A POLICY ANALYSIS OF INDUSTRIALIZATION AND FOREIGN TRADE FOR COSTA RICA

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A POLICY ANALYSIS OF INDUSTRIALIZATION AND FOREIGN TRADE FOR COSTA RICA

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CHAPTER I

INTRODUCTION

A majority of developing countries face constraints, both internal and external, on their process of economic development. On the internal side, insufficient generation of domestic savings can undermine the development process when the needed amount of savings cannot be raised domestically. On the external side, the constraint is represented by a foreign trade deficit, where exports do not generate enough foreign exchange to pay for imports.

A macroeconomic approach in development economics known as the two-gap analysis deals with this type of problem. Chenery and Bruno,[1] Tendulkar,[2] Bergsman and Manne,[3] and Weisskopf[4] are among the economists who have done extensive empirical work on this subject. Briefly, the two-gap approach studies the interactions between domestic savings and foreign inflow of capital by stating that economic development is a function of investment. Investment requires savings, which in some countries can be generated domestically. However, in most developing countries the needed savings fail to materialize because of infeasibilities involved in raising the domestic resources. This is why foreign capital plays a double role in gap analysis: it complements domestic savings making investment possible, and makes foreign exchange available to import capital goods, required to sustain the process of investment.

Economic planning requires setting objectives and utilizing policy instruments to achieve the given objectives. In Costa Rica institutionalized economic planning has been scarcely utilized in devising development policies. When economic planning viewed as a managerial tool of development has not been given a major importance in developing countries like in the case of Costa Rica, it becomes more difficult to arrive at solutions that will help the economy to overcome these internal and external constraints on development. This study will deal with economic planning, utilizing the linear programming approach based on the gap framework, to determine policy options that will produce faster rates of development in Costa Rica.

The Problem

Chenery[5] has stated that the concern of most developing countries in the period following World War II is not so much how to start growing but how to manage the changes in the economy as development proceeds in order to sustain growth. That is, economic development has become a problem of economic management, in which policies must be devised in order to overcome internal and external constraints on the economy, in order to achieve higher rates of development.

In Costa Rica, the process of economic planning as a tool for development was not known until the late 1970's. Since deliberate planning in general did not exist, it is difficult for policy makers to know whether the policies followed during the last two decades were the right ones to achieve faster development. Equally difficult is finding out what are the optimal policies to be implemented in the future.

A variety of policies have been devised and implemented in Costa Rica to lessen the impact on development of a scarcity of domestic financial resources and of a foreign trade deficit. For instance, starting in the early 1960's the country concentrated its efforts on a program of industrialization through an import substitution strategy complemented with export promotion as a means to foster economic development. The size of the domestic market limited this process of industrialization and import substitution possibilities consequently were exhausted. In 1963 Costa Rica joined the Central American Common Market (CACM) looking for a new development direction. By joining the CACM it was hoped that the market horizon would be expanded from a local to a regional dimension, and the industrialization program would be pushed ahead by furthering production for import substitution.

The import substitution industrialization effort of Costa Rica was most likely to be aimed at Traditional (consumption goods) and Intermediary (intermediate goods) industrial activities and less at Metal-mechanic (capital goods) activities, because it would be very difficult for a small developing country like Costa Rica, with very limited financial resources and market size, to develop heavy industrial activities. Thus, by joining the CACM the import substitution industrialization could be pushed further in two dimensions: substitution of imports from Central America and substitution of imports from the rest of the world.

The possibility of controlling for the foreign trade imbalance by fostering exports of manufactured goods, particularly to Central America, was another major reason for joining the CACM. With a free trade policy within the CACM, Costa Rica could expand its industrial

sales more easily into Central America. Then, by joining the CACM the export effort received a new bidimentional perspective because Costa Rica could export industrial products to the CACM and continue, at the same time, exporting to the rest of the world. In later years the export emphasis has been shifted gradually to promoting industrial exports to the rest of the world, and greater controls have been imposed to cut down imports from the rest of the world, also.

Financial resources for development, in addition to their scarcity, have been misallocated to some degree. A portion of the domestic credit has been channeled to commercial activities and to personal consumption away from industrial and agricultural activities, reducing the availability of funds to finance further development of these strategic sectors.

Development objectives of the country since the early 1960's have been:

1. To increase growth of output with an emphasis on industrial production through an import substitution industrialization program.

2. To increase growth of exports, with an emphasis on Non-traditional products[6] exported to Non-traditional markets.[7]

3. To reduce the foreign trade deficit, with an emphasis on the rest of the world trade, by decreasing imports, increasing exports (Non-traditional) and controlling the outflow of foreign exchange.

To summarize, the problem is to find out whether the industrialization and export promotion policy followed by Costa Rica to overcome the constrains on development and achieve a faster pace of development was the optimal one, and to explore the effectiveness of other policy

options through simulations with a linear programming model based on the gap framework.

Purpose of the Study

The purpose of this study is to answer two major questions:

1. Was the industrialization policy followed by Costa Rica in the last two decades successful? That is, could the rate of growth have been higher?

2. What other policy options could have been followed by Costa Rica for faster development? That is, what are other policies that the country could have emphasized?

The answers to these questions will shed some light on the obstacles to economic development in Costa Rica. This will assist planners and policy makers in devising development policies that are, first, based on economic principles and, second, that help in overcoming the persistent constraints.

In particular, by examining in detail the industrialization of Costa Rica during the last two decades, including foreign trade of industrial products, the study will attempt to identify major accomplishments and major weaknesses of this policy, thus, suggesting to planners what in this policy should be modified and what should be emphasized.

Significance of the Study

This study is conducted to determine optimal development policies for Costa Rica, emphasizing industrialization and foreign trade.

The research is significant for the following reasons:

1. A review of related empirical studies revealed that this is the first one to be undertaken for Costa Rica, utilizing the linear programming approach based on the gap framework.

2. The value of the study is enhanced by the fact that through policy experiments simulations on the effects of different policies on output and foreign trade will be obtained. Thus, it will provide valuable guidelines to Costarican planners on what the most promising development policies are and on the economic management of those policies. This is intended to be a study dealing with applied economic development, whose results could be useful for those involved in day-to-day planning in Costa Rica.

3. Being the first study of this kind for Costa Rica, this study will provide a stimulus for further studies. It will also provide the basis for further research on the problem.

Organization of the Study

This study is divided into four additional chapters. Chapter II presents a descriptive background of the most important development policies followed by Costa Rica from the early 1960's to the late 1970's. Five groups of policies will be presented: industrial development and import substitution, agricultural development policy, exchange rate policy, foreign exchange policy, and export promotion policy. The industrialization of the country during this period will be studied in detail and the implications for planning policies explored.

Chapter III introduces the theoretical framework of the study. First, a review of some previous empirical studies relating to the programming approach to development will be conducted. Second, a

linear programming model of industrialization and foreign trade for Costa Rica will be presented, including the main features of the model and its algebraic statement.

Chapter IV presents the results and findings of policy experiments with the model, and Chapter V sets forth the major conclusions and some policy recommendations of the study.

ENDNOTES

[1]H. Chenery and M. Bruno, "Development Alternatives in an Open Economy," Economic Journal, Vol. 72 (March, 1962), pp. 79-103.

[2]S. Tendulkar, "Interaction Between Domestic and Foreign Resources in Economic Growth: Some Experiments for India," in H. Chenery (ed.), Studies in Development Planning (Cambridge, 1971), pp. 122-144.

[3]J. Bergsman and A. Manne, "An Almost Consistent Intertemporal Model for India's Fourth and Fifth Plans," in I. Adelman and E. Thorbecke (eds.), The Theory and Design of Economic Development (Baltimore, 1966), pp. 239-256.

[4]T. Weiskopf, "Alternative Patterns of Import Substitution in India," in H. Chenery (ed.), Studies in Development Planning (Cambridge, 1971), pp. 92-121.

[5]H. Chenery, Structural Change and Development Policy (London, 1979), p. 1.

[6]Non-traditional exports are those of the industrial sector. Exports of Commercial Export-oriented agriculture, that are subject to some degree of industrial processing are also included in this grouping.

[7]Non-traditional markets or rest of the world means all other markets except CACM.

CHAPTER II

DEVELOPMENT POLICIES FOLLOWED SINCE THE EARLY 1960'S

This chapter will focus on the economic background of the problem under study. First, the major problems facing the development process of Costa Rica are briefly stated. Second, attention is given to the main structural changes in the economy, particularly those that have taken place in the Industrial Sector. The variables examined are those related to the economic growth such as sectoral gross production, sectoral investment and international trade of industrial products. The study period goes from the early 1960's to the late 1970's, although sometimes we will go outside that period for purposes of gathering greater understanding of the economic background of the problem under study. Finally, the major development policies followed by Costa Rica will be presented and summarized. This chapter will set the scene for viewing the most critical problems of the policies undertaken by Costa Rica and their implications for economic planning, helping in this way to identify policy options in order to solve those problems.

The Constraints on Development

To define the problem of economic development in Costa Rica it is necessary to examine the major obstacles facing developmental policies and their implementation. The main problems can be stated as follows.

1. There has been a systematic foreign trade imbalance represented by a deficit in the current account. Increased dependency on foreign trade makes the economy dependent on the international price fluctuations of primary products, the major exports for Costa Rica. Therefore export earnings are decreased, and consequently reduces the ability to import machinery, equipment and intermediate products for the industrialization of the country. In addition to this situation, a dual exchange rate system has been implemented in order to protect foreign exchange availabilities and to control the trade deficit. A side effect of this implementation is that industrial exports are being promoted at the expense of agricultural ones because the former sector enjoys a more favorable exchange rate than the latter. That is, foreign exchange earnings (dollars) of industrial exports to the rest of the world are converted into colones (Costa Rica's currency) at an exchange rate that is subject to periodic depreciations, whereas foreign exchange earnings of agricultural exports are converted into colones at an exchange rate not subject to periodic depreciation.

2. According to the Central Bank, scarce financial resources for development have been misallocated to some degree.[1] Because of a relative lack of financial regulation in the domestic banking system,[2] some proportion of the credit resources for agricultural and industrial activities are misallocated (for development purposes) to commercial and personal consumption activities.[3]

3. The Central Bank has frequently pointed out that a propensity for conspicuous consumption (the consumption of luxury-oriented goods that are not essential for development) in the Costarican society, puts

additional pressure on the balance of payments and on scarce foreign exchange, since a major portion of these non-essential goods are imported.[4]

4. The relative smallness of the domestic market acts as an obstacle to industrial output expansion, since plants of economic size cannot be built on the basis of only the internal market.[5] By joining CACM[6] the domestic market gained a regional dimension, but severe disruptions of trade flows within CACM are commonplace[7] mostly because of political and social unstability in the other member countries of this organization.[8]

5. The lack of experience and extrepreneurship in the Costarican private sector has made implementation of industrial projects slow and costly.[9] In addition, the attraction of rapid and safe profits in commercial activities makes industrial and agricultural activities relatively risky ventures.

6. A deficient public administration organization places further uncertainties on the horizon of entrepreneurs, particularly because of a lack of an effective and meaningful planning and economic management infrastructure.[10] An economic management infrastructure is a system composed of a group of competent individuals (economists), a set of given economic goals, a set of given economic policies to achieve the goals, and a set of operating government institutions (ministries in general) to execute the policies. Its objective is to apply scientific economic principles in managing the policies so as to meet overall goals. It involves formulating decisions and initiating appropriate operative actions to implement the policies; organizing, coordinating and controlling the activities of the operating units so that the

results actually fit the goals, and finally, analyzing, adjusting and monitoring the execution and the results of decisions and operative actions taken to implement the policies (feedback).

These problems, that are mentioned in govenment documents and reports, involve constraints on economic development, namely limited domestic financial resources, limitation of foreign exchange earnings and lack of absortive capacity, that is, absence of planning and economic management capabilities. This study will identify the optimal policies for overcoming these problems.

Overview of Sectoral Structural Changes

Sectoral Breakdown of the Economy

In order to facilitate the analysis of the problem under study, and later on to represent the economy in terms of a programming model, a four-sector breakdown will be used: Industry, Agriculture, Commerce, and Rest of the Services.

The Industrial Sector includes all manufacturing activities. Individual activities are identified according to the Uniform International Industrial Classification (UIIC) at a two digit level. This is the scheme used by the Central Bank of Costa Rica and available data are at that level of aggregation. This sector comprises 20 activities, and they are usually arranged in three groups: Traditional, including consumption goods; Intermediary, including intermediate products; and Metal-Mechanic, including capital goods (see Appendix A).[11] The level of production and imports to this sector will be endogenously determined in the programming model to be described later, permitting us to identify the most crucial factors of import substitution. Most

of capital and intermediate goods enter the country only as non-competitive imports, and the domestic production of these goods, particularly capital goods, is very limited.

The Agricultural Sector will be represented by Commercial Export-oriented Agriculture. This has been one of the major sectors in the Costarican economy, and the single largest generator of foreign exchange. It has received the greatest amount of credit resources of the National Banking System during most of the last two decades. It will be assumed that this sector does not import consumption goods, because domestic production generally covers domestic demand for basic foods. There have been no major shortages of food in Costa Rica, whose economy is still substantially agricultural-based. This sector exports only to the rest of the world because the agricultural products of CACM countries tend to be similar.

The Commerce Sector represents wholesale and retail activities. This sector is important because it imports consumption goods of a non-essential nature, and thus is one of the major contributors to the foreign trade deficit, and a source of the drainage of foreign exchange. Another important characteristic of Commerce is its link with domestic financial resources, most significantly, in the form of a negative tendency, continuously pointed out by the Central Bank of Costa Rica, to the misallocation of credit. Briefly, the National Banking Financial Firms channel credit away from agricultural and industrial activities to commercial activities and to personal consumption, both of which are less productive uses of resources. Commercial activities are less productive because they do not manufacture any product that adds to the domestic output or that can be exported. The major cause of

this misallocation is interest rate differentials that make loans to commercial activities and personal consumption more profitable to Banking Financial Firms.[12] Another form of misallocation is found in the behavior of wealthy and politically powerful agricultural-based groups of society who utilize a portion of the credit resources obtained from Banking Financial Firms for agricultural activities, to purchase consumption goods of the Commerce Sector. The misallocation of credit in Costa Rica was possible because of a relative absence of financial regulation laws during this period, a low level of enforcement by the Central Bank of existing laws, and the ability of wealthy and politically powerful agricultural-based groups of society to misuse funds that otherwise should be utilized in agricultural activities. Although the Central Bank has not measured the extent of this misallocation of resources, it has continuously stressed that this unproductive utilization of domestic financial resources aggravates the Balance of Payments problem by increasing consumption goods imports, drains scarce foreign exchange availabilities, and reduces the amount of investible funds for the Agricultural and Industrial sectors.

Some of the measures that were applied or upgraded in the mid 1970's to help control for the growth of the Commerce Sector, by making non-essential imported consumption goods more expensive and thus minimize its effect on the Balance of Payments are a higher exchange rate for importing this type of good, and control and redirection of credit away from the Commerce sector. Finally, this sector does not export goods of any type.

The Rest of the Services Sector is a residual sector that includes Government, Real Estate, Financial Services, Transport, Construction,

Electricity, Water and Gas, and Services. This sector does not export goods of any type.

Gross Production

Table I shows that since the late 1960's the share of Agriculture in total gross production has been declining dramatically, In effect, its contribution went down from around a quarter in 1957 to less than 15 percent of total gross production in 1979. At the same time, Industry increased its share steadily, reaching 35 percent in 1979, while Commerce and Rest of the Services maintained their shares at about 15 percent and a third of total gross production, respectively.

TABLE I

STRUCTURE AND GROWTH OF SECTORAL GROSS PRODUCTION

Sector	1957	1962	1979	Growth Rate 1957-1979
	----------In Percentage----------			
Agriculture	24.1	20.2	13.8	10.5
Industry	28.4	30.3	35.6	14.5
Commerce	15.2	14.2	16.0	13.6
Rest of the Services	32.3	35.3	34.6	13.7
Total Gross Production	100.0	100.0	100.0	13.4

Source: Computed from Table XXIX, Appendix B.

The Industrial Sector has become predominant, growing at an annual rate[13] greater than that for total gross production, largely due to the

industrialization policy based on the development of an import substitution manufacturing sector and the joining of CACM to expand the market horizon of Costa Rica. The loss of dynamism experienced in the Agricultural Sector, as reflected in the lowest growth rate among all the sectors of the economy, and an even lower growth rate than that for the whole economy, is probably due to the relative absence of attention given to this sector in the policies followed by Costa Rica since the late 1950's. In countries like Costa Rica, whose economy is still based on a large Agricultural Sector, neglecting the potential of this sector for further growth can have important effects on foreign trade activities, which in turn could jeopardize an industrialization policy.

Gross Investment

The behavior of sectoral gross investment for the Agricultural and Industrial Sectors in Table II is similar to that described for sectoral gross output: a sharp decline in agricultural investment and a steady increase in industrial investment. An industrialization policy that made industrial investment attractive to entrepreneurs and a lack of policy emphasis on agricultural investment largely explain this result. The increasing importance of the Rest of the Services sectoral investment in total gross investment can be explained by a more dynamic governmental activity during the 1970's directed towards expanding social services and services to production (Health, Education, Roads, Electricity Generation and Communications).[14]

TABLE II

STRUCTURE AND GROWTH OF SECTORAL GROSS INVESTMENT

Sector	1957	1962	1979	Growth Rate 1957-1979
	----------In Percentage----------			
Agriculture	30.1	25.4	7.3	7.6
Industry	14.4	16.7	18.7	16.1
Commerce	18.2	17.0	4.4	7.6
Rest of the Services	37.3	40.9	69.6	18.0
Total Gross Investment	100.0	100.0	100.0	14.7

Source: Computed from Table XXX, Appendix B.

Imports

Imports constitute a major factor in maintaining a systematic foreign trade deficit (see Table III).

TABLE III

TRADE BALANCE

Year	Total Imports (1)	Total Exports (2)	Trade Balance (3) = (2)-(1)
	----------Million Colones----------		
1962	753.9	558.7	- 195.2
1979	11970.5	7269.0	- 4701.5

Source: Computed from Tables XXXI, XXXV, and XXXVII, Appendix B.

Total imports have been expanding drastically since the late 1950's. By growing at an annual rate that is greater than that of total gross output (14.8 percent, see Table IV), they have placed increasing pressure on the country's ability to provide foreign exchange to pay for them.

TABLE IV

TOTAL IMPORTS BY USE OR ECONOMIC DESTINATION: STRUCTURE AND GROWTH

Use or Economic Destination	1958	1962	1979	Growth Rate 1958-1979
	----------In Percentage----------			
Capital Goods for Agriculture	4.0	2.8	2.1	11.3
Intermediate Goods for Agriculture	7.4	7.1	2.6	9.2
Capital Goods for Industry	12.5	16.2	17.3	16.6
Intermediate Goods for Industry	27.4	32.3	32.2	15.7
Capital Goods for Rest of the Services	1.8	4.0	7.8	23.1
Intermediate Goods for Rest of the Services	14.7	12.5	12.9	14.1
Consumption Goods	32.2	25.1	25.1	13.5
Total Imports	100.0	100.0	100.0	14.8

Source: Computed from Table XXXI, Appendix B.

The accelerated expansion of total imports in this period was due to the dynamic expansion of industrial imports (capital goods and intermediate products) needed to meet increases in industrial gross output. In fact, the share of industrial imports in total imports went from 40 percent in 1958 to about 50 percent in 1979, and they grew faster (about 16 percent) than total imports (around 15 percent).

Of the two types of industrial imports mentioned, the greater is intermediate products. In fact, this has been the largest type of import in the structure of total imports since industrialization began.

Consumption goods imports contributed also to the greater growth of total imports in the period considered, although they are not as important as industrial imports in the structure of total imports. Agricultural imports (capital goods and intermediate products) reduced their share in total imports from 11 percent to about 5 percent, reflecting the behavior of a declining Agricultural Sector.

Since Costa Rica joined the CACM, foreign trade gained a bidimentional configuration, represented by two markets, Central America (CA) and the Rest of the World (RW). By decomposing imports according to their market of origin, new insights can be obtained into the foreign trade problem of the country. In fact, by looking at Table V it is clear that RW is the trading area which contributes the most to the trade deficit, because for the last two decades imports from this area have normally accounted for over 85 percent of total imports, whereas imports from CA have normally accounted for less than 15 percent of total imports. It is clear then that by joining the CACM Costa Rica reduced its dependency on imports from the RW market, because the share of total imports from the latter declined from about 100 percent to 85 percent, and imports from CA grew more than twice as fast as total imports (see Table VI). However, the country is still highly dependent on RW imports.

As in the structure of total imports, in the structure of imports from each trading area (see Tables VI and VII), industrial imports (capital goods and intermediate products) are also becoming the most

TABLE V

STRUCTURE OF TOTAL IMPORTS BY USE OR ECONOMIC DESTINATION AND AREA OF ORIGIN: CENTRAL AMERICA AND REST OF THE WORLD

Use or Economic Destination	Central America			Rest of the World			Total		
	1958	1962	1979	1958	1962	1979	1958	1962	1979
Capital Goods for Agriculture	0.0	0.0	15.0	100.0	100.0	85.0	100.0	100.0	100.0
Intermediate Goods for Agriculture	4.1	2.5	15.0	95.9	97.5	85.0	100.0	100.0	100.0
Capital Goods for Industry	0.8	0.5	15.0	99.2	99.5	85.0	100.0	100.0	100.0
Intermediate Goods for Industry	0.4	1.6	15.0	99.6	98.4	85.0	100.0	100.0	100.0
Capital Goods for Rest of the Services	0.0	0.0	15.0	100.0	100.0	85.0	100.0	100.0	100.0
Intermediate Goods for Rest of the Services	0.0	6.3	15.0	100.0	93.7	85.0	100.0	100.0	100.0
Consumption Goods	0.9	5.2	15.0	99.1	94.8	85.0	100.0	100.0	100.0
Total Imports	0.8	2.9	15.0	99.2	97.1	85.0	100.0	100.0	100.0

Source: Computed from Tables XXXI, XXXIII, and XXXIV, Appendix B.

important ones by continuously increasing their share in total imports of their respective trading area. Industrial imports grow faster than total imports from their respective market and even faster than gross industrial output. The share of consumption goods imports in each area declined to 25.1 percent by the late 1970's, and agricultural imports in both markets remained very small. The ability of the Central American market to reduce the dependency of Costa Rica on the RW market for importing goods is best illustrated by the explosive[15] annual growth rates of industrial imports from this market during the last two decades (33 percent and 37 percent).

TABLE VI

TOTAL IMPORTS FROM CENTRAL AMERICA BY USE OR ECONOMIC DESTINATION: STRUCTURE AND GROWTH

Use or Economic Destination	1958	1962	1979	Growth Rate 1958-1979
	----------In Percentage----------			
Capital Goods for Agriculture	0.0	0.0	2.1	100.0
Intermediate Goods for Agriculture	37.5	6.1	2.6	16.1
Capital Goods for Industry	12.5	3.0	17.3	33.7
Intermediate Goods for Industry	12.5	18.2	32.2	37.7
Capital Goods for Rest of the Services	0.0	0.0	7.8	100.0
Intermediate Goods for Rest of the Services	0.0	27.3	12.9	100.0
Consumption Goods	37.5	45.4	25.1	29.5
Total Imports from Central America	100.0	100.0	100.0	31.9

Source: Computed from Table XXXIII, Appendix B.

TABLE VII

TOTAL IMPORTS FROM THE REST OF THE WORLD BY USE OR ECONOMIC DESTINATION: STRUCTURE AND GROWTH

Use or Economic Destination	1958	1962	1979	Growth Rate 1958-1979
	----------In Percentage----------			
Capital Goods for Agriculture	4.1	2.9	2.1	10.4
Intermediate Goods for Agriculture	7.1	7.1	2.6	8.6
Capital Goods for Industry	12.5	16.6	17.3	15.8
Intermediate Goods for Industry	27.6	32.8	32.2	14.8
Capital Goods for Rest of the Services	1.8	4.1	7.8	22.2
Intermediate Goods for Rest of the Services	14.8	12.0	12.9	13.2
Consumption Goods	32.1	24.5	25.1	12.6
Total Imports from the Rest of the World	100.0	100.0	100.0	14.0

Source: Computed from Table XXXIV, Appendix B.

Imports can be characterized as follows:

1. An accelerated increase in total imports during the last two decades, growing faster than total gross output. The major reasons for this behavior of total imports were the industrialization policy followed by Costa Rica and the joining of CACM, which got the country into a free trade zone with no restrictions on imports from member countries.

2. An even faster increase in industrial imports to meet machinery, equipment and inputs needed for the development of an import substitution industrial sector.

3. A sharp decrease in the share of agricultural imports in total imports due to a decline in that sector's output. This was

caused, in turn, by a policy that neglected for the most part, the potential of this sector for growth.

4. A decline first, and then a static share of consumption goods imports in total imports. This behavior can be explained by the domestic production of consumption goods due to the development of an import substitution manufacturing sector, and governmental measures to restrict imports of this type, especially non-essential consumption goods.

5. Finally, imports from RW constitute the bulk of Costarican imports, being the major contributors to the foreign trade deficit of the country.

Exports

Exports grew from colones 558.5 million to colones 7269.1 million from 1962 to 1979, that is, an annual growth rate of 16.3 percent during the last two decades (see Table VIII).

TABLE VIII

GROWTH OF TOTAL EXPORTS

Year	Total Exports	Growth Rate 1962-1979 (Percent per year)
	------Million Colones---------	
1962	558.7	
1979	7269.0	16.3

Source: Computed from Tables XXXV and XXXVII, Appendix B.

The bulk of Costarican exports is composed of primary products (see Table IX), in spite of a tremendous development of industrial exports, which starting from scratch in the early 1960's, represented more than 40 percent of total exports in 1980 (see Table X). Thus, due in part to declining agricultural production, agricultural exports have been losing ground in total exports at a rapid pace. Coffee remains the major agricultural export, representing more than 50 percent of total agricultural exports, and bananas are in second place. Some degree of diversification has been achieved in agricultural exports, principally through the development of beef exports, which is the single most dynamic agricultural export, boasting a 24 percent annual growth rate in the last two decades. A major factor in explaining why coffee remains the most important primary export and beef has been growing at such a rate, is that these activities have received more than 50 percent of the financial resources available for financing economic development, namely domestic credit, during most of the last two decades.[16]

If we were to evaluate the industrialization policy followed by Costa Rica since the early 1960's by looking only at the performance of industrial exports, it could be considered as successful. In fact, industrial exports have been growing at an explosive annual rate of more than 33 percent (see Table X) compared with only 14 percent for agricultural exports. This satisfactory performance is explained not only by a policy that emphasized the development of a domestic manufacturing sector, but also included joining the CACM (which expanded the market horizon for industrial exports), implementing an exchange rate policy, and adopting a set of export promotion measures to dynamize industrial exports.

TABLE IX

STRUCTURE AND GROWTH OF AGRICULTURAL EXPORTS

Product	1962	1979	Growth Rate 1962-1979
	----------In Percentage----------		
Coffee	59.4	52.5	13.3
Bananas	32.8	28.4	13.1
Beef	3.3	13.7	24.1
Sugar	3.4	2.8	13.0
Fish	1.1	0.9	12.2
Cocoa	na*	1.7	--
Total Agricultural Exports	100.0	100.0	14.1

*na = Not Available.

Source: Computed from Table XXXV, Appendix B.

TABLE X

GROWTH OF INDUSTRIAL EXPORTS AND PERCENTAGE OF TOTAL EXPORTS

Year	Total Exports (1)	Industrial Exports (2)	Growth Rate 1962-1979	Percentage of (2) on (1)
	----------Million Colones----------			
1962	558.7	16.1		2.8
1979	7269.0	2163.0	33.4%	29.8
1980	7728.4	3208.6		41.5

Source: Computed from Tables XXXV and XXXVII, Appendix B.

Major Development Policies Implemented By Costa Rica

Industrial Production and Import Substitution

Production policy basically rests on the Import Substitution Policy. The Import Substitution Policy seeks the development of Industrial Sector production to replace imports thus helping to reduce for the foreign trade deficit. The fundamentals of the development of industrial production are contained in the Protection and Industrial Development Act (1959).[17] The major points of this development act were:

1. To grant custom duties protection to industrial activities that generate benefits to the economy, as follows: very low import duties for importing intermediate (IG) and capital (KG) goods not available in the country, high import duties for importing IG and consumption goods (CG) that compete with similar domestically produced goods.

2. The National Banking System was to support this industrial development program through the channeling of domestic savings to, and an adequate credit policy toward, the Industrial Sector.

3. The Central Bank was to grant a lower or Overvalued Exchange Rate (OER) for importing intermediary and capital goods not available in the country, and a higher or Free Market Exchange Rate (FER) for importing intermediary and consumption goods that compete with similar domestic production.[18]

4. To establish a tax on competitive imports, basically consumption goods, equal to three times the import duties on them. This tax was never to be less than 75 percent of the CIF value of competitive imports.

Some specific measures of this development act were:

1. Benefits of the act were basically for new industrial activities that manufactured or assembled products not available in the country, or that were available but their production satisfies less than 10 percent of domestic consumption.

2. The time period an industrial plant was to enjoy the benefits awarded was determined according to the degree to which the following conditions are met, but was not to be less than five years:[19] contribution to the national income, utilization of intermediary goods of domestic origin in the production process, utilization of domestic intermediary goods of agricultural origin, effects on the Balance of Payments (export generation), and employment generation.

3. Waiving 99 percent of import duties for importing intermediary and capital goods.

4. Tax benefits: waiving 100 percent of the corporation income tax during the first half and 50 percent during the second half of the time period awarded, waiving 100 percent of export taxes, waiving an amount of the corporation income tax due equivalent to the portion of reinvested profits.

5. The Central Bank was to determine the percentage of foreign exchange earned by exports of these industrial activities that was to be negotiated at the FER.

In all, the Import Substitution Industrialization Policy adopted by Costa Rica seeks to develop domestic manufacturing activities to replace imports. At first, producing consumption goods was the logical step, because the country already had manufacturing activities of this type to start with. In fact, the production of intermediate

products and capital goods was almost non-existent during the late 1950's (see Table XI).

TABLE XI

STRUCTURE AND GROWTH OF INDUSTRIAL GROSS PRODUCTION BY GROUP

Group	1957	1962	1979	Growth Rate 1957-1979
	----------In Percentage----------			
Traditional	87.5	85.7	64.3	12.9
Intermediary	6.9	8.1	20.8	20.4
Metal-Mechanic	3.0	3.5	10.9	21.4
Residual	2.6	2.7	4.0	16.9
Total Industrial Gross Production	100.0	100.0	100.0	14.5

Source: Computed from Table XXXVIII, Appendix B.

By the late 1970's the share of consumption goods output in total industrial output had declined sharply and some diversification of industrial output was achieved with the development of a small intermediary and capital goods production, representing 20.8 percent and 10.9 percent, respectively, of total industrial output. These manufacturing activities have been growing at rates greater than that of total industrial gross output. A major reason explaining the declining share of consumption goods production and the steady increase in intermediary and capital goods in the Costarican industrial sector is that by the late 1970's the phase of easy or "exuberant" import substitution[20] had been exhausted, and identification of new

opportunities for substituting consumption goods become harder.[21] This encouraged entrepreneurs to emphasize the domestic production of intermediary goods and simple capital goods to meet some of the demand for these products originating in the consumption goods manufacturing activities,[22] which was being satisfied by imports. Although progress has been made, intermediary and capital goods remain small activities in total manufacturing output, mostly because they are harder to identify and undertake, require large amounts of financial resources for investment, mastering a technology that the country does not have domestically, and large market size.[23] These problems are particularly important constraints on the development of capital goods activities.

Interesting relationships are discovered for import substitution activities when the behavior of industrial output is compared with the behavior of imports by market of origin. In fact, in both the Central American and the rest of the world markets the share of consumption goods imports declined, at the same time entrepreneurs began to switch from consumption goods production to producing intermediary goods and some capital goods (see Tables VI, VII, and XI). These trends mean that an intensive process of import substitution of consumption goods has taken place, until a point was reached where additional opportunities for substituting imports of this type were exhausted. This process has been stronger with respect to the Central American area, as confirmed by the very low percentage that consumption goods imports represent in the total supply of consumption goods by area (3.8 percent for CA and 17.5 percent for RW).[24]

Some degree of import substitution has taken place with respect to intermediary goods imports from Central America, but very weak

substitution has occurred with respect to the rest of the world market. In fact, not only is the domestic production of intermediary goods still small, but intermediary goods imports, especially those for industry, are the largest group in each market in the late 1970's, with RW being the largest supplier (see Table V). These findings are exemplified by the percentages, that intermediary goods imports from RW and from CA represent in the total supply of these products by area (53.4 percent and 17.9 percent, respectively).

Finally, since the domestic production of capital goods is almost nonexistent, import substitution here has occurred in much lesser porportion that for consumption or intermediary goods. As in the case of intermediary goods, RW is the major supplier of capital goods (see Table V). There has been import substitution of a small magnitude with respect to the RW market and of a greater magnitude with respect to the CA market. These findings are confirmed by the percentages that capital goods imports from RW and from CA represent in the total supply of these products by market (56 percent and 19.4 percent, respectively).

As for industrial investment, its structure is a reflection of the behavior of industrial gross output: a sharp decline in consumption goods investment in favor of a major increase in intermediary goods investment, and a relatively stable but very low investment in capital goods (see Table XII). The reasons explaining this behavior of industrial investment are the same ones as for the structure of industrial output.

The Industrial Production and Import Substitution Policy can be characterized as follows:

TABLE XII

STRUCTURE AND GROWTH OF INDUSTRIAL GROSS INVESTMENT BY GROUP

Group	1960	1979	Growth Rate 1960-1979
	----------In Percentage----------		
Traditional	70.0	41.7	14.3
Intermediary	23.2	52.5	22.6
Metal-Mechanic	5.4	4.1	15.9
Residual	1.4	1.7	18.7
Total Industrial Gross Investment	100.0	100.0	17.9

Source: Computed from Table XL, Appendix B.

1. It has been one of the major causes for the greater dynamism and development of an industrial sector in the Costarican economy during the last two decades.

2. Some degree of diversification has been achieved in the structure of industrial output and investment by developing small intermediary and capital goods activities. This result can be considered as a positive effect of the industrialization process of the country, since these activities were almost non-existent in the early 1960's.[25]

3. There is evidence that a major import substitution has occurred during the last two decades with respect to the Central American area, mainly in consumption goods imports, and in intermediary and capital goods imports also. A less intensive import substitution has occurred with respect to the rest of the world area. In this last

area, substitution of consumption goods imports has been greater than in intermediary and capital goods, where imports still represent over 50 percent of total supply.

4. Since institutionalized planning did not exist during most of the last two decades, there has been an important degree of uncertainty and lack of knowledge in the Costarican Government as to what the industrialization policy adopted in the early 1960's was for. That is, what if any, were the objectives that this policy was supposed to achieve? The Central Brank has pointed out that it is not known whether this policy was undertaken to solve the problem in the Balance of Payments through import substitution, to generate foreign exchange, or to create jobs, to mention just some objectives that could be achieved.[26] Thus, an evaluation of this policy needs to be undertaken to find out what the effects were on the economy of attempting to achieve some major objectives. This study intends to answer this type of question, through simulations with a linear programming model, in which maximizing industrial output and the industrial trade balance are part of the Costarican development objectives, whereas some import substitution parameters will be among the policy instruments.

Agricultural Production Policy

The Agricultural Sector has not been given a major policy emphasis, since development strategy has been focused on the Industrial Sector. Support for Traditional Agriculture (subsistence agriculture and producers operating with traditional methods in small size farms) rests basically on the usual government programs, generally for basic grains, like providing a few additional storage facilities, price

stabilizing operations, operations fixing minimum prices, and encouraging the utilization of agricultural outputs as inputs for the Industrial Sector (mainly for food-oriented manufacturing activities). One of the major reasons for the relative absence of policy emphasis on Traditional Agriculture is that in general it does not export. Regarding Commercial Export-oriented Agriculture, its major export product is Coffee, which traditionally has enjoyed plenty of public credit to help maintain and increase production and to finance exports. Except for this, no major policy emphasis has been given to the Agricultural Sector.

To illustrate the major obstacles that discouraged the Costarican Government from basing a development strategy on an already declining Agricultural Sector, we will summarize some of the problems of the sector that were mentioned in a comprehensive study by the Central Bank on Agricultural Production Policy[27] and in another study by the Planning Office.[28]

1. The low profitability of agricultural activities, namely basic grains production, arises because of a lack of soil conservation programs, a scarcity of better quality soils, a lack of innovation in cultivation processes, a lack of grain diversification programs, a scarcity of marketing facilities and market information, a lack of agricultural labor and financing problems associated with credit worthiness and the timing, allocation and amount of credit for these activities.

2. An acute concentration of agricultural production activities in the hands of a few persons able to use mechanical technology in planting and harvesting crops, thus obtaining a high profitability.

Since rural dwellers cannot have access to this technology and bigger land size, their cultivation activities are unprofitable, discouraging them from further production activities. Additionally, the benefits of agricultural exports did not accrue to the small farmer and peasants, acting as a disincentive to undertake new initiatives.

3. The prevailing land ownership system of Latifundio-Minifundio, which consists of a few large size farms in the hands of a few and many very small plots of land for the rest of the rural dwellers.

4. A relative exhaustation of an easy stage of incorporating new land into cultivation associated with a relative expansion of extensive-type cattle raising activities has contributed to a much faster exhaustation of land that would have been otherwise dedicated to cultivation. As a result, land for cultivation has become scarce and its price has gone up, making it very difficult or impossible for peasants to acquire.

5. A lack of cooperative efforts in land utilization, cultivation and harvesting on the part of peasants and rural dwellers has the effect of weakening any effort to establish an organized agribusiness. Costarican peasants and rural dwellers tend to be very independent and individualistic in their decisions, so it is impractical to require them to get together in partnership for land cultivation. Furthermore, distrust is commonplace among peasants who do not know each other.

6. Finally, for the last two decades there has been a relative lack of government planning, policy and support towards the sector's activities. In general, there is neither a specialized institution nor the personnel necessary to organize and train rural dwellers in how to work together in a business-like manner, how to utilize agricultural technology, and how to use and distribute profits.

To summarize, one of the major factors explaining the loss of dynamism in the Agricultural Sector for the last two decades is the neglect of this sector and its potential for further growth in the policies followed by Costa Rica during that period. One objective of this study is to find out what the effects on the economy would have been had a policy emphasizing agricultural production been undertaken. These findings will shed light on the importance of this sector for Costarican economic development.

Exchange Rate Policy

The main thrust of this policy has been to control excessive short-run pressure on the country's available foreign exchange, while at the same time promoting industrial production expansion and encouraging Non-traditional products exported to Non-traditional markets. Basically, this policy has consisted of using a dual exchange rate system, with periodic switching to a single exchange rate system. The dual system consists of the Overvalued Exchange Rate (OER) and the Free Market Exchange Rate (FER). In general the switching from the dual to the single system took place by increasing the OER to the level of the FER, so that exchange rate unifications have experienced an upward trend (see Table XIII).

There has been a tendency to grant the OER temporarily only to import some essential intermediary groods not available within the country (some essential consumption goods imports have also been granted the OER). The FER applies to all other imports. After joining the CACM, the exchange rate policy had to be adjusted for repercussions on CACM trade, because any measure taken which tended

to discriminate against other CACM members would most likely have been reciprocated by the other members. In general, Costarican imports from the CACM have been subject to the FER. When essential intermediary goods are being imported from the rest of the world at the OER, the same rate must also apply to similar products from CACM, otherwise CACM production would be put at a disadvantage. In general, foreign exchange earnings of all traditional exports and those of the Non-traditional type to CACM are converted at the OER, but for Non-traditional products exported to Non-traditional markets 50 percent has been converted at the FER and the other half at the OER. In the early 1980's this percentage was increased to 95 percent. This serves not only as an export promotion policy for industrial products, but also works against agricultural exports by diminishing incentives for exporting.

