2009.

# Annex 4
# Methodological annex on the estimate of the indirect effect of participation in the juice value chain

Based on a per capita consumer spending model that was converted to a model representing total household consumer spending and including the variable of farm participation in the Frutika value chain, the equation as modified for the purposes of this study is as follows:

$$C_{ij} = a_i Y_j + b_{1i} Y_j \ln(y_j) + b_{2i} N_j + b_{3i} \ln(S_j) + b_{4i} frutika + \sum_{i=1}^{5} g_{hi} D_{jh} + \mu_{ij} \quad (1)$$

where $C_{ij}$ represents consumer spending on good type *i* (production, labour, input, goods and services, food, non-food items etc.) by household or farm *j*; $Y_j$ is total consumer spending by the household *j* (proxy of total income); $y_j$ is per capita consumer spending by household *j*; $N_j$ is the number of household members; $S_j$ is the subsistence ratio in reference to the goods produced by the household. To incorporate the effect of the Frutika value chain on spending, the equation includes a dummy for participation (*frutika*) and other binary variables of districts that attempt to reflect differences in preferences, availability of goods and services and price differences between the regions. Based on this model, estimated using the ordinary least squares method, the elasticities were calculated of the different types of spending linked to the types of agricultural growth linkages, generalized as:

$$\frac{\partial C}{\partial Y}\frac{Y}{C} = (a_i + b_{1i+} b_{1i} \ln(y)\frac{Y}{C} \quad (2)$$

# X. Analysis of the effects of trade opening on household welfare: an application to Chile, 1999-2006

***Alfonso Finot***
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***José Durán Lima***

## A. Introduction

There is a consensus in the international trade literature about the potential welfare benefits of a more open trading regime, always assuming competitive market conditions and the absence of information asymmetries.[94] This effect could be greater still in small countries with small or underdeveloped domestic markets. At a time of many new trade agreements, each with a growing number of partners, it is natural to ask what effect trade liberalization might have on poverty and income distribution. To answer this question, it is necessary to properly identify the mechanisms whereby the effects of liberalization spread through the economy. Surprisingly, this type of analysis has not yet been fully developed in the literature and there are few empirical analyses of the subject, partly because data were inadequate until recently.[95]

Establishing the relationship between international trade liberalization and poverty, especially in developing countries, is essential as a guide to public policy and so that the potential benefits of trade opening can be capitalized upon as efficiently as possible. Proper characterization of these effects in Latin America remains a work in progress.[96] More common have been studies evaluating the possible effects of the free trade agreements negotiated or planned by the countries, and even in these cases the effects on poverty and income distribution are evaluated on the basis of ex ante models, which only present possible effects going forward and do not evaluate impacts in the past. Very few studies

[94] Bernhofen and Brown (2004), Helpman and Krugman (1987) and Fischer and Serra (1996), among others.
[95] See Goldberg and Pavcnik (2004) for a review of the recent literature and Reina and Zuluaga (2008) for an account of studies relating to Latin America.
[96] See Giordano (2009).

analyse the actual effects of agreements already signed by the countries. The main constraint arising from the lack of studies of this nature has been the absence of detailed, disaggregated information. Lack of information has been ceasing to be a problem in recent years thanks to the availability of larger amounts of data at the firm level and the systematization of household surveys (microdata). It is now possible to undertake ex post impact studies based on the evolution of observed data for prices, incomes, spending and tariff protection. The present study seeks to shed some light on the effects of trade opening on the different sectors of the economy and to analyse the most important pass-through channels, especially as regards poverty and income distribution.

The aim of the study is to take the new methodologies developed in the recent literature on the ex post effects of free trade agreements and apply them to the evaluation of social effects, and particularly those on poverty and income distribution. The idea is to use the information available in the region's countries to characterize the short-term impact of a trade opening process on households in countries that changed their trade policies in the last decade of the twentieth century and the first decade of the twenty-first, especially those countries where liberalization has gone furthest, such as Chile, Costa Rica and Mexico. In all these cases, the process of trade policy change is of longer standing and has been further-reaching than in other countries of the region. In any event, there has been a new impetus towards economic integration in the last few years following the signing of a large number of free trade agreements, both bilateral and multilateral, by other countries in the region.

This study represents the start of an effort to develop a tool that is flexible enough to be able to evaluate the application of different policies. The first case study to be used was that of Chile, and what was evaluated were the direct effects from the signing of new trade agreements between 1999 and 2006 on the welfare of households in the Metropolitan Region of Santiago, the country's most populous region.

The general finding is that, on average, the effect of lower tariffs and the lower domestic prices associated with them is to improve welfare, especially for lower-income households. The effect encountered is positive right across the income distribution. The variability of the benefits is fairly high, however, particularly in the first and second income quintiles, which reveals the greater vulnerability of these groups. For the population of the Metropolitan Region as a whole, the welfare gains observed are fairly minor, as they do not exceed 0.15%.

Another important finding of this analysis is that the pass-through of tariff adjustments to domestic prices is incomplete, very much so in the case of some product groups such as foods. This creates scope for complementary policies aimed at inducing competition with a view to the benefits of trade opening being effectively passed on to final consumers and not just captured by firms or business groups. This effect is brought into relief by simulating results for pass-through coefficients of 1, which yield much greater welfare effects (up from 0.15% to 1.3% of income).

The results of the parameters estimated (coefficient of price pass-through from the border to the domestic economy and price elasticity of tradables and non-tradables) provided a basis for some alternative policy simulations to quantify what the short-term benefits would be for families, other things being equal, in the event that other forms of market opening had been introduced as part of the country's trade policy.

The document is organized as follows. After this introduction, section B reviews the literature. Section C develops the theoretical general equilibrium model with microdata, allowing the welfare effects of trade opening on households to be identified. Part D describes the data used and the econometric methodology. Part E presents the findings for the Chile case study. Lastly, part F presents the main conclusions and policy recommendations.

## B. Literature review

In recent studies, it is possible to distinguish two different methodological approaches to identifying the effects of international trade on inequality and poverty levels. One uses ex ante simulations with computable general equilibrium models and combinations of these with microsimulation analyses. This is known as the top-down approach, and its analytical basis is the use of the household surveys in the countries' national censuses to define a baseline that is then used to simulate changes in prices, employment by skill level and wages, all obtained from the general equilibrium simulations. Monte Carlo econometric techniques are then used to re-estimate the poverty and inequality indicators.[97]

The second methodology combines the use of observed international trade figures with another dataset, usually of household survey, family expenditure and domestic price data. This methodology tends to be less restrictive in its assumptions and can be used to exploit the microdata that have recently become available in almost all the region's countries. A number of important studies have been conducted along these lines. Topalova (2005) uses household surveys in a number of districts in India to evaluate the impact on poverty and income distribution. Goldberg and Pavcnik (2005) analyse the impact of market opening in urban areas of Colombia. Porto (2006) studies market opening in the case of Argentina. Hanson (2005) and Nicita (2009) analyse the case of Mexico. Thomas and others (2002) study the impact of the financial crisis on families in Indonesia. Goh and Javorcik (2007) examine the changing wage structure in Poland. Balat and Porto (2005) review policies complementary to trade liberalization and their impact on rural areas of Zambia. Lastly, Levinsohn and McMillan (2005) analyse the subject of international aid in Ethiopia.

The evidence found in these studies regarding the relationship between trade opening, inequality and poverty can be summarized as follows: (i) having complementary policies in place makes it more likely that poorer families will participate in gains from trade; (ii) export development and access to foreign investment have an impact on poverty reduction; (iii) financial crises are most costly for the poor; (iv) market opening produces winners and losers among the lower-income population (most studies show trade reform increasing the wages of people who are poor but have ties to export sectors or sectors where foreign direct investment is rising, while poverty in formerly protected sectors increases); and (v) poor people in countries with a glut of unskilled workers do not always benefit from market opening.[98]

The greatest contribution of these studies is that they show us different strategies for analysing and measuring the effect of trade liberalization on poverty and family incomes. Paradoxically, all the studies except Porto (2006) and Nicita (2009) are concerned to characterize the effects from the perspective of income variation. It is important, however, to supplement the analysis by measuring the effect trade policies have on domestic prices, as this transmission channel has a direct impact on household welfare, at least in the short run.

Methodologically, this document follows the line of development of Porto (2006) and Nicita (2009). In both cases, the idea is to characterize the effects of trade opening on the basis of a household-level microeconomic model, with different econometric techniques subsequently being used to estimate the parameters identified in the model.

This document also supplements the analysis with the extensive empirical literature pioneered by Feenstra (1989) and Froot and Klemperer (1989), whose focus is on measuring the degree to which

[97] Some references that summarize the method developed in this part of the literature and can be recommended include Bourguignon, Bussolo and Cockburn (2010) and the reviews carried out by Wong and Kulmer (2010) and Tellería, Ludeña and Fernández (2010) in this volume.

