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# IMPLICATIONS OF THE OPENING OF TRADE ON PRODUCTION, INCOME DISTRIBUTION AND THE BALANCE OF TRADE: A COMPUTABLE GENERAL EQUILIBRIUM MODEL FOR COSTA RICA WITH COUNTERFACTUAL SIMULATIONS

Marco V. Sánchez Cantillo

January 1999

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Marco V. Sánchez Cantillo

January 1999

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# Chapter One

# INTRODUCTION

## 1.1. INTRODUCTION

Many studies developed in Costa Rica have discussed the implications of the opening of trade process on the country's economy. Most of the studies agree on the fact that the process has shifted production towards non-traditional products, exports have been highly promoted and the effect on income distribution has been positive. A minority of the studies has been opposed to these conclusions and has argued that the implementation of alternative trade policies to the opening of trade would have been much more beneficial for the country. However, most of these conclusions have been drawn on the base of common sense and descriptive data analysis, whereas only a few of them have been based on quantitative analysis. Indeed, no well-known modelling technique has been used to arrive at such conclusions and to apply scenario simulations for policy formulation. In addition, the impact of the opening of trade has not been clearly separated from the effects of other structural adjustment policies. It is imperative to add that there is also a lack of objectiveness in many of the studies, as ideological interests have biased the debate on the opening of trade.

Such weaknesses call for the importance of analysing the opening of trade process by using a modelling technique, based on a more objective perspective. This justifies the realisation of this study, which involves the construction of a computabie general equilibrium model to analyse more realistically the opening of trade and to separate its effects from other structural adjustment policies.

## 1.2. STATEMENT OF THE RESEARCH PROBLEM

Costa Rica is a small and open country that enjoyed rapid development during the 1960s and early 1970s, mainly based on exports of a few agricultural commodities, principally coffee and bananas, and the expansion of industrial production. When the terms of trade deteriorated in the late 1970s, as coffee prices dropped and oil prices rose, the government applied expansionary domestic policies to maintain GDP growth. However, the deficits of the public sector resulted in an acceleration of inflation, an appreciation of the Colón, and growing balance of payments deficits, which were largely financed through stepped-up external borrowing, especially from commercial banks.

By 1980, the Colón was seriously overvalued; uncertain economic policies led to capital flight and loss of international reserves. The government allowed the Colón to float by the end of 1980, but as the unbalance in the public finances was not solved, the situation reached crisis proportions during 1981; GDP declined by 2.3 per cent, the current account deficit rose to 15.8 per cent of GDP, the non-financial public sector deficit reached 13.6 per cent of GDP, and inflation climbed up to 37 per cent. Faced with rapidly increasing debt service obligations and depletion of external reserves, Costa Rica suspended the debt service to all but multilateral creditors in August 1981. In response, foreign commercial banks stopped all voluntary lending to the country (MIDEPLAN, 1990).

As a way of facing the debt crisis, stabilising and reactivating the economy, Costa Rica began to implement stabilisation and structural adjustment policies after 1984. The main component of such policies is the opening up of the economy, which targets the integration into the world market. It is

worth mentioning that these policies have been based on a new export-oriented strategy. The participation in multilateral agreements, the Central American Common Market (MCCE) and the free trade agreement with Mexico have also strengthened up the opening of trade in Costa Rica.

The main opening of trade policies are the reduction of import tariffs and export taxes, the concession of export subsidies and the exchange rate devaluation. Some important changes have occurred in the economy after the application of these policies. One example is the transformation in the production structure, which is largely reflected on the agricultural sector. This sector had received high protection for traditional activities such as coffee, bananas, sugar cane, meat and basic grains, before the opening of trade started in 1984. These activities had historically played a key role for Costa Rica's economic development. However, after the new strategy started being implemented, new non-traditional products such as pineapples, ornamental plants, flowers, melons, root vegetables and some manufactures, became relatively more important for the GDP and the exports.

It has been argued that such a change in the structure of production has led to important implications for the economy. Firstly, the discouragement of production in traditional activities has created 'social pressures' for a large amount of producers who depend on them. Secondly, as production of the new non-traditional products requires new types of technologies to be produced, which are largely owned by multinationals and a few local producers, it has been argued that the process has led to concentration in production and income. Many of the 'traditional producers', who played a crucial role for the economy in the past, have left their rural villages to seek work in informal activities in urban areas. Multinational companies have recruited an important number of them who have stayed in the rural areas. In both cases, it has been argued that social conditions of rural households have deteriorated, which has consequently affected income distribution in the country.

Regarding international trade, the opening of trade policies have clearly promoted exports. Exports of non-traditional agricultural products and some non-traditional manufactures have been rising ever since the opening up of the economy began. However, imports continue to growth faster, which makes it difficult to determine whether the opening of trade has been effective to reduce the negative gap in the balance of trade.

From the background already presented, it seems that the opening of trade has had several implications on Costa Rica's economy. The difficulty that arises around such problems is that other structural adjustment policies, as for instance the deregulation of the economy and the reform of the public sector, may have also impacted on the structure of production, the balance of trade and the social conditions of households. The fact that the effects of the opening of trade policies have not been isolated makes it difficult to be certain about the implications of the whole process.

## 1.3. RESEARCH OBJECTIVE

The research objective is to analyse the implications of the opening of trade process in Costa Rica, focusing on production, income distribution and the balance of trade. The analysis is carried out by using a Computable General Equilibrium (CGE) model that involves *counterfactual* simulation in which policy instruments such as import tariffs, export taxes and export subsidies are manipulated, in order to determine how the opening of trade would have impacted on the Costa Rican economy.

## 1.4. RESEARCH HYPOTHESES

In correspondence with the problem stated in Section 1.2, the hypotheses to be tested in this research can be stated as follows:

1. *The opening of trade process implemented in Costa Rica after 1984 has strongly affected production, as the policy instruments tend to promote new export activities.*
2. *The opening of trade has worsened income distribution as on the one hand, it has benefited production activities led by multinationals and large producers, and on the other hand, many rural households have been affected as their production activities have been discouraged.*
3. *The promotion of exports has not led to a reduction in the balance of trade deficit, as aimed by the opening of trade strategy.*

## 1.5. METHODOLOGY

The methodology used in the research is explained in Chapter Four. Nevertheless, it is important to briefly outline some aspects of it. The research hypotheses are tested by using a Computable General Equilibrium (CGE) model whose construction was one of the tasks of the research. The CGE model is static and calibrated to the Social Accounting Matrix (SAM) 1991 for Costa Rica. The justification of using a CGE model lies on the fact that it provides a rigorous framework in which the interaction of all the economic actors across markets can be simulated simultaneously, in a context where trade policies to open up the economy can be implemented. Furthermore, such a type of model has not been constructed in Costa Rica to analyse the implications of the opening of trade, as briefly mentioned in the introductory section of this chapter.

The analysis is comparative as it includes several policy simulation scenarios of the *counterfactual* type, in which one simulates what the effects on production, income distribution and the balance of trade would have been, if the opening of trade policies had been differently applied with respect to the base year 1991. In addition, the model production function gives only the initial production values for the base year 1991, but it is not included in the model to iterate when carrying out policy simulations. The selected policy instruments that are manipulated in the *counterfactual* scenarios are import tariffs, export taxes and export subsidies, which have indeed been the main policy variables used for opening up the economy in Costa Rica.

## 1.6. PLAN OF THE PAPER

This paper is organised as follows. After having introduced the paper in this chapter, Chapter Two presents a theoretical review of the implications of trade liberalisation in developing countries. Chapter Three summarises the opening of trade process in Costa Rica, where the main policies to open up the economy are explained along with the performance of the economy during 1984-1996. Chapter Four presents the methodology that is used to analyse the opening of trade process. The core chapters of the paper are Chapters Five and Six. Chapter Five deals with the construction of a CGE model to analyse the implications of the opening of trade in Costa Rica, where the assumptions and the model structure are presented. Chapter Six is devoted to analyse the opening of trade by carrying out *counterfactual* simulation scenarios through the manipulation of the policy instruments. Finally, a brief summary of the chapters, the main findings of the research, the policy recommendations and the future improvements to the CGE model are presented in Chapter Seven.

# Chapter Two

# THEORETICAL REVIEW OF THE EFFECTS OF TRADE LIBERALISATION IN DEVELOPING COUNTRIES

## 2.1. INTRODUCTION

The purpose of this chapter is to present a theoretical review of the effects of trade liberalisation in developing countries, focusing on the traditional trade theory. It is well known that neither markets are perfect nor an 'invisible hand' can help to optimise the use of resources; therefore, trade policy becomes a key issue. However, it appears that the traditional trade theory continues nowadays to be valid. The policies implemented by many developing countries since the 1980s are firmly based on such a theoretical approach.

The aim of the review presented in this chapter is to identify some of the effects that are theoretically expected from liberalising trade in developing countries. Such effects are briefly compared at the end of the paper with the effects found for Costa Rica, after having carried out a general equilibrium exercise. The analysis focuses on the effects on production, welfare (income distribution and employment) and the balance of trade. Trade liberalisation is analysed as a package of policies aimed at the reduction of import tariffs, export taxes and export subsidies, i.e. other sort of trade barriers are not considered. The effects of trade liberalisation are explained by using the neoclassical general-partial equilibrium approach.

Section 2.2 analyses the expected effects of trade liberalisation in developing countries according to the traditional trade theory. In Section 2.3, the potential effects of free trade on growth and welfare are explained, and how such effects can be rather positive if developing countries liberalise trade. Section 2.4 briefly shows how the fundamentals of World Bank's policies and the General Agreement on Tariffs and Trade (GATT) are strongly based on the traditional trade theory. Finally, Section 2.5 presents the final remarks of the chapter.

## 2.2. TRADITIONAL TRADE THEORY AND TRADE LIBERALISATION

### 2.2.1. The traditional view of trade and developing countries

The message of the traditional trade theory is clear about the benefits of free trade. More than two hundred years ago, Adam Smith concluded that free trade should be the guiding principle for all countries. In the early nineteenth century, David Ricardo elaborated the theory of comparative advantage, which holds that countries benefit from trade when they specialise in the production of the commodity of their comparative advantage. The classical and neoclassical theories explain that because of factor endowments and technology differences, developing countries should specialise in the production and export of primary commodities to developed nations in exchange for manufactured products (Salvatore, 1995: 330). By allowing increasing capacity utilisation and the exploitation of economies of scale, such an exchange enhances productivity and full employment of production factors. Hence, the increasing national product leads to the maximisation of welfare in the long run (Balassa, 1987: 32-33).

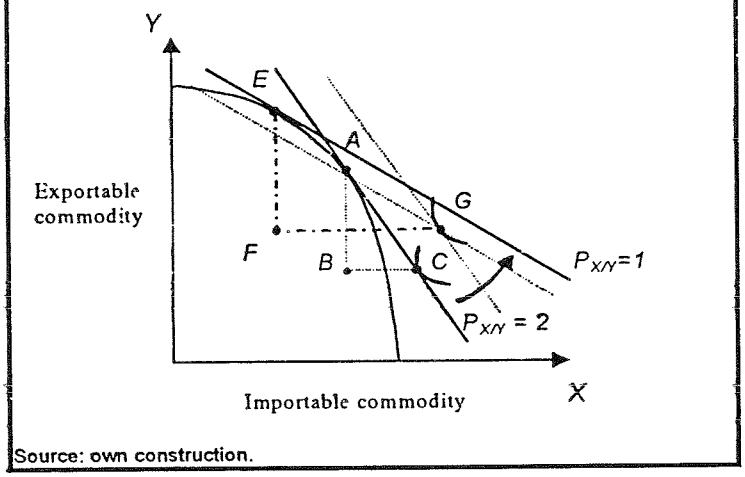
However, these positive effects are threatened when countries implement barriers that impede free trade. The most important type of barrier has historically been the import tariff, that is a tax or duty levied on traded goods once they cross the national boundaries.[1] The other important type of restriction is the export tax, which is a duty on exported commodities. Exports can also be enhanced by an export subsidy, which is the granting of tax relief to the country's exporters. These instruments have been largely used by developing countries at different stages of their development.

### 2.2.2. Neoclassical general-partial equilibrium analysis

#### 2.2.2.1. Expected effects of reducing an import tariff

According to the neoclassical general equilibrium analysis, a reduction of an import tariff tends to lower the domestic price of the importable commodity, reducing it by the full amount of the tariff for individual producers and consumers in the developing country.[2] However, the price of the commodity is to remain constant for the developing country as a whole since the country itself collects the tariff.

**Figure 2.1. General equilibrium effects of a tariff reduction**




Source: own construction.

Let us briefly illustrate the effects of the reduction of an import tariff. Figure 2.1 shows the production frontier of a developing country that is labour-abundant and produces commodity *Y*. Initially, the country produces at point *A* on its production frontier and consumes at point *C* on its indifference curve. At the relative price $P_{X/Y}=2$, which includes an import tariff, the country exchanges the distance *BC* (imports) for the distance *AB* (exports) with the rest of the world. Total trade for this country is represented by the 'trade triangle' *ABC*. Let us suppose that the country imposes a 100 per cent reduction in the *ad valorem* tariff on imports of commodity X. The first effect occurs on the relative price of commodity X in the country, which is expected to fall to $P_{X/Y}=1$ for domestic producers and consumers. Facing the lower new price, production is settled at point *E* where the price line is tangent to the country's production frontier.

The effects can be summarised as follows. On the production side, the country ends up producing more of the exportable commodity and less of the importable commodity. The effect on the balance of trade depends on the initial situation, which can only be known by applying a

[1] There are several types of import tariffs: the *ad valorem* tariff is expressed as a fixed percentage of the value of the traded commodity; the *specific tariff* is expressed as a fixed sum per physical unit of the traded commodity; and the *compound tariff*, which combines an *ad valorem* tariff and a *specific tariff* (Salvatore, 1995: 220).

[2] The reduction of the tariff in a developing country is never expected to affect world prices.

quantitative analysis. However, the figure shows that there is an increase in total trade –the 'trade triangle' *EFG* becomes much larger, which can be explained by the fact that the country is more specialised, so that it exports more of commodity *Y* and uses their export earnings to import more of commodity *X*. Following the **Stolper-Samuelson theorem**, there is also an effect on wages. The expansion in the production of commodity *Y* (the labour intensive commodity) requires a higher labour-capital ratio (*L/K*) so that there is substitution of capital for labour, and the ratio of factors remuneration (*w/r*) rises. This leads to a higher capital labour ratio (*K/L*) in the production of both commodities. As each unit of *L* is combined with more *K*, the productivity of labour increases leading to an increase in real wages (*w*) in the long term. The final result is a greater share of labour earnings in national income (Salvatore, 1995: 235).

Thus, the tariff reduction is expected to bring about positive effects for developing countries as trade, production and income rise. This argument is also complementary to that of not imposing new import tariffs. According to the theory, the imposition of new tariffs represents a threat for developing countries as the affected imports supplier countries are likely to retaliate, which can create negative effects for developing countries when the reaction comes from a developed country.

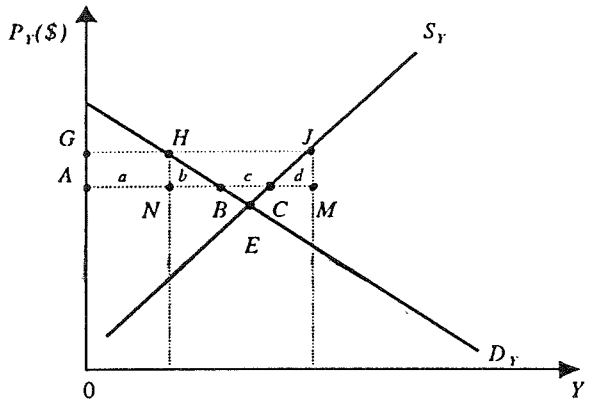
### 2.2.2.2. Expected effects of granting an export subsidy and reducing and export tax

Traditional trade theory warns about other important forms of trade restrictions. Although there are other types of trade restrictions, this section considers only export subsidies and export taxes. The reduction of an export subsidy must be expected to be positive, since the subsidy works as a form of dumping.[3] By reducing export subsidies, developing countries avoid the imposition of 'antidumping duties' by other countries that may try to offset price differentials. However, the common case in developing countries is the granting of export subsidies, which is expected to have different implications in the economy.

Let us use the neoclassical partial equilibrium approach to analyse the effects of granting an export subsidy to exports of commodity Y. There appears in Figure 2.2 the demand ($D_Y$) and supply ($S_Y$) of commodity *Y*, which is produced and exported by a developing country. In the initial situation, the price without export subsidies is at point *A*, so that the country produces *AC*, consumes *AB*, and exports the remaining *BC*. If the government grants an export subsidy to exports of commodity *Y*, the immediate effect is to occur on the price. Assuming that the new price is settled at point *G* with the export subsidy, this would represent a higher price for producers and consumers of commodity Y. At this new price, the country produces *GJ*, consumes *GH*, and exports the remaining difference *HJ*. Thus, the higher price of commodity *Y* benefits producers (and exporters) but harms consumers. There is also an increase in the cost of the subsidy for the country's taxpayers. Consumers' loss is represented by the area *a* + *b*, producers' gains by the area *a* + *b* + *c*, and the increase in the cost of the subsidy for the taxpayers by the area *b* + *c* + *d*. The overall gain is defined by the sum of triangles *b* and *d*. This means that producers-exporters gain more than the sum of consumers' loss and the increase of the cost of the subsidy for the taxpayers. The opposite can be expected from decreasing an export subsidy where the most benefited agent is the consumer.

[3] Dumping can be defined as the export of a commodity at below cost or as the sale of a commodity at a lower price in the international market than in the country itself.

Figure 2.2. Partial equilibrium effects of granting an export subsidy




Source: own construction.

Broadly speaking, an export tax has the opposite effects to an export subsidy on domestic price, consumption, output and exports. The effect of a reduction in export taxes can be explained as the effect of granting an export subsidy. By applying the partial equilibrium analysis already used for the case of the export subsidy, one could conclude that the implication of reducing export taxes would be positive for producers-exporters but negative for consumers.[4]

## 2.3. BENEFITS OF TRADE LIBERALISATION FOR DEVELOPING COUNTRIES

### 2.3.1. Potential effects of free trade on growth

The traditional trade theory stresses the gains developing countries can obtain from free trade. First, it represents a 'vent for surplus' since it leads to a full utilisation of otherwise underemployed domestic resources. Second, the expansion of international markets results in division of labour and economies of scale. Third, free trade is a vehicle for the transmission of new ideas, new technology, and managerial skills. Fourth, free trade is effective against monopolies as it stimulates greater efficiency by domestic producers to meet foreign competition. These benefits are expected to work together, hence increasing productivity growth and consequently growth in developing countries.

Most investigations confirm that after the Second World War, there has been a significant positive relation between primary exports and growth in developing countries. Such studies are inspired by the trade-engine theory of Lewis and the generally accepted insights of Robertson, Haberler, Balassa and Krueger who have also considered trade as an "engine of growth" (in Jepma, 1986: 94, 104). This conclusion has been recently supported by Kwasi (1996), who concluded that the export effect of primary goods on GDP growth is rather positive (Kwasi, 1996: 473-474).

The impact of trade on growth comes from higher productivity, expanded production and export revenues. These factors encourage productive domestic investments that are considered a transition to a higher economic growth. The creation of investment begins when the export income flows are spent on domestic consumption, on imports or saved. In the short run, the increase in domestic demand as income increases, encourages the utilisation of underemployed resources and

[4] According to *Lerner's symmetry theorem*, assuming zero balance of trade, an *ad valorem* export tax has the same effects on relative prices as an *ad valorem* import tariff at the same rate on the importable (see Vousden, 1990: 46).

thus creates new investment opportunities in the long term. If the investment opportunity creates new savings, there will be a net increase in domestic capital formation. The new investment also generates backward and forward linkages that are diverted into other sectors and the introduction of new technology (Adams and Behrman, 1982: 19-22, 39-45).

The income generated from exporting primary commodities is also useful to finance imports, mainly of capital goods. The availability of complementary imports (spare parts, intermediate products, replacement equipment, etc.) is vital for achieving efficiency of resource use and increasing the level of domestic investment; both elements are key aspects in the economic growth process, as empirically proved by Maizels (1992).

### 2.3.2. Potential effects of free trade on income distribution, employment and wealth

The positive effect of the higher growth resulting from free trade is expected to contribute to the attainment of goals of income distribution, employment and wealth, as they interact with the domestic distribution of income and wealth in numerous direct and indirect ways. The direct effect depends upon the ownership of domestic factors used in production. When the distribution of factor ownership is fair, trade is to have a substantial impact on the economic welfare (Griffin, 1989: 94). Among the indirect effects are: returns to factors in other sectors of the economy; the impact of the primary-export sector on exchange rates having widespread distributional implications; and the beneficiaries of government expenditures on goods and services that are financed by revenues generated from primary-commodity exports (Thoburn, 1977: 23-24).

Balassa (1987) argues that outward-oriented strategies to export primary commodities by developing countries benefit the creation of employment because the activities on which the exportation is based are labour intensive. The analyses carried out by Banerji and Riedel (1980), Carvalho and Haddad (1981), Krueger (1983) and Fields (1984) support this argument (in Balassa, 1987: 30). The higher demand for labour leads to higher real wages. The effect on employment and wages may be expected to contribute to rise incomes of the poor (Balassa, 1987: 38,39).

### 2.3.3. Maximising the benefits from trade

The defenders of free trade argue that the positive effects of trade have been hampered in developing countries by the imposition of trade barriers. Balassa *et. al.* (1987) concluded that the cost of protection in these countries is rather high in terms of growth. After applying estimations for several countries in the 1960s, they found this cost equal to 9.5 per cent of GNP in Brazil, 6.2 per cent of GNP in Chile and Pakistan, 3.7 per cent of GNP in the Philippines, and 2.5 per cent of GNP in Mexico. They also concluded that countries with high protection have imposed a considerable burden on production and exports, whereas countries with a relatively low level of protection have achieved growth of agricultural production and important improvements in export performance (Balassa *et. al.*, 1987: 88). Krueger and Michalopoulos (1985) showed that the average rate of growth of both GNP and exports was higher for outward-oriented developing countries with relatively balanced trade incentives than for inward-oriented developing countries characterised by high protection during two periods 1960-1973 and 1973-1981 (in Balassa and Michalopoulos, 1987: 591).

Other studies have considered the impact of protection on welfare by applying partial and general equilibrium analyses. Partial analyses carried out by Batchelor and Minford (1977), Stone

(1977) and Cline *et. al.* (1978) among others, have helped to conclude that the reduction of protectionism is positive in terms of welfare (in Milner, 1985: 125-126). Brown and Whalley (1980) applied a general equilibrium analysis and concluded that the potential gains from removing tariffs and other trade distortions can be very large (in Milner, 1985: 127-128).

Recent literature supports the idea that trade liberalisation in developing countries is likely to result in economic growth. According to Helleiner (1993), *"there is now a mainstream consensus that openness in economic relations with the rest of the world – in trade and other spheres – is likely to be conducive to economic growth"* (Helleiner, 1993: 408). This is not a new proposition, however the emphasis in the mainstream logic behind it has changed. The focus is no longer on the 'static' social costs of resource misallocation as resulted from an inefficient utilisation of trading opportunities, but rather on the 'dynamic' role of free trade in stimulating productivity growth. Klein *et. al.* (1987) concluded, by applying the LINK system[5], that the imposition of tariffs and other trade barriers hampers trade, and this consequently affects dynamic growth in production and therefore welfare for all participants (Klein *et. al.* 1987: 84).

Contemporary developments in the theory of endogenous growth, starting with Romer (1986) and Lucas (1989), provide a theoretical basis for the relationship between free trade and long-run economic growth and development. This theory postulates that lowering trade barriers speeds up the rate of economic growth and development. The long run results are the absorption of new technology developed in advanced countries at a faster rate, new benefits that flow from research and development, and larger economies of scale in production. Additionally, lower tariffs are expected to lead to fewer prices distortions, more efficient use of domestic resources across sectors, and greater specialisation along with more efficiency in production of intermediate inputs.

Michaely *et. al.* (1991) analysed the effects of trade liberalisation in developing countries and concluded that in the long run, countries that have applied strong trade liberalisation processes can expect no damaging effects on employment and an acceleration of economic growth. In addition, balance of trade implications were found positive since exports reacted favourably to a significant degree when trade liberalisation was applied. Imports also tended to increase but their trend appears to be closely associated with that of exports, hence no balance of trade deterioration is evident (Michaely *et. al.*, 1991: 72, 87, 140-141). Similarly, several recent empirical studies have analysed data on country performances of models of 'export-led' growth with results that appear to demonstrate the advantages of freer trade from the point of view of both static and dynamic efficiencies (in Edwards, 1993 and Paganetto and Scandizzo, 1996).

## 2.4. THE FUNDAMENTALS OF WORLD BANK'S TRADE POLICIES AND THE GENERAL AGREEMENT ON TARIFFS AND TRADE

It seems that the traditional trade theory has recently strengthened up in developing countries, where the economies have been opened and the trade policies simplified. In the 1980s, many developing countries that had earlier followed an import substitution strategy began to implement outward orientations based on the ideas of the traditional trade theory. The role of the World Bank has been important in strengthening up this orientation, after the debt crisis of 1980-1982 and the

[5] The LINK system brings together major macroeconomic models for 79 countries, in a consistent world model for studying global economic problems. For more details, see Klein *et. al.* (1987) in Salvatore (1987), pp. 69-94.

success of the so-called 'Asian Tigers'. In general, the reforms have involved reductions in average tariff rates and quantitative import restrictions, which have resulted in a much higher degree of openness, as measured by the sum of export and imports as a ratio of GDP (Salvatore, 1995: 350).

The particular aspect of the liberalisation policies recommended by the World Bank is the concession of export subsidies. The justification to such a policy relies on the fact that most developing countries created an anti-export bias when implementing import substitution strategies. World Bank studies, conducted by Krueger and Bhagwati, clearly argue that trade liberalisation is a reform leading to more reliance on the price mechanism and a reduction in the anti-export bias of trade regime. Thus, the introduction of export subsidies into such a regime is viewed as a move towards liberalisation because it reduces the bias against exports (Dean *et. al.* 1994: 3).

Studies by Michaely, Papageourgiou, and Choksi (1991) point out that trade liberalisation should include an evaluation of policies concerning lowering tariffs and removing export taxes, in addition to the implementation of export subsidies. Michaely (1986) confirms the idea of moving from neutrality (no export bias) towards intensive liberalisation. Falvez and Kim (1992) argue that export subsidies should also be considered as a method of avoiding balance of payments problems. However, such incentives should be reduced simultaneously with import barriers.

Most of the developing countries that have implemented World Bank liberalisation policies have also joined the General Agreement of Tariffs and Trade (GATT). This has increased the chances of successfully implementing the reforms to open up the economies. The focus of the GATT has been on market access through a reduction in trade barriers and the abolition of discrimination among products. The GATT's principles have also relied on the traditional trade theory. Blackhurst, Marian and Tumlir (1977), as part of the staff of the GATT Secretariat, argued that the benefits of trade liberalisation may be classified into consumption gains, production gains, and economies of scale gains, among others. As a complement to the GATT, the Uruguay Round of Multilateral Trade Negotiations (1986-1991) looked at the reduction of protectionism and the removal of distortions to trade. After the Uruguay Round was held, over 60 developing and former centrally planned countries have unilaterally liberalised their trade (Goldin and van der Mensbrugghe, 1992: 5).

## 2.5. FINAL REMARKS

The traditional trade theory is quite clear in suggesting that trade policy in developing countries should aim at freer trade, which is expected to lead to positive effects on exports and production, as 'static' and 'dynamic' benefits appear. Consequently, the most important effect is expected to be a higher growth, which makes possible the achievement of welfare benefits. These are also the expected effects of trade liberalisation policies applied since the 1980s in developing countries, as part of the World Bank structural adjustment policies, which have aimed at the reduction of import tariffs and export taxes at a faster pace. The concession of export subsidies, as part of such policies, seems to be the innovation made to the traditional trade theory, as exports are to be temporally promoted to fight the anti-export bias and improve the balance of trade. This is exactly how trade policy has been implemented in Costa Rica since 1984, as will be explained in the following chapter.

# Chapter Three

# THE OPENING OF TRADE PROCESS IN COSTA RICA

## 3.1. INTRODUCTION

At the beginning of the 1980s, the strategy of import substitution implemented in Costa Rica since the 1950s showed its structural deficiencies. At the same time, there were a series of external factors in the short run that affected the economy severely. Both situations generated the most severe economic crisis since the 1930s. As a reaction to the crisis, the government began to convince a great number of professionals, academicians and politicians about the urgency of changing the strategy of development implemented since the 1950s. Besides this effort, international financial institutions such as the International Monetary Fund (IMF) and the World Bank (WB), among others, concentrated their financial support in accordance to such an initiative.

The reaction against the crisis was the application of adjustment policies to stabilise and reactivate the economy. These policies were part of the Structural Adjustment Programmes recommended by the IMF and the WB and were implemented through three processes, namely: opening of trade, deregulation of the economy and reform of the public sector. The first process is the core of the whole change, whereas the last two aim at creating a more appropriate environment to the successful implementation of the opening of trade (Monge and Lizano: 1997: 9-10).

This chapter explains the opening of trade process in Costa Rica, focusing on the main policies and the way in which the Costa Rican economy has performed after the process began. Section 3.2 defines the opening of trade and deals with its objectives. Section 3.3 shows the main opening of trade policies and the evolution of the key policy instruments since 1984. The chapter also shows in Section 3.4 the performance of the economy by explaining production, trade and fiscal variables. Finally, the final remarks of the chapter are presented in Section 3.5.

## 3.2. DEFINITION OF THE OPENING OF TRADE AND ITS MAIN GOAL

The opening of trade is a mixture of liberalisation measures with temporal protectionist measures, although its final aim is the liberalisation of trade as such. Damill and Keifman (1992) argue that the opening of trade applies to all those policies designed to direct an economy towards international markets, where exports are the core of the whole process. According to Rhee (1984), the opening of trade has to be developed in a 'neutrality regime' in which economic policies favour the export sector, so that it can compete in the international markets more fairly and without distortions. Such a compensation is justified by the existence of distortions in the economy such as import tariffs and export taxes and must be granted when exports are oriented to third markets and not to the domestic market.[6] This is the type of strategy implemented in Costa Rica, where import tariffs and export taxes are reduced, while exports are granted incentives when they are targeted towards third markets.

[6] For the case of Costa Rica, third markets refer to all the markets outside of Central America.

The main objective of the opening of trade process in Costa Rica is the insertion of the economy into the world market, as the domestic and the regional markets offer no possibilities for economic growth in the long run. This strategy has forced the country to show greater levels of competitiveness, which has consequently obliged it to implement the following reforms:

a) The reduction of protection to all those activities competing with imported goods through the reduction of 'import barriers' and the elimination of distortions in domestic markets,
b) the concession of subsidies and other incentives to exports of non-traditional products, in order to compensate the 'anti-exports bias' created with the strategy of import substitution,
c) the reduction of export taxes, and
d) the implementation of new macroeconomic policies aimed at creating a more beneficial and stable environment to the opening of trade process.