Summarizing, the objectives of the Exchange Rate Policy followed by Costa Rica during the last two decades were, first to protect available foreign exchange by making imports more expensive and second, to promote industrial exports to the rest of the world. Since a side effect of this policy was to diminish incentives for exporting agricultural products, and also industrial exports to Central America, this study will determine what the effects on the economy would have been had the country pursued an Exchange Rate Policy that encouraged agricultural exports and also industrial exports to Central America instead of industrial exports to the rest of the world. Finally, the effects on foreign trade of different values for the exchange rates of the dual system and also the effects of switching from the dual to the single exchange rate system will be examined.

TABLE XIII

PAIRS OF VALUES OF THE DUAL EXCHANGE RATE SYSTEM DURING THE 1950-1982 PERIOD

Overvalued Rate	Free Market Rate
----------Colones----------	
5.67	6.65
5.67	8.78
6.65	8.60
6.65	38.25
20.00	40.00
20.00	63.00

Sources: Central Bank of Costa Rica, 25 Years in Diagrams 1950-1974 (San Jose, 1976), p. 16; La Nacion, La Nacion International (San Jose, July 1982), p. 14.

Foreign Exchange Policy

As most Less Developed Countries do, the policy of Costa Rica on this matter has been to attempt to secure as many foreign funds as possible, at the most favorable terms (long term and low interest rate). Of course this ultimately depends on the policies of the lending countries, so that, for the most part, the ability to obtain foreign funds rests on exogenous factors. The Foreign Exchange and the Exchange Rate Policies are highly interrelated, and seek to save available foreign exchange and to minimize the foreign trade deficit. The following are some of the measures that were taken or upgraded during the 1970's in order to save and to best utilize scarce foreign exchange.

1. It was recommended that capital goods imports for industry and agriculture not available in the country be financed with foreign funds. As an exception, the OER would be granted if this condition was met.

2. Granting the FER to all imports, with the temporary exception of some essential intermediary and capital goods imports.

3. Quantitative restrictions on available government foreign exchange that the public could buy. The Central Bank sells only 50 percent of required foreign exchange at the different exchange rates, the other half must be obtained from the Free Market.

4. Previous deposit requirements: a proportion of the value of capital and consumption goods to be imported is required to be deposited in the Central Bank for six months. Deposit requirements are higher for consumption goods than for capital goods imports. Intermediary goods imports are not subject to previous deposit requirements.

5. To cut down consumption goods imports, taxes on imports of this type of goods have been upgraded in the 1970's and domestic credit to finance the consumption of these goods has been restricted. Import taxes apply also to capital goods imports, but in a lesser magnitude, and do not apply to intermediary imports and CACM trade.

6. Foreign exchange earned by agricultural exports and industrial exports to the CACM is negotiated with the Central Bank at the OER, while 95 percent of foreign exchange earned by Non-traditional products exported to Non-traditional markets is negotiated at the FER.

Export Promotion Policy

The objective of this policy has been to expand exports of

Non-traditional products. After joining the CACM this policy emphasis continued, but it was gradually switched around in the mid 1970's to that of expanding exports of Non-traditional products to Non-traditional markets. The following have been the most important steps taken in this area:

1. An exchange rate differential favoring exports of Non-traditional products exported to Non-traditional markets.

2. Financing up to 100 percent of the value of invoices in credit sales of industrial and agricultural exports.

3. The Tax Credit Certificate (TCC). The TCC is a credit certificate for waiving taxes, equivalent to 15 percent of the FOB value of Non-traditional products exported to Non-traditional markets. To quality, firms must generate a minimum domestic value added of production of 35 percent. This measure represents an attempt to link incentives to industrialization to export performance.

4. The Export Increment Certificate (EIC). The firms that have qualified and hold TCC can apply for an additional export benefit, the EIC. The EIC is a certificate equivalent to up to 10 percent of the increase over last calendar year's FOB value of Non-traditional products exported to Non-traditional markets.

5. The Export Promotion Fund. This fund was created to support the export effort of Non-traditional products exported to Non-traditional markets. The most important objectives of this fund are to finance projects whose production is to substitute non-competitive imports, to help in financing exports of Non-traditional products to Non-traditional markets, to finance purchases of capital goods for firms whose production is export oriented, and to set up corporations

for international marketing, to help in selling domestic products abroad.

We have judged the industrial export performance of Costa Rica as successful (see p. 24). However, by examining the structure of industrial exports and their market of destination new insights are gained into what particular types of goods are the most dynamic in total industrial exports.

Within the structure of industrial exports a dramatic change has taken place. In fact, at the beginning of the industrialization of Costa Rica in the early 1960's, the group Traditional or consumption goods, comprising most processed foods, textiles, wood products, and so forth, boasted a share in total industrial exports of around 80 percent, but by the late 1970's its share dropped by more than half the previous value, and intermediate products and capital goods exports increased their shares from 12.5 percent and 4.2 percent, to 40.4 percent and 22.6 percent, respectively (see Table XIV).

TABLE XIV

TOTAL INDUSTRIAL EXPORTS BY GROUP: STRUCTURE AND GROWTH

Group	1962	1979	Growth Rate 1962-1979
	----------In Percentage----------		
Traditional	79.1	37.0	27.6
Intermediary	12.5	40.4	43.0
Metal-Mechanic	4.2	22.6	47.0
Residual	4.2	0.0	-100.0
Total Industrial Exports	100.0	100.0	33.4

Source: Computed from Table XXXVII, Appendix B.

To confirm this change, these types of exports grew at explosive annual rates of 43 and 47 percent respectively during the last two decades, compared with only 27.6 percent for the Traditional industrial group of exports. The major reasons explaining this behavior are as follows:

1. By the late 1970's the stage of easy import substitution was over and entrepreneurs started emphasizing production of intermediary and capital goods and deemphasizing the production of consumption goods, thus consumption goods production lost its dynamism and so did consumption goods exports.

2. By the late 1970's, also, it was realized that consumption goods exports were not as profitable as they were thought to be in the early 1960's. In fact, the Planning Office considers consumption goods activities as having an income elasticity of less than one, whereas intermediary and capital goods are thought to have an income elasticity greater than one,[29] thus making the latter more capable of generating sizeable amounts of foreign exchange to finance a greater part of intermediary and capital goods imports needed for the industrialization of the country.

3. Finally, by specializing in exporting intermediary and capital goods, a greater dynamism would be achieved in the economy, since these manufacturing activities would also meet part of the demand for intermediary and capital goods generated in the consumption goods activities.[30]

As to industrial exports by market of destination, in both the Central American and the rest of the world markets the same pattern exists in the structure of industrial exports as that explained for

the structure of total industrial exports (see Tables XV and XVI). The switch of policy by the mid 1970's mentioned on p. 39, emphasizing industrial exports to the rest of the world[31] and giving less emphasis to industrial exports to the Central American market, was due to the political and social instability existing in the Central American area, which has interrupted the flow of trade to that area frequently and for long periods of time, creating uncertainty and heavy losses to Costarican entrepreneurs.[32] Some of these crises have been the war between Honduras and El Salvador (1971-1972), Nicaragua's earthquake (1973), Nicaragua's Revolution (1980-1981), El Salvador's Revolution (1980-1983) and political tension in Guatemala and Honduras (1981-1983). However, in spite of the change of policy emphasis, Central America remains the major market for Costarican exports, receiving well over 70 percent of the country's industrial exports by the late 1970's (see Table XVII).

TABLE XV

TOTAL INDUSTRIAL EXPORTS TO CENTRAL AMERICA BY GROUP: STRUCTURE AND GROWTH

Group	1962	1979	Growth Rate 1962-1979
	----------In Percentage----------		
Traditional	50.0	37.4	37.6
Intermediary	24.0	39.4	44.1
Metal-Mechanic	13.0	23.2	44.9
Residual	13.0	0.0	-100.0
Total Industrial Exports to Central America	100.0	100.0	40.0

Source: Computed from Table XLII, Appendix B.

TABLE XVI

TOTAL INDUSTRIAL EXPORTS TO THE REST OF THE WORLD BY GROUP: STRUCTURE AND GROWTH

Group	1962	1979	Growth Rate 1962-1979
	----------In Percentage----------		
Traditional	93.4	35.5	18.7
Intermediary	6.6	43.9	40.5
Metal-Mechanic	0.0	20.6	100.0
Residual	0.0	0.0	0.0
Total Industrial Exports to the Rest of the World	100.0	100.0	25.6

Source: Computed from Table XLII, Appendix B.

TABLE XVII

STRUCTURE OF TOTAL INDUSTRIAL EXPORTS BY GROUP AND ECONOMIC AREA OF DESTINATION: CENTRAL AMERICA AND REST OF THE WORLD

Group	Cent. Amer.		Rest of World		Total	
	1962	1979	1962	1979	1962	1979
	----------In Percentage----------					
Traditional	21.2	77.0	78.8	23.0	100.0	100.0
Intermediary	65.0	74.0	35.0	26.0	100.0	100.0
Metal-Mechanic	100.0	78.0	0.0	22.0	100.0	100.0
Residual	100.0	0.0	0.0	0.0	100.0	---
Total Industrial Exports	33.5	76.0	66.5	24.0	100.0	100.0

Source: Computed from Table XLII, Appendix B.

A major reason explaining the heavy concentration of Costarican exports in the Central American market is that it is much harder for a small country like Costa Rica, where industrialization is in its early stage, to compete in world markets like Europe and the United States.

The Export Promotion Policy can be characterized as follows.

1. A lack of promotion of agricultural exports. The major reasons explaining this absence of government promotion of agricultural exports are that they are considered not dynamic enough to propel a sustained process of development, they are subject to a high price elasticity of demand and a low income elasticity in their international markets, and finally, their supply is heavily dependent on intangible factors like weather conditions.[33]

2. An active promotion of industrial exports which started emphasizing exports to Central America and, then, in the mid 1970's was switched to emphasize industrial exports to the rest of the world because of political and social instability in the Central America area. This switch of emphasis in this policy has not proved effective, yet, since Central America continues to be the major market for Costarican exports, and it has been difficult to compete in the rest of the world market.

3. A major change took place in the structure of total industrial exports, where consumption goods exports were overtaken by intermediary goods exports. The same change took place in the structure of industrial exports to both the Central American and the rest of the world markets. Capital goods exports are also becoming important in total industrial exports as well as in industrial exports to both markets. The major reasons explaining these dramatic changes are the

Import Substitution Industrialization Policy followed by Costa Rica (which made possible the development of intermediary and capital goods manufacturing activities), the joining of the CACM (which had the effect of expanding the dimension of the local market), the export promotion efforts, and the realization of the greater potential for export, foreign exchange generation and expansion of the Industrial Sector of intermediary and capital goods exports.[34]

4. In general, this policy can be considered successful, since a new exporting sector that did not exist in the early 1960's was developed. This is perhaps one of the major accomplishments of the development policies followed by Costa Rica during the last two decades.

Summary of Policies

A diversity of policies, emphasizing industrial development, were followed during the 1960's and 1970's. Although some of them are interrelated and serve different purposes at the same time, an attempt was made to classify the most important ones under five headings. It is worth observing the heavy orientation in all these policies toward problems related to the foreign trade sector, mainly the rest of the world trading area. This orientation toward the foreign trade sector is a good indicator of the magnitude of the international economic relations problem the country has continuously faced during the last two decades. Through simulations with a linear programming model to be described in the next chapter, the effects on the economy of emphasizing or deemphasizing some of these policies studied will be explored. A summary of the policies adopted by Costa Rica in the period under study is provided in Table XVIII.

TABLE XVIII

POLICIES FOLLOWED, POLICY GOALS, AND MAJOR POLICY EMPHASIS

Variable or Parameter	Policies Followed*	Policy Goals*	Major Policy Emphasis
Industrial Production	Import Substitution.	To increase industrial production and develop the Industrial Sector.	Yes
Import Substitution	Replace imported CG and IG (particularly CG from RW) by domestic industrial production.	To cut down imports and develop the Industrial Sector.	Yes
Agricultural Production	Domestic credit financing.	To increase agricultural production.	No
Exchange Rates	FER for KG, IG and CG imports. OER for Traditional exports and Non-traditional exports to CACM. FER for NTP-NTM.	To save and increase foreign exchange, and to increase NTP-NTM.	Yes
Imports	Limiting imports of KG and CG (Particularly CG from RW).	To cut down imports.	Yes
Exports	Increasing NTP-NTM. Increasing Traditional exports.	To increase exports. To increase exports.	Yes No
Credit, Savings and Investment	Channel them to the Industrial and Agricultural Sectors (particularly to the Industrial Sector), away from the Commerce Sector (consumption).	To finance the development of the Industrial and Agricultural Sectors production (particularly the industrial production).	Yes

TABLE XVIII (Continued)

Variable or Parameter	Policies Followed*	Policy Goals*	Major Policy Emphasis
Consumption	Limiting consumption of imported CG (particularly from RW).	To cut down consumption of CG.	Yes
Foreign Exchange	Save and increase foreign exchange.	To help solve the foreign trade deficit.	Yes

*KG = Capital Goods, IG = Intermediary Goods, CG = Consumption Goods, FER = Free Market Exchange Rate, OER = Overvalued Exchange Rate, CACM = Central American Common Market, NTP-NTM = Non-traditional Products exported to Non-traditional Markets, RW = Rest of the World.

Summary

The economic background of the study was presented in this chapter. First, the major constraints on Costarican development and the main problems facing development policies were presented. Second, an overview of the sectoral structural changes in the economy examined major changes in Gross Production, Gross Investment, Imports and Exports. The third part of this chapter focused on reviewing the major development policies followed by Costa Rica, emphasizing particular problems and accomplishments in the implementation of these policies, thus suggesting possible policy adjustments in order to overcome some of the problems. From this review, the main characteristics of the Costarican economy by the late 1970's were spelled out, namely, a changed economic structure, where dependency on agriculture turned into dependency on industry since agriculture was considered as a non-dynamic sector unable to lead the economic development of the country, and the development of new activities in manufacturing and exports that were almost non-existant in the early 1960's.

ENDNOTES

[1]Central Bank of Costa Rica, Some Considerations Regarding the Need to Establish a Limit on the Amount of Credit National Banking System Financial Firms Can Loan (San Jose, 1973), pp. 2-5.

[2]Ibid., pp. 1-2.

[3]Central Bank of Costa Rica, Determination of the Portfolio Structure that Banking and Private Financial Firms Could Have, No. 2352 (San Jose, 1973), pp. 1-8.

[4]Central Bank of Costa Rica, Determination of the Interest Rate That Private Financial Firms of Investment and Credit Could Pay (San Jose, 1973), p. 3.

[5]Central Bank of Costa Rica, The Behavior of the Manufacturing Sector (San Jose, 1972), p. 25.

[6]CACM countries are: Costa Rica, Nicaragua, El Salvador, Honduras and Guatemala.

[7]Central Bank of Costa Rica, 1972, pp. 2-3.

[8]Permanent Secretariat of the General Treaty for Central American Economic Integration, The Integrated Development of Central America in the Present Decade, Vol. I (Buenos Aires, 1973), pp. xi-xv.

[9]Planning Office, National Development Plan: Diagnose (San Jose, 1973), pp. 91-92.

[10]Ibid., pp. 52-53, 81-82.

[11]There is a fourth group called "Residual" including all other industrial activities that do not belong to any of the groups mentioned.

[12]Central Bank of Costa Rica, No. 2352, 1973, p. 3.

[13]All growth rates are computed using the formula $[f(t)/f(0)]^{1/n} - 1$ where f(t) = final year value, f(0) = base year value, n = number of years.

[14]Planning Office, 1973, pp. 44-49.

[15]The term "explosive" is defined as an accelerated pace of expansion observed in an economic variable.

[16]Central Bank of Costa Rica, Credit and Monetary Accounts 1969-1973 (San Jose, 1974), p. 20.

[17]Industries Ministry, Protection and Industrial Development Act (San Jose, 1965).

[18]The Overvalued Exchange Rate (OER) is determined by the Central Bank of Costa Rica, for the government, to buy and sell dollars. The Free Market Exchange Rate (FER) is freely determined by the availability and demand for dollars in the hands of the public. This rate is subject to upward variation depending on the availability of dollars in the free market, because demand is usually stronger.

[19]The usual time period awarded has been between 10 and 15 years.

[20]A. Hirschman, "The Political Economy of Import Substitution Industrialization in Latin America," Quarterly Journal of Economics, Vol. 82 (February, 1968), pp. 1-32.

[21]Central Bank of Costa Rica, 1972, p. 2.

[22]Permanent Secretariat of the General Treaty for Central American Economic Integration, The Integrated Development of Central America in the Present Decade, Vol. IV (Buenos Aires, 1974), pp. 37-38.

[23]Central Bank of Costa Rica, The Industrial Development of Costa Rica and Its Main Problems (San Jose, 1973), p. 6.

[24]These are import substitution parameters whose computation will be explained in Appendix F.

[25]Permanent Secretariat of the General Treaty for Central American Economic Integration, 1974, p. 24.

[26]Central Bank of Costa Rica, The Costarican Economy: Its Evolution in the 1958-1970 Period (San Jose, 1970), p. 23.

[27]Central Bank of Costa Rica, Comments on the Project to Enact the Basic Grains Agricultural Production Law Proposed by Congressman Pedro Arauz (San Jose, 1974), pp. 1-9.

[28]Planning Office, 1973, pp. 34-36.

[29]Planning Office, Industrial Sector Operative Plan for 1975 (San Jose, 1974), p. 4.

[30]Planning Office, National Development Plan 1974-1978: Productive Sectors: Industrial Sector (San Jose, 1974), p. 4.

[31]Ibid., pp. 3-4, 31-32.

[32]Central Bank of Costa Rica, 1972, p. 4.

[33]Permanent Secretariat of the General Treaty for Central American Economic Integration, 1973, p. 22.

[34]Permanent Secretariat of the General Treaty for Central American Economic Integration, 1974, pp. 46-54.

CHAPTER III

QUANTITATIVE MODELS FOR ECONOMIC DEVELOPMENT

This chapter introduces the field of planning models, reviews the literature concerning empirical studies utilizing these models and presents the model that will be utilized in this study. This chapter provides the theoretical framework and is the basis for the subsequent chapters which present the empirical analysis and interpretation of results.

Economic Policy and Planning Models

The field of economic policy utilizing planning models is concerned with the analysis of decision problems whose economic data can be expressed quantitatively in an operational sense. In less developed countries quantitative economic policy has been related to furthering economic development, utilizing development programming models which provide an initial basis for analyzing the implications of alternative policy scenarios, for example, the optimum allocation of investment between sectors, land reform, or foreign trade.[1] The quantitative analysis of development planning may be divided into three steps. First, the formulation of the policy problem where an objective function representing the preferences of policy-makers is specified, the quantitiative model, including behavioral and technical constraints and identities, is presented and boundary conditions stated. Tinbergen[2]

was the first one to define this step, which is also known as the Tinbergen Framework. Three types of constraints or linear inequalities are commonly specified in applied planning models:[3]

1. Constraints reflecting real limitations on economic growth, like the Balance of Payments, and bounds on total factor availability.

2. Constraints representing important but not well understood limitations on growth, like absorptive capacity restrictions on the quantum of investment which can be undertaken in a given industry, upper bound on savings reflecting difficulties in governmental action directed towards mobilizing domestic financial resources, and upper bounds on imports which compete with established domestic industries.

3. Constraints on an ad hoc basis to avoid overspecialization in trade and other forms of extreme behavior to which linear programming models are prone.

In the second step, the variables of the problem are classified by their properties such as direct control by the policy-makers, in which case they represent policy instruments. In the third step, the derivation of optimum decision rules, and the sensitivity of these rules to changing conditions associated with the value of the policy instruments is studied. This step points out the economic management aspects of a given policy. The operation of a planning model consists in taking the desired values of the target variables and then calculating the constellation of values of the policy instruments required to attain the given target values subject to the constraints.[4]

This three-step procedure based on mathematical programming is particularly useful in analyzing policy scenarios specified by policy-makers in developing countries, because through parametric programming

methods some development objective can be maximized or minimized subject to the limitations or constraints on the economy. The most common of these limitations are the scarcity of domestic savings and the scarcity of foreign exchange. The planning policies of less developed countries are frequently aimed at methods of eliminating these major constraints on their economies. A low saving level makes capital inflows important for these countries, because they supplement domestic resources, enabling them to import needed capital goods for industrialization. Domestic savings may not make available the correct kind of resources, because developing countries are generally unable to produce capital goods. Thus, foreign capital inflows provide the foreign exchange resources needed to import these capital goods.[5] The lack of substitution between saving and foreign exchange is the centerpiece of multigap analysis. Both limitations on growth arise from the immobility and rigidity of developing countries economic structures. Furthermore, the existence of fixed exchange rate systems in many of these countries imposes a limit on which domestic resources can be converted into needed foreign exchange.[6] The interaction of savings and foreign exchange limitations on development is best illustrated in connection with the industrialization of developing countries. When exports are limited exogenously by an inelastic world demand and non-competitive imports are required in fixed proportions for domestic production or investment or both, a point is reached beyond which domestic savings can not be put to use, and the growth of domestic production cannot be increased for lack of foreign exchange to purchase required complementary inputs like capital and intermediary imports. When this point is reached, a higher growth rate can be attained only by dealing with

the foreign exchange directly, that is, by increasing industrial exports, reducing non-competitive imports or increasing the inflow of foreign capital resources.[7]

Another limitation on growth is absorptive capacity, by which is meant the relative lack of capabilities to formulate, implement, and manage development plans in developing countries, that is, a limitation of those skilled managers, labor and civil servants necessary to increase productive investment.[8]

Mathematical programming models of development based on the gap analysis also provide a good framework to explore through policy experimentation the effects on a developing economy of pursuing certain policies with different types and degrees of emphasis, in order to find out an optimum set of policies that would help this type of economy achieve a faster rate of development. Also, the obstacles to further development can be better identified, providing the policy-makers and planners useful indications regarding the economic management of the policies adopted.

Review of Related Literature

The literature on programming models of development is vast. Economists trained in empirical studies focus on quantitative modelling of policies that have been or are able to be readily adopted in developing countries. Economic development theorists are more concerned with testing economic theories, or devising new ones in order to enhance the understanding of development processes.

Tendulkar,[9] introduced a multisectoral single-period optimizing programming model, whose objective is to maximize aggregate consumption.

The major purpose of his work is to study the interaction between the savings and the foreign exchange constraints in India's development. Two versions of the model were presented: first, an open-loop variant where the mobilization of domestic savings does not pose a binding constraint on the economy, so that foreign exchange availability becomes the binding constraint; second, a close-loop variant which makes endogenous to the system the problem of mobilizing domestic saving by specifying marginal propensities to save out of income. Policy experiments were carried out by varying the level of the exogenously specified external resource flow. The supplementary role of foreign exchange was measured by its shadow price. One of the major findings of this study is that in the closed-loop variant the shadow price of foreign exchange is higher than in the open-loop variant, reflecting the fact that additional foreign resources increase import capacity as well as domestic investment capacity, whereas in the open-loop variant they serve only to remove the limitations on import capacity.

Utilizing an interindustry programming model that concentrates on the structure of imports and production, Weisskopf[10] analyzed the implications of the import substitution strategy for India's economy by increasing the relative weight of foreign resources in minimizing an objective function which is a weighted sum of domestic and foreign resource costs. The former are the labor costs or wages associated with achieving terminal year targets for aggregate consumption, investment, exports and imports. Foreign resource costs are the foreign exchange costs of financing imports required to achieve the given targets. Weisskopf's work has three major findings. First, as the cost of foreign exchange (measured by an exchange rate between

dollars and rupees) was increased, reflecting an increasing premium on foreign exchange, domestic production, progressively replaced imports. When the exchange rate was infinite, domestic production replaced all competitive imports. Second, with unchanged growth targets with respect to consumption, investment, exports and so on, when the relative weight of the foreign resource cost in the objective function was varied, a trade-off between external capital inflow and domestic savings was derived. As the relative weight of external resource cost was increased, more domestic savings and less foreign capital were used to achieve the given targets, and the replacement of foreign capital by domestic savings became increasingly costly. Finally, as the relative weight of foreign resource cost increased, the economy-wide capital-output ratio, representing the efficiency of investment, rose, reflecting increasing costs of import substitution or equivalently, the increasing productivity of foreign resource inflow.

The increasing productivity of foreign exchange, and the rise in the capital-output ratio representing inefficiency in the investment process from building a domestic production sector as the inflow of foreign capital decreases, has been pointed out not only in Weisskopf's study but also by Manne and Weisskopf,[11] in a model that examines the effects of alternative patterns of decrease of capital inflow.

Bergsman and Manne[12] studied the time path of the foreign exchange constraint under different aggregate growth and import substitution strategies for India's Fourth and Firth Year Development Plans utilizing a consistency model, which postulates sectoral supply-demand output balance consistency in the target year of both plans. The major result of their work is that a faster decline in the ratio of

imports to domestic production in the capital goods sectors requires higher imports to be used in building up domestic capacity and consequently larger trade deficits in the earlier years. These deficits are more than offset by the imports saved in the later years. The sum of the trade deficits during the planning period is less with a faster import substitution strategy than with a slower one. The finding that a larger foreign resource inflow in the early years to build up capacity in import substituting industries decreases the total aid needed to sustain targeted growth rates over the planning period, constitutes the policy implication of this study.

Chenery and MacEwan[13] used external capital inflows as a choice variable in examining optimal growth strategies with varying amounts of capital inflow to determine the productivity of foreign aid in Pakistan. Their optimal solutions fall into a three-period time pattern. First foreign capital is used to push investment to its upper limit of absorptive capacity to create domestic production capacity of tradable and non-tradable goods. Second, investment growth is slowed down and its composition is shifted in favor of capacity creation for exportable goods, while the inflow of capital is phased-out. Finally, foreign aid is reduced to zero and balanced growth in both tradable and non-tradable production is achieved. This time pattern and the finding that foreign inflow of capital in the first period of the planning horizon is used to build capacity for import substitution are similar to those reported by Bergsman and Manne. Finally the authors advised that when there is foreign exchange availability, there should be concentration on the ability

to invest, not on the ability to raise domestic savings. This type of advise corresponds to Tendulkar's open-loop mechanism.

In studying the role of foreign trade in Israel, Chenery and Bruno[14] examined the productivity of foreign exchange in the period 1950-1959. They identified three limits on the process of development: supply and demand of labor, supply and demand of domestic capital, and foreign exchange. However, foreign exchange was found to be the most important growth limitating factor. Also, they found that the productivity of foreign inflow of capital is high if foreign exchange is the only limitating factor on growth.

A further important study including 50 countries was conducted by Chenery and Strout.[15] The objective of this study was to analyze the process of development with external assistance in quantitative terms, examining the role of external assistance as contributing to the mobilization of domestic resources. Three constraints on growth were identified: skill limitations, savings or investment limitation, and trade or import limitation. The study point out the conditions under which external capital inflow may make possible a substantial acceleration in the process of development. Over short periods of time aid should be used in increasing domestic productive capacity, because it is adding resources to domestic savings. During these periods, the productivity of foreign capital is high and the economy is dependent on foreign aid. In longer periods, increases in output should be allocated so as to increase savings, thus reducing the amounts of foreign capital inflow needed, as well as the trade gap. In all, the use that is made of successive increments in output is likely to be more important than the efficiency with which external capital is used in the short initial periods.

Taylor[16] examined the interactions among the three limitations reported by Chenery and Bruno and Chenery and Strout. Using control theory he shows that there is a predictable sequence of binding gaps over time. He found that, in general, in programming models of development planning incorporating the absorptive capacity, domestic saving and the balance of payments constraints, first absorptive capacity tends to bind, then savings, and finally the balance of payments.

The major findings of mathematical programming models of development planning based on the gap framework can be summarized as follows.

1. The shadow price of foreign inflow of capital falls when the level of aid inflow is increased, and rises when domestic savings are increased to replace foreign resources, reflecting an interaction between domestic savings and foreign capital inflows in the process of development. Thus, foreign resources play a double role in financing development. First, they supplement savings to make possible a flow of non-competitive imports for industrialization of a developing country, easing the trade gap. Second, they add additional resources to meet investment requirements in building a domestic productive capacity, which in turn increases income and savings (Tendulkar's closed-loop mechanism), moderating the savings constraint.[17]

2. In the early stages of development, foreign inflows of capital tend to be at a high level to facilitate the creation of domestic productive capacity with a long-lasting payoff without increasing costs. When there is flexibility in choosing the time pattern of aid and development, it is optimal to obtain more inflow of capital initially and to repay it in later years by expanding exports and by

import substitution. A decrease in foreign capital inflow in later stages of development leads to expansion of exports from different sectors, showing that the profitability of these sectors changes over time.[18]

3. Multisectoral programming models do not necessarily imply that only one of the two gaps (savings or trade) can be closed. Rather, foreign exchange enables the economy to close both gaps simultaneously. Thus, in a well-planned economy, growth should be limited simultaneously by shortages of savings and shortages of non-competitive imports. Only if there is an inefficient allocation of resources, can one constraint completely dominate the other.[19]

A Linear Programming Model of Industrialization and Foreign Trade for Costa Rica

Main Features

The policy model of this study reached its present form only after an extensive period of computer experimentation. It is a multiobjective four-sector static linear programming model for industrialization and foreign trade that concentrates on the structure of production and imports and incorporates the major constraints on Costarican development and the institutional feature of joining the CACM. The study period is 1962-1979, because during this period the major strategic development decisions were taken. Another factor in selecting the study period was data availability. All of the variables in the model are expressed in incremental form.

Starting with the basic structural parameters and initial conditions of the economy, we are interested in generating alternative patterns of

domestic production and imports which satisfy a set of development objectives in the target year (for example, increasing industrial production or increasing agricultural production) which would maximize a weighted multiobjective function. By varying the weights in the multiobjective function, the effect of alternative policies which satisfy the desired objectives, on sectoral production composition and on international trade, is simulated. Additional solutions are generated also by varying, in the multiobjective function, the values of the exchange rates of the dual system implemented through the exchange rate policy followed by Costa Rica. These exchange rates represent some of the most strategic policy parameters for Costa Rica. In general, an exchange rate measures the relative scarcity of foreign exchange. As this rate is increased, a premium is placed upon foreign exchange. At a given exchange rate we expect some intermediary, capital and consumption goods imports, both from Central America and the rest of the world, but the general tendency would be for domestic production to be cheaper than importing (basically for consumption goods). As this rate is increased, reflecting a premium on foreign exchange, the tendency would be to replace competitive imports by domestic production. Were the exchange rate to be infinite, all competitive imports (basically consumption goods) would be replaced by domestic production, reducing import expenses to the minimum essential non-competitive imports. Policy experiments will also be conducted by simulating the effects on the economy of switching from a dual exchange rate system to a single system, by giving appropriate values to the exchange rates. Finally, an element of choice in the programming model is brought into play by variation of the exchange rates between colones and dollars.

The resulting allocation of domestic production and imports will be reflected in changes in import levels.

To better understand the implications of import substitution industrialization for Costarican development, two versions of the model will be presented: an import substitution version and a no import substitution version. Policy experiments will be conducted side-by-side on both versions. The objective of all these policy simulations will be to determine the optimal set of policies that Costa Rica should follow to overcome the constraints on development. All of the solutions will yield insights to the trade-offs in terms of sectoral production and foreign exchange of reallocating resources to one sector at the expense of the others.

A breakdown of imports, industrial exports and import substitution by economic area and type of good, is introduced in the model to attempt to isolate individual effects on each type of good by area, in the sectoral arrangement of the economy.

Algebraic Statement of the Model

The variables and parameters specified in the model are defined as follows.

1. Notation

I -- Industrial Sector

A -- Agricultural Sector

C -- Commerce Sector

R -- Rest of the Services Sector

CA -- Central America

RW -- Rest of the World

KG -- Capital Goods

IG -- Intermediate Goods

CG -- Consumption Goods

RG -- Residual Goods

2. Endogenous variables (all variables refer to target year "t")

X^i = Gross production of sector i; i = I, A, R, C

X_i^I = Gross industrial production by type of good i; i = KG, IG, CG, RG

I^i = Gross investment in sector i; i = I, A, R, C

I_i^I = Gross industrial investment by type of good i; i = KG, IG, CG, RG

S = Domestic savings

M_j^i = Sector i imports of goods type j; i = I, A, R; j = KG, IG

M_{CG}^C = Sector C imports of CG

$M_i^{I_j}$ = Industrial sector imports from economic area j of goods type i; j = CA, RW; i = KG, IG

$M_i^{A_j}$ = Agricultural Sector imports from economic area j of goods type i; j = CA, RW; i = KG, IG

$M_i^{R_j}$ = Sector R imports from economic area j of goods type i; j = CA, RW; i = KG, IG

$M_{CG}^{C_j}$ = Sector C imports of CG from economic area j; j = CA, RW

$M_i^{T_j}$ = Total imports of goods type i from economic area j; i = KG, IG, CG; j = CA, RW

M_i^T = Total imports of goods type i; i = KG, IG, CG

M^i = Total imports sector i; i = I, A, C, R

W^i = Intermediate demand sector i; i = I, A, R

M^{I_j} = Industrial sector imports from economic area j; j = CA, RW

M^{i_j} = Total imports sector i from economic area j; i = I, A, C, R; j = CA, RW

M = Total imports

3. Exogenous variables (all variables refer to target year "t")

$\bar{C}^i$ = Private consumption expenditure sector i; i = I, A, R, C

$\bar{E}$ = Total exports

$\bar{E}^i$ = Exports sector i; i = I, A, R, C

$\bar{E}_i^{I_j}$ = Industrial exports to economic area j of goods type i; j = CA, RW; i = KG, IG, CG, RG

$\bar{F}$ = Total foreign exchange

$\bar{G}^i$ = Government expenditure in sector i; i = I, A, R, C

$\bar{E}^{i_j}$ = Sector i exports to economic area j; i = I, A, R, C; j = CA, RW

4. Parameters

δ_I = Policy weight of industrial production

δ_A = Policy weight of agricultural production

δ_I^{CAM} = Policy weight of industrial imports from Central America

δ_I^{CAE} = Policy weight of industrial exports to Central America

δ_I^{RWM} = Policy weight of industrial imports from the rest of the world

δ_I^{RWE} = Policy weight of industrial exports to the rest of the world

δ_A^M = Policy weight of agricultural imports

δ_A^E = Policy weight of agricultural exports

γ_2 = Free market exchange rate

γ_1 = Overvalued exchange rate

γ_3 = 1979 exchange rate utilized by SIECA for data conversion from colones to dollars

ℓ^i = $ICOR^{20}$ sector i; i = I, A, R, C

ℓ_i^I = Industrial ICOR by type of good i; i = KG, IG, CG, RG

m_i^j = Sector j marginal propensity to import goods type i; j = I, A, R; i = KG, IG

m_{CG}^C = Sector C marginal propensity to import CG

$m_i^{I_j}$ = Industrial marginal propensity to import from economic area j goods type i; j = CA, RW; i = KG, IG

$m_i^{A_j}$ = Agricultural Sector marginal propensity to import from economic area j goods type i; j = CA, RW; i = KG, IG

$m_i^{R_j}$ = Sector R marginal propensity to import from economic area j goods type i; j = CA, RW; i = KG, IG

$m_{CG}^{C_j}$ = Sector C marginal propensity to import CG from economic area j; j = CA, RW

$\mu_i^{I_j}$ = Proportion of total imports of goods type i from economic area j in total industrial supply of goods type i; i = KG, IG, CG; j = CA, RW

e_i^j = Exogenous growth rate of industrial exports to economic area j of goods type i; j = CA, RW; i = KG, IG, CG, RG

$e^{A_{RW}}$ = Exogenous growth rate of agricultural exports

n = Number of years between base and target year

θ = Stock flow conversion factor

g = Growth rate of total gross investment

5. The equations

The programming model utilized can be expressed in the following summary form:

$$\text{Maximize} \quad \pi = c'Y$$

$$\text{subject to} \quad AY \leq \bar{X}$$

$$Y \geq 0$$

where π = Objective function,

c = 1xn row vector of objective constants,

Y = nx1 vector of endogenous variables defined for the model,

$\bar{X}$ = mx1 vector of constants corresponding to the values of the exogenous variables and autonomous components in the model, and

A = mxn matrix of constant coefficients corresponding to the parameters of the model.

A weighted multiobjective function to be maximized is given by equation (1), where the arguments of the objective function are the levels of industrial production, agricultural production, CACM industrial foreign trade, rest of the world industrial foreign trade, and agricultural foreign trade.[21]

$$\begin{aligned} \text{Max } \pi = {} & \delta_I X_t^I + \delta_A X_t^A - \delta_I^{CAM} \gamma_2 \frac{M_t^{I_{CA}}}{\gamma_3} + \delta_I^{CAE} \gamma_1 \frac{E_t^{I_{CA}}}{\gamma_3} \\ & - \delta_I^{RWM} \gamma_2 \frac{M_t^{I_{RW}}}{\gamma_3} + \delta_I^{RWE} \gamma_2 \frac{E_t^{I_{RW}}}{\gamma_3} \\ & - \delta_A^M \gamma_2 \frac{M_t^A}{\gamma_3} + \delta_A^E \gamma_1 \frac{E_t^A}{\gamma_3} \end{aligned} \tag{1}$$

This specification of the multiobjective function includes an attempt to represent the dual exchange rate system implemented by Costa Rica. The definition and values of the policy weights are given in Appendix F and in Chapter IV, respectively. Weighted multiobjective functions in linear programming models have been utilized by Applegate[22] for Guatemala, Weisskopf[23] for India, Chenery and MacEwan[24] for Pakistan and MacEwan[25] for Pakistan.

The expressions (2) through (5) represent the sectoral supply-demand balances.

$$X_t^i \geq X_0^i + \Delta\bar{E}_t^i + (\bar{C}_t^i - C_0^i) + (\bar{G}_t^i - \bar{G}_0^i) \qquad i = I, A, R \tag{2}$$

$$X_t^C + M_{t,CG}^C \geq X_0^C + M_{0,CG}^C + \Delta\bar{E}_t^C + (\bar{C}_t^C - C_0^C) + (\bar{G}_t^C - G_0^C) \tag{3}$$

$$W_t^i = (M_{t,IG}^i - M_{0,IG}^i) + W_0^i \qquad i = I, A, R \tag{4}$$

$$I_t^i \leq (M_{t,KG}^i - M_{0,KG}^i) + I_0^i \qquad i = I, A, R \tag{5}$$

The intermediate demand and the demand for capital goods in the supply-demand balances were handled in the following way. Because industrialization is just beginning in the period under study and is based on an import substitution strategy, most intermediary and capital goods are not available and must be imported, so it is reasonable to assume that these types of imports represent the intermediate demand and the demand for capital goods respectively (see Appendix C for an explanation of this procedure). In addition, since an input-output table does not exist for Costa Rica, by utilizing the outlined procedure this problem is solved. Exports of Commerce and Rest of the Services are zero, since these sectors do not export (see pp. 14-15). There is no intermediate demand and demand for capital goods for Commerce, because this sector imports only consumption goods. Likewise, the other sectors do not import consumption goods.

Inequality (6) gives the sectoral absorptive capacity constraints.

$$I_t^i \leq I_0^i + \theta \ell^i (X_t^i - X_0^i) \qquad i = A, R, C \tag{6}$$

These constraints represent limits in the ability to invest or to absorb capital as a result of organizational, managerial and entrepreneurial bottlenecks, shortages of complementary inputs, and scarcity of abilities to plan and carry on development plans. The constraints state that investment activity in the target year cannot be greater than investment in the base year plus the investment generated out of increased output from the base to the target year. The incremental capital-output ratio ℓ^i refers to the capital required per unit of additional output in the ith user sector, that is, investment is classified by sector of destination. Since capital goods are imported in the model because they

are not available domestically, a classification of capital goods sectors by origin and destination cannot be made. The parameter θ is the stock-flow conversion factor which is a device to convert the additions to capital stock over a given horizon into the investment flow of the target year of the planning period. For the Industrial Sector, absorptive capacity is defined by type of good as follows.

$$I^I_{t,i} \leq I^I_{0,i} + \theta \ell^I_i (X^I_{t,i} - X^I_{0,i}) \qquad i = KG, IG, CG, RG \qquad (7)$$

Constraints of the form as in (6) and (7) have been utilized in several studies to represent limits on ability to invest. Tendulkar[26] utilized for India an inequality similar to the ones assumed here. Taylor[27] used an inequality where investment could not be greater than a fraction of the current level of output. Chenery and MacEwan[28] assumed that investment could not increase over the past level of investment multiplied by a skill-determined growth rate, and Chenery and Strout[29] followed the same procedure. A good summary of the literature on absorptive capacity in less developed countries is in Ndebbio.[30]

Import demand is represented by inequalities (8) to (15). These constraints state that actual imports have to be at least as great as the levels of required imports to sustain the current levels of production and investment. Required imports are a function of the change in output.

