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9. ABSTRACT

This Ph.D. thesis outlines an approach to multi-country development planning and the programming of economic activities for the East Caribbean Common Market (ECCM). Regional economic integration of the Windward and Leeward Islands is needed to transform these Eastern Caribbean societies from their present state of dependent underdevelopment. This requires coordinated development planning and allocation among member countries of new production activities. The heavy reliance of each of the ECCM economies on non-regional markets fragments the regional economy. To fuse their product markets as well as their factor markets will require free movement of labor and capital within the region. Some of the empirical examples discussed include production of footwear in St. Kitts and St. Vincent, fruit canning operations in the same two places, and a woven-fabric garment manufacturing operations in St. Lucia.

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by

**Vincent Arnold Richards**

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AN APPROACH TO MULTI-COUNTRY DEVELOPMENT PLANNING  
AND INDUSTRIAL PROGRAMMING FOR THE  
EAST CARIBBEAN COMMON MARKET

A Thesis

Presented to the Faculty of the Graduate School  
of Cornell University for the Degree of  
Doctor of Philosophy

*211(d) Grant  
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by

Vincent Arnold Richards

June 1975

## BIOGRAPHICAL SKETCH

The author was born on November 16, 1945 in Sweetes, Antigua, West Indies. After graduating from high school in 1963, he taught at the Hill Secondary School, St. John's, Antigua until 1967, when he entered Carleton University, Ottawa, Canada. In 1970, he was awarded a B. A. (First Class Honours) in Economics and History by Carleton. He continued his studies at the same institution on a Carleton Graduate Fellowship, and received his M. A. in Economics in 1971. While at Cornell the author has been a part-time Lecturer in Caribbean Studies at Cornell's Africana Studies and Research Center. He has taught Economics as a Teaching Assistant at Cornell and as a Sessional Lecturer in International Economics at Carleton.

To my parents,  
Estella and Myrick

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Statistical data was gathered from government statistical offices in Antigua, St. Vincent, Dominica, Grenada, St. Lucia, St. Vincent and Trinidad and from the Commonwealth Caribbean Regional Secretariat in Guyana. I owe special thanks to the many individuals in these organizations who offered kind assistance. Winifred Nedd in Antigua, Emelda Rennie in Trinidad and Ione Marshall in Guyana deserve special mention.

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## LIST OF ABBREVIATIONS

CARICOM	Caribbean Community and Common Market
CARIFTA	Caribbean Free Trade Association
ECAFE	United Nations Economic Commission for Asia and the Far East
ECCM	East Caribbean Common Market
ECLA	United Nations Economic Commission for Latin America
UNIDO	United Nations Industrial Development Organization
CDB	Caribbean Development Bank
GDP	Gross Domestic Product
LDCS	Less Developed Member Countries
MDCS	More Developed Member Countries
CIC	Caribbean Investment Corporation
ST. KITTS	St. Kitts-Nevis-Anguilla
\$	Eastern Caribbean (E.C.) dollar unless specifically stated otherwise; U.S. \$1 = E.C. \$2

*Jaroslav Pavić*

AN APPROACH TO MULTI-COUNTRY DEVELOPMENT PLANNING  
AND INDUSTRIAL PROGRAMMING FOR THE EAST  
CARIBBEAN COMMON MARKET

Vincent Arnold Richards, Ph.D.

Cornell University 1975

Various forms of regional economic integration schemes comprised of underdeveloped countries have emerged in recent years. One such scheme is the East Caribbean Common Market (ECCM). Its members are seven small West Indian countries, the Leeward and Windward Islands.

The central argument of this study is that regional economic integration within the setting of the Leeward and Windward Islands should incorporate arrangements for coordinated regional development planning and the programmed allocation of new production activities among member countries. The theoretical outlines of an approach to multi-country development planning and industrial programming are presented and then applied to the ECCM.

The need to include multi-country development planning and programming in the economic integration exercise is based on the reasoning that, given the structural characteristics of the ECCM economies and the goal of economic development for which the countries strive, standard trade liberalization properties of customs unions will do very little at structural transformation of the economies.

Important elements of a theory of economic integration appropriate for small structurally dependent economies are outlined. The sources of benefits of economic integration are identified and analyzed. The need for multi-country development planning is established. The present institutional features of the Caribbean economic integration movement are reviewed and assessed.

The provisions governing the ECCM are seen to constitute the key elements of an appropriate economic integration regime. It is found, however, that none of the important provisions have been implemented.

The suggested approach to regionally coordinated development planning within an economic integration scheme involves three levels of plan coordination. The first level involves aggregative multi-sectoral multi-country planning utilizing linear programming techniques and the input-output structure of the national economies. Regional investment expenditures are minimized given specific aggregate income growth targets. Structural transformation occurs by ensuring that a specific configuration of differential sectoral growth rates is achieved. The second level of planning explicitly incorporates, within an input-output mixed-integer programming structure, the possible introduction of new sectors in the national economies. The use of the region's investment resources is optimized. The third level of planning coordination consists of partial equilibrium linear programming of projects to ascertain their optimal production locations, given the need to fulfill demand requirements at specified consuming centers.

Results of the empirical analysis of the first level of planning suggest that coordinated regional planning compared to its nationalistic counterpart generates benefits. It appears, however, that in relative terms the gains are not overwhelming. Applications of the third level of planning cover six manufacturing projects. Criteria underlying their selection are set out in the study. The empirical results, which provide estimates of total (production and transport) costs, optimal and second-best production locations of each project, together with assessment of its economic viability, indicate that substantial benefits are forthcoming in this level of planning coordination within the ECCM.

## CHAPTER 1

### INTRODUCTION

In the past ten years or so, governments of Commonwealth Caribbean countries have embarked upon a program of regional economic integration as one approach to promote the economic development of these countries. The main institutional manifestation of the economic integration strategy has been the founding of the Caribbean Community and Common Market (CARICOM) comprising twelve countries<sup>1</sup>. Within the Caribbean Common Market is a smaller integration scheme known as the East Caribbean Common Market. This is comprised of the Leeward and Windward Islands.

The objective of the present study is to outline an approach to multi-country development planning and the programming of economic activities for the East Caribbean Common Market (ECCM). The argument advanced is that, given the structural characteristics of the ECCM economies and the goal of economic development for which these countries strive, regional coordination of development planning and the formulation of a regional plan to allocate new industrial activities should be features of an appropriate economic integration framework. Without these two features, it is argued, the gains that theoretically arise from economic integration are unlikely to be forthcoming in the ECCM. Furthermore, in their absence, the distribution of what little benefits that accrue are likely to be highly skewed in favor of one or two members. In other words, in the context of the Leeward and Windward Islands, it is felt that regionally coordinated development planning and industrial programming are necessary for the acquisition of benefits as well as for their equitable distribution among member countries of an integration scheme.

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1 - The countries are Barbados, Guyana, Jamaica, and Trinidad and Tobago which are designated more developed member countries; Antigua, St. Kitts-Nevis-Anguilla, Montserrat (Leeward Islands), Dominica, Grenada, St. Lucia, St. Vincent (Windward Islands), and Belize which are referred to as the less developed member countries of the common market.

Although the need to coordinate economic development planning has been recognized in the literature, few attempts have been made to study this question in depth. Consequently, this is an area in which substantial work needs to be done. The present effort which is limited to a very small common market cannot hope to cover all the important facets of the subject. The most that can be hoped is that some of these are identified and adequately analyzed.

Most of the existing work on Caribbean economic integration has looked at the ECCM countries as a single entity. While this may be convenient for some purposes, it is quite unsatisfactory for policy formulation and implementation. The seven countries have separate political and administrative machineries and there is no supranational authority which moulds their various policies and programs into a single regional plan. Collaboration among the countries on several issues does take place but participation is conditioned by national goals, priorities, etc. Therefore, analysis of the economic problems of the Leeward and Windward Islands should recognize the individual administrative structures. The present study takes this feature into account.

## 1.2 Organization of Study

The economic environment in which the multi-country programming framework is placed is outlined in Chapter 2. The economic structure of the Leeward and Windward Islands is discussed emphasizing the smallness and openness of each economy and of the combined ECCM market. In terms of size, the largest country with respect to population (St. Lucia) has slightly more than 100,000 people and their combined population is under one half million. The combined gross domestic product (GDP) of the ECCM countries was estimated in 1969 at U.S. \$112 million, translating into a per capita GDP of U.S. \$219. As regards openness of the economy, the sectors that are the main generators of economic activity (export agriculture and tourism) depend almost exclusively on foreign

markets. Import coefficients are invariably high; for 1971 the ratio of imports to GDP was 0.91. The analysis is primarily quantitative; a qualitative discussion of the structural characteristics of the economy is deferred to Chapter 4.

In Chapter 3 the traditional theory of economic integration is surveyed to ascertain its relevance to an economic integration scheme comprising the Leeward and Windward Islands. The concepts of trade diversion and trade creation in the neoclassical framework and their implications for the economic welfare effects of customs union are analyzed. The chapter also discusses the terms of trade effects and the impact of scale economies on the likely benefits of economic integration.

The outlines of an appropriate theoretical economic integration framework for the ECCM countries are presented in Chapter 4. The analysis of this chapter builds upon the relevant features of customs union theory. In it are advanced the arguments for the need to integrate a regional approach to development planning and industrial programming in a common market scheme. Emphasis is placed on the structural features of the ECCM economies within which the economic integration regime must operate. Also emphasized are the notion of development and associated normative objectives which appear applicable to an Eastern Caribbean setting. The sources of economic integration benefits are identified as are the problems of economic polarization and poor regional transformation which will require concerted action if they are not to impede the progress of Caribbean economic integration.

Chapter 5 presents a review of the Commonwealth Caribbean integration movement. The early years as manifested in the Caribbean Free Trade Association (CARIFTA) and the ECCM, as well as the more recent institutional structure of CARICOM are analyzed. The strengths and weaknesses of the present institutional arrangements are isolated and directions in which the integra-

tion exercise may fruitfully move are suggested. Discussion of the role of some supporting regional institutions such as the Caribbean Development Bank is also taken up.

The following four chapters of the study present an approach to regionally coordinated development planning and industrial programming. Chapter 6 deals with the theoretical framework while the empirical outlines are discussed in Chapters 7, 8 and 9.

The discussion in Chapter 6 begins with a review of the approaches to development planning in economic integration schemes. A model of nationalistic development planning is then developed, followed by a model of coordinated development planning in an economic integration scheme. The former establishes a reference point by which each participating country of the economic union can evaluate the latter. The model of coordinated multi-country planning consists of three levels. At the first level of planning, regional investment expenditures are minimized within the context of a linear programming multi-sectoral input-output structure. The production structure of each participating economy is represented by its input-output relationships and the exogenously determined expansion of aggregate output of the regional economy is distributed among the various established sectors and member countries in line with their comparative investment costs.

The second level of planning incorporates explicitly into the model the possible introduction of new sectors (projects) in member economies. The multi-sectoral input-output framework is retained. The model is of the mixed integer programming type which permits it to accommodate new sectors that are characterized by economies of scale. At this level of coordinated regional planning the objective is to minimize investment costs.

In the third level of planning a partial equilibrium model of project location is presented. The objective function minimizes total (production and

transport) costs in supplying specified demands for a given product in various demand centers. While production is constrained to take place in one or more of the member countries, demand centers may be outside of the common market. The mathematical structure of the model is that of mixed integer programming. This level of planning may be viewed as regional industrial programming.

Discussion of the statistical data used in the illustrative empirical exercises of coordinated multi-country planning is taken up in Chapter 7. The criteria underlying the choice of the projects in the industrial programming scheme are also outlined.

The empirical results of regionally coordinated development planning are analyzed in Chapter 8. The analysis emphasizes the savings in regional investment outlays that result from regional planning compared to nationalistic planning. The relative sectoral and member economy growth rates and their inferences concerning regional comparative advantage are discussed. The extra-regional and intra-regional trade patterns that emerge under the multi-country planning regime are also analyzed. The general conclusion to be drawn from the analysis is that within the multi-sectoral input-output planning framework coordinated regional planning, compared to its nationalistic counterpart generates benefits. However, it appears that in relative terms the gains are not overwhelming.

Chapter 9 presents empirical analyses of six projects that could form the beginnings of a regional industrial programming scheme for the ECCM. Each project is investigated separately and the optimal location(s) of plant(s) to satisfy requirements at specified demand centers are determined. The analyses also present second best location solutions for each project. The general conclusion is that the projects appear economically viable. In addition, the benefits of regional programming of industries compared to national industrial

programming is shown to be quite substantial.

The concluding chapter, Chapter 10, summarizes the main results of the study and draws some tentative conclusions. The weaknesses and strengths of the suggested approach to multi-country planning in the ECCM are discussed. Brief comments are made on a few areas of importance to the successful operation of the programming scheme and which are not analyzed in the present work.

## CHAPTER 2

### THE ECONOMIES OF THE LEEWARD AND WINDWARD ISLANDS

From an international standpoint one feature of the Leeward and Windward Islands that stands out is their extremely small size. Taken together, the total land area is 1181 square miles, the area of land in farms in 1961 was 365,221 acres and estimated population in 1970 was under half million. The smallest of them, Montserrat, has land area of only 32 square miles, and had in 1961 a meagre 17,418 acres in farms, which nevertheless was 85 percent of its total land area. Its estimated population in 1970 was 12,300.