[98] Giordano (2009) offers a detailed examination of the current state of knowledge about trade and poverty and concludes that that preexisting policies and socio-economic conditions are central to the interaction between trade and poverty.

tariff and exchange-rate changes are passed through to imported product prices.[99] Studies in this area have usually focused on measuring the exchange rate, finding evidence of a partial adjustment in the pass-through of the exchange rate to import prices, at least in the short run. In the case of tariff pass-through effects, empirical studies are much thinner on the ground and only three stand out: Feenstra (1989) for the United States, Menon (1993) for Australia and Mallick and Marques (2008) for India. The conclusions of these studies reinforce the idea that import prices adjust only partially if at all to tariff changes, and in some industries adjustments might actually have the opposite sign, depending on the structure of the market.

## C. Methodology

Like Nicita (2009), we follow Porto (2006) in the theoretical method used to measure the effects of liberalization on household welfare. In this case, we define an expenditure function for each household j that depends on a certain level of utility and on a price vector $p_i$ for tradable goods and $p_k$ for non-tradables. In equilibrium, this expenditure function must be equal to incomes characterized by an exogenous consumption level $x_0^h$, the sum of the wage income of household members $w_m^h$capital income $G^h$ and transfers $\phi^h$.[100] Equilibrium is characterized by equation (1).

$$e^h(p_i, p_k, u^h) = x_0^h + \sum_m w_m^h + G^h + \phi^h \tag{1}$$

One way of calculating the change in welfare for each household h is to calculate the compensating variation, which is defined as the sum of money that needs to be provided to or withdrawn from a household so that there is no change between its initial situation and its situation following the change in the tariff level $\tau_i$. By taking the expenditure differential and making it equal to the change in exogenous expenditure, assuming equilibrium conditions in the goods and factor market, it is possible to characterize the compensating variation in relation to expenditure as:

$$\frac{dx_o^h}{e^h} = \underbrace{\left[s_i^h \frac{\partial \ln(p_i)}{\partial \ln(\tau_i)} \mathrm{dln}(\tau_i)\right]}_{Direct\ Price\ Effect} + \underbrace{\left[\sum_k s_k^h \frac{\partial \ln(p_k)}{\partial \ln(p_i)} \frac{\partial \ln(p_i)}{\partial \ln(\tau_i)} \mathrm{dln}(\tau_i)\right]}_{Indirect\ Price\ Effect} - \underbrace{\left[\sum_m (\theta_m^h \varepsilon_{wmpi}) \frac{\partial \ln(p_i)}{\partial \ln(\tau_i)} \mathrm{dln}(\tau_i)\right]}_{Indirect\ Wage\ Effect} \tag{2}$$

Where $s_i^h$ is the share of tradable good I in household h, $s_k^h$ is the share of non-tradable good k in household h. $\theta_m^h$ is the income share of individual m in household h and $\varepsilon_{\mathrm{wmpi}}$ is wage-price elasticity.[101]

In this way it is possible to analyse the impact of trade opening on household welfare at three levels: a direct one that evaluates the effect of the tariff change on domestic prices for tradable goods (the first part of equation (2)), an indirect one that considers the change in non-tradable goods prices resulting from the change in tradable goods prices (the second part of equation (2)) and a third one that captures the change in the production structure resulting from the price change, which influences wage changes (the third part of equation (2)). The advantage of writing out the problem in this way is that each of the effects is isolated, enabling us to deal with each case separately and carry out an econometric estimation of each effect.

We shall now present the strategy for estimating each effect, noting that this study

[99] Frankel, Parsley and Wei (2005) can be recommended for a review of progress in this area.
[100] This specification implicitly ignores effects on saving.
[101] A more detailed description of this derivation can be found in Porto (2006).

concentrates on the first two effects, ignoring the third one.[102] The implicit assumption behind this simplification is that there is no change in the labour market as a result of trade opening. Leaving this aspect out of consideration tends to give the findings a positive bias, but the analysis remains valid considering that its objective is to clarify short-run effects.

## 1. Estimating the price pass-through coefficient

Unlike Porto (2006), but like other studies on short-term price pass-through, this paper does not assume that tradable goods markets are perfectly competitive, so that tariff-adjusted international equilibrium prices are not directly equated with domestic prices. The other fundamental difference is that observed tradable product prices were used in the exercise, so that it was unnecessary to make any inference about price changes. This meant that the degree of tariff pass-through to the domestic market could be estimated directly.

Formally, we can approximate $\frac{\partial \ln(p_i)}{\partial \ln(\tau_i)} \mathrm{dln}(\tau_i)$ using the following tradable price dynamic:

$$p_i = p_i^*(1+\tau_i)^{\alpha} \tag{3}$$

where $p_i$ is the domestic price of tradable good i in local currency, $p_i^*$ is the international price of tradable good i in local currency, $\tau_i$ is the tariff and α is the pass-through factor for the effect of tariff changes on local prices. By taking the differential of equation (3) in logarithms, we can approximate the direct effect as follows:

$$\frac{\partial \ln(p_i)}{\partial \ln(\tau_i)} \mathrm{dln}(\tau_i) \cong \alpha \tag{4}$$

To estimate α in this section, we adapt the methodology proposed by Mallick and Marques (2008) for calculating the parameters for pass-through of tariff changes to tradable product prices. The functional form specified by this relationship (arrived at by resolving an imperfect competition model in which importers have the option of adjusting prices when the exchange rate changes or tariffs are adjusted) is given by the following equation:

$$dp_{it}^m = \phi_i + (1-\delta_i) d\ln(e_t) + \alpha_i d\ln(\tau_{it}) \tag{5}$$

where $\phi_i = (1-\delta_i) d\ln(MC_i)$, with $MC_i$ being the marginal cost associated with the specific sector i, which is assumed to be constant throughout the period studied, while $e_t$ is the nominal exchange rate and $\tau_{it}$ the tariff for sector i in period t and $\alpha_i = -\delta_i K$ , where K is a scaling constant. The parameters $\delta_i$ and $\alpha_i$ therefore depend on the degree of market competition.[103] If $\delta_i = 0$ then the importer has the market power to absorb all changes, which means that there is zero pass-through of any tariff cut to domestic prices.[104]

[102] See the literature review section for more details of studies that include the income effect. An extension of this study which includes the income effect is forthcoming. Here, it is the impact on short-term prices that is considered.

[103] The δ coefficient varies between 0 and 1 and is related to the ability of the importer to set prices in the market. δ affects pass-through of both exchange-rate and tariff changes. See Mallick and Marques (2008) for greater detail in the derivation.

[104] Formally, the importer has the market power to decide how much of the change to pass through to the local price, and this creates a problem of asymmetrical adjustment if our understanding is that a benefit-maximizing firm passes through increases but not reductions. This is not a problem in our application because tariffs only fell, and it is therefore assumed that all importers in principle are going to be unwilling to pass on this reduction.

Using this result, we can specify the econometric function to be estimated as follows:

$$dp_{it}^{m} = \phi_i + \mu d\ln(e_t) + \alpha_i d\ln(\tau_{it}) + \varepsilon_{it} \quad (6)$$

Setting out from the characterization of α, the first part of equation (2) is calculated directly since the share of output within the consumption basket $s_i^h$ is observable. Removing the assumption of full pass-through of tariff changes to local prices on the basis of the information available is a non-trivial extension that enables us to produce more realistic calculations of the effects of trade opening; besides, it is natural to assume imperfect markets in at least some product categories.

## 2. The indirect effect of tariffs on non-tradable goods

The second step in the estimation strategy is to characterize the effect of import prices on non-tradables prices in the economy, the second effect in equation (2). In this case we needed to find parameters that would let us duly characterize the ratio $\partial \ln(p_k) / \partial \ln(p_i)$. For this, we followed the specification proposed

by Porto (2006) in which non-tradables prices are assumed to be an unknown function of tradables prices

and of υ and φ.

$$p_k = p_k(p_i, \upsilon, \phi) \quad (7)$$

where υ and ϕ are factors related to the state of the economy.[105] An adjustment dynamic was introduced to

$$\log p_{kt} = A + \sum_{i\in I} \alpha_{0i} \log p_{it} + \frac{1}{2}\sum_{i\in I}\sum_{j\in K\{k\}} \alpha_{ijt} \log p_{it} \log p_{jt} + \sum_{i\in I} \beta_{0i} \log p_{it-1} + \frac{1}{2}\sum_{i\in I}\sum_{j\in K\setminus\{k\}} \beta_{ijt} \log p_{it-1} \log p_{kt-1} + c_t'\gamma_c + \mu_t \quad (8)$$

Equation (8) represents the functional form to be estimated in the data where $c_t'$ is a vector of control variables and $\mu_t$ the white noise error term, k is the non-tradable product, *j* represents the non-tradable product groups in the set *K* that are different than k and *i* represents the tradable products groups in the set *I*. For each non-tradable prices group k, this specification yields a vector of parameters corresponding to each of the tradable product groups $i \in I$ and the interaction with the tradable and the non-tradable product groups.