Step I

$$M^I_{t,i} \geq M^I_{0,i} + m^I_i (X^I_t - X^I_0) \qquad i = KG, IG \qquad (8)$$

$$M^A_{t,i} \geq M^A_{0,i} + m^A_i (X^A_t - X^A_0) \qquad i = KG, IG \qquad (9)$$

$$M^R_{t,i} \geq M^R_{0,i} + m^R_i(X^R_t - X^R_0) \qquad i = KG \tag{10}$$

$$M^C_{t,CG} \geq M^C_{0,CG} + m^C(X^C_t - X^C_0) \tag{11}$$

Step II

$$M^{I_j}_{t,i} \geq M^{I_j}_{0,i} + m^{I_j}_i(M^I_{t,i} - M^I_{0,i}) \qquad j = CA, RW;\ i = KG, IG \tag{12}$$

$$M^{A_j}_{t,i} \geq M^{A_j}_{0,i} + m^{A_j}_i(M^A_{t,i} - M^A_{0,i}) \qquad j = CA, RW;\ i = KG, IG \tag{13}$$

$$M^{R_j}_{t,i} \geq M^{R_j}_{0,i} + m^{R_j}_i(M^R_{t,i} - M^R_{0,i}) \qquad j = CA, RW;\ i = KG, IG \tag{14}$$

$$M^{C_J}_{t,CG} \geq M^{C_J}_{0,CG} + m^{C_j}(M^C_{t,CG} - M^C_{0,CG}) \qquad j = CA, RW \tag{15}$$

Imports are classified according to the Classification of Imports by Use or Economic Destination (CUOED). Demand for imports by sector, and according to type of good is estimated in two steps. In the first step, total sectoral imports depend on the change in sectoral output levels; in the second step sectoral imports by origin (Central America or rest of the world) are estimated utilizing first step changes in sectoral import levels. The Industrial, Agricultural and Rest of the Services sectors import capital and intermediary goods, but the Commerce Sector imports consumption goods only.

The specification of imports as a function of the output level, has been applied by Chenery and Strout[31] to a number of developing countries, and Chenery and Bruno[32] have utilized a variant in which imports are a function of a proportion of final demand components. The two-step estimation procedure is used by Chenery[33] in his model of industrialization. An advantage of this procedure is that aggregate imports by type of good serve as a control total for its area components.

The import substitution constraints (16) and (17) are defined for the Industrial Sector, because it is the only sector that can produce capital, intermediary, and consumption goods for import substitution. The constraints are specified by type of good, and broken down by economic area (Central America and rest of the world). The import substitution parameters can serve as policy instruments. The inequalities state that the change in actual imports cannot exceed a certain proportion of the change in total supply, where total supply is equal to production plus imports.

$$M^{T_j}_{t,i} \leq M^{T_j}_{0,i} + \mu^{I_j}_{i}[(X^{I}_{t,i} - X^{I}_{t,0}) + (M^{T_j}_{t,i} - M^{T_j}_{0,i})] \qquad (16)$$

$$j = CA, RW; \; i = KG, IG$$

$$M^{C_j}_{t,CG} \leq M^{C_j}_{0,CG} + \mu^{I_j}_{CG}[(X^{I}_{t,CG} - X^{I}_{0,CG}) + (M^{C_j}_{t,CG} - M^{C_j}_{0,CG})] \qquad (17)$$

$$j = CA, RW$$

It is assumed that capital and intermediary goods imports represent the non-competitive imports of industry, agriculture and Rest of the Services. The scope for import substitution can be exogenously restricted (only some of these products may actually be profitably substitutable), so a fraction of total supply must be satisfied by non-competitive imports. Alternatively, since most of these products cannot be produced in the country, import substitution can be assumed to be very low or non-existent. Consumption goods imports represent the competitive imports. Here, import substitution is allowed full scope, so that there is a free choice between importing or expanding domestic productive capacity to satisfy whatever supply is generated in the target year over and above that which can be satisfied by capacity existing in the base year. Constraints (16) and (17) are of

the same type utilized by Srinivassan,[34] Tendulkar,[35] and Weisskopf.[36] There is no import substitution constraint for the Rest of the Services and Commerce sectors because they do not produce import substitutes of any type. Recall also that the policy emphasis as to import substitution is on the Industrial Sector.

Exports constraints are expressed by economic area of destination according to type of good. Exports are exogenously determined by defining exogenous growth rates. The justification for treating exports exogenous can be traced to the dependency of export earning of most developing countries on world demand, weather conditions and international competition in trade. It is assumed that the Agricultural Sector exports only to the Rest of the World, since Central American countries produce similar agricultural products. Industrial exports are classified according to the Central American Uniform Tariffs Classification (CAUTC) but for data consistency purposes will be arranged in a pattern similar to the Traditional-Intermediary-Metal-Mechanic-Residual grouping.

$$\Delta\bar{E}^{I_j}_{t,i} \leq (1 + e^{j}_{i})^{n} E^{I_j}_{0,i} - E^{I_j}_{0,i} \qquad j = CA, RW;\ i = IG, CG \tag{18}$$

$$\Delta\bar{E}^{I_{CA}}_{t,KG} \leq (1 + e^{CA}_{KG})^{n} E^{I_{CA}}_{0,KG} - E^{I_{CA}}_{0,KG} \tag{19}$$

$$\Delta\bar{E}^{I_{RW}}_{t,KG} = 107.1 \tag{20}$$

$$\Delta\bar{E}^{I_{CA}}_{t,RG} - \Delta\bar{E}^{I_{CA}}_{t,RG}\, P \leq (1 + e^{CA}_{RG})^{n} E^{I_{CA}}_{0,RG} - E^{I_{CA}}_{0,RG} \tag{21}$$

$$\Delta\bar{E}^{I_{RW}}_{t,RG} \leq (1 + e^{RW}_{RG})\ E^{I_{RW}}_{0,RG} - E^{I_{RW}}_{0,RG} \tag{22}$$

$$\Delta\bar{E}^{A_{RW}}_{t} \leq (1 + e^{A_{RW}})\ E^{A_{RW}}_{0} - E^{A_{RW}}_{0} \tag{23}$$

Equation (20) represents a case where exports were zero in the base year and inequality (21) a case where exports went from positive in the base year to zero in the target year; thus, that specification allows the handling of a negative value in the model.

Inequality (24) represents the trade gap. Foreign capital inflow is assumed to be greater than the balance of trade deficit. If a country's domestic financial resources are to be supplemented from abroad, such a flow of resources will appear as a positive magnitude (an excess of imports over exports) in the trade accounting framework. Foreign capital inflow is assumed exogenous, since from the practical point of view political and strategic factors in lending countries affect the flow of aid and private investment going to developing countries.

$$\bar{F}_t \geq (M_t - M_0) - \Delta\bar{E}_t + F_0 \tag{24}$$

The savings gap is given by inequality (25). Total domestic resources and investment are allocated so as to maximize production and foreign exchange, while satisfying demand and capacity constraints. This allocation is likely to be heavily dependent on demand for imports. Foreign capital can be devoted to either purchasing needed imports or investing in creating productive capacity for import substitution. To the extent that these funds are used to import needed inputs and capital goods, domestic savings will be adversely affected.

$$\sum_i I_t^i \leq (S_t - S_0) + (\bar{F}_t - F_0) + \sum_i I_0^i \qquad i = I, A, C, R \tag{25}$$

Equations (26) and (27) are accounting identities for industrial output and investment.

$$X_t^I = X_{t,KG}^I + X_{t,IG}^I + X_{t,CG}^I + X_{t,RG}^I \tag{26}$$

$$I_t^I = I_{t,KG}^I + I_{t,IG}^I + I_{t,CG}^I + I_{t,RG}^I \tag{27}$$

Equalities (28) to (32) are definitions for imports. The first one sums imports of goods type i by economic area of origin j. These totals are then utilized in the import substitution constraints for capital and intermediary goods. The second definition sums industrial imports by economic area. These totals are utilized in the objective function. The third definition sums imports by sector (Industrial, Agricultural and Rest of the Services), and the fourth gives the total for the Commerce Sector. The last definition gives total imports.

$$M_{t,i}^{T_j} = M_{t,i}^{I_j} + M_{t,i}^{A_j} + M_{t,i}^{R_j} \qquad j = CA, RW;\ i = KG, IG \tag{28}$$

$$M_t^{I_j} = M_{t,KG}^{I_j} + M_{t,IG}^{I_j} \qquad j = CA, RW \tag{29}$$

$$M_t^i = M_{t,KG}^i + M_{t,IG}^i \qquad i = I, A, R \tag{30}$$

$$M_t^C = M_{t,CG}^C \tag{31}$$

$$M_t = M_t^I + M_t^A + M_t^R + M_t^C \tag{32}$$

Equalities (33) and (34) are included in the model on an ad hoc basis for technical reasons to avoid any extreme behavior in trade, to which linear systems are prone, namely an overspecialization in imports from any of the two trading areas of Costa Rica.

$$M_{t,j}^i = M_{t,j}^{i_{CA}} + M_{t,j}^{i_{RW}} \qquad i = I, A, R;\ j = KG, IG \tag{33}$$

$$M_{t,CG}^C = M_{t,CG}^{C_{CA}} + M_{t,CG}^{C_{RW}} \tag{34}$$

Equalities (35) to (39) are definitions for exports. The first sums industrial exports by economic area. The second gives total industrial exports. The third defines Commerce and Rest of the Services as non-exporting sectors. The fourth represents the assumption that agriculture exports only to the rest of the world, and the last one gives total exports.

$$E_t^{I_j} = E_{t,KG}^{I_j} + E_{t,IG}^{I_j} + E_{t,CG}^{I_j} + E_{t,RG}^{I_j} - E_{t,RG}^{I_j} P \quad j = CA, RW \tag{35}$$

$$E_t^I = E_t^{I_{CA}} + E_t^{I_{RW}} \tag{36}$$

$$E_t^i = 0 \qquad i = C, R \tag{37}$$

$$E_t^A = E_t^{A_{RW}} \tag{38}$$

$$E_t = E_t^I + E_t^A + E_t^C + E_t^R \tag{39}$$

Policy experiments will be conducted by assigning different values to the policy weights in the multiobjective function. The assigned values of the weights in each experiment are intended to reflect trade-offs in the relative importance of the multiple development objectives for the Costarican economy. These values are provided in the next chapter. For instance, $\delta_I^{RWE} = 1$ and $\delta_A^E = 0$ would imply that the export promotion policy for industrial exports to the rest of the world is emphasized while at the same time no policy action of any kind is undertaken for promoting agricultural exports. Additional experiments will be conducted by varying the values of the exchange rates in the multiobjective function.

Summary

This chapter introduced the field of quantitative economic development modelling and presented the theoretical framework of the study. The first two parts covered economic policy and planning models in developing countries and the relevant literature about programming models in development planning. The objective was to provide the theoretical base for the study. The last part presented a linear programming model of industrialization and foreign trade for Costa Rica. This model is the empirical tool of analysis to be utilized in the study, and incorporates the major constraints on Costarican development. By assigning different values to the policy weights in the model, alternative policy scenarios are generated, and thus, the effects on the economy of emphasizing or deemphasizing different development policies are simulated.

This chapter is related to the next one, as it provides the operational quantitative model-building framework of the study, and the model to be utilized in the analysis of policy experimentation.

ENDNOTES

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[17]T. N. Srinivassan, "The Foreign Trade Sector in Planning Models," in C. Blitzer (ed.). Economy-Wide Models and Development Planning (London, 1975), pp. 165-166.

[18]Ibid., p. 166.

[19]H. Chenery and T. Weisskopf, "Introduction," in H. Chenery (ed.). Studies in Development Planning (Cambridge, 1971), p. 92.

[20]The incremental capital-output ratio (ICOR) is defined as the investment from an additional unit of output.

[21]CACM industrial foreign trade includes both industrial imports from Central America and industrial exports to Central America. Rest of the world industrial foreign trade includes both industrial imports from the rest of the world and industrial exports to the rest of the world. Agricultural foreign trade includes both agricultural imports and agricultural exports.

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[23]Weisskopf, p. 111.

[24]Chenery and MacEwan, p. 214.

[25]A. MacEwan, "Problems of Interregional and Intersectoral Allocation: The Case of Pakistan," in H. Chenery (ed.). Studies in Development Planning (Cambridge, 1971), pp. 155-172.

[26]Tendulkar, p. 126.

[27]Taylor, 1971, p. 51.

[28]Chenery and MacEwan, p. 217.

[29]Chenery and Strout, p. 685.

[30]J. Ndebbio, "Absorptive Capacity and Growth Rates in Nigeria, 1961-1976," (Unpublished Ph. D. dissertation, Oklahoma State University, 1980).

[31]Chenery and Strout, p. 689.

[32]Chenery and Bruno, p. 87.

[33]H. Chenery, Structural Change and Development Policy (London, 1979), pp. 74-75.

[34]Srinivassan, pp. 159-160.

[35]Tendulkar, p. 125.

[36]Weisskopf, p. 109.

CHAPTER IV

ANALYSIS OF EMPIRICAL RESULTS

This chapter will examine and discuss the empirical results obtained by performing policy experiments with the multiobjective linear programming model outlined in the preceeding chapter. The results of pursuing different combinations of policies will be compared in order to determine their effects on Costarican economic development, and the optimal combination of development policies to accelerate Costarican development.

The Policy Experiments

The results of this study were derived by making an optimal jump from the base to the target year of the planning period, with the linear programming model developed in Chapter III. Beginning with the initial conditions and the exogenously determined growth rates of industrial and agricultural exports, forecasts of the major macroeconomic variables of the Costarican economy were obtained by assigning ten different sets of values to the policy weights in the multiobjective function to be maximized. The experiments performed are intended to simulate the effect on the economy of the major development policies undertaken by Costa Rica during the last two decades. These policies were described in Chapter II. Table XIX presents a description of the experiments that were undertaken. In order to study the exchange rate policies followed

TABLE XIX

DESCRIPTION OF POLICY EXPERIMENTS

Experiment	Description
E-1A	to control* industrial imports from Central America and promote Industrial exports to Central America, while no policy action is undertaken for the rest of the world area for both, industrial imports and exports. All other policy weights are held constant at their original levels.
E-1B	to control industrial imports from the rest of the world and promote industrial exports to the rest of the world, while no policy action is undertaken for the Central American area for both industrial imports and exports. All other policy weights are held constant at their original levels.
E-2A	to control industrial imports from the rest of the world and promote industrial exports to the rest of the world, while no policy action is undertaken for the Agricultural Sector trade** and the Industrial and Agricultural production policy is emphasized. The industrial trade policy emphasis with respect to the Central American area is kept constant at its original level.
E-2B	to control agricultural imports and promote agricultural exports, while no policy action is undertaken for the rest of the world industrial trade and the Industrial and Agricultural production policy is emphasized. The industrial trade policy emphasis with respect to Central American area is kept constant at its original level.
E-3A	to control industrial imports from Central America and promote industrial exports to Central America, while no policy action is undertaken for the Agricultural Sector trade and the Industrial and Agricultural production policy is emphasized. The industrial trade policy emphasis with respect to the rest of the world area is kept constant at its original level.

TABLE XIX (Continued)

Experiment	Description
E-3B	to control agricultural imports and promote agricultural exports while no policy action is undertaken for the Central American industrial trade and the Industrial and Agricultural production policy is emphasized. The industrial trade policy emphasis with respect to the rest of the world area is kept constant at its original level.
E-4A	to emphasize the industrial production policy and no policy action is undertaken for the Agricultural Sector production; while the industrial trade policy with respect to the rest of the world and the agricultural trade policy are given the same degree of emphasis. The industrial trade policy emphasis with respect to the Central American area is kept constant at its original level.
E-4B	to emphasize the agricultural production policy and no policy action is undertaken for the Industrial Sector production; while the industrial trade policy with respect to the rest of the world and the agricultural trade policy are given the same degree of emphasis. The Industrial trade policy emphasis with respect to the Central American area is kept constant at its original level.
E-5A	to emphasize the industrial production policy and no policy action is undertaken for the Agricultural Sector production; while the industrial trade policy with respect to Central America and the agricultural trade policy are given the same degree of emphasis. The industrial trade policy with respect to the rest of the world area is kept constant at its original level.

TABLE XIX (Continued)

Experiment	Description
E-5B	to emphasize the agricultural production policy and no policy action is undertaken for the Industrial Sector production; while the industrial trade policy with respect to Central America and the agricultural trade policy are given the same degree of emphasis. The industrial trade policy emphasis with respect to the rest of the world area is kept constant at its original level.

*To control industrial or agricultural imports means emphasizing an import policy whose effect is to reduce these imports.

**The industrial or agricultural trade policy includes both the import controlling policy and the export promotion policy for each sector.

by Costa Rica, two more sets of experiments were conducted. The first set (denoted by letters C and D) simulates a depreciation of the free market exchange rate, that is, increasing the value of this exchange rate from 8.60 colones per dollar to 63.0 colones per dollar, while the second set (denoted by the letters E and F) simulates an exchange rate unification where the value of the overvalued exchange rate is increased from 6.65 colones per dollar to 63.0 colones per dollar, to just equal the value of the depreciated free market exchange rate. These last two sets of experiments are in essence the same as those described in Table XIX, except for the respective changes in the values of the exchange rates. Finally, to quantify the effect of the import substitution industrialization policy in the economy, a no-import substitution version and an import substitution version of the model were run for each of the three sets of experiments. In the first version, the import substitution policy does not exist in the policy maker's portfolio of development policies (the import substitution constraints (16) and (17) are dropped from the model) while in the second version this policy is included in the model. In all, 60 different experiments were conducted, 30 for each version of the model. However the results of only 12 experiments for the first version and 13 for the second are being reported, since the remainder give exactly the same results (Table XX presents the rest of the experiments together with their respective equivalent). The calculated values of the parameters in the multiobjective function for the three sets of experiments in the two versions (the policy weights multiplied by the exchange rates) are given in Appendix H.

TABLE XX

THREE SETS OF EXPERIMENTS AND THEIR EQUIVALENT EXPERIMENTS: NO-IMPORT SUBSTITUTION AND IMPORT SUBSTITUTION VERSIONS

Set Number	No-Import Substitution		Import Substitution	
	Experiment	Equivalent Experiment	Experiment	Equivalent Experiment
I	E-2A	E-1A	E-2A	E-1A
	E-3A	E-1A	E-3A	E-1A
	E-3B	E-2B	E-3B	E-2B
	E-4A	E-2B	E-4A	E-2B
	E-4B	E-1A	E-4B	E-1A
	E-5A	E-2B	E-5A	E-2B
	E-5B	E-1A	E-5B	E-1A
II	E-3C	E-1A	E-2C	E-1D
	E-3D	E-2D	E-3C	E-1A
	E-2C	E-1D	E-3D	E-2D
	E-4D	E-1B	E-4C	E-1D
	E-5C	E-2D	E-4D	E-3F
	E-5D	E-1A	E-5C	E-2D
III	E-1E	E-1C	E-1E	E-1A
	E-1F	E-1D	E-1F	E-1D
	E-2F	E-2B	E-2F	E-2B
	E-4F	E-1B	E-4F	E-5D
	E-5F	E-1A	E-5F	E-5D

Notes: Letters A and B in Set I represent the experiments in Table XIX. Letters C and D in Set II represent the depreciation of the free market exchange rate implemented in experiments A and B. Letters E and F in Set III represent an exchange rate unification implemented in experiments C and D.

The ten sets of values of the policy weights are provided in Table XXI. The assigned values of the weights in each experiment are intended to reflect trade-offs in the relative importance of the multiple development objectives for the Costarican economy. For instance $\delta_I = 1$ and $\delta_A = 0$ would imply that the industrial production policy is emphasized while at the same time no policy action of any kind is undertaken for the agricultural production policy. Table XXII provides a summary of the policy parameters of the programming model for Costa Rica. Additional experiments can be conducted by adjusting the value of some of these parameters. A suggested direction of adjustment is provided in the table.

Analysis of Macroeconomic Results Generated by the No-Import Substitution Version

Overview of Macroeconomic Results

Table XXIII presents the empirical results when import substitution is not part of the development policies followed by Costa Rica. The policies that generate the highest levels of total output in the economy, and consequently the highest rates of economic development are those dealing with Central American industrial trade (controlling industrial imports and industrial exports promotion), agricultural trade (controlling agricultural imports and agricultural exports promotion), industrial and agricultural production, and the exchange rates (depreciation of the free market exchange rate and an exchange rate unification). These types of policies (as in experiments E-1A, E-2B, E-1C and E-3E) generated annual development rates ranging from 16 percent to 16.8 percent. All of these rates of economic development are higher

TABLE XXI

TEN SETS OF WEIGHTS

Experiment	δ_I	δ_A	δ_I^{CAM}	δ_I^{CAE}	δ_I^{RWM}	δ_I^{RWE}	δ_A^{M}	δ_A^{E}
BS*	.70	.30	.10	.10	.70	.70	.20	.20
E-1A, E-1C, E-1E	.70	.30	6.0	1.0	0	0	.20	.20
E-1B, E-1D, E-1F	.70	.30	0	0	11.0	1.0	.20	.20
E-2A, E-2C, E-2E	1.0	1.0	.10	.10	11.0	1.0	0	0
E-2B, E-2D, E-2F	1.0	1.0	.10	.10	0	0	6.0	1.0
E-3A, E-3C, E-3E	1.0	1.0	6.0	1.0	.70	.70	0	0
E-3B, E-3D, E-3F	1.0	1.0	0	0	.70	.70	6.0	1.0
E-4A, E-4C, E-4E	1.0	0	.10	.10	1.0	1.0	1.0	1.0
E-4B, E-4D, E-4F	0	1.0	.10	.10	1.0	1.0	1.0	1.0
E-5A, E-5C, E-5E	1.0	0	1.0	1.0	.70	.70	1.0	1.0
E-5B, E-5D, E-5F	0	1.0	1.0	1.0	.70	.70	1.0	1.0

*Basic Solution.

TABLE XXII

MAIN POLICY PARAMETERS AND SUGGESTED ADJUSTMENTS

Symbol	Definition*	Suggested Direction of Adjustment
γ_1, γ_2	OER** and FER	$\gamma_1\uparrow$, $\gamma_2\uparrow$
ℓ^i	ICOR sector i; i = A, R, C	$\ell^A\uparrow$, $\ell^C\downarrow$, ℓ^R(constant)
ℓ^I_i	Industrial ICOR by type of good i; i = KG, IG, CG, RG	ℓ^I_{KG} (constant), $\ell^I_{IG}\uparrow$ (major emphasis), $\ell^I_{CG}\uparrow$, ℓ^I_{RG} (constant)
m^j_i	Sector j marginal propensity to import goods type i; j = I, A, R; i = KG, IG	$m^I_{KG}\downarrow$(mainly for RW), m^I_{IG}(constant), $m^A_{KG}\downarrow$(mainly for RW), m^A_{IG}(constant), $m^R_{KG}\downarrow$
m^{C_j}	Sector C marginal propensity to import CG; j = CA, RW	$m^{C_j}\downarrow$(major emphasis, particularly on RW)
e^j_i	Industrial exports growth rate by type of goods i; i = KG, IG, CG, RG; j = CA, RW	$e^j_{KG}\uparrow$, $e^j_{IG}\uparrow$, $e^j_{CG}\uparrow$(major emphasis on all of these, particularly RW), $e^j_{RG}\uparrow$
e^A	Agricultural exports growth rate	$e^A\uparrow$
μ^I_i	Proportion of total imports of goods type i in total industrial supply of goods type i; i = KG, IG, CG	μ^I_{KG}(constant), $\mu^I_{IG}\downarrow$, $\mu^I_{CG}\downarrow$(major emphasis, particularly on RW)

*OER = Overvalued Exchange Rate, FER = Free Market Exchange Rate, ICOR = Incremental Capital Output Ratio, I = Industrial Sector, A = Agricultural Sector, C = Commerce Sector, R = Rest of the Services Sector, KG = Capital Goods, IG = Intermediary Goods, CG = Consumption Goods, RG = Residual Goods, RW = Rest of the World, CA = Central America.

**To simulate switching from a dual to a single exchange rate system, γ_1 can be altered to equal γ_2 (see p. 84).

TABLE XXIII

SUMMARY OF POLICY EXPERIMENTS RESULTS--NO IMPORT SUBSTITUTION VERSION

Experiment	X^I	X^A	X^C	X^R	X^I_{KG}	X^I_{IG}	X^I_{CG}	X^I_{RG}	I^I	I^A	I^C	I^R	I^I_{KG}	I^I_{IG}	I^I_{CG}
	Million Colones														
E-1A	19234.1	18781.3	8638.9	18733.9	0.0	0.0	19234.1	0.0	1183.8	1502.5	390.7	1386.7	7.9	64.7	1075.9
E-1B	17596.4	8708.5	8638.9	18733.9	0.0	0.0	17596.4	0.0	1087.1	739.0	390.7	1386.7	7.9	64.7	979.2
E-2B	23671.4	7454.3	8638.9	18733.9	0.0	0.0	23671.4	0.0	1445.6	643.9	390.7	1386.7	7.9	64.7	1337.7
E-1C	18832.8	16313.1	8638.9	18733.9	0.0	0.0	18832.8	0.0	1160.1	1315.4	390.7	1386.7	7.9	64.7	1052.2
E-1D	17392.4	7454.3	8638.9	18733.9	0.0	0.0	17392.4	0.0	1075.1	643.9	390.7	1386.7	7.9	64.7	967.2
E-2D	19234.1	5983.8	8638.9	18733.9	0.0	0.0	19234.1	0.0	1183.8	532.2	390.7	1386.7	7.9	64.7	1075.9
E-4C	17596.4	7291.4	8638.9	18733.9	0.0	0.0	17596.4	0.0	1087.1	631.5	0.0	1386.7	7.9	64.7	979.2
E-2E	17392.4	7454.3	8638.9	18733.9	16394.1	0.0	998.3	0.0	1112.8	643.9	0.0	1386.7	1012.8	64.7	0.0
E-3E	19234.1	18781.3	8638.9	18733.9	18235.7	0.0	998.3	0.0	1225.7	1502.5	0.0	1386.7	1125.7	64.7	0.0
E-3F	17596.4	7454.3	8638.9	18733.9	16598.0	0.0	998.3	0.0	1125.3	643.9	0.0	1386.7	1025.3	64.7	0.0
E-4E	17596.4	7454.3	8638.9	18733.9	0.0	0.0	17596.4	0.0	1087.1	643.9	0.0	1386.7	7.9	64.7	979.2
E-5E	19234.1	7454.3	8638.9	18733.9	0.0	0.0	19234.1	0.0	1183.1	643.9	0.0	1386.7	7.9	64.7	1075.9

TABLE XXIII (Continued)

Experiment	I^{I}_{RG}	S	M^{I}_{KG}	M^{I}_{IG}	M^{A}_{KG}	M^{A}_{IG}	M^{R}_{KG}	M^{R}_{IG}	M^{C}_{CG}	$M^{I_{CA}}_{KG}$	$M^{I_{CA}}_{IG}$	$M^{I_{RW}}_{KG}$	$M^{I_{RW}}_{IG}$	$M^{A_{CA}}_{KG}$	$M^{A_{CA}}_{IG}$
	Million Colones														
E-1A	35.3	0.0	1865.3	3728.8	1373.6	751.2	1174.9	50.1	3028.2	245.8	397.8	1619.5	3331.0	177.4	97.9
E-1B	35.3	0.0	1705.2	3408.6	610.1	357.4	1174.9	50.1	3028.2	223.3	361.6	1481.8	3047.0	77.2	43.4
E-2B	35.3	0.0	2299.3	4596.3	515.0	308.3	1174.9	50.1	3028.2	306.8	495.8	1992.4	4100.4	64.7	36.6
E-1C	35.3	0.0	1826.1	3650.4	1186.5	654.7	1174.9	50.1	3028.2	240.3	388.9	1585.7	3261.4	152.8	84.5
E-1D	35.3	0.0	1685.2	3368.8	515.0	308.3	1174.9	50.1	3028.2	220.5	357.1	1464.7	3011.6	64.7	36.6
E-2D	35.3	0.0	1865.3	3728.8	403.5	250.8	1174.9	50.1	3028.2	245.8	397.8	1619.5	3331.0	50.1	28.6
E-4C	35.3	0.0	1705.2	3408.6	502.6	301.9	1705.2	50.1	3028.2	223.3	361.6	1481.8	3047.0	63.1	35.7
E-2E	35.3	0.0	1685.2	3368.8	515.0	308.3	1174.9	50.1	3028.2	220.5	357.1	1464.7	3011.6	64.7	36.6
E-3E	35.3	0.0	1865.3	3728.8	1373.6	751.2	1174.9	50.1	3028.2	245.8	397.8	1619.5	3331.0	177.4	97.9
E-3F	35.3	0.0	1705.2	3408.6	515.0	308.3	1174.9	194.2	3028.2	223.3	361.6	1481.8	3047.0	64.7	36.6
E-4E	35.3	0.0	1705.2	3408.6	515.0	308.3	1174.9	194.2	3028.2	223.3	361.6	1481.8	3047.0	64.7	36.6
E-5E	35.3	0.0	1865.3	3728.8	515.0	308.3	1174.9	1351.6	3028.2	245.8	397.8	1619.5	3331.0	64.7	36.6

TABLE XXIII (Continued)

Experiment	A_{RW} M_{KG}	A_{RW} M_{IG}	R_{CA} M_{KG}	R_{CA} M_{IG}	R_{RW} M_{KG}	R_{RW} M_{IG}	C_{CA} M_{CG}	C_{RW} M_{CG}	T_{CA} M_{KG}	T_{RW} M_{KG}	T_{CA} M_{IG}	T_{RW} M_{IG}	I_{CA} M	I_{RW} M	A_{CA} M
	Million Colones														
E-1A	1196.2	653.3	191.2	0.0	983.7	50.1	321.1	2707.1	614.5	3799.4	495.8	4034.4	643.7	4950.5	275.3
E-1B	532.8	314.0	191.2	0.0	983.7	50.1	321.1	2707.1	491.8	2998.4	405.0	3411.1	585.0	4528.8	120.6
E-2B	450.2	271.7	191.2	0.0	983.7	50.1	321.1	2707.1	562.9	3426.4	532.4	4442.3	802.7	6092.9	101.3
E-1C	1033.6	570.1	191.2	0.0	983.7	50.1	321.1	2707.1	584.4	3603.1	473.5	3881.7	629.3	4847.2	237.4
E-1D	450.2	271.7	191.2	0.0	983.7	50.1	321.1	2707.1	476.5	2898.7	393.7	3333.5	577.7	4476.3	101.3
E-2D	353.4	222.2	191.2	0.0	983.7	50.1	321.1	2707.1	487.2	2956.6	426.5	3603.3	643.7	4950.5	78.7
E-4C	439.5	226.2	191.2	0.0	983.7	50.1	321.1	2707.1	477.7	2905.1	397.4	3363.4	585.0	4528.8	98.8
E-2E	450.2	271.7	191.2	0.0	983.7	50.1	321.1	2707.1	476.5	2898.7	393.7	3333.5	577.7	4476.3	101.3
E-3E	1196.2	653.3	191.2	0.0	983.7	50.1	321.1	2707.1	614.5	3799.4	495.8	4034.4	643.7	4950.5	275.3
E-3F	450.2	271.7	191.2	19.5	983.7	174.7	321.1	2707.1	479.3	2915.8	417.8	3493.4	585.0	4528.8	101.3
E-4E	450.2	271.7	191.2	19.5	983.7	174.7	321.1	2707.1	479.3	2915.8	417.8	3493.4	585.0	4528.8	101.3
E-5E	450.2	271.7	191.2	176.4	983.7	1175.1	321.1	2707.1	501.8	3053.5	610.9	4777.9	643.7	4950.5	101.3

TABLE XXIII (Continued)

Experiment	M^{A}_{RW}	M^{R}_{CA}	M^{R}_{RW}	M^{I}	M^{A}	M^{C}	M^{R}	M	$E^{I_{CA}}_{KG}$	$E^{I_{CA}}_{IG}$	$E^{I_{CA}}_{CG}$	$E^{I_{CA}}_{RG}$	$PE^{I_{CA}}_{RG}$	$E^{I_{RW}}_{KG}$	$E^{I_{RW}}_{IG}$
	Million Colones														
E-1A	1849.5	191.2	1033.8	5594.2	2124.8	3028.2	1225.1	11972.5	380.6	645.4	612.4	0.0	0.7	107.1	227.2
E-1B	846.8	191.2	1033.8	5113.9	967.5	3028.2	1225.1	10334.8	0.7	0.0	0.0	0.0	0.7	107.1	227.2
E-2B	722.0	191.2	1033.8	6895.7	823.3	3028.2	1225.1	11972.5	380.6	645.4	612.4	0.0	0.7	107.1	227.2
E-1C	1603.8	191.2	1033.8	5476.5	1841.2	3028.2	1225.1	11571.2	380.6	645.4	612.4	0.0	0.7	107.1	0.0
E-1D	722.0	191.2	1033.8	5054.1	823.3	3028.2	1225.1	10130.8	0.7	0.0	0.0	0.0	0.7	107.1	23.2
E-2D	575.6	191.2	1033.8	5594.2	654.4	3028.2	1225.1	10502.0	380.6	645.4	612.4	0.0	0.7	107.1	227.2
E-4C	705.8	191.2	1033.8	5113.9	804.6	3028.2	1225.1	10171.9	0.0	645.4	612.4	0.0	1257.8	107.1	227.2
E-2E	722.0	191.2	1033.8	5054.1	823.3	3028.2	1225.1	10130.5	380.6	645.4	612.4	0.0	1638.4	107.1	23.2
E-3E	1849.5	191.2	1033.8	5594.2	2124.8	3028.2	1225.1	11972.5	380.6	645.4	612.4	0.0	0.7	107.1	227.2
E-3F	722.0	210.7	1158.4	5113.9	823.3	3028.2	1369.2	10334.8	380.6	645.4	612.4	0.0	1638.4	107.1	227.2
E-4E	722.0	210.7	1158.4	5113.9	823.3	3028.2	1369.2	10334.8	380.6	645.4	612.4	0.0	1638.4	107.1	227.2
E-5E	722.0	367.7	2158.8	5594.2	823.3	3028.2	2526.5	11972.5	380.6	645.4	612.4	0.0	0.7	107.1	227.2

TABLE XXIII (Continued)

Experiment	$E^{I_{RW}}_{CG}$	$E^{I_{RW}}_{RG}$	$E^{I_{CA}}$	$E^{I_{RW}}$	E^{I}	E^{A}	E^{C}	E^{R}	E	W^{I}	W^{A}	W^{R}
	Million Colones											
E-1A	174.1	0.0	1637.7	508.4	2146.1	4566.4	0.0	0.0	6712.5	3728.8	751.2	50.1
E-1B	174.1	0.0	0.0	508.4	508.4	4566.4	0.0	0.0	5074.8	3408.6	357.4	50.1
E-2B	174.1	0.0	1637.7	508.4	2146.1	4566.4	0.0	0.0	6712.5	4596.3	308.3	50.1
E-1C	0.0	0.0	1637.7	107.1	1744.8	4566.4	0.0	0.0	6311.2	3650.4	654.7	50.1
E-1D	174.1	0.0	0.0	304.7	304.7	4566.4	0.0	0.0	4870.8	3368.8	308.3	50.1
E-2D	174.1	0.0	1637.7	508.4	2146.1	3095.9	0.0	0.0	5242.0	3728.8	250.8	50.1
E-4C	174.1	0.0	0.0	508.4	508.4	4403.5	0.0	0.0	4911.9	3408.6	301.8	50.1
E-2E	174.1	0.0	0.0	304.4	304.4	4566.4	0.0	0.0	4870.8	3368.8	308.3	50.1
E-3E	174.1	0.0	1637.7	508.4	2146.1	4566.4	0.0	0.0	6712.5	3728.8	751.2	50.1
E-3F	174.1	0.0	0.0	508.4	508.4	4566.4	0.0	0.0	5074.8	3408.6	308.3	194.2
E-4E	174.1	0.0	0.0	508.4	508.4	4566.4	0.0	0.0	5074.8	3408.6	308.3	194.2
E-5E	174.1	0.0	1637.7	508.4	2146.1	4566.4	0.0	0.0	6712.5	3728.8	308.3	1351.6

than the actual 1962-1979 rate of 15.5 percent. The rest of the experiments generated levels of total output inferior to the actual 1979 level of 54087.3 million colones. For instance, controlling industrial imports from Central America and promoting industrial exports to that area, while the policy emphasis on the production policies is held constant at its original level (E-1A), generated a total output of 65388.2 million colones with total imports remaining unchanged at their base run level of 11972.5 million colones. This level of total output can also be achieved within an exchange rate unification framework, by dealing in the same way with Central American industrial trade while the industrial and agricultural production policies are emphasized (E-3E). Again, total imports remained unchanged at their base run level. A somewhat lower level of total output (62518.7 million colones) is generated by dealing again with the Central American industrial trade when there is a depreciation of the free market exchange rate (E-1C). Here, the exchange rate policy followed cut down imports by 401.3 million colones, with agricultural imports absorbing 70.6 percent and industrial imports from the rest of the world 25.7 percent of this reduction. The rest was absorbed by industrial imports from Central America (3.6 percent). Finally, by controlling agricultural imports and promoting agricultural exports, with no policy action undertaken for industrial trade with the rest of the world, while the industrial and agricultural production policies are emphasized, generated a level of total output of 58498.5 million colones with agricultural output and imports greatly diminished but total imports unchanged at their base run level (E-2B).

These findings suggest that the growth of total output in Costa Rica depends very little on Central American imports of machinery, equipment and intermediate products, but depends highly on agricultural imports of machinery and inputs. It will be shown that total output also depends highly on industrial imports of machinery, equipment and intermediate products from the rest of the world. They also suggest that a depreciation of the free market exchange rate diminishes total output, slowing down development, with agricultural imports absorbing most of the import-reducing effect of the depreciation, and that an exchange rate unification tends to improve development if accompanied by an emphasis on production policies when agricultural imports are not controlled.

Macroeconomic Results When the Production Policies are not Emphasized

Let us look at the total output trade-off between E-1A and E-1B in which the production policies are not emphasized. In the first one, industrial imports from the rest of the world are not controlled, but in the second one they are, causing a decline in total output of 11710.5 million colones and of 1637.7 million colones in total imports, with agricultural imports absorbing 70.6 percent and industrial imports from the rest of the world 25.7 percent of this reduction. The rest of the reduction was absorbed by industrial imports from Central America. Observe also that a direct relationship between the industrial production policy and the import controlling policy on industrial imports from the rest of the world has been found, since everytime these imports are controlled industrial output decreases.

The same behavior occurs again by looking at the total output trade-off between E-1C and E-1D which simulate the effect of a depreciation of the free market exchange rate. When industrial imports from the rest of the world are controlled (E-1D), the loss in total output reaches 10299.2 million colones and total imports decline by 1440.4 million colones, with agricultural imports absorbing 70.6 percent and industrial imports from the rest of the world 25.7 percent of the reduction. Note that in this case the levels of total output and total imports are inferior to the ones in the former pair of experiments, reflecting the reinforcing effect of the depreciation of the free market exchange rate on the import controlling policy. As total imports decline so does total output, owing to a positive relationship between output and imports in the model. These findings suggest that good economic management ability is needed when it comes to implementing and managing the exchange rate policy (depreciation of the free market exchange rate) since it will not only reinforce a policy aimed at controlling industrial imports from the rest of the world but also will decrease industrial imports from Central America and agricultural imports in a greater magnitude than would have otherwise occurred by controlling imports from the rest of the world only. This reinforcing behavior of the exchange rate policy contributes to a deeper decline in total output and to lower rates of development.