The task of this chapter is to present a quantitative overview of the structure and growth of the economies of the Leeward and Windward Islands. From the analysis, the environment in which regionally coordinated development planning as an integral part of the economic integration exercise is advocated, can be appreciated. Our first line of business is to establish the general structural contours of the ECCM economies. We attempt this in Section 2.1. A look at the human resources of the ECCM countries is made in Section 2.2 and a final section provides a discussion of their international trade patterns.

The discussion in this chapter is deliberately far from comprehensive. Somewhat satisfactory quantitative analyses of the economies of the Windward and Leeward Islands by Bryden [ 18 ] and O'Loughlin [ 88 ] are easily accessible.<sup>1</sup> Further, a comprehensive analysis of the structural features of these economies will constitute too long a detour from the main objective of the present study.

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1. In addition, ECLA Office for the Caribbean prepares an annual survey covering the main economic developments in these countries. See ECLA [ 50 ].

## 2.1 Growth and Structure of the ECCM Economies

A general view of the structure of the ECCM regional economy and its constituent parts may be derived from Table 2.1 which shows the sectoral contribution to GDP at current factor cost for the years 1967 and 1972. It will be noticed that for the ECCM countries combined the export agriculture and government sectors account for the largest amounts of the identified sectors. The relative sectoral shares are presented in Table 2.2. The sectors oriented almost exclusively to foreign demand (export agriculture and tourism) accounted for 20.1 percent of regional GDP in 1967 and 17.1 percent in 1972. Accompanying this relative decline of 4.0 percent, the increase in the share of the construction sector where growth is due largely to the expansion of tourist facilities should be observed.

Export agriculture's relative importance in the economic activity of the region has declined substantially, from 16.0 percent to 9.8 percent. Indeed, its estimated final output of \$32.6 million in 1972 is slightly less than its final output in 1967. The hotels sector gave a contrasting performance with its relative share increasing from 4.1 percent to 7.3 percent. Its absolute contribution to GDP trebled over the period.

Manufacturing plays a relatively small role in the region's economic activity contributing less than 4 percent of aggregate output. Various industrial incentives aimed at encouraging the expansion of this sector have been offered by the governments of the ECCM countries, mainly to foreign investors.<sup>1</sup> As the figures in Tables 2.1 and 2.2 indicate, despite some growth it is struggling to maintain its minor relative position.

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1. For a review of the industrial incentives given by Dominica, see Williams [105].

TABLE 2.1

Estimates of GDP by Main Sectors at Current Factor Cost  
of ECCM Countries, 1967 and 1972

\$ million

	Antigua	Dominica	Grenada	Mont.serrat	St. Kitts	St. Lucia	St. Vincent	TOTAL
<u>1967</u>								
Export Agriculture	0.2	6.0	7.9	0.1	6.4	7.7	4.8	33.1
Domestic Agriculture	0.8	4.3	5.3	1.2	4.4	3.2	4.0	27.2
Manufacturing	1.2	2.1	1.2	0.1	0.6	1.8	1.0	8.0
Construction	9.0	1.9	3.7	2.0	2.1	4.7	1.8	29.2
Distribution	4.4	2.5	5.7	1.5	3.1	6.9	4.2	28.3
Government	7.3	4.5	6.1	1.9	5.4	6.6	5.4	37.2
Hotels	4.5	0.4	2.0	0.3	0.4	0.7	0.2	8.5
Others	6.9	7.0	7.1	1.7	4.8	8.1	7.3	42.9
TOTAL GDP	34.1	29.0	39.0	8.6	27.5	39.7	28.4	201.3
<u>1972</u>								
Export Agriculture	0.5	6.4	7.5	0.03	5.8	8.2	4.8	33.2
Domestic Agriculture	1.2	6.3	5.7	1.1	6.8	4.4	4.8	36.3
Manufacturing	1.5	2.1	1.4	0.2	1.2	2.6	2.1	10.1
Construction	2.1	7.1	4.1	3.4	8.7	9.5	4.7	39.6
Distribution	8.8	3.1	10.8	1.5	6.2	6.8	10.2	47.4
Government	7.2	8.6	11.8	3.0	8.8	14.6	7.3	61.3
Hotels	10.3	1.7	4.5	0.8	1.1	4.0	2.0	24.4
Others	12.1	8.2	9.5	2.9	6.7	12.9	6.7	68.6
TOTAL GDP	53.2	44.6	59.8	15.5	49.0	73.3	44.1	329.5

NOTE: Sectors may not sum to totals because of rounding

SOURCE: ECCLA, ESTIMATED REGIONAL ACCOUNTS and Yearly Review of Economic Activity, 1973, Port of Spain, 1974.

TABLE 2.2  
Sectoral Shares in GDP of ECCM Countries,  
1967 and 1972

	%							
	Antigua	Dominica	Grenada	Montserrat	St. Kitts	St. Lucia	St. Vincent	ECCM
<u>1967</u>								
Export Agriculture	0.6	20.7	20.8	1.2	23.3	19.4	15.8	16.0
Domestic Agriculture	2.3	14.8	13.9	14.0	16.0	8.1	14.1	11.3
Manufacturing	3.5	7.2	3.2	1.2	2.2	4.5	3.5	3.9
Construction	26.4	6.6	8.4	23.2	8.7	11.8	6.3	12.2
Distribution	12.9	8.6	13.7	17.4	11.3	17.4	14.8	13.5
Government	21.4	16.6	16.1	22.1	19.6	16.6	19.0	15.3
Hotels	13.2	1.4	5.3	3.5	1.5	1.8	0.7	4.1
Others	20.2	24.1	15.7	19.8	17.5	20.4	25.7	20.9
TOTAL GDP	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
<u>1972</u>								
Export Agriculture	0.9	14.3	12.6	0.2	13.5	11.2	9.5	9.8
Domestic Agriculture	2.3	13.7	9.6	13.5	11.2	6.0	11.3	8.8
Manufacturing	2.1	7.8	2.5	1.9	2.6	3.5	3.4	3.7
Construction	21.6	15.9	10.2	25.2	20.2	13.4	9.5	15.4
Distribution	16.5	7.0	21.5	16.1	14.0	22.9	23.1	18.1
Government	13.5	19.3	19.8	19.4	20.5	19.9	16.6	15.4
Hotels	19.4	3.8	7.6	5.2	2.6	5.5	4.5	7.3
Others	20.7	18.4	11.4	18.7	15.6	17.6	22.0	18.6
TOTAL GDP	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

NOTE: Sector shares may not add to 100 because of rounding

SOURCE: Computed from Table 2.1

The share of domestic agriculture fell from 11.3 percent to 8.8 percent and may reflect a continuation of the downward trend in the self sufficiency of food supplies in the ECCM countries noted by Bryden [18, pp. 32-37] for the 1962-1966 period. In this context it may be observed that the relative position of the distribution sector has increased from 13.5 percent to 18.1 percent. The distributive trades are concerned mainly with the marketing of imported goods and thus its relative growth indicates the increased reliance on foreign supplies to fulfill regional demand requirements. As a general point therefore, it may be said that the Windward and Leeward Islands depend substantially on non-ECCM markets and sources of supply.

The figures in Tables 2.1 and 2.2 also give some idea of the economic structure of the individual ECCM countries. It will be observed that government activities are significant in all economies, that export agriculture is dominant in Dominica, Grenada, St. Kitts, St. Lucia and St. Vincent, but almost non-existent in Antigua. The latter has occurred because of the demise of the sugar industry which previously dominated export agriculture in Antigua. In the latter country tourism is a dominant economic activity, while in Grenada and St. Lucia it is emerging as an important sector. The members with the strongest domestic agriculture sectors are Dominica, Montserrat and St. Vincent. In all member countries manufacturing is still at an embryonic stage.

With respect to growth of aggregate output of the regional economy, the increase from \$205.3 million to \$333.3 million translates into an annual compounded growth rate of 9.7 percent. This would be an impressive performance were this growth in real output. Taking inflation, which has been particularly rapid in recent years, into account would indicate a growth performance that is modest at best<sup>2</sup>. Of the sectors, export agriculture declined absolutely,

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2 - The retail price index is the only price series available, and not for all countries. For St. Lucia, the index (April 1964=100) rose from 110.2 in 1967 to 155.4 in 1972 implying an annual price increase of 6.9 percent. For St. Kitts the movements of the price index between 1967 and 1972 imply an annual price increase of 6.4 percent, for Dominica 5.9 percent.

hotels activity grew at the phenomenal rate of 21.1 percent per annum while construction expanded at the annual rate of 14.4 percent, substantially above the aggregate rate. The annual growth rates for the remaining sectors are 8.3 percent, 4.7 percent, 15.5 percent and 9.8 percent for manufacturing, domestic agriculture, distribution and government respectively.

Of the individual economies, St. Lucia experienced the highest growth rate (12.3 percent) and Dominica the lowest (8.6 percent) during the 1967 to 1972 period. Two countries, St. Lucia and Montserrat, had growth rates above the regional rate. For all the countries the hotels sector shows consistently high rates of growth ranging from 16.2 percent in Grenada to 46.1 percent in St. Vincent. Similar high growth performance is evident in the construction industry whose growth ranged from 12.9 percent in Grenada to 26.4 percent in Dominica. All the country and sectoral growth rates appear in Table 2.3.

Finally, we look at the per capita output patterns. In Table 2.4 estimates of per capita gross domestic product at current factor cost are presented. For the ECCM countries combined, per capita GDP in 1970 was estimated at \$534 or approximately U.S.\$267. This is a very rough index of the low level of economic development in these countries. Over the 1963 to 1970 period per capita GDP in current prices grew at an annual rate of 6.9 percent. Montserrat experienced the highest growth rate (17.8 percent) while Grenada had the lowest (3.6 percent). As noted earlier, inflation has been a serious problem in the ECCM countries in recent years so that only a part of this growth is in real terms. Estimates of per capita GDP in constant prices for the individual economies are unavailable. However, Shillingford and Blades [ 96 ] report estimates of per capita GDP in constant (1970) prices for the ECCM as a whole. The figures for 1962 and 1971 are \$452.1 and \$557.9 respectively, implying an annual growth rate of 2.3 percent.<sup>3</sup>

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3 - The 1963 and 1970 figures are \$444.7 and \$545.6 which translate into an annual growth in real per capita GDP of 2.9 percent. Note that the Shillingford-Blades estimate for 1970 is different from that given in Table 2.4

TABLE 2.3

Growth\* of Estimated GDP of ECCM Countries, 1967 to 1972

	%							St.	ECCM
	Antigua	Dominica	Grenada	Montserrat	St. Kitts	St. Lucia	Vincent		
Export Agriculture	18.3	1.3	-1.0	-24.1	-2.0	1.3	-1.4	-0.1	
Domestic Agriculture	8.1	7.0	1.5	11.2	1.7	6.4	4.5	4.7	
Manufacturing	5.8	10.2	4.5	11.0	12.1	7.4	8.1	8.3	
Construction	25.6	26.4	12.9	13.4	25.8	14.7	16.9	14.4	
Distribution	13.9	4.3	18.0	10.2	13.2	17.8	17.7	15.5	
Government	-0.3	11.7	13.2	9.1	9.8	15.9	6.0	9.6	
Hotels	16.6	28.9	16.2	19.6	20.2	34.9	46.1	21.1	
Others	11.2	3.2	5.8	10.7	6.7	9.3	5.7	7.4	
TOTAL GDP	8.9	8.6	9.0	11.8	8.9	12.3	8.8	9.7	

\*Annual compounded rates between years shown

SOURCE: Computed from Table 2.1

TABLE 2.4

Estimates of Per Capita GDP at Current Factor  
Cost of ECCM Countries, 1963 and 1970

	1963	1970	Annual Growth Rate*
Antigua	\$418	\$656	604%
Dominica	345	484	4.8%
Grenada	317	423	3.6%
Montserrat	283	987	17.8%
St. Kitts	337	568	7.5%
St. Lucia	374	600	9.8%
St. Vincent	281	416	5.6%
ECCM	330	534	6.9%

\*Annual compounded growth rate between 1963 and 1970.

SOURCE: 1963, O'Loughlin [88]; 1970, computed from population estimates in Economist Intelligence Unit [56] and GDP estimates in Caribbean Community Secretariat [19].

## 2.2 Population and Labor Force of ECCM Countries

The results of the 1970 population census of the ECCM countries are not yet readily available. Other estimates place the 1970 population of the Leeward and Windward Islands at 480,300, an increase of 13,700 over the 1960 census figure of 466,500. This represents a modest annual rate of growth of 0.3 percent over the decade though the individual countries had varying growth experiences. The individual country population figures are shown in Table 2.5.

The economically active population, a measure of the labor force, was 149,300 in 1960, representing 32.0 percent of the total population. Using this proportion gives an estimated available work force of 153,700 in the ECCM countries in 1970. Of course, the relationship between the economically active population and total population is not static and is affected by demographic, social and economic factors. The estimate should therefore be seen as a rough guide to the region's available manpower<sup>1</sup>.

In terms of the labor force actually employed during 1970, available census figures for Dominica and St. Lucia are presented in Table 2.6. It can be seen that in both countries agriculture and related activities accounted for about 40 percent of the population at work. Services follow as the next leading generator of jobs accounting for over 20 percent of the employed work force.

Very few reliable statistics are available on the unemployment situation in the ECCM countries for recent years. However, all informed causal empirical estimates agree that it is a serious problem. A comprehensive labor force and employment survey carried out in Antigua during 1972 reports an unemployment rate of 20.4 percent in that country<sup>2</sup>. Using the figures in Tables 2.5 and 2.6,

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1 - The Economist Intelligence Unit [56] uses a 35% proportion in its estimates of the labor force of the ECCM countries. These are the figures given in Table 2.5.