Note should also be taken of the potential for serial autocorrelation of errors, given that nominal prices are used for the estimation. Because prices are grouped into eight categories, to avoid the potential problem of heteroskedasticity the estimations were carried out by the generalized least squares method using the methodology proposed by Cochrane-Orkut.[106] The results are presented in the following section.

As mentioned in the previous section, this paper does not set out to analyse the dynamic effects of labour market changes, and accordingly estimates of the income effect are not included.

[105] Formally, υ is factor endowment in the economy and φ is the technical progress factor; these are assumed to be constant and will be captured by the intercept in the econometric estimation. Details in Porto (2006).

[106] Different specifications were tried out for the model and this last one proved the best. See the annex for an example in the case of food.

Completing the analysis by estimating these parameters is certainly a challenge that will be taken up in future.

# D. Applying the model. The case of Chile

## 1. Selecting a country for the case study

To carry out a particular application of the model to the derivation of social impacts, we reviewed the countries that had signed the most free trade agreements and applied the furthest-reaching trade reforms in the past two decades. For these countries, the availability of information in all the databases required for the modelling was analysed. Table X.1 shows the availability of the requisite information for the countries of Latin America, providing the basis for the selection of a pilot country for the methodology. Note that it is necessary to have a number of datasets with particular data on: (i) the evolution of border protection at the product level (tariffs), (ii) family incomes and expenditure by representative product group, (iii) socio-economic household surveys, (iv) the evolution of domestic prices in the economy and (v) imports at the product level.

Taking into account the data availability analysis, the relevance of a study like the one proposed and, above all, the judgement as to whether the exercise proposed in the previous section would definitely be possible, the conclusion was that there were at least three countries for which an ex post study was possible at the present time. These are Chile, Costa Rica and Guatemala, where reforms are of longer standing than in others of the countries considered. Another group of countries in which this methodology might usefully be applied are the remaining Central American countries, El Salvador, Honduras and Nicaragua, which on average have also been granted large preferences and have more than 37 trading partners. The domestic prices dataset presented the greatest problems of accessibility.

In terms of scope for applying the method, Chile was the best option and was accordingly selected for the pilot exercise, although this does not mean that similar exercises cannot be carried out in future for other countries. The following subsection details the steps taken to prepare the data before the proposed methodology was applied.

**TABLE X.1**
**LATIN AMERICA (SELECTED COUNTRIES): AVAILABILITY OF INFORMATION REQUIRED FOR THE PROPOSED ANALYSIS (AS OF NOVEMBER 2010)**

| Country | Most-favoured-nation tariff (2009) | Tariff applied (2009 estimate) | Number of countries preferences granted by | Preferences as percentage of total imports | Surveys available | | | Tariffs and imports |
|---|---|---|---|---|---|---|---|---|
| | | | | | Household | Family income and expenditure | Domestic prices | |
| Brazil | 13.6 | 11.8 | 12 | 13.6% | Yes | Yes | No | Yes |
| Chile | 6.0 | 1.0 | 60 | 83.7% | Yes | Yes | Yes | Yes |
| Colombia | 12.5 | 9.4 | 15 | 24.5% | Yes | Yes | No | Yes |
| Costa Rica | 5.4 | 1.1 | 51 | 78.8% | Yes | Yes | … | Yes |
| Ecuador | 11.2 | 7.9 | 11 | 29.9% | Yes | Yes | No | Yes |
| El Salvador | 5.9 | 1.6 | 40 | 72.4% | Yes | Yes | No | Yes |
| Guatemala | 5.6 | 1.6 | 38 | 72.3% | Yes | Yes | No | Yes |
| Honduras | 5.6 | 1.1 | 37 | 79.9% | Yes | Yes | No | Yes |
| Mexico | 11.5 | 2.4 | 43 | 79.4% | Yes | Yes | Yes | Yes |
| Nicaragua | 5.6 | 1.3 | 39 | 77.6% | Yes | Yes | No | Yes |
| Peru | 5.5 | 2.0 | 17 | 63.8% | Yes | Yes | No | Yes |
| Dominican Republic | 7.1 | 2.0 | 47 | 72.3% | … | … | … | Yes |
| Venezuela (Bolivarian Republic of) | 12.2 | 4.8 | 25 | 60.3% | Yes | Yes | No | Yes |

Source: Prepared by the authors on the basis of World Trade Organization (WTO), World Tariff Profiles (http://stat.wto.org), United Nations Commodity Trade Database (COMTRADE) and information provided by national statistical offices.

## 2. Description of the Chile data

For the methodology described above to be applied, as already noted, it is necessary to bring together a variety of databases and surveys that usually intersect at only a few points. The following are all the data sources selected in accordance with the needs of the model:

- The family expenditure survey (EPF) for 1997 and 2007, prepared by the National Institute of Statistics (INE) of Chile, was used to calculate the shares of different products in each household's consumption basket.
- Average tariffs weighted by imports from the country's trading partners were used to define changes in trade policy. This information was obtained from the Trade Analysis and Information System (TRAINS) of the United Nations Conference on Trade and Development (UNCTAD).
- Nominal exchange rate series were obtained from the databases published by the Central Bank of Chile for the period between January 1982 and September 2010.
- The required domestic price information was taken from the INE database. This database has a coverage of 456 final consumption products and services for the Metropolitan Region of Santiago. The periodicity of the data is monthly from January 1999 to December 2008 and matches that of the basket of products used to calculate the Consumer Price Index (CPI). These products were grouped into eight categories: (i) food, (ii) housing, (iii) household equipment, (iv) clothing, (v) transport, (vi) health care, (vii) education and leisure and (viii) others. [107]
- The family income data are also taken from the EPF for 1997 and 2007.

A particular challenge was to find a way of using common variables to integrate the price databases with the international trade databases and the income and expenditure survey. For this purpose, each product in the CPI goods and services basket was individually mapped with its respective spending category in the EPF, which in turn was mapped with its respective product category in the nomenclature of the six-digit Harmonized Commodity Description and Coding System. [108] This procedure was crucial for effectively capturing any changes between 1999 and 2006, the last year for which mapped and processed information was available at the close of the financial year.

The work of correlating tariff changes with changes in the set of prices available was carried out in full; these accounted for 96% of the EPF expenditure categories. In the case of tradables, all the goods in the consumption basket had their corresponding codes in the Harmonized System.

Table X.4 further on presents the structure of family incomes in the two surveys by quintiles and the evolution of tariffs during the period of analysis for each of eight product groups. It also illustrates the degree of inequality by expenditure on each product group in the 1997-2007 period.

A detailed analysis shows that tariffs changed dramatically between 1999 and 2006, with tariff cuts of between 5% and 10% for all product groups. This meant that the average effective tariff fell from 10% to 1.9%. At the same time, it shows how the aggregate preferences of the population shifted between 1997 and 2007, the years when the EPF was processed. Note that the bulk of aggregate spending by Chilean families is in the food, health-care and household equipment categories.

## 3. Calculating price pass-through coefficients

Using the econometric specification described in equation (6) and the data described in the previous section, a balanced panel was constructed for the 1999-2008 period covering 483 products grouped

[107] A listing of the products in each category can be found in the appendix to Duran, Finot and LaFleur (2010).
[108] The mapping lists will be available from the authors upon request.

into eight categories. Unit root tests were then carried out to verify that the panel series were all stationary. The results of the tests show that prices at least were not stationary in levels but were in first differences, so this specification was used for the estimates.

The parameter estimates for price pass-through from the border to the domestic market are presented in Table X.2. These parameters show that with the exception of one category of health-care products, all the adjustment factors match what economic intuition would suggest, both in the normal panel data model and in the model adjusted for potential problems of heteroskedasticity and autocorrelation. [109]

**TABLE X.2**
**ESTIMATED EFFECT OF DIRECT PASS-THROUGH OF TARIFF CHANGES ON DOMESTIC PRICES**

| Product category | Panel data | | Generalized least square panel data | |
|---|---|---|---|---|
| | Coefficients | Standard errors | Coefficients | Standard errors |
| Food | 0.075* | (0.025) | 0.140* | (0.020) |
| Housing | 0.059 | (0.061) | 0.093** | (0.038) |
| Equipment | 0.077** | (0.031) | 0.114* | (0.022) |
| Clothing | 0.215* | (0.039) | 0.330* | (0.024) |
| Transport | 0.150 | (0.106) | 0.134* | (0.046) |
| Education | 0.068 | (0.042) | 0.119* | (0.024) |
| Health care | -0.107* | (0.036) | -0.243* | (0.024) |
| Other | 0.723* | (0.136) | 0.883* | (0.082) |
| Diff ln(Exchange rate) | 0.885* | (0.018) | 0.735* | (0.017) |
| Observations | | 5 762 | | 5 762 |
| Number of subgroups | | 230 | | 230 |

Source: Prepared by the authors on the basis of econometric estimates.
Note: Standard errors in parentheses.
** significant at 5%.
* significant at 1%.