Since 1984 the government has adopted trade policies to accelerate the insertion of the economy into the world market. Morales and Corrales (1988) argue that the most important measures to accelerate opening of trade process have been the reduction of tariff barriers and non-tariff barriers to imports, the new incentives to non-traditional exports and the policy of flexible exchange rate. It is generally accepted that these policies have given a more neutral trade policy regime for the insertion of new export activities into the international markets in similar conditions to those prevailing in the absence of distortions (Monge and Lizano, 1997: 10).

## 3.3. OPENING OF TRADE POLICIES AFTER 1984

### 3.3.1. Reduction of export taxes and concession of export incentives

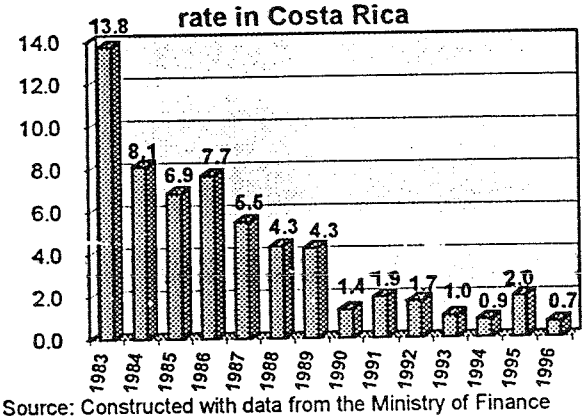
The opening of trade process initiated in Costa Rica in 1984 through the approval of several laws aimed at the creation of a legal framework to support the new process, mainly the promotion of non-traditional exports. Such legal changes began with the approval of the 'Law for Export Promotion' (*Ley de Promoción a las Exportaciones*) which aimed at the consolidation of the regulations to promote exports. This law included among other things the creation of Export Promotion Zones (*Zonas francas*), 'export contracts', and the National Council for Investments *(Consejo Nacional de Inversiones*). The law also incorporated the reforms to the export tax regime along with the simplification of procedures for obtaining export permits.

The creation of 'export contracts' is one of the main policies to promote exports. These contracts guarantee free access to inputs and capital goods bought abroad for all non-traditional export activities towards third markets. The reform also included the removal of most taxes on non-traditional exports and the introduction of an export subsidy called CAT (*Certificado de Abono Tributario*). The CAT is a subsidy *ad valorem* between 15 and 30 per cent on the FOB value of exports, its exact rate is computed according to the national value added of non-traditional products and the destination to third countries (Monge and González, 1994: 22-23). In addition, the tax on profits earned by exporters of non-traditional products was also eliminated with the new law.

Figures 3.1 and 3.2 show the reduction in the overall export tax rate and the CATS granted to exports, respectively. These policy instruments started being used in 1983, however it was not until 1984 that the authorities officially began applying opening of trade policies. As can be seen in Figure 3.1, the overall export tax rate was 13.8 per cent in 1983. As a result of the policies to open up the

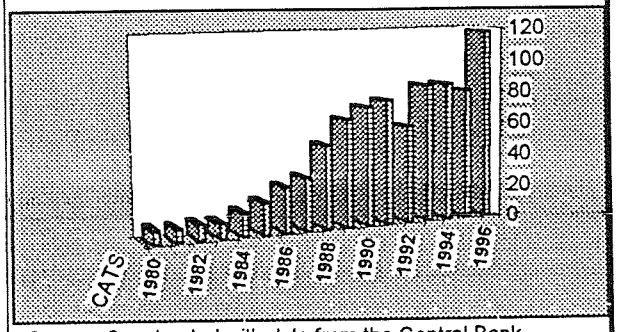
economy and the "Law for Export Promotion", such a rate began to fall dramatically. The incorporation of the country into the GATT in 1990 also influenced the reduction of export taxes. One can identify a period of fast reduction of the export tax from 1983 to 1990, and another period of gradual reduction but of very low rates from 1990 to 1996. Note that in 1994 and 1996 the overall export tax rate fell to levels of less than 1 per cent. The average annual growth rate shows that the export tax rate has declined dramatically by 9.4 per cent between 1984 and 1996. It decreased by approximately 16.3 per cent in the period of fast reduction, while it fell by 3.8 per cent in the period of low rates.

**Figure 3.1. Trend of the export tax rate in Costa Rica**




Source: Constructed with data from the Ministry of Finance and the Central Bank of Costa Rica.

**Figure 3.2. CATS granted in Costa Rica (In millions of US dollars)**




Source: Constructed with data from the Central Bank of Costa Rica

The export promotion has also involved rather high concessions of incentives. Despite the fact that between 1980 and 1983 there was an effort to promote exports of non-traditional products through granting CATS, it was not until 1984 that the export promotion began to rise dramatically, as can be seen in Figure 3.2. In 1984, exporters of non-traditional products (mainly of agricultural origin) received approximately 14.4 millions of US dollars from CATS. This amount of money started growing very fast as exports of non-traditional products began to increase. Such a trend was even stronger in the 1990s, where the CATS amounted to 117.8 millions of US dollars in 1996 only. The average annual growth rate indicates that the concession of CATS has grown by 24.5 per cent between 1984 and 1996.

### 3.3.2. Reduction of import tariffs and other import restrictions

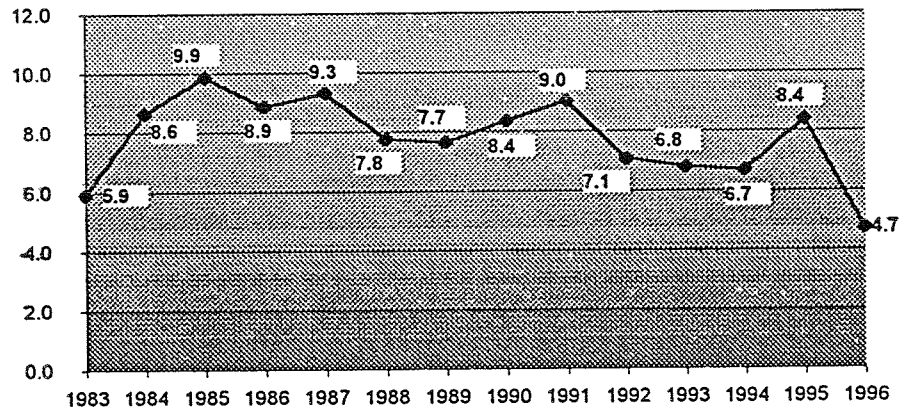
The opening of trade also aims at the reductions of import tariffs, which were initiated in 1985 with a series of legal reforms. In that year, a new customs regime was approved by the Central American Common Market, which included tariffs between 35 and 100 per cent on final goods (Robbins and Gindling, 1997: 4). The tariffs continued to be reduced in 1986 with the first structural adjustment programme (SAP I), when a gradual reduction of tariffs on final goods and the elimination of all quantitative restrictions on imports were incorporated. In 1987 the reforms moved on consumer goods, whose tariffs were reduced by 10 per cent for all goods with import tariffs greater than 40 per cent. The tariff reforms on final goods continued in 1988 through biennial reductions of the import tariff, which had to be reduced between 1/6 and 1/10 twice a year until 1992. In addition, the so-called 'deposits on imports' (*depósitos a la importación*) that were established in the 1980s by the Central Bank to reduce the excess demand by importers, were reduced from 50 to 10 per cent in 1989 (*Op. Cit.*, 1997: 4).

Two important facts for the opening of trade process occurred in 1990. First, the country became a member of the GATT. Secondly, the process of structural adjustment continued through a second programme (SAP II), which included further reductions of tariffs and quantitative restrictions on imports. Two years later the so-called 'deposits on imports' (*depósitos a la importación*) were definitely eliminated for all imports, the exchange rate was liberalised and a new reduction of tariffs on final goods was applied by 4 and 6.5 per cent (Monge and Lizano, 1997: 4).

The Central Bank also began to decrease the so-called 'over-rates on imports' (*sobretasas a la importación*) since 1985, which were further tariffs applied to certain goods only. From this year up to 1990, these 'over-rates on imports' were between 4 and 5 per cent for most goods, excepting for capital goods whose rate was only 2 per cent. The 'over-rates on imports' were definitely removed in 1992 as a measure to continue the opening of trade process. The period 1985-1992 was a period of gradual reduction of the nominal and effective protection, which continued in 1993 when the maximum import tariff was fixed at 20 per cent (Monge and González, 1994: 20).

The reduction of import tariffs was also targeted to benefit the promotion of exports, mainly of non-traditional products whose final destination was new markets. Exports of non-traditional products were exonerated from import tariffs on raw materials used in the production process. In addition, the exoneration was also extended to capital goods utilised in the production of export goods (Corrales and Monge, 1990: 47).

**Figure 3.3. Trend of the import tariff rate in Costa Rica**




Source: Constructed with data from the Ministry of Finance and the Central Bank of Costa Rica.

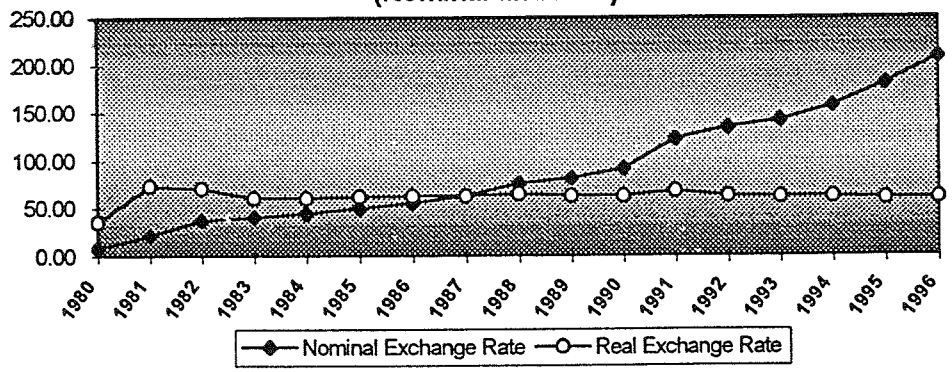
As noticed in Figure 3.3, the reductions in the overall import tariff started in 1985 when the new regime ruled by the Central American Common Market began to be implemented. The overall import tariff rate was 9.9 per cent in 1985; since then, the tariff has shown a tendency to fall slightly. The increases in 1987, 1991 and 1995 are explained by the implementation of temporal policies aimed at the deceleration of the rising imports that were affecting the balance of trade. The important decrease from 1987 to 1988 is explained as being due to the reduction of import tariffs on consumer goods, while the reduction from 1991 to 1994 is explained as the country became a member of the GATT and the second structural adjustment program began to be implemented. The strongest reduction between 1995 and 1996 was the result of the application of the free trade agreement with Mexico and the incorporation to the rules of the World Trade Organisation (WTO). Although there are some increases of the import tariff during the period under study, the overall trend indicates a slight reduction in the import tariff rate.

### 3.3.3. Devaluation of the exchange rate

In order to face the debt crisis, Costa Rica's authorities devalued the Colón in 1980. This was followed by multiple and different exchange rate regimes up to 1984. In June of that year, the exchange rate was unified to 43.5 Colones per US dollar and the Central Bank adopted the so-called policy of 'frequent mini-devaluations' (*mini-devaluaciones frecuentes*), which resulted in a gradual depreciation of the nominal exchange rate. In 1992, the exchange rate market was liberalised (although certain intervention by the Central Bank was still allowed) and a flexible exchange rate regime was adopted. However, after 1992 up to now, the tendency of the exchange rate has been towards devaluation, as the Central Bank has intervened aiming at keeping export earnings at a profitable level. Thus, one can indeed argue that the opening of trade has been closely accompanied by a gradual sub-valuation of the nominal exchange rate.

The trend shown by the bilateral nominal and real exchange rate in Costa Rica during the period 1980-1996 is easy to explain since both rates show no important fluctuations and rather maintain a unique trend.[7] As a result of the debt crisis, the bilateral nominal exchange rate devalued dramatically by 1342 per cent from 1980 to 1982. However, from 1983 up to 1996 the bilateral nominal exchange rate continued to rise steadily (see Figure 3.4). Note that in 1984, the year in which the opening of trade process officially started, the bilateral nominal exchange rate was 44.53 Colones per US dollar. At the end of the period, and after a steady devaluation of the Colón, this rate amounted to 208.4 Colones per US dollar. Regarding the bilateral real exchange rate, it rose by 2815 per cent from 1980 to 1982 as a result of the debt crisis. From 1983, as opposed to what has happened to the bilateral nominal exchange rate, the bilateral real exchange rate has levelled off, depreciating only slightly in 1987, 1995 and 1996, and appreciating slightly in 1988 and 1991.

**Figure 3.4. Costa Rica's Bilateral Exchange Rate**
**Colones per US dollar**
**(Nominal and Real)**




Source: Constructed with data from the Central Bank of Costa Rica and International Monetary Fund.

[7] The bilateral nominal exchange rate (*BNER*) corresponds to the price of one US dollar in terms of Colones and was obtained from the Central Bank of Costa Rica. The bilateral real exchange rate (*BRER*) was calculated by the author and considers the prices of both Costa Rica and its main trading partner the United States. The prices correspond to the consumer price index in both countries and were obtained from the International Monetary Fund (International Financial Statistics Yearbook 1997). Thus, the *BRER* was calculated as follows:

$$BRER = \frac{BNER.P^*}{P}$$

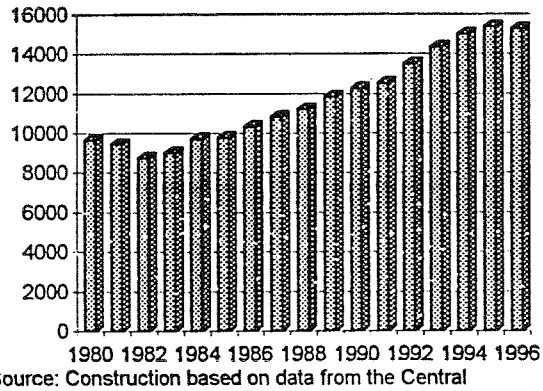
where $P^*$ denotes prices in the Unites States, and $P$ denotes prices in Costa Rica.

## 3.4. ECONOMIC PERFORMANCE DURING THE OPENING OF TRADE

### 3.4.1. Production

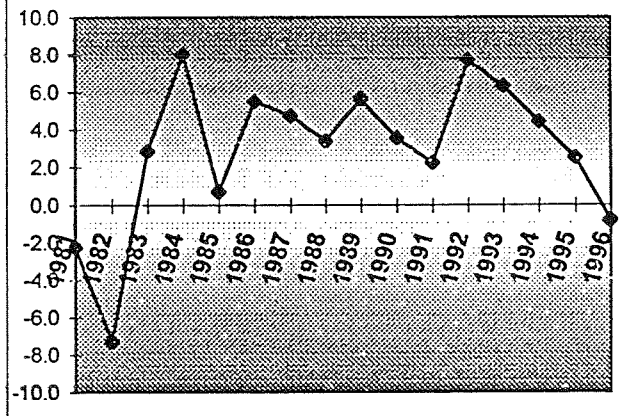
Costa Rica's economy has shown a sharp increase of the growth rate during the opening of trade. As can be seen in Figure 3.5, real GDP recuperated after the crisis of 1980-1982 and began to rise sharply until 1995. From 1995 to 1996 there was a slow down in the upward trend that the real GDP had previously shown. Figure 3.6 shows the annual growth rate of real GDP during 1981-1996. As can be observed, the growth in production seems to be to some extent irregular, although as mentioned already, it was partially sustained until 1992. Afterwards, the economy started losing dynamism, and in 1996 it showed a negative growth rate. As can be seen in Table 3.1 in the Appendix, real GDP shows an average annual growth rate of 4.2 per cent during 1984-1996.

Figure 3.5. Trend of real GDP in Costa Rica (In millions of Colones of 1966)




Source: Construction based on data from the Central Bank of Costa Rica

Figure 3.6. Real growth rate of GDP in Costa Rica




Source: Construction based on data from the Central Bank of Costa Rica

According to the Ministry of Planning and Economic Policy of Costa Rica (MIDEPLAN), such a loss of economic dynamism can be attributed to adjustment policies that have been applied to reduce the fiscal deficit in addition to the implementation of restrictive monetary policies. These policies have led to higher interest rates that have discouraged domestic demand. In addition, the slow economic growth of Costa Rica's main trading partners, the fall in the international price of coffee and the difficult situation of the bananas market under the European regime imposed from 1995 have also affected production. Furthermore, the adverse weather conditions that severely affected agriculture and the lack of incentives for the production of basic grains have played a role in the negative trend shown in production, mainly in the last two years (MIDEPLAN, 1997: 160-161).

The sector that has shown the highest growth is Services and trade, with an average annual growth rate of 5.3 per cent (see Table 3.1 in the Appendix). It seems that the opening of trade has benefited this sector, as its growth rate is even higher than the overall GDP growth rate. Tourism is the most dynamic activity of this sector since 1986, with earnings that have annually increased by approximately 23 per cent (Monge and Lizano, 1997: 21).

The sector with the second highest growth is Industry, with an annual growth of 4.3 per cent. Monge and Lizano (1997) argue that such growth is explained as being due to the fact that the opening of trade has contributed to the insertion of this sector into the world economy. The sector

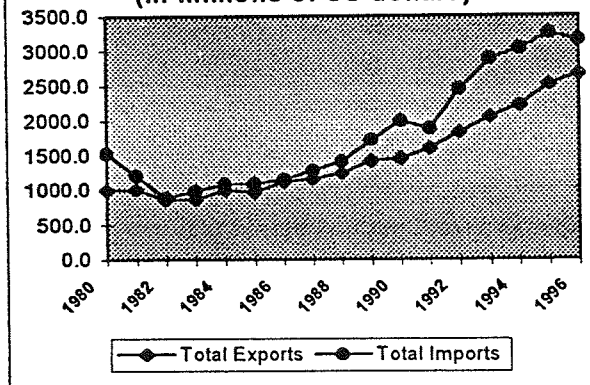
Agriculture, forestry and fishing has also shown an average annual growth rate of 3.6 per cent (see Table 3.1 in the Appendix). The dynamism of this sector is explained by the emergence of non-traditional activities, showing an average annual growth rate of 4.6 per cent, only between 1986 and 1993 (*Op. Cit.*, 1997: 18). Traditional activities (coffee, bananas, sugar cane, cattle rising, etc.) show a modest growth rate during the same period. The most affected activity during the opening of trade is 'basic grains' (rice, maize and beans), its participation in total production has fell because the government has gradually removed the high protection that was granted to it before 1984. The sector Construction shows an average annual growth rate of 3.1 per cent, however, the downward fluctuations suggest that this sector has not performed very well during the opening of trade. The negative growth rates in 1990, 1991, 1995 and 1996 can be largely explained as being due to the fall in private construction and the deceleration of public investment that has resulted from the restriction process of the public expenditure.

The composition of Costa Rica's GDP has not changed with the opening of trade, although some trends are worth highlighting. The productive structure in 1996 does not differ from the structure of 1984. However, the share in GDP of important sectors such as Agriculture, forestry and fishing and Industry, has been decreasing slightly. On the contrary, the share of the sector Services and trade has been increasing sharply. The average share for 1984-1996 indicates that 36.5 per cent of GDP corresponds to Services and trade, 20.2 per cent to Industry, 17.8 per cent to Agriculture, forestry and fishing, 3.7 per cent to Construction, and 14.1 per cent to other sectors (see Table 3.2 in the Appendix). These figures show that Costa Rica can be characterised by being an 'economy of services', with a bias towards services that has further strengthened during the opening of trade.

### 3.4.2. International Trade

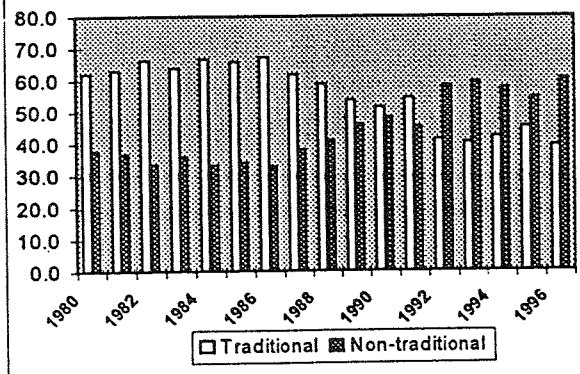
The policies to open up the economy have drastically affected the flows of trade in Costa Rica, as new export activities have emerged and there is more freedom to buy goods and services from abroad. As can be seen in Figure 3.7, exports have increased dramatically after 1984 leading to an average annual growth rate of 9.1 per cent during 1984-1996. This seems to be one of the most important effects of the opening of trade in Costa Rica.

**Figure 3.7. Costa Rica's Total Exports and Total Imports (In millions of US dollars)**




Source: Constructed with data from the Central Bank of Costa Rica.

**Figure 3.8. Percentage structure of Costa Rica's Total Exports (Traditional and Non-traditional)**




Source: Constructed with data from the Central Bank of Costa Rica.

One important effect is the change in the structure of exports, which has shifted to non-traditional products. After 1984, exports of traditional products (coffee, bananas, sugar cane, cattle rising, traditional manufactures, etc.) have been decreasing dramatically as most of the incentives have been targeted to non-traditional exports. As mentioned in section 3.3, the reduction of export taxes and the increase in export subsidies are aimed at promoting non-traditional activities (fruits, ornamental flowers and non-traditional manufactures) directed towards third markets. Hence, exports of non-traditional products show an average annual growth rate of 4.5 per cent, whereas on the contrary, exports of traditional products decrease on average by 3.3 per cent during 1984-1996. Such change can be seen in Figure 3.8, where the share of non-traditional exports in total exports increased dramatically from 33.4 per cent in 1984 to 60.6 per cent in 1996.

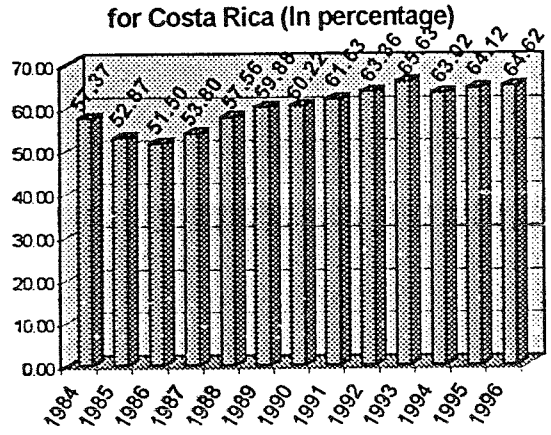
The export promotion has also been effective to enlarge markets as exports have moved towards markets outside of Central America (see Table 3.3 in the Appendix). The average annual growth rate indicates that exports towards Central America have risen by 7.4 per cent between 1984 and 1996. However, other markets such as North America and Europe, have enlarged much faster. Exports towards North America have increased dramatically, mainly by the fact that the United States is the main destination of Costa Rica's exports and that the commercial relations with Mexico have strengthened very much. As can be seen in Table 3.3 (see Appendix), exports to Mexico have increased dramatically by 1069.7 per cent during 1984-1996. The most impressing figure is the average annual growth rate of exports towards Germany, which amounts to 1427.1 per cent during 1984-1996. The European markets have also extended sharply in the same period, in countries such as Belgium and Luxembourg, United Kingdom and Sweden, where exports have increased by 30.2, 33.5 and 27.3 per cent, respectively. Costa Rica's exports have also extended to Asia, mainly to Japan, whose purchases from Costa Rica have risen by approximately 22 per cent during 1984-1996.

Despite the fact that exports have grown in 1984-1996, imports have risen much faster, as can be seen in Figure 3.7. Note that imports showed a slight fall in 1991 and 1996, however they kept rising steadily during the opening of trade process. As shown in Table 3.4 in the Appendix, imports show an average annual growth rate of 9.8 per cent during 1984-1996, which is much higher than the growth of exports. The main origin of the imports has been the United States, whose exports towards Costa Rica represented 43.4 per cent of Costa Rica's total imports in 1996 (MIDEPLAN, 1997: 133-134).

As can be seen in Table 3.4 (see Appendix), there is also a slight change in the structure of imports. Although the country is dependent on imported raw materials for manufacture, this dependency has relatively decreased comparing to imports of consumer goods and materials for construction, which show an increasing share in the total mainly in the 1990s. Between 1984 and 1996, imports of raw materials showed an average annual growth rate of 7.8 per cent, whereas imports of consumer goods and materials for construction showed an average annual growth rate of 15.8 and 15.7 per cent, respectively. Furthermore, imports of capital goods also showed an important average annual growth rate of 12.7 per cent.

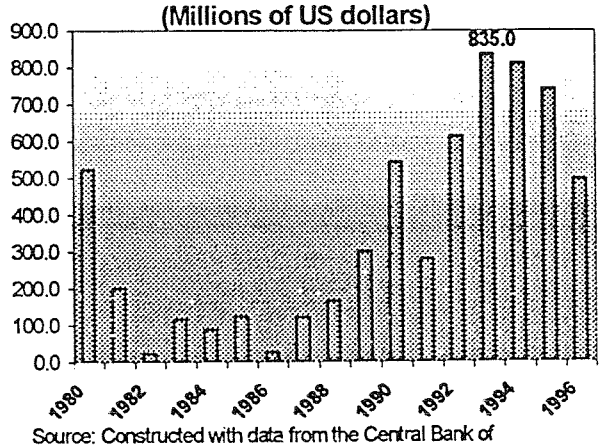
The opening of trade process has been effective to increase the participation of the economy in the world market. The opening of trade indicator (*OTI*) shows that Costa Rica's economy has opened sharply after 1984.[8] Note in Figure 3.9 that the *OTI* was 57.37 per cent in 1984 when the process officially began. Although the *OTI* fell sharply from 1984 to 1985, it started rising until reaching 64.62 per cent in 1996. Costa Rica is characterised as one of the most opened economies in the world (as measured by the *OTI*). The degree of opening of Costa Rica's economy is much higher than the one shown by many industrialised countries; e.g., in the case of the United States and Japan, the *OTI* does not exceed 20 per cent (MIDEPLAN, 1997: 125).

**Figure 3.9. Indicator of opening of trade for Costa Rica (In percentage)**




Source: Constructed with data from the Central Bank of Costa Rica.

**Figure 3.10. Costa Rica's Deficit of Trade (Millions of US dollars)**




Source: Constructed with data from the Central Bank of Costa Rica.

Despite the success of the policies in opening up the economy, there has been a faster increase of imports relative to exports. Note in Figure 3.10 that after 1986, the deficit of trade began to rise dramatically amounting to 835 millions of US dollars in 1993, representing 11.1 per cent of GDP. Even though the deficit began to fall after 1993, it continued to show rather high levels (9.7, 8.2 and 5.5 per cent of GDP for 1994, 1995 and 1996, respectively). The average annual growth rate indicates that the deficit of trade has increased dramatically by 42.4 per cent between 1984 and 1996.

### 3.4.3. The fiscal deficit

Along with the deficit in the balance of trade, Costa Rica has also faced a fiscal problem. Even though governments' total revenue has increased on average during the opening of trade, the growth of governments' total expenditure is higher. The average annual growth rate indicates that total revenue has risen by 23.2 per cent in 1984-1996, whereas at the same time, total expenditure has also gone up by 24.1 per cent in the same period. This trend is shown in Figure 3.11 and complemented by the information shown in Figure 3.12. As can be seen, the government's fiscal unbalance was 3.0 per cent of GDP in 1984, when the opening of trade began. After that year, the deficit has been rising dramatically, amounting to rather high levels mainly in 1994, 1995 and 1996, when the deficit represented 6.9, 4.4 and 5.2 per cent of GDP, respectively. Many argue that a logical explanation to such a deficit is the fall in income resulting from the reduction in import tariffs and

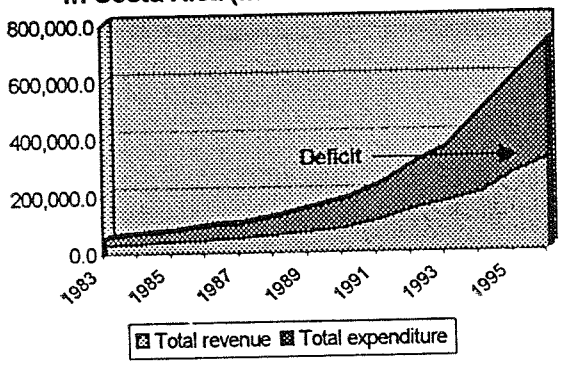
[8] The opening of trade indicator (*OTI*) is the ratio between total trade (exports plus imports) with respect to GDP. The equation used to calculated it is written as follows:

$$OTI = \left(\frac{X+M}{GDP}\right)*100$$

where $X$ and $M$ denote exports and imports respectively, and $GDP$ is gross domestic product at current prices.

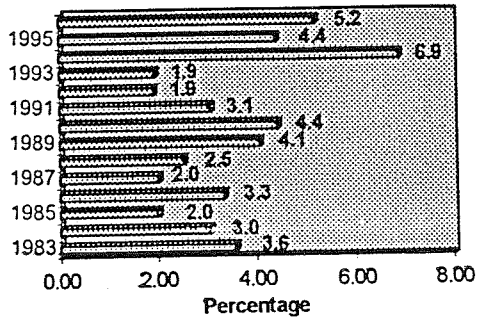
export taxes, mainly in the 1990s. Such criticism has also been complemented by the argument that the concession of export subsidies has worsened the problem of fiscal deficit.[9] Nevertheless, some other factors such as tax evasion, inefficiency in tax collection and the expansion of the public expenditure have also played a role in the increasing trend shown by the fiscal unbalance, mainly from 1994 to 1996.

**Figure 3.11. Government's total revenue and expenditure in Costa Rica (In millions of colones)**




Source: Construction based on data from the Ministry of Finance.

**Figure 3.12. Central Government's deficit with respect to GDP in Costa Rica**




Source: Construction based on data from the Ministry of Finance and the Central Bank of Costa Rica.

## 3.5. FINAL REMARKS

The opening of trade has been extensively carried out, however it is still far from being completed. According to Monge and Lizano (1997), there is still an important 'dispersion' in the rates of effective protection in manufacturing activities. The opening up is even slower in the agricultural sector, because Costa Rica negotiated very high tariff barriers for agricultural products when it became a member of the GATT in 1991. This protection is expected to decrease sharply between 1996 and 2004 so that new changes could occur in the economy. It must be added that the incentives for non-traditional exports are to be removed at the end of 1999. This will certainly generate some other changes in the economy that are worth analysing in the future.

[9] An average ratio of CATS to government's total expenditure indicates that 5.1 per cent of total expenditure has been annually granted to non-traditional exports during the period 1984-1996.