2 - Personal communication of author with Statistical Officer of Antigua Labor Department.

TABLE 2.5

Estimates of Population and Labor Force of  
ECCM Countries, 1960 and 1970

Country	Population (000)		Labor Force *(000)	
	1960	1970	1960	1970
Antigua	54.2	62.0	18.2	21.1
Dominica	88.7	70.3	23.4	24.6
Grenada	88.7	95.0	27.3	33.3
Montserrat	12.2	12.3	4.3	4.3
St. Kitts	56.7	50.6	19.6	17.7
St. Lucia	86.1	101.1	31.4	35.4
St. Vincent	79.9	89.0	24.9	31.1
ECCM	466.5	480.3	149.3	168.1

\*For 1970, 35% of total population

SOURCE: 1960, Bryden [ 18 ]; 1970, Economist Intelligence  
Unit [ 56 ].

TABLE 2.6

Industrial Distribution of Working Population, Dominica  
and St. Lucia, 1970

Industry	Person at Work			
	Dominica		St. Lucia	
	No.	%	No.	%
Agriculture <sup>a</sup>	7726	39.4	10464	39.7
Manufacturing	1545	7.9	2153	8.2
Construction	1906	9.7	3129	11.9
Electricity <sup>b</sup>	1219	6.2	2259	8.6
Commerce	1737	8.9	1339	5.1
Transport <sup>c</sup>	704	3.6	1078	4.1
Services	4662	23.8	5653	21.4
Not Stated	118	0.6	304	1.2
TOTAL	19617	100.0	26379	100.0

a. plus forestry, fishing, hunting, mining and quarrying

b. plus gas, water, sanitary services

c. plus storage and communications

SOURCE: Dominica Annual Statistical Digest, 1970-1972, St. Lucia Annual  
Statistical Digest, 1972-1973

the unemployment rates for Dominica and St. Lucia are 20.3 percent and 25.5 percent respectively<sup>3</sup>. The generally similar structural features of all the ECCM economies suggest that the other countries have unemployment rates of comparable magnitude. It is evident then that the Leeward and Windward Islands suffer from an unemployment problem that has reached crisis proportions.

In the absence of detailed results of the 1970 population census, discussion of the levels of educational attainment and relative skill composition of the labor force can add very little to the analyses of O'Loughlin [ 88 ] and Bryden [ 18 ]. Consequently, it will suffice to quote the latter on this matter.

Vocational training is almost non-existent in the smaller islands, so that skills are either acquired overseas or through 'on the job' training. The general picture is one of a small elite with a high level of educational attainment, and the bulk of the adult population having only a very inadequate primary education and little formal training of any sort beyond that level. [ 18 , p. 19 ].

### 2.3 International Trade Patterns

International trade plays an exceptionally important role in the ECCM economies. Their absolute size and economic structure are such that domestic production is geared mainly to foreign markets while domestic demand is satisfied largely by imports. This pattern has been a consequence of the plantation economy that the Windward and Leeward Islands have inherited from their colonial past<sup>1</sup>. The extent of the dependence on foreign trade can be gauged from Table 2.7 which gives the ratio of imports to gross domestic product for selected years. For all the countries combined, the value of imports was more than 80 percent of the estimated gross domestic product at factor cost in 1972.

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3 - Smaller labor force estimates derived from the use of a 32 percent labor force - total population figure (the ECCM proportion in 1960) instead of the 35 percent used in Table 2.5, give unemployment rates of 12.8 percent and 18.5 percent for Dominica and St. Lucia respectively.

1 - For an excellent analysis of plantation economies see Beckford [ 10 ].

TABLE 2.7

ECCM Imports and Exports as Percentage of GDP, 1961, 1963, 1967 and 1972.

Country	Imports as % of GDP				Exports as % of GDP			
	1961	1963	1967	1972	1961	1963	1967	1972
Antigua	88.6	92.6	111.6	146.8*	20.7	22.7	24.6	43.1*
Dominica	50.8	55.1	59.7	73.7	25.1	26.0	27.5	29.1
Grenada	56.0	51.0	63.4	71.9	22.7	26.6	22.5	27.7
Montserrat	58.4	70.7	60.5	77.9	12.5	9.0	8.6	0.5
St. Kitts	64.1	60.1	59.1	71.1	46.9	41.3	32.9	28.7
St. Lucia	50.2	57.1	74.4	74.5	29.2	27.4	29.4	29.7
S. Vincent	51.2	52.7	55.7	80.9	23.4	26.0	22.3	25.2
ECCM	59.5	61.6	72.6	87.6+	25.2	29.8	25.1	23.1+

\*1969 +1969 figures used for Antigua

SOURCE: Computed from GDP estimates in O'Loughlin [87], O'Loughlin [88] and ECLA [50], and trade statistics in Annual Trade Reports and unpublished data at Statistical Offices of individual countries.

TABLE 2.8

Imports of ECCM Countries from Selected Sources, 1967.

	U.S.A.		U.K.		Canada		CARICOM		All Countries	
	\$m	%	\$m	%	\$m	%	\$m	%	\$m	%
Antigua	11.5	29.4	8.9	22.8	3.6	9.2	6.0	15.3	39.1	100.0
Dominica	2.5	14.5	5.8	33.5	2.0	11.6	3.1	17.9	17.3	100.0
Grenada	8.3	34.4	2.6	10.8	2.7	10.8	4.1	17.0	24.1	100.0
Montserrat	1.4	20.3	2.1	30.4	0.5	11.6	1.1	21.7	6.9	100.0
St. Kitts	2.2	13.6	4.8	29.6	2.6	16.0	3.1	19.1	16.7	100.0
St. Lucia	4.1	13.9	10.1	34.7	3.0	10.2	5.3	18.0	29.5	100.0
St. Vincent	1.7	16.8	4.9	31.0	1.9	10.0	3.9	24.7	15.8	100.0
ECCM	31.7	21.3	29.2	26.2	16.5	11.1	27.0	18.1	148.9	100.0

SOURCE: Annual Trade Reports for 1967 of individual countries.

In no country was the proportion below 70 percent and in one of them, Antigua, the dependence on imports has reached such extreme levels that the value of imports exceeded estimated gross domestic product.

The figures in Table 2.7 also indicate that the dependence on foreign sources of supply has increased over the period 1961 to 1972. For all countries, the import percentage for 1972 is significantly larger than that for 1961. Indeed, for the four selected years shown there is a continuous upward trend in the percentage in all countries, except for St. Kitts and Grenada. The temporary break in the upward trend for these countries, however, does not affect the continuous increasing dependence of the ECCM as a whole on foreign sources of supply.

Earlier in this chapter, it was noted that the export agriculture and tourism sectors which depend almost exclusively on foreign markets dominate the ECCM economies. Additional insight into the importance of foreign markets may be derived from the ratio of merchandise exports to gross domestic product. Figures for selected years are presented in Table 2.7. The value of merchandise exports of the Windward and Leeward Islands taken together has been above 20 percent of estimated gross domestic product for all the years shown between 1961 and 1972. For Antigua the percentage was as high as 43.4 in 1969.

Table 2.8 gives a breakdown of the sources of the 1967 imports of the ECCM countries. Two points may be noted. First, three metropolitan countries, Canada, United Kingdom and U.S.A., supply almost 60 percent of the imports. The import share of the three metropolitan countries is greater than 50 percent for all the ECCM countries and is as high as 62.3 percent for Montserrat. CARICOM countries, including ECCM members, account for 18.1 percent. Second, despite relatively higher growth of imports from Commonwealth Caribbean sources

in recent years, the three metropolitan countries continue to be the main supply areas.

As for the destination distribution of exports, analysis of the 1967 trade statistics reveals a pattern similar to that for imports. Canada, United Kingdom and U.S.A. are the markets for the bulk of the exports of the ECCM countries. Except for Antigua which shipped 35.4 percent of its merchandise exports to the metropolitan countries, the proportion of the individual ECCM countries' exports accounted for by these countries was above 60 percent, ranging from 63.5 percent for Montserrat to 90.0 percent for Dominica<sup>2</sup>.

We comment on two other aspects of the trade of the ECCM countries, the pattern of their visible trade balance and the magnitude of intra-ECCM trade. All of them have experienced balance of trade deficits even before the 1960s and the deficits have, by and large, been increasing in size over the years. Table 2.9 reports the deficits for selected years. An important feature of the trade deficits is that for all countries they are larger than the value of exports for the later years.

In view of the economic integration question which the present study addresses in a particular area, some knowledge of the magnitude of intra-ECCM trade is useful. In 1967 the value of intra-ECCM imports was \$1.3 million which represents a miniscule 0.9 percent of total imports. For individual countries the proportion of imports from ECCM sources ranged from 0.3 percent for St. Kitts to 2.5 percent for Dominica<sup>3</sup>.

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2 - The percentages for the other ECCM countries are: Grenada 78.4, St. Lucia 79.4, St. Kitts 86.3 and St. Vincent 69.4.

3 - The proportions for the other countries are: Antigua 0.6 percent, Grenada 0.5 percent, Montserrat 2.2 percent, St. Lucia 0.5 percent and St. Vincent 0.8 percent.

TABLE 2.9  
Balance of Visible Trade<sup>+</sup> of ECCM Countries, 1961,  
1963, 1967, 1972

\$ million

	<u>1961</u>		<u>1963</u>		<u>1964</u>		<u>1972</u>	
	\$m	%ofX*	\$m	%ofX	\$m	%ofX	\$m	%ofX
Antigua	15.0	329.0	15.9	222.6	34.6	696.8	40.3	239.0
Dominica	3.3	45.7	4.2	53.3	6.5	59.5	19.4	144.3
Grenada	10.2	171.2	7.2	91.3	15.5	180.6	32.3	308.1
Montserrat	1.7	356.3	2.4	684.0	6.7	2907.0	12.0	9801.6
St. Kitts	2.1	21.0	4.0	48.0	7.2	79.5	18.4	152.2
St. Lucia	5.6	71.8	8.7	109.4	17.9	153.3	53.6	354.4
St. Vincent	6.9	118.6	6.5	102.4	9.5	150.1	28.5	424.5

+ All the visible trade balances are deficits; that is, imports are greater than exports in all cases. The usual negative signs are omitted.

\* X = exports

SOURCE: Annual Trade Reports of the individual countries for the years given.

Doubtless, there are many other aspects of the ECCM economics on which background information could be provided. Such an exercise, however, will take us too far afield from the main subject of the present study. The foregoing discussion has hopefully set out the basic structural outlines of the ECCM economies. In any event, the main qualitative features of the ECCM economies will be presented in Chapter 4 as a prelude to the elements of an appropriate theory of economic integration for these countries.

## CHAPTER 3

### TRADITIONAL ECONOMIC INTEGRATION THEORY: A SURVEY

In the past twenty years various forms of economic integration among underdeveloped countries have emerged. Such preferential trading blocs, it is believed, will accelerate the pace of economic development in these countries by, among other things, causing certain favorable changes in the pattern, direction and composition of the members' international trade and stimulating industrial development.

Paralleling the emergence of the economic integration schemes has been the elaboration of a theory of economic integration. The impetus of by far the greater part of this theory has been the promotion of economic integration experiments in the developed economies, specifically the European countries. Partly because of this, the theory has concentrated on matters of commercial policy and its welfare implications than on the general problem of economic development. Nevertheless, it will be useful to survey this theory to see whether its conclusions regarding trade policy are applicable to underdeveloped countries. In addition, a survey of the theory can be valuable if its approach suggests a method of analysis for an appropriate theory of economic integration for developing countries. In this chapter the traditional theory of economic integration is reviewed to ascertain its relevance to the problem of underdevelopment.

#### 3.1 Scope of Traditional Theory

The traditional theory of economic integration has almost exclu-

sively been presented in terms of customs union theory and its main focal point has been with the welfare effects of customs union formation. Economic integration is seen as a process and as a state of affairs. As a state of affairs it is characterised by the absence of various forms of discriminatory measures between national economies; as a process, it is characterised by a set of measures aimed at removing discrimination between economic units of different nation states. In this framework various levels of economic integration are identified and these are free trade area, customs union, common market, economic union, and complete economic integration.<sup>1</sup>

A free trade area removes tariffs on intra-regional trade for commodities 'originating' in one of the member countries. By originating is meant that the good is wholly or partly (with a specified minimum) produced within the region. Goods of non-area origin are subject to the prevailing tariffs of a member whether they enter its market directly from a non-member or indirectly through another participating country. Each member is free to set its own tariffs on commodities of non-area origin. A customs union is that state of economic integration in which tariffs and quantitative restrictions on all trade among members are removed and a uniform tariff structure on the imports from non-participating countries is imposed. A common market is characterised by the absence of restrictions on both trade and factor movements among members, and the imposition of a uniform tariff structure applicable to the trade with non-member countries. A higher level of economic integration is an economic union which "combines the suppression of restrictions on commodity and factor movements with some degree of harmonization of national economic policies, in order to remove discrimination that was due to

1 - Bela Balassa [7, pp. 1-2]. For an alternative classification of states of economic integration, see H. Shibata [95].

disparities in these policies. Finally, total economic integration presupposes the unification of monetary, fiscal, social, and countercyclical policies and requires the setting-up of a supranational authority whose decisions are binding for the member states." [Balassa, 7 p. 12]

It is important to note the scope of economic integration theory in the traditional approach. Viewed narrowly, it is confined to "that branch of tariff theory which deals with the effects of geographically discriminatory changes in trade barriers." [Lipsey 75 p.496]. Given a generous interpretation, it also considers aspects of spatial location of industry and thus draws upon bits of location theory in addition to international trade theory. But, as noted above, the emphasis of theoretical work has been with welfare effects within the framework of the narrow scope so that only the occasional paper considers locational aspects. In terms of our interest—the usefulness of the traditional theory for economic integration schemes among underdeveloped countries—the limited scope should be borne in mind, for as we shall argue later, an appropriate theory of economic integration for underdeveloped countries must be viewed as an integral part of a theory of development and not simply as an extension of the standard theory of tariffs.