The findings show that adjustment of tariff changes is far from matching the hypothesis of a single price and thus of perfectly competitive markets with full pass-through. This evidence agrees with the findings of similar studies, of which we can name Feenstra (1989), Menon (1993) and Mallick and Marques (2008), with the last of these also finding results with a negative sign for some sectors. It should be noted that the category with the highest pass-through is clothing, which covers textiles, apparel and footwear, followed by the food and equipment groups. Although the others category shows a high coefficient, this grouping contains only a few products. All the coefficients are statistically significant.

With the estimated pass-through coefficients by product group, and with the information on the consumption basket of each household, it is possible to estimate the direct effect on each household on the basis of the EPF data. The objective is to compare the sensitivity of benefits to international price changes by income level, on the basis of tariff changes in the period.

[109] The coefficients are adjusted for potential problems of heteroskedasticity or error autocorrelation with a model of generalized least squares in panel. The market for medicines is a special case; Chile recently had an investigation into collusion among pharmacies that clearly revealed a low-competition environment and could explain the sign of the coefficient.

## 4. Findings for the indirect price effect

The second step in the estimation strategy is to characterize the effect of import prices on non-tradables prices in the economy, the second effect in equation (2). For this, the regressions were run in accordance with the specification of equation (8); in this case, different specifications were run starting with the ordinary least squares model, but there are two problems to be taken into account. First, each product category has its own variance, so there is a problem of heteroskedasticity; furthermore, because prices are what are at issue, there is a problem of serial correlation of errors. Although this problem does not affect the level of the estimator found, it does affect the quantification of the standard errors. To correct this, we used the methodology proposed by Cochrane-Orcutt, which controls for both problems (heteroskedasticity and correlation of errors) at the same time.

For each of the product categories, we ran the regression that had the price level of the tradable products category as its dependent variable and all non-tradable product price categories as independent variables. Lagged prices and month and year dummies were also included as controls. By way of illustration, the annex shows the results of all the models for the specific case of the food category.

The findings presented in Table X.5 represent the full regressions using the Cochrane-Orcutt methodology with all the controls and dummies for each of the product categories. There is no ex ante presumption of what the right signs for the coefficients are, as these depend on the degree to which products are complementary or interchangeable. However, it is possible to observe that the coefficients which are statistically significant are usually those which are associated with the same category.

By way of illustration, we analyse the elasticity coefficient between the prices of the food inputs required for non-tradable food activities, including restaurants and hotel services among other users of certain imported products such as bread, biscuits and preserves, flours, dairy products, soft drinks and natural fruit juices, spirits, fruit and vegetables, etc. The coefficient calculated is 0.256. From this it follows that if there is a change of 1% in tradable food product prices, one quarter will pass through to the prices of non-tradable products. In summary, the expected effects in terms of lower domestic prices for restaurant and hotel tourist services are quite small. Much the same thing, with low and significant coefficients (0.162), is observed in the case of housing and non-tradable related services.

In the cases of non-tradable health-care and education services, no direct relationship is observed, as the coefficients are actually negative and non-significant. The logical conclusion is that for education services and medical care of various kinds, lower prices for school materials such as textbooks or for medicines do not affect the prices of education and health services, respectively.

When the categories are completely different, the correlations are usually not significant in the regression, and this holds for many of the cases indicated in Table X.3. The results reported in Table X.5 also demonstrate the presence of autocorrelation when the difference in Durbin-Watson indicators between models is observed.

**TABLE X.3**
**RESULTS OF THE ESTIMATION: EFFECT OF INDIRECT TRADABLES PRICE PASS-THROUGH ON NON-TRADABLES PRICES**
*(Cochrane-Orcutt methodology)*

| Tradables \ Non-tradables | Food | Housing | Equipment | Clothing | Transport | Health care | Education | Others |
|---|---|---|---|---|---|---|---|---|
| Food | 0.256* | -0.014 | 0.080+ | 0.046 | 0.012 | 0.043 | 0.062** | 0.092** |
| | (0.034) | (0.096) | (0.048) | (0.061) | (0.061) | (0.029) | (0.025) | (0.041) |
| Housing | 0.134* | 0.162** | 0.072 | 0.119+ | 0.207* | 0.060** | 0.047 | 0.124* |
| | (0.049) | (0.065) | (0.044) | (0.070) | (0.069) | (0.027) | (0.038) | (0.042) |
| Equipment | 0.623* | 1.428* | 0.214 | 0.255 | -0.378 | 0.139 | 0.684* | 0.629+ |

(continues)

Table X.3 (conclusion)

| Tradables \ Non-tradables | Food | Housing | Equipment | Clothing | Transport | Health care | Education | Others |
|---|---|---|---|---|---|---|---|---|
| | (0.194) | (0.469) | (0.320) | (0.377) | (0.611) | (0.240) | (0.208) | (0.366) |
| Clothing | 0.163 | -0.014 | -0.029 | 0.306+ | -0.037 | -0.091 | -0.241 | -0.049 |
| | (0.103) | (0.201) | (0.123) | (0.180) | (0.244) | (0.115) | (0.149) | (0.156) |
| Transport | -0.061 | -0.239** | -0.013 | -0.063 | 0.070 | -0.021 | -0.135* | -0.101+ |
| | (0.057) | (0.093) | (0.056) | (0.066) | (0.076) | (0.029) | (0.039) | (0.056) |
| Health care | -0.060 | -0.132+ | 0.010 | -0.149** | 0.025 | -0.027 | 0.001 | -0.032 |
| | (0.041) | (0.067) | (0.042) | (0.072) | (0.108) | (0.027) | (0.042) | (0.043) |
| Education | 0.233+ | 0.198 | -0.025 | -0.149 | 0.571+ | 0.052 | -0.267 | 0.063 |
| | (0.138) | (0.318) | (0.174) | (0.209) | (0.318) | (0.156) | (0.172) | (0.196) |
| Others | 0.038** | -0.028 | 0.023 | 0.040 | 0.059 | 0.018 | 0.075* | 0.031 |
| | (0.019) | (0.056) | (0.018) | (0.041) | (0.039) | (0.023) | (0.018) | (0.019) |
| Number of observations | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 |
| $R^2$ | 0.995 | 0.847 | 0.965 | 0.979 | 0.982 | 0.972 | 0.997 | 0.987 |
| Durbin-Watson statistic | 1.76 | 1.96 | 1.99 | 2.08 | 1.86 | 1.67 | 2.04 | 1.84 |
| Durbin-Watson statistic 0 | 0.90 | 1.04 | 1.22 | 1.05 | 1.11 | 0.92 | 1.48 | 0.98 |

Source: Prepared by the authors on the basis of econometric estimates.
Note: Standard errors in parentheses.
+ Significant at 10%.
** significant at 5%.
* significant at 1%.

## E. Welfare effects

This section calculates the welfare effect, in accordance with measures 1 and 2 described in equation (2), on the basis of the calculations of the pass-through coefficients for tradable and non-tradable products in the preceding section, in addition to the household expenditure structure described below.[110] The results are analysed at the level of income groupings (quintiles and deciles) to reach a correct appreciation of the effects of trade policy changes on the welfare of the most economically vulnerable households. At the same time, the extent of inequality is illustrated with a measure that relates differences in consumption between the last and first population quintiles. In order to make the analysis comprehensive and obtain derivations for public policy purposes, we proceeded to estimate the money amount (millions of pesos) for the whole population and for different groups of households at the level of population deciles and quintiles.

Table X.4 illustrates the extent of tariff changes by product group between 1999 and 2006, together with the evolution of the family expenditure structure in these same groups. When inequality levels for different population segments are calculated by quintiles, the highest-income quintile (Q5) is found to have spent about 17.5 times more than the lowest income quintile (Q1) in 2007 or thereabouts. Although this fell between 1997 and 2007, inequality is quite elevated for several groups.

[110] It should be stressed once again that the measures arrived at in the exercises presented are a representation of the real short-run effects on the population of Santiago, Chile, and do not include the indirect effect on wages resulting from any gains/losses that might have derived from trade policy reforms. Were these effects considered, the results could alter. A calculation for this type of direct effect on employment will be presented in future.