Finally, an exchange rate unification on top of the depreciation of the free market exchange rate (experiments E-1E and E-1F which turned out the same results as E-1C and E-1D) did not have any effect on the level of total output beyond the reducing effects of the depreciation of the exchange rate. So it can be stated that an

exchange rate unification will not affect the level of total output and imports, since the overvalued exchange rate applies to industrial exports to Central America and to agricultural exports, not to imports.

Macroeconomic Results When the Production Policies are Given the Same Degree of Policy Emphasis

Regarding the dependence of total output on agricultural imports, let us look at the effects on total output of the trade-off between industrial trade with the rest of the world and agricultural trade, provided by experiments E-2A (which turned out the same results as E-1A) and E-2B. In the first one, agricultural imports are not controlled, but in the second one they are, causing a sharp decline in total output of 6889.7 million colones and of 1301.5 million colones in agricultural imports. However, the level of total imports did not change since the reduction in agricultural imports was offset by an equal increase in industrial imports to meet an increase in industrial output due to an emphasized industrial production policy (note that industrial imports from the rest of the world are not being controlled, so industrial output is free to follow the emphasized industrial production policy). Observe also that the import controlling policy on agricultural imports drove agricultural output down by 11327.0 million colones, to a magnitude almost equal to the very low actual 1979 level of 7451.3 million colones, more than offsetting the policy emphasis on the agricultural production policy. Thus, the increase in industrial output was not enough to offset the sharp decline in agricultural output and prevent total output from declining, even with an unchanged

level of total imports. The same findings are provided by experiments E-3A and E-3B.

When a depreciation of the free market exchange rate is implemented in situations E-2A and E-2B (experiments E-2C, which turned out the same results as E-1D, and experiment E-2D), total output decreases; however, the decrease is less when agricultural imports are controlled. Also, agricultural exports are hurt by the depreciation of the exchange rate, in spite of an emphasized export promotion policy for agricultural exports. In fact, when agricultural imports are controlled in E-2D, total output and imports increase slightly (371.2 million colones for each one) over the uncontrolled agricultural imports total output level (E-2C), and agricultural imports decline sharply. Total imports increase because the reduction in agricultural imports is more than offset by an increase in industrial imports to meet an increase in industrial output due to an emphasized industrial production policy (note that industrial output is free to increase due to an emphasized industrial production policy since industrial imports from the rest of the world are uncontrolled). Observe that the sharp decline in agricultural imports, in this case, drove agricultural output to the lowest level of all experiments (5983.8 million colones), more than offsetting the policy emphasis on the agricultural production policy. A reduction in agricultural exports also contributed to this large decline in agricultural output. Total output increased because the decline in agricultural output was more than offset by the increase in industrial output. Note that in this pair of experiments the levels of total output and imports involved are inferior to the ones in the experiments E-2A and E-2B, reflecting the effect of the depreciation

of the free market exchange rate on total imports, and, in turn, on total output. However, the finding that total output and imports increased slightly when agricultural imports are controlled, shows that the exchange rate policy (depreciation) hurts agricultural development far more than industrial development. The key to understanding this phenomenon is found in the production policies. In fact, when agricultural imports are controlled as in E-2B, this controlling policy more than offsets the policy emphasis on agricultural production, resulting in sharp decreases in agricultural output (60.3 percent) and agricultural imports (61.2 percent). The decreases are accentuated (an extra 19.7 percent loss in agricultural output) by depreciating the free market exchange rate, as in E-2D. However, when industrial imports from the rest of the world are controlled, as in E-2A, the policy emphasis on industrial production offsets the policy emphasis on controlling these industrial imports, so that industrial output remains unchanged at its base run level of 19234.1 million colones. It takes a depreciation of 632.5 percent of the free market exchange rate in order to obtain a small 9.5 percent decrease in the level of industrial output under these circumstances. Of course, when industrial imports from the rest of the world are not controlled, industrial output is free to respond upward to an emphasized industrial production policy, and a depreciation of the exchange rate under these circumstances does not prevent industrial output from increasing.

These findings show that the production policies are the major factor explaining why a depreciation of the free market exchange rate hurts agricultural development more than industrial development. Basically, what is involved here is the existence of a heavy inverse

relation between the agricultural production policy and the exchange rate policy, through the import-reducing effects of the depreciation on agricultural imports. This same relationship explains, in turn, the inverse relationship between total output and the exchange rate policy. A lower level of agricultural exports generated by the depreciation of the exchange rate contributed also to maintaining the inverse relation between the agricultural production policy and the exchange rate policy. The independence of the industrial production policy from the policy controlling industrial imports from the rest of the world is so strong that it takes an explosive depreciation of the exchange rate, on top of a policy controlling industrial imports from the rest of the world, to cause a small decline in the level of industrial output.

An exchange rate unification (experiments E-2E and E-2F, with E-2F providing the same results as E-2B) improved development by reversing the negative effect of the depreciation of the exchange rate on total output, when agricultural imports are controlled (E-2F), exactly offsetting the extra 19.7 percent loss experienced in agricultural output, and increasing industrial output. This result can be explained by looking at the effect of the exchange rate unification on agricultural and industrial exports. When agricultural imports are controlled and agricultural exports promoted (E-2F), the exchange rate unification reinforces the policy emphasis on promoting agricultural exports, offsetting the negative effect of the depreciation of the free market exchange rate on these exports. As agricultural exports increase, a reinforced agricultural export promotion policy tends to offset part of the negative effect of the depreciation of the exchange rate (on top of a policy controlling agricultural imports) on

agricultural output, so that agricultural output increases to meet the increase in agricultural exports. As agricultural exports increase, so do total exports and, in turn, agricultural and total output.

The reinforcing effect of the exchange rate unification on the industrial export promotion policy can be visualized as follows. As the exchange rate unification is implemented and industrial exports to the rest of the world are emphasized (E-2E), industrial exports decline because industrial exports to Central America are driven down to zero in spite of the exchange rate incentives brought about by a depreciation of 847.3 percent of the overvalued exchange rate. This behavior is due to a greater export promotion policy emphasis on industrial exports to the rest of the world relative to industrial exports to Central America, whose policy emphasis is kept constant at its original level. As industrial exports decline, so do total exports and in turn industrial and total output. However, when industrial exports to the rest of the world are not emphasized (E-2F), industrial exports increase since industrial exports to Central America are driven back from the zero level to their maximum level of 1637.7 million colones due to the incentives created by the exchange rate unification, because in this case the policy emphasis on promoting this type of exports is kept constant, and industrial exports to the rest of the world were not diminished in spite of a zero policy emphasis on the industrial export promotion policy. As industrial exports increase, so do total exports and in turn industrial and total output. A section of this chapter discussing the role of exports in economic development will be presented below.

To summarize, when a trade-off between industrial trade with the rest of the world and agricultural trade is considered, total output declines sharply whenever agricultural imports are controlled because agricultural output experiences a large decline due to a much lower level of agricultural imports. A depreciation of the free market exchange rate accentuates this decline, but an exchange rate unification improved total output by exactly offsetting the decline experienced in agricultural output when the depreciation of the free market exchange rate was implemented, due to an improvement in the level of agricultural exports. Industrial output tends to be independent of a controlling policy on industrial imports from the rest of the world and much less affected by a depreciation of the free market exchange rate than is agricultural output.

Let us consider now the effects on total output of the trade-off between industrial trade with Central America and agricultural trade when, first, a depreciation of the free market exchange rate, and, second, an exchange rate unification are implemented.

The trade-off between experiments E-3C (with the same results as E-1A) and E-3D (with the same results as E-2D), simulating the effect of a depreciation of the exchange rate, shows that whenever agricultural imports are controlled (E-3D) total output and imports decrease sharply, and so do agricultural output and agricultural imports. Observe that these levels of total output and imports are less than in experiment E-3B, reflecting the import-reducing effects of the depreciation of the exchange rate on total imports. Also, they are equal to the levels generated by experiment E-2D, which implies that the depreciation of the exchange rate has the same effects on total

output and imports no matter from which trading area industrial imports are left uncontrolled. The relationship between the agricultural production policy and the exchange rate policy, and between total output and the exchange rate policy, is the same as outlined before. But the relationship between the industrial production policy and the import controlling policy on industrial imports differs slightly. The difference is found in the extent of the effect of the policies controlling industrial imports from Central America, and controlling industrial imports from the rest of the world, on the industrial production policy. For instance, in experiment E-3A, the emphasis on the industrial production policy offsets the policy controlling industrial imports from Central America, which is the same findings as for the effect of this production policy on the policy controlling imports from the rest of the world (E-2A). However, the effect on industrial output of the policy controlling industrial imports from Central American is so weak, that even an explosive depreciation of the exchange rate on top of this policy was not strong enough to reduce the level of industrial output as happened in experiment E-2C, so that industrial output remained unchanged at its base run level (E-3C). This finding suggests that, although the exchange rate policy has a much weaker effect on industrial output than it does on agricultural output, it does have a differential effect on industrial output depending on the trading area from which industrial imports are being controlled. That is, an explosive depreciation of the free market exchange rate on top of a policy controlling industrial imports will hurt industrial output only if industrial imports from the rest of the world are being controlled. This result also confirms our earlier

finding that the growth of output in Costa Rica depends very little on industrial imports from Central America.

An exchange rate unification (E-3E and E-3F) worsens development by accentuating the decline in total output by 167.2 additional million colones when agricultural imports are controlled (E-3F). However, agricultural output is improved and industrial output decreased. The export-promoting effects of the exchange rate unification on exports is the rationale for understanding this finding. As in the case of the trade-off between industrial trade with the rest of the world and agricultural trade, in this case, when agricultural imports are controlled and agricultural exports promoted (E-3F), the exchange rate unification reinforces the agricultural export promotion policy more than offsetting the effect of the depreciation of the free market exchange rate (on top of a policy controlling agricultural imports) on reducing agricultural output (E-3D), so that, as agricultural exports increase so does agricultural output. Industrial output decreases in response to a decline in industrial exports to Central America, which are driven down to the zero level because of a lack of policy emphasis on export promotion policy, in spite of the exchange rate incentives brought about by an explosive depreciation of the overvalued exchange rate. The decline in industrial output is large enough to more than offset an emphasized industrial production policy and, in turn, offset the increase in agricultural output, so that total output decreases.

Summarizing, when the trade-off between industrial trade with Central America and agricultural trade is considered, total output declines sharply as agricultural imports are controlled, a depreciation

of the free market exchange rate accentuates this decline, and an exchange rate unification adds a further decline in total output by reinforcing the decline experienced when implementing the depreciation of the free market exchange rate. This last result is due to the high downward sensitivity of industrial exports to Central America to a zero policy emphasis on the industrial export promotion policy to Central America. Industrial output is independent of a controlling policy on industrial imports from Central America even when a depreciation of the exchange rate is implemented.

Macroeconomic Results When the Production Policies are Given Differential Degrees of Policy Emphasis

Let us consider now the effect of the production policies on total output in more detail by looking at experiments E-4A and E-4B (which turned out the same results as E-2B and E-1A), presenting a trade-off between the industrial and agricultural production policies when the industrial trade policy with the rest of the world and the agricultural trade policy are given the same degree of policy emphasis.

Clearly, total output declines whenever there is a zero policy emphasis on the agricultural production policy, and increases whenever this policy is emphasized. The key to understanding this finding is the fact that industrial output is much less sensitive downward to changes of policy emphasis on the industrial production policy, than agricultural output is to changes of policy emphasis on the agricultural production policy. In fact, when there is a zero policy emphasis on the industrial production policy (E-4B), industrial output decreases by 18.7 percent but agricultural output decreases by 60.3 percent

when there is a zero policy emphasis on the agricultural production policy (E-4A). Thus, the direct relationship between the decline in total output and a zero policy emphasis agricultural production policy is based on the finding that the 60.3 percent loss in agricultural output, with a zero emphasis agricultural production policy, more than offsets a 23.1 percent increase in industrial output when the industrial production policy is emphasized at the same time. Exactly the same findings are provided by experiments E-5A and E-5B.

When a depreciation of the free market exchange rate is implemented in situations E-4A and E-4B, the levels of total, industrial and agricultural output and imports decrease (experiments E-4C and E-4D, with E-4D providing the same results as E-1B). The decrease in total output is larger when there is a zero policy emphasis on the agricultural production policy (E-4C), because of a greater decline in agricultural output due in part to the reinforcing effect of the depreciation of the exchange rate on the policy controlling agricultural imports. So a greater decline in agricultural imports contributes to a larger decline in agricultural output. Another contributing factor to the decline in agricultural output is the reinforcing nature of the export-promoting effects of the depreciation of the exchange rate on the policy emphasis on promoting industrial exports to the rest of the world, relative to promoting agricultural exports and industrial exports to Central America. This differential export-promoting effect of the depreciation of the exchange rate creates a disparity of policy emphasis on export promotion policies, which reduces agricultural exports in 162.9 million colones, and drives industrial exports to Central America down to the zero level. The decline in agricultural

exports adds to a further decline in agricultural output and, in turn, in total output. In fact, a zero policy emphasis agricultural production policy reduces total output by 1417.1 additional million colones when the depreciation of the exchange rate is implemented, as compared with situation E-4D in which the agricultural production policy is being emphasized. Furthermore, there is a complete independence of total output from the industrial production policy. This independence is due, in turn, to the fact that when the depreciation of the exchange rate is implemented, industrial output turned out to be independent of the industrial production policy, too, since no matter when the emphasis on this policy is, industrial output does not change. The latter remains fixed at 17594.4 million colones, reflecting only the effect of the depreciation of the exchange rate. The total independence of industrial output from the industrial production policy is explained by two factors. First, the depreciation of the exchange rate reinforces the policy emphasis on the policy controlling industrial imports from the rest of the world, driving industrial imports to a minimum level, so there is a fixed lower amount of output compatible with that level of industrial imports. Second, the depreciation of the exchange rate also reinforces the policy emphasis on promoting industrial exports to the rest of the world, relative to the policy emphasis on promoting industrial exports to Central America, which is kept constant at its original level. This disparity of degrees of policy emphasis on industrial export promotion drives industrial exports to Central America down to the zero level and, thus, acts as the second factor contributing to the lower level of industrial output.

These results confirm our earlier findings that there is, first, an inverse relationship between total output and the depreciation of

the exchange rate. Second, that there is also a strong inverse relationship between the agricultural production policy and the depreciation of the exchange rate. This second finding explains our first one. Third, industrial output tends to be insensitive to changes of policy emphasis on the industrial production policy and completely independent when a depreciation of the exchange rate is implemented. Fourth, that although industrial output tends to be independent of the effects of a depreciation of the exchange rate, it does decline when industrial imports from the rest of the world are controlled as the depreciation of the exchange rate is implemented.

The implementation of an exchange rate unification in experiments E-4C and E-4D will improve development by offsetting 162.9 million colones of the loss in total output caused by the depreciation of the free market exchange rate, when there is a zero policy emphasis on the agricultural production policy (E-4E). This is the only different effect of an exchange rate unification on the economy, since all other results found when the depreciation of the exchange rate was carried on remained unchanged (experiment E-4F, which turned out the same results as E-1B). The observed improvement in total output is due to the fact that the depreciation of the overvalued exchange rate reinforces the export promotion policy on agricultural exports, offsetting the decline in these exports originating in the disparity of policy emphasis on export promotion policies created when the depreciation of the free market exchange rate was implemented. Since agricultural exports increase, so does agricultural output and, in turn, total output.

Similar findings are obtained when the trade-off between the industrial and agricultural production policies is considered, given

that the same policy emphasis is applied to the industrial trade with Central America and the agricultural trade, as the depreciation of the free market exchange rate is implemented (experiments E-5C and E-5D, providing the same results as E-2D and E-1A respectively). Again, the depreciation of the free market exchange rate slows down development by decreasing agricultural output and imports and, in turn, total output, but only when there is a zero policy emphasis on the agricultural production policy (E-5C). Industrial output remains unchanged at its base run level of 19234.1 million colones. Thus, the depreciation of the exchange rate contributes to the decline in total output by reinforcing the policy emphasis on controlling agricultural imports, and as agricultural imports decline so does agricultural output and, in turn, total output. A second factor contributing to the decline in total output is the disparity in policy emphasis on export promotion policies created by the depreciation of the exchange rate. Since agricultural exports are discriminated against adversely, as they decline so does agricultural output and, in turn, total output. Observe that industrial exports to Central America remained unchanged at their maximum value in spite of the depreciation of the exchange rate, since in this case, as the export promotion policy towards promoting industrial exports to Central America is emphasized more relative to the export promotion policy towards promoting industrial exports to the rest of the world, the disparity in policy emphasis on export promotion policies created by the depreciation of the exchange rate is not enough to offset the policy emphasis on industrial exports to Central America, as it is, for example, in the case of experiment E-4C. Thus, industrial exports to Central American remain unchanged at their base run level of 1637.7 million colones. Finally, industrial output is

independent of any change of policy emphasis on the industrial production policy and of the effect of the depreciation of the exchange rate, since it remains unchanged at its base run level of 19234.1 million colones, in spite of the fact that the policy emphasis on controlling industrial imports from Central America is being reinforced by an explosive depreciation of the exchange rate. The total independence of industrial output from the industrial production policy is explained by the fact that industrial output depends very little on industrial imports from Central America, and also by the fact that as industrial exports to Central America are being emphasized more relative to industrial exports to the rest of the world, the disparity in policy emphasis created by the depreciation of the exchange rate does not drive industrial exports to Central America down to the zero level.

The implementation of an exchange rate unification (experiments E-5E and E-5F, with the latter providing the same results at E-1A) improves development by offsetting 1470.5 million colones of the loss in total output caused by the depreciation of the free market exchange rate when there is a zero policy emphasis on the agricultural production policy (E-5E). All other results (E-5F) remain the same as when the depreciation of the exchange rate was implemented. Again, the improvement in total output is due to the fact that agricultural output increased because the depreciation of the overvalued exchange rate reinforced the policy emphasis on promoting agricultural exports, offsetting the decline experienced in these exports when the depreciation of the free market exchange rate was implemented. Observe that the improvement in development when the exchange rate unification is carried on, is much greater in the case when industrial trade with Central America is emphasized (E-5E) than when industrial trade with

the rest of the world is emphasized (E-4E). This is because first, in the latter case, industrial output decreased by a larger amount when the depreciation of the free market exchange rate was implemented, and the policy controlling industrial imports from the rest of the world was being emphasized due to a lower level of industrial imports from the rest of the world. Second, the exchange unification did nothing to increase industrial exports to Central America, which remained at the zero level due to the disparity in policy emphasis on export promotion policies created by the depreciation of the exchange rate.

These results confirm our earlier finding that, for development purposes, industrial imports from Central America are not as important a constraint as industrial imports from the rest of the world are on industrial and total output growth. They also confirm the finding that agricultural imports are an important constraining factor on agricultural output growth and in turn on total output growth. The analysis of these findings has shown clearly that, for development purposes, industry is the dominating activity in the economy since industrial output is much less affected than agricultural output is, by adverse changes of policy emphasis on the production policy, by the slowing down effects on output of controlling imports of machinery and inputs, and by the import-diminishing effects of a depreciation of the free market exchange rate. In fact, only when industrial imports from the rest of the world are controlled does industrial output decrease to some extent. It is clear, also, that the potential of the agricultural sector for further development is very high, given that appropriate development policies be properly implemented to develop this sector.

The perception of Costa Rica's government in the late 1950's that development would be accelerated if based heavily on industrialization was misleading, since our results have shown that total output is greater whenever the agricultural production policy is emphasized and the industrial production policy is at the zero level of policy emphasis. In fact, during the last two decades the Costarican government did not pay much attention to determining the benefits for economic development of further developing the agricultural sector, because the dominating thought of those in charge of economic planning and management was that the many and complex problems that beset the agricultural sector, some of which were discussed in Chapter II, are a reflection of the sector's lack of dynamism and inability for further growth, instead of a reflection of the urgent need for appropriate development policies and institutional changes in order to achieve the tremendous potential of this sector for further development. In general, the neglecting of the agricultural sector's potential for growth and the adverse policies towards the sector's activities adopted by Costa Rica during the last two decades made the sector's performance worse than it would otherwise have been.

Macroeconomic Results for Industrial and Agricultural Exports

Industrial exports tend to be very sensitive downward in response to a zero policy emphasis export promotion policy, particularly industrial exports to Central America. Agricultural exports are less sensitive downward than industrial exports; however, they decline in response to a depreciation of the free market exchange rate even if

the agricultural export promotion policy is emphasized. A closer look at the behavior of exports reveals the following findings.

Agricultural Exports. Agricultural exports decline when there is a depreciation of the free market exchange rate, and recover from this decline when an exchange rate unification is implemented, given the following qualification. When the trade-off between industrial trade (with any of the areas) and agricultural trade is considered (experiments E-2A, E-2B, and E-3A, E-3B), agricultural exports decline with the implementation of the depreciation of the exchange rate only when the export promotion policy on agricultural exports is emphasized (E-2D and E-3D). This finding shows that the depreciation of the exchange rate is so explosive that as its import-reducing effects reinforce the policy controlling agricultural imports, agricultural output is driven down to reach its lowest level of 5983.8 million colones. As agricultural output declines so heavily, so do agricultural exports, offsetting the policy emphasis on promoting agricultural exports. It also reflects to some extent the behavior of agricultural businessmen when the depreciation of the free market exchange rate is implemented. Namely, businessmen in the agricultural sector tend to be discouraged by the way in which the government manages the exchange rate policy for promoting exports. That is, agricultural exports are not only discriminated against, but industrial exports are at the same time being promoted by conversion of dollar earnings into colones at an exchange rate that not only is higher than the one that is applied for converting agricultural export earnings into colones, but one that has also been depreciated by 632.5 percent. The paradoxical result is that an

explosive depreciation of the exchange rate creates such a disparity in export incentives between the industrial and the agricultural sectors, that agricultural exports will decline regardless of any effort to promote these exports.

An exchange rate unification reverses the effect on agricultural exports of the depreciation of the exchange rate by creating incentives for agricultural businessmen to export agricultural products. These incentives are brought about by depreciating the overvalued exchange rate by 847.3 percent, so that agricultural exports increase to their maximum level of 4566.4 million colones (E-2F and E-3F), even with a zero policy emphasis on agricultural export promotion policy (E-2E and E-3E).

Agricultural exports decline also with the depreciation of the exchange rate when there is a zero policy emphasis on the agricultural production policy (experiments E-4C and E-5C). Here agricultural exports decline even with an emphasized export promotion policy, since the lack of policy emphasis on the agricultural production policy is reinforced by the disparity in export incentives created by the depreciation of the free market exchange rate. Thus, agricultural exports decline not only due to a drastic decline in agricultural output but also due to the negative effect of the disparity in export promotion incentives, which works towards diminishing these exports. Again, an exchange rate unification reverses the negative effect of the depreciation of the exchange rate on agricultural exports, even with the zero policy emphasis on agricultural production policy in effect.

Industrial Exports to the Rest of the World. Industrial exports to the rest of the world are in general insensitive downwards to changes

of policy emphasis on the export promotion policy, and to either kind of exchange rate policy. However, in two situations these exports showed some degree of sensitivity.

The first situation is given by experiments E-1A and E-1B. Although these exports did not respond to any changes of policy emphasis on the export promotion policy, they did respond downward to a depreciation of the free market exchange rate. This downward response was stronger with a zero policy emphasis on export promotion policy (E-1C) than with an emphasized export promotion policy (E-1D). The reason for this behavior of industrial exports to the rest of the world is that the depreciation of the free market exchange rate has a twofold effect. First, it reinforces the policy emphasis on controlling industrial imports. As these imports decline so does industrial output and, in turn, industrial exports to the rest of the world. Second, it reinforces the policy emphasis on the export promotion policy of industrial exports to the rest of the world. However, the import-reducing effects turned out to be stronger than the export-promoting effects, and a zero policy emphasis export promotion policy does nothing to offset part of the import-reducing effects of the depreciation of the exchange rate. Thus, as industrial imports and output decline, industrial exports to the rest of the world experience a larger decline than it would have otherwise experienced had the export promotion policy been emphasized.

An exchange rate unification did nothing to change the reducing effects on industrial exports to the rest of the world of the depreciation of the exchange rate, since the overvalued exchange rate does not apply to these exports.

The second situation is given by experiments E-2A and E-2B, in which the production policies are being emphasized. Again, industrial exports to the rest of the world did not respond to any change of policy emphasis on the export promotion policy. A depreciation of the free market exchange rate reduced these exports, but only when the export promotion policy was emphasized (E-2C), and an exchange rate unification did not change the results of the depreciation of the free market exchange rate (E-2E). This behavior of industrial exports to the rest of the world is explained by the same reasons just mentioned. Basically, the import-reducing effects of the depreciation of the exchange rate are stronger than the export-promoting effects, and since the export promotion policy is being emphasized, part of the import-reducing effect is offset, so that, in this case industrial exports to the rest of the world are larger than in the case of experiment E-1C.

These findings suggest that, in general, industrial exports to the rest of the world are insensitive to changes of policy emphasis on the export promotion policy, and tend to be insensitive to either kind of exchange rate policy. However, it takes an explosive depreciation of the free market exchange rate when there is a zero policy emphasis on the export promotion policy to cause a large decrease in these exports (E-1C). Another situation in which these exports decline is when an emphasized export promotion policy offsets part of the import-reducing effect of the depreciation of the exchange rate on industrial imports from the rest of the world (E-2C). Thus these exports experience a smaller decline than in the previous situation. Finally, the finding that these exports declined when a depreciation of the free market exchange rate is implemented, in spite of the tremendous incentives for

increasing them, brought about by this depreciation, reflects the following behavior of industrialists. When the government depreciates the free market exchange rate, industrialists tend to be discouraged from venturing exporting to the rest of the world, because the explosive depreciation of the exchange rate creates the wrong kind of export incentives. For instance, exporters will realize risk-free profits by means of capital flight of their international assets, mainly dollar holdings, depositing these assets in foreign banks before the depreciation of the exchange rate takes place, and thereafter retrieving these funds to the country to convert them into colones at the new and higher exchange rate. A factor facilitating this type of transaction was the relative lack of control and regulation of the local foreign exchange market on part of the Central Bank during the period under study.

Industrial Exports to Central America. These exports turned out to be highly sensitive downwards in response to a zero policy emphasis on export promotion policy (for example E-1B), and also to the situation where the depreciation of the free market exchange rate is implemented, given that the export promotion policy towards industrial exports to the rest of the world is emphasized more relative to the export promotion policy towards these exports. In fact, whenever these conditions are met, industrial export to Central America are driven down to the zero level (for example E-2C). The depreciation of the exchange rate under these circumstances works always against these exports by reinforcing the policy emphasis on the export promotion policy towards industrial exports to the rest of the world.

An exchange rate unification will improve industrial exports to Central America only if the export promotion policy towards these exports is emphasized more than the export promotion policy towards industrial exports to the rest of the world.

These findings suggest the paradoxical conclusion than an export promotion policy for industrial exports to Central America has to be maintained just to prevent the current level of industrial exports to this market from being driven down to the zero level. Also, the high downward response of these exports to a decrease of emphasis on the export promotion policy reflects the tremendous sensitivity of these exports to disruptions of trade in the Central American Common Market due to political instability in that area. Some of the problems generating this type of instability were discussed in Chapter II. The negative repercussions of this political instability on Central American trade act to nullify any policy emphasis placed by Costa Rica on export promotion policy to this market.

Macroeconomic Results for the Balance of Trade

Let us consider now the impact on the balance of trade of pursuing different development policies. In general, our results (Table XXIV) show that the industrial trade balance with the rest of the world (π_I^{RW}) is always in defict no matter what policies are followed, that the agricultural trade balance (π^A) is always in surplus, and that the industrial trade balance with Central America (π_I^{CA}) is in deficit only when adverse policies towards the industrial trade with Central America are implemented. They also show that, when the industrial trade balance with Central America is in surplus, the agricultural trade balance

TABLE XXIV

INDUSTRIAL TRADE BALANCE WITH CENTRAL AMERICA AND THE REST OF THE WORLD AND AGRICULTURAL AND TOTAL TRADE BALANCES: NO-IMPORT SUBSTITUTION AND IMPORT SUBSTITUTION VERSIONS

Experiment	No IS Version				IS Version			
	π_I^{CA}	π_I^{RW}	π^A	π^T	π_I^{CA}	π_I^{RW}	π^A	π^T
	Million Colones							
E-1A	-994.0	4442.1	-2441.6	1006.5	-991.0	4463.7	-2466.2	1006.5
E-1B	585.0	4020.4	-3598.9	1006.5	-991.0	4463.7	-2466.2	1006.5
E-2B	-835.0	5584.5	-3743.1	1006.5	-835.0	5584.5	-3743.1	1006.4
E-1C	-1008.4	4740.1	-2725.2	1006.5	-991.0	4463.7	-2466.2	1006.5
E-1D	577.7	4171.6	-3743.1	1006.5	91.3	4152.3	-3237.0	1006.6
E-2D	-994.0	4442.1	-2441.5	1006.6	-994.0	4442.1	-2441.5	1006.6
E-4C	585.0	4020.4	-3598.9	1006.5	91.3	4152.3	-3237.0	1006.6
E-2E	577.7	4171.9	-3743.1	1006.5	91.3	4152.3	-3237.0	1006.6
E-3E	-994.0	4442.1	-2441.6	1006.5	-991.0	4463.7	-2466.2	1006.5
E-3F	585.0	4020.4	-3743.1	862.3	582.1	4167.2	-3743.1	1006.2
E-4E	585.0	4020.4	-3743.1	862.3	34.3	4167.5	-3743.1	458.7
E-5E	-994.0	4442.1	-3743.1	-295.0	-994.0	4442.1	-3743.1	-295.0

Notes: $\pi_I^{CA} = M^{I_{CA}} - E^{I_{CA}}$; $\pi_I^{RW} = M^{I_{RW}} - E^{I_{RW}}$; $\pi^A = M^A - E^A$; $\pi^T = \pi_I^{CA} + \pi_I^{RW} + \pi^A$. π^T does not include imports of the Rest of the Services and Commerce sectors.

surplus is much greater than the Central American industrial trade surplus, but that the industrial trade balance deficit with the rest of the world is large enough to more than offset both surpluses and always generate a deficit in the total trade balance (π^T). Furthermore, the total trade balance of Costa Rica turned out to be in deficit in all the experiments but one. Our findings can be summarized in greater detail as follows.

1. As to industrial trade with Central America, whenever the export promotion policy and the policy controlling industrial imports from this market are at the zero policy emphasis level, industrial trade with this market turns into deficit, since industrial export to Central America are driven down to the zero level and industrial imports from this market experience a small decline (E-1B). A depreciation of the free market exchange rate will reduce industrial imports from this market, improving the Central American industrial trade balance, since industrial exports to this market remain at the zero level (E-1D). The deficit will worsen, again, if the export promotion and import control policies towards the industrial trade with the rest of the world are emphasized more relative to the same policies towards the industrial trade with Central America, when the depreciation of the exchange rate is implemented (E-4C). The worsening of the Central American industrial trade balance in this case is explained, again, by the fact that industrial exports to this market are driven down to the zero level, not only due to a greater policy emphasis on the export promotion policy towards exporting industrial products to the rest of the world relative to exporting industrial products to Central America, but also due to the disparity in policy emphasis on export promotion policies towards both markets created by the depreciation of the exchange rate.

An exchange rate unification has no effect on the Central American industrial trade balance, since all of the trade balances obtained for this market, after the exchange rate unification has been implemented, are the same ones that were generated when the depreciation of the free market exchange rate was first implemented. In the experiment E-3F, the exchange rate unification apparently worsens the trade balance with this market as compared with E-3E. However, it is not the exchange rate unification that causes this worsening, but the change of policy emphasis on the export promotion policy. In fact, in E-3F with a zero policy emphasis on the export promotion policy, industrial exports to Central America are driven down to the zero level, while in E-3E with an emphasized export promotion policy, they stay at their maximum value. In both cases an exchange rate unification has been implemented.

2. As to industrial trade with the rest of the world, whenever the export promotion and the import controlling policies towards the industrial trade with this market are emphasized (E-1B), the industrial trade balance with this market will be improved, because the import control policy reduces industrial imports from this market, and as these imports decline, so does industrial output. Observe that the industrial production policy emphasis is kept constant at its original level. If the industrial production policy is emphasized while a zero policy emphasis is applied on the export promotion and import controlling policies towards the industrial trade with this market, the industrial trade balance with this market will worsen (E-2B). The reason for this result is that industrial imports from the rest of the world will increase to meet most of the increase in industrial output, since these imports are not being controlled, and industrial exports to this

market are insensitive downwards to a zero policy emphasis on the export promotion policy.

A depreciation of the free market exchange rate will improve the industrial trade balance with this market, when the industrial trade policy towards industrial trade with this market is emphasized more relative to the industrial trade policy towards industrial trade with Central America, even if the industrial production policy is being emphasized (E-4C), because the import controlling policy is being reinforced by the depreciation of the exchange rate, so that industrial imports from this market decline and, in turn, industrial output. Industrial exports to this market remain unchanged.

An exchange rate unification has no effect on the rest of the world industrial trade balance. The trade balance shown by E-4E is the same one that was generated when the depreciation of the free market exchange rate was first implemented. However, the exchange rate unification improved the trade balance with this market indirectly, through its export-promoting effect on agricultural exports (E-3F). As agricultural exports increase with the exchange rate unification, so does agricultural output, but at the expense of industrial output. As industrial output declines, so do industrial imports from the rest of the world to meet most of the decline in output. This improves the trade balance, since industrial exports to this market remain unchanged.

3. As to agricultural trade, when the import controlling policy towards agricultural imports is emphasized, agricultural imports decline and so does agricultural output, improving the agricultural trade balance (E-2B).

A depreciation of the free market exchange rate will improve the agricultural trade balance, even if the policy emphasis on the agricultural import controlling policy is held constant, because the depreciation of the exchange rate will reinforce the policy emphasis on the import controlling policy reducing agricultural imports and output (E-1D).

Regarding an exchange rate unification, the agricultural trade balance turned out to be much more sensitive than both industrial trade balances, to the export-promoting effect of the exchange rate unification. Although the agricultural trade balances shown in E-2E and E-3E are the same ones generated when the depreciation of the free market exchange rate was first implemented, the exchange rate unification did improve this trade balance in experiments E-3F, E-4E, and E-5E. In all these cases, clearly, the export-promoting effect of the unification increases agricultural exports and, in turn, agricultural output. As agricultural output increases, agricultural imports increase but less than agricultural exports rendering an improved agricultural trade balance.

4. As to the total trade balance, in general, it was insensitive to most combinations of policies, showing a fairly systematic trade deficit of 1006.5 million colones. The only case in which it turned into a surplus was when an exchange rate unification was implemented with a zero policy emphasis agricultural production policy and an emphasized industrial production policy, given that the Central American industrial trade and the agricultural trade policies are emphasized more relative to the industrial trade policy with the rest of the world (E-5E). The surplus was generated by the fact that both the Central American industrial trade and the agricultural trade balances experienced their maximum surpluses, outweighing the industrial trade

balance deficit with the rest of the world. Agricultural exports reached their maximum value due to the reinforcing export-promoting effect of the depreciation of the overvalued exchange rate on the export promotion policy. However the major factor responsible for the total trade surplus is agricultural trade, since the exchange rate unification did not affect industrial trade at all, but increased agricultural exports to their maximum value, with agricultural imports increasing much more less than agricultural exports as agricultural output increased.