#### Trade Creation, Trade Diversion and Welfare Effects

The two most important concepts of orthodox economic integration theory are trade creation and trade diversion introduced by Jacob Viner in his pioneering study [102]. Trade creation results when, as a consequence of tariff elimination, production of a commodity shifts from one member country to another member which produces it at lower real unit

costs. For the customs union as a whole this effect leads to an improvement of economic welfare since with the usual neoclassical assumptions of perfect competition and complete factor mobility nationally the factors of production of the region will be more efficiently allocated. It is important to point out therefore that if the displaced resources in the former member cannot be relocated into some other productive use, or if such relocation is at considerable real cost the country will have a problem on its hands. And in this new situation there can be no presumption that trade creation is always a favorable occurrence. In short, the removal of the (usually implicit) assumption of perfect mobility of factors of production between industrial activities is enough to cast doubt on one of the cherished conclusions of traditional integration theory that trade creation is welfare improving. The standard model of analysis assumes that customs union does not affect the world terms of trade so that trade creation is beneficial from the world viewpoint as well.

Trade diversion occurs when a member country replaces a lower cost non-member as a source of supply. In the Vinerian analysis of customs union where full employment is assumed, it follows that trade diversion results in a loss of economic welfare to the region if the production effects alone are considered. To show this it will suffice to summarize the graphical analysis of Lipsey [75] and Gehrels [59] whose main contribution to the theory was to show that if consumption effects as well as production effects are considered trade diversion can lead to a gain in economic welfare.<sup>2</sup>

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2. J.E. Meade [78] also made this discovery.

The essentials of the Lipsey-Gehrels interpretation of Viner's proposition concerning trade diversion are given in Figure 3.1 which graphs the production, consumption and trade possibilities of country A, a member of the customs union. Country A is a small country capable of producing commodities X and Y. Its production possibility curve has Ricardian properties so that if it engages in international trade it will specialize completely in producing one of the commodities, assumed to be Y in Figure 3.1. It imports commodity X at terms of trade which are unaffected by any tariffs it may impose. OA represents the production of Y in A and the slope of the line AC gives the terms of trade at which commodity X can be imported from country C, the most efficient producer of X. Free trade equilibrium occurs at E with A exporting AG of commodity Y and importing GE of commodity X. A's equilibrium consumption bundle consists of OG of Y and GE of X. If A imposes a non-preferential non-prohibitive tariff on its imports the equilibrium position remains unchanged provided that the tariff revenues collected by the government are returned to consumers in the form of lump-sum subsidies or in the government's consumption pattern mirrors that of the consumers. If A forms a trade-diverting customs union with country B this means that the import price of commodity X will increase as represented by the slope of the line AB. A crucial assumption is that consumption coefficients are fixed so that consumption must be on the ray OZ passing through E. The customs union equilibrium for country A is at F which represents a lower level of economic welfare than the pre-customs union equilibrium at E. This establishes Viner's proposition that a trade-diverting customs union is welfare reducing.

In terms of economic development the Viner proposition is of limited,

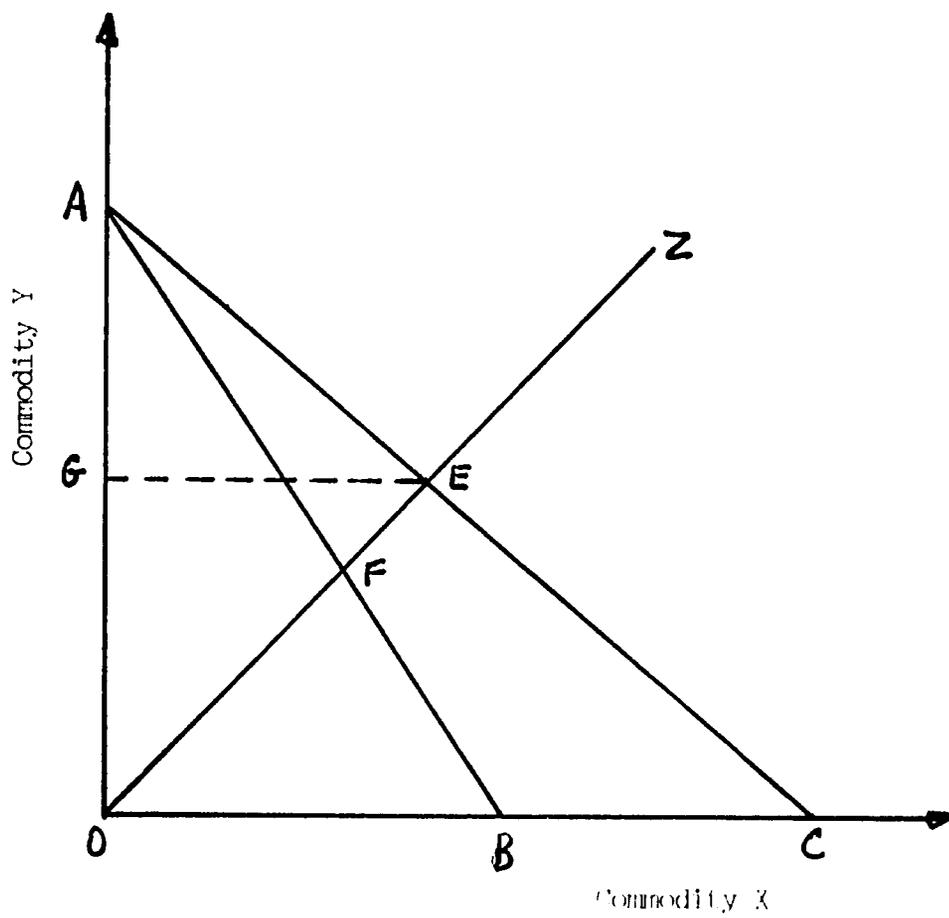


Figure 3.1 Trade Diversion and Welfare Reduction

if any, relevance. Much of the literature on economic development assumes unlimited supplies of labor and consequently high rates of unemployment, underemployment and areas of employment which show low levels of productivity in addition to other market distortions. Trade diversion, if it leads to increased utilization of unemployed resources (especially labor), induces a rise in the productivity of workers and helps the elimination of distortions will lead to an increase in the social product of the region and can therefore be beneficial<sup>1</sup>. Indeed, Linder [73] has suggested that an economic integration theory of relevance to underdeveloped countries should have trade diversion as a policy objective. It should be admitted, however, that the above criticism is related to the neoclassical assumptions of the Vinerian analysis and as such is applicable not only to Viner's work but to much of neoclassical theory.

Within the neoclassical framework however Viner's conclusion has been modified by relaxing the assumption of fixed coefficients of consumption and Ricardian production relationship. The works of Meade [78] Lipsey [75], and Gehrels [59] already referred to considered trade diverting customs union assuming variable consumption coefficients. With variations in the consumption mix possible, country A need not have an equilibrium at F (in Figure 3.1) in the post-customs union situation. It is then possible that trade diversion will augment country A's economic welfare. In his analysis of trade diversion Michaely [81] replaced Viner's Ricardian transformation frontier with one that is concave inward reflecting increasing marginal rates of transformation. Michaely also dispenses with community indifference curves and uses instead welfare criteria developed by Samuelson and Kemp. His analysis

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1. See Demas [ 39 ] for a discussion on this point.

confirms the Lipsey-Gehrels result that a trade diverting customs union can be welfare increasing.

Should the advocacy of trade diversion in customs union of under-developed countries be based upon the Lipsey-Gehrels finding and the Michaely confirmation? Hardly. As Demas [40, p. 85] notes, the consumption effects which is the basis of the Lipsey-Gehrels result "are somewhat far-fetched and, indeed, could only be taken seriously by someone whose innocence of mind has been destroyed by exposure to neo-classical economic theory"

The contributions of James Melvin [79] and Jagdish Bhagwati [13] can be viewed as an extension of Lipsey's welfare analysis of a trade-diverting customs union. Lipsey had argued that Viner's contention that trade diversion in customs union will result in a loss of economic welfare is based upon the implicit assumption that commodities are consumed in fixed proportions irrespective of relative prices. Bhagwati shows that within the Lipsey framework an alternative sufficient condition to the fixed-coefficient consumption pattern for the Viner contention to hold is that there be no change in the member country's imports after union formation. In addition, Bhagwati demonstrates that in a general equilibrium model with increasing marginal rates of transformation in production the condition of a fixed level of imports is sufficient for a trade diverting customs union to be welfare reducing whereas the Lipsey condition of fixed consumption coefficients is not. In the general case therefore two alternative sufficient conditions for a welfare reducing trade diverting customs union can be stated. First, there are no substitution possibilities in both production and consumption. Second, the change in the member country's imports resulting from the formation of

the union is nonpositive. The first of these two sufficient conditions for the Viner proposition was also derived in Melvin's analysis.

In a recent survey of the literature on customs union theory Melvyn Krauss [70] summarizes John Spraos' criticism of the Melvin-Bhagwati analyses of trade diversion. Spraos' criticism is that the Melvin-Bhagwati analyses confuse the concepts of trade creation and trade diversion and consequently mis-specify the problem of the relationship between trade diversion and change in economic welfare. The Spraos argument can be better appreciated if the essentials of the Bhagwati analysis are presented diagrammatically.

In Figure 3.2 AB represents the home Country A's production possibility frontier and the slope of the line  $P_1C_1E$  is the pre-customs union international terms of trade. Pre-customs union equilibrium production is at  $P_1$  where the tariff-inclusive domestic price ratio line  $P_1D$  is tangent to the production frontier; equilibrium consumption is at  $C_1$  on the international terms of the trade line  $P_1C_1E$ . The home country exports commodity X and imports commodity Y from the cheapest rest-of-the-world source. Creation of a customs union leads to elimination of tariffs on imports from partner country B which now replaces the rest of the world as the source of country A's imports. The new terms at which the home country, A acquires imports is given by the slope of KM. Equilibrium production shifts from  $P_1$  to  $P_2$  with domestic production of commodity X increased. If the commodities are consumed in fixed proportions, the post-union consumption equilibrium is given by a point on the ray OR through  $C_1$  and on the terms of trade line KM. This is given as  $C_2$ . It is clear that consumption level  $C_2$  represents a higher level of economic welfare than  $C_1$ . Since consumption

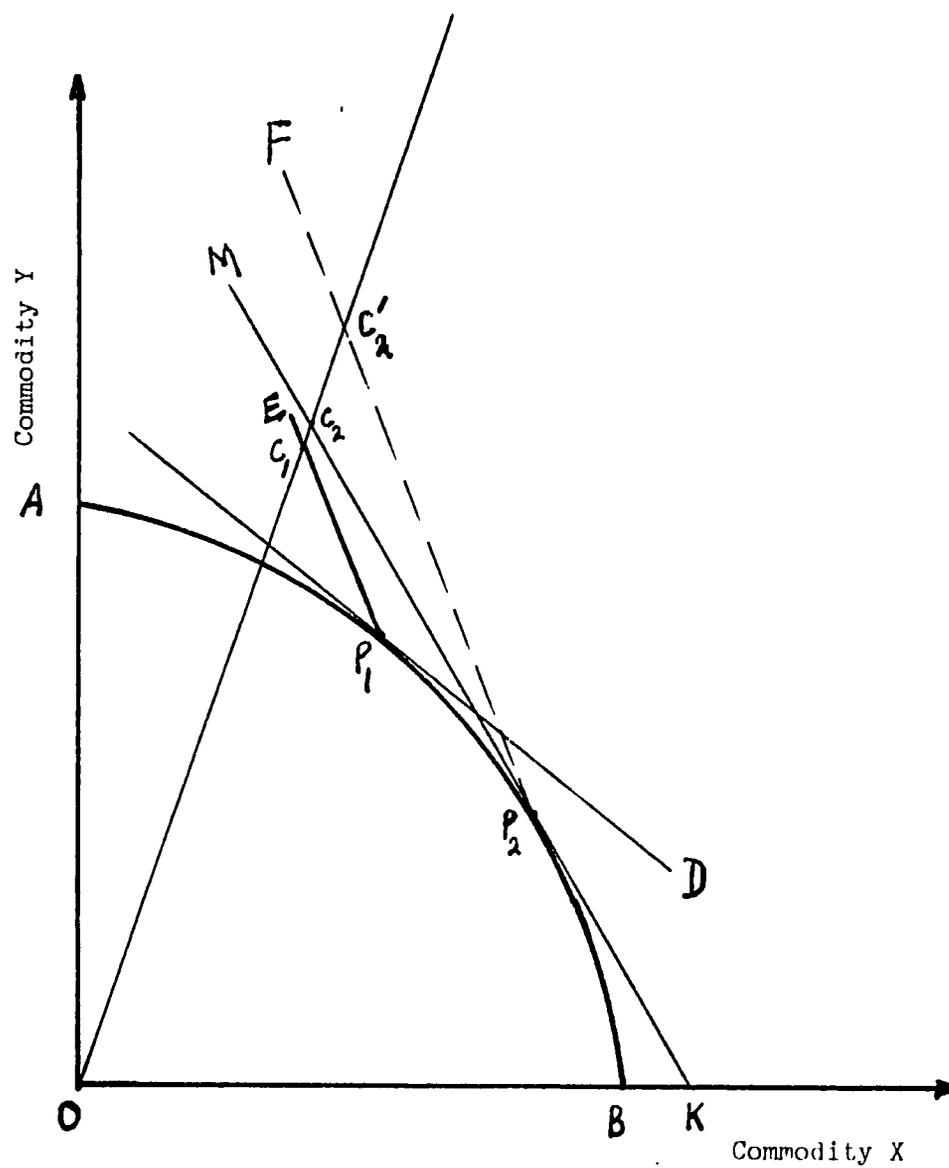


Figure 3.2 Trade Diversion and Welfare Improvement

coefficients are unchanged the welfare improving effect of the trade-diverting customs union (partner country has replaced more efficient rest of the world) is due to the production change from  $P_1$  to  $P_2$  in home country A. The welfare change from  $C_1$  to  $C_2$ , it may be noted, can be decomposed into two parts. The change from  $C_1$  to  $C'_2$ , represents the gain resulting from the production shift from  $P_1$  to  $P_2$ , the (international price-ratio) lines  $P_1C_1E$  and  $P_2C_2E$  being parallel. The second part consists of the movement from  $C'_2$  to  $C_2$  and is a loss resulting from the worsening terms of trade (from the slope  $P_1C_1E$  to that of  $KM$ ) experienced by the home country because of the trade-diverting character of the customs union.