**TABLE X.4**
**CHILE: EVOLUTION OF TARIFFS, FAMILY EXPENDITURE AND INEQUALITY IN HOUSEHOLD SPENDING**
*(Percentage points and multiples)*

| | Tariffs calculated *(Percentages)* | | | Family expenditure structure *(Percentages)* | | Inequality measured by family expenditure *(Multiples)* | |
|---|---|---|---|---|---|---|---|
| Product groups | 1999 | 2006 | Change 1999-2006 | 1997 | 2007 | Q5/Q1 1997 | Q5/Q1 2007 |
| Food | 10.0 | 3.3 | -6.7 | 21.5 | 21.5 | 5.3 | 6.1 |
| Housing | 10.0 | 0.4 | -9.6 | 7.0 | 5.1 | 33.4 | 43.4 |
| Equipment | 10.0 | 2.1 | -7.8 | 12.0 | 13.0 | 10.4 | 8.7 |
| Clothing | 10.0 | 4.6 | -5.4 | 10.4 | 8.5 | 46.2 | 26.1 |
| Transport | 10.0 | 2.8 | -7.3 | 5.9 | 6.3 | 40.1 | 40.5 |
| Health care | 10.0 | 1.2 | -8.8 | 28.6 | 22.6 | 48.0 | 39.1 |
| Education | 9.4 | 1.4 | -8.0 | 5.2 | 4.0 | 40.2 | 23.2 |
| Others | 10.0 | 0.4 | -9.6 | 9.4 | 7.1 | 71.3 | 69.5 |
| Total | 10.0 | 1.9 | -8.0 | 100.0 | 100.0 | 20.5 | 17.5 |

Source: Prepared by the authors on the basis of United Nations Conference on Trade and Development (UNCTAD), Trade Analysis and Information System (TRAINS), and 1997 and 2007 family expenditure surveys

Given the great heterogeneity in different households' consumption levels, evaluation requires spending structures to be disaggregated by product groups for the different population quintiles. It was this structure that largely determined the compensating variation and the greater or lesser incidence of the income distribution effects deriving from the tariff changes observed following the trade policy reforms that took place between 1997 and 2007.

Observation of developments in the family expenditure structure at the quintile level between 1997 and 2007, using data from the family expenditure surveys for those years, reveals the existence of a pattern that is generally heterogeneous in terms of differences between the two ends of the distribution but fairly homogeneous insofar as the preferences of households in the first three quintiles are predominantly concentrated in the food and equipment categories. These products account for some 65% of total spending in lower-income families (see Table X.5). Likewise, spending in the health-care group by the population stratum in the highest quintile is observed to be more significant.

**TABLE X.5**
**STRUCTURE OF FAMILY EXPENDITURE BY QUINTILES AND CATEGORIES, 1997 AND 2007**
*(Percentages of the total)*

| Quintile | 1997 | | | | | 2007 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Type of good | Q1 | Q2 | Q3 | Q4 | Q5 | Q1 | Q2 | Q3 | Q4 | Q5 |
| Food | 49.5 | 42.6 | 35.8 | 28.3 | 12.7 | 43.4 | 37.6 | 33.0 | 27.3 | 15.2 |
| Housing | 3.7 | 6.1 | 7.9 | 9.6 | 5.9 | 2.0 | 4.0 | 6.0 | 6.1 | 5.1 |
| Equipment | 17.2 | 16.2 | 16.2 | 16.2 | 8.7 | 22.2 | 18.8 | 16.0 | 14.1 | 11.1 |
| Clothing | 4.7 | 6.6 | 8.0 | 9.9 | 10.5 | 6.1 | 6.9 | 7.0 | 8.1 | 9.1 |
| Transport | 2.9 | 4.3 | 4.9 | 6.2 | 5.7 | 3.0 | 4.0 | 5.0 | 6.1 | 7.1 |
| Health care | 14.5 | 14.0 | 14.3 | 13.7 | 33.9 | 12.1 | 12.9 | 14.0 | 16.2 | 27.3 |
| Education | 2.5 | 3.4 | 4.7 | 5.6 | 5.0 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Other | 5.1 | 6.6 | 8.3 | 10.6 | 17.6 | 8.1 | 11.9 | 15.0 | 18.2 | 21.2 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Source: Prepared by the authors on the basis of the 1997 and 2007 family expenditure surveys.

# 1. Calculating the welfare effect

In view of the pass-through coefficients and elasticities between tradable and non-tradable products (as derived from the tariff changes calculated previously) and the spending structures of the different socio-economic strata, the effect on household welfare was calculated. For this, the following procedure was used: the data on spending per household were used to construct a matrix of weights for each of the products in each household's basket. The direct effects were calculated by multiplying the tariff change by the estimators for direct effects (pass-through) and indirect effects (change in prices of non-tradables resulting from the change in tradables prices). The result is a vector for each effect (direct and indirect) at the product level that contains the effect of the tariff change. The spending structure defined above (Table X.5) is used to calculate the direct and indirect effect on each household of the change in tariffs in the period considered.

The aggregate results for all income effects are presented in Table X.6. It should be noted that a simple decomposition of the income mass generated by the sum of trade policies in the period analysed yields a short-term benefit equivalent to US$ 59 million, or the equivalent of 0.06% of the gross geographic product of the Metropolitan Region[111] and 0.15% of total household income (see Table X.6). These findings point in the same direction as those of other studies that have found welfare across the economy to increase by between 0.5% and 1.8%,[112] although in these other cases the effect also includes static employment gains.

The calculations performed allow us to conclude that in respect of its short-run ex post effects the liberalization policy applied by Chile was favourable in terms of income for all households in the Metropolitan Region of Santiago. It now remains to break down this finding at the level of the different income strata in the population. The following section will derive the effects at the population quintile and decile level.

**TABLE X.6**
**CHILE (GREATER SANTIAGO): EQUIVALENT VARIATION AFTER LIBERALIZATION BETWEEN 1999 AND 2006**

| Income distribution | Millions of Chilean pesos | Millions of dollars (US$ 1 = 499.28 pesos) | Percentage of total |
|---|---|---|---|
| Gross geographic product of the Metropolitan Region of Santiago | | 75 586 | |
| Total household income (EPF) | 1 361 014 | 32 711 | 100.000% |
| Total effect | 2 002 | 48 | 0.147% |
| Direct effect | 1 967 | 47 | 0.145% |
| Indirect effect | 36 | 1 | 0.003% |

Source: Prepared by the authors on the basis of the methodology developed in the previous sections and the 2007 family expenditure survey.

[111] The GDP of the Metropolitan Region is estimated from its share in the total GDP of Chile (approximately 46% of the total).

[112] Harrison, Rutherford and Tarr (2003, 1997) estimated welfare gains of 1.8% for a situation in which unilateral cuts in the MFN tariff to 6% are combined with the application of additive regionalism policies, i.e., agreements with the United States, Mexico and others. Similarly, Schuschny, Lima and De Miguel (2007) estimated that the welfare gains deriving from various agreements as of around 2004 amounted to 1.2% of GDP for Chile. Schuschny, Lima and De Miguel (2008) likewise estimated additional benefits of 0.8% for the agreements signed by Chile with countries in Asia, especially China, Japan and the Republic of Korea.

## 2. Evolution of the effect by income level

The findings for the direct and indirect effects by quintile show a greater incidence in favour of quintiles 1 to 3, where the increases are large relative to the total income mass of the population (see Table X.7).

**TABLE X.7**
**CHILE (GREATER SANTIAGO): EQUIVALENT VARIATION AFTER THE TARIFF CHANGE BETWEEN 1999 AND 2006**
*(Millions of pesos a month and percentages)*

| Quintile | Total household income (2007) *(millions of pesos)* (A) | Direct effect *(percentage)* (B) | Indirect effect *(percentage)* ( C ) | Change in tariffs *(percentage points)* (D) | Compensating variation *(millions of pesos)* (E)=((B+C)*A/100)*-1 | Percentage of total |
|---|---|---|---|---|---|---|
| Q1 | 87 883 | -0.218 | -0.002 | -7.5 | 179 | 0.20 |
| Q2 | 143 865 | -0.192 | -0.002 | -7.6 | 258 | 0.18 |
| Q3 | 185 316 | -0.180 | -0.002 | -7.8 | 312 | 0.17 |
| Q4 | 267 718 | -0.164 | -0.002 | -7.9 | 422 | 0.16 |
| Q5 | 676 233 | -0.141 | -0.003 | -8.1 | 831 | 0.12 |
| **Total** | **1 361 014** | **-0.178** | **-0.002** | **-8.0** | **2 002** | **0.15** |

Source: Prepared by the authors on the basis of the methodology developed in the previous sections and the 2007 family expenditure survey.

A somewhat more extensive disaggregation of the effects at the decile level shows, however, that lower-income households have seen a greater variance in the observed impacts on the prices of their baskets than higher-income households. It can be seen that the price pass-through effect is largest (24%) in the first decile, with per capita monthly incomes of less than 62,171 Chilean pesos (or the annual equivalent of 746,052 pesos), being 6 percentage points higher than the average for all households in the distribution and 10 higher than that for the highest-income decile of households. This is a very important finding, particularly given that the first decile approximates to the population with incomes below the poverty line (52,504 pesos).

If all households from deciles 1 to 6 are considered, the effect proves to be above average in all of them. It should be noted that the average income of these deciles is below the mean income of the population of Greater Santiago and that the total effect is greater, allowing us to conclude that liberalization had a clear pro-poor bias in its short-run effects in that it favoured the lowest-income population strata in the fifth region (see Table X.8).