Comparison of Results Generated by the Import Substitution and the No-Import Substitution Versions

Major Microeconomic Results

In general, in both versions the industrial sector is the largest in terms of output level (Tables XXIII and XXV). When a policy of import substitution industrialization is pursued, industrial output tends to increase, the magnitude of the increase varying depending on the combination of policies followed. Owing to a positive relationship in the model between industrial output and some other variables, as industrial output increases so do industrial imports and investment. Agricultural output tends to decline as import substitution industrialization is pursued, except in experiment E-1B. Since agricultural output, imports and investment are positively related in the model, as agricultural output declines, so do agricultural imports and investment. Again, the magnitude of the decline in agricultural output depends on the combination of policies followed. In general, in both versions the

TABLE XXV

SUMMARY OF POLICY EXPERIMENTS RESULTS--IMPORT SUBSTITUTION VERSION

Experiment	X^I	X^A	X^C	X^R	X^I_{KG}	X^I_{IG}	X^I_{CG}	X^I_{RG}	I^I	I^A	I^C	I^R	I^I_{KG}	I^I_{IG}	I^I_{CG}
	Million Colones														
E-1A	19317.9	18567.2	8638.9	18733.9	2890.6	3305.9	13121.4	0.0	1209.6	1486.2	390.7	1386.7	185.0	273.9	715.2
E-1B	19317.9	18567.2	8638.9	18733.9	2890.6	3305.9	13121.4	0.0	1209.6	1486.2	390.7	1386.7	185.0	273.9	715.2
E-2B	23671.4	7454.3	8638.9	18733.9	2603.4	3637.6	17430.3	0.0	1467.2	643.9	390.7	1386.7	167.4	294.6	969.4
E-1C	19317.9	18567.2	8638.9	18733.9	2890.6	3305.9	13121.4	0.0	1209.6	1486.2	390.7	1386.7	185.0	273.9	715.2
E-1D	18108.4	6882.6	8638.9	18733.9	2206.9	2780.0	13121.4	0.0	1134.4	600.6	390.7	1386.7	143.1	240.6	715.2
E-2D	19234.1	5983.8	8638.9	18733.9	2234.7	2923.8	14075.5	0.0	1201.5	532.4	390.7	1386.7	144.8	249.7	771.5
E-4C	18108.4	6882.6	8638.9	18733.9	2206.9	2780.0	13121.4	0.0	1134.4	600.6	0.0	1386.7	143.1	240.6	715.2
E-5D	19234.1	17757.0	8638.9	18733.9	2843.2	3269.4	13121.4	0.0	1204.4	1424.8	0.0	1386.7	182.1	271.6	715.2
E-2E	18108.4	6882.6	8638.9	18733.9	2206.9	2780.0	13121.4	0.0	1732.1	600.6	0.0	1386.7	143.1	240.6	715.2
E-3E	19317.9	18567.2	8638.3	18733.9	2890.6	3305.9	13121.4	0.0	1850.3	1486.2	0.0	1386.7	185.0	273.9	715.2
E-3F	18167.6	7454.3	8638.3	18733.9	2240.4	2805.7	13121.4	0.0	1737.8	643.9	0.0	1386.7	145.2	242.3	715.2
E-4E	18167.6	7454.3	8638.3	18733.9	2240.4	2805.7	13121.4	0.0	1183.1	643.9	0.0	1386.8	145.2	242.3	715.2
E-5E	19234.1	7454.3	8638.3	18733.9	3145.7	2966.9	13121.4	0.0	1203.8	643.9	0.0	1386.7	200.7	252.5	715.2

TABLE XXV (Continued)

Experiment	I^{I}_{RG}	S	M^{I}_{KG}	M^{I}_{IG}	M^{A}_{KG}	M^{A}_{IG}	M^{R}_{KG}	M^{R}_{IG}	M^{C}_{CG}	$M^{I_{CA}}_{KG}$	$M^{I_{CA}}_{IG}$	$M^{I_{RW}}_{KG}$	$M^{I_{RW}}_{IG}$	$M^{A_{CA}}_{KG}$	$M^{A_{CA}}_{IG}$
	Million Colones														
E-1A	35.3	0.0	1873.5	3745.2	1357.3	742.8	1174.9	50.1	3028.2	247.0	399.7	1626.5	3345.5	175.2	96.7
E-1B	35.3	0.0	1873.5	3745.2	1357.3	742.8	1174.9	50.1	3028.2	247.0	399.7	1626.5	3345.5	175.2	96.7
E-2B	35.3	0.0	2299.3	4596.3	515.0	308.3	1174.9	50.1	3028.2	306.8	495.8	1992.4	4100.4	64.7	36.6
E-1C	35.3	0.0	1873.5	3745.2	1357.3	742.8	1174.9	50.1	3028.2	247.0	399.7	1626.5	3345.5	175.2	96.7
E-1D	35.3	0.0	1755.3	3508.8	471.7	286.0	1174.9	50.1	3028.2	230.3	372.9	1524.9	3135.8	59.0	33.5
E-2D	35.3	0.0	1865.3	3728.8	403.5	250.8	1174.9	50.1	3028.2	245.8	397.8	1619.5	3331.0	50.1	28.6
E-4C	35.3	0.0	1755.3	3508.8	471.7	286.0	1174.9	50.1	3028.2	230.3	372.9	1524.9	3135.8	59.0	33.5
E-5D	35.3	0.0	1865.3	3728.8	1295.9	711.2	1174.9	50.1	3028.2	245.8	397.8	1619.5	3331.0	167.2	92.4
E-2E	632.9	0.0	1755.3	3508.8	471.7	286.0	1174.9	50.1	3028.2	230.3	372.9	1524.9	3135.8	59.0	33.5
E-3E	676.0	21.9	1873.5	3745.2	1357.3	742.8	1174.9	50.1	3028.2	247.0	399.7	1626.5	3345.5	175.2	96.7
E-3F	635.0	0.0	1761.0	3520.3	515.0	308.3	1174.9	50.1	3028.2	231.2	374.3	1529.8	3146.0	64.7	36.6
E-4E	35.3	0.0	1761.0	3520.3	515.0	308.3	1174.9	50.1	3028.2	231.2	374.3	1529.8	3146.0	64.7	36.6
E-5E	35.3	0.0	1865.3	3728.8	515.0	308.3	2452.2	50.1	3028.2	245.8	397.8	1619.5	3331.0	64.7	36.6

TABLE XXV (Continued)

Experiment	$A_{M_{KG}}^{RW}$	$A_{M_{IG}}^{RW}$	$R_{M_{KG}}^{CA}$	$R_{M_{IG}}^{CA}$	$R_{M_{KG}}^{RW}$	$R_{M_{IG}}^{RW}$	$C_{M_{CG}}^{CA}$	$C_{M_{CG}}^{RW}$	$T_{M_{KG}}^{CA}$	$T_{M_{KG}}^{RW}$	$T_{M_{IG}}^{CA}$	$T_{M_{IG}}^{RW}$	I_{M}^{CA}	I_{M}^{RW}	C_{M}^{CA}
	Million Colones														
E-1A	1182.1	646.0	191.2	0.0	983.7	50.1	321.1	2707.1	613.5	3792.4	496.5	4041.7	646.7	4972.1	272.0
E-1B	1182.1	646.0	191.2	0.0	983.7	50.1	321.1	2707.1	613.5	3792.4	496.5	4041.7	646.7	4972.1	272.0
E-2B	450.2	271.7	191.2	0.0	983.7	50.1	321.1	2707.1	562.9	3426.4	532.4	4422.3	802.7	6092.9	101.3
E-1C	1182.1	646.0	191.2	0.0	983.7	50.1	321.1	2707.1	613.5	3792.4	496.5	4041.7	646.7	4972.1	272.0
E-1D	412.6	252.4	191.2	0.0	983.7	50.1	321.1	2707.1	480.7	2921.2	406.5	3438.4	603.3	4660.7	92.6
E-2D	353.4	222.2	191.2	0.0	983.7	50.1	321.1	2707.1	487.2	2956.6	426.5	3603.3	643.7	4950.5	78.7
E-4C	412.6	252.4	191.2	0.0	983.7	50.1	321.1	2707.1	480.7	2921.2	406.5	3438.4	603.3	4660.7	92.6
E-5D	1128.7	618.8	191.2	0.0	983.7	50.1	321.1	2707.1	604.3	3732.0	490.2	3999.9	643.7	4950.5	259.6
E-2E	412.6	252.4	191.2	0.0	983.7	50.1	321.1	2707.1	480.7	2921.2	406.5	3438.4	603.3	4660.7	92.6
E-3E	1182.1	646.0	191.2	0.0	983.7	50.1	321.1	2707.1	613.5	3792.4	496.5	4041.7	646.7	4972.1	272.0
E-3F	450.2	271.7	191.2	0.0	983.7	50.1	321.1	2707.1	487.2	2963.8	410.9	3467.9	605.5	4675.9	101.3
E-4E	450.2	271.7	191.2	0.0	983.7	50.1	321.1	2707.1	487.2	2963.8	410.9	3467.9	605.5	4675.9	101.3
E-5E	450.2	271.7	404.5	0.0	2047.6	50.1	321.1	2707.1	715.1	4117.4	434.4	3652.9	643.7	4950.5	101.3

TABLE XXV (Continued)

Experiment	M^{A}_{RW}	M^{R}_{CA}	M^{R}_{RW}	M^{I}	M^{A}	M^{C}	M^{R}	M	$E^{I_{CA}}_{KG}$	$E^{I_{CA}}_{IG}$	$E^{I_{CA}}_{CG}$	$E^{I_{CA}}_{RG}$	$PE^{I_{CA}}_{RG}$	$E^{I_{RW}}_{KG}$	$E^{I_{RW}}_{IG}$
	Million Colones														
E-1A	1828.2	191.2	1033.8	5618.8	2100.2	3028.2	1225.1	11972.5	380.6	645.4	612.4	0.0	0.7	107.1	227.2
E-1B	1828.2	191.2	1033.8	5618.8	2100.2	3028.2	1225.1	11972.5	380.6	645.4	612.4	0.0	0.7	107.1	227.2
E-2B	722.0	191.2	1033.8	6895.7	823.3	3028.2	1225.1	11972.5	380.6	645.4	612.4	0.0	0.7	107.1	227.1
E-1C	1828.2	191.2	1033.8	5618.8	2100.2	3028.2	1225.1	11972.5	380.6	645.4	612.4	0.0	0.7	107.1	227.2
E-1D	665.1	191.2	1033.8	5264.1	757.7	3028.2	1225.1	10275.1	380.6	132.1	0.0	0.0	0.7	107.1	227.2
E-2D	575.6	191.2	1033.8	5594.2	654.4	3028.2	1225.1	10502.0	380.6	645.4	612.4	0.0	0.7	107.1	227.2
E-4C	665.1	191.2	1033.8	5264.1	757.7	3028.2	1225.1	10275.1	380.6	132.1	0.0	0.0	0.7	107.1	227.2
E-5D	1747.5	191.2	1033.8	5594.2	2007.1	3028.2	1225.1	11854.8	380.6	645.4	612.4	0.0	0.7	107.1	227.2
E-2E	665.1	191.2	1033.8	5264.1	757.7	3028.2	1225.1	10275.1	380.6	645.4	612.4	0.0	1126.3	107.1	227.2
E-3E	1828.2	191.2	1033.8	5618.8	2100.2	3028.2	1225.1	11972.5	380.6	645.4	612.4	0.0	0.7	107.1	227.2
E-3F	722.0	191.2	1033.8	5281.4	823.3	3028.2	1225.1	10358.2	24.1	0.0	0.0	0.0	0.7	107.1	227.2
E-4E	722.0	191.2	1033.8	5281.4	823.3	3028.2	1225.1	10358.2	380.6	645.4	612.4	0.0	1067.1	107.1	227.2
E-5E	722.0	404.5	2097.8	5594.2	823.3	3028.2	2502.3	11948.2	380.6	645.4	612.4	0.0	0.7	107.1	227.2

TABLE XXV (Continued)

Experiment	$E^{I_{RW}}_{CG}$	$E^{I_{RW}}_{RG}$	$E^{I_{CA}}$	$E^{I_{RW}}$	E^{I}	E^{A}	E^{C}	E^{R}	E	W^{I}	W^{A}	W^{R}
	Million Colones											
E-1A	174.1	0.0	1637.7	508.4	2146.1	4566.4	0.0	0.0	6712.5	3745.2	742.8	50.1
E-1B	174.1	0.0	1637.7	508.4	2146.1	4566.4	0.0	0.0	6712.5	3745.2	742.8	50.1
E-2B	174.1	0.0	1637.7	508.4	2146.1	4566.4	0.0	0.0	6712.5	4596.3	308.3	50.1
E-1C	174.1	0.0	1637.7	508.4	2146.6	4566.4	0.0	0.0	6712.5	3745.2	742.8	50.1
E-1D	174.1	0.0	512.0	508.4	1020.4	3994.7	0.0	0.0	5015.1	3508.8	286.0	50.1
E-2D	174.1	0.0	1637.7	508.4	2146.1	3095.9	0.0	0.0	5242.0	3728.8	250.8	50.1
E-4C	174.1	0.0	512.0	508.4	1020.4	3994.7	0.0	0.0	5015.1	3508.8	286.0	50.1
E-5D	174.1	0.0	1637.7	508.4	2146.1	4566.4	0.0	0.0	6712.5	3728.8	711.2	50.1
E-2E	174.1	0.0	512.0	508.4	1020.4	3994.7	0.0	0.0	5015.1	3508.8	286.0	50.1
E-3E	174.1	0.0	1637.7	508.4	2146.1	4566.4	0.0	0.0	6712.5	3745.2	742.8	50.1
E-3F	174.1	0.0	23.4	508.4	531.8	4566.4	0.0	0.0	5098.2	3520.3	308.3	50.1
E-4E	174.1	0.0	571.2	508.4	1079.6	4566.4	0.0	0.0	5646.0	3520.3	308.3	50.1
E-5E	174.1	0.0	1637.7	508.4	2146.1	4566.4	0.0	0.0	6712.5	3728.8	308.3	50.1

level of output, imports and investment in Commerce and Rest of the Services remained unchanged.

These findings suggest that the perception of the Costarican government in the late 1950's that economic development, understood as an increasing degree of industrialization, would be accelerated if heavily based on industrialization was right if import substitution as a developent policy was incorporated in the policy-maker's portfolio of development policies. They also show that industrial development is achieved at the expense of agriculture when import substitution is pursued, confirming our earlier finding that the potential of the agricultural sector for further growth cannot be realized if adverse policies are implemented against the development of this sector. In fact, the import substitution policy implemented by Costa Rica in the early 1960's gave full support to making industrial activities of production, investment and trade attractive and profitable for businessmen to undertake, while at the same time little attempt was made to avoid the negative impact on agricultural development of switching resources to industrialization at an accelerated path. This tremendous unbalance in development strategy contributed to an even faster decline of agricultural output and it exacerbated the already depressed economic conditions and the problems of the agricultural sector.

To illustrate the employment and income distribution effects of neglecting agriculture, let us look at the distribution of the labor force and the salary differential between rural agriculture and urban industry. Since urban industry expansion is achieved at the expense of agriculture, and the urban industry average salary is about twice the agricultural average salary (in 1972 the industrial salary was

756 colones per month and the agricultural average salary was 388 colones per month), then, the distribution of earnings between urban industry and rural agriculture tends to change in factor of urban industry. In addition, given that a major proportion of the total labor force lives in rural areas engaged in agricultural activities (this proportion went from 49.7 percent in 1963 to 41.1 percent in 1972), then, a declining agricultural sector tends to generate unemployment in rural areas, and, thus, is another contributing factor in worsening the urban-rural disparity in the distribution of income. Urban industry not only pays a much higher salary but also employs only a small proportion of the total labor force (11.4 percent in 1963 and 12.1 percent in 1972).[1]

Within the industrial sector, consumption goods production is, in general, the only profitable activity when import substitution is not being pursued. When import substitution is implemented, there is a change in the structure of the industrial sector output. In fact, capital and intermediary goods emerge as new producing activities at the expense of consumption goods. Also, industrial investment into these new industrial activities increases with output. However, consumption goods output and investment remain still the largest industrial activities, in spite of their observed declining behavior. The importance of this finding is twofold. First, it confirms our conclusion in Chapter II that import substitution helped change and dynamize the Costarican economy by creating industrial activities that did not exist before. However, industrial imports of capital and intermediary goods have increased with import substitution, since the development of these new industrial activities needed these imports

because they were not available within the country. Second, since within consumption goods industrial activities, food-oriented activities are the major ones and utilize as inputs many agricultural products in raw form, to the extent that import substitution is carried out at the expense of agricultural output, then food-oriented industrial activities output growth could be adversely affected.

Overview of Macroeconomic Results

When the import substitution policy is pursued (Table XXV), the policies that generate the highest levels of total output, and thus, the highest rates of economic development, are basically the same ones as in the no-import substitution version. These policies (as in experiments E-1A, E-1B, E-1C, E-1E, E-2A, E-3C, E-3E, and E-4B) generated the same development rate of 16.8 percent, which is equal to the one obtained in the no-import substitution version and higher than the actual 1962-1979 rate of 15.5 percent. However, with import substitution total output is 130.0 million colones less than without it. Three of these combinations of policies (E-1A, E-1C, and E-3E) are exactly the same ones that maximized total output in the no-import substitution version. The finding that total output is lower when import substitution industrialization is pursued, shows that the perception of the Costarican government in the late 1950's, that economic development, understood as a growing level of total output, would be accelerated by pursuing an import substitution industrialization policy was misleading. In fact, although industrial output tends to increase with import substitution, this increase is achieved at the expense of agricultural output. As agricultural output experiences a faster

decline with import substitution, total output tends to be lower than without import substitution. The major macroeconomic results of comparing both versions are summarized as follows.

Macroeconomic Results When the Production Policies are not Emphasized

In the import substitution version, when the production policies are not emphasized, controlling industrial imports from either trading area does not decrease the level of total output (E-1A and E-1B). In the no-import substitution version, the level of total output did not decrease only when the control on imports was placed on industrial imports from Central America.

With import substitution, a depreciation of the free market exchange rate will not decrease the level of total imports and output if the import controlling policy on industrial imports from Central America is being emphasized (E-1C). Under these circumstances an exchange rate unification will not change either total imports or output (E-1E).

In the no-import substitution version, the depreciation of the exchange rate reduced total output and imports no matter from what area industrial imports were being controlled, although the reduction in total output was much smaller if industrial imports from Central America were being controlled. An exchange rate unification did not change the results generated by the depreciation of the exchange rate.

With import substitution, total output and imports decline when a depreciation of the free market exchange rate is implemented, given that the import controlling policy on industrial imports from the rest of the world is emphasized (E-1B). Under these circumstances,

agricultural imports end up absorbing 79 percent, and industrial imports from the rest of the world, 18.3 percent, of the decline in total imports. The rest was absorbed by industrial imports from Central America. In the no-import substitution version, agricultural imports absorbed 70.6 percent, and industrial imports from the rest of the world, 25.7 percent, of this decline. The implications of these findings can be summarized as follows.

1. When the production policies are not emphasized, the growth of total output does not depend on industrial imports from Central America, but depends heavily on industrial imports from the rest of the world, when import substitution is not pursued. However, as import substitution is pursued, total output is completely independent of the effects of a controlling policy on industrial imports from either trading area.

2. A depreciation of the free market exchange rate will decrease total output and imports in both versions when the import controlling policy on industrial imports from the rest of the world is emphasized, but it will not decrease total output in the import substitution version if the policy controlling industrial imports from Central America is emphasized. This finding suggests that when import substitution is pursued, the need for capital and intermediary goods to start the domestic production of substitutes for imports is so accentuated, that the country will continue to import the same amount of these goods from the Central American market, is spite of the depreciation of the exchange rate. It also shows that, as import substitution is pursued, Costa Rica places a much greater emphasis on controlling industrial imports from the rest of the world than on controlling industrial imports from Central America, since the effect

of the former on the balance of trade is much greater. Finally, when the depreciation of the exchange rate is implemented and industrial imports from the rest of the world are being controlled, agricultural imports are hurt in a greater degree with import substitution than without it, and industrial imports from the rest of the world are hurt less. This result confirms our earlier finding that import substitution industrialization has been pursued at the expense of agriculture, since in both versions the depreciation of the exchange rate hurts agricultural development more than industrial development, and this effect is maximized when import substitution is pursued.

3. In both versions, an exchange rate unification on top of the depreciation of the exchange rate did not affect total output beyond the effects of the depreciation of the exchange rate.

Macroeconomic Results When the Production Policies are Given the Same Degree of Policy Emphasis

The major macroeconomic results of comparing both versions when the production policies are given the same degree of policy emphasis can be summarized as follows.

1. In considering the effects on total output of the trade-off between industrial trade with the rest of the world and agricultural trade, the results are the same in both versions, since import substitution did not make any difference. Briefly, agricultural output reaches a very low level whenever agricultural imports are being controlled (E-2B), so that, as agricultural output declines so does total output. The level of total imports did not change, since the

reduction in agricultural imports was offset by an increase in industrial imports to meet an increase in industrial output due to an emphasized industrial production policy. Since industrial imports from the rest of the world are not being controlled, industrial output is free to respond to the policy emphasis on the industrial production policy. However, the increase in industrial output was not enough to offset the sharp decline in agricultural output, so that total output decreases, even with an unchanged level of total imports. These same results are obtained when one considers the effects on total output of the trade-off between industrial trade with Central America and agricultural trade (E-3B).

These findings suggest that agricultural development is independent of the import substitution policy, since it did not have any impact on agricultural output and imports, and they confirm our earlier finding that total output in Costa Rica depends heavily on agricultural imports.

2. When a depreciation of the free market exchange rate is implemented, the results are similar in both versions. Briefly, the depreciation of the exchange rate decreases total output and imports. However, the decrease is less when agricultural imports are controlled (E-2D), with agricultural output experiencing an extra loss of 19.7 percent, and agricultural exports being hurt in spite of an emphasized export promotion policy for agricultural exports. Total output decreases by less when agricultural imports are controlled, because the level of industrial output after the depreciation is not as low as it would be had industrial imports from the rest of the world been controlled (E-2C), thus offsetting part of the decline in agricultural output. Finally, as to the relationship between the industrial

production policy and the policy controlling industrial imports, the depreciation will hurt industrial output less when industrial imports from the rest of the world are being controlled, provided that import substitution is pursued (E-2C).

These findings show, again, that agricultural development is independent of the import substitution policy, and that a depreciation of the exchange rate hurts agricultural development more than industrial development, since industrial output tends to be independent of the policy controlling industrial imports from the rest of the world and agricultural output is very sensitive to the policy controlling agricultural imports. They also confirm our earlier finding that the depreciation of the exchange rate works against agricultural exports.

3. An exchange rate unification has the same effects in both versions, since import substitution did not make any difference. Briefly, the exchange rate unification improves development, reversing the negative effect of the depreciation of the exchange rate on total output when agricultural imports are controlled, by exactly offsetting the extra 19.7 percent loss experienced in agricultural output when the depreciation was implemented, and by increasing industrial output (E-2F). The improvement in agricultural and industrial output is due to increased levels of agricultural exports and industrial exports to Central America, thanks to the export incentives created by the depreciation of the overvalued exchange rate.

4. When a depreciation of the exchange rate is implemented in considering the trade-off between industrial trade with Central America and agricultural trade, again the results are similar in both versions,

since import substitution did not make any difference. Briefly, whenever agricultural imports are controlled, total output and imports and agricultural output and imports decline (E-3D). Also, in both versions the results are exactly the same as the ones obtained for the case when the depreciation was implemented on the trade-off between industrial trade with the rest of the world and agricultural trade, when agricultural imports were controlled (E-2D, point 2), showing that the depreciation has the same effects on the economy no matter from which area industrial imports are left uncontrolled.

5. In the trade-off between industrial trade with Central America and agricultural trade, an exchange rate unification worsens development by decreasing total output when agricultural imports are controlled (E-3F), if no import substitution policy is pursued. However, agricultural output is improved and industrial output worsened. Again, the improvement in agricultural output is due to the reinforcing export-promoting effect of the depreciation of the overvalued exchange rate on the agricultural export promotion policy, so that, as agricultural exports increase, so does agricultural output. Industrial output decreases in response to a decline in industrial exports to Central America, which are driven downwards to the zero level due to a zero policy emphasis on the export promotion policy, in spite of the export incentives brought about by an explosive depreciation of the overvalued exchange rate. The decline in industrial output is large enough to offset the increase in agricultural output, so that total output decreases.

The results are the opposite when import substitution is pursued: development is improved. Agricultural output increases and industrial

output decreases. Again, the improvement in agricultural output is due to an increase in agricultural exports due to the exchange rate unification. However, the decrease in industrial output is less than without import substitution, because industrial exports to Central America, although driven down due to a zero policy emphasis on export promotion policy, do not reach the zero level. Thus, the decline in industrial output is not large enough to offset the increase in agricultural output, so that total output increases. This finding shows that when the import substitution policy is pursued and agricultural imports are controlled first, an exchange rate unification tends to improve development by increasing industrial development, and second, that import substitution helps export performance by making industrial exports to Central America less vulnerable to a zero policy emphasis on export promotion policy, although it does not affect agricultural export performance.

Macroeconomic Results When the Production Policies are Given Differential Degrees of Policy Emphasis

The major effects of the production policies on total output, in comparing both versions, can be summarized as follows.

1. When a trade-off between the industrial and agricultural production policies is considered, given that the industrial trade policy with the rest of the world and the agricultural trade policy are given the same degree of policy emphasis, total output declines in both versions whenever there is a zero policy emphasis on the agricultural production policy (E-4A), and increases whenever this policy is emphasized (E-4B). However, the increase in total output is less when import substitution is pursued.

The rationale explaining this finding is that with import substitution there is, first, a much stronger direct relationship between the decline in total output and a zero policy emphasis on agricultural production policy, and, second, industrial output tends to be more sensitive upwards to an emphasized industrial production policy. Specifically, total output is less with import substitution when the agricultural production policy is not emphasized, because agricultural output experiences a larger decline than without import substitution due to the fact that industrial output experiences a larger increase as the industrial production policy is emphasized and import substitution is being pursued. The same results hold for the case when the industrial trade policy with Central America, and the agricultural trade policy, are given the same degree of policy emphasis. This finding confirms our earlier statement that although import substitution produces a higher level of industrial development, development as a whole is slowed down because industrial development is achieved at the expense of agricultural development.

2. When a depreciation of the free market exchange rate is implemented, in both versions the levels of total, industrial and agricultural output and imports decline (E-4C and E-4D), with the decrease in total output larger with a zero policy emphasis on agricultural production policy (E-4C). This occurs because of a greater decline in agricultural output, due, first, to the reinforcing import-reducing effect on the depreciation on the policy controlling agricultural imports (so that, as agricultural imports decline so does agricultural output) and, second, to a decline in agricultural exports (due to the disparity in policy emphasis on export promotion policies

brought about by the depreciation). As agricultural exports decline, so does agricultural output. Thus, the reduction in agricultural output comes from both supply-side and demand-side constraints. Industrial output declines, too, due to the reinforcing import-reducing effect of the depreciation on the policy controlling industrial imports from the rest of the world, and to a decline in industrial exports to Central America, originating in the disparity in policy emphasis on export promotion policies.

However, the decline in total output is less when import substitution industrialization is pursued. The reasons explaining this finding are that, first, agricultural output experiences a larger decline when import substitution is pursued not only due to a zero policy emphasis on agricultural production policy, but also to a larger import-reducing effect of the depreciation and larger export-reducing effect on agricultural exports. Second, industrial output experiences a smaller decline, not only because import substitution reinforces the industrial production policy, but also because as import substitution is pursued, industrial exports to Central America are less vulnerable to the export-reducing effects of the depreciation. Thus, although they decline, they are not driven down to the zero level which occurs when import substitution is not pursued. Since industrial output declines less than without import substitution, total output declines less also.

3. In both versions, the implementation of an exchange rate unification will improve development by offsetting part of the loss in total output caused by depreciation of the free market exchange rate when there is a zero policy emphasis on the agricultural production

policy (E-4E). However, the improvement in develompent is greater when import substitution is pursued. This greater improvement is due to the fact that the export-promoting effect of the depreciation of the overvalued exchange rate reinforces the export promotion policy on both agricultural exports and industrial exports to Central America. This helps to offset the decline in both of these exports originating in the disparity of policy emphasis on export promotion policies brought about by the depreciation of the free market exchange rate. As these exports increase, so do agricultural, industrial and total output. Observe that with import substitution, the exchange rate unification completely offsets the loss in agricultural exports and partially offsets the loss in industrial exports to Central America, whereas without import substitution, industrial exports to Central America remain at the zero level. Thus, industrial output remains unchanged at the lower level generated by the depreciation of the free market exchange rate.

4. When the trade-off between the industrial and the agricultural production policies is considered, given that the same policy emphasis is applied to the industrial trade with Central America and the agricultural trade, the results are similar in both versions when the depreciation of the free market exchange rate is implemented and there is a zero policy emphasis on the agricultural production policy (E-5C). Briefly, total, industrial and agricultural output, and imports decline due to the reinforcing import-reducing effect of the depreciation on the policy controlling agricultural and industrial imports. A second factor explaining the decrease in agricultural output is the export-reducing effect of the depreciation on agricultural exports.

Industrial exports were not affected by the depreciation. In all, import substitution did not make any difference between the results of both versions.

5. In both versions the implementation of an exchange rate unification will improve development by offsetting part of the loss in total output caused by the depreciation of the exchange rate when there is a zero policy emphasis on the agricultural production policy (E-5E). This improvement is due to the reinforcing export-promoting effect of the depreciation of the overvalued exchange rate on the agricultural export promotion policy. Thus, the loss in agricultural exports experienced when the depreciation of the free market exchange rate was implemented is completely offset. As agricultural exports increase, so does agricultural and total output. Industrial exports were not affected by the exchange rate unification. Again, import substitution did not make any difference between the results of both versions.

Macroeconomic Results for Industrial and Agricultural Exports

Agricultural Exports. When the production policies are not emphasized, agricultural exports did not change in the no-import substitution version when either a depreciation of the exchange rate or an exchange rate unification were implemented. However, as import substitution is pursued, agricultural exports decline when industrial imports from the rest of the world are controlled, and either a depreciation of the exchange rate (E-1D) or an exchange rate unification (E-1F) are implemented. This behavior of agricultural exports is explained by the fact that as import substitution is pursued, it

reinforces the industrial production policy in offsetting part of the import-reducing effect of the depreciation of the exchange rate, but it does not reinforce the agricultural production policy. Thus, agricultural output decreases not only because the increase in industrial output is achieved at its expense, but also because of the import-reducing effect of the depreciation. As agricultural output decreases so do agricultural exports. A second factor contributing to the decline in agricultural exports is the export-reducing effect of the depreciation. An exchange rate unification did not change the results generated by the depreciation of the exchange rate.

In the import substitution version agricultural exports decline with the depreciation of the exchange rate when the production policies are emphasized, regardless of any degree of policy emphasis on the agricultural export promotion policy (E-2D and E-2C). Of course, the decline is larger with a zero policy emphasis on this policy. In the no-import substitution version these exports decline only when the export promotion policy is emphasized (E-2D). In both versions an exchange rate unification reverses the export-reducing effect of the depreciation on agricultural exports, except when there is a zero policy emphasis on the export promotion policy, as import substitution is pursued (E-2E).

These are the only differences in the behavior of agricultural exports brought about when import substitution is pursued, since in all other experiments, it did not change the results outlined in the case of the no-import substitution version. These results showed that, first, agricultural exports declined with the depreciation of the exchange rate (E-2D and E-3D) and recovered from this decline when an

exchange rate unification was implemented, given that the export promotion policy on agricultural exports was being emphasized, and second, they declined whenever there was a zero policy emphasis on the agricultural production policy and a depreciation of the exchange rate was implemented, but recovered with the exchange rate unification.

Industrial Exports to the Rest of the World. When import substitution was not pursued, industrial exports to the rest of the world were insensitive to any changes of policy emphasis on the industrial export promotion policy (E-1A and E-1B), but they declined when the depreciation of the exchange rate was implemented. Also, an exchange rate unification did not change the results generated by the depreciation. However, as import substitution is pursued, industrial exports to the rest of the world turn completely insensitive downward, not only to changes of policy emphasis on the industrial export promotion policy, but also to the import-reducing effect of the depreciation.

The rationale behind this finding is that as import substitution is pursued, the industrial production policy is reinforced. Thus, it outweighs the import-reducing effect of the depreciation on industrial output, and in turn, prevents the export-promoting effect of the depreciation from being offset by the import-reducing effect. Thus, as industrial output increases with import substitution, so do industrial exports to the rest of the world.

An exchange rate unification did not add anything to these exports, since not only are they already at their maximum level, but also because the overvalued exchange rate does not apply to these exports.

Finally, the same rationale explains why these exports declined when import substitution was not pursued and the depreciation was implemented (E-2C), whereas they increased as import substitution was pursued.

Industrial Exports to Central America. In both versions industrial exports to Central America are highly sensitive downward in response to a zero policy emphasis on the industrial export promotion policy. However, they are less sensitive when import substitution is being pursued. In fact, they do not decrease when import substitution is pursued, and the policy emphasis on the Central American industrial export promotion policy is at the zero level (E-1B). It takes an explosive depreciation of the free market exchange rate (E-1D) to drive down these exports, but not to the zero level, as would happen had import substitution not been pursued.

Another type of situation in which industrial exports to Central America are decreased in both versions, is when the depreciation of the exchange rate is implemented, given that the rest of the world industrial export promotion policy is emphasized more relative to the Central American industrial export promotion policy (E-2C, E-4C, and E-4D). However, the decrease in industrial exports to Central America is less as import substitution is pursued. In fact, they are not driven down to the zero level as they would be had import substitution not been pursued. This behavior of industrial exports to Central America is based on the fact that import substitution reinforces the industrial production policy and thus offsets part of the import-reducing effect of the depreciation of the exchange rate on industrial output, preventing these exports from being driven down to the zero

level, in spite of the reinforcing export-promoting effect of the depreciation on the rest of the world industrial export promotion policy. This finding also reflects the stronger general position of the industrial sector as import substitution is pursued. This stronger position is reflected in turn in a better export performance to Central America.

Finally, in both versions, an exchange rate unification improves industrial exports to Central America only if the export promotion policy towards these exports is emphasized more relative to the export promotion policy towards industrial exports to the rest of the world (E-1E, E-3E).

Macroeconomic Results for the Balance of Trade

In both versions, π_I^{RW} always shows a trade deficit, π^A a surplus, and π_I^{CA} tends to show a deficit when adverse policies towards the industrial trade with Central America are implemented (Table XXIV). As import substitution is pursued, π_I^{CA} tends to be improved, since we have found that import substitution tends to reduce the downward vulnerability of industrial exports to Central America to adverse policies, π_I^{RW} tends to worsen, since as industrial output is increased with import substitution, industrial imports from the rest of the world also increase to meet most of this increase. π^A tends to improve, since with import substitution the expansion of industrial output is achieved at the expense of agricultural output, so less agricultural imports of machinery and inputs are required to meet a lower level of agricultural output. In both versions, π^T shows always a deficit, except in one case, which will be analyzed below. The systematic deficit observed in

π^T is generated by the fact that the deficit in π^{RW} more than offsets the surpluses in both π^{CA} and π^A. In addition, the magnitude of the deficit in π^T tends to be the same in both versions.

These findings suggest that, although in general, import substitution did not have a significant impact on reducing the total trade deficit of Costa Rica, it does have a differential effect on the composition of the total trade balance. Namely, it tends to improve the industrial trade balance with Central America by shifting the deficits that burden import substitution away from this market to the rest of the world industrial market, and by improving the surplus in agricultural trade. The rationale explaining this behavior in the trade balance is based on our earlier findings. First, with import substitution a greater level of industrial output generates a greater level of industrial imports from the rest of the world (since industrial output depends very little on industrial imports from Central America). Second, as import substitution reduces the downward vulnerability of industrial exports to Central America, the Central American trade balance tends to be improved. Third, as the expansion of industrial output with import substitution is achieved at the expense of agricultural output, agricultural output decreases and so do agricultural imports. Thus, the agricultural trade balance is improved.

The findings of a more detailed analysis comparing the balance of trade in both versions are summarized as follows.

1. As to industrial trade with Central America, when the industrial trade policy with this market is at the zero policy emphasis level (E-1B), the industrial trade balance with Central America goes from defict to surplus as import substitution is pursued. This is due to

the fact that industrial exports to Central America are not driven down to zero but remain at their maximum level, and industrial imports from this market experience only a small increase.

A depreciation of the free market exchange rate when the industrial trade policy with Central America is at the zero policy emphasis level (E-1D), greatly improves the industrial trade balance with this market as import substitution is pursued, because industrial exports to this market decrease but are not driven down to the zero level, and industrial imports from this market experience a small increase relative to the no-import substitution version. The industrial trade balance with Central America will improve greatly, again, as import substitution is pursued, even if the industrial trade policy with the rest of the world is emphasized more relative to the industrial trade policy with Central America when the depreciation of the exchange rate is implemented (E-4C). Again, the fact that industrial exports to Central America decrease, but are not driven down to the zero level as import substitution is pursued, is the major factor explaining this finding.

Regarding an exchange rate unification, industrial exports to Central America turned out to be more sensitive to the export-promoting effect of the exchange rate unification as import substitution is pursued. Although in both versions, the industrial trade balances with Central America shown in experiments E-2E and E-3F are the same ones generated by an earlier depreciation of the free market exchange rate, the large improvement in the Central American trade in E-2E as import substitution is pursued, is due not only to the fact that import substitution reduces the downward vulnerability of industrial exports to this market (reinforcing the export promotion policy), but

also to the fact that as industrial output increases with import substitution industrial imports from this market experience a small increase only. An exchange rate unification will improve the Central American trade balance greatly when the rest of the world industrial trade policy is emphasized more relative to the Central American industrial trade policy, as import substitution is pursued (E-4E). The improvement is basically due to the fact that, with import substitution, the downward vulnerability of industrial exports to Central America is greatly diminished, since the export promotion policy is reinforced not only by the export-promoting effect of the exchange rate unification, but, most importantly, by the reinforcing effect of import substitution on this policy. To confirm this last fact, observe that if the import substitution policy is dropped, industrial exports to Central America are driven down to the zero level, in spite of the export incentives brought about by the depreciation of the overvalued exchange rate. Another factor contributing to this improvement in the Central American industrial trade balance, is that as industrial output increases with import substitution, industrial imports from this market experience a small increase only.

Clearly, these findings confirm that with import substitution industrial exports to Central America are made much less vulnerable downward to adverse export promotion and exchange rate policies, because import substitution not only increases industrial output, making it possible to export a greater level of industrial products to this market, but also reinforces the export promotion policy.

2. As to industrial trade with the rest of the world, whenever the rest of the world industrial trade policy is emphasized (E-1B),

the industrial trade balance with the rest of the world is worsened as import substitution is pursued, since industrial imports from this market increase to meet most of the increase in industrial output.

A depreciation of the free market exchange rate will improve the rest of the world industrial trade balance when the industrial trade policy with this market is at the zero policy emphasis level, as import substitution is pursued (E-1C). The improvement is brought about not only by the export incentives created by the depreciation of the exchange rate, but, principally, by the reinforcing effect of import substitution on the rest of the world export promotion policy. Thus, industrial exports to this market increase. Of course, industrial output, and industrial imports from this market, also increase with import substitution. However the increase in industrial exports is larger than the increase in industrial imports, so that the industrial trade balance with this market is improved. Observe that the improvement in the trade balance would be greater, were the industrial trade policy with this market to be emphasized as import substitution is pursued (E-1D). The reinforcing effect of import substitution on the rest of the world industrial export promotion policy is confirmed by the fact that were the import substitution policy to be dropped, industrial exports to this market would decline drastically, in spite of the export incentives brought about by the depreciation of the exchange rate. The industrial trade balance with the rest of the world will worsen again when the rest of the world industrial trade policy is emphasized more relative to the Central American industrial trade policy, as the exchange rate is depreciated and import substitution is pursued (E-4C). The worsening of the industrial trade balance with the rest of the world

is due to the greater level of industrial imports from the rest of the world necessary to meet most of the increase in industrial output as import substitution is pursued. Observe that in this case, import substitution reinforces an emphasized industrial production policy offsetting the import control policy, in spite of the reinforcing import-reducing effect brought about by the depreciation.

An exchange rate unification will worsen the industrial trade balance with the rest of the world when the rest of the world industrial trade policy is emphasized more relative to the Central American industrial trade policy, as import substitution is pursued (E-3F and E-4E). Although neither the exchange rate unification nor the import substitution policy had any impact on industrial exports to the rest of the world, the worsening of the trade balance with this market is explained as an indirect side-effect of the exchange rate unification. In fact, the exchange rate unification drives industrial exports to Central America up from the zero level as import substitution is pursued. Thus, industrial output increases not only due to a greater level of industrial exports, but also due to the reinforcing effect of import substitution on an emphasized industrial production policy. As industrial output increases, so do industrial imports from the rest of the world, thus worsening the industrial trade balance with this market.

These findings show that import substitution tends to worsen the industrial trade balance with the rest of the world since it increases industrial output and in turn industrial imports from the rest of the world, with no effect on industrial exports to the rest of the world. In general, the exchange rate policies do not tend to improve the

trade balance with this market as import substitution is pursued, since industrial exports to this market are already at their maximum level and the industrial production policy is reinforced by import substitution. Thus, as industrial output is increased, so are industrial imports from this market, in spite of the reinforcing import-reducing effect of the depreciation of the exchange rate on the policy controlling industrial imports from this market.

3. As to agricultural trade, the worsening of the agricultural trade balance in E-1B can be explained as an indirect side-effect of pursuing the import substitution policy when the industrial trade policy with the rest of the world is being emphasized. In fact, the reinforcing effect of import substitution on the industrial production policy is so strong that industrial output increases offsetting the controlling policy on industrial imports from the rest of the world. As industrial output increases so does agricultural output and in turn agricultural imports. Since agricultural exports remain constant, the agricultural trade balance is made worse.

The importance of this finding is that it confirms our earlier result that there tend to be linkages of increasing importance between both the industrial and the agricultural sectors as development proceeds. That is, as industrial output increases with import substitution, within the industrial sector food-oriented industrial activities demand an increased level of agricultural products in raw form to produce processed foods. Thus, agricultural output tends, in turn, to be increased. However, food-oriented industrial activities, in spite of being still the major ones in the composition of industrial output, show a strong tendency towards declining, as new industrial activities

are brought about with import substitution, at the expense of the former ones. This strong tendency towards decline, places a limit on the extent of the backward-demand effect of industry expansion on agricultural output.

A depreciation of the exchange rate worsens the agricultural trade balance when the industrial trade policy with the rest of the world is emphasized, as import substitution is pursued (E-1D). The worsening in the agricultural trade balance is explained as follows. As the import-reducing effect of the depreciation reinforces the import control policy on agricultural imports, agricultural imports decrease along with agricultural output. However, the decline in agricultural output is larger as import substitution is pursued, since industrial output increases at the expense of agricultural output, offsetting part of the import controlling policy on industrial imports from the rest of the world, in spite of the reinforcing import-reducing effect of the depreciation. As agricultural output experiences a larger decline with import substitution, so do agricultural imports. The depreciation also has an export-reducing effect on agricultural exports, but as the decline in agricultural exports is larger than the decline in agricultural imports, the agricultural trade balance is worsened.

An interesting aspect of this finding is that it shows that as import substitution is pursued, the depreciation of the exchange rate destroys the backward-demand linkage between the industrial and agricultural sectors through its negative supply-side and demand-side effects on agricultural output, thus slowing down development. In fact, from the supply-side, the reinforcing import-reducing effect of the depreciation on the policy controlling agricultural imports hurts

agricultural development the most, decreasing agricultural output. However, industrial development is not hurt. From the demand-side, agricultural exports are discriminated against with the depreciation, and as they decline so does agricultural output. Both forces tend to strangle the agricultural sector, making it impossible to increase its output to meet the backward-demand effect provided by the increase in industrial output. These negative effects of the depreciation on agricultural output as import substitution is pursued, are minimized when the policy controlling industrial imports from Central America is emphasized (E-1C).