Spraos's argument is that the production shift from  $P_1$  to  $P_2$  is a movement from high-cost domestic production of commodity Y to a lower-cost source in the partner country. As such, Spraos designates the production gain as trade creation and contends, rightly in Krauss' view, that for the customs union to be welfare improving it must be trade-creating with respect to its production location effects.

It is clear that the Spraos contention is correct insofar as the shift in production locus from  $P_1$  to  $P_2$  is designated as trade creation because the shift is due to lower-cost partner source replacing high cost A production. It is equally clear however that trade diversion has occurred in the customs union since the partner country has replaced the cheapest rest-of-the-world source as a supplier of the country A's imports. The crux of the problem lies in the following question: Should a customs union be classified on the basis of one of its effects—in this case the trade diversion effect—without reference to its other effects including the trade creating effect, as Bhagwati and others have done? Or should it be classified, as Spraos' approach suggests, by the larger

of trade diversion and trade creation after these effects are isolated and their magnitudes compared? The confusion between the Melvin-Bhagwati and Spraos analyses is seen to arise from designating customs union by one effect or another. The solution to the confusion is to abandon the designation exercise. For clearly, there are many other effects of customs union which deserve as much theoretical treatment as trade diversion and trade creation. For neoclassical theorists to propose that the exhaustive classification for customs union be usurped by these latter two concepts, even in the neoclassical framework, is to lay bare the bias of neoclassical theory--a bias which some of these theorists will deny.

Unlike the considerable work that has been done on trade diversion, trade creation has received disproportionately little interest. The contribution of Spraos [97] is perhaps the most significant in this area. In modifying Lipsey's statement for a trade-creating customs union, he proposes a criterion for ascertaining whether a customs union leads to net trade diversion or net trade creation. Spraos reasoning is similar to that which he later used to question the Melvin-Bhagwati analysis discussed earlier. Increasing costs are assumed and it is shown that provided the least cost source is a non-member there will be both trade creation and trade diversion effects. The condition for a (net) trade creating customs union is found to depend on the differential of the two members' pre-union tariff rates and the union's common external tariff and the slopes of supply curves of the two members. The condition is given by:

$$(3.1) \quad \frac{\frac{\partial S_H}{\partial P_H}}{\frac{\partial S_L}{\partial P_L}} > \frac{c - t_L}{t_H - c}$$

where  $S$  = quantity supplied,  $P$  = price,  $t$  = pre-union tariff percentage,  $c$  = common external tariff percentage. Subscripts  $H$  and  $L$  refer to the more inefficient high tariff and less inefficient low tariff member countries respectively.

The above condition (3.1) for a trade-creating customs union assumes (i) the cheapest producer is not a member of the customs union, (ii) the pre-union tariffs of union members and the common external tariff are non-prohibitive, (iii) the common external tariff is less than the pre-union tariff rate of the member with the higher tariff rate, and (iv) demand curves are perfectly inelastic throughout. Spraos demonstrates that (3.1) is a sufficient condition for (net) trade creation for any values of the members' tariff prior to union formation and that it is necessary as well for infinitesimal movements between the members' pre-union tariffs and the common external tariff. In a similar but independent derivation Shibata [95] shows that if Spraos' assumption (iv) is relaxed the trade-creating condition becomes:

$$(3.2) \quad \frac{\frac{\partial S_H}{\partial P_H} - \frac{\partial D_H}{\partial P_H}}{\frac{\partial S_L}{\partial P_L} - \frac{\partial D_L}{\partial P_L}} > \frac{c - t_L}{t_H - c}$$

where additionally  $D$  represents quantity demanded.

The two most comprehensive theoretical contributions in traditional economic integration theory are the works of Vanek [99] and Kemp [66].

Both works take a general equilibrium approach and analyze the effects of various types of customs unions. Vanek distinguishes customs union among countries with similar economic structures and customs union between countries with dissimilar economic structures. The former is a customs union in which (in the three-country two-commodity model) the two partner countries export (import) the same commodity prior to union formation. The latter is a union in which the partner countries export (import) different commodities prior to the union. Vanek also distinguishes between a small union and a large union and therefore devotes a good deal of his analysis to terms of trade effects. (We turn to an analysis of terms of trade effects in the next section.)

Given the comprehensive nature of his study it is not possible to do justice to it in this survey. We simply mention a few of its main results.<sup>3</sup> The following results abstract from terms of trade effects, that is, a small customs union is considered:

(i) In a union of dissimilar economies the volume of post-union trade with the rest of the world may increase, decrease or remain unchanged compared to the trade situation prior to union formation if the common external tariff is equal to the pre-union tariffs of the member countries. While contraction of the volume of trade is the most likely outcome, the likelihood will be less the lower are the income elasticities of the export products of union members.

(ii) Intra-union trade in a union of dissimilar economies is most likely to expand if the union adopts the pre-union tariffs as the common external tariff.

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<sup>3</sup>. The results are summarized in Vanek [99 ; pp. 211-231].

(iii) A reduction in trade with the rest of the world will occur in a union of similar economies if it adopts the higher pre-union tariff as the common external tariff. If the lower initial tariff becomes the common external tariff union trade with the rest of the world will expand.

(iv) World welfare is more likely to increase the higher are the pre-union tariffs of the member countries and the lower is the common external tariff structure.

(v) From the standpoint of the individual union member's economic welfare, union formation can be beneficial or harmful. The member which competes with the rest of the world has the greater likelihood of gaining; the member which trades both with the rest of the world and its partner will experience a welfare loss.

(vi) The potential welfare of the union countries taken jointly can increase or decrease. The higher are the initial tariffs and the lower the common external tariff, the greater is the expectation of a welfare gain.

The study of Murray Kemp [66] extends Vanek's general equilibrium analysis of economic integration. Kemp's treatment of customs union is more mathematical and the main results of Vanek are confirmed. In addition, Kemp broadens the analysis to free trade areas, one of the few contributions in the traditional framework to consider free trade areas separately.<sup>4</sup> If any general conclusion can be made it is the very noncommittal one that "the [free trade] association of [countries] A and B may result in the creation, diversion, reversal or extinction of their joint trade with the rest of the world". [66, p. 72]. Additional rather specific assumptions must be made to arrive at clear cut results. Kemp gives a few of these.

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<sup>4</sup> - The only other work of the traditional school, to our knowledge, which has analyzed free trade areas separately is Shibata [95].

Another feature of the Kemp analysis is that international movements of capital are discussed [66, Chapter 5]. Specifically, he considers a case characterized by the following: (i) the rest of the world has investment in the customs union countries A and B prior to union formation; (ii) international terms of trade are constant; (iii) A and B initially completely specialize in the same commodity. Kemp shows that if the lower of the pre-union tariff becomes the common external tariff, then the high tariff country's welfare improves, the low tariff country's welfare remains unchanged, and the union leads to trade creation. On the other hand, if the higher pre-union tariff becomes the common external tariff the result is more complicated, the specific outcome depending upon the choice of additional assumptions. A third possibility regarding a choice of the common external tariff is for it to be an average of the initial duties of the two members. In this case, if the initial pattern of union-rest of the world trade and investment is preserved, the high tariff member will experience a welfare gain while the initially low tariff member experiences a welfare loss.

It is clear from the above that few clear-cut conclusions can be made about the welfare effects of traditional economic integration. Upon reflection this is not surprising since a host of factors--whether member countries are similar or dissimilar, height or pre-union and union tariffs, relative size of intra-union and extra-union trade, etc.--have to be taken into account.

In addition to the above Vanek-Kemp conclusions we may note three generalizations which appeared in Lipsey's early survey article [75].

First, for any given level of a country's international trade, a customs union is more likely to increase economic welfare the higher is the proportion of trade with the country's union partner and lower the proportion with non-union countries. Second, a customs union is more likely to be welfare augmenting the lower is the total volume of foreign trade relative to the size of the economy. Third, economic welfare is more likely to increase if the tariffs are gradually reduced rather than eliminated at once.

What implications do the above conclusions have for economic integration among underdeveloped countries? Lipsey argues that on the basis of the first two generalizations above, "the sort of countries who ought to form customs unions are those doing a high proportion of their foreign trade with their own partner, and making a high proportion of their total expenditure on domestic trade" [75 , pp. 508-509]. Since intra-regional trade relative to total trade is very small in most if not all regions of the undeveloped world, and since the foreign sector looms large in many of these economies, the implication of the theory seems to be that there is no economic rationale for the existing regional economic integration schemes in the underdeveloped world. Robert Allen [3 ] arrives at a similar conclusion arguing that the structural characteristics of less developed countries are such that economic integration offers little economic benefit to less developed countries.

This pessimistic position is rejected. We have indicated earlier some of the weaknesses of the traditional theory. The full reasoning for rejecting the negative conclusions of traditional integration theory, insofar as underdeveloped countries are concerned, will emerge after an appropriate theory of economic integration among developing countries is presented in Chapter 4.

### 3.3 Terms of Trade Effects

We now turn to an analysis of the terms of trade effects in the traditional theory. As with trade creation and trade diversion effects, the analysis of the terms of trade effects concentrates on its impact on the economic welfare of the customs union and the rest of the world. Meade [78], Vanek [99], and Kemp [66] have analyzed this effect extensively. Arndt [6], Melvin [79], and Johnson [63] have also discussed the terms of trade effect as did Viner in his classic work [102].

If a customs union is formed between two similar countries and the higher of the two initial duties becomes the common external tariff the international terms of trade will improve from the union standpoint if the size of the union relative to the rest of the world is such that the former can affect international prices. Kemp [66 pp.106-107] shows that "when the customs union adopts the higher of the two levels of protection anything can happen: both members may benefit, both may suffer, or one may benefit, the other suffer." For the rest of the world there is an unambiguous reduction in economic welfare since the terms of trade has moved against it. If the lower of the initial tariffs becomes the common external tariff, trade creation will result leading to a terms of trade movement in favour of the rest of the world. Consequently, the welfare of the rest of the world increases. As regards the union members the welfare results are indeterminate. If the common external tariff is an average of the two member countries' pre-union tariff rates, the presence of a terms of trade effect may lead to an increase in welfare for both members, or it may lead to a welfare loss for both. In short, anything can happen again.

With respect to a union comprising two countries of dissimilar economic structures the impact of a terms of trade effect is as follows: If an average of the initial tariffs is adopted as the common external tariff the terms of trade of the customs union with the rest of the world is most likely to improve, though it can deteriorate or remain unchanged. The likelihood of a terms of trade improvement diminishes the smaller are the income elasticities of export products of the union members. The economic welfare of the member countries may improve or deteriorate; the union member country competing with the rest of the world in international markets is most likely to experience an increase in welfare, its partner most likely to suffer. If the terms of trade move against the rest of the world its welfare will decrease if it is a single country or several countries which impose no duties on international trade [Vanek, 99, pp. 90-94].

Melvin [ ] inquires into the likelihood of a trade-diverting customs union increasing welfare for a member country when a terms of trade effect is present. He discusses graphically a case of a country with options of free trade, a non-preferential tariff regime and a customs union. He concludes that a welfare increasing trade-diverting customs union is less likely in the presence of a terms of trade effect. Krauss [70, pp. 422-423] has questioned Melvin's interpretation arguing that the correct conclusion is that in a customs union which results in the extinction of extra-union trade (the case considered by Melvin), the larger the terms-of-trade loss the greater must be the gross trade creation for union to improve economic welfare. It may be noted that the seemingly conflicting conclusions of Melvin and Krauss can be reconciled

by abandoning the designation of customs union on the basis of a particular effect.

The general results of Arndt's analysis [ 6 ] of the terms of trade effect are as inconclusive and conjectural as Kemp's and Vanek's. He points out that when the size of a customs union is such that it has enough economic power to influence the prevailing terms of trade, the union's impact on economic welfare may be greater than or less than the welfare changes due to the preferential tariff reduction. In addition, in a realistic situation where the rest of the world consists of several heterogeneous countries as opposed to one or several homogeneous countries of most of the standard analyses, statements about the effect of customs union on the terms of trade faced by the rest of the world are meaningless. For in this case changes in the terms of trade will augment the welfare of some countries and reduce that of others, and without assigning weights to the various countries no general statement can be made regarding rest-of-the-world welfare. In other words, Kemp's results about the welfare of the rest of the world become invalid.