**TABLE X.8**
**CHILE (GREATER SANTIAGO): DECOMPOSITION OF DIRECT AND INDIRECT EFFECTS BETWEEN 1999 AND 2006**
*(Thousands of pesos a month and percentages)*

| Decile | Number of people | Income cut-off by decile | Effects calculated (percentages) | | | Standard deviation | Symmetry measure |
|---|---|---|---|---|---|---|---|
| | | | Direct | Indirect | Overall effect | | |
| 1 | 768 162 | 62 171 | -24.3 | -0.15 | -24.5 | 19.95 | 0.58 |
| 2 | 712 521 | 87 643 | -19.2 | -0.18 | -19.4 | 19.57 | -0.68 |
| 3 | 686 470 | 109 843 | -19.5 | -0.19 | -19.7 | 17.17 | 0.88 |

(continues)

Table X.8 (conclusion)

| Decile | Number of people | Income cut-off by decile | Effects calculated (percentages) | | | Standard deviation | Symmetry measure |
|---|---|---|---|---|---|---|---|
| | | | Direct | Indirect | Overall effect | | |
| 4 | 628 541 | 133 836 | -18.8 | -0.20 | -19.0 | 18.17 | 0.79 |
| 5 | 596 831 | 163 455 | -18.0 | -0.21 | -18.2 | 18.91 | 1.03 |
| 6 | 532 692 | 203 904 | -17.9 | -0.22 | -18.1 | 17.28 | 1.02 |
| 7 | 512 588 | 265 701 | -16.5 | -0.23 | -16.7 | 15.31 | 1.07 |
| 8 | 474 192 | 376 650 | -16.2 | -0.24 | -16.5 | 18.08 | 0.46 |
| 9 | 474 837 | 645 137 | -14.5 | -0.28 | -14.8 | 14.77 | 1.36 |
| 10 | 400 267 | >645 137 | -13.7 | -0.32 | -14.1 | 15.83 | 1.55 |
| **Total** | **5 787 100** | **235 180** | **-17.8** | **-0.22** | **-18.0** | **17.46** | **0.82** |

Source: Prepared by the authors on the basis of the methodology developed in the previous sections and the 2007 family expenditure survey.

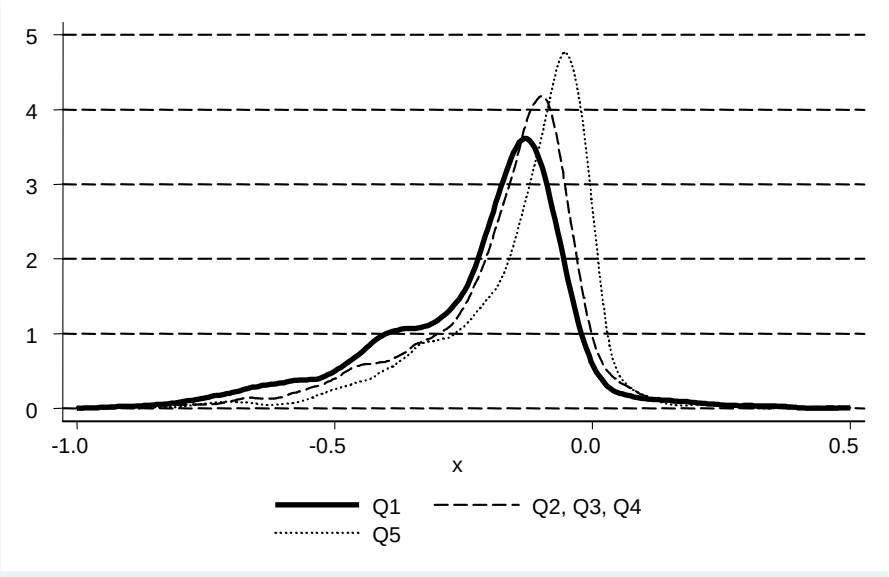
To determine the greater or lesser pro-poor effects of liberalization more clearly and comprehensively, the income distribution density function was defined for the first quintile, the fifth quintile and the other three quintiles (Q2 to Q4). Figure X.1 shows the number of households for each level of benefit. Overlapping the three functions, we see that the distribution of benefits in quintile 1 is centred more to the left, indicating a greater impact in favour of that group. [113] Similarly, Figure X.2 shows that a larger number of households obtain a greater benefit than in the rest of the quintiles. This chart also shows that in some cases (although relatively few), a small proportion of households in all quintiles experience a loss of welfare, this being the result of the negative pass-through coefficient for health care calculated in Table X.2.

Generally speaking, the more favourable outcomes for the poorest quintile are a clear manifestation of the pro-poor impact of trade policy changes in Chile between 1996 and 2006. Nonetheless, a somewhat more thorough analysis of alternative policies showed that public policy challenges remained (see next section).

Table X.9 calculates the equivalent variation for the different population quintiles at the level of both households and number of inhabitants. Note that each household in the poorest quintile is calculated to have received benefits amounting to some 7,000 pesos a year after liberalization, representing an increase in income of 0.22%. Measured in per capita terms, the benefits to individuals in the first quintile of households represent extra income of just over 1,450 pesos, or about 130 pesos a month. The amount of the benefit continues to rise by quintile, so that the wealthiest quintile experiences a somewhat larger increase in absolute welfare of 11,399 pesos for those forming part of this group. On average, the welfare gains are equivalent to a benefit of 4,100 pesos a year for each individual in the Metropolitan Region of Santiago.

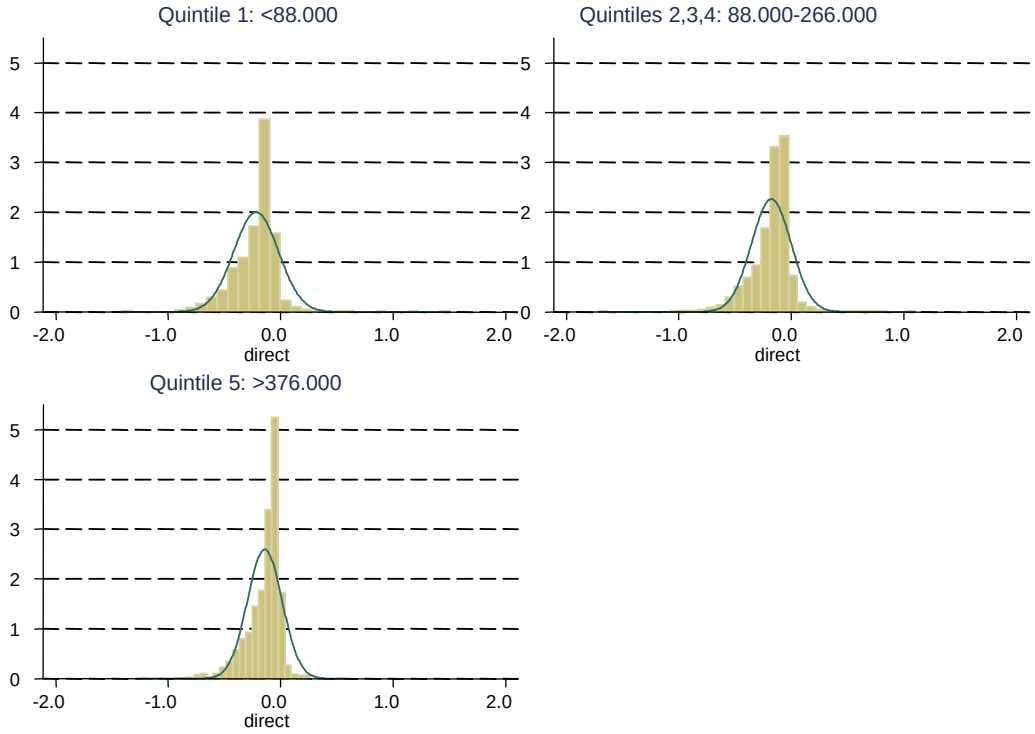
[113] The benefit is measured by the fall in the cost of the household basket, which is why the number reported is negative.

**FIGURE X.1**
**DISTRIBUTION OF BENEFITS AMONG HOUSEHOLDS BY QUINTILE**




Source: Prepared by the authors on the basis of the methodology developed in the previous sections and the 2007 family expenditure survey.

**FIGURE X.2**
**DISTRIBUTION OF BENEFITS AMONG HOUSEHOLDS BY QUINTILE**




Source: Prepared by the authors on the basis of the methodology developed in the previous sections and the 2007 family expenditure survey.