# Chapter Four

# METHODOLOGY

## 4.1. INTRODUCTION

This chapter aims at explaining the methodology that is followed to analyse the implications of the opening of trade process on production, income distribution and the balance of trade. The chapter focuses on explaining what a Computable General Equilibrium (CGE) model is, and how it can be calibrated to a Social Accounting Matrix (SAM) to achieve a base run equilibrium. The chapter also includes an explanation of SAMs, using as an example the SAM for Costa Rica. The chapter only deals with the general methodology, the construction of the CGE model for Costa Rica along with the policy simulations are explained in the following two chapters, respectively.

Aside from this introductory section, the chapter includes five more sections. In Section 4.2, a brief description of how CGE models originated along with their general definition is presented. Section 4.3 provides an explanation of the main types of CGE models that have been applied to the economies of developing countries. Two key stages of CGE modelling are presented in Sections 4.4 and 4.5, where the calibration procedures and the closure rules are explained, respectively. Finally, the final remarks of the chapter are presented in Section 4.6.

## 4.2. THE CONCEPTUAL DEFINITION OF A CGE MODEL

The general equilibrium model of an economy is an effort of continued intellectual revision of nearly two centuries. The roots of this framework can be found in Adam Smith's description of the capitalist behaviour, which is motivated by consideration of profitability in the selection of economic activities. In addition, John Stuart Mill contributed with elements of his demand theory and the response of economic agents to changes in taxes and import duties. In the nineteenth century, Leon Walras provided a general description of the functioning of a complex system where there is interaction of a number of interdependent economic units (Scarf and Shoven, 1984: ix). In the late 1940's and 1950s, others like Arrow, Debreu, Gale, Kuhn, McKenzie and Nikaido, solved the 'existence problem' for the general equilibrium model, when the remarkable burst of intellectual activity of mathematical economics took place. By that time, the model structure was formalised with a high degree of precision, and fixed point arguments were used to demonstrate market-clearance equilibrium to equate demand and supply simultaneously for all commodities (*Op. Cit.* 1984: x). Some other refinements have been made in the 1960s by Meade, Johnson and Harberger, who popularised the traditional two-sector general equilibrium models (Shoven and Whalley, 1992: 2). At the end of the 1970s and the beginning of the 1980s, new scholars have come with applications of CGE models for developing countries, where Robinson, Dervis, de Melo and Taylor have brought about the most important contributions.

A CGE model is a framework in which the interaction of various economic actors across markets is simulated. It incorporates an assumption of how individual actors' behaviour works, which should at the same time be specified by equations that describe such behaviour in terms of profit and utility maximisation. A requirement of all CGE models is the complete specification of supply and

demand in the markets considered, including all the nominal magnitudes in the circular flow. "*The models are thus structural in spirit, capturing market mechanisms explicitly*" (Robinson, 1989: 906). The fact that CGE models incorporate the general equilibrium links among production structure, incomes of various groups and the pattern of demand, has made them a very useful tool for development planning (Dervis, *et. al.* 1982: 131, 133)

The structure of a CGE model can be explained by listing its minimum structural components. Firstly, a CGE model should specify the economic agents subject to analysis. A Walrasian version would include producers and households; however, most CGE models now incorporate other agents such as the government, enterprises and the rest of the world, and even disaggregate them into several categories. Secondly, agents' behaviour should be specified by stating the rules on which their motivation depends and how their behaviour is constrained. Thirdly, the model must elaborate on how the agents make their decisions. For instance, in a Walrasian version, agents would guide their decisions by taking into account prices as the main signal. Fourthly, the model must also specify how the interaction between agents occurs, which certainly depends on the institutional structure of the economy under analysis. For instance, if one assumes perfect competition, this would imply that all agents are price takers and markets work perfectly. On the contrary, some constraints can be specified to limit the interaction between agents and some markets can be monopolistic.

The core part of the CGE modelling is the definition of equilibrium conditions, which are system constraints that must be satisfied.[10] In such a context, "*an equilibrium can be defined as a set of signals such that the resulting decisions of all agents jointly satisfy the system constraints*" (Robinson, 1989: 908). Robinson (1989) defines such signals as the equilibrating variables of the CGE model, which are analysed with more detail in Section 4.5.

## 4.3. MAIN TYPES OF CGE MODELS

### 4.3.1. The neoclassical CGE model

The neoclassical general equilibrium theory has provided the analytical underpinnings on which many CGE models have been based. Neoclassical CGE models are well known for their assumptions that producers are 'profit-maximisers' subject to technological constraints and consumers are 'utility-maximisers' subject to income constraints. The assumption of perfect competition gives body to these models, where each agent is a price taker and prices are flexible so that markets work perfectly. The production function in these models assumes a variety of functional forms, where Cobb-Douglas functions, Constant Elasticity of Substitution functions, generalised Leontief functions, translog functions, and various multi-level versions of these forms have been commonly used. As is done for most CGE models, in the neoclassical CGE model, input-output coefficients are used to determine the demand for intermediate goods. Furthermore, primary factors (capital and labour) are considered inputs in a neoclassical production function.

### 4.3.2. The structuralist CGE models

Despite the fact that neoclassical CGE models are largely applied to developed countries, their application is limited for developing countries. Rather, modellers have tried to capture 'structuralist' features in developing countries, which has implied redefining the CGE modelling. There are three

[10] For more details see Ginsburgh and Waelbroeck (1981) as recommended by Robinson (1989), p. 980.

types of structuralist models. The first type is called 'elasticity structuralist model' since it keeps the theoretical structure of the neoclassical model, but specifies limited substitution elasticities in a variety of important relationships. The second type is the well-known 'micro structuralist model', which assumes that some markets do not work perfectly and incorporates restrictions on factor mobility and prices, rationing, and neoclassical disequilibrium in one or more important markets. The third type is the 'macro structuralist model', which focuses on equilibrium achievement among various macro aggregates, such as savings, investment, exports, imports, and government expenditure/revenue among others (*Op. Cit.*: 1989: 913-914).

Several schools of thought in development economics have vindicated the structuralist CGE models. The school led by Hollis Chenery has supported the 'elasticity structuralist models'. The other two kinds of CGE models appear to be supported by the school that emphasises the disequilibria in macroeconomic mechanism. Here it is possible to identify a chain of thought that starts with Marx and continues nowadays with Lance Taylor.

## 4.4. THE DATA BASE AND THE CALIBRATION IN CGE MODELLING

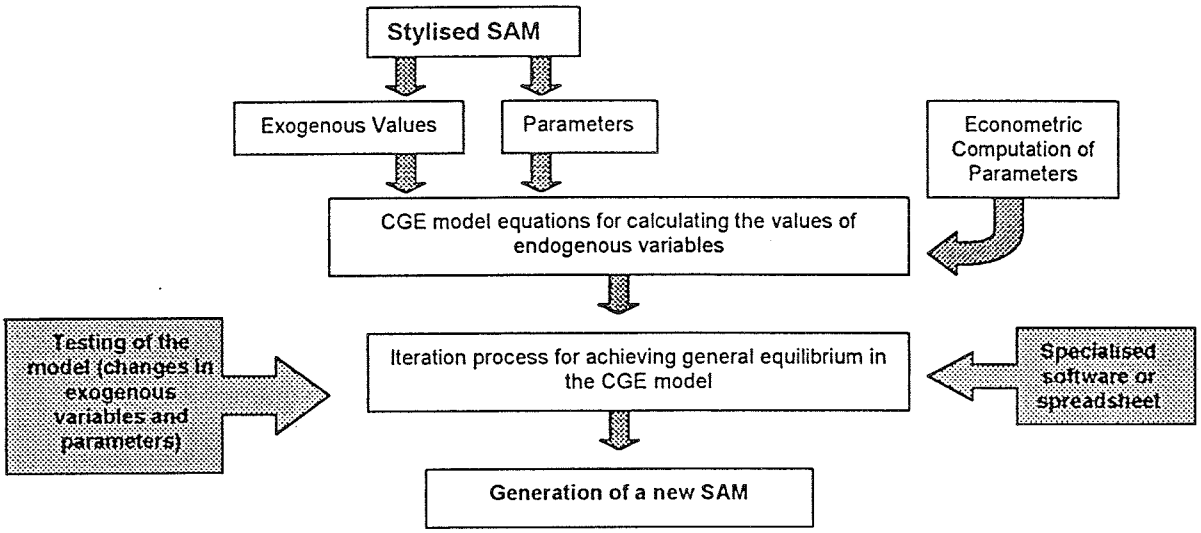
As Taylor (1990) argues, the numbers modellers feed into CGE models must be consistent with the national income and input-output accounting the model equations contain. Thus, CGE models can then be used for applying comparative static exercises around the base data set or for making other sort of exercises such as forecasting, bearing in mind that the accounting rules must be respected (Taylor, 1990: 7). It has become customary to impose tight bookkeeping of the model construction from the beginning by arraying the data in the form of a SAM. The other task of the modeller is the determination of parameters. It has also become customary to determine certain parameters from the SAM. Econometrics is the other 'route' followed by many when estimating parameters and coefficients, although the determination of parameters through calibration is also rather used.

### 4.4.1. Calibration in CGE modelling

The most used way of filling up CGE model equations is by imposing tight bookkeeping from the beginning by arraying the data in the form of a SAM. Notwithstanding, other data sets can also be used, since one only needs a benchmark equilibrium data set in which equilibrium conditions of the assumed underlying equilibrium model are satisfied (Mansur and Whalley: 1984). According to Reinert and Roland-Holst (1997), calibration refers to the process of calculating intercept and share parameters of a CGE model's mathematical functions –given exogenously specified behaviour elasticities- so that the model will replicate the base year SAM as basic equilibrium solution. Nearly every transaction in the SAM is used to calibrate a model function, calculate a policy parameter, or define model constraints and balances.

Figure 4.1 shows the basic steps to build up a calibrated CGE model. The starting point is the availability of a SAM, which becomes a 'stylised SAM' after being aggregated to make it more feasible to work. The SAM provides the exogenous values and the parameters that are directly calculated from it. Other parameters can be calculated by following different methods as explained below. Once the exogenous values and the parameters have been obtained, the model equations can be filled in order to calculate the endogenous variables. The general equilibrium is achieved by a process of iteration, where all the variables and parameters are connected with each other. The iteration process requires using either a specialised computing software or an own constructed spreadsheet.

## Figure 4.1. Calibration process in CGE model building




Source: own construction.

The outcome of a successful iteration process is a new SAM whose values must be the same as those recorded in the 'stylised SAM'. This is a reliable proof that the equilibrium has been achieved and the model has no construction mistakes. The complementary step is the testing of the consistency, where one changes exogenous values to make sure that the iteration works and the model has no inconsistencies. The result of this proof must be a new SAM, which although composed of different values, must be in equilibrium.

### 4.4.2. Basic characteristics of a SAM

A SAM is a square matrix that records the accounts for transactions of an economy. The SAMs were conceived as an initial step for understanding income distribution as an integral part of the development process. In that respect, Pyatt and Roe (1977) point out that the social accounting framework rearranges the national accounts *"to highlight the receipts of factor incomes and their disbursement over various spending institutions; and the extension is designed to divide the household sector into a number of groups distinguished by location (urban, rural), organisation (estates and other rural) and income"* (Pyatt and Roe, 1977: xix). The particular focus on income distribution is consistent with more conventional disaggregations of production, factors, trade, etc. (Pyatt and Round, 1977: 339).

In a SAM, for every row there is a corresponding column and the system is complete only if the corresponding row total and column total match. Moreover, the details of receipts by each particular account are recorded within each row, whereas the corresponding expenditures are recorded column-wise. Therefore, the entry in row *i*, column *j*, represents receipts by account *i* from account *j*.

Let us explain the structure of a SAM by using the 'stylised SAM 1991' for Costa Rica, which is also used to calibrate the CGE model. Costa Rica's SAM was built up by the Ministry of Planning and Economic Policy and its base year is 1991. This SAM is composed of 99 accounts, however it has been aggregated to 12 accounts to make it more feasible to work with at the time of building up the CGE model for Costa Rica. As Pyatt *et. al.* (1986) suggest, the extent to aggregate has depended on the objectives of the analysis (Pyatt *et. al.*, 1986: 111).

The 'stylised SAM 1991' for Costa Rica is composed of four production activities, namely Agriculture (AG), Industry (IND), Services and trade (S&T) and Construction and other nontraded (CONT) (see Table 4.1 in the Appendix). These production activities are represented in aggregated form in Table 4.2 by the account 'Activities'. Furthermore, the matrix incorporates no account for commodities and 'wants'. The 'stylised SAM 1991' considers separate accounts for factors of production. Labour is divided into urban and rural, whereas capital is recorded as a separate account. Urban labour and rural labour are represented in Table 4.2 by the account No. 2, whereas capital corresponds to the account No. 3. In addition, the matrix is composed of accounts for institutions, where households (urban and rural households), enterprises and the government have been separated (see accounts No. 4, 5 and 6 in Table 4.2). Moreover, account No. 7 is the 'Capital Account' at the aggregate level. The SAM also includes information concerning the taxes collected by the government. Accounts No. 8, 9, 10 and 11 show the indirect taxes, import tariffs, export taxes and export subsidies, respectively. Finally, the SAM includes the account 'ROW' (rest of the world) in which current and capital transactions with the rest of the world are recorded.

**Table 4.2. Structure of the 'stylised SAM 1991' for Costa Rica**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Σ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Activities | $T_{1.1}$ | 0 | 0 | $T_{1.4}$ | 0 | $T_{1.6}$ | $T_{1.7}$ | 0 | 0 | 0 | $T_{1.11}$ | $T_{1.12}$ | $T_{1.}$ |
| 2. Labour (Urban-Rural) | $T_{2.1}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $T_{2.12}$ | $T_{2.}$ |
| 3. Capital | $T_{3.1}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $T_{3.12}$ | $T_{3.}$ |
| 4. Households (Urban-Rural) | 0 | $T_{4.2}$ | $T_{4.3}$ | $T_{4.4}$ | $T_{4.5}$ | $T_{4.6}$ | 0 | 0 | 0 | 0 | 0 | $T_{4.12}$ | $T_{4.}$ |
| 5. Enterprises | 0 | $T_{5.2}$ | $T_{5.3}$ | 0 | 0 | $T_{5.6}$ | 0 | 0 | 0 | 0 | 0 | 0 | $T_{5.}$ |
| 6. Government | 0 | $T_{6.2}$ | 0 | $T_{6.4}$ | $T_{6.5}$ | $T_{6.6}$ | $T_{6.7}$ | $T_{6.8}$ | $T_{6.9}$ | $T_{6.10}$ | 0 | $T_{6.12}$ | $T_{6.}$ |
| 7. Cap. Account | $T_{7.1}$ | 0 | $T_{7.3}$ | $T_{7.4}$ | $T_{7.5}$ | $T_{7.6}$ | 0 | 0 | 0 | 0 | 0 | $T_{7.12}$ | $T_{7.}$ |
| 8. Indirect taxes | $T_{8.1}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $T_{8.}$ |
| 9. Import tariffs | $T_{9.1}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $T_{9.}$ |
| 10. Exp. Tax | $T_{10.1}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $T_{10.}$ |
| 11. Exp.Subsidy | 0 | 0 | 0 | 0 | 0 | $T_{11.6}$ | 0 | 0 | 0 | 0 | 0 | 0 | $T_{11.}$ |
| 12. ROW | $T_{12.1}$ | $T_{12.2}$ | $T_{12.3}$ | $T_{12.4}$ | $T_{12.5}$ | $T_{12.6}$ | 0 | 0 | 0 | 0 | 0 | $T_{12.12}$ | $T_{12.}$ |
| TOTAL | $T_{.1}$ | $T_{.2}$ | $T_{.3}$ | $T_{.4}$ | $T_{.5}$ | $T_{.6}$ | $T_{.7}$ | $T_{.8}$ | $T_{.9}$ | $T_{.10}$ | $T_{.11}$ | $T_{.12}$ | |

Note: Some cells that by definition can be filled up with numbers do appear with zeros for the case of the 'stylised SAM 1991' for Costa Rica.
Source: own elaboration based.

The intersections between rows and columns are the modules of a SAM. Their links create a circular economic flow that goes throughout the accounting system. Production activities receive payments from the sale of consumer goods, capital goods, and exports, which are recorded in the intersections $T_{1.4}$, $T_{1.6}$, $T_{1.7}$ and $T_{1.12}$ (see Table 4.2). They also receive revenue from selling intermediate goods to other production activities (as recorded in intersection $T_{1.1}$) and when the government grants export subsidies to them (as recorded in intersection $T_{1.11}$). All these revenues together make up the total sales or gross outputs of each of the production activities. Part of the sales revenue of each production activity is used to purchase raw materials, which may be either domestically produced (as recorded in intersection $T_{1.1}$) or bought from abroad (as recorded in intersection $T_{12.1}$). Another part is directed to pay for indirect taxes, import tariffs, and export taxes, along with the payment of the depreciation allowance. These outlays are recorded in the intersections $T_{8.1}$ $T_{9.1}$ $T_{10.1}$ and $T_{7.1}$, respectively. The remaining and most important part of the revenue takes the form of value added, which goes to the factors of production in the form of wages, rents, and profits, as shown in the intersections $T_{2.1}$ and $T_{3.1}$.

Factors of production receive incomes from the various production activities for provision of factor services. Thus, in the intersections $T_{2.1}$ and $T_{3.1}$ we have the distribution of income between the factors labour (urban and rural) and capital, i.e. wages and profits. Another income received by factors of production is that recorded in intersection $T_{2.12}$, that is factor incomes received from abroad. The factor incomes are then paid out to the providers of factor services. Thus, wages would go to rural and urban households, and profits to those institutions which own the factor capital, which are generally the enterprises. These incomes are denoted by intersections $T_{4.2}$, $T_{4.3}$, $T_{5.2}$ and $T_{5.3}$.

In addition to the factor services income, the institutions receive income from transfers among them. Such transfers are: tax payments to the government (intersections $T_{6.2}$, $T_{6.4}$, $T_{6.5}$ and $T_{6.6}$), profits distributed by companies to shareholders (intersection $T_{4.5}$), transfers between households (intersection $T_{4.4}$), subsidies paid out by the government to households (intersection $T_{4.6}$), and transfers from the government to enterprises (intersection $T_{5.6}$). Clearly, these incomes represent expenditures for those institutions making the transfers. The remaining income of each institution is saved (as recorded in intersections $T_{7.4}$, $T_{7.5}$ and $T_{7.6}$) or spent by households and the government on consumer goods (as recorded in intersections $T_{1.4}$ and $T_{1.6}$). Institutions can also receive current transfers from abroad, which are recorded in intersections $T_{4.12}$ and $T_{6.12}$, and, at the same time they could also transfer current income to abroad, as recorded in intersections $T_{12.4}$, $T_{12.5}$ and $T_{12.6}$.

Institutions can also acquire capital funds in the first instance from their own savings (intersections $T_{7.4}$, $T_{7.5}$ and $T_{7.6}$). There could also be a transfer or flow of funds between them through the savings institutions and capital markets, which in the 'stylised SAM 1991' is only recorded for the government (see intersection $T_{6.7}$). The total of funds available to the economy as a whole is also increased by capital receipts from the rest of the world, as shown in the intersection $T_{7.12}$. The funds obtained by each institution are in part transferred to other institutions as was described above. Beyond this, such funds are spent on capital goods that can be supplied either by domestic producers or by imports.

The total imports into the economy that are recorded in intersection $T_{12.1}$ are directed to the three broad categories of use, namely: final consumption, capital formation and intermediate consumption. On the other hand, the total receipts from the rest of the world are detailed with the major item receipts from exports of goods and non-factor services, which are recorded in intersection $T_{1.12}$.

### 4.4.3. Estimation of parameters

#### 4.4.3.1. Derivation of parameters from the SAM

One of the most widely ways of determining parameters is by directly deriving them from the SAM, by calculating the share of a particular expenditure with respect to the total expenditure. The parameters obtained are known as 'Average Propensities to Spend' (APS), whose analysis allows us to look at the structure of the economy in terms of flows between the economic agents. APS are used to analyse the expenditure structure of the economy in a comparative manner. In addition, APS are fixed, linear, valued at constant prices and considered stable over the short - to medium – term (Alarcón, 1997: 10, 17). By dividing for instance the value of cells $T_{7.4}$, $T_{7.5}$ and $T_{7.6}$ by the column-wise totals $T_{.4}$, $T_{.5}$ and $T_{.6}$ respectively, one obtains the average propensities to save for households, enterprises and the government, respectively. The same can be applied to obtain average propensities to consume, to import, and so on.

### 4.4.3.2. Stochastic estimation and estimation by calibration

The parameters used in a CGE model can also be computed through stochastic estimation, when the major consideration seems to be the choice of functional forms that are consistent with the basic model assumptions. Mansur and Whalley (1984) explain that the determination of parameters begins by selecting the functional forms, which can be of the type Cobb-Douglas, Stone-Geary and Constant Elasticity of Substitution (CES) (Mansur and Whalley, 1984: 93). Once the functional forms for demand and production functions are specified, the next step is to apply econometric estimation from which the parameter values are calculated.

Shoven and Whalley (1992) present an interesting technique for determining parameters through calibration, when one makes the assumption that there exists an equilibrium observed in the economy under consideration in the presence of the existing policies. The equilibrium is to be used to solve for model parameters. The benchmark equilibrium data can be used to calculate production function parameters of the use of capital and labour services in each sector of the model (Shoven and Whalley, 1992: 115). Let us assume CES valued-added functions for each of $N$ sectors in a two-factor tax CGE model in order to explain this technique. These functions can be written as follows:

$$Y_j = \left[\gamma_j \delta_j K_j^{-\rho_j} + (1-\delta_j) L_j^{-\rho_j}\right]^{-1/\rho_j} \qquad (j = 1 \ldots N)$$

where $\gamma_j$ is a constant defining units of measurement, $\delta_j$ is a weighting parameter, $\sigma_j$ is the elasticity of substitution, $K_j$ and $L_j$ are service inputs, and $Y_j$ is the sectors' value added.

The values for the capital and labour service inputs can be obtained from the benchmark equilibrium data. In addition, factor tax rates ($t_j^K$ and $t_j^L$) can also be directly derived from the initial data set. Prices associated with the equilibrium quantities are known, as factor prices ($P_K$ and $P_L$) are equal to one in the base year. Thus, once the elasticity parameter $\sigma_j$ is selected for each sector, the values of the share parameters $\delta_j$ are given by:

$$\delta_j = \left[\frac{K_j^{1/\sigma_j}(1+t_j^K)}{L_j^{1/\sigma_j}(1+t_j^L)}\right] \Big/ \left[1 + \left[\frac{K_j^{1/\sigma_j}(1+t_j^K)}{L_j^{1/\sigma_j}(1+t_j^L)}\right]\right]$$

Values for $\gamma_j$ are then derived from the zero-profit conditions for each sector, given the units definition of outputs. The requirement that the CES production function be consistent with the benchmark data and units implies that, given $\rho_j$, the other two parameters of the function can be determined. An analogous procedure can be used to compute parameters for household demand functions, demand function elasticities, trade elasticities and so on (*Op. Cit.* 1992: 116-123).

## 4.5. CLOSURE RULES IN CGE MODEL BUILDING

One of the most important steps in CGE modelling is the definition of closure rules, which are necessary to establish the mechanisms used to close the model. The selection of the 'closure' serves to typify the entire model or the modules within it. This step becomes key for the modeller as it helps to consistently introduce the definition of the model equations and facilitate the understanding of how the model works (Alarcón, 1997: 48). The selection of the closure is based on the school of though that supports the model structure.

Neoclassical closures assume full utilisation of factors, whereas output and income are assumed to be determined mainly via the production side. Here the equilibrium is reached as prices adjust to clear markets, and one of the prices is used as a unitary numeraire because relative prices influence on the real side of the economy.[11] It is also assumed that total investment is endogenously defined and equal to total savings. The equilibrium is tested by using excess demand equations for the product and factor markets and providing the system constraints defining equilibrium in the markets. The Walras' Law must then be satisfied as the sum of the nominal excess demands across all product and factor markets is zero. In addition, a balance of payments constraint is included to assure foreign exchange equilibrium (Robinson, 1989: 911-912).

On the contrary, "structuralist closures" take into account institutional constraints such as unlimited supplies of labour, supply rigidities, low domestic savings capacity and foreign savings constraints, among others. It has become customary to include structural rigidities by assuming a fixed nominal wage rate or government transfers, and the existence of mark-up pricing data due to supply constraints. Differently to the neoclassical closure, the structuralist closure assumes non-homogeneity, however it similarly incorporates a price index as the numeraire.

A typical Keynesian closure is composed of five rules, namely: income equals the value of output, prices are normalised (P = 1), consumption is a fraction of real income, output adjusts to satisfy demand-supply balance, and since savings are present in the system, there must be a demand injection in at least one sector to permit a sensible solution to exist (Taylor, 1990: 39). The demand injection is explained by increased exogenous investment. Given exogenous fixed savings rates, income and real output increase through a multiplier process that makes it possible to reach the equality between savings and investment. Because of the higher investment, firms are expected to hire labour as they are assumed to be on their demand curves for labour. Hence, the real wage must fall providing thus the driving variable by which the multiplier process works. Here the macro-equilibrating variable is the aggregate price index, as the nominal wage is considered fixed.

Price and quantity adjustments are the mechanism through which markets clear in the Kaleckian closure. Price-market-clearance is assumed to occur in some commodity markets, whereas quantity adjustments prevail in other markets where prices are cost-determined, usually defined by mark-ups over a variable production cost. Similarly to the Keynesian closure, the Kaleckian closure assumes savings equal investment through the exogenous investment adjustment. Thus, sectoral capital stocks become exogenous while sectoral rental rates become endogenous, so that the corresponding equations for factor's market can be removed. Sectoral employment can be assumed to be linked to sectoral output via labour-output coefficients. Finally, the definition of sectoral wages may include labour productivity growth rates (Alarcón, 1997: 52-53).

## 4.6. FINAL REMARKS

Although the modeller has available several data sets to fill his CGE model equations, it has been empirically proved by scholars like Robinson and Taylor, that the accounts of a SAM are the most feasible data source to provide the underlying data framework for CGE models with an income-expenditure account for each sector in the model. Because of this, the CGE model for Costa Rica is based on a SAM, and its calibration is carried out as explained in this chapter.

[11] The most commonly used numeraires are the producer or consumer price index, the real exchange rate, the wage rate, the GDP deflator or any particular commodity price among others.

# Chapter Five

# A CGE MODEL FOR ANALYSING IMPLICATIONS OF THE OPENING OF TRADE ON THE COSTA RICAN ECONOMY

## 5.1. INTRODUCTION

This chapter deals with the construction of a static Computable General Equilibrium (CGE) model to analyse the effects of the opening of trade process on Costa Rica's economy, focusing on production, income distribution and the balance of trade. The model is calibrated to the Costa Rican 'stylised-SAM' for 1991 and belongs to the family of CGE models developed since the second half of the 1970s, basically by Dervis, de Melo and Robinson (1982), as instruments of planning and policy analysis for developing countries. In addition, the model involves *counterfactual* simulation, hence it is structured to analyse what would have happened if the opening of trade policies had been differently applied with respect to the situation in 1991. Even though the model shows a neoclassical structure, it incorporates certain 'structuralist rigidities', as for instance in the labour market and in the determination of wages and the exchange rate. Therefore, the model can be placed among the so-called 'micro structuralist' CGE models, since some markets do not work perfectly and factor mobility restrictions are incorporated.

The general assumptions on which the model is based are presented in Section 5.2. Furthermore, the way in which the model has been calibrated and its closure rules are considered in Section 5.3. The model equations are shown in Section 5.4, where the construction of the model is explained along with the core model assumptions. Finally, the final remarks of the chapter are presented in Section 5.5, where some details about the running up of the model are mentioned.

## 5.2. GENERAL ASSUMPTIONS OF THE MODEL

Economic performance is assumed to be the outcome of decentralised decisions in the model, made by producers and consumers in response to market indicators, which are influenced by trade policy and the exogenous variables of the model (see Table 5.1 in the Appendix). However, markets are neither perfect nor producers and consumers guide their decisions strictly by neoclassical rules of profit maximisation and utility maximisation, respectively. The model specifies some rigidities and imperfections in the economy that are formally modelled. Furthermore, the model works with fixed prices for the base year 1991 since the analysis to be carried out is of the *counterfactual* type.

The "small-country assumption" is used in the model since Costa Rica is too small to affect the terms at which it trades. The country is a price taker and hence faces fixed exogenous world prices. This means that the relative prices system is exogenous, thus the country adjusts to exogenous prices and produces only commodities that can yield a profit. The country also exports a part of its production to pay for imports. Moreover, both supply and demand adjust to exogenous world prices in this economy, where transport costs as well as product differentiation are assumed insignificant.

Domestically produced and imported commodities of the same sector category are assumed imperfect substitutes.[12] As Dervis *et. al.* (1981) argue, *"this treatment is a compromise between the*

[12] This is the so-called "Armington" assumption.

*assumption of perfect substitutability found in the trade theory and the assumption of perfect complementarity found in 'two-gap' models"* (Dervis *et. al.*, 1981: 4). The justification for such a 'treatment' is that in a context of opening of trade, consumers and producers demand commodities according to their behaviour, regardless of whether these commodities are imported or produced domestically.

## 5.3. MODEL CALIBRATION AND CLOSURE RULES

The building up of the CGE model for Costa Rica implies tight bookkeeping from the start by arraying the data in the form of the 'stylised-SAM'. The base-year calibration procedure follows that initial prices and quantities are combined with parameters and elasticities to calculate share parameters and exogenous constants that validate the base-run values of the SAM (Vos, 1994: 8). The parameters derivation has been carried out by following the typical applied CGE modelling technique that is to derive all the average spending propensities directly from the SAM. In the case of tax and subsidy rates the derivation is also done from the 'stylised-SAM'. The trade elasticities and the Constant Elasticity of Substitution (CES)-functions parameters reflect a combination of own computations and borrowed estimates from other studies. The detail about the parameters, elasticities, and tax and subsidy rates is shown in Table 5.2 in the Appendix.

The model includes four sets of rules to close the whole system: (i) investment is assumed to equal total savings in the economy; (ii) prices are normalised; (iii) product market equilibrium is to be tested by excess demand equations by sectors, where supply and demand must be equal; and (iv) the balance of payments constraint is assumed to be zero, since the model incorporates the assumption of infinite availability of foreign exchange to finance imports.

## 5.4. CONSTRUCTION AND STRUCTURE OF THE MODEL

The model is composed of n=4 commodities; n-1 traded commodities from the sectors Agriculture, forestry and fishing (AG); Industry (IND); and Services and trade (S&T); and one nontraded commodity from the sector 'construction and other nontraded' (CONT).[13] It is assumed that the four commodities produced in the economy are demanded domestically at all relevant price configurations, which indirectly implies that any particular commodity has identical characteristics whether it is produced at home or abroad. In addition, the agents of the model are households of *k* categories (urban and rural), government and enterprises, and there are two factors of production: labour of *k* categories (urban and rural) and capital. Labour is considered as the only variable factor of production whose demand is defined in the model.