In summary, it may be said that the inclusion of the terms of trade effect has introduced an additional source of welfare change in the evaluation of customs union. It should be emphasized however that this inclusion has not provided clearer answers but rather made the earlier results more inconclusive. With respect to the utility of the traditional theory incorporating the terms of trade effect to developing countries, the specific results are of no value. With the exception of a few agricultural products and raw materials, regional groupings of underdeveloped countries are unlikely to markedly affect international prices. The terms of trade analysis has however pointed to a way of looking at customs

union which appears useful for these countries. As Arndt [5 p. 976] has pointed out, an implication of the terms of trade analysis is that "the combined economic power of the two countries acting in unison may accomplish what one country acting in isolation cannot bring off."

This implication suggests the following approach to customs union. The objectives of the countries should be identified; their individual capacities to achieve these objectives should be assessed; the alternative strategy of pooling their resources, policies and capacities either partially or completely to achieve their combined objectives should also be evaluated. The approach will then determine if there are benefits to pursuing the path of economic integration as opposed to the individualistic road. This approach is useful for underdeveloped countries because it focuses on the goals and objectives of these countries and the alternative strategies for the attainment of these goals. Such an approach permits the identification of the economic development goals--specific or general--of these countries and the analysis of economic integration not in terms of trade diversion and trade creation but rather in terms of whether this particular approach has a relatively good chance of achieving the stated objectives.

#### 3.4 Economies of Scale in Traditional Integration Theory

In his 1960 survey of customs union theory Richard Lipsey noted that little attention was paid to economies of scale in the traditional literature. Since then several attempts have been made to rectify this deficiency. Of importance are the contributions of Balassa [7, Chapter 6] and Corden [37].

The main concern of Corden's analysis is to determine the relevance of the concepts trade creation and trade diversion when economies of scale are incorporated into standard customs union theory. A static partial equilibrium framework is used and the economies of scale considered are those internal to firms, that is, internal economies of scale. Corden's conclusion is that trade diversion and trade creation are still relevant concepts but that two additional concepts, the cost-reduction effect and the trade-suppression effect need to be introduced into the orthodox theory. The former of the two new effects is felt to be the more important.

The Corden analysis proceeds as follows: Three countries A, B and C are considered, the first two forming the customs union and the last representing the rest of the world. A single homogeneous commodity is produced in country C and a single actual or potential producer exists in each country of the customs union. The cost structure in each union member is characterized by a declining average cost curve which reflects both private and social average costs; the average cost curve reaches its minimum point at a level above the export price whose f.o.b. level is set by country C; factor prices are fixed. The c.i.f. import price faced by the union countries is given by the rest of the world. In the pre-union situation neither of the member countries exports to the other because of their tariffs and relatively high production costs.

Prior to union formation the domestic price in A and B is given by c.i.f. import price set by C plus each country's tariffs on imports. At this domestic price there will correspond a given quantity of domestic demand and domestic average cost of production. Whether A and B each has domestic production initially depends upon the relation

between the average cost and the domestic price. If the domestic price is greater than the average cost of production the total demand will be met by domestic production and imports will be zero. If on the other hand, the domestic price is less than the average cost of the (potential) domestic producer at the quantity demanded, domestic demand will be met entirely by imports and domestic production is zero. The effects of the union will depend upon whether in the pre-union situation both countries had domestic production, neither had domestic production or one of them had domestic production.

Consider the first case first. Union formation will lead to the demise of the producer in one of the members, say country B, with country A supplying the entire union market. Since A's producer increases production internal economies of scale are exploited and average production cost falls. Corden divides the effect into two parts. First, the higher cost production in B is replaced by imports from a cheaper source of supply in the producer of country A. This is classified as orthodox trade creation. Second, country A supplies its own domestic needs at a cheaper cost because of its expansion. This is a new effect and is designated the cost-reduction effect.

The second initial trade-production possibility is that production takes place in country A and the rest of the world. Therefore country B initially receives her supply by importing from the rest of the world. The most likely result of union formation is that imports from the rest of the world are eliminated, country A's producer expanding output and supplying the entire union market. The two parts of the total effect are orthodox trade diversion and the new cost-reduction effect. In satisfying the demand in country B higher cost A production

replaces lower cost rest-of-the-world production as the source of imports-trade diversion. However, as A's production increases, average cost declines and A satisfies her own demand at lower cost-the cost-reduction effect. A less likely, though theoretically possible, result is that union formation results in country A's producer going out of business and country B's potential producer starting up production. B's producer will supply the entire union market. The total effect consists of a trade-creation effect and a trade-suppression effect. The former arises from the fact that cheaper B producer has replaced dearer A producer as the supplier of A's demand; the latter effect, analogous to trade diversion, occurs because the rest-of-the-world as a supplier of B's demand is replaced by the more expensive newly established B producer.

The final initial trade-production possibility is that both union countries had no production prior to union formation. Therefore union demands were initially met entirely by imports from C. With union formation we suppose the potential producer of B can produce at a cost below the given domestic price. The entire union demand will now be met by B's producer. Two effects result. There is a trade diversion effect for A since more expensive imports from B replace cheaper imports from the rest of the world. For B there is a trade-suppression effect, the newly established domestic producer replacing the cheaper rest-of-the-world source.

Corden notes that the analysis of economies of scale when more than one (potential or actual) firm exists in each member country and product differentiation is allowed becomes more complicated but that his conclusion regarding the usefulness of the four concepts remains intact.

Similar complexities arise if a general equilibrium analysis of economies of scale is attempted. In this case all four effects will occur simultaneously.

Finally, there is the question of dynamic results. Which member will supply the entire market after union formation in the case where each country has a single producer? In the case where several producers exist, which ones will stay in business and which ones will go out of business? These questions the theory is incapable of answering beyond saying that they depend upon the nature of oligopolistic competition, relative rates of gross investment, the relative mobility of factors in the two countries and other such factors. The standard statements regarding which country's welfare will increase cannot be made since the post-union production-trade schema between the member countries is not known.

The analysis of economies of scale provides yet another example of a situation where it is possible for two countries acting together to better achieve their objectives than acting separately. Where more than one product is involved the cost-reduction and other effects can be spread over the various commodities and member countries. For example, member A may produce for the entire union market commodities R, S and T while member B produces commodities X, Y and Z for the entire union market. In other words, specialization within the union to exploit economies of scale can lower the real cost of acquiring the various commodities for both members. In this case, however, a crucial requirement is that some arrangement regarding areas of specialization must be reached if both members are to share in the benefits arising from exploiting economies of scale.

In summary, with respect to the relevance of the traditional theory to underdeveloped countries the economies of scale analysis is important because it is one area in which economic integration can be justified on the basis that it can make attainable through collaborative effort of union countries objectives unattainable individually. The importance of Balassa's contribution is in marshalling the arguments--both empirical and theoretical--for making the economies of scale argument more than of theoretical curiosity. His conclusion concerning economies of scale in economic integration among two groups of developing countries is worthy of note:

Our observations on the extent of national markets, the size of average plants, and possibilities of standardization indicate that the scope of the exploitation of economies of scale is considerably greater in Latin American integration projects than in Europe...

Notwithstanding the restraining effects of the cost of transportation, the Latin American Free Trade Association, as well as the Central American Common Market, offers substantial opportunities for internal economies. This proposition is greatly strengthened if we consider the possibilities of economic development within the integration area, with the concomitant creation of new industries [7, p. 141].

### 3.5 The Cooper--Massell Framework

We have seen that in the analysis of the terms of trade and economies of scale effects the traditional theory has suggested an approach that can prove valuable for an economic integration theory among underdeveloped countries. This approach was pioneered by C.A. Cooper and B.F. Massell in an important paper [35]. In a second paper [36] they extended their analysis to a theory of economic integration for developing countries. The analysis of the first paper is reviewed presently, while discussion of the second is deferred to Chapter 4.

The Cooper-Massell argument is that given the framework of standard international trade theory free trade is the best policy from a cosmopolitan standpoint. From a single country viewpoint the only first best exception to universal free trade is the optimum tariff argument. Consequently, it can be demonstrated that an appropriate non-preferential tariff is superior to preferential tariff policy such as a customs union with respect to static efficient allocation of resources. An appropriate framework for economic integration theory should be the development of an economic theory of protection in which preferential and non-preferential alternatives can be evaluated.

In Figure 3.3 the essentials of the Cooper-Massell partial equilibrium analysis are presented. The figure shows the demand-supply configuration in country A, the home country for a particular commodity.  $D_A$  is the home market's demand curve,  $S_A$  is the supply curve of the home producers;  $S_{A+B}$  the supply curve for home and partner (country B) producers, the output of the latter entering duty free;  $S_W$  is the rest-of-the-world (country C) supply curve which is assumed to be horizontal since the home country's demand for imports is very small compared to total rest-of-the-world output. The stage is now set to compare a customs union policy and an appropriate policy of non-preferential tariff reduction.

If the initial non-discriminatory tariff is equal to  $RQ$ , the effective supply curve facing consumers in country A is  $RBT$ . Equilibrium consumption of the product is  $ON=QC$  of which  $OL$  is domestically produced and the remaining  $LN$  imported from the rest of the world. The formation of a customs union among countries A and B with the common external tariff for this commodity equal to the initial level  $RQ$  will not affect the levels of domestic price, domestic consumption and

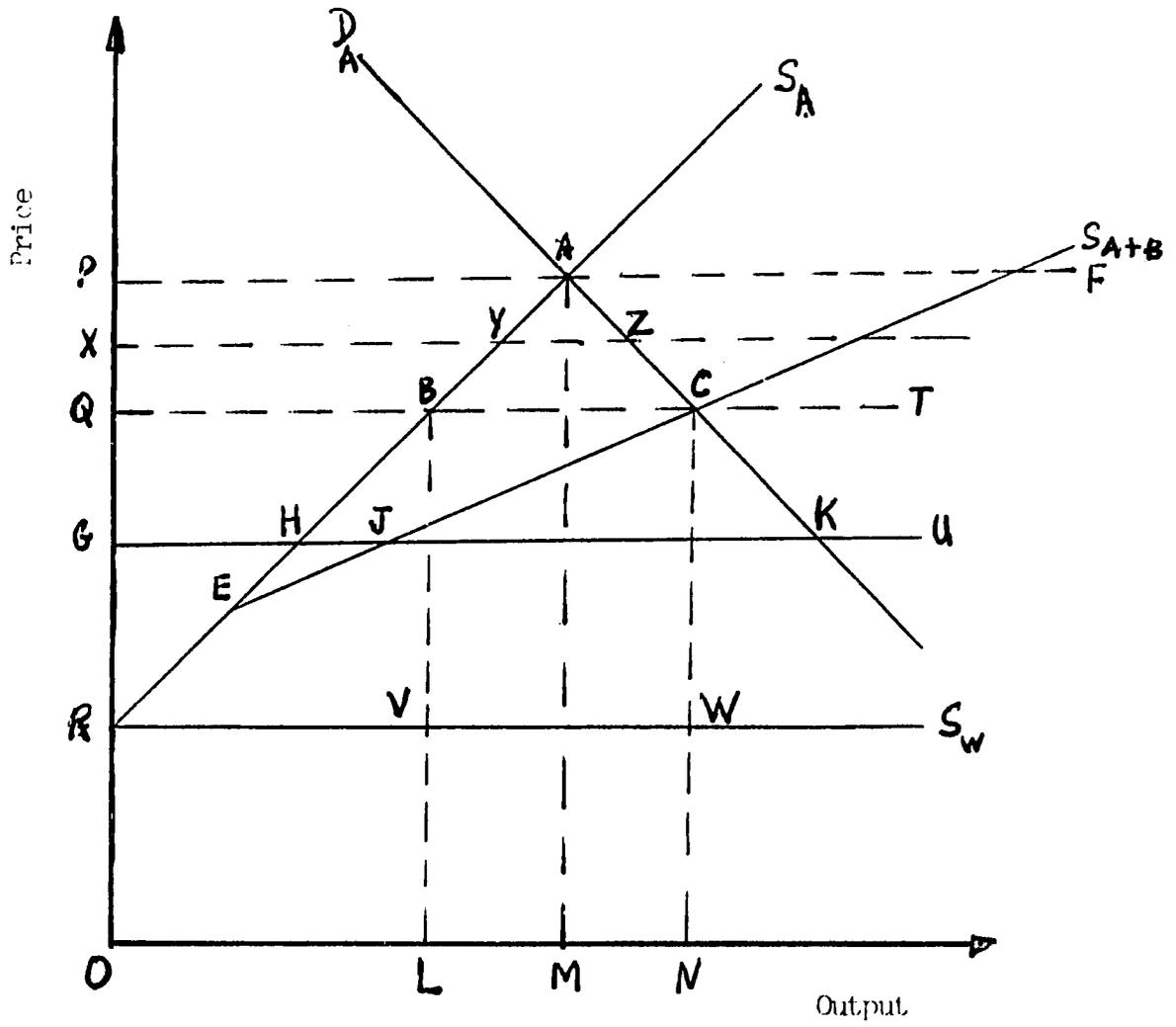


Figure 3.3 Alternative Policies of Protection

domestic production; these will remain OQ, ON and OL respectively. Indeed the level of imports will remain unchanged. However, with duty free privileges, producers of the partner country will replace completely the lowest-cost rest-of-the-world as the source of country A's imports. It is clear that the real resource cost of the commodity is greater when imported from partner country B than from the rest of the world; further customs revenue on this commodity is zero, the increase in real resource cost is equal to the loss in tariff revenue, the rectangle BCWV. This effect Cooper and Massell designate pure trade diversion.