**TABLE X.9**
**CHILE (GREATER SANTIAGO): EQUIVALENT VARIATION AFTER TARIFF CHANGE BETWEEN 1999 AND 2006**
*(Pesos and percentages)*

| | Annual equivalent variation | | Equivalent variation per household (pesos) | | Equivalent variation per person (pesos) | |
|---|---|---|---|---|---|---|
| | (Millions of pesos) | Percentage of total income in each quintile | Monthly | Annual | Monthly | Annual |
| Q1 | 1 439.8 | -0.218 | 548 | 6 582 | 121 | 1 453 |
| Q2 | 2 120.6 | -0.192 | 792 | 9 501 | 196 | 2 358 |
| Q3 | 2 614.9 | -0.180 | 955 | 11 462 | 276 | 3 311 |
| Q4 | 3 500.7 | -0.164 | 1 291 | 15 493 | 427 | 5 126 |
| Q5 | 7 914.5 | -0.141 | 2 547 | 30 563 | 950 | 11 399 |
| **Total** | **17 590.5** | **-0.178** | **1 227** | **14 718** | **346** | **4 152** |

Source: Prepared by the authors on the basis of the methodology developed in the previous sections and the 2007 family expenditure survey.

The following section explores some policy alternatives using certain assumptions that modify the baseline scenario defined previously. A counterfactual analysis is then performed and some policy conclusions drawn.

## 3. Some public policy simulations

This section simulates six counterfactual scenarios as alternatives to the changes observed and presented in the previous section. The characteristics of the alternative scenarios will now be described:

- Scenario 1: Uniform transfer of benefit: It is assumed that benefits are redistributed uniformly among all individuals, giving 4,152 pesos a year per individual in every household. Income exceeding the average is withdrawn from quintiles four and five and reallocated to the first three quintiles so that all individuals in the population receive the equivalent of 4,152 pesos.
- Scenario 2: Robin Hood-style transfers: The benefits of the higher-income quintiles are redistributed to the lower-income quintiles. A benefit equivalent to 5,000 pesos per individual per year was calculated for each inhabitant belonging to the first three quintiles. This amount is withdrawn from the benefit mass of the fourth and fifth quintiles.
- Scenario 3: Liberalization favouring the poor alone: It is assumed that tariff changes between 1999 and 2006 only occurred in the food and clothing groups, with the 1999 tariff level being retained for the remaining groups.
- Scenario 4: Further liberalization favouring the poor: There are assumed to have been further-reaching tariff changes favouring the consumption basket of the most vulnerable households, i.e., tariffs both on food, drinks and tobacco and on textile and clothing products are cut to zero.
- Scenario 5: Full price pass-through: This scenario simulates a rise in pass-through coefficients from the levels calculated in the econometric estimates presented in the study

to 1, following the lead of Porto (2006), who assumes full pass-through of tariff cuts to domestic prices.

- Scenario 6: Full price pass-through and Robin Hood-style transfers: This scenario simulates the rise in pass-through coefficients on the assumption of full pass-through of tariff cuts to prices plus simultaneous application of direct transfers from higher-income households to lower-income ones.

The results obtained are compared with the observed changes using the parameters calculated (Table X.10). It can be seen that policies to redistribute income from the top quintiles to the lowest-income ones have direct effects in improving inequality and thus in reducing somewhat the incidence of poverty.

If, in addition to the results observed, redistributive social policies had been implemented to help the lowest quintile of the population, either through provision of a uniform benefit (the same for the whole population) or one targeted only on the poorest, the income of these three groups would have been greatly increased. Although society as a whole does not register changes in welfare, scenarios 1 and 2 are clearly beneficial to the poor. Thence it can be concluded that well-targeted direct social policies can serve as a palliative to level the benefits playing field, especially if there are large asymmetries in the results, which is not the situation in the case analysed.

A second set of alternative measures, presented in scenarios 3 and 4, also show improvements benefiting the poor. Here it is shown how larger increases in sectors critical to consumption in the poorest households would tend to improve their relative position as regards benefits received. However, these gains would be marginally less than those observed.

Lastly, simulations 5 and 6 indicate percentage benefit changes in terms of total incomes for a situation where competition in the domestic market increases, i.e., where the pass-through coefficient is allowed to be equal to 1. In this case, welfare gains increase for all groups of households, but especially the poorest. It is interesting to observe that these benefits cease to be marginal for the poor when Robin Hood-style direct transfer policies are implemented, i.e., when income is withdrawn from the highest-income quintiles for the benefit of the bottom quintiles. The poor can increase their welfare by up to three times the observed level.

**TABLE X.10**
**CHILE (GREATER SANTIAGO): EQUIVALENT VARIATION AFTER THE TARIFF CHANGE BETWEEN 1999 AND 2006, OBSERVED CHANGES AND DIFFERENT SCENARIOS**
*(Percentages of total income)*

| Quintile | Observed changes | Social policy of direct transfers with income redistribution | | Alternative trade policy changes | | With rise in pass-through coefficient and income redistribution | |
|---|---|---|---|---|---|---|---|
| | | Scenario 1 Uniform transfer of the benefit | Scenario 2 Robin Hood-style transfers | Scenario 3 Pro-poor | Scenario 4 Further liberalization favouring poor | Scenario 5 Pass-throug= 1 | Full pass-through and Robin Hood-style transfers |
| Q1 | 0.20 | 0.58 | 0.68 | 0.26 | 0.24 | 1.88 | 6.10 |
| Q2 | 0.18 | 0.32 | 0.47 | 0.23 | 0.21 | 1.70 | 4.28 |
| Q3 | 0.17 | 0.21 | 0.39 | 0.22 | 0.19 | 1.57 | 3.57 |
| Q4 | 0.16 | 0.13 | 0.00 | 0.19 | 0.18 | 1.45 | 0.00 |
| Q5 | 0.12 | 0.04 | 0.00 | 0.16 | 0.14 | 1.07 | 0.00 |
| **Total** | **0.15** | **0.15** | **0.15** | **0.21** | **0.19** | **1.33** | **1.33** |

Source: Prepared by the authors on the basis of the methodology developed in the previous sections and the 2007 family expenditure survey.

# F. Conclusions and policy ideas

The study presented has been based on an ex post methodology developed to analyse the effects of liberalization on countries that have brought in trade policy changes, especially in the form of tariff reduction, either unilaterally or by signing free trade agreements. The analysis centres on welfare effects and changes in income distribution following liberalization, and three effects deriving from the estimation of a set of parameters are calculated: (i) the direct impact of price changes on each household's consumption basket in consideration of a coefficient of price pass-through from the border to the domestic market, (ii) the indirect impact of changes in tradable product prices on non-tradables and (iii) the impact of price changes on wages. The first two are calculated in the short run, without considering adjustment dynamics in consumption baskets, while the impact on incomes is felt over a longer period.[114] On the basis of the data available, the case of Chile, and specifically the Metropolitan Region of Santiago, was identified as a pilot for applying the method.

The present study differs from similar ones in that it includes an econometric estimate of the short-run coefficient of pass-through of international prices to domestic prices. The estimated pass-through coefficient was used to analyse household consumption patterns and the way price changes would affect the cost of the basket, which we term the equivalent variation.

From a public policy standpoint, the findings provide enough evidence to argue that liberalization in Chile went in the right direction, generating immediate welfare gains in the Metropolitan Region. The size of the effect calculated is small, bearing in mind that only the very short run is looked at and changes in the consumption basket are not allowed for. Households increased their potential consumption and income by about 0.18% of total baseline income, characterized by their preferences in the EPF 2007 survey. The results by product group were found to be greatest for food and household equipment.

The results of the simulations carried out using the family expenditure survey (EPF) determined that the overall effect (sum of direct and indirect effects) for the period of analysis (1999-2006) was pro-poor to the extent that the lower deciles benefited more than the higher deciles. When the effects were broken down by income quintile it was found that the poorest quintiles/deciles in the population gained more in relative terms than the higher-income groups, receiving an average of 0.4% more of their respective income total than the richest quintile of the population, and more than 5% in the most optimistic simulation.

The price effects of trade policy changes over the period in Chile are positive, although small. These findings point in the same direction as other studies carried out for Chile, which use other methodologies to compute the total effect of trade policy changes in the late 1990s at about 1%, including the effect on employment incomes, something we did not cover in this study. The empirical literature singles out labour markets as an important pass-through channel for the benefits from trade, and the findings presented here bear out that view.

The methodology deployed here also casts light on different potential ways of influencing this pass-through, whether involving further-reaching liberalization of the products that are most important for the poor population or improved pass-through coefficients. Alternative trade policy measures are shown to have more modest effects than direct transfer measures involving cash benefits and transfers between income levels.

[114] Evidence from the literature suggests that the effect of liberalization on incomes, acting through labour markets, is much larger for some households, but it is not clear whether this effect applies right across the poorer population. Most studies have concerned themselves with characterizing the effects on the income variation side. However, it is important to supplement this analysis by measuring the effect of trade policies on domestic prices, as this pass-through channel has a direct impact on household welfare, at least in the short run.

The results generally show that pass-through of trade policy changes has an effect on the poorest population and that there is scope for creating policies that take this link into account. This bias is partly due to the composition of consumption baskets at each income level, which means there is an opportunity for liberalization to adopt a still more favourable bias towards the poorest.