As shown in Table 5.3 in the Appendix, the model is composed of 44 equations. Once these equations were applied to the four sectors of the model, factors of production, and the agents, the model was made up of 133 equations that determined 133 endogenous variables. In addition, a total of 32 exogenous variables and 80 parameters were used in the model (see Table 5.1 in the Appendix). The basic notation of the model that is used throughout this section is shown in the Appendix.

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[13] The sectors are abbreviated as AG, IND, S&T and CONT in the following sections of the paper.
The sector CONT produces the so-called in modelling literature 'home goods', which are commodities that are not subject to international trade. The subscript *NT* denotes this sector in the model equations.

### 5.4.1. Sectoral Supply and Factor Markets

The four sectors of the model are assumed not to face capacity constraint, as the analysis applies to the short term, so that no additional investment is necessary. The domestic market for each sector clears for its price, which depends on the world market price of imported substitutes.[14] Furthermore, the model retains the assumption of fixed coefficients for intermediate technology and the composition of capital commodities.

Total supply by activities is specified in the model as in Vos (1994), where sectoral total output ($X_i^S$) equals the sum of domestic absorption ($D_i$) plus export subsidies ($te_i*E_i$) and exports by activities ($E_i$).[15] Thus, the equation for domestic sectoral supply can be denoted as:

$$X_i^S = D_i + (te_i * E_i) + E_i \qquad \textit{(Eq.1)}$$

where $E_i$ is defined as in section 5.4.6, $te_i$ denotes the export subsidy rate and $D_i$ is domestic absorption defined as:

$$D_i = \sum_j V_{ij} + C_i + Z_i \qquad \textit{(Eq.2)}$$

where $V_i$ is sectoral intermediate demand, $C_i$ is aggregate final demand by commodity (as defined in section 5.4.3), and $Z_i$ is gross investment by sector (as specified in section 5.4.4).

The model considers fixed amounts of capital in each sector and incorporates Leontief input-output technology for intermediate inputs, so that it is not necessary to specify a separate aggregation function for an intermediate-commodities aggregate. This implies that total intermediate demand by sector of origin can be directly specified as:

$$V_i = \sum_j V_{ij} = \sum_j a_{ij} X_j \qquad \textit{(Eq.3)}$$

where $a_{ij}$ are the input-output coefficients, which are fixed and calculated from the 'stylised-SAM'.

The sectoral labour input for the four sectors is an aggregation of labour of rural and urban origin.[16] The aggregation of labour by sector $L_{ik}$ with $k$ types of labour is given by:

$$L_i^a = L_i^a(L_{i1}, \ldots, L_{ik}) \qquad \textit{(Eq.4)}$$

Labour demands are not determined by the neoclassical conditions that wages equal the value of the marginal products of different types of labour. The model relaxes labour market clearance and allows real wage rigidities in the labour market, which appears more realistic for developing countries. Furthermore, it is assumed that there is excess of labour supply in the economy, which seems to be the case in Costa Rica's economy. This does not affect the solution of the model because, as Taylor (1990) argues, "*macro balance does not presuppose either full capacity use of full employment of labour...*" (Taylor, 1990: 16-17). Thus, the nominal wage bill is not the clearing-price in the labour market and is determined by the real wage $\overline{W_{ki}}$ (considered fixed in the model) and the price level defined below. The equation for the nominal wage bill can then be written as:

$$W_{ki} = \overline{W}_{ki} \sum_i P_i \Omega_i^{ll} \qquad \textit{(Eq.5)}$$

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[14] This effect is direct for the price of traded commodities and indirect for that of the nontraded commodity (see below).
[15] This specification includes a Cobb-Douglas production function that gives the initial level of output for 1991, but does not iterate in the model when carrying out policy simulation scenarios since the model is static. Furthermore, since the model is calibrated to the 'stylised-SAM', total sectoral supply must include export subsidies ($te_i$) granted to domestic tradable sectors. Note that neither $E_i$ nor $te_i$ in *Eq.1* should be taken into account for the sector CONT.
[16] The initial data of sectoral labour input were obtained from the Central Bank of Costa Rica.

where $\Omega_i^W$ denotes the weights in the price index that defines the nominal wage bill $W_{ki}$, and $P_i$ is, on the one hand, the composite price for traded commodities; and on the other hand, the domestic price for the only nontraded commodity, as explained in section 5.4.5.

For specifying the demand functions for labour by sector, it has been assumed a 'Cobb-Douglas situation', where the factor elasticity of substitution ($\sigma_i$) is equal to one, and therefore the coefficient of factor-substitution in the demand function ($\rho_i$) is equal to zero. Thus, the demand functions for labour by sector can be written as follows:

$$L_{ki} = b_{ki}\left(\frac{W_{ki}}{PD_i}\right)^{-\rho_i} \cdot X_i \qquad \textit{(Eq.6)}$$

where, $b_{ki}$ is the labour-output ratio obtained by dividing the base year employment by total output. Hence, the aggregate labour demand per category of labour assumes the following form:

$$L_k^D = \sum_i^n L_{ki} \qquad \textit{(Eq.7)}$$

According to Dervis *et. al.* (1982), this formulation for labour demands creates no complication since the assumption of fixed capital stocks makes the transformation set to be strictly convex. In addition, the resource constraints become 'side equations' giving the total possible employment of labour in the economy (see detail below). Furthermore, the fixed-wage specification creates no problem to the model because capital stock is a constant sector-specific factor. Payments to the factor capital in the four sectors are seen as a residual after payments for labour and intermediate inputs. Hence, total factor payments equal total value added.

The rigidities in the labour market and the excess labour supply involve further assumptions on how the excess supply is rationed in the system. One of the assumptions is that firms are always in their demand curves for labour, therefore unemployed labour is assumed to drop out of the economy, e.g. neither receives income nor generates effective demand (Ginsburgh and Robinson, 1983: 28). Although the model considers no constraint for the labour market, real wages continue to play a role in defining the demand for labour, sectoral profits, income of households and enterprises. Consequently, real wages play also a role in indirectly defining the savings-investment equilibrium.

The four model sectors are treated as composed by many similar firms (which can be the own members of the families interacting as capitalists or enterprises as such) maximising profits and bidding for factors. Since it is assumed perfect competition in product markets, all firms take commodity prices as given so that each sector is treated as one large price-taking firm (Dervis *et. al.* 1982: 143). The aggregate sectoral profits are determined residually as follows:

$$\Pi_i = X_i^S - (\sum_j V_{ij} + \sum_i W_{ki} + \Phi_i * X_i^S + td_i * X_i^S + tm_i * M_i + tx_i * E_i + M_i) \qquad \textit{(Eq.8)}$$

where, $\Phi_i$ denotes the rate of depreciation by sector, $td_i$ is the indirect tax rate per activity, $tm_i$ is the import tariff rate by activity, $tx_i$ is the export tax rate by activity, and $M_i$ and $E_i$ are imports and exports by activity, respectively.

### 5.4.2. Institutional Income

Total value added at market prices is distributed to the various institutions, which are the agents of the model whose behaviour is specified through an elaborate set of accounting and behavioural rules, in order to determine the way in which value added is distributed among them. The accounting

framework is based on the Costa Rican 'stylised-SAM', whereas the behavioural rules are determined through the equations of expenditure (consumption and savings), as explained in section 5.4.3.

Since the model is calibrated to a 'stylised-SAM', there will be within each household category (urban and rural) labourers (who own and supply the factor labour) and capitalists (who receive profits from their participation in capitalist activities). Enterprises own the capital stock and hence receive all capital income (except the unincorporated and distributed profits that go to the households). It is assumed that the government owns no capital and receives its income strictly from taxation.

### 5.4.2.1. Households' income

After having clarified that the households of *k* categories are composed not only of labourers but also of capitalists, the next step is to define households' income, whose equation can be written as follows:

$$Y_{Hk} = \left( \sum_i W_{ki} + UBP_{Hk} + DBP_{Hk} + \overline{GTR}_{Hk} + \overline{NHTR}_{Hk} \right) \qquad (Eq.9)$$

where $Y_{Hk}$ is households gross income for *k* categories, $W_k$ is the nominal wage bill per type of labour, $UBP_{Hk}$ denotes the unincorporated business profits to households of *k* categories, $DBP_{Hk}$ represents the distributed business profits to households of *k* categories, $\overline{GTR}_{Hk}$ denotes current transfers from the government to households of *k* categories, and $\overline{NHTR}_{Hk}$ represents net households' transfers to abroad going to *k* categories of households. The last two variables are exogenous and obtained from the 'stylised-SAM'.

The unincorporated business profits are a fixed proportion $\varpi_{Hk}$ of the capital income $Y_K$ (which is defined in *Eq.13*) and can hence be denoted as:

$$UBP_{Hk} = \sum_{Hk} \varpi_{Hk} * Y_K \qquad (Eq.10)$$

The shares $\kappa_{Hk}$ of household categories on distributed profit incomes determine the distributed profits to *k* categories of households. Hence, the equation for distributed business profits to households ($DBP_{Hk}$) can be written as follows:

$$DBP_{Hk} = \sum_{Hk} \kappa_{Hk} * Y_K \qquad (Eq.11)$$

Finally, disposable income by household categories can be written as:

$$YD_{Hk} = \sum_k Y_{Hk} (1 - t_k) \qquad (Eq.12)$$

where $t_k$ is the direct tax rate levied to *k* categories of households' gross income.

### 5.4.2.2. Enterprises' income

The definition of enterprises' income requires specifying the income of factor capital, which is to depend on the profits generated in all sectors of the economy and an exogenous amount of money that results from factor income from abroad ($\overline{KIFA}$). The income of factor capital can be determined as:

$$Y_K = \sum_i \Pi_i + \overline{KIFA} \qquad (Eq.13)$$

Having specified *Eq.13* allows us to denote the income of enterprises as follows:

$$Y_E = \left( Y_K - \sum_k DBP_{Hk} - DKTR - KIPA \right) \qquad (Eq.14)$$

where $Y_E$ is gross income of enterprises; $Y_K$ is gross income of factor capital; $\Sigma_k DBP_{Hk}$ is the sum of distributed business profits granted to $k$ categories of households, *DKTR* denotes domestic capital transfers[17]; and *KIPA* denotes the factor income paid abroad.

Domestic capital transfers are defined as a share of the income of factor capital. Thus, incorporating a parameter $\varepsilon_K$ that denotes capital transfers in the economy as a share of the income of factor capital yields an equation for domestic capital transfers of the form:

$$DKTR = \varepsilon_K * Y_K \qquad \textit{(Eq.15)}$$

Finally, capital income paid abroad is defined as a share $\gamma_K$ of gross capital income, so that this leakage of capital can be denoted as:

$$KIPA = \gamma_K * Y_K \qquad \textit{(Eq.16)}$$

Enterprises' disposable income $YD_E$ can then be obtained by subtracting the corporate tax (*tc*) and the unincorporated business profits ($UBP_{Hk}$) from enterprises' gross income, as below:

$$YD_E = Y_E * (1 - tc) - UBP_{Hk} \qquad \textit{(Eq.17)}$$

### 5.4.2.3. Government's income

It has already been said that government's income is strictly determined by the amount of money it collects from taxation. In addition, the government also receives income transfers from abroad or foreign aid, as shown by the 'stylised-SAM' (see Table 4.1 in the Appendix). Therefore, the equation to determine the income of the government has to be written as:

$$Y_G = t_k * \sum_k Y_{Hk} + tc * Y_E + ITI * \sum_i TINV_i + \sum_i td_i X_i^S + \sum_i tm_i M_i + \sum_i tx_i E_i + \overline{AID} \qquad \textit{(Eq.18)}$$

where, $Y_G$, $Y_{Hk}$, and $Y_E$ are the incomes of government, households of $k$ categories, and enterprises, respectively; *TINV* is total net investment; $X_i^S$ is the sectoral output; $E_i$ and $M_i$ are exports and imports, respectively; $\overline{AID}$ denotes foreign aid; $t_k$ is the direct tax rate levied on $k$ categories of households, *tc* is the corporate tax rate, *ITI* is the indirect tax rate on total gross investment, $td_i$ is the indirect tax rate by activity, $tm_i$ is the import tariff rate; and $tx_i$ is the export tax rate. The determination of total net investment by sector, imports by sector, and exports by commodity, will be explained below.

## 5.4.3. Savings and final demand

The economic agents are assumed to decide the amount of their income to be consumed after determining the proportion that is saved. These agents save a constant fraction of their disposable income. This is a Keynesian assumption as far as households are concerned (Robinson and Tyson, 1984: 252). However, the exogenous foreign savings must be added to determine total savings. Thus, total savings (*S*) is withdrawn from the system and is denoted as:

$$S = \sum_k \bar{s}_{Hk} YD_{Hk} + \bar{s}_E YD_E + \bar{s}_G Y_G + \overline{FS} \qquad \textit{(Eq.19)}$$

where *Hk* applies to urban and rural households, *E* applies to enterprises and *G* to government; $\overline{FS}$ denotes the exogenous foreign savings and $\bar{s}$ the fixed proportion of savings by agent.

[17] The SAM for Costa Rica records an amount of money going from the account 'factor capital' to the 'capital account'. This amount is recorded as indirect tax on investment, going from the 'capital account' to the account 'government'. Since the calibration of the CGE model has been carried out by using the Costa Rica's SAM as it was constructed, the variable *DKTR* has been included, so that a base run equilibrium can be reached.

Defining each agent's savings leaves them with a remaining amount of income to spend on final consumption of commodities from the four sectors of the economy. The demand for commodities depends on the decision of the *k* categories of households (urban and rural), which demand consumer commodities from the sectors of the economy; and the government, which demands a fixed amount of such consumer commodities. The consumption equations for households of *k* categories and the government are respectively:

$$C^{D}_{iHk} = \overline{q}_{iHk}\left(1-\overline{S}_{Hk}\right)YD_{Hk} \qquad \textit{(Eq.20)}$$

$$C^{D}_{iG} = \overline{C}^{D}_{iG} \qquad \textit{(Eq.21)}$$

where $\overline{q}_{ij}$ represents the set of expenditure share parameters that are obtained from the 'stylised-SAM', and $YD_{Hk}$ is the disposable income of *k* categories of households.

Aggregating such demand functions yields an aggregate final demand function for each commodity $C_i$ of the form:

$$C_i = C_{iHk} + \overline{C}_{iG} \qquad \textit{(Eq.22)}$$

The demand functions of households are not required to be strictly derived from explicit utility functions but must be homogeneous of degree zero in prices and incomes. They are supposed to be continuous and 'well behaved' so that each set of prices and associated incomes can be related to a unique vector of consumption demands. Since there are several groups of consumers, the same vector of consumption demands cannot recur for different sets of prices (Dervis *et. al.*, 1982: 147).

### 5.4.4. Total investment and investment by sector

Now, it is necessary to explain what happens to the total savings withdrawn from the flow of funds. It is assumed that all savings are spent on investment commodities. Thus, there is a predetermined share of investment net of depreciation going to each of the sectors, which is complemented by exogenous foreign savings. This leads to a total net investment (*TINV*) equation of the following form:

$$TINV = \sum_{Hk} \overline{S}_{Hk} YD_{Hk} + \overline{S}_{E} YD_{E} + \overline{S}_{G} Y_{G} + \overline{FS} \qquad \textit{(Eq.23)}$$

The mechanism of equating the aggregate savings and the aggregate investment is a macro closure of this model, which "*is necessary to maintain macroeconomic balance in the nominal flow of funds generated by the model solution*" (Robinson and Tyson, 1984: 252). This closure-rule is 'classical' since given the fixed saving rates and the exogenous savings, the endogenously determined volume of aggregate savings determines the volume of aggregate investment.

Once the aggregate net investment has been established, its sectoral allocation must be determined. The model incorporates a function as the one used by Robinson and Tyson (1984) which is based on the workings of financial markets in the investment allocation process. The function takes into account fixed coefficients ($\theta_i$) in order to divide total net investment among the sectors. Thus, the equation of net investment by sector ($I_i$) can be denoted as:

$$I_i = \theta_i * TINV \qquad \textit{(Eq.24)}$$

where $\theta_i$ are exogenous sectoral net investment shares determined from the 'stylised-SAM'.

Adding up depreciation to net investment by sector leads to obtain gross sectoral investment ($Z_i$) as it appears column-wise in the 'stylised-SAM'. The rate of depreciation ($\Phi_i$) is calculated from the 'stylised-SAM' as a percentage of sectoral output. Thus, gross sectoral investment for the base year can be determined as follows:

$$Z_i = I_i + (\Phi_i^* X_i^s) \qquad \textit{(Eq.25)}$$

The process of investment allocation is not explicitly modelled and the role of financial markets in the allocation of loanable funds is not considered. The model has consistency in this sense, as it considers a simple macro financial structure in which money is the only asset. This is also consistent with the price normalisation rule assumed in the model as explained in the next section.

### 5.4.5. The price system of the model

#### 5.4.5.1. Domestic price for traded commodities

The model differentiates between the domestic price of products produced in the tradable sectors, and the domestic price of the product produced in the aggregate non-tradable sector. The difference is that, given the small country assumption, the domestic price of traded commodities directly depends on the world fixed-price of imports (Robinson and Tyson, 1983: 7). Thus, the equation for the domestic price of traded commodities is written as:

$$PD_i = \overline{PW_i} * ER \qquad \textit{(Eq.26)}$$

where $PD_i$ is the domestic price for $n$-1 tradable sectors, $\overline{PW_i}$ is the world price denoted in US dollars, and $ER$ is the nominal exchange rate expressed as the price of one US dollar in terms of the Costa Rican currency, that is the Colón. It is worth mentioning that the model maintains a fixed and exogenous exchange rate. Since $\overline{PW_i}$ and $ER$ equal to unity, the domestic price for $n$-1 traded commodities also equals one in the base year 1991.

#### 5.4.5.2. Domestic price for the nontraded commodity

The derivation of the domestic price for the nontraded commodity falls on the normalisation rule that is explained with detail in section 5.4.7, which is incorporated as a closure rule. Such a rule implies that the model normalises around an overall price index that considers the prices in all markets, including imports and intermediate commodities. Thus, the equation that determines the domestic price of the nontraded commodity is given by:

$$PD_{NT} = \frac{\overline{P}}{\Omega_{NT}} - \frac{\sum_{i=1}^{n-1} P_i \Omega_i}{\Omega_{NT}} \qquad \textit{(Eq.27)}$$

where $\overline{P}$ is the exogenous level of aggregate price index, $P_i$ is the composite commodity price of traded commodities, $\Omega_i$ is the price index weight for the $n$-1 traded commodities, and $\Omega_{NT}$ is the price index weight for the only nontraded commodity.

Although the determination of the composite commodity price of traded commodities ($P_i$) is explained in section 5.4.7, it is relevant to mention at this point that this price is determined by a cost function derived from a Constant Elasticity of Substitution (CES) aggregation function that determines an aggregate of composite commodity. Let us remember that the $n$-1 traded commodities produced domestically and imported commodities are assumed imperfect substitutes. Therefore, consumers and producers can demand commodities produced domestically or imported, which involves the

specification of an aggregate commodity composed by both sorts of commodities. The composite commodity price of traded commodities ($P_i$) corresponds to the price of this aggregate commodity.

Equation *Eq.27* implies that the domestic price of the nontraded commodity is to be indirectly affected by trade policy and the exchange rate, in so far as the composite commodity price of traded commodities ($P_i$) depends on the price of imported commodities and the domestic price of traded commodities. The latter was already denoted in *Eq.26*, where the nominal exchange rate plays a role in determining the level. In addition, as specified below, the price of imported commodities is also affected by import tariffs. Policies such as the reduction of import tariffs create a price-effect through the domestic price of traded commodities and the price of imported commodities, which consequently affects the domestic price of the nontraded commodity.

The price effect can also be understood, as the overall price index must remain at its predetermined value in the base run. For instance, a devaluation of the local currency would increase the price of all traded commodities as explained in *Eq.26.* Therefore, keeping the overall price index at its predetermined value requires the price of the nontraded commodity to fall. The size of such a fall depends on the magnitude of the devaluation as well as on the weight of the nontraded commodity in the commodity basket that defines the price level.[18]

### 5.4.5.3. Price of imported commodities

The small-country assumption implies that Costa Rica is small on the import side -and on the export side as explained below. This means that the country constitutes only a small fraction of the market for commodities produced in the rest of the world. Thus, the world price of the imported substitute is exogenously fixed and the supply of imports is infinitely elastic at that price. Therefore, the price of imports in the domestic market is given by the following equation:

$$PM_i = \overline{PW_i}(1+tm_i)ER \qquad \textit{(Eq.28)}$$

where $tm_i$ denotes the *ad valorem* tariff on imports.

This specification implies a chain of causality affected by trade policy, since the latter influences on domestic prices. For instance, the government can impose an import tariff on certain category of imports, and by so doing it will raise the domestic price of that category of imports and the price of the domestically produced import-competing commodities. The government appears in the model as having control over the relative domestic prices of traded commodities, which makes trade policy become a powerful instrument that affects production, income distribution, and the balance of trade.

### 5.4.5.4. Price of exported commodities

On the export side, the small-country assumption is maintained, which implies that the country's export prices are fixed in the world market independently of the quantities exported. Nevertheless, export subsidies, export taxes, and the exchange rate are assumed to have some influence on the determination of export prices as well. Hence, the domestic currency receipts of exporters per unit of exports by sector *i* can be denoted as:

$$PE_i = PWE_i[1+(te_i - tx_i)]ER \qquad \textit{(Eq.29)}$$

where $PWE_i$ is the exports world dollar price, $te_i$ the export subsidy rate, and $tx_i$ the export tax rate.

[18] Each weight is the ratio of sectoral value output to total value output of the economy, as they appear in the SAM.

The world price of exports, $PWE_i$, which is the dollar price of the country's exports, is endogenously determined by its domestic production costs, export incentives, and exchange rate policy, as pointed out by Dervis *et. al.* (1982). Thus, this world price of exports can be determined as:

$$PWE_i = \frac{PD_i}{[1+(te_i - tx_i)]ER} \qquad \textit{(Eq.30)}$$

According to this specification of the world price of exports, an increase in domestic production costs is expected to increase $PD_i$ and therefore $PWE_i$ increases too. An increase in export subsidies ($te_i$) as well as an increase of the exchange rate ($ER$) lead to a fall in $PWE_i$. On the other hand, an increase of the export tax $tx_i$ can lead to an increase in $PWE_i$.

### 5.4.6. Product differentiation and the treatment of imports and exports

In a context of opening of trade, consumers and producers have available either domestic commodities or imported commodities, and they decide which of them to buy according to their needs, preferences, and convenience. To consider such a reality, the model treats imports as imperfect substitutes of domestically produced commodities. Therefore, it becomes necessary to define for each tradable commodity category from the sectors AG, IND, and S&T, a composite commodity $Q_i$. In other words, the model adopts the Armington assumption and incorporates such a composite commodity to distinguish between domestic commodities and foreign commodities. This commodity is a Constant Elasticity of Substitution (CES) function of commodities produced domestically ($D_i$) and produced abroad ($M_i$). Such an aggregation can be denoted by:

$$Q_i = \overline{B_i}\left[\delta_i M_i^{-\rho_i} + (1-\delta_i) D_i^{-\rho_i}\right]^{-1/\rho_i} = f(M_i, D_i) \qquad \textit{(Eq.31)}$$

where $\overline{B_i}$ and $\delta_i$ are CES parameters, $\rho_i$ is a CES substitution parameter, and $M_i$ and $D_i$ operate as "inputs" to produce the aggregate output ($Q_i$). Thus, the demand for imports and commodities produced domestically become derived demands (Dervis *et. al.*, 1981: 4). The solution to such a specification is to find a ratio of "inputs" ($M_i$ and $D_i$) so that the marginal rate of substitution (that is the slope of the iso-output curve for the composite commodity) is equal to the ratio of the price of the commodity produced domestically ($PD_i$) to the price of the imported commodity ($PM_i$). Robinson and Tyson (1984) explain that the desired ratio of imports to the domestic commodity is derived from first-order conditions for minimising cost and is a function of the relative prices of the domestic commodity and the imported substitute. Such a statement can be reflected in the following condition:

$$m_i = \frac{M_i}{D_i} = \left(\frac{PD_i}{PM_i}\right)^{\sigma_i} \cdot \left(\frac{\delta_i}{1-\delta_i}\right)^{\sigma_i} \qquad \textit{(Eq.32)}$$

where $\sigma_i = 1/(1+\rho_i)$ is the trade-substitution elasticity of commodity $i$ [19] and $\delta_i$ is the share parameter in the CES trade aggregation function.[20]

Given the "composite commodity" specification, the demand for imports depends on the relative price of domestically produced and imported commodities in the domestic market. Thus, the import demand functions are denoted as:

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[19] For the Costa Rica's CGE model, the trade elasticities of substitution have been borrowed from Dessus and Bussolo (1998), pp.15-16. The parameters $\overline{B_i}$ and $\delta_i$ of the CES function are computed by using the calibration procedure to estimate parameters explained in Shoven and Whalley (1992), pp.115-123.

[20] It has been assumed a CES function since they have recently become widely used in most CGE models for international trade. For more detail see de Melo and Robinson (1985), p. 11.

$$M_i = \left(\frac{\delta_i}{1-\delta_i}\right)^{\sigma_i} \cdot \left(\frac{PD_i}{PM_i}\right)^{\sigma_i} \cdot D_i \qquad \textit{(Eq.33)}$$

Here, a ratio of domestic commodities $d_i$ in total composite commodity use should be incorporated in order to specify the demand functions of the domestically produced components. Such a ratio is called 'domestic use ratio' and its determination is denoted as follows:

$$d_i = \frac{D_i}{Q_i} = f_i^{-1}(m_i, 1) \qquad \textit{(Eq.34)}$$

Since $m_i$ is a function of $PD_i/PM_i$ only, the 'domestic use ratio' will also depend only on such a ratio. Furthermore, the aggregate demand for the composite commodity $Q_i$ itself will depend on the relative price system.

Having defined $d_i$ allows specifying the demand for the domestically produced commodity. It is worth mentioning that consumers and producers demand this composite commodity and hence, the demands for imports and for domestic traded commodities become derived demands. Thus, $V_i$, $C_i$, and $Z_i$ denote, intermediate demand, consumption demand and investment demand for the composite commodities in each commodity category, respectively.[21] The 'domestic use ratio' transforms these demands into demands for domestically produced commodities. Multiplying each of these components by $d_i$ yields the demand equations for domestically produced components of the form:

$$V_i^d = d_i V_i \qquad \textit{(Eq.35)}$$

$$C_i^d = d_i C_i \qquad \textit{(Eq.36)}$$

$$Z_i^d = d_i Z_i \qquad \textit{(Eq.37)}$$

Combining these domestically produced commodities with imports, leads to obtain the aggregate demand for the composite commodity $Q_i$. Adding export subsidies granted to the tradable sectors of the model and exports $E_i$ to the three components of domestically produced commodities as specified in *Eq.35*, *Eq.36*, and *Eq.37*, results in the determination of the demand functions for domestically produced commodities of the form:[22]

$$X_i^D = d_i V_i + d_i C_i + d_i Z_i + (te_i E_i) + E_i \qquad \textit{(Eq.38)}$$

The model includes a function for exports by activity to analyse whether the opening of trade has promoted exports. Four assumptions were introduced to define such a function in the model. First, it is assumed product differentiation on the export side. This closely corresponds to the treatment of foreign trade that is found in some models to analyse the implications of multilateral tariff reductions (de Melo and Robinson, 1985: 2). Second, as de Melo (1988) suggests it, the assumption that foreign commodities and domestic import-competing commodities are imperfect substitutes in use is incorporated on the export side. Exports and commodities sold on the domestic market within the same sector classification are imperfect substitutes, which seems to be more realistic in a context of opening of trade. Third, in order to maintain the small-country assumption, it must be said that the country's market share of its products in the world market is too small so that it can be assumed an

[21] These demand components must equal those obtained in *Eq.3*, *Eq.22*, and *Eq.25* for the *n*-1 trade commodities.

[22] This specification of the demand function for domestically produced commodities implies that the import price can affect the demand for the domestic commodity through its effect on the composite price and the demand for the composite commodity. This function can also be used to determine the domestic demand for the nontraded commodity, where the 'domestic use ratio' is assumed to be equal to one and subsidies and exports equal to zero.

infinitely elastic export demand. Finally, exports by activity are determined through a constant foreign price elasticity of supply.[23] Thus, exports by activities are determined as follows:

$$E_i = E_{0i}\left(\frac{PE_i}{PD_i}\right)^{\eta_i} \qquad \textit{(Eq.39)}$$

where $PE_i$ is the price of exports as defined in *Eq.29*, $PD_i$ is the domestic price as defined in *Eq.26*, $E_{0i}$ is parameter that denotes exports by activity in the base year, and $\eta_i$ is the price elasticity of export supply for commodity *i*.[24]

The prices $PE_i$ and $PD_i$ depend on the nominal exchange rate. $PE_i$ also depends on policy instruments such as export subsidies ($te_i$) and export taxes ($tx_i$). Thus, the specification of exports by activities implies that trade-policy instruments affect exports. A devaluation of the Colón can increase the domestic price and the export price of traded commodities, leading consequently to a change of the exports by activity. The price of exports can also be affected by any change in the export subsidy rate or export tax rate, which could also influence the exports of the different activities.

### 5.4.7. Excess demand equations, balance of payments constraint and price normalisation

The way of pulling the various components of the model together and summarising its structure is by writing down the excess demand equations of the model as functions of the endogenous variables (Dervis *et. at.* 1982: 230). Having defined the demand and supply functions as in *Eq.38* and *Eq.1*, respectively, one can denote the sectoral excess demand as follows:[25]

$$EX_i = X_i^D - X_i^S = 0 \qquad \textit{(Eq.40)}$$

The supply and demand equations for product markets together yield a set of simultaneous equilibrium conditions as denoted in *Eq.40*, whose solutions provide equilibrium prices. This way, for the *n* domestic commodity prices, there are *n* equations in *n* variables. Finally, it is necessary to incorporate a balance of payments constraint in order to specify the market clearance condition for foreign exchange, which can assume the following form:

$$EF = \sum_{i=1}^{n-1} M_i - \sum_{i=1}^{n-1} E_i - F \qquad \textit{(Eq.41)}$$

where *F* denotes net foreign capital flows, whose residual determination is given by:

$$F = \sum_{i=1}^{n-1} M_i - \sum_{i=1}^{n-1} E_i \qquad \textit{(Eq.42)}$$

This specification requires the assumption that the country has no constraints to obtain foreign exchange to finance imports, which is necessary to equal the balance of payments constraint to zero. Thus, incorporating *Eq.41* leads to *n* + 1 equations in *n* + 1 variables and there are as many excess demand equations as there are prices.

Finally, by Walras' Law, the excess demand equations are not independent so that a price normalisation rule is required to close the system. As Dervis *et. al.* (1982) explain, there is a variety

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[23] For more detail see Vos (1994), p.6.

[24] The parameters $E_{0i}$ of exports by activity in the base year are set equal to the corresponding 'stylised-SAM' values, whereas the export elasticities have been borrowed from Dessus and Bussolo (1998), pp.15-16.