A second possibility is if the initial non-preferential tariff is less than RQ. In this case the domestic equilibrium price is less than OQ, equilibrium consumption is greater than ON and domestic production is less than OL with the differential between local production and consumption met by imports. Provided the tariff is greater than the vertical distance between R and E, say RG, the formation of a customs union will result in the replacement of some of A's imports from the rest of the world by imports from the more expensive partner B, and a reduction of tariff revenue. Specifically, with tariff RG, domestic tariff-inclusive price, local production, consumption and imports in the pre-and post-union situations are OG, GH, GK, and HK respectively. The origin of imports however differs in the pre- and post-union situations. Prior to customs union the entire amount of HK came from the cheapest country C source; with customs union, only JK of the HK imports comes from country C the remaining HJ originating in higher-cost partner country B. Accordingly, the acquisition of this part of the imports is at a higher real resource cost, the increase being equivalent to the customs revenue loss. This is again pure trade diversion.

A third initial tariff would be a prohibitive tariff in which case domestic demand is met entirely by domestic production. In Figure 3.3 this would be a tariff equal to or greater than RP. In this case domestic price is OP, domestic production (and consumption) PA. The formation of a customs union between countries A and B will lead to the replacement of some of the former's production by imports from partner B, which produces at lower real unit costs. Specifically, domestic price will decline to OQ, consumption in A increases from PA to QC, imports from partner B increase from zero to BC and domestic production declines from PA to QB. The reduction in local production is a trade creation effect since it is replaced by lower-cost partner production.

A final possible value of the initial customs duty may be considered. This is the case of the tariff falling between RQ and RP. If the tariff is say RX, initial domestic price, production and consumption are OX, XY and XZ respectively. Initial imports, YZ are supplied by the cheapest rest-of-the-source. With a customs union between A and B domestic price falls to OQ, domestic consumption increases to QC, local production contracts to QB from XY, and imports expand from YZ to BC. However, the lowest-cost country C no longer provides any of A's imports; they are now supplied totally by partner B. Part of the imports from B replaces higher cost A production and consequently reduces resource cost; the remainder replaces cheapest-source imports from country C and thus increases real resource cost. In the terminology of the standard theory, trade creation and trade diversion have occurred.

Cooper and Massell point out that with respect to the last two cases discussed above, country A has the option of choosing a non-preferential tariff equal to RQ instead of a customs union. In the event

of the choice of the former the domestic price, domestic consumption and local production are the same as if the latter were chosen. In addition, the non-preferential tariff option provides country A with a net gain equal to rectangle BCWV because its imports come from cheapest source country C instead of higher-cost partner B. They therefore divide the effects of customs union into two parts, a non-preferential tariff reduction (to RQ in Figure 3.3) followed by a customs union with the initial tariff as the common external tariff. They then argue [36 pp. 745-746] that any increase in welfare resulting from customs union formation is due entirely to the tariff reduction component since the second part is pure trade diversion--which reduces welfare. Therefore an appropriate policy of non-preferential protection is superior to a customs union.

It should be emphasized that the Cooper-Massell argument is not limited to a partial equilibrium framework in which it was originally cast. It is equally demonstrable in a general equilibrium analysis, as the following analysis due largely to Arndt [5] and Krauss [70] shows.

In Figure 3.4 PP is the production possibility frontier of country A, a small country which faces fixed terms of trade given by the slope to  $T_1Q_1$ . It is assumed that A engages in international trade when conditions of free trade prevail. The free trade equilibrium situation is given by production point  $Q_1$  and consumption point  $C_1$ . In the free trade situation country A exports commodity Y and imports commodity X; the level of welfare is given by indifference curve  $U_4$ .

Consider now the imposition of a prohibitive tariff, the third initial case discussed in the partial equilibrium analysis. The equili-

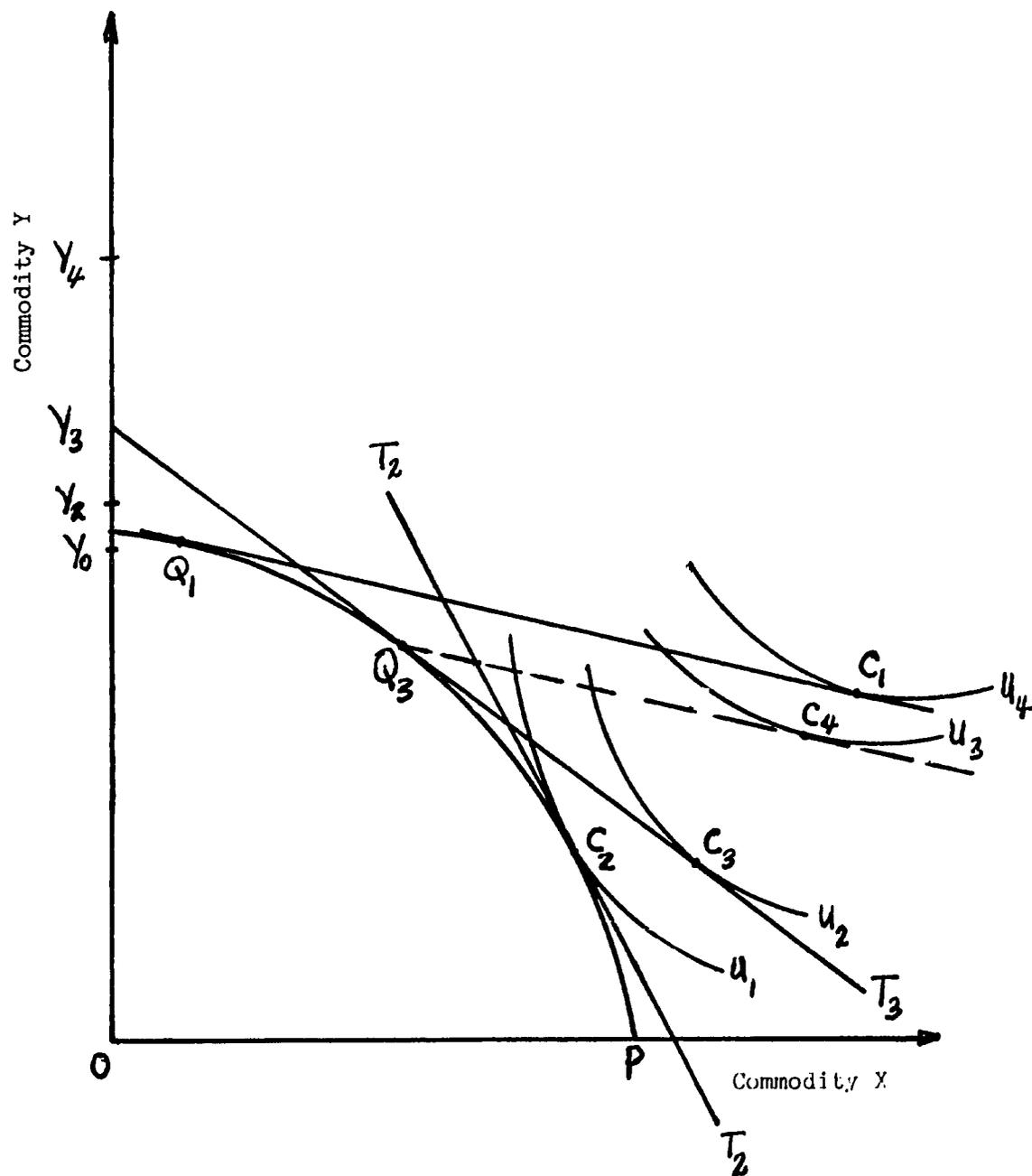


Figure 3.4 Welfare Effects of Alternative Protection Policies

Equilibrium consumption and production points must be identical and are given by the point  $C_2$ ; welfare level is given by indifference curve  $U_1$ . The domestic tariff-ridden price ratio is given by the slope of  $T_2T_2$ . We now lower the tariff so that the domestic tariff-ridden price ratio is reduced to the slope of  $Y_3T_3$ . Equilibrium production is  $Q_3$ . The equilibrium consumption point depends upon the government's disposal of the tariff revenues. If the tariff revenues are given to consumers equilibrium consumption is at point  $C_4$  where the slope of the indifference curve  $U_3$  is equal to the domestic price ratio. The international terms of trade line through the production point  $Q_3$  passes through  $C_4$ . If the tariff revenues are retained by the government consumption is a point  $C_3$ , where the tariff-ridden domestic price ratio line  $Y_3Q_3T_3$  is tangent to indifference curve  $U_2$ . The amount represented by the difference between  $C_3$  and  $C_4$  is the revenues the government has collected. In both cases, the welfare gain to country A resulting from a non-discriminatory tariff reduction is the difference between welfare level  $U_3$  and welfare level  $U_1$ .

The case of a preferential tariff reduction may now be considered. In order to compare this customs union case with the non-discriminatory tariff reduction case it is necessary to have the domestic price ratio in country A identical in both cases. For the customs union case the slope of  $Y_3Q_3T_3$  represents the price ratio in the partner country B. The equilibrium production point is  $Q_3$  and equilibrium consumption is  $C_3$ . Since A trades only with partner B, there are no tariff revenues and hence no government gain. Customs union leads to a welfare level  $U_2$  which is lower than the welfare level  $U_3$  achieved with a non-preferential tariff reduction. Consequently, starting from a situation of non-preferential protection, customs union is inferior to a non-preferential tariff reduction from the standpoint

of static resource allocation.

The reasoning behind this proposition can be better appreciated if the components of the total welfare change in both cases are identified. Using good Y as numeraire, for the non-preferential tariff reduction the total gain is  $Y_0Y_4$ . This consists of a consumption gain of the amount  $Y_0Y_2$ , a production gain of  $Y_2Y_3$  resulting from the fact that production has shifted away from the protected import-competing commodity X, and a (government) tariff revenue gain of  $Y_3Y_4$ . In the customs union case the total gain is  $Y_0Y_3$  comprising the consumption gain of  $Y_0Y_2$ , and a net trade creation (production) gain of  $Y_2Y_3$ . The net trade creation can be decomposed into a pure trade creation gain of  $Y_4Y_2$  and a pure trade diversion amount of  $Y_4Y_3$ . The pure trade diversion represents the difference between a non-preferential tariff reduction and a customs union which leads to the same domestic price ratio in country A. It will be noticed that this is equal to the tariff revenues of the non-preferential tariff reduction case, a result obtained in the partial equilibrium analysis as well.

The pure tariff reduction and pure trade diversion components of the total effect identified by Cooper-Massell are  $Y_4Y_0$  and  $Y_4Y_3$  respectively in the general equilibrium framework. As has been earlier established, the non-preferential tariff reduction policy is superior to a comparable customs union because the former has an identical welfare-increasing pure tariff reduction effect as the latter but does not have the customs union's welfare-decreasing pure trade diversion effect.

The Cooper-Massell argument has shifted the focus of customs union

theory on why governments form customs unions in the face of (on the basis of traditional theory) a less costly and more easily implemented policy of unilateral tariff reduction. In addition to the market swapping reason outlined by Cooper-Massell [36] for developing countries, Harry Johnson [64] in constructing an economic theory of commercial policy has outlined an argument for the formation of customs union. Johnson's analysis, which concentrates on a theory of industrial protection assumes that (i) political parties in the countries concerned attempt to gain and retain governmental power by promising and carrying out the wishes of the electorate, (ii) a collective or societal preference for domestic industrial production exists such that the electorate is prepared to support expenditures of real resources through governmental action to increase the volume of domestic industrial production and employment above the level that would materialize under free trade. Given the collective nature of the preference for industrial production individuals will not be willing to finance the necessary increment privately thereby requiring the financing of it by government means. Although there are several ways available to the government to raise the resources needed to increase industrial production a tariff is generally preferred because the funds for a direct subsidy to producers may be difficult to collect or the politicians and industrialists would view such an alternative risky because its resources cost can be readily determined by the electorate.

As it relates to preferential tariff reduction and customs union, Johnson's analysis [64] argues that such a policy can be beneficial provided that there is a collective preference for domestic industrial production and international trade conventions or domestic political

realities make direct export subsidization of industrial exports impracticable. If the initial situation is one of non-preferential tariff-ridden trade, a preferential tariff reduction, unlike a non-preferential reduction, because it leads to trade diversion will increase exports and industrial production of a partner country with the home country's industrial production remaining intact. Even after all imports of industrial products from the rest of the world has been diverted, discriminatory tariff reduction can still be preferable to a unilateral tariff reduction. The reason for this is that any further increase in imports by home country A resulting from a preferential reduction in tariff will be met entirely by its partner country B. For the unilateral tariff reduction case partner B's increase in industrial production (and exports) would be less than the additional imports of Country A. Consequently, the costs in terms of domestic industrial production sacrificed incurred by each partner of a customs union scheme for a unit increase in its partner's industrial production are less than the costs of a general tariff reduction. In an overall comparison of the two commercial policies however the additional trade diversion cost of the former would have to be taken into account. Preferential tariff reduction can be interpreted as an efficient way for each partner country to subsidize its industrial exports and thus stimulate its industrial production.