Another situation in which the agricultural trade balance worsens as the exchange rate is depreciated and import substitution is pursued, occurs when there is a zero policy emphasis on the agricultural production policy (E-4C). The worsening in the agricultural trade balance is explained again by the fact that industrial output increases at the expense of agricultural output as import substitution is pursued, and by the negative demand-side and supply-side effects of the depreciation on agricultural output as import substitution is pursued, destroying the backward-demand linkage between the sectors. These negative impacts on agricultural output are minimized if the agricultural production policy is emphasized (E-4D), thus improving the agricultural trade balance.

An exchange rate unification has no effect on the agricultural trade balance because in both versions the results are the same ones generated when the depreciation of the exchange rate was first implemented (E-2E and E-3E). Also, import substitution did not make any difference in the agricultural trade balance between both versions (E-3F, E-4E, and E-5E).

4. As to the total trade balance, it was in general insensitive to most combinations of policies, showing a systematic trade deficit of 1006 million colones. The only case in which a surplus (of 295 million colones) is shown for both versions was in experiment E-5E. In this experiment an exchange rate unification was implemented, given a zero policy emphasis agricultural production policy, an emphasized industrial production policy, and a greater emphasis on the Central American industrial trade policy and on the agricultural trade policy relative to the rest of the world industrial trade policy. The major factor explaining the total trade surplus is agricultural trade, since agricultural exports increase to their maximum level with the exchange rate unification while agricultural imports are cut down by the import controlling policy. Import substitution did not make any difference between both versions.

This finding shows that if obtaining a total trade surplus were the major development objective of Costa Rica, a sharp decrease in agricultural output is the price to be paid for that surplus, since agricultural imports must be cut down through depreciating the free market exchange rate. Also, explosive depreciations of the overvalued exchange rate are needed to equalize export incentives between the industrial and the agricultural sectors, in order to keep agricultural exports at their maximum level. This finding also points out the major strategic importance of this sector for Costarican foreign trade, since it is the largest generator of foreign exchange, and thus, the only sector capable of turning a total foreign trade deficit into a surplus. It would appear that the major purpose of this sector for Costa Rica is to play a role in foreign trade as a big generator of foreign exchange by

exporting a few key products, rather than to play a greater role in the domestic economy as supplier of inputs to industry or as employment generator. A factor limiting the role of this sector in foreign trade is the implementation of adverse exchange rate policies, which will work to diminish agricultural exports.

Summary

This chapter was concerned with the analysis of the effects on the economy of pursuing different combinations of development policies. At the macroeconomic level our major results show that industrial and agricultural outputs are positively related to their respective emphasized production policies, and as these outputs increase so do industrial and agricultural imports of machinery and inputs. A depreciation of the free market exchange rate constitutes a constraining factor from the supply-side on both outputs, slowing down development. Development is slowed down because both outputs decrease due to the reinforcing import-reducing effect of the depreciation on the import controlling policies, with agricultural output bearing most of the negative impact of the depreciation. However, the depreciation creates such a disparity in export promotion incentives between the industrial and the agricultural sectors, that industrial exports to Central America, and agricultural exports, are hurt badly, especially the former, through the export-reducing effect of the depreciation. Thus, these exports decline, constituting a demand-side contributing factor adding to the decline from the supply-side of the industrial and the agricultural outputs. An exchange rate unification, achieved by depreciating the overvalued exchange rate to equal the previously depreciated free market

exchange rate, corrects for the disparity in export promotion incentives brought about by the depreciation of the free market exchange rate, improving economic development.

The total trade balance presents a systematic deficit, showing that the foreign exchange saved by the depreciation of the free market exchange rate is more than offset by the greater decrease in exports, especially in industrial exports to Central America and agricultural exports. Thus this type of exchange rate policy hurts development, especially agricultural development. A total trade surplus can only be achieved at the expense of agricultural development by implementing an exchange rate unification, since agricultural imports and output are driven down to a very low level with an earlier depreciation of the free market exchange rate, and agricultural exports are protected from the export-reducing effect of the depreciation with the exchange rate unification. Import substitution does not play a significant role in reducing the total trade deficit, but it does tend to alter the composition of the trade balance of Costa Rica by shifting the deficits that burden import substitution away from the Central American market to the rest of the world market, and by improving the agricultural trade balance. Finally, it appears that the agricultural sector plays a greater role in foreign trade as a big generator of foreign exchange, than in the domestic economy as a supplier of inputs to industry or generator of employment.

We have found that the rate of economic development is the same with or without import substitution. However, the level of total output is somewhat less with import substitution. Also, import substitution has been achieved at the expense of the agricultural sector, since resources were shifted from agriculture to industry.

At the microeconomic level, import substitution has helped in dynamizing and bringing about structural changes in the industrial economy of Costa Rica, since new industrial activities emerged at the expense of consumption goods when import substitution was pursued. Also, import substitution helps in reducing the downward vulnerability of industrial exports to Central America.

ENDNOTE

[1]Planning Office, National Development Plan: Diagnose (San Jose, 1973), pp. 44, 69, 72-79, 85.

CHAPTER V

CONCLUSIONS AND IMPLICATIONS

This chapter culminates the analysis of Costarican development policies by, first, summarizing the major findings and conclusions of this study and their implications for Costarican economic development, and, second, by presenting a set of policy actions and recommendations for achieving a faster rate of development in Costa Rica.

Nature and Objectives of the Study

One of the major objectives of this dissertation is to contribute in laying down the foundations of a sound and organized system of institutionalized economic planning in Costa Rica. Since such a system of economic planning is still in its infancy in the country, an economic planning model like the one developed in this study constitutes a very useful tool for conducting empirical economic analysis. It is useful as a means of: first, determining the probable effects on the economy of implementing or adjusting economic development policies, second, evaluating the performance of some of the policies that have been implemented, and third, devising new policies to be implemented. We have concentrated most of our work on the first item.

Another major objective is to provide an example for Costarican planners and economic managers of an organized and systematic analysis, based on sound economic principles, of the macro and microeconomic

interrelationships among different development policies that are being pursued in order to achieve several development goals. Since in Costa Rica an economic management infrastructure to implement, adjust, track and analyze development policies devised by policy makers is still incipient, this type of work is scarcely done. What is commonly done is an ad hoc piecemeal approach to development policy, which in turn has generated a distorted and fragmented operational policy framework in which the different development policies tend to be uncoordinated, and the relationships between these policies and the development objectives are frequently ignored in practice.

Taking as an example the major policies devised and implemented by Costa Rica for achieving industrial development, we have shown how economic development has become a problem of economic management in this country, and that a lack of applied economic research and analysis of the policies implemented and their effects on the economy, has been one of the major constraints on development.

From a more operational point of view, we have set two major questions for which answers have been found. First, was the industrialization policy followed by Costa Rica in the last two decades successful? That is, could the rate of growth have been higher than it actually was? Second, what are the optimal policies for faster economic development?

In order to find the answers to these questions, first, an exhaustive and detailed analysis of the industrialization experience of Costa Rica during the last two decades was conducted in Chapter II, identifying its major accomplishments and weaknesses. Second, to evaluate quantitatively the effects on the economy of the policies implemented by Costa Rica in the period 1962-1979, a multiobjective

static linear programming model was developed in Chapter III and then used as an empirical tool for evaluation.

The evaluation is one of comparative statics, in which variables in the model are defined as changes taking place between 1962, when the industrialization activity was just beginning, and 1979. Four sectors representing the sectoral arrangement of the economy, along with 73 endogenous variables, 9 exogenous variables, and 53 parameters are incorporated into the model. Output, imports, exports and the exchange rates play a major role. Output and trade are the economic development objectives in this model. In all, eight objectives are included in the objective function. It is stated that the policy makers seek to maximize industrial and agricultural output, industrial exports (both to Central America and the rest of the world) and agricultural exports, while minimizing industrial and agricultural imports (both from Central America and the rest of the world) of machinery and inputs. By varying the values of the policy weights and the exchange rates in the objective function, policy experiments simulating the effect of pursuing different combinations of policies on the major macro and microeconomic variables, were conducted. This way, the major interrelationships among the policies were considered, their relation with the objectives clarified, and their effect on the economy quantitatively measured, permitting us to track, analyze, and control the changes that occur in the economy, and, thus, showing how economic development is a problem of economic management.

Summary of Major Macro and Microeconomic Findings, Conclusions, and Implications

Our findings support the conclusion that the rate of economic development in Costa Rica could have been greater if the rest of the world industrial import control policy had been deemphasized, the Central American industrial export promotion policy emphasized, the agricultural production policy emphasized, the agricultural import control policy deemphasized, the agricultural export promotion policy emphasized, and an exchange rate unification implemented to counterbalance the effect of a depreciation of the free market exchange rate on development. Import substitution did not make a significant difference in the rate of economic development between both versions of the model, although the level of total output is somewhat lower with import substitution.

In fact, with a deemphasized import control policy on industrial imports from the rest of the world, industrial output would not fall as much as it does when the reinforcing import-reducing effect works, as the depreciation is implemented. Thus, a greater level of industrial imports from the rest of the world generates a greater level of industrial output. As industrial output increases, so would agricultural output, due to: first, an emphasized agricultural production policy, second, a deemphasized import control policy on agricultural imports, third, the working of the backward-demand linkage from the industrial sector, and fourth, an exchange rate unification which improves agricultural export performance. Also, industrial exports to Central America would be improved with the exchange rate unification.

Thus, it appears that shifting dependency away from agriculture to industrialization has proved costly for Costa Rica, mostly because adverse policies were implemented towards agricultural development. Had the import control policy on agricultural imports been deemphasized, the agricultural production policy emphasized, and an exchange rate unification implemented, then much of the negative effect of switching resources away from agriculture to industry would have been avoided.

It has been shown that the growth of total output in Costa Rica depends very little on industrial imports of machinery and inputs from Central America, but depends highly on these industrial imports from the rest of the world, and on agricultural imports of machinery and inputs. Thus, to the extent that the rest of the world industrial import control policy and the agricultural import control policy are emphasized, both industrial and agricultural output will be decreased, slowing down development.

Clearly, a depreciation of the free market exchange rate diminishes total output, slowing down development, and significantly hurting agricultural development, since agricultural imports absorb most of the import-reducing effect of the depreciation. Also, it destroys the backward-demand linkage between the industrial and agricultural sectors. Agricultural output is badly hurt due to the negative demand-side and supply-side effects of the depreciation. Briefly, from the demand-side, the depreciation creates such a disparity in export incentives between the industrial and agricultural sectors, that agricultural exports are diminished (as well as industrial exports to Central America), and from the supply-side, the reinforcing import-reducing effect of the depreciation on the import control policy decreases agricultural imports sharply.

An exchange rate unification tends to improve development: first, by offsetting the demand-side effect of the depreciation on agricultural exports (so that, as agricultural exports increase so does agricultural output), second, by offsetting the demand-side effect of the depreciation on industrial exports to Central America (thus, as these exports increase so does industrial output), and third, by restoring the backward-demand linkage between the industrial and the agricultural sectors.

An interesting finding regarding the exchange rate policy is that it works better as an export promotion instrument than as an instrument to save foreign exchange. Briefly, as the free market exchange rate is depreciated, the saving of foreign exchange due to lower levels of imports is more than offset by losses in exports and output, and as the overvalued exchange rate is depreciated, there are substantial export gains and no losses in output.

As to export promotion policies, we have found that great policy emphasis has been placed on promoting industrial exports and much less policy emphasis on promoting agricultural exports. The implementation of the depreciation of the free market exchange rate exacerbates these disparities, although an exchange rate unification corrects for the disparities. At the microeconomic level within the industrial sector, the shift in policy emphasis away from promoting industrial exports to Central America to promoting industrial exports to the rest of the world has not yet proved effective, in spite of the reinforcing export-promoting effect of the depreciation. A major factor explaining this result is that it is quite difficult for a small developing country like Costa Rica, where industrialization is in its early stages, to compete in international markets. Also, the Central American market

remains still the largest export market for Costa Rica, in spite of serious political and social instability in that market, which frequently causes heavy losses to Costarican exporters.

As to the balance of trade, a systematic trade deficit is its major characteristic, with industrial trade with the rest of the world the most important generator of deficits. Both the industrial trade with Central America, and (especially) the agricultural trade, tend to show surpluses. However, the rest of the world industrial trade deficit more than offsets both surpluses rendering a total trade deficit. The agricultural sector is the only sector capable of turning the total trade deficit into a surplus, but the price to pay is high: namely, a sharply diminished level of agricultural output due to a zero policy emphasis agricultural production policy, and an emphasized import control policy on agricultural imports reinforced by a depreciation. Also, an exchange rate unification is necessary to keep agricultural exports at their maximum level, thus preventing them from falling as the depreciation is implemented.

Regarding the industrialization experience of Costa Rica, our work shows that one major objective it is supposed to achieve is an increase in industrial output, thus diversifying the economy. However, shifting the dependency of the economy from agriculture to industrialization seems to generate more costs than benefits since it has been achieved at the expense of agricultural development. We have shown that this result is basically due to poor implementation and economic management of development policies. In fact, the potential level of agricultural output is 18781.3 million colones and the actual level achieved by Costa Rica was only 7451.3 million colones, or about 40 percent of what

it could be. The second major objective of industrialization in Costa Rica is to generate foreign exchange through exports as a means of improving the total trade balance. These are in fact the two objectives towards which most of the development policies followed by this country during the last two decades have been directed. For instance, an emphasized import control policy on industrial imports, an emphasized industrial production policy, an emphasized industrial export promotion policy, a depreciation of the free market exchange rate, and an import substitution industrialization policy.

Clearly, the first objective has been achieved so far, since industry has been the fastest growing sector in the economy, with industrial output outgrowing total output. As to the second objective, there is no question that the export performance of the industrial sector has been spectacular. In fact, these exports have been growing at an explosive rate of 33.4 percent, compared with only 16.3 percent for total exports and 14.1 percent for agricultural exports (see Chapter II). Also, the industrialization policies implemented by Costa Rica played a large role in increasing these exports, which were almost non-existent in the early 1960's. However, in spite of this satisfactory result in industrial export performance, the total trade balance continues to show a deficit. The major reason explaining this situation is a relative lack of economic planning and economic management expertise, and the fact that applied economic research to support those activities is scarcely utilized. This led to serious errors in policy devising and implementation and failures in perceiving fundamental interrelationships among the development policies. The first error is failure to see that there is no way to achieve increases

in industrial output without heavy increases in industrial imports from the rest of the world. The second error is a failure to recognize that there is no way within the actual conditions of the Costarican economy of increasing the rate of growth of output by increasing industrial development if this increase is achieved at the expense of agricultural development. The implication of this second point for the balance of trade is that as agricultural imports decline, there is an equal increase in industrial imports and thus the trade deficit remains the same. Third, planners failed to see that there is no way of improving the balance of trade by controlling industrial imports through depreciation of the free market exchange rate, if at the same time the depreciation drives industrial and agricultural exports to very low levels, especially industrial exports to Central America. Fourth, planners did not perceive that without an exchange rate unification there is no way to correct for the disparities in export promotion incentives between the industrial and the agricultural sector created by an earlier depreciation.

As to import substitution industrialization, our results support the conclusion that it has been achieved at the expense of agricultural development. However, it has contributed to dynamize and diversify the industrial economy by bringing about the new capital and intermediary industrial activities that virtually did not exist before, but it has not contributed to a reduction in the trade deficit of Costa Rica.

Within the industrial sector, an interesting microeconomic result as import substitution is pursued is, that the emergence of the new capital and intermediary industrial activities is achived at the expense of consumption goods industrial activities, showing clearly

the diversifying and dynamizing effects of import substitution on the industrial economy of Costa Rica. Also, industrial investment into these new activities increases with output.

Although import substitution has not played a significant role in reducing the trade deficit of Costa Rica, it has changed the composition of the deficit by shifting the deficits that burden import substitution away from the industrial trade with Central America towards the industrial trade with the rest of the world, and by improving agricultural trade.

Finally, as import substitution is pursued, the interrelationships among the development policies and between the industrial and the agricultural sectors tend to become harder to discover and understand, as the economy becomes more dynamic and grows in complexity. Two kinds of interrelationships are of particular interest. First, emphasizing industrial exports to Central America to seek improvements in the total trade balance, as import substitution is pursued and the exchange rate unification is implemented, may generate the opposite results. In fact, as the exchange rate unification is implemented, its export-promoting effect reinforces the Central American industrial export promotion policy, and industrial exports to Central America will increase. However, as these exports increase so does industrial output, not only due to the higher level of industrial exports, but also due to the reinforcing effect of import substitution on the industrial production policy. Since industrial output depends heavily on industrial imports from the rest of the world, as industrial output increases so do these imports, worsening the trade balance, because industrial trade with the rest of the world is the major generator of trade deficits.

Second, as import substitution reinforces the industrial production policy, increasing industrial output, the agricultural trade balance may worsen. In fact, as industrial output increases with import substitution, the working of the backward-demand linkage between the industrial and the agricultural sectors will increase agricultural output, also. As agricultural output increases, so do agricultural imports, worsening the agricultural trade balance, and, in turn, the total trade balance, since this sector is the most important one in Costarican foreign trade.

Policy Actions and Recommendations

The following policy actions and recommendations are based both on the industrialization experience of Costa Rica analyzed in Chapter II, and on the findings and conclusions provided in Chapter IV.

1. Since import substitution is achieved at the expense of agricultural development, adjustments in some of the policies that have been implemented are needed to counterbalance this negative effect on agricultural development; for instance, emphasizing the agricultural production policy and the agricultural export promotion policy, and deemphasizing the controlling policy on agricultural imports of machinery and inputs. This way agricultural output will be hurt much less and total output increased. However, let us stress that only small benefits can be derived for agricultural development from these policy adjustments as long as much needed institutional and micro-economic changes in the agricultural sector are not implemented. Some of these are: (1) a reorganization of land tenure and ownership in order to increase farm size, necessary for the utilization of mechanical

technology in planting and harvesting crops, (2) development of an administrative infrastructure that provides training and technical assistance to peasants and small agricultural producers in land cultivation, agribusiness administration and marketing, (3) implementation of administrative controls which would ensure that export benefits accrue to the small farmer and rural dweller, (4) improvement and extension of educational opportunities to rural dwellers and peasants for acquiring and improving basic problem-solving literacy and numeracy skills, and (5) provision of the financial resources to bring about these changes. It will be required that the National Banking System approaches this task not with the traditional profit-making commercial banking philosophy, but with a development one.

2. Industry will continue its tendency to be the dominant sector in the economy, and some policy adjustments are called for in order to minimize the impact of a greater level of industrial output on the balance of trade. Most required policy adjustments are at the micro-economic level within the sector. For instance, it is of extreme importance that the domestic production of intermediary products (like basic industrial chemical substances, simple iron and steel components, fertilizers and pesticides, packaging products and petroleum refining) and simple capital goods (like small scale industrial machinery, small scale agricultural equipment, machinery and equipment parts and components, electric devices and instrumentation, and industrial and agricultural tools) be accelerated in order to diminish imports of these products, thus, improving the industrial trade balance, particularly with the rest of the world. Also, additional investment projects in these sectors must be export-oriented, in order to help

in reducing the impact on the industrial trade balance of additional import requirements as industrial output increases. Highly qualified and experienced business managers and technicians are urgently needed to keep investment projects in these areas profitable, and incentives for further investment of this type must be linked to export performance.

3. As for exchange rate policy, it is clear that the economic management of this policy has been poor, not only due to lack of qualified personnel but, most importantly, due to the little value that applied economic research is given in the existing planning and economic management infrastructure of Costa Rica. In fact, the idea of the Central Bank that the major effect of the exchange rate policy is to save and protect scarce foreign exchange is a misconception Briefly, the foreign exchange-saving effects of the depreciation of the free market exchange rate are minimal, since as imports decline, output (especially agricultural output), is decreased due to both the supply-side and the demand-side effects of the depreciation, destroying the backward-demand linkage between both the industrial and the agricultural sectors, thus, slowing down development. The implication of this is that as output decreases exports are decreased, too, but more than the reduction in imports, and, thus, more than enough to offset the foreign exchange-saving effects of the depreciation. The paradoxical result is that the more the exchange rate is depreciated in an effort to save foreign exchange, the worse the trade deficit tends to be, since the increasing disparity in export incentives between the industrial and the agricultural sectors drives industrial exports to Central America down to the zero level and reduces agricultural exports. Thus, our results support a decision towards an exchange

rate unification, as an effective way to equalize export incentives between the industrial and the agricultural sectors. In this way, exports will be increased improving the balance of trade, the generation of the wrong kind of export incentives for exporters will be eliminated, and development will be promoted.

4. As to the participation of Costa Rica in the Central American Common Market, the implication of our findings is that there are gloomy prospects for trading with this market. In fact, two major findings support the conclusion that this market has lost a great deal of its earlier dynamism and, thus, Costa Rica should not expect a high growth rate of trade with this market. First, industrial exports to Central America are highly vulnerable downwards not only due to adverse trade and exchange rate policies but, most importantly, due to the political instability in that area, which nulifies any export promotion effort. Second, the growth of output in Costa Rica depends very little on Central American imports of machinery and inputs. However, we do not think that a definite pull-out from this commercial agreement is viable at this time, since this tends to be the natural market for Costarican industrial exports,[1] not only because of very low transport costs but also because of the free trade regime within the Central American area. Another consideration supporting this policy action is that so much has been invested in industrial projects which are Central America export-oriented, that a pull-out will cause more losses than benefits. An alternative to a pull-out of the Central American Common Market is to emphasize and redirect, as Costa Rica has been doing, industrial exports to non-Central American markets, through bilateral commercial agreements.[2] For example, commercial agreements could be

suscribed with Mexico, Colombia, Brazil, Venezuela, Argentina, and the Caribbean countries. The prospects for trade with the Arab region should also be examined. Let us stress that, without qualified personnel trained in international trade and finance, and without an effective international trade administrative infrastructure to handle these affairs, few benefits can be realized from these new initiatives.

5. Improving the balance of trade is one of the major objectives of Costarican planners. However, a foreign trade surplus can only be achieved at the expense of agricultural development. Briefly, the price to pay for a foreign trade suplus is a sharply diminished level of agricultural output and imports. This can be achieved through implementing policies adverse towards the agricultural sector; namely, a zero policy emphasis on agricultural production policy and a depreciation of the free market exchange rate reinforcing the import control policy on agricultural imports. An exchange rate unification is mandatory, too, in order to prevent agricultural exports from being driven down from their maximum level by the disparity in export incentives between the agricultural and the industrial sectors brought about by the depreciation. The major implication of this finding is that Costa Rica tends to look at the agricultural sector more as a big generator of foreign exchange in foreign trade, than as a part of the domestic economy playing a role as a supplier of inputs to industry or generator of employment. The idea that this sector is a gold mine in foreign trade is another misconception of Costarican policy-makers and economic managers. In fact, this approach implies a much lower rate of economic development. Our results show that development is much greater with an emphasized agricultural production policy even if

there is a zero policy emphasis on the industrial production policy, and a lower rate of development leads to a lower level of trade. Thus, more emphasis should be given to the role of this sector in the domestic economy to improve development and foreign trade.

6. As to import substitution industrialization, our findings do not support the conclusion that the rate of development is lower with import substitution than without it. Our policy recommendation is to continue implementing this policy, but to make the following adjustments. First, proceed with the unification of the exchange rate to improve export performance. Second, as mentioned in point 2, emphasize the production of intermediary and simple capital goods to meet domestic needs and for export to non-Central American markets. Third, as stated in points 1 and 5, improve agricultural development.

7. Since we have shown that in Costa Rica, economic development is a problem of economic management, there is not much need for developing and implementing new policies or creating new ministries or public administration offices that tend to duplicate existing institutions, errors, and misconceptions and, thus, contribute to generate more confusion and uncertainty in the business horizon of industrial and agricultural businessmen. What is really needed more is the appropriate implementation, adjustment, analysis, and evaluation of the already existing development policies and their unknown effects on the economy. In fact, the lack of an organized and effective economic management infrastructure translates in turn into a lack of trained personnel in applied economic research, and a lack of economic know-how at the very operational level of policy devising and implementation, thus making this job very difficult or impossible to perform.

Little is to be gained from implementing the policy adjustments that we have suggested unless the country develops this infrastructure.

8. A side-effect of the lack of an effective economic management infrastructure is the relative lack of coordination between monetary, fiscal policies, and development policies. This lack of coordination generates further confusion and uncertainty. For instance, within monetary policy, credit financing of industrial and agricultural development tends to be less effective as long as wealthy groups of society misuse these funds, utilizing them for other purposes like purchasing luxury-oriented imported consumption goods, thus, contributing to the trade deficit. This problem must be corrected by proper regulation and enforcing of existing laws. Also, the structure of interest rates for credit financing of economic activities must be such that it redirects credit away from commercial activities and toward industry and agriculture. Exchange rate policy (depreciation), will be much less effective in reducing imports if credit policy is not tightened, so as to reduce consumption goods imports. Also, an expenditure-reducing fiscal policy must complement the expenditure-switching effect (making imported goods more expensive than the domestic ones) of the exchange rate policy to improve the balance of trade. As a complementary policy action, the tax revenues generated by taxing expenditures on imported goods, particularly consumption goods, must be utilized to enhancing export incentive mechanisms and not to finance public works and administration expenditures. Finally, the exchange rate and the foreign exchange policies must work together. Briefly, by having a single exchange rate system the free market for foreign exchange would be eliminated, avoiding its destabilizing effects on the foreign

exchange-saving aspect of a tightened foreign exchange policy. As long as an uncontrolled parallel market for foreign exchange exists, most efforts by the Central Bank to control the outflow of foreign exchange are ineffective.

9. As to the usefulness of large scale macroeconomic linear programming planning models within an economic management infrastructure such as Costa Rica, the many problems that we have encountered in developing and building our model, most of which are discussed in the appendixes, indicate that before more models can be built, a tremendous statistical and econometric effort is needed in order to produce the adequate data that these models require. In addition, highly trained personnel in model-building and implementation of model results is needed on a full-time basis. Also, at the present stage of development in Costa Rica, smaller sectoral models linked to overall macro-models will be very useful in identifying the effects of global development policies on individual economic activities. As Meier[3] has stated, before placing so much emphasis on model-building and implementation of new policies, development planners need to know what is wrong and how to put it right. That is, development economists must recognize that there is still an inadequate understanding of the complex workings of developing countries' fragmented economies. In addition, few academicians have ever had the practical experience of living and working in these countries for periods of time long enough to acquire first-hand knowledge, and thus correct for this handicap.

10. Future research in development planning in Costa Rica should focus on linking domestic policies to international finance. Namely, the analysis of the balance of payments problems should be carried

further to include the monetary approach in international finance. That is, linking trade deficits to monetary and fiscal policies in the countries with which Costa Rica is trading (especially the United States), and taking into account the effect of those policies on the exchange rates and on the domestic monetary and fiscal policies. Frenkel and Johnson,[4] Putnam and Wilford,[5] and Stern[6] have done extensive applied work on this subject.

11. Finally, decades of a piecemeal and disorganized policy and economic management approach to solving development problems, have has a snowball-effect on most of these problems, since they have not been solved while at the same time additional misconceptions and confusion have been added to them.[7] This snowball-effect has significantly increased the magnitude of these problems. Thus, many of them cannot be solved in the short-term, even with an adequate economic management infrastructure. In addition, Costa Rica's resources are so limited when compared with the magnitude of development problems that, if she could command the required resources to solve these problems, she would in fact not be a developing country.[8]

ENDNOTES

[1]Planning Office, National Development Plan 1974-1978. Productive Sectors: Industrial Sector (San Jose, 1974), p. 7.

[2]Economic Commission for Latin America, "Central America: Industrial Policy Problems," Economic Bulleting for Latin America (March, 1964), pp. 117-130.

[3]G. Meier, Leading Issues in Economic Development (New York, 1976), pp. 850-855.

[4]J. Frenkel and H. Johnson, The Monetary Approach to the Balance of Payments (Toronto, 1980); J. Frenkel and H. Johnson, The Economics of Exchange Rates (Boston, 1978).

[5]B. Putnam and D. Wilford, The Monetary Approach to International Adjustment (New York, 1978).

[6]R. Stern, The Balance of Payments: Theory and Economic Policy (New York, 1973).

[7]Planning Office, National Development Plan: Diagnose (San Jose, 1973), pp. 52-53, 82; Central American Institute for Public Adminitration, Public Administration Problems in the Latin American Developing Countries (San Jose, 1970), pp. 1-30.

[8]B. Higgins, Economic Development: Principles, Problems and Policies (New York, 1968), p. 334.

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APPENDIXES

APPENDIX A

LIST OF 20 INDUSTRIAL ACTIVITIES BY GROUP

TABLE XXVI

INDUSTRIAL ACTIVITIES BY GROUP

Industrial Activity (UIIC)*		Group
		Traditional
1	20	Food Industries
2	21	Beverages
3	22	Tobacco
4	23	Textiles
5	24	Shoes and Clothing
6	25	Wood Products
7	26	Furniture and Accessories
8	29	Leather and Leather Products
		Intermediary
9	27	Paper and Paper Products
10	30	Rubber
11	31	Substances and Chemical Products
12	32	Derived Products of Petroleum and Coal
13	33	Non-Metallic Mineral Products
		Metal-Mechanic
14	34	Basic Metals Industries
15	35	Metallic Products, except Transport Machinery and Equipment
16	36	Machinery except Electrical
17	37	Electrical Machinery, Equipment and Artifacts
18	38	Transport Equipment Construction
		Residual
19	28	Printing, Editorials and Related Industries
20	39	Miscellany Industries

*Uniform international industrial classification code.

Source: Central Bank of Costa Rice, Some Economic Indicators of the Industrial Sector 1972 (San Jose, 1973), pp. 7-8.

APPENDIX B

STATISTICAL SERIES OF VALUES OF THE VARIABLES IN THE MODEL

TABLE XXVII

SECTORAL GROSS DOMESTIC PRODUCT, 1957-1979

Year	Agricultural[a]	Industrial	Commerce	Rest of the Services[b]	Total
	Million Colones				
1957	704.7	337.4	423.9	872.3	2338.3
1958	668.0	405.3	434.4	958.4	2466.1
1959	630.5	423.2	470.7	1048.6	2573.0
1960	672.4	473.6	504.8	1112.9	2763.7
1961	763.9	463.6	486.9	1202.3	2916.7
1962	806.3	529.8	537.9	1296.5	3170.5
1963	875.2	603.0	574.4	1408.4	3461.0
1964	879.1	645.7	604.2	1467.5	3596.5
1965	924.2	522.1	793.0	1552.2	3791.5
1966	994.4	692.3	879.1	1684.0	4249.9
1967	1065.3	733.9	918.2	1839.0	4556.4
1968	1178.6	847.2	1011.0	1992.7	5029.5
1969	1303.1	945.2	1116.3	2211.4	5576.0
1970	1469.4	1119.6	1371.4	2491.8	6452.2
1971	1443.5	1250.3	1502.2	2821.3	7017.3
1972	1601.6	1387.4	1651.4	3309.6	7950.0
1973	1962.6	1725.6	2054.0	3931.1	9673.3
1974	2522.6	2453.8	2754.8	5133.5	12864.7
1075	3417.7	3067.9	3203.5	6755.6	16444.7
1976	4213.0	3632.7	3832.5	8557.9	20236.1
1977	5762.5	4448.4	5134.3	10433.1	25778.3
1978	6163.5	5019.3	5950.1	12422.0	29554.9
1979	6398.4	6331.5	7056.5	14797.9	34584.2

[a]Includes cattle-raising.

[b]Services; construction; electricity; water and gas; transport; financial services; real estate; government.

Sources: Central Bank of Costa Rica, National Accounts of Costa Rica 1957-1970 (San Jose, 1972), p. 2; Permanent Secretariat of the General Treaty for Central American Economic Integration, Selected Statistical Series of Central America and Panama (November 1973) (Guatemala, 1973), pp. 81, 93; Permanent Secretariat of the General Treaty for Central American Economic Integration, Macroeconomic Statistics of Central America, 1970-1980 (July 1981) (Guatemala, 1981), p. 6; Central Bank of Costa Rica, Some Economic Indicators of the Industrial Sector (San Jose, 1972), pp. 1-2; Central Bank of Costa Rica, National Accounts of Costa Rica 1971-1980 (San Jose, 1981), p. 26.

TABLE XXVIII

STRUCTURE OF SECTORAL GROSS DOMESTIC PRODUCT, 1957-1979

Year	Agricultural	Industrial	Commerce	Rest of the Services	Total
	----------Percentage----------				
1957	30.1	14.4	18.2	37.3	100.0
1958	27.1	16.4	17.6	38.9	100.0
1959	24.5	16.4	18.3	40.8	100.0
1960	24.3	17.1	18.3	40.3	100.0
1961	26.2	15.9	16.7	41.2	100.0
1962	25.4	16.7	17.0	40.9	100.0
1963	25.3	17.4	16.6	40.7	100.0
1964	24.4	18.0	16.8	40.8	100.0
1965	24.4	13.8	20.9	40.9	100.0
1966	23.4	16.3	20.7	39.6	100.0
1967	23.4	16.1	20.1	40.4	100.0
1968	23.4	16.9	20.1	39.6	100.0
1969	23.4	17.0	20.0	39.6	100.0
1970	22.8	17.3	21.3	38.6	100.0
1971	20.6	17.8	21.4	40.2	100.0
1972	20.2	17.4	20.8	41.6	100.0
1973	20.3	17.8	21.2	40.7	100.0
1974	19.6	19.1	21.4	39.9	100.0
1975	20.8	18.6	19.5	41.1	100.0
1976	20.8	18.0	18.9	42.3	100.0
1977	22.3	17.3	19.9	40.5	100.0
1978	20.9	17.0	20.1	42.0	100.0
1979	18.5	18.3	21.4	42.8	100.0

Source: Computed from Table XXVII.

TABLE XXIX

SECTORAL GROSS PRODUCTION, 1957-1979

Year	Agricultural[a]	Industrial	Commerce	Rest of the Services[b]	Total
	----------Million Colones----------				
1957	820.6	970.6	520.6	1104.3	3416.1
1958	777.9	1048.6	533.5	1213.3	3573.3
1959	734.2	1091.8	578.1	1327.5	3731.6
1960	783.0	1257.8	620.0	1408.9	4069.7
1961	889.6	1201.8	598.0	1522.1	4211.5
1962	939.0	1407.5	660.6	1641.3	4648.4
1963	1019.2	1565.1	705.5	1783.0	5072.8
1964	1023.7	1677.2	742.1	1857.8	5300.8
1965	1076.3	1935.2	974.0	1965.0	5950.5
1966	1158.0	2202.1	1079.7	2131.9	6571.7
1967	1240.6	2368.8	1127.7	2338.1	7075.2
1968	1372.5	2759.2	1241.7	2522.7	7896.1
1969	1517.5	3022.8	1371.0	2799.6	8710.9
1970	1711.2	3048.5	1684.3	3154.6	9598.6
1971	1681.0	3910.7	1845.0	3571.7	11008.4
1972	1865.1	4296.5	2028.2	4189.9	12379.7
1973	2285.5	5704.7	2522.7	4976.7	15489.6
1974	2937.7	8284.9	3383.4	6498.9	21095.9
1975	3980.1	9979.4	3934.5	8552.5	26446.5
1976	4906.2	11781.5	4707.1	10834.1	32228.9
1977	6710.7	15504.7	6305.9	13208.1	41729.4
1978	7177.7	15913.4	7307.9	15726.0	46125.0
1979	7451.3	19235.3	8666.8	18733.9	54087.2

[a]Includes cattle-raising.

[b]Services; construction; electricity; water and gas; transport; financial services; real estate; government.

Sources: Permanent Secretariat of the General Treaty for Central American Economic Integration, Selected Statistical Series of Central America and Panama (November 1973) (Guatemala, 1973), p. 89; Central Bank of Costa Rica, Some Economic Indicators of the Industrial Sector 1972 (San Jose, 1973), pp. 7-8; Permanent Secretariat of the General Treaty for Central American Economic Integration, Selected Statistical Series of Central America and Panama (November 1980) (Guatemala, 1980), p. 96; Merril, W., Fletcher, 1., Hoffman, R., and Applegate, M., Panama's Economic Development: the Role of Agriculture (Iowa, 1975), pp. 41-42, Table XXVII.

TABLE XXX

SECTORAL GROSS FIXED INVESTMENT, 1957-1979

Year	Agricultural	Industrial	Commerce	Rest of the Services	Total
	----------Million Colones----------				
1957	133.0	63.6	80.4	165.0	442.0
1958	123.6	74.8	80.2	177.3	455.9
1959	122.2	81.8	91.3	203.5	498.8
1960	112.0	78.7	84.2	185.5	460.4
1961	132.1	80.2	84.2	207.8	504.3
1962	150.1	98.7	100.4	241.6	590.8
1963	157.1	108.0	103.0	252.7	620.8
1964	144.2	106.4	99.3	241.0	590.9
1965	178.0	100.7	152.5	298.4	729.6
1966	172.2	120.0	152.3	291.4	735.9
1967	195.2	134.3	167.6	336.9	834.0
1968	206.4	149.1	177.3	349.3	882.1
1969	239.5	174.0	204.7	405.3	1023.5
1970	289.5	219.7	270.5	490.1	1269.8
1971	196.6	251.2	93.1	1037.6	1578.5
1972	158.0	307.5	88.6	1246.1	1800.2
1973	156.2	485.2	116.4	1493.8	2251.6
1974	225.5	605.0	219.4	2124.9	3174.8
1975	253.8	636.1	134.1	2670.9	3694.9
1976	274.5	799.3	249.3	3522.9	4846.0
1977	391.1	1043.7	299.3	4154.7	5888.8
1978	447.5	1289.5	306.9	4908.5	6952.4
1979	665.4	1687.1	400.4	6297.0	9049.9

Sources: Central Bank of Costa Rica, National Accounts of Costa Rica 1957-1970 (San Jose, 1972), p. 5; Central Bank of Costa Rica, National Accounts of Costa Rica 1960-1973 (San Jose, 1975), p. 12; Central Bank of Costa Rica, National Accounts of Costa Rica 1971-1980 (San Jose, 1981), pp. 40-41; Table XXVIII.

TABLE XXXI

TOTAL IMPORTS BY USE OR ECONOMIC DESTINATION, 1958 - 1979

Year	Capital Goods for Agriculture	Intermediate Goods for Agriculture	Capital Goods for Industry	Intermediate Goods for Industry	Capital Goods for Rest of the Services	Intermediate Goods for Rest of the Services	Consumption Goods	Total
	Million Colones							
1958	26.5	48.4	82.1	180.2	11.9	96.7	211.3	657.1
1959	27.2	50.3	84.8	186.2	11.9	100.0	219.2	679.6
1960	29.1	53.7	90.8	198.7	13.2	106.0	233.2	724.7
1961	19.2	49.7	113.3	225.2	27.8	87.4	174.9	697.5
1962	21.2	53.6	121.9	243.8	29.8	94.1	189.5	753.9
1963	23.2	58.3	132.5	264.3	32.4	102.0	205.4	818.1
1964	25.8	64.9	148.4	296.1	36.4	114.6	229.9	916.1
1965	29.8	67.6	185.5	406.1	72.9	106.6	319.3	1187.8
1966	29.8	66.9	183.5	402.8	71.5	106.0	316.7	1177.2
1967	31.8	71.5	197.4	431.9	76.8	111.9	339.9	1261.2
1968	35.1	91.4	169.6	522.7	58.3	113.3	426.6	1417.0
1969	41.1	100.0	223.3	555.1	113.3	118.6	471.7	1623.1
1970	42.4	110.6	341.2	737.4	118.6	166.3	581.0	2097.5
1971	71.1	136.8	391.8	808.5	158.9	184.5	664.0	2415.6
1972	83.6	162.7	457.4	969.0	221.4	190.6	647.2	2731.9
1973	80.9	90.8	585.9	1292.0	272.9	369.7	872.4	3564.6
1974	102.8	159.2	868.0	2549.2	390.4	810.8	1405.1	6285.5
1975	169.7	179.1	907.6	2269.3	444.8	743.0	1234.1	5947.6
1976	188.5	195.4	1216.1	2310.5	509.1	736.2	1446.6	6602.4
1977	243.4	250.2	1429.5	2929.2	802.1	995.0	2103.9	8753.3
1978	232.2	293.1	1602.6	3120.3	935.8	1270.9	2535.0	9989.9
1979	250.2	308.5	2073.9	3851.4	940.1	1546.0	3000.4	11970.5

TABLE XXXI (Continued)

Sources: Permanent Secretariat of the General Treaty for Central American Economic Integration, VI Central American Statistical Compendium (Guatemala, 1975), p. 295; Permanent Secretariat of the General Treaty for Central American Economic Integration, Selected Statistical Series of Central America and Panama (November 1980) (Guatemala, 1980), p. 23; Permanent Secretariat of the General Treaty for Central American Economic Integration, Macroeconomic Statistics of Central America 1970-1980 (July 1981) (Guatemala, 1981), p. 17; Central Bank of Costa Rica, Some Economic Indicators of the Industrial Sector 1980 (San Jose, 1981), p. 40; Planning Office, Financial Economic Indicators (May-June, 1976) (San Jose, 1976), p. 16.