The potential for a liberalization programme to improve income distribution and reduce poverty depends on its differentiated impact. The share of food products is three times as great in the consumption basket of the first quintile as in that of the highest quintile, but the change in tariffs between 1999 and 2007 was smaller in this category than in most others (although the price pass-through coefficient is not high for these products).

Another conclusion of no less importance is that there is scope for complementary competition policies that encourage higher pass-through of tariffs to prices. One of the main reasons why the results are modest is that liberalization passes through to domestic prices to only a small degree, as demonstrated by policy simulations assuming full price pass-through. In this scenario, welfare gains would have been around 1.3% instead of 0.2%. Transfer policies associated with measures to increase competition in local markets would have large multiplier effects in terms of improvements in the relative incomes of the poor, with a much further-reaching impact on the reduction of inequality.

We shall now summarize the main policy recommendations, both technical and economic, derived from the study presented here. These points are offered for consideration as an input into the debate on ex post evaluations of trade policy changes and the way these feed through into new policy design.

- Trade policies have to take account of national development objectives. In the case of Chile, the effects of tariff reductions are very evenly spread, since there is no tariff escalation, and they could well provide a basis for applying supplementary social policies, as it is clear that pass-through of prices from the border to the domestic economy alone does not have a decisive enough impact to reduce the incidence of poverty. Applying protection policies of an inclusive type, however, does prove to have more immediate effects.

- Increasing economic competition to raise pass-through coefficients. A low coefficient indicates that domestic chains are uncompetitive, either because demand elasticity is low or because sellers have the power to extract a large portion of the rent from lower prices at the border. Policies to increase competitiveness in domestic markets, together with actions to reduce friction for transactions in the product marketing chain, are also important for their effect in increasing the benefits from liberalization. Governments need to make an even greater effort to lower transaction costs, as these operate as a form of protection for domestic firms.

- It is suggested that direct transfer policies be applied in cases where liberalization is prejudicial to lower-income sectors of the population, although this is not the case with the results observed for liberalization in the Metropolitan Region of Santiago in Chile. The simulations carried out for direct transfers, be these horizontal across the whole population or clearly pro-poor (Robin Hood-style), have markedly pro-poor effects, and the welfare gains tend to be skewed towards lower-income sectors.

- We recommend the evaluation of gradualist trade policies whereby the effects of liberalization are concentrated in sectors where they benefit lower-income individuals most. Emphasis must be laid, however, on the need for due weight to be given to the opportunity cost of liberalizing intermediate goods needed to improve competitiveness in sectors that have comparative advantages in export products. It is crucial here for this methodology to be combined with others, such as partial equilibrium or computable general equilibrium models, particularly where trade policy research is concerned.

- We suggest that similar analyses be carried out for other countries that still have high levels of protection for certain products in particular and few free trade agreements, but that have applied liberalization policies for capital goods and intermediate inputs, examples being Ecuador and the Plurinational State of Bolivia. These exercises could yield a variety of results. We suggest that analyses be carried out in these instances to compare case studies on protection structures of this type, which are akin to the differentiated levels seen in the protection structures of the MERCOSUR and Andean Community customs unions.
- We recommend that this methodology be used to complete the analysis of the wage effect, including more general results that encompass not just immediate short-run effects but medium- and long-term ones as well. This is a challenge for the future.

Lastly, it needs to be borne in mind that trade policy does not aim primarily at solving the problems of poverty and inequality, but that it does contribute to this. It is in this spirit that the methodology and exercises proposed have been applied, on the understanding that these are complementary to other methodologies developed for the same purpose. Accordingly, it would be wrong to dismiss efforts by a country's authorities to open up new markets on the grounds that the poverty impacts of price pass-through have been very small, or indeed almost marginal. Fortunately, the method also shows that there is scope for public policy to build on this small margin, which can be expanded to benefit the most vulnerable groups in the population.

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# Annex 1

**TABLE X.A1**
**DESCRIPTION AND SOURCES OF THE VARIABLES USED IN THE REGRESSIONS**

| Variable | Description | Source |
|---|---|---|
| Nominal exchange rate | Nominal exchange rate in dollars per Chilean peso, 1999-2008 (monthly) | Central Bank of Chile |
| Product price level | Prices of 483 products in Chilean pesos, Metropolitan Region of Santiago, 1999-2008 (monthly) | National Institute of Statistics (INE) of Chile |
| Tariffs | Weighted average import tariff at the product level, 1999-2008 (annual) | UNCTAD-Trade Analysis and Information System (TRAINS) |
| Imports | Imports in nominal prices at the product level, 1999-2008 (monthly) | UNCTAD-United Nations Commodity Trade Database (COMTRADE) |
| Expenditure per product | Family spending at the product level, Metropolitan Region of Santiago, 1997 and 2007 | INE Chile family expenditure survey |
| Family income | Family income at the household level, Metropolitan Region of Santiago, 1997 and 2007 | INE Chile family expenditure survey |
| Socio-economic characteristics | Personal and household characteristics, Metropolitan Region of Santiago, 1997 and 2007 | INE Chile family expenditure survey |

Source: Prepared by the authors.

**TABLE X.A2**
**PRODUCTS INCLUDED IN THE CONSUMPTION BASKET OF THE CPI FOR THE METROPOLITAN REGION OF SANTIAGO**

| Product group | Number of products in basket | Brief description |
|---|---|---|
| Food | 162 | Baked products, flours, meat, fish, prepared foods, soft drinks, fruit and vegetables, liqueurs and alcoholic drinks, carbonated drinks and natural juices. |
| Housing | 29 | Rent, mortgage payments, property taxes, spending on services such as water and gas, fuels, kitchen appliances and tools such as drills, hammers and paints. |
| Household equipment | 84 | Light bulbs, fluorescent tubes, detergents, bedclothes, cleaning utensils, cookers, washing machines, furniture, ovens, televisions, cameras, computers and printers, among others. |
| Clothing | 75 | Textile products, garments and footwear for all household members (children and adults). |
| Transport | 26 | Spending on cars, buses, flights, car washing, windscreens, shock absorbers, tyres and car parts. |
| Health care | 44 | Numerous medicines such as antacids, flu remedies, contraceptives, high blood pressure medications, vitamins, cough remedies and bronchodilators, among others, plus medical consultations and spending on medical utensils: syringes, towels, scissors, shampoo, colognes and other personal hygiene material. |
| Education and leisure | 55 | School textbooks, non-school texts, newspapers, magazines, small notebooks, large notebooks, pens, pencils, writing pads, tempera, cardboard, glue, recorder, etc., plus education costs. |
| Others | 8 | Professional services, lawyers' fees, notaries' fees, cigarettes, spending on guest and boarding houses, funeral services, association membership dues, spending on care homes, financial spending. |

Source: Prepared by the authors, on the basis of figures provided by the National Institute of Statistics (INE) of Chile. Further details in Durán, Finot and LaFleur (2010).

**TABLE X.A3**
**DIFFERENT REGRESSION MODELS FOR TRADABLE VERSUS NON-TRADABLE PRODUCT PRICES**

| Food (non-tradables) | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | OLS | OLS+dummy | OLS+dummy+ controls | Cochrane-Orcutt |
| Food (tradables) | 0.360* | 0.281* | 0.259* | 0.256* |
| | (0.034) | (0.027) | (0.024) | (0.034) |
| Housing (tradables) | 0.186* | 0.166* | 0.082** | 0.134* |
| | (0.040) | (0.029) | (0.038) | (0.049) |
| Equipment (tradables) | 0.062 | 0.385+ | -0.118 | 0.623* |
| | (0.235) | (0.198) | (0.178) | (0.194) |
| Clothing (tradables) | -0.103 | 0.127 | 0.146+ | 0.163 |
| | (0.089) | (0.102) | (0.079) | (0.103) |
| Transport (tradables) | -0.047 | -0.070+ | -0.013 | -0.061 |
| | (0.043) | (0.039) | (0.036) | (0.057) |
| Health care (tradables) | 0.070** | -0.015 | -0.015 | -0.060 |
| | (0.035) | (0.048) | (0.038) | (0.041) |
| Education/leisure (tradables) | -0.124 | 0.302 | 0.103 | 0.233+ |
| | (0.133) | (0.187) | (0.155) | (0.138) |
| Others (tradables) | 0.158* | 0.056* | -0.007 | 0.038** |
| | (0.024) | (0.016) | (0.018) | (0.019) |
| Observations | 120 | 120 | 120 | 120 |
| R-squared | 0.996 | 0.999 | 0.999 | 0.995 |
| Durbin-Watson statistic | | | | 1.76 |
| Durbin-Watson 0 statistic | | | | 0.90 |

Source: Prepared by the authors on the basis of econometric estimates.
Note: Standard errors in parentheses.
+ Significant at 10%.
** Significant at 5%.
* Significant at 1%.