[25] There are two ways of determining the demand in CONT. First, one can use *Eq.38* and assume that the 'domestic use ratio' is equal to one, and export subsidies and exports by activity are equal to zero. Second, the demand of this sector can be obtained by adding up its components $V_i$, $C_i$, and $Z_i$, as determined in *Eq.3*, *Eq.22*, and *Eq.25*.

of normalisation equations, starting by those in which the wage of labour is fixed and all the prices are expressed in terms of wages, and ending with those in which the price of any commodity is fixed (which is called the numéraire commodity) and all the prices are expressed in terms of it. This model incorporates a price-normalisation rule that provides a "no-inflation" benchmark against which all prices changes are relative prices changes (*Op. Cit.*, 1982: 150, 192-193). In other words, the normalisation is done around an aggregate price index that assumes the following form:

$$\sum_{i=1}^{n-1} P_i \Omega_i + PD_{NT} \Omega_{NT} = \overline{P} \qquad \textit{(Eq.43)}$$

where $\Omega_i$ and $\Omega_{NT}$ denote the weights defining the price index ($\Sigma\Omega$=1 for all the commodities)[26], $P_i$ is the composite commodity price of traded commodities whose determination will be explained below, $PD_i$ is the domestic price of the nontraded commodity, and $\overline{P}$ is the exogenous level of aggregate price index, which is kept constant and equals to unity in the base year. Thus, the value of the aggregate price level is set exogenously by the normalisation rule, and represents an overall index of prices to buyers in all markets, including imports and intermediate commodities.

The normalisation rule is considered just a rule of a numéraire to keep the model as a barter model, similarly to the theoretical models of international trade. This way, the model is consistent with input-output and linear programming models, as they incorporate no money. Money never appears explicitly in the model and remains neutral providing only a simple transfer mechanism to close the flow of funds accounts. Since the model focuses on resource allocation issues and foreign trade is modelled to explain the opening of trade, the aggregate price level is explicitly considered as exogenous and the problems related to its determination are implicitly treated separately from problems related to the determination of relative prices and incentives (*Op. Cit.*, 1982: 150-151).

Given the assumption of cost minimisation by consumers of domestic commodities and imported commodities, the values of the composite commodity price are given by the cost minimisation function that corresponds to the CES aggregation function, which is denoted as follows:

$$P_i = \frac{1}{B_i}\left[\delta_i^{\sigma_i} \cdot PM_i^{(1-\sigma_i)} + (1-\delta_i)^{\sigma_i} \cdot PD_i^{(1-\sigma_i)}\right]^{1/(1-\sigma_i)} \qquad \textit{(Eq.44)}$$

where all the CES parameters were already introduced in equations *Eq.31*, *Eq.32*, and *Eq.33*.

This normalisation closes the system and allows solving the model for *n* domestic commodity prices as a function of the exchange rate, the exogenous parameters and the government policy variables. The solution can be started by substituting the initial prices and exchange rate into the sectoral demand and supply functions so as to obtain numerical estimates of excess demands in each sector.

## 5.5. FINAL REMARKS

The Costa Rica's CGE model was run by an iteration process, in which 133 equations determined 133 endogenous variables simultaneously. The equations were settled up in a spreadsheet built up in Excel 7.0 for Windows 97. In addition, the general equilibrium was tested by generating a new SAM; after reaching the base run equilibrium, the consistency of the model was examined by applying changes to all the exogenous variables and the policy instruments.

[26] The weights of each sector's price are shown in Table 5.2 in the Appendix.

# Chapter Six

# POLICY SIMULATION SCENARIOS

## 6.1. INTRODUCTION

Once the Computable General Equilibrium (CGE) model for Costa Rica was solved, the next step was to carry out policy simulation scenarios of the *counterfactual* type. Such exercise aims at analysing the implications of the opening of trade in Costa Rica, focusing on production, income distribution and the balance of trade. Since production is determined in the model by total demand, the analysis includes the components of total demand. Furthermore, savings as well as external requirements of foreign exchange to finance imports are also incorporated.

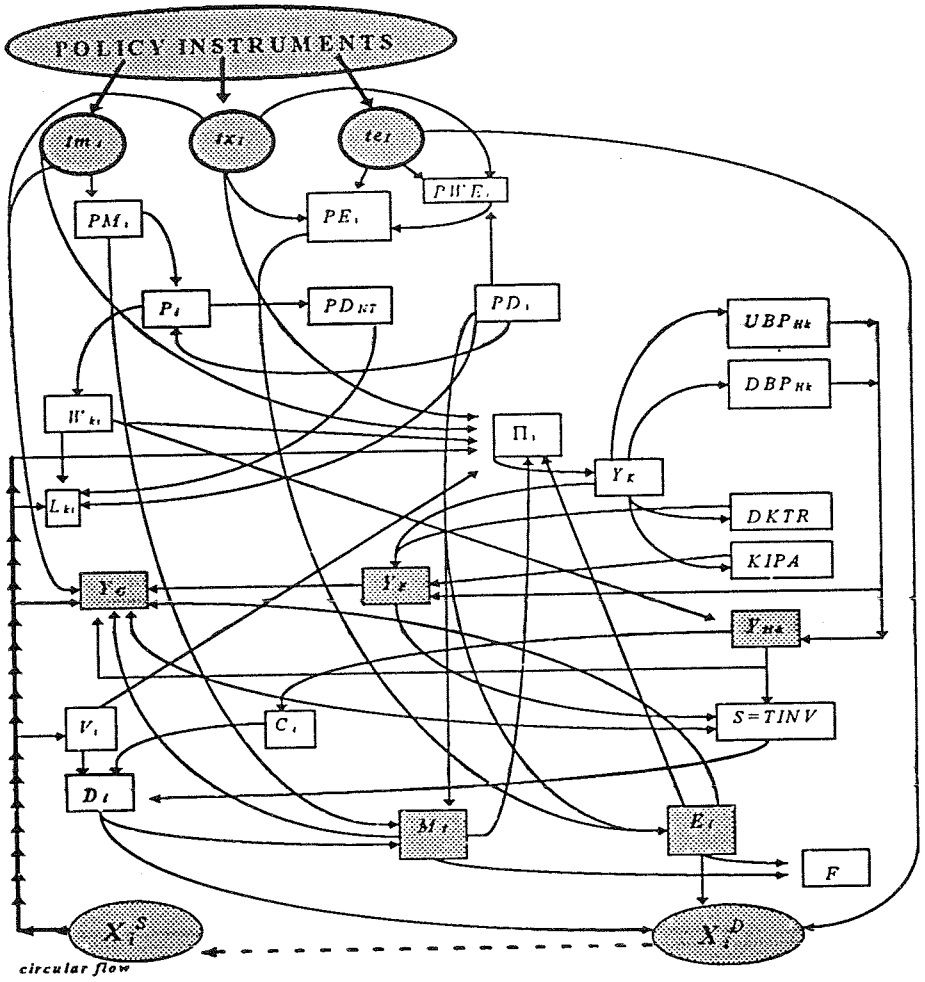
The policy instruments used to carry out the *counterfactual* simulation are import tariffs, export taxes and export subsidies. It is important to observe that, as explained in Chapter Three, these instruments have been used in Costa Rica to promote the opening of trade along with the devaluation of the exchange rate. Regarding the latter, the model assumes a fixed and exogenous exchange rate, which is not used for the policy simulation scenarios.

This chapter provides in Section 6.2 a general description of the way in which the policy instruments are expected to affect the endogenous variables in the model, by using an analysis of the 'reduced form' of the CGE model. Section 6.3 presents the policy simulation scenarios, whose results are summarised in Section 6.4 and compared in the same section with some of the results obtained in other studies on the opening of trade in Costa Rica. Finally, Section 6.5 briefly provides some final remarks of the chapter.

## 6.2. THE REDUCED FORM OF THE CGE MODEL FOR COSTA RICA

The way of showing how a CGE model works, in terms of connecting all its variables and parameters, is by analysing the flow created by any injection from the exogenous variables. This analysis is developed by using the 'reduced form' of the model, which explains how any change in the policy instruments generates a flow that goes throughout the system, resulting in a new situation of equilibrium. It is worth mentioning that wherever the change is applied, the effect of liberalising trade starts by affecting relative prices. Figure 6.1 shows the 'reduced form' of the CGE model for Costa Rica, where the policy instruments are allocated at the top of the figure from which the flow begins. The 'reduced form' of the model is explained by considering individually each policy instrument, as shown in the next three sections.

Figure 6.1. Reduced form of the CGE model for Costa Rica




## 6.2.1. Effects of an import tariff change

Three main effects occur when varying import tariffs in the system. The most important effect occurs on the price of imports ($PM_i$), whereas the other two effects come through the 'taxation effect' on government's income ($Y_G$) and profits ($\Pi_i$). Let us first look at the effect generated by the price of imports ($PM_i$) on income, production and the balance of trade. As can be seen in Figure 6.1, any change in the price of imports ($PM_i$) will affect imports ($M_i$) and the composite price ($P_i$).[27] The change in imports affects the balance of trade, the external requirements of foreign exchange to finance imports, government's income ($Y_G$) and profits ($\Pi_i$). The effect on government's income is due to the increased base on which import tariffs are levied. Profits affect the income of the factor capital ($Y_K$) creating an effect on households' income ($Y_{Hk}$) and enterprises' income ($Y_E$). Since the change in the income of these two agents increases the base on which direct taxes are levied, a change in government's income ($Y_G$) should also be expected. Regarding the change in the composite price ($P_i$), it directly affects the nominal wage bill ($W_{ki}$) in all the sectors, and therefore a change in households' income ($Y_{Hk}$) and profits ($\Pi_i$) must be expected to occur. Profits affect the income of the factor capital ($Y_K$) and consequently, households' income ($Y_{Hk}$) and enterprises' income ($Y_E$) are impacted. This also increases the base on which direct taxes are deduced so that an effect on government's income ($Y_G$) must also be expected to occur.

[27] As explained in Chapter Five, the composite price ($P_i$) corresponds to the price of a composite good that incorporates commodities produced domestically and imported commodities.

The change in import tariffs directly affects government's income ($Y_G$) and profits ($\Pi_i$). Government's income ($Y_G$) is affected as the change in import tariffs ($tm_i$) leads to a 'taxation effect'. Profits ($\Pi_i$) change because they are defined residually in the model, and this variation affects households' income ($Y_{Hk}$) and enterprises' income ($Y_E$) as mentioned earlier.

All the changes in agents' income ($Y_{Hk}$, $Y_E$, and $Y_G$) affect consumption ($C_i$) and savings ($S$). Since the model assumes that savings ($S$) equal investment ($TINV$), the change in agents' income affects total investment too. Therefore, domestic absorption ($D_i$) must be expected to vary leading to a variation in imports ($M_i$) and total demand ($X_i^D$). Since the model specifies that total sectoral supply ($X_i^S$) is determined by total sectoral demand ($X_i^D$), the latter is expected to affect the former, which consequently changes intermediate demand ($V_i$), government's income ($Y_G$) and profits ($\Pi_i$). Profits ($\Pi_i$) are also affected by the change in intermediate demand ($V_i$), as shown in the left button part of Figure 6.1, leading to a change in households' income ($Y_{Hk}$) and enterprises' income ($Y_E$). Thus, the change in production creates an effect on agents' income ($Y_{Hk}$, $Y_E$, and $Y_G$) that at the same time generates a circular effect as described earlier.

### 6.2.2. Effects of an export tax change

Three effects occur when export taxes are altered. Firstly, the most important effect is on the price of exports ($PE_i$), which directly affects exports ($E_i$) starting a chain of effects on government's income ($Y_G$) (because of export taxes), profits ($\Pi_i$), the balance of trade, the requirements of foreign exchange ($F$) and domestic total demand ($X_i^D$). The latter affects total supply ($X_i^S$) and thus intermediate demand ($V_i$), government's income ($Y_G$) and profits ($\Pi_i$). The effect on profits, which also occurs due to the change in intermediate demand (see Figure 6.1), makes the income of the factor capital ($Y_K$) change affecting consequently the income of all the agents ($Y_{Hk}$, $Y_E$, and $Y_G$). Secondly, there is a 'taxation effect' that affects government's income, as the variation in the export tax affects the levied exports. Thirdly, profits ($\Pi_i$) are also affected as they derive residually and depend on the export tax rate ($tx_i$) and exports ($E_i$). As explained earlier, the change in profits affects enterprises' income ($Y_E$) and households' income ($Y_{Hk}$) through the change in the income of the factor capital ($Y_K$).

The effects on agents' income alter the system as savings, consumption and investment change, affecting consequently domestic absorption ($D_i$). The change in domestic absorption ($D_i$) impacts on imports ($M_i$) and total supply ($X_i^S$). Imports ($M_i$) affect the balance of trade and thus the requirements of foreign exchange to finance imports ($F$). Government's income ($Y_G$) must be expected to change, as far as the change in imports ($M_i$) adjusts the base on which import tariffs are levied. Regarding total supply ($X_i^S$), it affects government's income ($Y_G$) as the amount of money collected from indirect taxes rises, and also affects intermediate demand ($V_i$) and profits ($\Pi_i$). Profits ($\Pi_i$) are simultaneously affected by the change in intermediate demand ($V_i$) as shown in Figure 6.1. The variation of profits leads to a change in agents' income ($Y_{Hk}$, $Y_E$, and $Y_G$) through the change in the income of the factor capital ($Y_K$). Thus, an iteration is initiated as new income is injected into the system generating a new situation of equilibrium.

### 6.2.3. Effects of an export subsidy change

According to the flow presented in Figure 6.1, any variation in export subsidies provokes two major effects on the system. On the one hand, the most important effect occurs on the price of exports ($PE_i$), which consequently has an impact on exports ($E_i$). From this point in the system,

government's income varies as the base on which exports are taxed changes. Consequently, the balance of trade is affected leading to a change in the requirements of foreign exchange to finance imports ($F$). Furthermore, the change in exports ($E_i$) directly affects total demand ($X_i^D$). On the other hand, the change in the price of exports ($PE_i$) has an indirect effect on total demand ($X_i^D$) since not only exports increase ($E_i$) but also the base to grant the export subsidy ($te_i$).

As can be seen, the change in the price of exports ($PE_i$) generates two different causality chains that end up affecting total demand ($X_i^D$). Any change in total demand ($X_i^D$) affects three components in the system. First, there is a 'taxation effect' as the base for levying indirect taxes rises. Second, intermediate demand ($V_i$) varies, which consequently generates an effect on profits ($\Pi_i$). Third, profits are also affected as they are generated residually, so that the increased base to tax exports ($E_i$) impacts on them ($\Pi_i$). The variation in profits ($\Pi_i$) also affects agents' income as the income of the factor capital changes. Thus, the change in the price of exports affects all agents' income ($Y_{Hk}$, $Y_E$, and $Y_G$), the balance of trade and the requirements of foreign exchange to finance imports ($F$).

The change in agents' income ($Y_{Hk}$, $Y_E$, and $Y_G$) impacts on savings ($S$), investment ($TINV$) and consumption ($C_i$). Therefore, domestic absorption ($D_i$) changes, which consequently implies a variation in imports ($M_i$) and total supply ($X_i^S$). Imports ($M_i$) affect the balance of trade, the requirements of foreign exchange to finance imports, and government's income ($Y_G$). The other effect occurs when total supply ($X_i^S$) changes, since this varies the agents' income ($Y_{Hk}$, $Y_E$, and $Y_G$) as explained for the two previous cases. Thus, the variation of income must be expected to initiate an iteration that leads to a new equilibrium solution.

## 6.3. POLICY SIMULATION SCENARIOS

After having established an understanding of how the policy instruments are expected to affect production, income and the balance of trade, the analysis moved on to the application of policy simulation scenarios. In all the scenarios carried out, the policy instruments were changed by 50 per cent for all commodities. This is a rough average variation not very different to that applied to the three policy instruments between 1991 and 1992. The scenarios are of the *counterfactual* type, hence they are to indicate what would have happened to production, income distribution and the balance of trade, if the policy instrument rates had been reduced (for import tariffs and export taxes) and/or increased (for export subsidies) by 50 per cent with respect to the situation in 1991.[28]

Although all the variables are defined in nominal terms in the model, the fact that the policy simulation analysis is *counterfactual* makes all the variables operate as real ones as the simulations apply for a static comparative analysis. Therefore, all the *counterfactual* scenarios carried out are expected to tell something about the implications of opening of trade policies on real production, distribution of real income and the balance of trade.

### 6.3.1. Counterfactual simulation effects of reducing import tariffs by 50 per cent

This section shows the results of four policy simulation scenarios in which import tariffs were reduced. In the first three scenarios, the reduction of import tariffs was applied individually to each tradable sector. The fourth scenario was a reduction of import tariffs in all the tradable sectors

[28] For more details see Adelman and Taylor (1990), pp. 42-59.

simultaneously. The analysis is shown in three sections, where the implications on production, income and the balance of trade are analysed individually. In order to facilitate the explanation, the analysis begins with the effects on the balance of trade.

### 6.3.1.1. Effects on the balance of trade

The effect on the balance of trade comes about as the reduction in import tariffs makes imports cheaper for the country, so that an increase in imports must be expected to occur. Scenario No. 1 showed that a reduction of the import tariff in Agriculture, forestry and fishing (AG) affects the balance of trade very slightly. Indeed, the changes shown in Table 6.1 have very little interpretation. This can be explained by the fact that the country is a 'net exporter' of agricultural products, so that imports of this type would not be expected to increase considerably.

**Table 6.1. Impact of a 50% import tariff reduction on the balance of trade**

| OBJECTIVE VARIABLES | BASE VALUES 1991 | SCENARIO No. 1 Reduction for AG | | SCENARIO No. 2 Reduction for IND | | SCENARIO No. 3 Reduction for S&T | | SCENARIO No. 4 For all the sectors | |
|---|---|---|---|---|---|---|---|---|---|
| | | Values | Change % | Values | Change % | Values | Change % | Values | Change % |
| a. Balance of trade | | | | | | | | | |
| AG. | 58136.55 | 58128.73 | -0.0135 | 58314.03 | 0.3053 | 58360.27 | 0.3848 | 58524.62 | 0.6675 |
| IND. | -109651.74 | -109649.58 | -0.0020 | -120200.33 | 9.6201 | -105876.28 | -3.4431 | -116286.40 | 6.0507 |
| S&T | 47766.80 | 47767.09 | 0.0006 | 48163.18 | 0.8298 | 32012.86 | -32.9509 | 32579.96 | -31.7937 |
| Total | -3748.39 | -3753.76 | 0.1433 | -13723.11 | 266.1069 | -15503.16 | 313.5951 | -25181.82 | 571.8038 |
| b. Foreign Exchange Requirements | 3748.39 | 3753.76 | 0.1433 | 13723.11 | 266.1069 | 15503.15 | 313.5951 | 25181.82 | 571.8038 |

Source: computed from the CGE model for Costa Rica.

Scenario No. 2 showed that a reduction of the import tariff in the sector Industry (IND) had unsustainable implications on the balance of trade as the trade deficit rose dramatically. The most important effect occurred on the sector itself, where the trade deficit increased by 9.6 per cent (see Table 6.1). This led to an increase of nearly 266 per cent in the requirements of foreign exchange to finance imports, which would be rejected by international organisations with which Costa Rica maintains financial obligations. The effects on the other two tradable sectors AG and S&T were found to be very slight (0.3 and 0.8 per cent respectively).

The results showed that the reduction of the import tariff in Services and Trade (S&T) has similar effects as those found for IND, in the sense that the strongest effect occurred on the sector itself. As shown in Table 6.1, the trade surplus in S&T fell by 33 per cent with the reduction of the tariff. Despite the fact that the trade deficit fell by 3.4 per cent in IND, the negative effect on S&T made the overall balance of trade deficit to increase by 313.6 per cent, which as mentioned earlier, would be an unsustainable situation to negotiate with international financial organisations.

The effects of the reduction of import tariffs in IND and S&T were reflected when applying Scenario No. 4, in which import tariffs were reduced in all the sectors simultaneously. As can be seen in Table 6.1, a general reduction such as this was found to affect negatively the balance of trade in IND and S&T. The deficit increased by 6 per cent approximately in IND, whereas the trade surplus fell by 31.8 per cent in S&T. This led to a dramatic increase of 571 per cent in the balance of trade deficit of the economy, which would create a problem to finance the requirements of foreign exchange as already explained. Thus, one can conclude that the reduction of import tariffs promotes imports more strongly than it promotes exports, a fact that is reflected in the rapid increase of the trade deficit.

### 6.3.1.2. Effects on income distribution

Income distribution is analysed in two ways. First, an analysis of factorial income is presented to see the way in which the remuneration to factors is affected when a reduction in import tariffs is

applied. It is worth mentioning that the effects on wages were found to be very slight in all the scenarios carried out, therefore the analysis of factorial income is concentrated on profits. Second, an analysis of institutional income is also incorporated to detect the way in which agents' income would be expected to change when reducing import tariffs, and the way in which the income gap between urban and rural households would vary with such a policy.

Table 6.2 summarises the effects of a reduction in import tariffs on income. Scenario No. 1 indicated a rather slight effect on income (factorial and personal), when a reduction of 50 per cent was applied to import tariffs in AG. The contraction in profits and institutional income was found to be so slight that it cannot be argued that a reduction of import tariffs in AG creates an important effect on income distribution.

**Table 6.2. Impact of a 50% import tariff reduction on income distribution**

| OBJECTIVE VARIABLES | BASE VALUES 1991 | SCENARIO No. 1 Reduction for AG | | SCENARIO No. 2 Reduction for IND | | SCENARIO No. 3 Reduction for S&T | | SCENARIO No. 4 For all the sectors | |
|---|---|---|---|---|---|---|---|---|---|
| | | Values | Change % | Values | Change % | Values | Change % | Values | Change % |
| *FACTORIAL INCOME* | | | | | | | | | |
| a. Profits | | | | | | | | | |
| AG. | 63394.20 | 63388.32 | -0.0093 | 62587.21 | -1.2730 | 62376.99 | -1.6046 | 61589.38 | -2.8470 |
| IND. | 69961.34 | 69960.80 | -0.0008 | 62117.12 | -11.2122 | 69016.95 | -1.3499 | 61315.80 | -12.3576 |
| S&T | 101987.49 | 101985.99 | -0.0015 | 99918.85 | -2.0283 | 90366.19 | -11.3948 | 88461.85 | -13.2621 |
| CONT | 19330.35 | 19329.72 | -0.0033 | 18439.38 | -4.6092 | 18214.08 | -5.7747 | 17350.16 | -10.2440 |
| *INSTITUTIONAL INCOME* | | | | | | | | | |
| a. Households' disposable income | | | | | | | | | |
| Urban households | 311762.49 | 311758.96 | -0.0011 | 306972.24 | -1.5365 | 305698.09 | -1.9452 | 301053.80 | -3.4349 |
| Rural households | 208317.00 | 208315.09 | -0.0009 | 205724.38 | -1.2446 | 205034.77 | -1.5756 | 202521.16 | -2.7822 |
| Income gap between urban and rural households | 103445.50 | 103443.88 | -0.0016 | 101247.86 | -2.1244 | 100663.31 | -2.6895 | 98532.64 | -4.7492 |
| b. Enterprises' disposable income | 27627.10 | 27625.54 | -0.0560 | 25508.49 | -7.6686 | 24944.97 | -9.7083 | 22290.92 | -17.1482 |
| c. Government's income | 198150.54 | 198145.60 | -0.0025 | 188570.61 | -4.8347 | 186958.78 | -5.6481 | 177662.31 | -10.3397 |

Source: computed from the CGE model for Costa Rica.

Moving on to Scenario No. 2, where the reduction of import tariffs was only applied to IND, profits were found to be negatively impacted (see Table 6.2). The most affected sector was IND itself, where profits fell by 11.2 per cent. The other sectors were strongly affected too, including the non-tradable sector CONT where profits fell by 4.6 per cent. As shown in Figure 6.1, this is the result of the direct effect created on profits since they are derived residually in the model. Moreover, the reduction in the import tariff affected the price of imports ($PM_i$), which consequently influenced imports ($M_i$) and thus the residual determination of profits. The final effect on supply must also be expected to affect profits as explained below. As pointed earlier, the change in profits generates a flow that goes to the institutional income of the agents.

Regarding the latter, the effect starts as enterprises' income ($Y_E$) and households' income ($Y_{Hk}$) vary, creating an effect on government's income ($Y_G$), which is also affected by the reduction of the tariff itself and the final impact from domestic supply, as described in section 6.2.1. Scenario No. 2 shows that the effects on profits clearly affected institutional income. The stronger impact occurred on enterprises' disposable income and government's income, which decreased by 7.7 and 4.8 per cent, respectively. Households' disposable income decreased by 1.5 and 1.2 per cent for urban and rural respectively, and consequently the income gap between households (urban and rural) decreased. This effect has no interpretation in terms of income distribution because both incomes of urban and rural households decreased simultaneously.

Let us analyse the reduction of import tariffs in S&T. As can be seen in Table 6.2, profits were found to fall in all the sectors. Two particular aspects must be mentioned in that respect. First, the reduction of the tariff affected the most the profits earned in the sector itself, which fell dramatically by

11.4 per cent. Second, similarly as occurred when reducing the tariff in IND, the second most affected sector was CONT whose profits fell sharply by 5.8 per cent. Profits in AG and IND decreased slightly by 1.6 and 1.4 per cent, respectively.

The fall in profits in S&T resulted in a significant reduction of institutional income. As shown in Table 6.2, the largest impact occurred on enterprises' disposable income, which decreased by 9.7 per cent. Households' disposable income decreased sharply by 1.9 and 1.6 per cent for urban and rural, respectively. These reductions along with the reduction of the tariff reduced government's income by 5.7 per cent. The results have no interpretation in terms of income distribution as all incomes fell.

A simultaneous reduction of import tariffs was applied to all the tradable sectors in Scenario No. 4. The results indicate that such a reduction affects dramatically profits, mainly in IND and S&T, where there was a fall of 12.4 and 13.3 per cent, respectively. Profits in CONT also fell dramatically by 10.2 per cent, as there was a price effect when the price of imports ($PM_i$) varied, affecting the domestic price of nontraded goods ($PD_{NT}$) through a change in the composite good price ($P_i$) (see Figure 6.1). The change in the domestic price of nontraded commodities and the composite good price affected labour demand and wages, leading to a change in profits. The least affected sector was AG, however, the fall in its profits (2.9%) was also important.

Moving on to institutional income, the dramatic decrease in profits resulted in a fall in the disposable income of enterprises and households. Thus, government's income was also found to fall, which was even worsened by the reduction of the tariff itself as it had a 'fiscal effect'. As can be seen in Table 6.2, the most affected institutions were the enterprises with profits that fell by 17.1 per cent. This had implications on households' disposable income and government's income. Since households' disposable income decreased by 3.4 and 2.8 for urban and rural respectively, the reduction in the income gap of households has no meaning in terms of income distribution. Government's income decreased by 10.4 per cent, which could give us some hints about why the fiscal deficit of the government has increased with the opening of trade, as explained in Chapter Three. It can be concluded from Scenarios No. 1, 2, 3 and 4, that a further reduction of import tariffs with respect to the situation of 1991 would have tended to negatively affect income generation in the country. The analysis of income distribution is meaningless since all agents' income was found to be decreasing.

### 6.3.1.3. Effects on production

The effects of reducing import tariffs on production are shown in Table 6.3. In scenario No. 1, a reduction of the import tariff was applied in AG. This reduction had a very slight negative impact on production. As explained in section 6.2.1, production depends on domestic demand in the model, which was found not to be strongly affected (see Table 6.3.a in the Appendix). This can be explained by the fact that agents' income was not altered in such a way that domestic demand could create an impact on production.

One explanation to the insignificant effect on production from opening up the sector AG is that Costa Rica is a 'net exporter' of agricultural goods, in many of which it shows high levels of competitiveness. This makes the opening of trade of this sector less attractive than it could be if applied to IND for instance. Indeed, this may be one of the main reasons why the reduction of import tariffs in AG has not been a priority in Costa Rica.

Table 6.3. Impact of a 50% import tariff reduction on production

| OBJECTIVE VARIABLES | BASE VALUES 1991 | SCENARIO No. 1 Reduction for AG | | SCENARIO No. 2 Reduction for IND | | SCENARIO No. 3 Reduction for S&T | | SCENARIO No. 4 For all the sectors | |
|---|---|---|---|---|---|---|---|---|---|
| | | Values | Change % | Values | Change % | Values | Change % | Values | Change % |
| PRODUCTION | | | | | | | | | |
| AG. | 191570.67 | 191569.64 | -0.0005 | 190154.31 | -0.7393 | 189785.36 | -0.9319 | 188412.09 | -1.6488 |
| IND. | 688403.11 | 688397.50 | -0.0008 | 680626.49 | -1.1297 | 678613.50 | -1.4221 | 671073.34 | -2.5174 |
| S&T | 524921.57 | 524917.90 | -0.0007 | 519863.45 | -0.9636 | 518545.12 | -1.2147 | 513640.89 | -2.1490 |
| CONT | 202824.30 | 202823.31 | -0.0005 | 201418.51 | -0.6931 | 201063.04 | -0.8684 | 199699.92 | -1.5404 |

Source: computed from the CGE model for Costa Rica.

Scenario No. 2 (see Table 6.3) showed that production is negatively impacted when one simulates a reduction of import tariffs in IND. The most important variation occurred in IND itself, where production decreased by 1.1 per cent. The other negative impact occurred in S&T, whose production fell slightly by 0.9 per cent. This effect can be explained as due to the reduction of institutional income already explained, which led to a fall in domestic demand. The fall in the institutional income led to a reduction of savings that resulted in a fall of investment, affecting consequently production (see Table 6.3.a in the Appendix). A similar situation was found in Scenario No. 3, in which the reduction of the tariff was only applied to S&T, with the difference that the most opened sector (S&T) was not the most affected. Production in S&T decreased by 1.2 whereas it fell by 1.4 in IND. The fall in production in AG and CONT was by approximately 1 per cent.

Scenario No. 4 involved a simultaneous reduction of import tariffs in all the sectors. The reduction of institutional income that resulted from the simultaneous reduction of import tariffs in all the tradable sectors led to a decrease in domestic demand (see Table 6.3.a in the Appendix). With the exception of the sector CONT, final consumption fell by more than 3 per cent in all the sectors. Regarding intermediate demand, it decreased by more than 2 per cent in all the sectors. The total value of investment decreased by 4.7 per cent, while investment also fell at the sectoral level by more than 3.6 per cent in all the sectors. Consequently, the fall in domestic demand affected total production in the overall. The most affected sector was IND, where production fell by 2.5 per cent approximately. S&T was the other sector strongly affected, whose output decreased by 2.2 per cent. Production in AG and CONT also decreased by 1.7 and 1.5, respectively. Thus, one can conclude that if import tariffs had been reduced by 50 in all the sectors, production would have been dramatically hampered with respect to the situation of 1991.