TABLE XXXII

STRUCTURE OF TOTAL IMPORTS BY ECONOMIC AREA OF ORIGIN:
CENTRAL AMERICA AND REST OF THE WORLD 1973-1979

Year	Total Imports (1)	Imports from Central America (2)	Imports from the Rest of the World (3) = (1) - (2)
	----------In Percentage----------		
1973	100.0	18.4	81.6
1974	100.0	15.8	84.2
1975	100.0	16.5	83.5
1976	100.0	17.6	82.4
1977	100.0	16.4	83.6
1978	100.0	17.4	82.6
1979	100.0	15.0	85.0

Source: Permanent Secretariat of the General Treaty for Central American Economic Integration, Macroeconomic Statistics of Central America 1970-1980 (July 1981), (Guatemala, 1981), p. 19.

TABLE XXXIII

IMPORTS FROM CENTRAL AMERICA BY USE OR ECONOMIC DESTINATION, 1958-1979

Year	Capital Goods for Agriculture	Intermediate Goods for Agriculture	Capital Goods for Industry	Intermediate Goods for Industry	Capital Goods for Rest of the Services	Intermediate Goods for Rest of the Services	Consumption Goods	Total
	Million Colones							
1958	0.0	2.0	0.7	0.7	0.0	0.0	2.0	5.4
1959	0.0	9.3	3.3	3.3	0.0	0.0	9.9	25.8
1960	0.0	8.6	2.6	3.3	0.0	0.0	8.6	23.1
1961	0.0	1.3	0.7	5.3	0.0	7.3	11.9	26.5
1962	0.0	1.3	0.7	4.0	0.0	6.0	10.0	22.0
1963	0.0	1.3	0.7	4.6	0.0	6.6	10.6	23.8
1964	0.0	3.3	1.3	10.6	0.0	15.2	24.5	54.9
1965	1.3	2.6	0.7	33.1	1.3	9.9	48.4	97.3
1966	2.0	4.0	0.7	53.0	2.0	15.2	76.2	153.1
1967	3.3	6.0	1.3	76.8	3.3	22.5	112.6	225.8
1968	4.0	8.6	2.6	115.9	1.3	19.2	171.6	323.2
1969	4.0	10.6	3.3	119.2	2.0	20.5	178.2	337.8
1970	2.6	13.2	4.6	170.9	1.3	31.1	229.9	453.6
1971	5.5	19.3	5.5	187.9	1.4	32.5	276.4	528.5
1972	7.3	23.5	8.8	234.6	2.9	30.0	273.4	580.5
1973	15.1	16.6	108.1	237.4	49.9	68.0	160.3	655.4
1974	16.6	24.9	136.8	402.9	61.3	127.7	222.2	992.4
1975	28.3	29.1	150.0	374.5	73.7	122.5	204.0	982.1
1976	33.4	34.3	214.2	406.2	89.1	129.4	254.5	1161.1
1977	39.4	41.1	234.0	479.9	131.1	162.8	345.4	1433.7
1978	40.3	50.6	278.5	542.5	162.8	221.1	441.4	1737.2
1979	37.7	46.3	312.8	581.9	142.3	233.1	453.3	1807.4

TABLE XXXIII (Continued)

Sources: Permanent Secretariat of the General Treaty for Central American Economic Integration, VI Central American Statistical Compendium (Guatemala, 1975), p. 323; Permanent Secretariat of the General Treaty for Central American Economic Integration, Selected Statistical Series of Central America and Panama (November 1980) (Guatemala, 1980), p. 23; Tables XXXI and XXXII.

TABLE XXXIV

IMPORTS FROM THE REST OF THE WORLD BY USE OR ECONOMIC DESTINATION, 1958-1979

Year	Capital Goods for Agriculture	Intermediate Goods for Agriculture	Capital Goods for Industry	Intermediate Goods for Industry	Capital Goods for Rest of the Services	Intermediate Goods for Rest of the Services	Consumption Goods	Total
	Million Colones							
1958	26.5	46.4	81.5	179.5	11.9	96.7	209.3	651.8
1959	27.2	41.0	81.5	182.9	11.9	100.0	209.3	653.8
1960	29.1	45.1	88.2	195.4	13.2	106.0	224.6	701.6
1961	19.2	48.4	112.6	219.9	27.8	80.1	163.0	671.0
1962	21.2	52.3	121.2	239.8	29.8	88.1	179.5	731.9
1963	23.2	57.0	131.8	259.7	32.4	95.4	194.8	794.3
1964	25.8	61.6	147.1	285.5	36.4	99.4	205.4	861.2
1965	28.5	65.0	184.8	373.0	71.6	96.7	270.9	1090.5
1966	27.8	62.9	182.8	349.8	69.5	90.8	240.5	1024.1
1967	28.5	65.5	196.1	355.1	73.5	89.4	227.3	1035.4
1968	31.1	82.8	167.0	406.8	57.0	94.1	255.0	1093.8
1969	37.1	89.4	220.0	435.9	111.3	98.1	293.5	1285.3
1970	39.8	97.4	336.6	566.5	117.3	135.2	351.1	1643.9
1971	65.6	117.5	386.3	620.6	157.5	152.0	387.6	1887.1
1972	76.3	139.2	448.6	734.4	218.5	160.6	373.8	2151.4
1973	65.8	74.2	477.8	1054.6	223.0	301.7	712.1	2909.2
1974	86.2	134.3	731.2	2146.3	329.1	683.1	1182.9	5293.1
1975	141.4	150.0	757.6	1894.8	371.1	620.5	1030.1	4965.5
1976	155.1	161.1	1001.9	1904.3	420.0	606.8	1192.1	5441.3
1977	204.0	209.1	1195.5	2449.3	671.0	832.2	1758.5	7319.6
1978	191.9	242.5	1324.1	2577.8	773.0	1049.8	2093.6	8252.7
1979	212.5	262.2	1761.1	3269.4	797.9	1312.9	2547.0	10163.0

Source: Computed by subtraction from Tables XXXI and XXXIII.

TABLE XXXV

AGRICULTURAL EXPORTS, 1962-1980

Year	Product						
	Coffee	Bananas	Beef	Sugar	Fish	Cocoa	Total
	Million Colones						
1962	322.0	178.2	17.9	18.5	6.0	n.a.*	542.6
1963	304.7	170.9	33.1	33.8	6.0	n.a.	548.5
1964	318.0	187.5	39.7	33.8	9.3	n.a.	588.3
1965	308.7	187.5	21.9	30.5	7.3	n.a.	555.9
1966	348.5	193.4	36.4	57.6	7.9	n.a.	643.8
1967	363.0	204.7	58.3	56.3	7.3	n.a.	689.6
1968	366.4	283.5	79.5	58.3	9.3	n.a.	797.0
1969	369.7	341.2	100.7	60.3	7.3	n.a.	879.2
1970	484.3	442.5	119.2	66.9	9.3	12.6	1134.8
1971	409.8	442.2	142.3	89.1	13.8	10.4	1107.6
1972	571.0	606.9	207.4	96.0	11.0	22.0	1514.3
1973	710.6	685.7	238.9	162.5	12.1	33.3	1843.1
1974	1034.6	815.7	283.5	202.3	16.6	48.9	2401.6
1975	830.4	1242.6	275.1	413.1	20.6	45.4	2827.2
1976	1318.9	1274.3	347.9	211.7	30.0	59.1	3241.9
1977	2735.5	1288.1	377.9	133.7	25.7	146.5	4707.4
1978	2634.4	1456.0	517.6	134.5	37.7	129.4	4909.6
1979	2679.0	1451.8	699.3	145.7	42.8	87.4	5106.0
1980	2124.5	1466.3	606.8	237.4	48.8	36.0	4519.8

*n.a. = Not available.

Sources: Permanent Secretariat of the General Treaty for Central American Economic Integration, Selected Statistical Series of Central America and Panama (November 1973) (Guatemala, 1973), p. 43; Permanent Secretariat of the General Treaty for Central American Economic Integration, Selected Statistical Series of Central America and Panama (November 1980) (Guatemala, 1980), p. 30; Permanent Secretariat of the General Treaty for Central American Economic Integration, Macroeconomic Statistics of Central America, 1970-1980 (July 1981) (Guatemala, 1981), p. 15.

TABLE XXXVI

STRUCTURE OF INDUSTRIAL EXPORTS
BY GROUP IN 1963

Group	1963
	In Percentage
Traditional	78.8
Intermediary	11.0
Metal-Mechanic	5.8
Residual	4.4
Total	100.0

Source: Permanent Secretariat of the General Treaty for Central American Economic Integration, The Integrated Development of Central America in the Present Decade: Integrated Industrial Development, Vol. IV (Buenos Aires, 1974), Table 9 (Statistical Appendix).

TABLE XXXVII

INDUSTRIAL EXPORTS BY GROUP, 1962-1980

Year	Traditional	Intermediary	Metal Mechanic	Residual	Total
			Million Colones		
1962	12.7	2.0	0.7	0.7	16.1
1963	27.2	3.9	2.0	1.3	34.4
1964	82.8	11.3	6.6	4.6	105.3
1965	101.4	13.9	7.3	5.9	128.5
1966	143.1	19.8	10.6	7.9	181.4
1967	155.7	21.9	11.3	8.6	197.5
1968	106.7	89.4	61.6	5.3	263.0
1969	108.0	94.7	67.5	6.0	276.2
1970	127.8	137.1	82.8	0	347.7
1971	114.0	187.3	97.4	0	398.7
1972	129.7	225.8	112.9	0	468.4
1973	204.8	296.3	156.5	0	657.6
1974	372.2	486.6	219.7	0	1078.5
1975	362.5	591.3	217.7	0	1171.5
1976	1676.2	647.9	326.5	0	2650.6
1977	631.6	711.3	440.5	0	1783.4
1978	714.7	763.6	441.3	0	1919.6
1979	799.5	875.0	488.5	0	2163.0
1980	1238.4	1270.9	699.3	0	3208.6

Sources: Central Bank of Costa Rica, Some Economic Indicators of the Industrial Sector 1980 (San Jose, 1981), pp. 21-23, 26-31, 33, 36; Central Bank of Costa Rica, Some Economic Indicators of the Industrial Sector 1974 (San Jose, 1975), pp. 6-9; Table XXXVI.

TABLE XXXVIII

INDUSTRIAL GROSS PRODUCTION BY GROUP, 1950-1979

Year	Traditional	Intermediary	Metal Mechanic	Residual	Total
	----------Million Colones----------				
1950	444.1	24.5	9.1	19.6	497.3
1951	473.2	34.4	11.5	14.0	533.1
1952	533.2	28.7	15.5	16.7	594.1
1953	573.4	34.9	16.4	16.6	641.3
1954	663.6	42.9	17.8	15.7	740.0
1955	729.2	47.2	21.5	18.4	816.3
1956	751.6	57.1	25.6	46.3	880.6
1957	849.7	67.0	29.1	24.8	970.6
1958	911.3	82.2	31.9	23.2	1048.6
1959	952.6	80.2	32.0	27.0	1091.8
1960	1099.0	90.0	41.0	27.8	1257.8
1961	1030.1	94.2	47.1	30.4	1201.8
1962	1205.5	114.5	49.7	37.8	1407.5
1963	1312.4	155.6	65.6	31.5	1565.1
1964	1315.6	213.3	90.7	57.6	1677.2
1965	1507.9	245.1	109.3	72.9	1935.2
1966	1700.6	255.7	162.3	83.5	2202.1
1967	1793.9	306.0	178.1	90.8	2368.8
1968	2025.2	405.3	228.6	100.1	2759.2
1969	2171.6	455.1	281.5	114.6	3022.8
1970	2488.9	52.8	333.2	173.6	3084.5
1971	2700.2	640.5	391.7	178.3	3910.7
1972	2925.2	757.1	422.9	191.3	4296.5
1973	3844.2	1006.2	592.7	261.6	5704.7
1974	5260.6	1785.6	870.4	368.3	8284.9
1975	6213.9	2431.3	929.8	404.4	9979.4
1976	7977.8	2255.6	1068.2	479.9	11781.5
1977	10643.8	2772.4	1506.6	581.9	15504.7
1978	11260.9	2193.1	1799.6	659.8	15913.4
1979	12369.1	4005.6	2089.3	771.3	19235.3

Sources: Central Bank of Costa Rica, Some Economic Indicators of the Industrial Sector 1972 (San Jose, 1973), pp. 7-8; Permanent Secretariat of the General Treaty for Central American Economic Integration, Selected Statistical Series of Central America and Panama (November 1973) (Guatemala, 1973), p. 89; Permanent Secretariat of the General Treaty for Central American Economic Integration, Selected Statistical Series of Central America and Panama (November 1980) (Guatemala, 1980), p. 96.

TABLE XXXIX

STRUCTURE OF PROTECTION AND INDUSTRIAL DEVELOPMENT CONTRACTS BY GROUP,* 1960-1979

Year	Traditional	Intermediary	Metal Mechanic	Residual	Total
	----------Percentage----------				
1960	70.0	23.2	5.3	1.5	100.0
1961	11.8	84.7	3.5	-	100.0
1962	12.4	73.0	11.1	3.5	100.0
1963	54.8	21.3	14.4	9.5	100.0
1964	53.7	38.9	6.1	1.3	100.0
1965	49.6	41.7	7.2	1.5	100.0
1966	47.4	36.4	13.7	2.5	100.0
1967	30.0	59.4	9.7	0.9	100.0
1968	56.8	8.5	28.5	6.2	100.0
1969	71.6	18.8	7.4	2.2	100.0
1970	55.4	25.6	17.6	1.4	100.0
1971	41.6	12.2	44.7	1.5	100.0
1972	28.2	61.2	7.3	3.3	100.0
1973	55.3	21.0	15.1	8.6	100.0
1974	90.7	5.0	2.4	1.9	100.0
1975	38.3	37.6	20.2	3.9	100.0
1976	76.9	18.2	3.7	1.2	100.0
1977	56.4	33.4	7.7	2.5	100.0
1978	38.1	41.7	14.2	6.0	100.0
1979	41.7	52.5	4.1	1.7	100.0

*Data refer to the amount to be invested in industrial projects.

Sources: Central Bank of Costa Rica, Some Economic Indicators of the Industrial Sector 1974 (San Jose, 1975), pp. 22-25; Central Bank of Costa Rica, Some Economic Indicators of the Industrial Sector 1980 (San Jose, 1981), pp. 44-46.

TABLE XL

INDUSTRIAL GROSS FIXED INVESTMENT BY GROUP, 1960-1979

Year	Traditional	Intermediary	Metal-Mechanic	Residual	Total
			Million Colones		
1960	55.1	18.3	4.2	1.1	78.7
1961	9.5	67.9	2.8	-	80.2
1962	12.2	72.0	11.0	3.5	98.7
1963	59.2	23.0	15.5	10.3	108.0
1964	57.1	41.4	6.5	1.4	106.4
1965	50.0	42.0	7.2	1.5	100.7
1966	56.9	43.7	16.4	3.0	120.0
1967	40.3	79.8	13.0	1.2	134.3
1968	84.7	12.7	42.5	9.2	149.1
1969	124.6	32.7	12.9	3.8	174.0
1970	121.7	56.2	38.7	3.1	219.7
1971	104.5	30.6	112.3	3.8	251.2
1972	86.7	188.2	22.4	10.2	307.5
1973	268.3	101.9	73.3	41.7	485.2
1974	548.7	30.3	14.5	11.5	605.0
1975	243.6	239.2	128.5	24.8	636.1
1976	614.7	145.5	29.5	9.6	799.3
1977	588.6	348.6	80.4	26.1	1043.7
1978	491.3	537.7	183.1	77.4	1289.5
1979	703.5	885.7	69.2	28.7	1687.1

Source: Computed from Tables XXX and XXXIX.

TABLE XLI

STRUCTURE OF INDUSTRIAL EXPORTS BY GROUP AND ECONOMIC AREA OF DESTINATION: CENTRAL AMERICA AND REST OF THE WORLD, 1963-1969

Group	1963			1969			1971/1972			1972/1973		
	Central America	Rest of the World	Total	Central America	Rest of the World	Total	Central America	Rest of the World	Total	Central America	Rest of the World	Total
	Percentage											
Traditional	17.0	83.0	100.0	32.0	68.0	100.0	80.0	20.0	100.0	77.0	23.0	100.0
Intermediary	93.0	7.0	100.0	81.0	19.0	100.0	73.0	27.0	100.0	74.0	26.0	100.0
Metal-Mechanic	100.0	0.0	100.0	88.0	12.0	100.0	77.0	23.0	100.0	78.0	22.0	100.0
Residual	67.0	33.0	100.0	87.0	13.0	100.0	91.0	9.0	100.0	92.0	8.0	100.0
Total	32.0	68.0	100.0	53.0	47.0	100.0	75.8	24.2	100.0	76.0	24.0	100.0

Sources: Permanent Secretariat of the General Treaty for Central American Economic Integration, The Integrated Development of Central America in the Present Decade: Integrated Industrial Development, Vol. 4, (Buenos Aires, 1974), Tables 9 and 10 (Statistical Appendix); Central Bank of Costa Rica, Considerations on Foreign Investment: Participation in the Country's Manufactured Exports (San Jose, 1974), pp. 19-20.

TABLE XLII

INDUSTRIAL EXPORTS BY GROUP AND ECONOMIC AREA OF DESTINATION: CENTRAL AMERICA AND REST OF THE WORLD 1962-1980

Year	Traditional		Intermediary		Metal-Mechanic		Residual		Total	
	CA*	RW*	CA	RW	CA	RW	CA	RW	CA	RW
	Million Colones									
1962	2.7	10.0	1.3	0.7	0.7	0.0	0.7	0.0	5.4	10.7
1963	4.6	22.5	3.3	0.7	2.0	0.0	0.7	0.7	10.6	23.9
1964	13.9	68.9	10.6	0.7	0.7	0.0	3.3	1.3	28.5	70.9
1965	17.2	84.1	12.6	1.3	7.3	0.0	4.0	2.0	41.1	87.4
1966	45.7	97.4	15.9	4.0	9.3	1.3	6.6	1.3	77.5	104.0
1967	49.7	106.0	17.9	4.0	10.0	1.3	7.3	1.3	84.9	112.6
1968	33.8	72.9	72.2	17.2	54.3	7.3	4.6	0.7	164.9	98.1
1969	34.4	73.5	76.8	17.9	59.6	7.9	5.3	0.7	176.1	100.0
1970	102.3	25.8	100.0	37.1	63.6	19.2	0.0	0.0	265.9	82.1
1971	91.2	22.8	136.8	50.4	75.3	22.1	0.0	0.0	303.3	95.3
1972	104.1	25.7	164.9	60.8	87.2	25.7	0.0	0.0	355.4	112.2
1973	158.0	46.9	219.2	77.1	77.1	34.8	0.0	0.0	454.3	158.8
1974	286.8	85.4	359.8	126.8	171.6	48.1	0.0	0.0	818.2	260.3
1975	279.4	83.1	437.9	153.4	169.7	48.0	0.0	0.0	887.0	284.5
1976	388.2	116.5	479.1	168.8	254.5	72.0	0.0	0.0	1121.8	357.3
1977	485.9	145.7	526.2	185.1	343.6	96.8	0.0	0.0	1355.7	427.6
1978	585.3	129.4	564.8	198.8	344.5	96.8	0.0	0.0	1494.6	425.0
1979	615.2	184.2	647.0	228.0	381.4	107.1	0.0	0.0	1643.7	519.3
1980	953.9	284.5	940.1	330.8	545.0	154.3	0.0	0.0	2439.0	769.6

*CA = Central America; RW = Rest of the World.

Source: Computed from Tables XXXVII and XLI.

TABLE XLIII

EXCHANGE RATES UTILIZED BY SIECA TO CONVERT COLONES INTO DOLLARS*

Year	Exchange Rate
	Colones Per Dollar
Up to 1970	6.625
1971	6.91
1972	7.33
1973	7.56
1974	8.29
1975-1980	8.57

*SIECA = Permanent Secretariat of the General Treaty for Central American Economic Integration.

Source: Permanent Secretariat of the General Treaty for Central American Economic Integration, Selected Statistical Series of Central America and Panama (November, 1980), (Guatemala, 1980), p. viii.

APPENDIX C

DERIVATION OF THE SUPPLY-DEMAND BALANCES

Let us start with the basic supply-demand balance given by inequality (1).

$$\Delta X_t + \Delta M_t^{com} \geq \Delta W_t + \Delta \bar{C}_t + \Delta I_t + \Delta \bar{G}_t + \Delta \bar{E}_t \qquad (1)$$

where M^{com} = competitive imports.

Given that competitive imports are the consumption goods imported only by the Commerce Sector and assuming that the intermediate demand and the demand for capital goods are represented by imports of intermediate and capital goods, inequality (1) is expressed as follows.

$$\Delta X_t^i \geq \Delta \bar{C}_t^i + \Delta \bar{G}_t^i + \Delta \bar{E}_t^i \qquad i = I, A, R \qquad (2)$$

$$\Delta X_t^C + \Delta M_{t,CG}^C \geq \Delta \bar{C}_t^C + \Delta \bar{G}_t^C + \Delta \bar{E}_t^C \qquad (3)$$

$$\Delta W_t^i = \Delta M_{t,IG}^i \qquad i = I, A, R \qquad (4)$$

$$\Delta I_t^i \leq \Delta M_{t,KG}^i \qquad i = I, A, R \qquad (5)$$

APPENDIX D

DATA DISCUSSION

Gross Production

Gross production data are available only for the Industrial Sector in terms of the Traditional-Intermediary-Metal-Mechanic-Residual breakdown needed for the model. For the other sectors gross production data can be generated for the years 1957-1979 by utilizing the 1961 sectoral proportions derived by Merril, Fletcher, Hofmann and Applegate[1] from an input-output table of Panama, the only country in the area for which such a table is available. The procedure used to generate the required data is based on the assumption that sectoral value added (gross domestic product) is a constant proportion of gross sectoral production, or:

$$\alpha^i = V^i/X^i \rightarrow X^i = (1/\alpha^i)V^i \qquad i = A, R, C$$

where X^i = gross production sector i,

V^i = value added sector i, and

α^i = sectoral constant proportions.

The values of the α's are: Agricultural Sector (0.8587), Commerce (0.8142), and Rest of the Services (0.7899).[2]

Gross Domestic Product

These data are available with a breakdown by economic activity, suitable for direct use in the model.

Consumption

Final private consumption expenditure is available in aggregate form. A breakdown by economic activity can be generated by applying the percentage breakdown of the gross domestic product data to the

aggregate figures of private consumption. This procedure is a matter of convenience. However, it can be argued that the greater the size of an activity (for example in terms of production level or the number of people employed in it) the greater is the expenditure on final private consumption that can be expected from that activity.

Gross Fixed Investment

These data are available by economic activity only for the period 1971-1979. For the years 1957-1970, a breakdown is obtainable by applying to the aggregated figures the percentage breakdown by economic activity of the gross domestic product data. Although the major reason for using this procedure is convenience, the following economic reasoning can be given. Since labor is not a scarce factor in Costa Rica but capital is, manufacturing is likely to be closely associated with the availability of machinery and equipment. If this is correct, then further increases in production can be expected from additional increases in machinery, that is, further gross fixed investment. In summary, the structure of production can be taken as reflecting the structure of fixed investment. For the Industrial Sector there are no gross fixed investment data available in the Traditional-Intermediary-Metal-Mechanic-Residual breakdown. The desired breakdown for the industrial investment data can be generated for 1960-1979 by applying to these aggregate data, the percentage composition by industrial group of the Planned Industrial Investment data under the Protection and Industrial Development Act.

Protection and Industrial Development Contracts

These data represent the amount of gross fixed investment that businessmen plan to undertake in order to create or expand an industrial enterprise at the time they are granted industrial development incentives through a contract with the government. These data are published following the Traditional-Intermediary-Metal-Mechanic-Residual industrial grouping.

Industrial Exports

Industrial exports data are available at the product level by decreasing ranges of value for the years 1968-1979, according to the Central American Uniform Tariffs Classification (CAUTC). In order to express export data in a form convenient for use in the model, industrial products were arranged in such a way as to obtain the Traditional-Intermediary-Metal-Mechanic-Residual grouping (see Appendix E). For the years 1962-1967, data are available in aggregate form, so in order to obtain a breakdown by industrial group, we applied to the aggregate data the percentage breakdown by group existing in 1963, according to data of SIECA for that year.

The next task is to express exports of the industrial groups, by economic area of destination (Central America and Rest of the World). A breakdown, in the form needed, is available only for the years 1963 and 1969, and the periods 1971-1972 and 1972-1973. The breakdown is based on data from industrial inquiries conducted by SIECA (for 1963 and 1969), and on data from a sample of industrial firms obtained by the Central Bank of Costa Rica (for the periods 1971-1972 and 1972-1973). To obtain the desired Central America-Rest of the World breakdown,

we must apply the percentage structure by industrial group of the available breakdown, to the industrial group export data. The following schedule was used.

Period:	1962-1965	1966-1969	1970-1972	1973-1979
Percentage Structure to be Applied:	1963	1969	1971/72	1972/73

Agricultural Exports

This category includes exports of the Commercial Export-Oriented Agriculture. There is no breakdown by economic area of destination. Recall that the Agricultural Sector exports only to the Rest of the World.

Imports

Total imports are classified according to the Classification of Imports by Use or Economic Destination (CUOED). In order to express these data in a convenient form to be used in the model, the only modification needed is in relation to the Rest of the Services Sector. Capital goods imports of this sector will be "Transport Equipment" and intermediary goods imports will be "Fuels and Lubricants", "Building Material" and "Diverse".[3] The next task is to break down imports by economic area of origin (Central America and Rest of the World). Since there are data for 1958-1972 for the Central American area, imports from the Rest of the World are readily obtained by subtraction. For the years 1973-1979, the only available breakdown is one of SIECA for aggregate imports. Our procedure applied that percentage structure by area to our economic categories of imports to obtain the desired breakdown.

Foreign Exchange

This variable is defined as the balance of trade deficit, and was computed as total imports less total exports.

All of the data for this study were available in current prices. When data were in dollars they were converted into colones by applying the exchange rates utilized by SIECA to convert colones into dollars (Table XLIII, Appendix B).

A summary of data availability and sources is provided in Table XLIV.

Other Data Adjustments

In the framework of the supply-demand balances and the savings constraint the data were not consistent. This suggested obtaining one of the variables by subtraction in order to get the data back into consistency. In the supply-demand balances it was believed that production, exports and consumption were consistent data, thus government expenditure[4] was obtained by difference in both the base and the target year since it is an exogenous variable in the model. The procedure utilized for each sector was the following.

$$X_j^i = \bar{C}_j^i + \bar{G}_j^i + \bar{E}_j^i \qquad i = I, A, R;\ j = 0, t$$

$$X_j^C + M_{j,CG}^C = \bar{C}_j^C + \bar{G}_j^C + \bar{E}_j^C \qquad j = 0, t$$

then,

$$\bar{G}_j^i = X_j^i - \bar{C}_j^i - \bar{E}_j^i$$

$$\bar{G}_j^C = X_j - \bar{C}_j^C - \bar{E}_j^C + M_{j,CG}^C$$

TABLE XLIV

AVAILABILITY AND SOURCES OF DATA

Variable	Years	Source*
Sectoral Gross Production	1957-1979	Computed from sectoral gross domestic product
Industrial Gross Production by Group	1950-1979	SIECA, CBCR
Sectoral Gross Domestic Product	1957-1979	SIECA, CBCR
Savings	1962	Computed by subtraction in the saving gap equation
Sectoral Consumption	1962, 1979	CBCR
Sectoral Government Expenditure	1962, 1979	Computed by subtraction in the supply-demand balance equations
Sectoral Gross Fixed Investment	1957-1979	CBCR
Industrial Gross Fixed Investment by Group	1960-1979	Computed from the industrial gross fixed investment data
Protection and Industrial Development Contracts	1960-1979	CBCR
Industrial Exports	1962-1980	CBCR
Agricultural Exports	1962-1980	SIECA
Imports	1958-1979	SIECA, CBCR
Foreign Exchange	1962, 1979	Computed by subtraction as total imports less total exports

*SIECA = Permanent Secretariat of the General Treaty for Central American Economic Integration; CBCR = Central Bank of Costa Rica.

In the saving constraint it was believed that foreign exchange and investment were consistent data, thus, saving[5] was obtained by difference for the base year, utilizing the following procedure.

$$\sum_i I_0^i = S_0 + F_0 \qquad i = I, A, R, C$$

then,

$$S_0 = \sum_i I_0^i - F_0$$

The actual computation of government expenditure and savings is provided in Appendix G.

ENDNOTES

[1]W. Merrill, L. Fletcher, R. Hoffmann and M. Applegate, Panama's Economic Development: The Role of Agriculture (Ames, 1975), pp. 41-42.

[2]This value is the arithmetic mean of the proportions for: Construction (0.5000), Utilities (0.6614), Finances (0.9202), Housing (0.9897), and Services (0.8783).

[3]Recall that the activities Transport and Construction are part of the Rest of the Services Sector. As to "Fuels and Lubricants," they are imported and marketed by the activity Government, which is also included in the Rest of the Services Sector.

[4]Government expenditure data were available in aggregate form. A breakdown by economic activity was generated utilizing the same procedure outlined for obtaining private consumption expenditure by economic activity.

[5]Savings data were available in aggregate form.

APPENDIX E

CLASSIFICATION OF INDUSTRIAL EXPORTS BY GROUP

TABLE XLV

CLASSIFICATION OF INDUSTRIAL EXPORTS BY GROUP

CAUTC*	Description	Group**
032-01-01	Sardines	T
081-09-02	Animals food	T
062-01-02	Sugar candy and bonbons	T
022-02-01	Milk and cream	T
032-01-07	Canned fish	T
072-02-00	Cocoa powder	
053-03-00	Fruit marmalade, fruit jelly and fruit pulps, whether hermetically packed or not	T
073-01-00	Chocolate products	T
091-00-00	Margarine and butter	T
099-09-05	Concentrated substances to make non-alcoholic beverages	T
072-03-00	Peanut butter	T
048-04-02	Cookies--all kinds	T
013-02-00	Processed and canned meat	T
055-02-04	Preserved mixed pickles	T
112-04-00	Distilled alcoholic beverages	T
412-06-00	Palm-tree oil	T
611-01-00	Tanned leather except furs	T
655-04-03	Cloths and felts	T
632-09-00	Wood manufactured products	T
656-03-00	Blankets--all kinds	T
653-05-00	Artificial or synthetic fibers textiles	T
653-07-00	Crochet textiles of any textile fiber	T
631-00-00	Smoothed wood	T
651-00-00	Textile fibers yarn and thread	T
657-02-00	Carpets, rugs and tapestries	T
841-02-03	Clothing and apparel	T
821-00-00	Furniture and accessories	T
851-00-00	Shoes--all kinds	T
841-19-06	Corsets, brassieres and other intimate apparel	T

TABLE XLV (Continued)

CAUTC*	Description	Group**
599-09-15	Other chemical materials and products	IN
552-01-00	Perfumes and cosmetics	IN
552-03-00	Wax, bitumen and other wood and leather cleaning and polishing products	IN
533-00-00	Paints, pigments, lacquer and related products	IN
599-01-01	Waxed paper	IN
641-00-00	Paper and pasteboards	IN
561-00-00	Fertilizers	IN
541-09-00	Medicines and drugs	IN
599-02-00	Insecticides and pesticides	IN
599-01-04	Other non-manufactured synthetic plastic materials and artificial resins	IN
642-01-02	Pasteboard boxes	IN
665-01-00	Glass containers	IN
629-01-02	Tires and tubes	IN
642-09-00	Paper pulp products	IN
899-07-01	Plastic table utensils (spoons, knives, forks, etc.)	IN
899-11-01	Plastic products	IN
891-02-02	Records	IN
699-29-06	Metal corks and corks with metal crowns	MM
699-12-02	Hand tools for artisans	MM
699-21-00	Metallic containers for transporting and storage	MM
681-07-00	Metallic sheets	MM
681-13-00	Iron and steel tubes	MM
721-03-02	Fluorescent lamps	MM
721-19-07	Plugs, interrupters or commuters, switches, fuses, connection boxes and other electrical accessories	MM
716-12-02	Refrigerators and freezers	MM
721-02-00	Dry electrical batteries	MM
721-13-00	Wire for electricity transmission	MM

TABLE XLV (Continued)

CAUTC*	Description	Group**
721-04-01	Radios and transmitters	MM
721-01-05	Mechanisms to operate switches, instrument panels, commuters and distributors	MM
812-04-04	Lamps and lanterns--all kinds	MM
892-09-00	Printed matter and designs on pasteboards	RE
899-99-06	Zippers	RE

*CAUTC = Central American Uniform Tariffs Classification.

**T = Traditional; IN = Intermediary; MM = Metal-Mechanic; and RE = Residual.

APPENDIX F

ESTIMATION OF MODEL PARAMETERS

This appendix presents specific characteristics of the linear programming model for Costa Rica and provides the operational quantitative model-building framework of the study. The focus is on first, presenting the methods used to estimate the model parameters, second, highlighting the major problems found regarding the value of some of these parameters when experimentation with the model was carried on, and third, providing the results of the estimations.

Characteristics of the Model and Method of Solution

The model has four sectors, 73 endogenous variables, 9 exogenous variables and 53 parameters. It is represented by 86 rows or constraints and 73 columns or variables. It is comparative static since it compares the base year with the target year values of the variables. Output, exports, imports and the exchange rates play a major role.

The technique used to solve the multiobjective optimization problem is a computer package called the Mathematical Programming System (MPS) or another version called the Mathematical Programming System Extended (MPSX) of the 360 or 370 series.

Policy Weights in the Objective Function

The policy weights are simple percentages, whose value will be selected according to the type of policy that is being emphasized. The value of these weights is given in Chapter IV, Table XXII.

Incremental Capital-Output Ratios

The incremental capital-output ratio (ICOR) for sector i, ℓ^i, is defined as the investment from an additional unit of output. These ratios were obtained by fitting the following equations.

$$I_t^i = \ell^i(X_t^i - X_{t-1}^i) \qquad i = A, R, C$$

For the Industrial Sector, the equations were:

$$I_{t,i}^I = \ell_i^I(X_{t,i}^I - X_{t-1,i}^I) \qquad i = KG, IG, CG, RG$$

Equations (1) and (2) in Table XLVI for the Agricultural and Commerce sectors were estimated utilizing 1957-1979 data, and equations (3) to (6) for industrial ICOR's, were fitted using 1960-1979 data. For the Agricultural Sector and the industrial investment group IG, the original regression estimates of their parameters were not significant. Several specifications of these equations were estimated utilizing a trend variable, a trend variable in logarithmic form, expressions of the variables as a share of gross domestic product, and as a share of gross domestic product in incremental form. Since these alternative specifications resulted in no significant improvements, a selection among these was made based on the highest R^2 value to determine the parameters for the model. Finally, the Rest of the Services Sector, ICOR, was obtained as the ratio $I_t^R/(X_t^R - X_0^R)$ since experimentation with the model utilizing its original regression estimate suggested that it was inconsistent.

TABLE XLVI

SUMMARY OF ESTIMATED EQUATIONS*

Equation**	R^2	D-W	
$I_t^A = 0.0887\ (X_t^A - X_{t-1}^A) + 0.0141\ (X_t^A - X_{t-1}^A)\ t_t$	0.4673	0.4763	(1)
$(0.10)(0.8944) \qquad (0.32)(0.0434)$			
$I_t^C = 0.1983\ (X_t^C - X_{t-1}^C)$	0.5635	2.0310	(2)
$(5.21)(0.0380)$			
$I_{t,KG}^I = 0.3343\ (X_{t,KG}^I - X_{t-1,KG}^I)$	0.7073	2.2751	(3)
$(6.41)(0.0521)$			
$I_{t,IG}^I = -0.5402\ (X_{t,IG}^I - X_{t-1,IG}^I) + 0.0466\ (X_{t,IG}^I - X_{t-1,IG}^I)\ t_t$	0.4509	0.9952	(4)
$(-0.95)(0.5715) \qquad (1.49)(0.0312)$			
$I_{t,CG}^I = 0.3216\ (X_{t,CG}^I - X_{t-1,CG}^I)$	0.8425	1.6056	(5)
$(9.81)(0.0327)$			
$I_{t,RG}^I = 0.3567\ (X_{t,RG}^I - X_{t-1,RG}^I)$	0.7334	2.3309	(6)
$(6.84)(0.0521)$			

TABLE XLVI (Continued)

Equation**	R^2	D-W	
$M^I_{t,KG} - M^I_{t-1,KG} = 0.0978\ (X^I_t - X^I_{t-1})$ $(7.41)(0.0132)$	0.7332	2.5631	(7)
$M^I_{t,IG} - M^I_{t-1,IG} = 0.1955\ (X^I_t - X^I_{t-1})$ $(4.92)(0.0397)$	0.5474	2.4387	(8)
$M^A_{t,KG} - M^A_{t-1,KG} = 0.0242\ (X^A_t - X^A_{t-1})$ $(3.16)(0.0077)$	0.3221	1.9047	(9)
$\frac{M^R_{t,KG} - M^R_{t-1,KG}}{GDP_t - GDP_{t-1}} = 0.0650\ (\frac{X^R_t - X^R_{t-1}}{GDP_t - GDP_{t-1}})$ $(3.57)(0.0181)$	0.3782	1.9606	(10)
$M^C_{t,CG} - M^C_{t-1,CG} = 0.3558\ (X^C_t - X^C_{t-1})$ $(9.82)(0.0362)$	0.8213	2.4092	(11)
$M^{I_{CA}}_{t,KG} - M^{I_{CA}}_{t-1,KG} = 0.1406\ (M^I_{t,KG} - M^I_{t-1,KG})$ $(4.38)(0.0321)$	0.4774	2.3025	(12)
$M^{I_{CA}}_{t,IG} - M^{I_{CA}}_{t-1,IG} = 0.1130\ (M^I_{t,IG} - M^I_{t-1,IG})$ $(8.54)(0.0132)$	0.7763	2.0989	(13)

TABLE XLVI (Continued)

Equation**	R^2	D-W	
$M^{I_{RW}}_{t,KG} - M^{I_{RW}}_{t-1,KG} = 0.8594\ (M^{I}_{t,KG} - M^{I}_{t-1,KG})$	0.9715	2.3025	(14)
(26.77) (0.0321)			
$M^{I_{RW}}_{t,IG} - M^{I_{RW}}_{t-1,IG} = 0.8870\ (M^{I}_{t,IG} - M^{I}_{t-1,IG})$	0.9953	2.0989	(15)
(67.04) (0.0132)			
$M^{A_{CA}}_{t,KG} - M^{A_{CA}}_{t-1,KG} = 0.1312\ (M^{A}_{t,KG} - M^{A}_{t-1,KG})$	0.5596	2.1544	(16)
(5.17) (0.0254)			
$M^{A_{CA}}_{t,IG} - M^{A_{CA}}_{t-1,IG} = 0.1385\ (M^{A}_{t,IG} - M^{A}_{t-1,IG})$	0.9280	1.8465	(17)
(16.45) (0.0084)			
$M^{A_{RW}}_{t,KG} - M^{A_{RW}}_{t-1,KG} = 0.8688\ (M^{A}_{t,KG} - M^{A}_{t-1,KG})$	0.9824	2.1544	(18)
(34.21) (0.0254)			
$M^{A_{CA}}_{t,IG} = M^{A_{CA}}_{t-1,IG} = 0.8615\ (M^{A}_{t,IG} - M^{A}_{t-1,IG})$	0.9980	1.8465	(19)
(102.34) (0.0084)			
$M^{R_{CA}}_{t,IG} - M^{R_{CA}}_{t-1,IG} = 0.1356\ (M^{R}_{t,IG} - M^{R}_{t-1,IG})$	0.8069	2.4531	(20)
(9.37) (0.0145)			

TABLE XLVI (Continued)

Equation**	R^2	D-W	
$M^{R_{RW}}_{t,IG} - M^{R_{RW}}_{t-1,IG} = 0.8644\ (M^{R}_{t,IG} - M^{R}_{t-1,IG})$	0.9941	2.4531	(21)
(59.73)(0.0145)			
$M^{C_{CA}}_{t,CG} - M^{C_{CA}}_{t-1,CG} = 0.1096\ (M^{C}_{t,CG} - M^{C}_{t-1,CG})$	0.2768	1.5622	(22)
(2.84)(0.0387)			
$M^{C_{RW}}_{t,CG} - M^{C_{RW}}_{t-1,CG} = 0.8904\ (M^{C}_{t,CG} - M^{C}_{t-1,CG})$	0.9619	1.5622	(23)
(23.02)(0.0387)			

*The "t" ratio and the standard error of the parameter are given in the first and second brackets respectively.