### 6.3.2. Counterfactual simulation effects of reducing export taxes by 50 per cent

This section shows the results of four policy simulation scenarios in which export taxes were reduced. There are three scenarios where the reduction of the tax was applied individually to each sector. In the fourth scenario, the reduction was simultaneously applied to all the sectors. The results are presented as in the previous section, starting with the balance of trade.

#### 6.3.2.1. Effects on the balance of trade

The reduction of the export tax in AG provoked a rather slight fall in the deficit of trade surplus of the sector itself, which cannot be considered important since it did not even amount to 0.1 per cent (see Table 6.4). The trade surplus of the sector S&T was also found to fall very slightly by 0.2 per cent, which does not seem to be an important effect. On the contrary, there was an increase of 0.8 per cent in the deficit of trade in IND. The negative impact on the balance of trade in IND reflected in the overall deficit of trade, which increased by 28.6 per cent. This would imply an unsustainable situation for the country to maintain its financial commitments with international organisms.

**Table 6.4. Impact of a 50% export tax reduction on the balance of trade**

| OBJECTIVE VARIABLES | BASE VALUES 1991 | SCENARIO No. 4 Reduction for AG | | SCENARIO No. 5 Reduction for IND | | SCENARIO No. 6 Reduction for S&T | | SCENARIO No. 7 For all the sectors | |
|---|---|---|---|---|---|---|---|---|---|
| | | Values | Change % | Values | Change % | Values | Change % | Values | Change % |
| a. Balance of trade | | | | | | | | | |
| AG. | 58136.55 | 58082.17 | -0.0935 | 58130.37 | -0.0106 | 58133.22 | -0.0057 | 58072.66 | -0.1099 |
| IND. | -109651.74 | -110545.79 | 0.8154 | -109753.27 | 0.0926 | -109706.56 | 0.0500 | -110702.14 | 0.9579 |
| S&T | 47766.80 | 47645.07 | -0.2548 | 47752.98 | -0.0289 | 47759.34 | -0.0156 | 47623.78 | -0.2994 |
| Total of the Economy | -3748.39 | -4818.55 | 28.5499 | -3869.91 | 3.2421 | -3814.01 | 1.7506 | -5005.70 | 33.5426 |
| b. Foreign Exchange Requirements | 3748.39 | 4818.55 | 28.5499 | 3869.92 | 3.2421 | 3814.01 | 1.7506 | 5005.70 | 33.5426 |

Source: computed from the CGE model for Costa Rica.

The reduction of the export tax was found to similarly affect the balance of trade when applied to the sectors IND and S&T. Note in Table 6.6 (Scenarios No. 5 and 6) that no important effects on the balance of trade were found at the sectoral level, although the total deficit of the economy increased by 3.2 and 1.8 per cent when the reduction was applied to IND and S&T, respectively.

Scenario No. 7 involved a simultaneous reduction of the export tax in all the sectors. Insignificant reductions in the balance of trade surplus in AG and S&T were found. However, the increase in imports of industrial goods is the reason why the overall balance of trade deteriorated after reducing export taxes. This could indeed be the real situation of country, where although export taxes have been reduced, there has not been a faster increase in exports relative to imports, as argued in Chapter Three.

### 6.3.2.2. Effects on income distribution

The effects of reducing the export tax seem to be more beneficial than in the case of reducing import tariffs. However, as shown in Table 6.5 (Scenarios No. 4, 5 and 6), the reduction was found to only impact on AG where the only important positive effect on profits was seen. Scenario No. 4 showed that the reduction in the export tax in AG raises profits no only in the sector itself by 4.4 per cent, but also in CONT by 1.2 per cent. Although Scenarios No. 5 and 6 showed positive impacts on profits when the export tax was reduced in IND and S&T, such an impact was not strong enough to be analysed as profits were found to increase by less than 1 per cent (see Table 6.5).

**Table 6.5. Impact of a 50% export tax reduction on income distribution**

| OBJECTIVE VARIABLES | BASE VALUES 1991 | SCENARIO No. 4 Reduction for AG | | SCENARIO No. 5 Reduction for IND | | SCENARIO No. 6 Reduction for S&T | | SCENARIO No. 7 For all the sectors | |
|---|---|---|---|---|---|---|---|---|---|
| | | Values | Change % | Values | Change % | Values | Change % | Values | Change % |
| *FACTORIAL INCOME* | | | | | | | | | |
| a. Profits | | | | | | | | | |
| AG. | 63394.20 | 66175.65 | 4.3875 | 63422.28 | 0.0443 | 63409.36 | 0.0239 | 66218.89 | 4.4558 |
| IND. | 69961.34 | 70184.98 | 0.3197 | 70274.51 | 0.4476 | 69975.05 | 0.0196 | 70511.87 | 0.7869 |
| S&T | 101987.49 | 102622.76 | 0.6229 | 102059.63 | 0.0707 | 102181.83 | 0.1906 | 102889.25 | 0.8842 |
| CONT | 19330.35 | 19569.05 | 1.2348 | 19357.46 | 0.1402 | 19344.99 | 0.0757 | 19610.79 | 1.4508 |
| *INSTITUTIONAL INCOME* | | | | | | | | | |
| a. Households' disposable income | | | | | | | | | |
| Urban households | 311762.49 | 313362.87 | 0.5133 | 311944.23 | 0.0583 | 311860.62 | 0.0315 | 313642.74 | 0.6031 |
| Rural households | 208317.00 | 209183.16 | 0.4158 | 208415.36 | 0.0472 | 208370.11 | 0.0255 | 209334.64 | 0.4885 |
| Income gap between urban and rural households | 103445.50 | 104179.70 | 0.7098 | 103528.87 | 0.0806 | 103490.52 | 0.0435 | 104308.10 | 0.8339 |
| b. Enterprises' disposable income | 27627.10 | 28334.90 | 2.5620 | 27707.47 | 0.2909 | 27670.50 | 0.1571 | 28458.68 | 3.0100 |
| c. Government's income | 198150.54 | 196629.81 | -0.7675 | 197977.84 | -0.0872 | 198057.29 | -0.0471 | 196363.86 | -0.9017 |

Source: computed from the CGE model for Costa Rica.

Moving on to institutional income, the reduction of export taxes was found to slightly reduce government's income in all the sectors, but the only relatively important effect was detected in AG (0.8%). On the contrary, enterprises' disposable income was positively impacted wherever the reduction of the export tax was applied, although the only important effect occurred when the

reduction was applied to AG, where enterprises' disposable income rose by 2.6 per cent. Households' disposable income was slightly affected, however, the impact appeared to benefit more urban households. This is shown in Table 6.5, where the income gap between households rises, mainly when the reduction of taxes is applied to AG. The results on institutional income in IND and S&T are not explained in this section since they were found to be rather slight (Scenarios No. 4 and 5).

Scenario No. 7 reproduces a simultaneous reduction of the export tax for all the sectors. The effects already explained for the reduction of the export tax in AG were reflected in this scenario. Profits were positively impacted in AG by 4.5 per cent and in CONT by 1.5 per cent. The profits generated benefited enterprises' disposable income, which rose by 3.0 per cent. Households' disposable income was affected very weakly, however, there was an increase in the income gap between households (0.8%). This last effect means that the reduction of export taxes had a negative impact on income distribution with respect to the situation of 1991. This was also supported by the fact that enterprises were the most benefited agents in the economy. On the contrary, government's income decreased, because the export tax reduction had a fiscal effect as Costa Rica's exports of agricultural products generate a very high share of income from export taxes.

### 6.3.2.3. Effects on production

The 'income effect' of reducing the export tax is expected to trickle down into production, as domestic demand is expected to be larger. However, after carrying out Scenarios No. 4, 5, 6, and 7, the conclusion is that the 'income effect' is too weak to impact positively on production. As can be noticed in Table 6.6, no important effect on production was found. Moreover, the export tax reduction generated no important effects on intermediate demand, investment and final consumption (see Table 6.6.a in the Appendix). This means that the higher income generated by enterprises is directed towards imports and/or profit repatriation rather than towards domestic production.

**Table 6.6. Impact of a 50% export tax reduction on production**

| OBJECTIVE VARIABLES | BASE VALUES 1991 | SCENARIO No. 4 Reduction for AG | | SCENARIO No. 5 Reduction for IND | | SCENARIO No. 6 Reduction for S&T | | SCENARIO No. 7 For all the sectors | |
|---|---|---|---|---|---|---|---|---|---|
| | | Values | Change % | Values | Change % | Values | Change % | Values | Change % |
| PRODUCTION | | | | | | | | | |
| AG. | 191570.67 | 192004.64 | 0.2265 | 191619.95 | 0.0257 | 191597.28 | 0.0139 | 192080.53 | 0.2661 |
| IND. | 688403.11 | 690721.35 | 0.3368 | 688666.37 | 0.0382 | 688545.26 | 0.0206 | 691126.76 | 0.3956 |
| S&T | 524921.57 | 526474.91 | 0.2959 | 525097.96 | 0.0336 | 525016.82 | 0.0181 | 526746.55 | 0.3477 |
| CONT. | 202824.30 | 203200.93 | 0.1857 | 202867.07 | 0.0211 | 202847.40 | 0.0114 | 203266.79 | 0.2182 |

Source: computed from the CGE model for Costa Rica.

## 6.3.3. Counterfactual simulation effects of increasing export subsidies by 50 per cent

The promotion of exports through export subsidies in Costa Rica has been biased towards non-traditional products that are mostly produced in the agricultural sector.[29] Thus, the *counterfactual* simulation developed through increasing export subsidies in IND and S&T is to indicate what would have happened if the incentives were granted to the other tradable sectors, at the same magnitude as they were granted to the agricultural sector.

[29] For more details see section 3.3.1 in Chapter Three.

### 6.3.3.1. Effects on the balance of trade

As can be noticed in Table 6.7, the granting of higher export subsidies to tradable sectors created an unsustainable situation. In all the scenarios, the balance of trade deteriorated in all the sectors. The surplus shown in AG and S&T fell slightly whereas the deficit shown in IND rose sharply. The stronger negative impact on IND influenced in such a way that the total requirements of foreign exchange to finance the deficit became unsustainable. The negative effect was to some extent stronger when the increased export subsidy was granted to IND and S&T. This implicitly suggests that the policy of granting more subsidies to the agricultural sector, as implemented by Costa Rica's government, can be considered as having less negative effects on the balance of trade than targeting the other tradable sectors. However, the 'fiscal cost' of the subsidy for AG appears to be the highest. In addition, the negative impact on the balance of trade in IND shows that the country is highly dependent on imported goods produced in that sector, mainly raw materials.

**Table 6.7. Impact of a 50% export subsidy increase on the balance of trade**

| OBJECTIVE VARIABLES | BASE VALUES 1991 | SCENARIO No. 8 Reduction for AG | | SCENARIO No. 9 Reduction for AG | | SCENARIO No. 10 Reduction for AG | | SCENARIO No. 11 Reduction for AG | |
|---|---|---|---|---|---|---|---|---|---|
| | | Values | Change % | Values | Change % | Values | Change % | Values | Change % |
| a. Balance of trade | | | | | | | | | |
| AG. | 58136.55 | 58082.08 | -0.0937 | 58023.28 | -0.1948 | 58052.39 | -0.1448 | 57884.65 | -0.4333 |
| IND. | -109651.74 | -110434.59 | 0.7139 | -111049.50 | 1.2747 | -111182.69 | 1.3962 | -113363.30 | 3.3849 |
| S&T | 47766.80 | 47647.26 | -0.2502 | 47569.72 | -0.4126 | 47463.51 | -0.6349 | 47146.90 | -1.2978 |
| Total | -3748.39 | -4705.25 | 25.5272 | -5456.50 | 45.5691 | -5666.79 | 51.1794 | -8331.76 | 122.2757 |
| b. Foreign Exchange Requirements | 3748.39 | 4705.25 | 25.5272 | 5456.50 | 45.5691 | 5666.79 | 51.1794 | 8331.76 | 122.2757 |

Source: computed from the CGE model for Costa Rica.

### 6.3.3.2. Effects on income distribution

The increase in the export subsidy granted to AG reflects what has certainly been done in Costa Rica after the opening of trade was introduced. This situation was simulated in Scenario No. 8, where the increase in the export subsidy was only applied to AG. As can be seen in Table 6.8, the increased export subsidies led to an increase in profits by 2.5 per cent for the sector itself and by 1 per cent for CONT. As shown in Figure 6.1, profits are expected to rise as the increased export subsidies lead to larger exports, which directly impacts on profits.

**Table 6.8. Impact of a 50% export subsidy increase on income distribution**

| OBJECTIVE VARIABLES | BASE VALUES 1991 | SCENARIO No. 8 Reduction for AG | | SCENARIO No. 9 Reduction for IND | | SCENARIO No. 10 Reduction for S&T | | SCENARIO No. 11 For all the sectors | |
|---|---|---|---|---|---|---|---|---|---|
| | | Values | Change % | Values | Change % | Values | Change % | Values | Change % |
| *FACTORIAL INCOME* | | | | | | | | | |
| a. Profits | | | | | | | | | |
| AG. | 63394.20 | 64976.82 | 2.4965 | 63909.21 | 0.8124 | 63776.89 | 0.6037 | 65874.52 | 3.9125 |
| IND. | 69961.34 | 70157.16 | 0.2799 | 71934.87 | 2.8209 | 70344.29 | 0.5474 | 72513.64 | 3.6482 |
| S&T | 101987.49 | 102611.31 | 0.6117 | 103016.00 | 1.0085 | 105840.15 | 3.7776 | 107492.48 | 5.3977 |
| CONT | 19330.35 | 19518.23 | 0.9719 | 19613.15 | 1.4630 | 19747.99 | 2.1606 | 20218.67 | 4.5954 |
| *INSTITUTIONAL INCOME* | | | | | | | | | |
| a. Households' disposable income | | | | | | | | | |
| Urban households | 311762.49 | 312831.10 | 0.3428 | 313330.19 | 0.5028 | 313840.16 | 0.6664 | 316476.46 | 1.5120 |
| Rural households | 208317.00 | 208895.36 | 0.2776 | 209165.47 | 0.4073 | 209441.49 | 0.5398 | 210868.33 | 1.2247 |
| Income gap between urban and rural households | 103445.50 | 103935.74 | 0.4739 | 104164.71 | 0.6953 | 104398.67 | 0.9214 | 105608.14 | 2.0906 |
| b. Enterprises' disposable income | 27627.10 | 28099.71 | 1.7107 | 26933.75 | 2.5097 | 28545.99 | 3.3261 | 29711.96 | 7.5465 |
| c. Government's income | 198150.54 | 198934.73 | 0.3958 | 199391.10 | 0.6261 | 200029.36 | 0.9482 | 202054.12 | 1.9700 |

Source: computed from the CGE model for Costa Rica.

Three interesting conclusions about the effect on institutional income can be drawn from Scenario No. 8. First, the most benefited agents were the enterprises, whose income rose by 1.7 per cent. Second, there was a fairly slight increase in government's income, which can be explained as being due to the increase in exports and the already explained increase in profits. As already

mentioned, the subsidy is aimed at promoting exports whose growth generates a positive 'fiscal effect' as the export tax base increases. Third, the increased subsidy granted to AG had no important implications for households' disposable income, although it slightly worsened the distribution between urban and rural households as the income gap increased by 0.5 per cent.

Scenarios No. 9 and 10 show the effects of higher export subsidies in IND and S&T, respectively, which is different to the policy applied in Costa Rica. Even though an increase in the export subsidy for IND raised profits in all the sectors (0.8, 2.8, 1.0 and 1.5 per cent, respectively), institutional income distribution did not improve since the most benefited agents were the enterprises with an income that rose by 2.5 per cent. In addition, the positive effect on government's income was rather weak (0.6%) and households' disposable income increased in such a way (0.5 and 0.4 per cent for urban and rural, respectively) that the income gap between households worsened by 0.7 per cent.

A similar result was found when the increase in export subsidies was only applied to S&T, although the effects on profits in AG and IND were much weaker (0.6 and 0.5 per cent, respectively), whereas those on the sector itself and CONT were stronger (3.8 and 2.1 per cent, respectively). Regarding institutional income distribution, the effect of the increased subsidy was found to raise even further enterprises' disposable income by 3.3 per cent. The government received an income that rose by almost 1 per cent, which hints that the 'fiscal effect' of greater exports plays a role in this case. Despite the fact that households' disposable income tended to rise more than in the two previous scenarios (by 0.7 and 0.5 per cent for urban and rural, respectively) the income gap between households continued to worsen by 0.9 per cent.

Scenario No. 11 showed that the increase in the export subsidy generated a lot of changes in income when it was applied to all the tradable sectors simultaneously. As can be seen in Table 6.8, profits were found to rise dramatically once the increased subsidy was granted (by 3.9, 3.7, 5.4 and 4.6 per cent, respectively). This consequently explains why enterprises' disposable income also increased dramatically by 7.5 per cent. Moreover, the higher profits and the higher exports explain the rise of nearly 2 per cent in government's income. There was also a positive effect on household's income (1.5 and 1.2 per cent for urban and rural, respectively); however, urban households' disposable income rose more than rural households' disposable income, which explains the increase of 2.1 per cent in the income gap between households.

The conclusion drawn from Scenarios No. 8, 9, 10 and 11 is that, no matter which sector is granted an increased export subsidy, there is a bias towards more income for enterprises whereas the income gap between households tends to worsen. Furthermore, granting increased export subsidies to AG would be expected to generate a reduced income for the government, which means that the cost of the subsidy is rather high in this sector. On the contrary, granting increased export subsidies to the other two tradable sectors would raise income for the government, since exports and profits are promoted in such a way that the cost of the subsidy becomes relatively lower. Therefore, the exercise tells us that an increase in the export subsidy not only for AG, but also for IND and S&T, would be expected to worsen income distribution and positively affect government's income. However, it is deemed important to analyse whether the positive effect on government's income would be strong enough to compensate the cost of the import tariff and export tax reductions. This analysis is carried out below, where a scenario involves simultaneous reductions of import tariffs and export taxes along with an increase of the export subsidy in the three tradable sectors.

### 6.3.3.3. Effects on production

The effects on production of increasing export subsidies in each of the sectors are explained straightforward, as they are quite similar. Scenarios No. 8, 9 and 10 showed that production increased in the sector where the increased subsidy is conceded. Although production in the other sectors also rose, the effect was not as strong as it was in the sector that was conceded the larger export subsidy (see Table 6.9). Such an effect can be explained as being due to the larger income injected into the system (as explained in section 6.3.3.2), which provokes an increase in the components of domestic demand that consequently raises total demand. Going into the details of these components, the rise in production was largely explained by an increase of investment in the sector that was granted the higher subsidy (see Table 6.9.a in the Appendix).

**Table 6.9. Impact of a 50% export subsidy increase on production**

| OBJECTIVE VARIABLES | BASE VALUES 1991 | SCENARIO No. 8 Reduction for AG | | SCENARIO No. 9 Reduction for IND | | SCENARIO No. 10 Reduction for S&T | | SCENARIO No. 11 For all the sectors | |
|---|---|---|---|---|---|---|---|---|---|
| | | Values | Change % | Values | Change % | Values | Change % | Values | Change % |
| PRODUCTION | | | | | | | | | |
| AG. | 191570,67 | 193925,80 | 1,2294 | 192474,56 | 0,4718 | 192242,33 | 0,3506 | 195501,35 | 2,0518 |
| IND. | 688403,11 | 690433,02 | 0,2949 | 695233,21 | 0,9922 | 692372,80 | 0,5767 | 701232,81 | 1,8637 |
| S&T | 524921,57 | 526446,91 | 0,2906 | 527436,42 | 0,4791 | 532913,84 | 1,5226 | 536954,04 | 2,2922 |
| CONT | 202824,30 | 203120,74 | 0,1462 | 203270,50 | 0,2200 | 203483,26 | 0,3249 | 204225,90 | 0,6910 |

Source: computed from the CGE model for Costa Rica.

When the increased export subsidy was applied to all the sectors simultaneously, a positive effect was found on production, though more strongly in the tradable sectors, as shown in Table 6.9 (Scenario No. 11). This positive effect is explained as domestic demand was increased by the larger income injected into the economy. Furthermore, production also benefited from increased exports, as they had a positive impact on total demand. It can be concluded that a part of the income generated by raising the export subsidy has a positive effect on production. However, the dramatic increases in the deficit of trade indicate that the largest part of such an income is deviated towards imports.

## 6.3.4. Counterfactual simulation effects of a complete opening of trade process

A complete opening of trade process was simulated through Scenario No. 12, in which both import tariffs and export taxes were decreased, whereas export subsidies were increased, simultaneously in all the sectors. Regarding the balance of trade, although exports were positively impacted by the reduction of export taxes and increased export subsidies, the reduction of import tariffs had a stronger effect, mainly in IND where the deficit increased dramatically by 10.5 per cent. One explanation to this is that the country is highly dependent on industrial imported products such as raw materials and capital goods. As shown in Table 6.10, there was also a very strong effect on the balance of trade in S&T, whose surplus fell by 34.1 per cent. The effect on the balance of trade in AG was so slight (0.1%) that it cannot be considered important.

**Table 6.10. Impact of a 50% reduction in export taxes and import tariffs, and a 50% increase in export subsidies on the balance of trade**

| OBJECTIVE VARIABLES | BASE VALUES 1991 | SCENARIO No. 12 All the sectors | |
|---|---|---|---|
| | | Values | Change % |
| a. Balance of trade | | | |
| AG. | 58136.55 | 58217.30 | 0.1389 |
| IND. | -109651.74 | -121190.22 | 10.5228 |
| S&T | 47766.80 | 31482.68 | -34.0909 |
| Total of the Economy | -3748.39 | -31490.24 | 740.1007 |
| b. Foreign Exchange Requirements | 3748.39 | 31490.24 | 740.1007 |

Source: computed from the CGE model for Costa Rica.

The effect of the complete opening of trade was found to have a dramatic impact on profits. As can be seen in Table 6.11, profits fell dramatically in IND, S&T and CONT, by 8.2, 7.3 and 4.4 per cent, respectively. On the contrary, profits in AG increased dramatically by approximately 5.5 per cent. The reason to such an effect on profits in AG could be to some extent attributed to large international companies that have been taking advantage of the opening of trade by installing their plants in Costa Rica, specifically in export promotion zones for non-traditional agricultural products. Such companies have not only benefited from lower import tariffs, which have given them the opportunity of buying cheaper intermediate goods from abroad, but also from reduced export taxes and mainly increased export subsidies. However, enterprises' disposable income was found to fall by 6.9 per cent in the overall, as profits from the other sectors (IND, S&T, and CONT) fell more strongly. The negative effect from the complete opening of trade also expanded on household's income, whose income gap was found to fall, but without any meaning in terms of income distribution as both incomes went down by 1.4 and 1.1 per cent for urban and rural, respectively. The largest negative effect occurred on government's income, which fell dramatically by 9.5 per cent. This suggests that the 'fiscal cost' of the opening of trade process is one of the reasons why the fiscal deficit has worsened in Costa Rica since the opening of trade started, as explained in Chapter Three.

**Table 6.11. Impact of a 50 % reduction in export taxes and import tariffs, and a 50% increase in export subsidies on income distribution**

| OBJECTIVE VARIABLES | BASE VALUES 1991 | SCENARIO No. 12 All the sectors | |
|---|---|---|---|
| | | Values | Change % |
| *FACTORIAL INCOME* | | | |
| a. Profits | | | |
| AG. | 63394.20 | 66854.99 | 5.4592 |
| IND. | 69961.34 | 64231.46 | -8.1901 |
| S&T | 101987.49 | 94571.77 | -7.2712 |
| CONT | 19330.35 | 18475.69 | -4.4213 |
| *INSTITUTIONAL INCOME* | | | |
| a. Households' disposable income | | | |
| Urban households | 311762.49 | 307414.25 | -1.3947 |
| Rural households | 208317.00 | 205963.61 | -1.1297 |
| Income gap between urban and rural households | 103445.50 | 101450.64 | -1.9284 |
| b. Enterprises' disposable income | 27627.10 | 25703.98 | -6.9610 |
| c. Government's income | 198150.54 | 179332.12 | -9.4970 |

Source: computed from the CGE model for Costa Rica.

The fall in income affected production since domestic demand and investment fell, as shown in Tables 6.12 and 6.12.a (the latter is presented in the Appendix). The interesting result found was that production in AG and S&T was slightly increased. On the contrary, production in the other two sectors fell slightly. Therefore, one cannot expect a significant effect on total production with respect to the situation of 1991, if the policy instruments had moved as simulated in Scenario No. 12.

**Table 6.12. Impact of a 50% reduction in export taxes and import tariffs, and a 50% increase in export subsidies on production**

| OBJECTIVE VARIABLES | BASE VALUES 1991 | SCENARIO No. 12 All the sectors | |
|---|---|---|---|
| | | Values | Change % |
| PRODUCTION | | | |
| AG. | 191570.67 | 192783.68 | 0.6332 |
| IND. | 688403.11 | 686248.38 | -0.3130 |
| S&T | 524921.57 | 527252.09 | 0.4440 |
| CONT | 202824.30 | 201475.81 | -0.6649 |

Source: computed from the CGE model for Costa Rica.

## 6.4. COMPARISON OF THE MODEL RESULTS WITH SIMILAR STUDIES

Although the reduction in export taxes and the increase in export subsidies were found to positively affect households' disposable income (although negatively affecting the income gap between households), it was found that the reduction in import tariffs has a stronger effect as profits and enterprises' disposable income decrease in such a way that households' disposable income fell in the overall. Thus, one can conclude that the opening of trade affects negatively the situation of households. Other studies on the effects of the opening of trade on income distribution have come to similar conclusions.

Robbins and Gindling (1997) used the "Family Surveys on Employment and Unemployment" of Costa Rica from 1976 to 1993 in order to analyse inequality during the opening of trade.[30] By applying econometric techniques, they found that after the opening of trade began in 1984, the relative demand for labour has moved towards more skilled labour mostly found in urban areas. This has caused income distribution inequality between households (Robbins and Gindling, 1997: 18-32).

Monge and González (1994) complemented the 'shifting analysis' with econometric techniques and found that the opening of trade must be expected to benefit income distribution in Costa Rica. However, such an effect is rather weak as they explained themselves. According to their results, the income gain from a unilateral opening of trade would be equal to 0.9 per cent of the GDP in 1989 (Monge and González, 1994: 51-115, 123). A similar result was also found in this study through the policy scenarios carried out when decreasing export taxes and increasing export subsidies, in which the increases in households' income were found to be rather weak.

Others like Corrales and Monge (1990) analysed the welfare costs in the context of opening of trade in Costa Rica. By using the 'Harberger's triangles of trade', they found that the welfare cost resulting from the protectionist scheme seems to be low, less than 1 per cent of the GDP (Corrales and Monge, 1990: 133).[31] One can expect from such a conclusion a weak impact on income distribution from the opening of trade, which according to the model results seems to be the case of reduced export taxes and increased export subsidies, but not the case of reduced import tariffs.

An analysis of labour markets in Latin America carried out by Thomas (1996), suggests that the opening of trade in countries such as Costa Rica has reduced income of labour and shifted workers into lower paying employment in the short term. In the rural markets, rural labour has been forced to abandon their land, which has led to an increase in landless rural labour and migration to the cities. This has been accompanied by a process of informalisation of urban labour. Both processes have led to a lower net share of national income going to households (Thomas, 1996: 98-100). This result seems to be similar to the one obtained in this study, as the opening of trade policies were found to negatively affect households' income.

Monge and González (1994) analysed the implications of the export subsidies granted in Costa Rica and found that a subsidy such as the CAT leads to a loss of welfare for a small country such as Costa Rica. One of the most negative effects is the reduction of the 'consumer surplus' and the increase of the 'producer surplus'. Both effects result in a net loss of welfare as the cost of the subsidy is paid by the whole society (Monge and González, 1994: 59-61). It is worth mentioning that

[30] The "Family Surveys on Employment and Unemployment" cover 1 per cent of the total population and provide information about households' income, working hours, types of employment, education, age, etc.

[31] Corrales and Monge (1990) only took into consideration the cost of the inefficient allocation of resources.

the 'fiscal cost' of the export subsidies granted in Costa Rica was found to be rather high in this study, which to some extent supports the conclusion of Monge and González (1994).

The analysis of counterfactual scenarios also showed that the opening of trade implies a high cost for the government, whose income is dramatically reduced. This can be one of the most important causes for the fiscal deficit faced by Costa Rica since the opening of trade began. In addition, the cost of subsidising exports for the government was found to be much cheaper if the subsidies were granted to IND and S&T. The subsidies granted to AG seem to provoke a very slight positive effect that results from the higher export earnings. When it was simulated the concession of export subsidies to IND and/or S&T, exports were found to increase in such a way that the taxable base on exports raised government's income more than proportionally with respect to the cost of the subsidy.

Monge and González (1994) argue that the export subsidies have been one of the most important reasons for the fiscal problem in Costa Rica. The fiscal problem has even worsened as exports of non-traditional products have gone up with the opening of trade. The concession of such subsidies has also resulted in 'rent-seeking' and deviation of resources that could have been directed to finance more productive projects at the social level. Both authors also argue that such subsidies are not appropriate to expand markets and increase the export earnings of the country. The only effect of such a way of promoting exports is a domestic redistribution of income on the basis of an inefficient utilisation of resources (*Op. Cit.*, 1994: 62-65).

Moving on to production, the opening of trade was found to affect positively AG and S&T, although very slightly. The opposite was found for IND and CONT, where production fell slightly. The analysis showed no strong impacts on total production, since income was directed towards imports and repatriation of profits rather than towards domestic demand. It is expected an increase of imports not only of industrial goods but also of consumer goods and services. In addition, the higher profits generated in AG seem to be largely repatriated as transnational firms appropriate most of them.

Bulmer-Thomas (1996) analysed the liberalisation of trade in Latin American countries and concluded that its biggest disappointment in countries such a Costa Rica is the weak impact on economic growth. Bulmer-Thomas found that growth in the 1990s is still below the levels achieved in the three decades before the 1980s (Bulmer-Thomas, 1996: 305). This coincides with the model results, where production was found to be weakly affected by the opening of trade policies.

Regarding imports, the opening of trade has culminated in a larger competition in services mainly of the financial type. The reduction of import tariffs applied as part of the free trade agreement with Mexico has led to a higher supply of Mexican services in Costa Rica. The same sort of policy has led to a larger supply of final consumer goods from Mexico and the United States. Such goods are offered by more competitive firms that supply the same product as domestically supplied by local producers, but at a much lower price. As Monge and González (1994) put it, the liberalisation of imports could be expected to increase consumption possibilities, but not necessarily economic growth (*Op. Cit.*, 1994: 126). It is worth mentioning that, as explained in Chapter Three, imports of consumer goods show an important increase after 1984s. This seems to be an explanation to the impact on imports and the weak effect on production shown by the model results.

It was already mentioned that an important component of the increased imports would be expected to be raw materials for manufacture. Corrales and Monge (1990) concluded that the reduction of import tariffs between 1986 and 1992 has not reduced the dependency on imported raw materials for manufacture (Corrales and Monge, 1990: 131-132). The model results obtained in this study suggest that the reduction in import tariffs can be expected to increase dependency on imported raw materials. The lack of important effects on production suggests that the country could even be importing raw materials that were produced domestically in the past, as they became even cheaper with the reduction of import tariffs. However, it is important to note that, as explained in Chapter Three, although imports of raw materials rise after 1984, their importance in the total tends to fall though they continue to hold the highest share in total imports. On the contrary, imports of consumer goods not only tend to rise but also increase their relative importance with respect to total imports.

Monge and González (1995) carried out an econometric analysis to study the implications of the reduction in import tariffs. They calculated the 'correlation coefficient of ranges' between the change in nominal protection and the rate of growth of imports. The correlation was found negative and statistically significant (with a value of – 0.35743). Accordingly, they concluded that the reduction of tariffs has provoked an increase in imports in some agricultural and manufacturing sectors, displacing domestic production (Monge and González, 1995: 73). A similar result was found in this study as imports of manufactured goods were found to increase with the reduction of import tariffs, whereas production was not highly promoted.

## 6.5. FINAL REMARKS

Following the building up of the CGE model, the *counterfactual* policy simulation was carried out to understand how the model works and the way in which production, income and the balance of trade are affected after manipulating the selected policy instruments. It is clear from the Costa Rican CGE model that the opening of trade policies are expected to directly affect relative prices in the economy. This leads to a circular chain of effects; trade is directly affected whereas a series of changes in agents' income affect domestic demand, which consequently varies total supply. From this point onwards, income is generated as production increases, so that a new equilibrium is to be reached.

This mechanism reflected the expected effects of the opening of trade process on Costa Rica's economy, when a further opening up of the economy was carried out with respect to the situation in 1991. It is of particular interest to note that, since the structure of the economy has not changed drastically since 1991, the model results can also explain the expected impacts of the opening of trade for more recent years. However, as will be explained in the next chapter, the analysis could draw some more accurate conclusions if certain changes are incorporated to the model.

# Chapter Seven

# CONCLUSIONS

## 7.1. BRIEF SUMMARY

This section provides a summary of the paper by highlighting the main issues discussed in each chapter. The design of the research was presented in Chapter One, where the problem regarding the opening of trade process was stated. Furthermore, the research hypotheses and the research objective were also stated, in addition to a brief preamble of the methodology used.

Chapter Two outlined the benefits of trade liberalisation for developing countries from the point of view of the traditional trade theory. The theoretical approach suggests that trade liberalisation brings about positive effects on production and exports that are conducive to growth, which consequently leads to improving welfare. This rationalisation has been promoted since the 1980s by World Bank's policies in developing countries, which have involved reductions in import tariffs and export taxes. It was highlighted that, as an innovation to the theory, these policies have suggested the concession of temporal export subsidies to face the anti-export bias that resulted from import substitution strategies and to fight the balance of trade deficits.

In Chapter Three, the main opening of trade policies implemented in Costa Rica since 1984 where summarised, focusing on the reduction of import tariffs and export taxes and the concession of export subsidies, as recommended by the World Bank. In addition, the performance of the economy indicated that production and trade have risen during the opening of trade process. Nonetheless, two problems have emerged in the country. On the one hand, there appears that imports have accelerated much faster than exports. On the other hand, the government's fiscal deficit has worsened dramatically.

The methodology was presented in Chapter Four, where the definition and structure of a CGE model along with the main types of CGE models were highlighted. The chapter also elaborated on the steps for building and calibrating a CGE model, where the calibration technique of imposing tight bookkeeping from the beginning of the model construction by arranging the data in the form of a SAM was explained. This step is complementary to the estimation of parameters which, as was explained, can be carried out by either calculating average propensities to spend from the SAM or applying stochastic estimation and calibration. Finally, the importance of the closure rules as the means of giving consistency to the CGE models was highlighted along with the main types of closures.

Chapter Five elaborated on the construction of a static CGE model for analysing the implications of the opening of trade in Costa Rica. The model was structured to carry out *counterfactual* simulations in order to analyse what would have happened on the economy if the opening of trade policies had been applied differently with respect to the base year 1991. The model is of the 'micro-structuralist' type and can be identified within the category of models used to analyse implications of structural adjustment policies in developing countries. Since the model is static and includes *counterfactual* simulation, the production function only provided the initial production values and was not included in the model. The model comprises the 'small-country assumption' and the assumption of imperfect substitution between domestically produced and imported commodities. In

addition, the model was found consistent with 133 equations that determined 133 endogenous variables simultaneously. The general solution of the model included the following closure rules: (i) investment was assumed to equal total savings in the economy, (ii) normalisation of prices was incorporated, (iii) product markets equilibrium was tested through excess demand equations, and (iv) there was a balance of payments constraint whose closure was done by assuming no restrictions of foreign exchange to finance imports.

In Chapter Six, the analysis moved on to policy simulation scenarios, where the expected results of the opening of trade process were explained through the 'reduced form' of the model. The policy simulation was *counterfactual;* thus, the analysis was focused on what would have happened if the opening of trade had been larger with respect to the situation in 1991. The chapter summarised the results of twelve *counterfactual* scenarios, in which import tariffs and export taxes were reduced by 50 per cent, while export subsidies were increased by 50 per cent, in all the tradable sectors. Such changes were applied to each tradable sector individually in nine scenarios. Three scenarios considered simultaneously the reduction in import tariffs and export subsidies, and the increase in export subsidies in each tradable sector separately. There was also one scenario that considered a full process of opening of trade, in which import tariffs and export taxes were reduced and export subsidies were increased in all the tradable sectors simultaneously. All the scenarios brought about interesting results that are summarised in the next section. Most of these results were briefly compared at the end of the chapter with the existing related studies for Costa Rica.

## 7.2. MAIN FINDINGS OF THE RESEARCH

The main task of this research was to analyse the implications of the opening of trade process in Costa Rica, focusing on production, income distribution and the balance of trade, by using a CGE model. In summary, the main findings of the research can be outlined as follows:

**Production;** the results found contradict the first research hypothesis as the model showed no important effects on production. The reduction of export taxes and the increase of export subsidies were found to slightly benefit production in sectors such as Agriculture, forestry and fishing and Services and trade. However, the effect of reducing import tariffs turned out to be stronger as production was found to fall in all the sectors. When import tariffs and export taxes were reduced, while at the same time export subsidies were increased, the effects on total production were found to be insignificant. Therefore, the effects of the import tariff reduction out-weighted that of the export tax reduction and the export subsidy increase concerning total production. This effect is explained by the trend shown by the income generated as a result of the opening of trade, as explained below.

**Profits;** the generation of profits in Agriculture, forestry and fishing was positively impacted by the reduction of export taxes and the concession of export subsidies. This can be explained by the fact that this sector plays the most important role in total exports. Since the country is a 'net exporter' of agricultural products, the reduction in import tariffs had no important effects on this sector in terms of profits. On the contrary, it was found that a reduction in import tariffs promotes competition from abroad in Industry and Services and trade, so that profits were threatened dramatically. The lack of comparative advantages in these sectors – mainly in Industry - explains why the reduction in export taxes and the concession of export subsidies did not raise profits in these sectors. This negative effect was consequently found to affect profits in the sector 'construction and other nontraded'.

**Enterprises' income;** the fall in profits in Industry, Services and trade, and 'construction and other nontraded' out-weighted more than the increased profits in Agriculture, forestry and fishing, as enterprises' disposable income fell in the overall. A further element that could have influenced this result is that a large portion of the profits generated in Agriculture, forestry and fishing is repatriated, as it is earned by transnationals that produce non-traditional agricultural products.

**Households' income;** the reduction in export taxes and the concession of export subsidies were found favourable for the generation of households' disposable income; however, the reduction in import tariffs more than compensated such effect. The dramatic fall in enterprises' disposable income as resulted from the reduced tariffs led to a reduction in labour demand that affected the income of households.

**Government's income;** the opening of trade policies were found to lead to a reduction of government's income. The reduction of export taxes and import tariffs along with the granting of export subsidies did not increase income for the government as expected, which can be explained as being due to the effects on production and income of households and enterprises. In addition, it was found that the export subsidies have the highest 'fiscal cost' when granted to Agriculture, forestry and fishing as government's income rises fairly slightly in comparison to the increase in the other two tradable sectors.

**Income distribution;** the second research hypothesis was found to be true. Although income rises slightly in Agriculture, forestry and fishing because of the opening of trade process, there appears that the most benefited agents are the transnationals allocated in this sector, as a large part of the profits seems to be repatriated instead of being invested in the country. The situation of rural households deteriorated as stated in the hypothesis, which also occurred to urban households. The effect on the income gap of households was found to be undetermined in terms of income distribution as the income of both urban and rural households fell. The analysis of income distribution among all the institutions is similarly unclear as the total income of all the institutions was found to fall.

**The balance of trade;** the third research hypothesis was also found to be true because the export promotion did not lead to a reduction in the balance of trade deficit. Although exports were highly promoted with the reduction in export taxes and the concession of export subsidies, the reduction in import tariffs had a stronger effect as imports were relatively more promoted. Thus, the balance of trade deficit was found to rise dramatically, leading to unsustainable requirements of foreign exchange to finance imports. Imports of raw materials for manufacture, services and mainly consumer goods seem to be highly promoted. This can be expected to have two important effects. On the one hand, imported raw materials could be replacing raw materials produced domestically in the past, as they became cheaper with the reduction of import tariffs. On the other hand, the opening of trade could be encouraging imports of consumer goods relative to imports of capital goods. Both effects are negative for the development of the local industry.

## 7.3. POLICY RECOMMENDATIONS

The results found in this study give scope for recommending policies. Costa Rica's authorities have already determined further reductions in import tariffs that are expected to culminate at the end of the year 2004 in a larger opening up of the economy. One recommendation of this study is the revision of such projected reductions for raw materials, consumer goods and services. Let us

remember that the reduction in import tariffs was found to highly promote imports of raw materials, consumer goods and services at the expense of domestic production and the balance of trade. Therefore, the reductions of import tariffs for these types of goods/services that have been projected up to the year 2004 should be more gradual. The type of raw materials, consumer goods and services whose importation seems to damage local production should also be determined.

Costa Rica's government has also projected further reductions in export taxes as part of the export promotion policies. In addition, export subsidies have already been defined for the year 1999. Export taxes can continue to be reduced as an incentive to promote exports. On the contrary, it is recommended that the concession of export subsidies be reduced. Let us remember that higher export subsidies were found quite costly for the government, mainly when granted to Agriculture, forestry and fishing, and not very effective to reduce the balance of trade deficit and to improve income distribution. In addition, the largest beneficiaries of export subsidies have been the transnationals, which repatriate a large part of their profits instead of investing it in the country.

## 7.4. FURTHER IMPROVEMENTS TO THE MODEL

The CGE model for Costa Rica could be improved to more accurately conclude the implications of the opening of trade on production, income distribution and the balance of trade. Broadly speaking, seven suggestions can be given to improve the model, which are outlined as follows:

**Incorporation of dynamism;** the inclusion of dynamism would allow tracing economic behaviour in time and thus drawing conclusions for the long term. Since a production function has to be incorporated, the model would allow determining the extent to which the opening of trade policies can affect capital accumulation. This consequently would tell us about the effects on the growth rate and the extent to which such a rate responds to the opening of trade. In addition, employment growth can also be determined; since it is the other component – along with capital accumulation – that determines the rate of growth in the economy, although a small portion of growth can be the result of 'technical progress', which can also be modelled. Dynamism would also be useful to forecast effects, e.g. one could simulate the expected effects of the opening of trade policies that Costa Rica's government has already projected up to the year 2004.

In addition to the incorporation of a production function, dynamism would also imply updating the exogenous variables and parameters from period to period and calculating new parameters. The determination of a rate of capital accumulation requires computing a depreciation rate. Productivity increases are typically observed in a dynamic model, so that it would become necessary to calculate the relevant production input-output parameters over time. Predetermined nominal prices also have to be updated from one period to the next, considering inflation and other economic variables. The exchange rate would have to be indexed according to a specific exchange rate regime.

**Incorporation of prices;** the incorporation of prices is necessary as far as the model becomes dynamic. There are two major ways of incorporating prices. On the one hand, CGE models can be composed of endogenous prices in a flex-price system, where the specified demand and supply determine the equilibrium prices for the product markets. On the other hand, CGE models can also involve mark-up prices when the economy is composed of imperfect markets. For the case of the Costa Rican model, it would be recommendable to use both sorts of prices. In Costa Rica, prices are

relatively flexible in sectors such as Agriculture, forestry and fishing and Services and trade. On the contrary, mark-up prices would have to be incorporated in Industry and the non-tradable sectors.

**Incorporation of new policy instruments;** it would be convenient to incorporate the exchange rate as a policy instrument for the policy simulation. Indeed, the exchange has been rather used to promote exports as part of the opening of trade policies.

**Estimation of trade parameters;** the econometric estimation of trade parameters –export and import elasticities- should be carried out since these parameters were borrowed from another study at the time of calculating imports and exports functions. This would certainly make the model both more original and complete.

**Revision of closure rules;** it would be appropriate to analyse the extent to which the closure rules are realistic. The closure rule used for the balance of payments constraint, that is the assumption of infinite availability of foreign exchange to finance imports, seems to be unrealistic for a country such as Costa Rica that keeps financial commitments with international organisations. Therefore, it becomes necessary to incorporate other sort of closure for the balance of payments constraint.

**Construction of a new SAM;** the SAM that was used to calibrate the model is the product of continued updates, which started since the mid-1950s with the construction of the first input-output matrix for Costa Rica. There is not certainty on the extent to which the SAM reflects the current structure of the Costa Rican economy. Therefore, it becomes convenient to construct a new SAM to calibrate the CGE model, so that the analysis would certainly consider the current structure of the economy and would help to draw conclusions on the most recent implications of the opening of trade.

**Desegregation of the SAM;** in addition to the construction of a new SAM, it would be advantageous to use a larger disaggregation of it at the time of calibrating the CGE model. Production could be analysed by specific production activities instead of using broad production sectors; e.g., the agricultural sector could be analysed by traditional and non-traditional production activities, which would be very appropriate for the analysis of the opening of trade in Costa Rica. Factor remuneration could be analysed according to levels of skills. Households' income would be approached not only by type of household but also by levels of skills. The analysis of profit appropriation would be more accurate if enterprises are disaggregated into public, private and foreign. Regarding the rest of the world, the analysis would become quite interesting if the trade flows could be studied by region.

## 7.5. FINAL COMMENT

The research has succeeded in analysing simultaneously the production, income distribution and balance of trade effects of the opening of trade process in Costa Rica, which has not been achieved by the existing studies. In the end, although the paper has yielded answers to the stated inquiries, it left others open that can be satisfied by incorporating the changes recommended for improving the CGE model. Further research becomes also interesting as far as the model results differed from those expected by the traditional trade theory. Production was not strongly promoted, income generation did not trickle down, and the balance of trade deteriorated. Therefore, future research could also include the testing of the traditional trade theory, which can be more accurate if the model incorporates the changes recommended.

## Table 3.1. Growth of real gross domestic product in Costa Rica (In percentages)

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | Average Growth 84-96 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GDP | -- | -2.3 | -7.3 | 2.9 | 8.0 | 0.7 | 5.5 | 4.8 | 3.4 | 5.7 | 3.6 | 2.3 | 7.7 | 6.3 | 4.5 | 2.5 | -0.8 | 4.2 |
| Agriculture, forestry and fishing | -- | 5.1 | -4.7 | 4.0 | 10.1 | -5.5 | 4.8 | 4.2 | 4.6 | 7.4 | 2.5 | 6.3 | 4.0 | 2.4 | 2.6 | 4.5 | -0.6 | 3.6 |
| Industry | -- | -0.5 | -11.4 | 1.8 | 10.4 | 2.0 | 7.3 | 5.5 | 2.2 | 3.4 | 2.6 | 2.1 | 10.3 | 6.4 | 4.2 | 3.1 | -4.2 | 4.3 |
| Construction | -- | -21.7 | -31.9 | 4.7 | 23.6 | 5.6 | 3.1 | 1.1 | 0.0 | 12.4 | -2.3 | -7.5 | 2.6 | 16.5 | 4.2 | -8.8 | -9.7 | 3.1 |
| Services and Trade | -- | -5.5 | -5.6 | 6.4 | 5.2 | 2.8 | 6.8 | 6.0 | 4.4 | 6.7 | 6.0 | 1.8 | 11.1 | 8.8 | 6.1 | 2.4 | 1.2 | 5.3 |
| Others | -- | 1.8 | -2.6 | 0.7 | 1.5 | 1.0 | 2.0 | 2.5 | 2.4 | 2.3 | 1.8 | 1.4 | 1.4 | 2.1 | 2.5 | 2.3 | 0.6 | 1.8 |

1/ January estimation

Source: Central Bank of Costa Rica (Department of National Accounts).

## Table 3.2. Structure of gross domestic product in Costa Rica (In percentages)

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | Average Growth 84-96 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GDP | 100.0 | 100.0 | 99.8 | 100.7 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | |
| Agriculture, forestry and fishing | 18.0 | 19.3 | 19.9 | 20.1 | 20.5 | 19.2 | 19.1 | 19.0 | 19.2 | 19.5 | 19.3 | 20.1 | 19.4 | 18.7 | 18.3 | 18.7 | 18.7 | 17.8 |
| Industry | 22.0 | 22.4 | 21.4 | 21.2 | 21.6 | 21.9 | 22.3 | 22.4 | 22.1 | 21.7 | 21.5 | 21.4 | 22.0 | 22.0 | 21.9 | 22.0 | 21.3 | 20.2 |
| Construction | 6.2 | 5.0 | 3.7 | 3.7 | 4.3 | 4.5 | 4.4 | 4.2 | 4.1 | 4.4 | 4.1 | 3.7 | 3.5 | 3.9 | 3.9 | 3.4 | 3.1 | 3.7 |
| Services and Trade | 36.9 | 35.7 | 36.3 | 37.6 | 36.6 | 37.3 | 37.8 | 38.2 | 38.6 | 39.0 | 39.9 | 39.7 | 40.9 | 41.9 | 42.5 | 42.5 | 43.3 | 36.5 |
| Others | 16.9 | 17.6 | 18.5 | 18.1 | 17.0 | 17.1 | 16.5 | 16.1 | 16.0 | 15.5 | 15.2 | 15.1 | 14.2 | 13.6 | 13.4 | 13.4 | 13.5 | 14.1 |

Source: Constructed with base on data from the Central Bank of Costa Rica (Department of National Accounts).

**Table 3.3. Costa Rica's exports by destination (In millions of US dollars)**

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | Average Growth 84-96 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CENTRAL AMERICA | 311.7 | 284.1 | 207.9 | 225.5 | 229.3 | 182.4 | 143.5 | 158.2 | 164.9 | 186.1 | 184.6 | 231.4 | 307.1 | 335 | 353.1 | 428 | 496.9 | **7.4** |
| Guatemala | 65.5 | 75.8 | 64.3 | 87.9 | 75.9 | 39.2 | 37.2 | 43.6 | 55.3 | 60.1 | 52.3 | 58.6 | 75.2 | 85.6 | 102.7 | 117 | 131.9 | **5.7** |
| El Salvador | 52.5 | 43.5 | 33.1 | 41 | 44.5 | 46.3 | 29 | 36.5 | 43.5 | 46.6 | 35.9 | 43.8 | 55.5 | 63 | 72.8 | 90.9 | 104.4 | **9.4** |
| Honduras | 28.2 | 34.8 | 23.2 | 25.1 | 44.7 | 30.8 | 22.7 | 17.5 | 14.3 | 15.2 | 18.3 | 18.7 | 43.2 | 51.8 | 44.9 | 54.6 | 67.7 | **14.7** |
| Nicaragua | 124.1 | 83.8 | 46.6 | 36.9 | 27.9 | 27.2 | 11.6 | 12.1 | 16.7 | 22.2 | 28.1 | 56.7 | 74.5 | 67.5 | 67.7 | 87.3 | 100.9 | **14.3** |
| Panama | 41.4 | 46.2 | 40.7 | 34.6 | 36.3 | 38.9 | 43 | 48.5 | 35.1 | 42 | 50 | 53.6 | 58.7 | 67.1 | 65 | 78.2 | 92 | **8.6** |
| NAFTA | 332.3 | 327.8 | 281.7 | 281.1 | 373.2 | 372.7 | 456.2 | 533.1 | 533.7 | 651.4 | 677.2 | 715.3 | 871.6 | 1012.4 | 983.3 | 1070.2 | 1846.1 | **16.9** |
| United States | 327.5 | 303.5 | 261.2 | 274.5 | 354.2 | 354.1 | 436.1 | 512.7 | 502.9 | 592.3 | 606.4 | 658 | 824.4 | 947.6 | 933 | 1020.3 | 1740.1 | **16.5** |
| Canada | 3.7 | 5.2 | 7 | 6.5 | 5.5 | 10.9 | 14.4 | 18.8 | 28 | 54 | 56.3 | 42.1 | 29.6 | 36.6 | 28.5 | 33.4 | 44.6 | **22.2** |
| Mexico | 1.1 | 19.1 | 13.5 | 0.1 | 13.5 | 7.7 | 5.7 | 1.6 | 2.8 | 5.1 | 14.5 | 15.2 | 17.6 | 28.2 | 21.8 | 16.5 | 61.4 | **1069.7** |
| Colombia | 3.6 | 5.4 | 3.4 | 1.9 | 1.7 | 1.8 | 2 | 1.5 | 5.3 | 7.4 | 2.9 | 3.5 | 6.8 | 9.3 | 10.8 | 16.5 | 22 | **36.0** |
| Venezuela | 2.2 | 3.1 | 5.6 | 3.1 | 1.8 | 5.7 | 3.3 | 2 | 9.6 | 6.2 | 2.3 | 4.2 | 7.6 | 12.4 | 9.1 | 14.5 | 12.7 | **47.8** |
| Germany | 116.3 | 123.3 | 122.2 | 0.7 | 130.2 | 120.8 | 157.1 | 168.2 | 173.3 | 177 | 172.5 | 158.1 | 191.5 | 175.1 | 203.7 | 168.8 | 197.5 | **1427.1** |
| Belgium and Luxembourg | 22.4 | 23.8 | 10.7 | 9.6 | 10.3 | 11.1 | 13.3 | 10.8 | 10.7 | 27 | 66 | 60.1 | 87.8 | 125.5 | 151.7 | 146 | 121.4 | **30.2** |
| Finland | 25.5 | 17.5 | 19.3 | 19.7 | 19.4 | 21.8 | 25.4 | 24 | 16.6 | 15.2 | 12.7 | 7.4 | 8.7 | 7.6 | 17.2 | 34.7 | 19.7 | **8.8** |
| United Kingdom | 2.6 | 10.5 | 26.1 | 12.2 | 46.6 | 27.1 | 42.4 | 24.9 | 26.8 | 31.8 | 28.5 | 29.8 | 23.9 | 36.9 | 65.8 | 100.6 | 94.9 | **33.5** |
| Italy | 42.4 | 29.1 | 31.6 | 31.9 | 33.5 | 20.1 | 36.2 | 33.2 | 52.4 | 62.4 | 62.5 | 66.4 | 94.7 | 86.2 | 107 | 127.6 | 144.5 | **16.2** |
| The Netherlands | 29.1 | 25.5 | 24.9 | 21 | 22.2 | 19.3 | 28.7 | 30.4 | 35.5 | 33.4 | 43.5 | 42.1 | 35.3 | 42 | 60.5 | 87.5 | 108.5 | **15.4** |
| Sweden | 9.2 | 12.3 | 8.8 | 6.8 | 10 | 12 | 17 | 6.1 | 11 | 10 | 9.8 | 6.2 | 6.7 | 6.9 | 12.9 | 23.6 | 46.5 | **27.3** |
| Japan | 8 | 5.4 | 6.1 | 4.8 | 4.8 | 5.2 | 10.3 | 11.9 | 10 | 8.7 | 15.3 | 20.3 | 13.6 | 12.3 | 18.2 | 27.7 | 35.2 | **22.0** |
| Other countries | 96.4 | 140.3 | 122.1 | 254.2 | 123.4 | 176 | 185.2 | 154 | 220.4 | 198 | 170.4 | 244.9 | 185.4 | 133.4 | 249.1 | 411.8 | 446 | **11.6** |

Source: Central Bank of Costa Rica

Table 3.4. Structure of Costa Rica's Imports (in millions of US dollars and percentages)

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | Average Growth 84-96 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Raw materials | 623.7 | 567.3 | 481.7 | 535.8 | 566.6 | 536.8 | 536.2 | 649.4 | 689.9 | 833.7 | 832.3 | 808.3 | 977.1 | 1058.8 | 1177.4 | 1431.9 | 1350.6 | 7.8 |
| Consumption goods | 388.0 | 251.9 | 134.0 | 177.1 | 203.5 | 202.0 | 232.8 | 179.1 | 310.2 | 379.6 | 461.2 | 439.3 | 638.2 | 822.7 | 897.3 | 849.7 | 925.6 | 15.8 |
| Capital goods | 324.0 | 258.4 | 166.3 | 150.8 | 208.9 | 228.5 | 279.8 | 341.3 | 288.3 | 358.1 | 467.5 | 394.4 | 555.8 | 722.0 | 620.9 | 656.0 | 567.1 | 12.7 |
| Materials for construction | 72.4 | 46.2 | 15.0 | 16.8 | 20.3 | 28.3 | 36.6 | 35.5 | 42.3 | 53.2 | 63.5 | 72.3 | 88.1 | 93.0 | 118.2 | 109.9 | 101.3 | 15.7 |
| Fuels and Oils | 95.5 | 75.5 | 86.1 | 99.4 | 82.6 | 89.9 | 48.6 | 55.2 | 64.5 | 78.2 | 149.5 | 153.1 | 163.3 | 174.1 | 203.3 | 200.8 | 201.3 | 9.3 |
| Others | 19.6 | 9.2 | 10.1 | 7.9 | 11.8 | 12.7 | 13.5 | 19.7 | 14.6 | 11.8 | 15.7 | 9.2 | 18.4 | 15.1 | 8.1 | 4.5 | 5.1 | 4.6 |
| **TOTAL** | **1523.2** | **1208.5** | **893.2** | **987.8** | **1093.7** | **1098.2** | **1147.5** | **1280.2** | **1409.8** | **1714.6** | **1989.7** | **1876.6** | **2440.9** | **2885.7** | **3025.2** | **3252.8** | **3151.0** | **9.8** |
| | | | | | | | *Structure in percentages* | | | | | | | | | | | |
| Raw materials | 40.9 | 46.9 | 53.9 | 54.2 | 51.8 | 48.9 | 46.7 | 50.7 | 48.9 | 48.6 | 41.8 | 43.1 | 40.0 | 36.7 | 38.9 | 44.0 | 42.9 | -1.5 |
| Consumption goods | 25.5 | 20.8 | 15.0 | 17.9 | 18.6 | 18.4 | 20.3 | 14.0 | 22.0 | 22.1 | 23.2 | 23.4 | 26.1 | 28.5 | 29.7 | 26.1 | 29.4 | 5.4 |
| Capital goods | 21.3 | 21.4 | 18.6 | 15.3 | 19.1 | 20.8 | 24.4 | 26.7 | 20.4 | 20.9 | 23.5 | 21.0 | 22.8 | 25.0 | 20.5 | 20.2 | 18.0 | 2.2 |
| Materials for construction | 4.8 | 3.8 | 1.7 | 1.7 | 1.9 | 2.6 | 3.2 | 2.8 | 3.0 | 3.1 | 3.2 | 3.9 | 3.6 | 3.2 | 3.9 | 3.4 | 3.2 | 6.1 |
| Fuels and Oils | 6.3 | 6.2 | 9.6 | 10.1 | 7.6 | 8.2 | 4.2 | 4.3 | 4.6 | 4.6 | 7.5 | 8.2 | 6.7 | 6.0 | 6.7 | 6.2 | 6.4 | -0.4 |
| Others | 1.3 | 0.8 | 1.1 | 0.8 | 1.1 | 1.2 | 1.2 | 1.5 | 1.0 | 0.7 | 0.8 | 0.5 | 0.8 | 0.5 | 0.3 | 0.1 | 0.2 | -5.5 |

Source: Central Bank of Costa Rica.

## Table 4.1. STYLISED SOCIAL ACCOUNTING MATRIX FOR COSTA RICA: 1991

| ACCOUNTS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Agriculture, forestry, and fishing | 6012.92 | 68162.37 | 27.12 | 112.48 | | | | 22023.25 | 11516.02 | | | 7303.11 | | | | 3840.89 | 72567.51 | 191570.67 |
| 2 Industry | 22855.27 | 102680.62 | 48185.64 | 20257.30 | | | | 142627.89 | 83282.96 | | | 151421.88 | | | | 6411.51 | 110680.04 | 688403.11 |
| 3 Services and trade | 24580.27 | 93891.17 | 132157.42 | 34001.94 | | | | 70244.94 | 55779.81 | | | 31823.89 | | | | 0.00 | 82442.11 | 524921.57 |
| 4 Construction and other nontrade | 159.73 | 1231.32 | 7566.63 | 1526.59 | | | | 13793.09 | 10952.76 | | 111876.55 | 55717.64 | | | | | | 202824.30 |
| 5 Urban labour | 4891.61 | 26606.35 | 81957.27 | 72123.94 | | | | | | | | | | | | | | 185579.18 |
| 6 Rural labour | 45375.26 | 17283.82 | 42104.24 | 37093.12 | | | | | | | | | | | | | | 141856.44 |
| 7 Capital | 63394.20 | 69961.34 | 101987.49 | 19330.35 | | | | | | | | | | | | | 11990.09 | 266663.47 |
| 8 Urban Households | | | | | 184668.51 | 141582.71 | 77533.40 | | | 46742.10 | 37788.29 | | | | | | 5436.27 | 352168.57 |
| 9 Rural Households | | | | | | | 59443.70 | | | 8690.63 | 24553.57 | | | | | | 4099.74 | 238370.34 |
| 10 Enterprises | | | | | | | 99983.32 | | | | | | | | | | | 99983.32 |
| 11 Government | | | | | | | | 40406.07 | 30053.35 | 16923.50 | | 4387.62 | 51659.42 | 41977.06 | 5954.71 | | 6788.80 | 198150.54 |
| 12 Capital Account | 2655.01 | 61840.69 | 12565.46 | 16111.46 | | | 4387.62 | 62983.38 | 46772.42 | 19768.11 | 13374.58 | 35395.03 | | | | | 10195.50 | 286049.26 |
| 13 Indirect tax | 2141.77 | 11882.65 | 35367.89 | 2267.11 | | | | | | | | | | | | | | 51659.42 |
| 14 Import tariffs | 5.30 | 13955.44 | 28016.32 | 0.01 | | | | | | | | | | | | | | 41977.07 |
| 15 Export tax | 5068.37 | 575.56 | 310.79 | 0.00 | | | | | | | | | | | | | | 5954.71 |
| 16 Export subsidy | | | | | | | | | | | 10252.40 | | | | | | | 10252.40 |
| 17 ROW | 14430.96 | 220331.78 | 34675.31 | | 910.68 | 273.73 | 25315.43 | 84.94 | 13.02 | 7858.98 | 305.15 | | | | | | 95907.62 | 400107.68 |
| TOTAL | 191570.67 | 688403.11 | 524921.57 | 202824.30 | 185579.18 | 141856.44 | 266663.47 | 352168.57 | 238370.35 | 99983.32 | 198150.54 | 286049.17 | 51659.42 | 41977.06 | 5954.71 | 10252.40 | 400107.68 | |

Source: Own aggregation with based on the Costa Rican SAM 1991, built up by the Ministry of Planning and Economic Policy of Costa Rica.