**A correction for autocorrelation utilizing the Cochrane-Orcutt method has been made when necessary.

Stock-Flow Conversion Factor

This parameter was computed utilizing the following formula.

$$\theta = \frac{g}{1 - e^{-gn}}$$

where

$$g = \left(\frac{I_t}{I_0}\right)^{1/n} - 1$$

and θ = Stock-Flow conversion factor,

I_0 = total investment in the base year,

I_t = total investment in the target year,

g = exogenous growth rate of total investment, and

n = number of years between base and target years.

The results were as follows:

$$\theta = \frac{0.1741}{1 - 0.0518} = 0.1836 \qquad \text{where } g = \left(\frac{9049.9}{590.8}\right)^{1/17} - 1 = 0.1741$$

Marginal Import Parameters

For Step I, m_j^i is defined as the increase in total sectoral imports of goods type i per unit increase in sectoral output. For Step II, the import parameters are defined as the increase in total sectoral imports from economic area j of goods type i, per unit increase in total sectoral imports of goods type i (this is the increase in total sectoral imports in Step I). These parameters were estimated by fitting the following equations.

Step I

$$(M^I_{t,i} - M^I_{t-1,i}) = m^I_i(X^I_t - X^I_{t-1}) \qquad i = KG, IG$$

$$(M^{A}_{t,i} - M^{A}_{t-1,i}) = m^{A}_{i}(X^{A}_{t} - X^{A}_{t-1}) \qquad i = KG, IG$$

$$(M^{R}_{t,i} - M^{R}_{t-1,i}) = m^{R}_{i}(X^{R}_{t} - X^{R}_{t-1}) \qquad i = KG$$

$$(M^{C}_{t,CG} - M^{C}_{t-1,CG}) = m^{C}_{CG}(X^{C}_{t} - X^{C}_{t-1})$$

Step II

$$(M^{I_j}_{t,i} - M^{I_j}_{t-1,i}) = m^{I_j}_{i}(M^{I}_{t,i} - M^{I}_{t-1,i}) \qquad j = CA, RW;\ i = KG, IG$$

$$(M^{A_j}_{t,i} - M^{A_j}_{t-1,i}) = m^{A_j}_{i}(M^{A}_{t,i} - M^{A}_{t-1,i}) \qquad j = CA, RW;\ i = KG, IG$$

$$(M^{R_j}_{t,i} - M^{R_j}_{t-1,i}) = m^{R_j}_{i}(M^{R}_{t,i} - M^{R}_{t-1,i}) \qquad j = CA, RW;\ i = KG, IG$$

$$(M^{C_j}_{t,CG} - M^{C_j}_{t-1,CG}) = m^{C_j}(M^{C}_{t,CG} - M^{C}_{t-1,CG}) \qquad j = CA, RW$$

The estimated equations (7) to (23) utilizing data for the period 1958-1979 are given in Table XLVI. The parameter m^{R}_{KG} was not statistically significant, initially. Other specifications were estimated utilizing a trend variable, a trend variable in logarithmic form, expressing the variables as a share of gross domestic product, and finally expressing the variables as a share of gross domestic product in incremental form. The parameter turned out to be significantly different from zero in the last two specifications of the import equation. The parameter of the latter form was selected on the basis of the R^2 and the standard error of the estimate. The parameter m^{A}_{IG} was computed as the ratio $\Delta M^{A}_{IG}/\Delta X^{A}$ utilizing base and target year data, since experiments with the model suggested that its regression estimate was inconsistent. This procedure was used to compute the estimates of the parameters $m^{R_{CA}}_{KG}$ and $m^{R_{RW}}_{KG}$ for the same reason, although in these two cases the new estimates were very close to the regression estimates.

Import Substitution Parameters

These parameters represent the proportion that the change in total imports of goods type i from economic area j are of the change in the total supply of goods type i. The parameters measure the extent to which imports are replaced by domestic industrial production. The import substitution parameters were computed utilizing the following formula.

$$\mu_i^{I_j} = \Delta M_i^{T_j} / (\Delta X_i^I + \Delta M_i^{T_j}) \qquad i = KG, IG; \; j = CA, RW$$

where $X_i^I + M_i^{T_j}$ is defined as the total supply of the good type i.

For consumption goods the formula is as follows.

$$\mu_{CG}^{I_j} = \Delta M_{CG}^{C_j} / (\Delta X_{CG}^I + \Delta M_{CG}^{C_j}) \qquad j = CA, RW$$

The estimates of the import substitution parameters are provided in Tables XLVII and XLVIII.

Growth Rates of Exports

These parameters are exogenous. They were computed for both industrial exports by type of good and trading area of destination, and for agricultural exports, utilizing 1962 and 1979 export data. In both cases these parameters were calculated using the following formula, which provides annual growth rates:

$$e = (E_t/E_0)^{1/n} - 1$$

where e = Exogenous annual growth rate of exports,

E_0 = base year export level,

E_t = target year export level, and

n = number of years between base and target years.

TABLE XLVII

COMPUTATION OF IMPORT SUBSTITUTION PARAMETERS FOR THE CENTRAL AMERICAN AREA BY TYPE OF GOOD*

Variable or Parameter** (KG)	Value*** t	Value 0	Variable or Parameter (IG)	Value t	Value 0	Variable or Parameter (CG)	Value t	Value 0
	Million Colones							
$M_{KG}^{I_{CA}}$	312.8	0.7	$M_{IG}^{I_{CA}}$	581.9	4.0			
$M_{KG}^{A_{CA}}$	37.7	0.0	$M_{IG}^{A_{CA}}$	46.3	1.3			
M_{KG}^{CA}	142.3	0.0	$M_{IG}^{R_{CA}}$	233.1	6.0			
$M_{KG}^{T_{CA}}$	492.8	0.7	$M_{IG}^{T_{CA}}$	861.3	11.3	$M_{CG}^{C_{CA}}$	453.3	10.0
X_{KG}^{I}	2089.3	49.7	X_{IG}^{I}	4005.6	114.5	X_{CG}^{I}	12369.1	1205.5
$\mu_{KG}^{I_{CA}}$	0.1944		$\mu_{IG}^{I_{CA}}$	0.1793		$\mu_{CG}^{I_{CA}}$	0.0382	

TABLE XLVII (Continued)

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*The formula used is:

$$\mu_i^{I_j} = (M_{t,i}^{T_j} - M_{0,i}^{T_j})/(X_{t,i}^{I} - X_{0,i}^{I}) + (M_{t,i}^{T_j} - M_{0,i}^{T_j}) \qquad j = CA;\ i = KG,\ IG$$

$$\mu_{CG}^{I_j} = (M_{t,CG}^{C_j} - M_{0,CG}^{C_j})/(X_{t,CG}^{I} - X_{0,CG}^{I}) + (M_{t,CG}^{C_j} - M_{0,CG}^{C_j}) \qquad j = CA$$

**KG = capital goods; IG = intermediary goods; CG = consumption goods; CA = Central America.

***0 = base year (1962), t = target year (1979).

Source: Computed from Tables XXXIII and XXXVIII (Appendix B).

TABLE XLVIII

COMPUTATION OF IMPORT SUBSTITUTION PARAMETERS FOR THE REST OF THE WORLD AREA BY TYPE OF GOOD*

Variable or Parameter** (KG)	Value*** t	Value 0	Variable or Parameter (IG)	Value t	Value 0	Variable or Parameter (CG)	Value t	Value 0
	Million Colones							
$M_{KG}^{I_{RW}}$	1761.1	121.2	$M_{IG}^{I_{RW}}$	3269.4	239.8			
$M_{KG}^{A_{RW}}$	212.5	21.2	$M_{IG}^{A_{RW}}$	262.2	52.3			
$M_{KG}^{R_{RW}}$	797.9	29.8	$M_{IG}^{R_{RW}}$	1312.9	88.1			
$M_{KG}^{T_{RW}}$	2771.5	172.2	$M_{IG}^{T_{RW}}$	4844.5	380.2	$M_{CG}^{C_{RW}}$	2547.0	179.5
X_{KG}^{I}	2089.3	49.7	X_{IG}^{I}	4005.6	114.5	X_{CG}^{I}	12369.1	1205.5
$\mu_{KG}^{I_{RW}}$	0.5603		$\mu_{IG}^{I_{RW}}$	0.5343		$\mu_{CG}^{I_{RW}}$	0.1750	

TABLE XLVIII (Continued)

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*The formula used is:

$$\mu_i^{I_j} = (M_{t,i}^{T_j} - M_{0,i}^{T_j}) \,/\, (X_{t,i}^{I} - X_{0,i}^{I}) + (M_{t,i}^{T_j} - M_{0,i}^{T_j}) \qquad j = RW;\ i = KG,\ IG$$

$$\mu_{CG}^{I_j} = (M_{t,CG}^{C_j} - M_{0,CG}^{C_j}) / (X_{t,CG}^{I} - X_{0,CG}^{I}) + (M_{t,CG}^{C_j} - M_{0,CG}^{C_j}) \qquad j = RW$$

**KG = capital goods; IG = intermediary goods; CG = consumption goods; RW = Rest of the World.

***0 = base year (1962), t = target year (1979).

Source: Computed from Tables XXXIV and XXXVIII (Appendix B).

The estimates of the growth rates of exports are provided in Table XLIX.

All model parameters are listed in Table L together with their estimate, while Table LI, provides the value of the exogenous or autonomous components of the model, which make up the right hand side of the constraint equations. Finally, the linear programming model is summarized using a tableau in Appendix I.

TABLE XLIX

COMPUTATION OF GROWTH RATES OF EXPORTS*

Parameter**	Years*** 0	Years*** t	Period n	Export Values*** 0	Export Values*** t	Growth Rate
	----------Million Colones----------					
e_{KG}^{CA}	1962	1979	17	0.7	381.4	0.4486
e_{IG}^{CA}	1962	1979	17	1.3	647.0	0.4409
e_{CG}^{CA}	1962	1979	17	2.7	615.3	0.3762
e_{RG}^{CA}	1962	1979	17	0.7	0.0	-1.0
e_{KG}^{RW}	1962	1979	17	0.0	107.1	--
e_{IG}^{RW}	1962	1979	17	0.7	228.0	0.4054
e_{CG}^{RW}	1962	1979	17	10.0	184.2	0.1869
e_{RG}^{RW}	1962	1979	17	0.0	0.0	0.0
e^{A}_{RW}	1962	1979	17	542.6	5106.0	0.1410

*The formula used is:

$$e = (E_t/E_{t-1})^{1/n} - 1$$

**KG = capital goods; IG = intermediary goods; CG = consumption goods, RG = Residual goods; CA = Central America; RW = Rest of the World.

***0 = base year (1962), t = target year (1979).

Source: Computed from Tables XXXV and XLII (Appendix B).

TABLE L

SUMMARY OF PARAMETERS AND THEIR ESTIMATES

Parameter	Estimate
θ	0.1836
ℓ^{A}	0.4130
ℓ^{R}	0.3650
ℓ^{C}	0.1983
ℓ^{I}_{KG}	0.3343
ℓ^{I}_{IG}	0.3452
ℓ^{I}_{CG}	0.3216
ℓ^{I}_{RG}	0.3567
m^{I}_{KG}	0.0978
m^{I}_{IG}	0.1955
m^{A}_{KG}	0.0242
m^{A}_{IG}	0.0391
m^{R}_{KG}	0.0650
m^{C}	0.3558
$m^{I_{CA}}_{KG}$	0.1406
$m^{I_{RW}}_{KG}$	0.8594

TABLE L (Continued)

Parameter	Estimate
$m_{IG}^{I_{CA}}$	0.1130
$m_{IG}^{I_{RW}}$	0.8870
$m_{KG}^{A_{CA}}$	0.1312
$m_{KG}^{A_{RW}}$	0.8688
$m_{IG}^{A_{CA}}$	0.1385
$m_{IG}^{A_{RW}}$	0.8615
$m_{KG}^{R_{CA}}$	0.1670
$m_{KG}^{R_{RW}}$	0.8330
$m_{IG}^{R_{CA}}$	0.1356
$m_{IG}^{R_{RW}}$	0.8644
$m^{C_{CA}}$	0.1096
$m^{C_{RW}}$	0.8904
$\mu_{KG}^{I_{CA}}$	0.1944
$\mu_{KG}^{I_{RW}}$	0.5603
$\mu_{IG}^{I_{CA}}$	0.1793
$\mu_{IG}^{I_{RW}}$	0.5343

TABLE L (Continued)

Parameter	Estimate
$\mu_{CG}^{I_{CA}}$	0.0382
$\mu_{CG}^{I_{RW}}$	0.1750
e_{KG}^{CA}	0.4486
e_{IG}^{CA}	0.4409
e_{CG}^{CA}	0.3762
e_{RG}^{CA}	-1.0
e_{IG}^{RW}	0.4054
e_{CG}^{RW}	0.1869
e_{RG}^{RW}	0.0
$e^{A_{RW}}$	0.1410

TABLE LI

VALUES OF THE EXOGENOUS COMPONENTS OF THE MODEL*

Exogenous Components	Values
$X_0^I + (\bar{C}_t^I - C_0^I) + (\bar{G}_t^I - G_0^I)$	17088.0
$X_0^A + (\bar{C}_t^A - C_0^A) + (\bar{G}_t^A - G_0^A)$	2887.9
$X_0^R + (\bar{C}_t^R - C_0^R) + (\bar{G}_t^R - G_0^R)$	18733.9
$X_0^C + M_{0,CG}^C + (\bar{C}_t^C - C_0^C) + (\bar{G}_t^R - G_0^R)$	11667.2
$I_0^I - M_{0,KG}^I$	-23.2
$I_0^A - M_{0,KG}^A$	128.9
$I_0^R - M_{0,KG}^R$	211.8
$I_{0,KG}^I - \theta\ell_{KG}^I X_{0,KG}^I$	7.9
$I_{0,IG}^I - \theta\ell_{IG}^I X_{0,IG}^I$	64.7
$I_{0,CG}^I - \theta\ell_{CG}^I X_{0,CG}^I$	-58.9
$I_{0,RG}^I - \theta\ell_{RG}^I X_{0,RG}^I$	35.3
$I_0^A - \theta\ell^A X_0^A$	78.9
$I_0^C - \theta\ell^C X_0^C$	76.3
$I_0^R - \theta\ell^R X_0^R$	131.6
$M_{0,KG}^I - m_{KG}^I X_0^I$	-15.7

TABLE LI (Continued)

Exogenous Components	Values
$M^{I}_{0,IG} - m^{I}_{IG} X^{I}_{0}$	-31.4
$M^{A}_{0,KG} - m^{A}_{KG} X^{A}_{0}$	-1.5
$M^{A}_{0,IG} - m^{A}_{IG} X^{A}_{0}$	16.9
$M^{R}_{0,KG} - m^{R}_{KG} X^{R}_{0}$	-76.9
$M^{C}_{0,CG} - m^{C} X^{C}_{0}$	-45.5
$M^{I_{CA}}_{0,KG} - m^{I_{CA}}_{KG} M^{I}_{0,KG}$	-16.4
$M^{I_{CA}}_{0,IG} - m^{I_{CA}}_{IG} M^{I}_{0,IG}$	-23.5
$M^{I_{RW}}_{0,KG} - m^{I_{RW}}_{KG} M^{I}_{0,KG}$	16.4
$M^{I_{RW}}_{0,IG} - m^{I_{RW}}_{IG} M^{I}_{0,IG}$	23.5
$M^{A_{CA}}_{0,KG} - m^{A_{CA}}_{KG} M^{A}_{0,KG}$	-2.8
$M^{A_{CA}}_{0,IG} - m^{A_{CA}}_{IG} M^{A}_{0,IG}$	-6.1
$M^{A_{RW}}_{0,KG} - m^{A_{RW}}_{KG} M^{A}_{0,KG}$	2.8
$M^{A_{RW}}_{0,IG} - m^{A_{RW}}_{IG} M^{A}_{0,IG}$	6.1
$M^{R_{CA}}_{0,KG} - m^{R_{CA}}_{KG} M^{R}_{0,KG}$	-4.9766
$M^{R_{CA}}_{0,IG} - m^{R_{CA}}_{IG} M^{R}_{0,IG}$	-6.8
$M^{R_{RW}}_{0,KG} - m^{R_{RW}}_{KG} M^{R}_{0,KG}$	4.9766

TABLE LI (Continued)

Exogenous Components	Values
$M^{R_{RW}}_{0,IG} - m^{R_{RW}}_{IG} M^{R}_{0,IG}$	6.8
$M^{C_{CA}}_{0,CG} - m^{C_{CA}}_{CG} M^{C}_{0,CG}$	-10.7692
$M^{C_{RW}}_{0,CG} - m^{C_{RW}}_{CG} M^{C}_{0,CG}$	10.7692
$(1 - \mu^{I_{CA}}_{KG}) M^{T_{CA}}_{0,KG} - \mu^{I_{CA}}_{KG} X^{I}_{0,KG}$	-9.1
$(1 - \mu^{I_{CA}}_{IG}) M^{T_{CA}}_{0,IG} - \mu^{I_{CA}}_{IG} X^{I}_{0,IG}$	-11.2
$(1 - \mu^{I_{CA}}_{CG}) M^{C_{CA}}_{0,CG} - \mu^{I_{CA}}_{CG} X^{I}_{0,CG}$	-36.4321
$(1 - \mu^{I_{RW}}_{KG}) M^{T_{RW}}_{0,KG} - \mu^{I_{RW}}_{KG} X^{I}_{0,KG}$	-47.9
$(1 - \mu^{I_{RW}}_{IG}) M^{T_{RW}}_{0,IG} - \mu^{I_{RW}}_{IG} X^{I}_{0,IG}$	115.9
$(1 - \mu^{I_{RW}}_{CG}) M^{C_{RW}}_{0,CG} - \mu^{I_{RW}}_{CG} X^{I}_{0,CG}$	-62.875
$(1 + e^{CA}_{KG}) 17 \; E^{I_{CA}}_{0,KG} - E^{I_{CA}}_{0,KG}$	380.6
$(1 + e^{CA}_{IG}) 17 \; E^{I_{CA}}_{0,IG} - E^{I_{CA}}_{0,IG}$	645.4
$(1 + e^{CA}_{CG}) 17 \; E^{I_{CA}}_{0,CG} - E^{I_{CA}}_{0,CG}$	612.4
$(1 + e^{CA}_{RG}) 17 \; E^{I_{CA}}_{0,RG} - E^{I_{CA}}_{0,RG}$	-0.7
$107.1 + E^{I_{RW}}_{0,KG}$	107.1
$(1 + e^{RW}_{IG}) 17 \; E^{I_{RW}}_{0,IG} - E^{I_{RW}}_{0,IG}$	227.2
$(1 + e^{RW}_{CG}) 17 \; E^{I_{RW}}_{0,CG} - E^{I_{RW}}_{0,CG}$	174.1

TABLE LI (Continued)

Exogenous Components	Values
$(1 + e^{A_{RW}})^{17} E_0^{A_{RW}} - E_0^{A_{RW}}$	4566.4
$-(\bar{F}_t - F_0) - M_0$	-5260.0
$\sum_i I_0^i - S_0 + (\bar{F}_t - F_0)$	4701.5

*All other exogenous components were equal to zero and were not listed.

APPENDIX G

COMPUTATION OF THE VALUES OF SECTORAL GOVERNMENT EXPENDITURE ($\bar{G}^i$) AND AGGREGATE SAVINGS (S)

TABLE LII

COMPUTATION OF SECTORAL GOVERNMENT EXPENDITURES

Sector	Supply-Demand Balance*	Value of Sectoral Government Expenditures
	----------	Million Colones ----------
Industrial	$G_0^I = X_0^I - C_0^I - E_0^I$	$G_0^I = 1407.5 - 368.1 - 16.1 = 1022.8$
	$\bar{G}_t^I = X_t^I - \bar{C}_t^I - E_t^I$	$\bar{G}_t^I = 19235.3 - 4234.1 - 2163.0 - 12838.2$
Agricultural	$G_0^A = X_0^A - C_0^A - E_0^A$	$G_0^A = 939.8 - 559.8 - 542.6 = -163.4$
	$\bar{G}_t^A = X_t^A - \bar{C}_t^A - E_t^A$	$\bar{G}_t^A = 7451.3 - 4280.4 - 5106.0 = -1935.1$
Rest of the Services	$G_0^R = X_0^R - C_0^R - E_0^R$	$G_0^R = 1641.3 - 901.5 - 0.0 = 739.8$
	$\bar{G}_t^R = X_t^R - \bar{C}_t^R - E_t^R$	$\bar{G}_t^R = 18733.9 - 9902.8 - 0.0 = 8831.1$
Commerce	$G_0^C = X_0^C - C_0^C - E_0^C + M_{0,CG}^C$	$G_0^C = 660.6 - 374.7 - 0.0 + 189.5 = 475.4$
	$\bar{G}_t^C = X_t^C - \bar{C}_t^C - E_t^C + M_{t,CG}^C$	$\bar{G}_t^C = 8666.8 - 4720.0 - 0.0 + 3000.4 = 6947.2$

*0 = base year (1962), t = target year (1979).

Source: Computed from Tables XXIX, XXXI, XXXV and XXXVII (Appendix B).

TABLE LIII

COMPUTATION OF AGGREGATE SAVINGS

Savings Gap*		Value of Savings
		--------Million Colones-------
$S_0 = \sum_i I_0^i - F_0$	i = I, A, C, R	S_0 = 590.8 - 195.4 = 395.4
$S_t = \sum_i I_t^i - \bar{F}_t$	i = I, A, C, R	S_t = 9049.9 - 4701.5 = 4348.4

*0 = base year (1962), t = target year (1979).

Source: Computed from Table XXX (Appendix B).

APPENDIX H

CALCULATED VALUES OF THE PARAMETERS IN THE MULTIOBJECTIVE FUNCTION FOR THE THREE SETS OF EXPERIMENTS

TABLE LIV

VALUE OF THE PARAMETERS IN THE OBJECTIVE FUNCTION FOR THE FIRST SET OF POLICY EXPERIMENTS

Experiment	δ_I	δ_A	$\frac{\gamma_{2}^{**}}{\gamma_3}$	$\frac{\gamma_{1}^{**}}{\gamma_3}$	δ_I^{CAM}	$\delta_I^{CAM}\frac{\gamma_2}{\gamma_3}$	δ_I^{CAE}	$\delta_I^{CAE}\frac{\gamma_1}{\gamma_3}$
BS*	0.70	0.30	1.0035	0.7760	0.10	0.1003	0.10	0.0776
E-1A	0.70	0.30	1.0035	0.7760	6.0	6.021	1.0	0.7760
E-1B	0.70	0.30	1.0035	0.7760	0.0	0.0	0.0	0.0
E-2A	1.0	1.0	1.0035	0.7760	0.0	0.0	0.0	0.0
E-2B	1.0	1.0	1.0035	0.7760	0.0	0.0	0.0	0.0
E-3A	1.0	1.0	1.0035	0.7760	6.0	6.021	1.0	0.7760
E-3B	1.0	1.0	1.0035	0.7760	0.0	0.0	0.0	0.0
E-4A	1.0	0.0	1.0035	0.7760	0.0	0.0	0.0	0.0
E-4B	0.0	1.0	1.0035	0.7760	0.0	0.0	0.0	0.0
E-5A	1.0	0.0	1.0035	0.7760	1.0	1.0035	1.0	0.7760
E-5B	0.0	1.0	1.0035	0.7760	1.0	1.0035	1.0	0.7760

TABLE LIV (Continued)

Experiment	δ_I^{RWM}	$\delta_I^{RWM} \frac{\gamma_2}{\gamma_3}$	δ_I^{RWE}	$\delta_I^{RWE} \frac{\gamma_2}{\gamma_3}$	δ_A^{M}	$\delta_A^{M} \frac{\gamma_2}{\gamma_3}$	δ_A^{E}	$\delta_A^{E} \frac{\gamma_1}{\gamma_3}$
BS*	0.70	0.7024	0.70	0.7024	0.20	0.2007	0.20	0.1552
E-1A	0.0	0.0	0.0	0.0	0.20	0.2007	0.20	0.1552
E-1B	11.0	11.03	1.0	1.0035	0.20	0.2007	0.20	0.1552
E-2A	11.0	11.03	1.0	1.0035	0.0	0.0	0.0	0.0
E-2B	0.0	0.0	0.0	0.0	6.0	6.021	1.0	0.7760
E-3A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E-3B	0.0	0.0	0.0	0.0	6.0	6.021	1.0	0.7760
E-4A	1.0	1.0035	1.0	1.0035	1.0	1.0035	1.0	0.7760
E-4B	1.0	1.0035	1.0	1.0035	1.0	1.0035	1.0	0.7760
E-5A	1.0	1.0035	1.0	1.0035	1.0	1.0035	1.0	0.7760
E-5B	1.0	1.0035	1.0	1.0035	1.0	1.0035	1.0	0.7760

*BS = Basic Solution.

**$\gamma_1 = 6.65$; $\gamma_2 = 8.60$; $\gamma_3 = 8.57$.

TABLE LV

VALUE OF THE PARAMETERS IN THE OBJECTIVE FUNCTION FOR THE SECOND SET OF POLICY EXPERIMENTS

Experiment	δ_I	δ_A	$\frac{\gamma_{2**}}{\gamma_3}$	$\frac{\gamma_{1**}}{\gamma_3}$	δ_I^{CAM}	$\delta_I^{CAM}\frac{\gamma_2}{\gamma_3}$	δ_I^{CAE}	$\delta_I^{CAE}\frac{\gamma_1}{\gamma_3}$
BS*	0.70	0.30	1.0035	0.7760	0.10	0.1003	0.10	0.0776
E-1C	0.70	0.30	7.3512	0.7760	6.0	44.10	1.0	0.7760
E-1D	0.70	0.30	7.3512	0.7760	0.0	0.0	0.0	0.0
E-2C	1.0	1.0	7.3512	0.7760	0.10	0.7351	0.10	0.0776
E-2D	1.0	1.0	7.3512	0.7760	0.10	0.7351	0.10	0.0776
E-3C	1.0	1.0	7.3512	0.7760	6.0	44.10	1.0	0.7760
E-3D	1.0	1.0	7.3512	0.7760	0.0	0.0	0.0	0.0
E-4C	1.0	0.0	7.3512	0.7760	0.10	0.7351	0.10	0.0776
E-4D	0.0	1.0	7.3512	0.7760	0.10	0.7351	0.10	0.0776
E-5C	1.0	0.0	7.3512	0.7760	1.0	7.3512	1.0	0.7760
E-5D	0.0	1.0	7.3512	0.7760	1.0	7.3512	1.0	0.7760

TABLE LV (Continued)

Experiment	δ_I^{RWM}	$\delta_I^{RWM} \frac{\gamma_2}{\gamma_3}$	δ_I^{RWE}	$\delta_I^{RWE} \frac{\gamma_2}{\gamma_3}$	δ_A^{M}	$\delta_A^{M} \frac{\gamma_2}{\gamma_3}$	δ_A^{E}	$\delta_A^{E} \frac{\gamma_1}{\gamma_3}$
BS*	0.70	0.7024	0.70	0.7024	0.20	0.2007	0.20	0.1552
E-1C	0.0	0.0	0.0	0.0	0.20	1.4702	0.20	0.1552
E-1D	11.0	80.86	1.0	7.3512	0.20	1.4702	0.20	0.1552
E-2C	11.0	80.86	1.0	7.3512	0.0	0.0	0.0	0.0
E-2D	0.0	0.0	0.0	0.0	6.0	44.10	1.0	0.7760
E-3C	0.70	5.1458	0.70	5.1458	0.0	0.0	0.0	0.0
E-3D	0.70	5.1458	0.70	5.1458	6.0	44.10	1.0	0.7760
E-4C	1.0	7.3512	1.0	7.3512	1.0	7.3512	1.0	0.7760
E-4D	1.0	7.3512	1.0	7.3512	1.0	7.3512	1.0	0.7760
E-5C	0.70	5.1458	0.70	5.1458	1.0	7.3512	1.0	0.7760
E-5D	0.70	5.1458	0.70	5.1458	1.0	7.3512	1.0	0.7760

*Basic solution with the exchange rate values as in Table LIV.

**$\gamma_1 = 6.65$; $\gamma_2 = 63$; $\gamma_3 = 8.57$.

TABLE LVI

VALUE OF THE PARAMETERS IN THE OBJECTIVE FUNCTION FOR THE THIRD SET OF POLICY EXPERIMENTS

Experiment	δ_I	δ_A	$\frac{\gamma_{2**}}{\gamma_3}$	$\frac{\gamma_{1**}}{\gamma_3}$	δ_I^{CAM}	$\delta_I^{CAM}\frac{\gamma_2}{\gamma_3}$	δ_I^{CAE}	$\delta_I^{CAE}\frac{\gamma_1}{\gamma_3}$
BS*	0.70	0.30	1.0035	0.7760	0.10	0.1003	0.10	0.0776
E-1E	0.70	0.30	7.3512	7.3512	6.0	44.10	1.0	7.3512
E-1F	0.70	0.30	7.3512	7.3512	0.0	0.0	0.0	0.0
E-2E	1.0	1.0	7.3512	7.3512	0.10	0.7351	0.10	0.7351
E-2F	1.0	1.0	7.3512	7.3512	0.10	0.7351	0.10	0.7351
E-3E	1.0	1.0	7.3512	7.3512	6.0	44.10	1.0	7.3512
E-3F	1.0	1.0	7.3512	7.3512	0.0	0.0	0.0	0.0
E-4E	1.0	0.0	7.3512	7.3512	0.10	0.7351	0.10	0.7351
E-4F	0.0	1.0	7.3512	7.3512	0.10	0.7351	0.10	0.7351
E-5E	1.0	0.0	7.3512	7.3512	1.0	7.3512	1.0	7.3512
E-5F	0.0	1.0	7.3512	7.3512	1.0	7.3512	1.0	7.3512

TABLE LVI (Continued)

Experiment	δ_I^{RWM}	$\delta_I^{RWM} \frac{\gamma_2}{\gamma_3}$	δ_I^{RWE}	$\delta_I^{RWE} \frac{\gamma_2}{\gamma_3}$	δ_A^{M}	$\delta_A^{M} \frac{\gamma_2}{\gamma_3}$	δ_A^{E}	$\delta_A^{E} \frac{\gamma_1}{\gamma_3}$
BS*	0.70	0.7024	0.70	0.7024	0.20	0.2007	0.20	0.1552
E-1E	0.0	0.0	0.0	0.0	0.20	1.4702	0.20	1.4702
E-1F	11.0	80.86	1.0	7.3512	0.20	1.4702	0.20	1.4702
E-2E	11.0	80.86	1.0	7.3512	0.0	0.0	0.0	0.0
E-2F	0.0	0.0	0.0	0.0	6.0	44.10	1.0	7.3512
E-3E	0.70	5.1458	0.70	5.1458	0.0	0.0	0.0	0.0
E-3F	0.70	5.1458	0.70	5.1458	6.0	44.10	1.0	7.3512
E-4E	1.0	7.3512	1.0	7.3512	1.0	7.3512	1.0	7.3512
E-4F	1.0	7.3512	1.0	7.3512	1.0	7.3512	1.0	7.3512
E-5E	0.70	5.1458	0.70	5.1458	1.0	7.3512	1.0	7.3512
E-5F	0.70	5.4158**	0.70	5.1458	1.0	7.3512	1.0	7.3512

*Basic solution with the exchange rate values as in Table LIV.

**$\gamma_1 = 63$; $\gamma_2 = 63$; $\gamma_3 = 8.57$.

APPENDIX I

DERIVATION OF THE LINEAR PROGRAMMING TABLEAU

The model presented in Chapter III can be summarized using a tableau presented in Table LIV. All endogenous variables will be placed on the top of the tableau. The farthest left hand side will be the name of the constraints whereas the farthest right hand side will be the constraints' constants. The bottom of the tableau will be the objective function. The elements of the matrix inside the tableau will be the parameters associated with the constraint.

TABLE LVII

THE LINEAR PROGRAMMING TABLEAU

	X^i	X^C	X^I_i	I^i	I^I_i	S	M^i_j	M^C_{CG}	$M^{I_j}_i$	$M^{A_j}_i$	$M^{R_j}_i$	$M^{C_j}_{CG}$	$M^{T_j}_i$	M^{P_j}	M^i	M	$E^{I_j}_i$	E^i	E^{I_j}	E^C	E	W^i	RHS
SDB-i	1																	-1					$\leq X^i_0 + (\bar{C}^i_t - C^i_0) + (\bar{G}^i_t - G^i_0)$ i = I, A, R
SDB-C		1						1												-1			$\leq X^C_0 + (\bar{C}^C_t - C^C_0) + (\bar{G}^C_t - G^C_0)$
INID-i							-1															1	$= W^i_0 - M^i_{0,IG}$ i = I, A, R
INVD-i				1			-1																$\leq I^i_0 - M^i_{0,KG}$ i = I, A, R
ACAP-I^I_i			$-\theta\ell^I_i$		1																		$\leq I^I_{0,i} - \theta\ell^I_i X^I_{0,i}$ i = KG, IG, CG, RG
ACAP-i	$-\theta\ell^i$			1																			$\geq I^i_0 - \theta\ell^I X^i_0$ i = A, C, R
MD-i_j	$-m^i_j$						1																$\geq M^i_{0,j} - m^i_j X^j_0$ i = I, A; j = KG, IG
MD-R_{KG}	$-m^R_{KG}$						1																$\geq M^R_{0,KG} - m^R_{KG} X^R_0$
MD-C_{CG}	$-m^C$							1															$\geq M^C_{0,CG} - m^C X^C_0$
MD-I^j_i							$-m^{I_j}_i$		1														$\geq M^{I_j}_{0,i} - m^{I_j}_i M^I_{0,i}$ j = CA, RW; i = KG, IG
MD-A^j_i							$-m^{A_j}_i$			1													$\geq M^{A_j}_{0,i} - m^{A_j}_i M^A_{0,i}$ j = CA, RW; i = KG, IG
MD-R^j_i							$-m^{R_j}_i$				1												$\geq M^{R_j}_{0,i} - m^{R_j}_i M^R_{0,i}$ j = CA, RW; i = KG, IG
MD-C^j_{CG}								$-m^{C_j}$				1											$\geq M^{C_j}_{0,CG} - m^{C_j} - M^C_{0,CG}$ j = CA, RW
IS-i^j			$-\mu^I_j$										$1-\mu^I_j$										$\leq \mu^{I_j}_i X^I_{0,i} + (1-\mu^{I_j}_i) M^{T_j}_{0,i}$ j = CA, RW; i = KG, IG
IS-CG^j			$-\mu^I_{CG}$					$1-\mu^{I_j}_{CG}$															$\leq \mu^{I_j}_{CG} X^I_{0,CG} + (1-\mu^{I_j}_{CG}) M^{C_j}_{0,CG}$
E-I^j_i																	1						$\leq (1+e^j_i)^n E^{I_j}_{0,i} - E^{I_j}_{0,i}$ j = CA, RW; i = KG, IG, CG, RG
E-ARW																		1					$\leq (1+e^A)^n E^A_0 - E^A_0$
TTG																-1					1		$\leq (\bar{F}_t - F_0) - M_0$
TSG				Σ_i		-1																	$\leq (\bar{F}_t - F_0) - S_0 + \Sigma_i I^i_0$ i = I, A, C, R
DEF-X^I	1		$-\Sigma_i$																				= 0 i = KG, IG, CG, RG

TABLE LVII (Continued)

	X^i	X^C	X^I_i	I^i	I^I_i	S	M^i_j	M^C_{CG}	M^I_{ij}	M^A_{ij}	M^R_{ij}	M^C_{CGj}	M^T_{ij}	M^P_j	M^i	M	E^I_{ij}	E^i	E^I_j	E^C	E	W^i		RHS
DEF-I^I				1	$-\Sigma_i$																		= 0	i = KG, IG, CG, RG
DEF-M^T_{ij}									-1	-1	-1		1										= 0	j = CA, RW; i = KG, IG
DEF-M^I_{ij}									-1					1									= 0	P = I; j = CA, RW; i = KG, IG
DEF-M^A_{ij}										-1				1									= 0	P = A; j = CA, RW; i = KG, IG
DEF-M^R_{ij}											-1			1									= 0	P = R; j = CA, RW; i = KG, IG
DEF-M^I							$-\Sigma_j$								1								= 0	i = I; j = KG, IG
DEF-M^A							$-\Sigma_j$								1								= 0	i = A; j = KG, IG
DEF-M^R							$-\Sigma_j$								1								= 0	i = R; j = KG, IG
DEF-M^C								-1							1								= 0	i = C
DEF-M															$-\Sigma_i$	1							= 0	i = I, A, R, C
DEF-E^I_{ij}																	$-\Sigma_i$		1				= 0	j = CA, RW; i = KG, IG, CG, RG
DEF-E^i																		1	$-\Sigma_j$				= 0	i = I; j = CA, RW
DEF-E^i																				1			= 0	i = C
DEF-E^i																		1					= 0	i = R
DEF-E																		$-\Sigma_i$			1		= 0	i = I, A, C, R
CARW-I^i							1		$-\Sigma_i$														= 0	j = CA, RW; i = KG, IG
CARW-A^i							1			$-\Sigma_i$													= 0	j = CA, RW; i = KG, IG
CARW-R^i							1				$-\Sigma_i$												= 0	j = CA, RW; i = KG, IG
CARW-C_{CG}								1				$-\Sigma_j$											= 0	j = CA, RW
OBJE	$-\Sigma_i \delta^I_i$						$-\Sigma_i \delta^M_I \frac{\gamma_2}{\gamma_3}$								δ^M_A			$\delta^E_A \delta^E_I \frac{\gamma_w}{\gamma_3}$						i = I, A; j = CA, RW; w = {1 for j = CA, 2 for j = RW

Note: SBD = supply-demand balance; INTD = intermediary demand; INVD = investment demand; ACAP = absorptive capacity; MD = import demand; IS = import substitution; E-I = industrial exports; E-ARW = agricultural exports; TTG = trade gap; TSG = savings gap; DEF = definition; CARW = Central America plus rest of the world imports adding up ad hoc constraint; OBJE = objective function; RHS = right hand side.

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