## Basic Notation used in the model

### a) Production Activities

- General notation (*i* or *j* for *n* sectors-commodities in the economy).[1]
- Sectoral notation: Agriculture, forestry and fishing (AG), Industry (IND), Services and trade (S&T), and 'construction and other nontraded' (CONT).

### b) Factors of Production

- Labour (*L*)
- Capital (*K*)
- Urban and rural categories (*k*)

### c) Institutions

Households (*H*)
Enterprises (*E*)
Government (*G*)
Urban and rural categories (*k*)

### d) Differentiation of commodities produced in the economy

Traded commodities (*T*)
Nontraded commodities (*NT*)

[1] When specified, *i* only applies to the tradable sectors-commodities of the economy.

## Table 5.1. List of variables, parameters and elasticities

### Endogenous variables

| *Variable* | *No. of cases* | *Name of the variable* |
|---|---|---|
| $X_i^S$ | 4 | Total supply by activities |
| $D_i$ | 4 | Domestic absorption |
| $V_{ij}$ | 4 | Total intermediate demand |
| $W_{ki}$ | 8 | Nominal wage bill |
| $L_i^a$ | 8 | Aggregation of labour by sector |
| $L_{ki}$ | 8 | Demand functions for labour by sector |
| $L_k^D$ | 2 | Total demand for labour category *k* |
| $\Pi_i$ | 4 | Aggregate sectoral profits |
| $Y_{Hk}$ | 2 | Gross income of households of *k* categories |
| $UBP_{Hk}$ | 2 | Unincorporated business profits to households of *k* categories |
| $DBP_{Hk}$ | 2 | Distributed business profits to households of *k* categories |
| $YD_{Hk}$ | 2 | Disposable income by household category |
| $Y_E$ | 1 | Gross income of enterprises |
| $Y_K$ | 1 | Income of factor capital |
| *DKTR* | 1 | Domestic capital transfers |
| *KIPA* | 1 | Capital income paid abroad |
| $YD_E$ | 1 | Enterprises' disposable income |
| $Y_G$ | 1 | Government's income |
| *S* | 1 | Total savings |
| $C^D_{iHk}$ | 8 | Consumption of *k* categories of households |
| $C^D_{iG}$ | 4 | Consumption of the government |
| $C_i$ | 4 | Aggregate final demand |
| *TINV* | 1 | Total investment net of depreciation |
| $I_i$ | 4 | Net investment by sector |
| $Z_i$ | 4 | Gross investment by sector |
| $PD_i$ | 3 | Domestic price of traded commodities |
| $PD_{NT}$ | 1 | Domestic price of nontraded commodities |
| $PM_i$ | 3 | Price of imported commodities |
| $PE_i$ | 3 | Price of exported commodities |
| $PWE_i$ | 3 | World price of exports |
| $P_I$ | 3 | Composite commodity price |
| *P* | 1 | Price level in the normalisation function |
| $Q_I$ | 3 | CES aggregation of the composite commodity |
| $m_i$ | 3 | Ratio of imports to the domestic commodity |
| $d_i$ | 3 | Domestic use ratio |
| $V_i^d$ | 3 | Demand for domestically produced intermediate inputs |
| $C_i^d$ | 3 | Demand for domestically produced final commodities |
| $Z_i^d$ | 3 | Demand for domestic gross investment by sector |
| $X_i^d$ | 4 | Demand for domestically produced commodities |
| $M_I$ | 3 | Demand for imports |
| $E_i$ | 3 | Exports by activity |
| $EX_i$ | 4 | Excess demand for product markets |
| *EF* | 1 | Balance of payments constraint |
| *F* | 1 | Net foreign capital flows |

## Exogenous and Policy variables

| *Variable* | *No. of cases* | *Name of the variable* |
|---|---|---|
| $NHTR_{Hk}$ | 2 | Net households transfers to abroad |
| $GTR_{Hk}$ | 2 | Government transfers to households of *k* categories |
| *KIFA* | 1 | Capital income from abroad |
| *AID* | 1 | Foreign Aid |
| *FS* | 1 | Foreign Savings |
| $PW_i$ | 3 | World price of imports |
| *ER* | 1 | Nominal exchange rate |
| $\overline{W_{ki}}$ | 4 | Real wage bill |
| $td_i$ | 4 | Indirect tax rate |
| $tm_i$ | 3 | Import tariff rate |
| $tx_i$ | 3 | Export tax rate |
| $te_i$ | 3 | Export subsidy rate |
| $t_k$ | 2 | Direct tax rate on households |
| *tc* | 1 | Corporate tax rate |
| *ITI* | 1 | Indirect tax rate on total gross investment |

## Parameters and Elasticities

| *Variable* | *No. of cases* | *Name of the variable* |
|---|---|---|
| $a_{ij}$ | 16 | Input-Output coefficients |
| $b_i$ | 4 | Labour-Output ratio |
| $\sigma_i$ | 4 | Elasticity of substitution in the labour demand |
| $\rho_i$ | 4 | Coefficient of substitution in the labour demand |
| $\Phi_i$ | 4 | Coefficient of sectoral depreciation |
| $\Omega_i^W$ | 4 | Weights of real wage in the price index |
| $\Omega_i$ | 4 | Weights defining the price index |
| $\varpi_{Hk}$ | 2 | Fixed proportion of unincorporated business profits from capital income |
| $\kappa_{Hk}$ | 2 | Shares of distributed profit incomes to households |
| $\varepsilon_K$ | 1 | Capital transfers as a share of the income of factor capital |
| $\gamma_K$ | 1 | Capital income paid abroad as a share of gross capital income |
| $\overline{s}$ | 4 | Proportions of savings per agent |
| $\overline{q}_{ij}$ | 8 | Expenditure shares parameters |
| $\theta_i$ | 4 | Sectoral net investment shares |
| $B_i$ | 3 | CES parameter |
| $\rho_i$ | 3 | Parameter of substitution in the CES function |
| $\delta_i$ | 3 | Share parameter in the CES trade aggregation function |
| $\sigma_i$ | 3 | Trade elasticity of substitution in the CES function |
| $\eta_i$ | 3 | Price elasticity of export demand |
| $E_{0i}$ | 3 | Exports by activity in the base year |

**Note:** there are 133 endogenous variables in the model, which are determined by the 133 equations shown in Table 3 in this Appendix.

## Table 5.2. CGE Model for Costa Rica: Parameter, elasticity and tax rates specification

### 1. PRODUCTION AND FACTOR MARKETS

| Input-Output coefficients ($a_{ij}$) | AG | IND | S&T | CONT |
|---|---|---|---|---|
| AG | 0.0314 | 0.0990 | 0.0001 | 0.0006 |
| IND | 0.1193 | 0.1492 | 0.0918 | 0.0999 |
| S&T | 0.1283 | 0.1364 | 0.2518 | 0.1676 |
| CONT | 0.0008 | 0.0018 | 0.0144 | 0.0075 |
| Coefficient of sectoral depreciation ($\Phi_i$) | 0.0139 | 0.0898 | 0.0239 | 0.0794 |

| Labour-Output ratio ($b_i$) | URBAN | RURAL |
|---|---|---|
| AG | 0.5806 | 0.7304 |
| IND | 0.1278 | 0.1608 |
| S&T | 0.2297 | 0.2889 |
| CONT | 0.7007 | 0.8815 |

| Elasticity of substitution in the labour demand ($\sigma_i$) | |
|---|---|
| AG | 1.0000 |
| IND | 1.0000 |
| S&T | 1.0000 |
| CONT | 1.0000 |
| Coefficient of substitution in the labour demand ($\rho_i$) | |
| AG | 0.0000 |
| IND | 0.0000 |
| S&T | 0.0000 |
| CONT | 0.0000 |
| Weights of real wage in the price index ($\Omega_i^W$) | |
| AG | 0.1192 |
| IND | 0.4282 |
| S&T | 0.3265 |
| CONT | 0.1262 |

### 2. INCOME GENERATION

| | URBAN | RURAL |
|---|---|---|
| Fixed proportion of unincorporated business profits from capital income ($\varpi_{Hk}$) | 0.2908 | 0.2229 |
| Shares of distributed profit incomes to households ($\kappa_{Hk}$) | 0.8432 | 0.1568 |

| | |
|---|---|
| Capital transfers as a share of the income of factor capital ($\varepsilon_K$) | 0.0165 |
| Capital income paid abroad as a share of gross capital income ($\gamma_K$) | 0.0949 |

### 3. SAVINGS, CONSUMPTION AND INVESTMENT

| | H (URBAN) | H (RURAL) | E | G |
|---|---|---|---|---|
| Proportions of savings per agent ($\bar{s}$) | 0.3834 | 0.3773 | 0.2380 | 0.0675 |
| Expenditure shares parameters ($\bar{q}$ij) | H (URBAN) | H (RURAL) | | |
| AG | 0,1341 | 0,0929 | | |
| IND | 0,8682 | 0,6718 | | |
| S&T | 0,4276 | 0,4499 | | |
| CONT | 0,0840 | 0,0883 | | |

| Sectoral net investment shares ($\theta_i$) | |
|---|---|
| AG | 0,0304 |
| IND | 0,5851 |
| S&T | 0,1258 |
| CONT | 0,2587 |

## 4. PRICES, TAX AND SUBSIDY RATES

| | AG | IND | S&T | CONT |
|---|---|---|---|---|
| Indirect tax rate ($td_i$) | 0.0112 | 0.0173 | 0.0674 | 0.0112 |
| Import tariff rate ($tm_i$) | 0.0004 | 0.0633 | 0.8080 | ----- |
| Export tax rate ($tx_i$) | 0.0698 | 0.0052 | 0.0038 | ----- |
| Export subsidy rate ($te_i$) | 0.0529 | 0.0579 | 0.0000 | ----- |

| | URBAN | RURAL |
|---|---|---|
| Direct tax rate on households ($t_k$) | 0.1147 | 0.1261 |

| Weights defining the price index ($\varsigma_i$) | |
|---|---|
| AG | 0.1192 |
| IND | 0.4282 |
| S&T | 0.3265 |
| CONT | 0.1262 |
| Corporate tax rate ($tc$) | 0.1693 |
| Indirect tax rate on total gross investment ($ITI$) | 0.0178 |

## 5. EXPORTS PARAMETERS AND ELASTICITIES

| Price elasticity of export supply for commodity $i$ ($\eta_i$) | |
|---|---|
| AG | 3.0 |
| IND | 2.0 |
| S&T | 1.5 |
| Parameter of exports by activity in the base year ($E_{0i}$) | |
| AG | 72567.51 |
| IND | 110680.04 |
| S&T | 82442.11 |

## 6. CES FUNCTIONS PARAMETERS AND ELASTICITIES

| CES parameter ($B_i$) | |
|---|---|
| AG | 1.7327 |
| IND | 1.8965 |
| S&T | 1.4553 |
| Parameter of substitution ($\rho_i$) | |
| AG | -0.6667 |
| IND | -0.5000 |
| S&T | -0.3500 |
| Share parameter in the CES trade aggregation function ($\delta_i$) | |
| AG | 0.3336 |
| IND | 0.3832 |
| S&T | 0.1689 |
| Trade elasticity of substitution ($\sigma_i$) | |
| AG | 3.000 |
| IND | 2.000 |
| S&T | 1.500 |

**Note:** The functional forms in which these parameters, elasticities and tax rates, are used appear in the Appendix as well.

## Table 5.3. Model equations

### I. SECTORAL SUPPLY, INTERMEDIATE DEMAND AND FACTOR MARKETS

| No. | Equation | Cases |
|---|---|---|
| Eq.1 | $X_i^s = D_i + (te_i * E_i) + E_i$ | n equations = 4 |
| Eq.2 | $D_i = \sum_j V_{ij} + C_i + Z_i$ | n equations = 4 |
| Eq.3 | $V_i = \sum_j V_{ij} = \sum_j a_{ij} X_j$ | n equations = 4 |
| Eq.4 | $L_i^a = L_i^a(L_{i1},..,L_{ik})$ | n*m equations = 8 |
| Eq.5 | $W_{ki} = \overline{W}_{ki} \sum_i P_i \Omega_i^W$ | n*m equations = 6 |
| Eq.6 | $L_{ki} = b_{ki}\left(\frac{W_{kj}}{PD_i}\right)^{-\rho_i} \cdot X_i$ | n*m equations = 8 |
| Eq.7 | $L_k^D = \sum_i^n L_{ki}$ | m equations = 2 |
| Eq.8 | $\Pi_i = X_i^s - (\sum_j V_{ij} + \sum_i W_{ki} + \Phi_i * X_i^s + td_i * X_i^s + tm_i * M_i + tx_i * E_i + M_i)$ | n equations = 4 |

Sub-total: 42 equations

### II. INCOME OF AGENTS

| No. | Equation | Cases |
|---|---|---|
| Eq.9 | $Y_{Hk} = \left(\sum_i W_{ki} + UBP_{Hk} + DBP_{Hk} + \overline{GTR}_{Hk} + \overline{NHTR}_{Hk}\right)$ | m equations = 2 |
| Eq.10 | $UBP_{Hk} = \sum \varpi_{Hk} * Y_K$ | m equations = 2 |
| Eq.11 | $DBP_{Hk} = \sum_{Hk} \kappa_{Hk} * Y_K$ | m equations = 2 |
| Eq.12 | $YD_{Hk} = \sum_k Y_{Hk}(1 - t_k)$ | m equations = 2 |
| Eq.13 | $Y_E = \left(Y_K - \sum_k DBP_{Hk} - DKTR - KIPA\right)$ | One equation |
| Eq.14 | $Y_K = \sum_i \Pi_i + \overline{KIFA}$ | One equation |
| Eq.15 | $DKTR = \varepsilon_K * Y_K$ | One equation |
| Eq.16 | $KIPA = \gamma_K * Y_K$ | One equation |
| Eq.17 | $YD_E = Y_E * (1 - tc) - UBP_{Hk}$ | One equation |
| Eq.18 | $Y_G = t_k * \sum_k Y_{Hk} + tc * Y_E + ITI * \sum_i TINV_i + \sum_i td_i X_i^s + \sum_i tm_i M_i + \sum_i tx_i E_i + \overline{AID}$ | One equation |

Sub-total: 14 equations

## III. SAVINGS, CONSUMPTION AND INVESTMENT

| No. | Equation | Cases |
|---|---|---|
| Eq.19 | $S = \sum_{k} \bar{s}_{Hk} YD_{HK} + \bar{s}_{E} YD_{E} + \bar{s}_{G} Y_{G} + \overline{FS}$ | One equation |
| Eq.20 | $C^{D}_{iHk} = \bar{q}_{iHk} \cdot (1 - \bar{s}_{Hk}) YD_{Hk}$ | n * m equations = 8 |
| Eq.21 | $C^{D}_{iG} = \bar{C}^{D}_{iG}$ | n equations = 4 |
| Eq.22 | $C_{i} = C_{iHk} + \bar{C}_{iG}$ | n equations = 4 |
| Eq.23 | $TINV = \sum_{Hk} \bar{s}_{Hk} YD_{Hk} + \bar{s}_{E} YD_{E} + \bar{s}_{G} Y_{G} + \overline{FS}$ | One equation |
| Eq.24 | $I_{i} = \theta_{i} * TINV$ | n equations = 4 |
| Eq.25 | $Z_{i} = I_{i} + (\Phi_{i} * X^{s}_{i})$ | n equations = 4 |

Sub-total: 26 equations

## IV. PRICE SYSTEM

| No. | Equation | Cases |
|---|---|---|
| Eq.26 | $PD_{i} = \overline{PW_{i}} * ER$ | n-1 equations = 3 |
| Eq.27 | $PD_{NT} = \frac{\bar{P}}{\Omega_{NT}} - \frac{\sum_{i=1}^{n=1} P_{i} \Omega_{i}}{\Omega_{NT}}$ | One equation |
| Eq.28 | $PM_{i} = \overline{PW_{i}} (1 + tm_{i}) ER$ | n-1 equations =3 |
| Eq.29 | $PE_{i} = PWE_{i} [1 + (te_{i} - tx_{i})] ER$ | n-1 equations =3 |
| Eq.30 | $PWE_{i} = \frac{PD_{i}}{[1 + (te_{i} - tx_{i})] ER}$ | n-1 equations =3 |
| Eq.44 | $P_{i} = \frac{1}{B_{i}} \left[ \delta_{i}^{\sigma_{i}} PM_{i}^{(1-\sigma_{i})} + (1 - \delta_{i})^{\sigma_{i}} PD_{i}^{(1-\sigma_{i})} \right]^{1/(1-\sigma_{i})}$ | n-1 equations = 3 |
| Eq.43 | $\sum_{T=3}^{n-1} \overline{PW_{T}} ER \, \Omega_{T} + PD_{NT} \Omega_{NT} = \bar{P}$ | One equation |

Sub-total: 17 equations

## V. COMPOSITE GOOD EQUATIONS

| No. | Equation | Cases |
|---|---|---|
| Eq.31 | $Q_i = \overline{B_i}\left[\delta_i M_i^{-\rho_i} + (1-\delta_i) D_i^{-\rho_i}\right]^{-1/\rho_i} = f(M_i, D_i)$ | n - 1 equations = 3 |
| Eq.32 | $m_i = \frac{M_i}{D_i} = \left(\frac{PD_i}{PM_i}\right)^{\sigma_i} \cdot \left(\frac{\delta_i}{1-\delta_i}\right)^{\sigma_i}$ | n - 1 equations = 3 |
| Eq.34 | $d_i = \frac{D_i}{Q_i} = f_i^{-1}(m_i, 1)$ | n - 1 equations = 3 |
| Eq.35 | $V_i^d = d_i V_i$ | n - 1 equations = 3 |
| Eq.36 | $C_i^d = d_i C_i$ | n - 1 equations = 3 |
| Eq.37 | $Z_i^d = d_i Z_i$ | n - 1 equations = 3 |
| Eq.38 | $X_i^D = d_i V_i + d_i C_i + d_i Z_i + (te_i E_i) + E_i$ | n equations = 4 |
| | | Sub-total: 22 equations |

## VI. FOREIGN TRADE

| No. | Equation | Cases |
|---|---|---|
| Eq.33 | $M_i = \left(\frac{\delta_i}{1-\delta_i}\right)^{\sigma_i} \cdot \left(\frac{PD_i}{PM_i}\right)^{\sigma_i} \cdot D_i$ | n - 1 equations = 3 |
| Eq.39 | $E_i = E_{0i}\left(\frac{PE_i}{PD_i}\right)^{\eta_i}$ | n - 1 equations = 3 |
| | | Sub-total: 6 equations |

## VII. EXCESS DEMAND FOR PRODUCT MARKETS AND BALANCE OF PAYMENTS CONSTRAINT

| No. | Equation | Cases |
|---|---|---|
| Eq.40 | $EX_i = X_i^D - X_i^S = 0$ | n equations = 4 |
| Eq.41 | $EF = \sum_{i=1}^{n-1} M_i - \sum_{i=1}^{n-1} E_i - F$ | One equation |
| Eq.42 | $F = \sum_{i=1}^{n-1} M_i - \sum_{i=1}^{n-1} E_i$ | One equation |
| | | Sub-total: 6 equations |
| | | TOTAL: 133 EQUATIONS |

Note: the numbering of the equations corresponds to the one used in Chapter Five.

TABLE 6.3.a. Impact of a 50% import tariff reduction on domestic demand

| OBJECTIVE VARIABLES | BASE VALUES 1991 | SCENARIO No. 1 Reduction for AG | | SCENARIO No. 2 Reduction for IND | | SCENARIO No. 3 Reduction for S&T | | SCENARIO No. 4 For all the sectors | |
|---|---|---|---|---|---|---|---|---|---|
| | | Values | Change % | Values | Change % | Values | Change % | Values | Change % |
| I. INTERMEDIATE DEMAND | | | | | | | | | |
| AG. | 74314.89 | 74314.30 | -0.0008 | 73499.39 | -1.0974 | 73288.23 | -1.3815 | 72497.52 | -2.4455 |
| IND. | 193978.82 | 193977.43 | -0.0007 | 192045.18 | -0.9968 | 191544.39 | -1.2550 | 189669.55 | -2.2215 |
| S&T | 284630.81 | 284628.83 | -0.0007 | 281879.30 | -0.9667 | 281165.90 | -1.2173 | 278498.06 | -2.1546 |
| CONT | 10484.26 | 10484.19 | -0.0007 | 10385.68 | -0.9403 | 10360.09 | -1.1843 | 10264.50 | -2.0960 |
| II. SAVINGS AND INVESTMENT | | | | | | | | | |
| a. Total savings | 153093.99 | 153091.72 | -0.0015 | 149818.87 | -2.1393 | 149010.92 | -2.6670 | 145835.02 | -4.7415 |
| b. Total (net) investment | 153093.99 | 153091.72 | -0.0015 | 149818.87 | -2.1393 | 149010.92 | -2.6670 | 145835.02 | -4.7415 |
| c. Investment by sector (gross) | | | | | | | | | |
| AG. | 7303.11 | 7303.03 | -0.0011 | 7184.05 | -1.6303 | 7154.40 | -2.0362 | 7038.95 | -3.6172 |
| IND. | 151421.88 | 151420.04 | -0.0012 | 148806.88 | -1.7270 | 148153.29 | -2.1586 | 145617.60 | -3.8332 |
| S&T | 31823.89 | 31823.52 | -0.0012 | 31290.82 | -1.6751 | 31157.63 | -2.0936 | 30640.72 | -3.7179 |
| CONT | 55717.64 | 55716.98 | -0.0012 | 54758.68 | -1.7211 | 54521.42 | -2.1469 | 53591.52 | -3.8159 |
| III. FINAL CONSUMPTION | | | | | | | | | |
| AG. | 33544.27 | 33543.92 | -0.0011 | 33062.48 | -1.4363 | 32934.33 | -1.8183 | 32467.23 | -3.2108 |
| IND. | 225910.86 | 225908.48 | -0.0011 | 222682.87 | -1.4289 | 221824.26 | -1.8089 | 218694.64 | -3.1943 |
| S&T | 126024.75 | 126023.44 | -0.0010 | 124251.22 | -1.4073 | 123779.48 | -1.7816 | 122060.00 | -3.1460 |
| CONT | 136522.40 | 136522.14 | -0.0002 | 136274.16 | -0.2549 | 136181.53 | -0.3227 | 135843.89 | -0.5698 |

Source: computed from the CGE model for Costa Rica.

TABLE 6.6.a. Impact of a 50% export tax reduction on domestic demand

| OBJECTIVE VARIABLES | BASE VALUES 1991 | SCENARIO No. 4 Reduction for AG | | SCENARIO No. 5 Reduction for IND | | SCENARIO No. 6 Reduction for S&T | | SCENARIO No. 7 For all the sectors | |
|---|---|---|---|---|---|---|---|---|---|
| | | Values | Change % | Values | Change % | Values | Change % | Values | Change % |
| I. INTERMEDIATE DEMAND | | | | | | | | | |
| AG. | 74314.89 | 74558.34 | 0.3276 | 74342.53 | 0.0372 | 74329.82 | 0.0201 | 74600.91 | 0.3849 |
| IND. | 193978.82 | 194556.59 | 0.2978 | 194044.43 | 0.0338 | 194014.25 | 0.0183 | 194657.62 | 0.3499 |
| S&T | 284630.81 | 285456.90 | 0.2902 | 284724.62 | 0.0330 | 284681.47 | 0.0178 | 285601.36 | 0.3410 |
| CONT | 10484.26 | 10513.99 | 0.2836 | 10487.64 | 0.0322 | 10486.08 | 0.0174 | 10519.19 | 0.3332 |
| II. SAVINGS AND INVESTMENT | | | | | | | | | |
| a. Total savings | 153093.99 | 153869.51 | 0.5066 | 153182.06 | 0.0575 | 153141.55 | 0.0311 | 154005.13 | 0.5951 |
| b. Total (net) investment | 153093.99 | 153869.51 | 0.5066 | 153182.06 | 0.0575 | 153141.55 | 0.0311 | 154005.13 | 0.5951 |
| c. Investment by sector (gross) | | | | | | | | | |
| AG. | 7303.11 | 7332.67 | 0.4048 | 7306.47 | 0.0460 | 7304.92 | 0.0248 | 7337.84 | 0.4755 |
| IND. | 151421.88 | 152083.91 | 0.4372 | 151497.06 | 0.0496 | 151462.47 | 0.0268 | 152199.69 | 0.5137 |
| S&T | 31823.89 | 31958.63 | 0.4234 | 31839.19 | 0.0481 | 31832.16 | 0.0260 | 31982.20 | 0.4974 |
| CONT | 55717.64 | 55948.19 | 0.4138 | 55743.82 | 0.0470 | 55731.78 | 0.0254 | 55988.51 | 0.4861 |
| III. FINAL CONSUMPTION | | | | | | | | | |
| AG. | 33544.27 | 33705.23 | 0.4798 | 33562.55 | 0.0545 | 33554.14 | 0.0294 | 33733.38 | 0.5638 |
| IND. | 225910.86 | 226989.29 | 0.4774 | 226033.32 | 0.0542 | 225976.99 | 0.0293 | 227177.89 | 0.5609 |
| S&T | 126024.75 | 126617.27 | 0.4702 | 126092.04 | 0.0534 | 126061.06 | 0.0288 | 126720.89 | 0.5524 |
| CONT | 136522.40 | 135738.75 | 0.0852 | 136535.61 | 0.0097 | 136529.53 | 0.0052 | 136759.09 | 0.1001 |

Source: computed from the CGE model for Costa Rica.

TABLE 6.9.a. Impact of a 50% export subsidy increase on domestic demand

| OBJECTIVE VARIABLES | BASE VALUES 1991 | SCENARIO No. 8 Reduction for AG | | SCENARIO No. 9 Reduction for IND | | SCENARIO No. 10 Reduction for S&T | | SCENARIO No. 11 For all the sectors | |
|---|---|---|---|---|---|---|---|---|---|
| | | Values | Change % | Values | Change % | Values | Change % | Values | Change % |
| I. INTERMEDIATE DEMAND | | | | | | | | | |
| AG. | 74314.89 | 74590.05 | 0.3703 | 75019.92 | 0.9487 | 74729.81 | 0.5583 | 75710.00 | 1.8773 |
| IND. | 193978.82 | 194732.20 | 0.3884 | 195380.84 | 0.7228 | 195450.53 | 0.7587 | 197605.93 | 1.8699 |
| S&T | 284630.81 | 285643.58 | 0.3558 | 286386.30 | 0.6168 | 287381.07 | 0.9663 | 290149.33 | 1.9388 |
| CONT | 10484.26 | 10514.07 | 0.2844 | 10536.84 | 0.5015 | 10612.09 | 1.2192 | 10694.48 | 2.0051 |
| II. SAVINGS AND INVESTMENT | | | | | | | | | |
| a. Total savings | 153093.99 | 153733.29 | 0.4176 | 154037.95 | 0.6166 | 154360.87 | 0.8275 | 155944.13 | 1.8617 |
| b. Total (net) investment | 153093.99 | 153733.29 | 0.4176 | 154037.95 | 0.6166 | 154360.87 | 0.8275 | 155944.13 | 1.8617 |
| c. Investment by sector (gross) | | | | | | | | | |
| AG. | 7303.11 | 7365.16 | 0.7127 | 7344.30 | 0.5640 | 7360.88 | 0.6541 | 7444.12 | 1.9308 |
| IND. | 151421.88 | 151978.30 | 0.3675 | 152587.79 | 0.7700 | 152519.78 | 0.7251 | 154242.12 | 1.8625 |
| S&T | 31823.89 | 31940.83 | 0.3674 | 32002.84 | 0.5623 | 32174.58 | 1.1020 | 32470.46 | 2.0317 |
| CONT | 55717.64 | 55906.58 | 0.3391 | 55997.29 | 0.5019 | 56097.73 | 0.6822 | 56566.32 | 1.5232 |
| III. FINAL CONSUMPTION | | | | | | | | | |
| AG. | 33544.27 | 33651.75 | 0.3204 | 33701.95 | 0.4700 | 33753.24 | 0.6230 | 34018.39 | 1.4134 |
| IND. | 225910.86 | 226630.96 | 0.3188 | 226967.27 | 0.4676 | 227310.93 | 0.6197 | 229087.44 | 1.4061 |
| S&T | 126024.75 | 126420.39 | 0.3139 | 126605.17 | 0.4606 | 126793.98 | 0.6104 | 127770.04 | 1.3849 |
| CONT | 136622.40 | 136700.09 | 0.0569 | 136736.37 | 0.0834 | 136773.44 | 0.1106 | 136965.10 | 0.2508 |

Source: computed from the CGE model for Costa Rica.

TABLE 6.12.a. Impact of a 50% reduction in export taxes and import tariffs, and a 50% increase in export subsidies on domestic demand

| OBJECTIVE VARIABLES | BASE VALUES 1991 | SCENARIO No. 12 All the sectors | |
|---|---|---|---|
| | | Values | Change % |
| I. INTERMEDIATE DEMAND | | | |
| AG. | 74314.89 | 74138.98 | -0.2367 |
| IND. | 193978.82 | 193881.40 | -0.0502 |
| S&T | 284630.81 | 284853.25 | 0.0782 |
| CONT | 10484.26 | 10504.86 | 0.1965 |
| II. SAVINGS AND INVESTMENT | | | |
| a. Total savings | 153093.99 | 149437.83 | -2.3882 |
| b. Total (net) investment | 153093.99 | 149437.83 | -2.3882 |
| c. Investment by sector (gross) | | | |
| AG. | 7303.11 | 7208.92 | -1.2898 |
| IND. | 151421.88 | 149088.95 | -1.5407 |
| S&T | 31823.89 | 31419.76 | -1.2699 |
| CONT | 55717.64 | 54664.66 | -1.8899 |
| III. FINAL CONSUMPTION | | | |
| AG. | 33544.27 | 33106.94 | -1.3037 |
| IND. | 225910.86 | 222980.72 | -1.2970 |
| S&T | 126024.75 | 124414.87 | -1.2774 |
| CONT | 136622.40 | 136306.29 | -0.2314 |

Source: computed from the CGE model for Costa Rica.

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