The Johnson analysis gives two important results. First, in contrast to the Vinerian analysis, trade diversion resulting from production shifts have a beneficial effect to the partner. For although it costs in terms of higher import prices it does not involve a contraction of domestic industry. Second, trade creation resulting from shifts in

production locality has a detrimental effect for although it leads to a cheapening of supplies, it involves a contraction of domestic industrial production which is valued for its collective consumption property. Thus where domestic industrial production is highly valued trade diversion will be preferable to trade creation.

With respect to the characteristics of countries that are likely to form a customs union, the analysis identifies (i) countries that have strong and comparable degrees of collective preference for industrial production, and (ii) countries that have a similar degree of comparative advantage in industrial production or in which levels of economic development do not differ significantly. The analysis also predicts that a customs union treaty is most likely to have stipulations aimed at ensuring an equitable sharing among members of the growth in industrial production in the union.

### 3.6 Traditional Customs Union Theory and Developing Countries

It now suffices to highlight the parts of the foregoing discussion which are of interest to underdeveloped countries. First, the results of the analysis of customs union à la Viner and Lipsey, with its excessive emphasis on static economic welfare effects of trade diversion and trade creation are of little relevance precisely because underdeveloped countries are mainly interested in the growth and development potential of economic policies. Additionally, the assumptions of perfect competition, full employment and utilization of resources, absence of externalities and perfect factor mobility on which the analysis is based are so unreal for developing countries that the results offer little

guidance to policy makers. Also, the definition of a country's economic welfare as constituting only the consumption of private goods distorts the results if used in a situation where the concept of economic welfare has both private and public good components, a likely condition in the case of a country's economic development. We have seen from the Johnson analysis that a simple extension of the concept of a society's economic welfare to include collective consumption (and financing) of public goods (in this case domestic industrial production) can reverse the earlier conclusion regarding the welfare implications of trade creation and trade diversion. The early analysis is of value nevertheless if only because it points out that trade diversion whatever its beneficial effects--by inter-commodity substitution a la Lipsey or via retention of valuable industrial production a la Johnson--does involve real resource cost via higher import prices and that this cost must be reckoned with in an overall assessment of customs union. Similarly the analysis indicates the savings in resource use brought about by trade creation irrespective of its detrimental effect on domestic industrial production or some similar collective objective.

The analysis of the terms of trade effect is of value to underdeveloped countries not for its specific results for these are unlikely to be of any importance given the relatively small size of regional groupings of developing countries. A possible exception may be in a few agricultural products and natural resources. It is of relevance because it foreshadowed an approach to economic integration which, as was outlined earlier, attempts to determine the goals of the countries and the conditions under which countries can achieve their goals at a

smaller cost acting together than by individual action, As such the theory takes on a forward-looking complexion, a very desirable feature of a theory for countries which are concerned with structural changes in their economies.

The traditional analysis of economies of scale is perhaps the most important part of the theory so far as underdeveloped countries are concerned. Despite the unwarranted pessimism of several of the so-called objective writers<sup>5</sup>, economies of scale offer a good avenue to exploit the larger markets and larger and wider resource base that economic integration generates. If the potential economies of scale are exploited, balanced operation of the cost-reduction, trade-suppression, trade-diversion and trade-creation effects can bring about increases in industrial (or some other favoured type of) production for each member country, at reduced real resource costs. Also, as with the terms of trade analysis, the analysis of economies of scale focussed economic integration theory on how coordinated action by several countries can lead to an easier and less costly realization of goals than each country's individual action. The market swapping arrangement of Cooper and Massell to be discussed in the next chapter and Harry Johnson's theory of protectionism as it related to customs union outlined above are offshoots of this approach. And this is the approach that, in our view, serves as an appropriate starting point for a theory of economic integration for developing countries. The extended review of the Cooper-Massell framework is justifiable on the grounds that it marks an important turning point in customs union theory from the standpoint of

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5. For a more detailed discussion of the doubts raised by these writers, see the

developing countries. As we saw, it established the fact that the emphasis of the earlier analysis of customs union is misplaced because within that framework customs union formation is irrational, if not impossible. In other words, it laid bare the inadequacy of the earlier analysis in explaining important features of observed international commercial policy and prompted a shift in emphasis which resulted in an approach to economic integration useful for underdeveloped countries. It will be our task in the following chapter to elaborate on this approach and to present the outlines of a theory of economic integration for small developing countries.

## CHAPTER 4

### ECONOMIC INTEGRATION IN SMALL UNDERDEVELOPED COUNTRIES

In the previous chapter the traditional theory of economic integration was surveyed in an attempt to isolate those aspects that are of relevance to underdeveloped countries. The objective of this chapter is to build upon the important features that were identified and provide the outline of a theory of economic integration for developing countries. In light of the earlier discussion the appropriate starting point is the Cooper-Massell market swapping analysis of economic integration. This is taken up in Section 4.1 together with the Andic-Andic-Dosser [4] extension of the Cooper-Massell approach. The central task of the chapter is performed in Sections 4.2 and 4.3 where the main elements of a theory of economic integration appropriate for the underdeveloped countries of the Eastern Caribbean are presented. These sections build on the works of Balassa [8], Brewster and Thomas [17], Demas [40], Kitamura [68], Linder [72], McIntyre [77] and Wolfe [106] among others. An important element of the theory is concerned with the question of the intra-regional transportation system which is discussed in Section 4.4.

#### 4.1 The Cooper-Massell Theory of Customs Union and the Andic-Andic-Dosser Extension

That the traditional theory of customs unions is inadequate from the standpoint of the underdeveloped countries was indicated in Chapter 3. The approach taken by Cooper and Massell is to shift customs union theory from "a disguised argument for free trade" to "an analysis of alternative policies for protection". This they accomplish in their first paper [35]. In a companion paper [36] they extend their approach to economic integration among underdeveloped countries. Recognizing that "a principal objective

of economic integration among less developed countries is to foster industrial development and to guide such development along more economic lines" [36 p.462], they build their analysis on the assumption that a collective preference exists for domestic industrial production compared with other types of economic activity. Additional domestic industrial production however is achieved at the cost of reduced national income since from a cosmopolitan standpoint the underdeveloped country supposedly has a comparative disadvantage in industrial production. Economic integration is a vehicle for minimizing the opportunity cost of additional domestic industry by joining with other underdeveloped countries to achieve the industrial development goal.

The essentials of the Cooper-Massell analysis are as follows: In Figure 4.1 the marginal cost (assumed constant) of domestic industrial production in country A is given by the step-shaped cost curve  $AS_1$ . Cost is measured in the opportunity cost sense; it is the extra cost incurred by producing the industrial production domestically instead of importing it. Each horizontal segment of the step represents a different manufacturing activity ranked in order of least to highest cost. It is assumed that the country's comparative advantage is in agricultural production so that its entire production of industrial products is domestically consumed. Thus the length of each horizontal segment of  $AS_1$  represents local demand of the particular industrial product. As more domestic industrial production is undertaken higher-cost manufacturing activities are chosen.

Nationalistic industrial development, that is, industrial development without collaboration with other countries, will give rise to a level of production such that the marginal rate at which the underdeveloped country is prepared to trade off national income for industrial production is equal

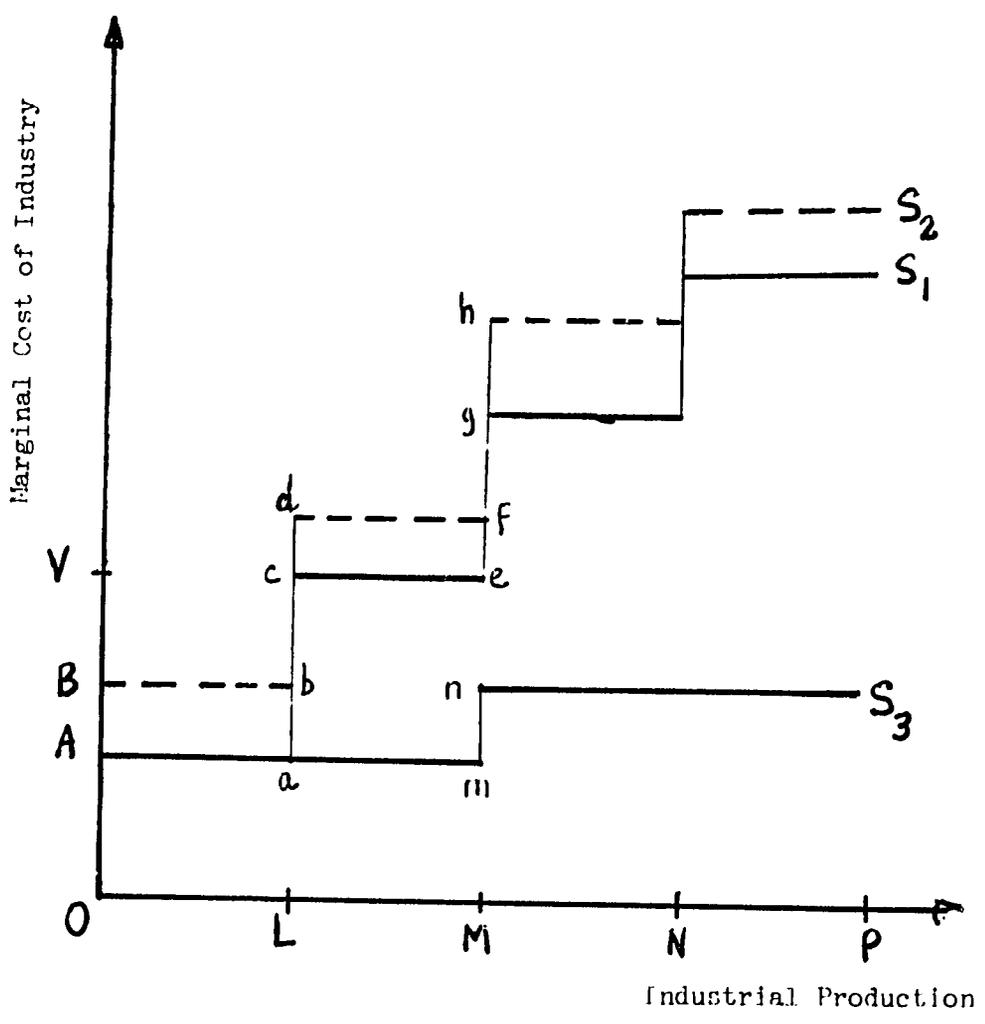


Figure 4.1 Economic Integration and Industrial Development

Segment Au = shoes    ce = hats  
 Bb = coats    df = shirts

to the marginal cost of industrial output. In Figure 4.1 this is given by  $V_e$  industrial production, the marginal cost of which is  $OV$ ; a downward sloping curve (not drawn) representing the collective demand for industrial production intersects the supply curve at  $e$ . The cost to the country of  $V_e$  industrial output is  $OAaceM$  of sacrificed national income. Can economic integration reduce this amount?

Economic integration permits two underdeveloped countries to pool their markets. In Figure 4.1 the supply curve of industrial production of another country B is also given. This is the step-shaped curve  $BS_2$ . For simplicity, assume that national demand is the same for each industrial product and is equal for the two countries. This implies that the horizontal segments of  $AS_1$  and  $BS_2$  are all equal. Assume further that prior to the economic integration scheme national preferences are such that in each country equilibrium industrial production is equal to  $OM$ . Then for country A industrial development involves a cost of area  $OAaceM$  as noted above. For country B a cost of  $OBbdfM$  is incurred. Countries A and B form a customs union and coordinate their industrial development plans. If the cheapest way of producing the combined industrial output of the two countries is sought a step-shaped regional supply curve given as  $AS_3$  is generated. This curve lies below the two national supply curves. Country A will cease production of hats and double its output of shoes from  $Aa$  to  $Am$ , exporting one half to country B. Country B will double its production of coats from  $Bb$  to  $nS_3$  and terminate production of shirts; one half of its coats is exported to partner country A. For each country the level of industrial production has remained unchanged but the cost incurred in terms of national income foregone has declined from  $OAaceM$  to  $OAmM$  for country A and from  $OBbdfm$  to  $MnS_3P$  for country B. The benefit in income saved by pursuing industrial development in the framework of economic integration is equal to the area

acem for country A and to bdfn for country B. This is the central point of the Cooper-Massell argument. Economic integration can lower the cost of industrial development in underdeveloped countries.

The smaller cost of industrial development within the customs union arises from production taking place in the lower cost country and the doubling of output in a particular activity to supply demand in both member countries. Note that since the production of hats and shirts are terminated the analysis assumes that the composition of domestic industrial production does not enter into the industrial development policies. However, this is not a crucial assumption and the cost reduction result of economic integration can be demonstrated with the composition of industrial output entering as a factor in the industrial development preferences.

As the opportunity cost structures are drawn in Figure 3.1 both member countries achieve their desired level of industrial development at the minimum cost to the customs union. However, it is possible for one member to lose all its industrial production if the rule of minimum cost to the customs union as a whole is strictly followed. A case in point would be if the lowest (coats) segment Bb of country B's supply curve were above the second (hats) segment c e of the supply curve of country A. In such a case least cost production of OP industrial production would involve country A producing OM shoes and MP hats. Coat and shirt production will cease in country B and it will be left producing only agricultural products. Provided that the industrial development preferences are determined at the national level, the most likely situation, this result will be unacceptable. For a viable customs union the common external tariff would have to be so structured that each country's desired level of industrial development is achieved. This might be accomplished by an explicit arrangement

for the distribution of regional industrial production between the two countries. Such an arrangement implies coordinated development planning among the member countries for a viable economic integration scheme.

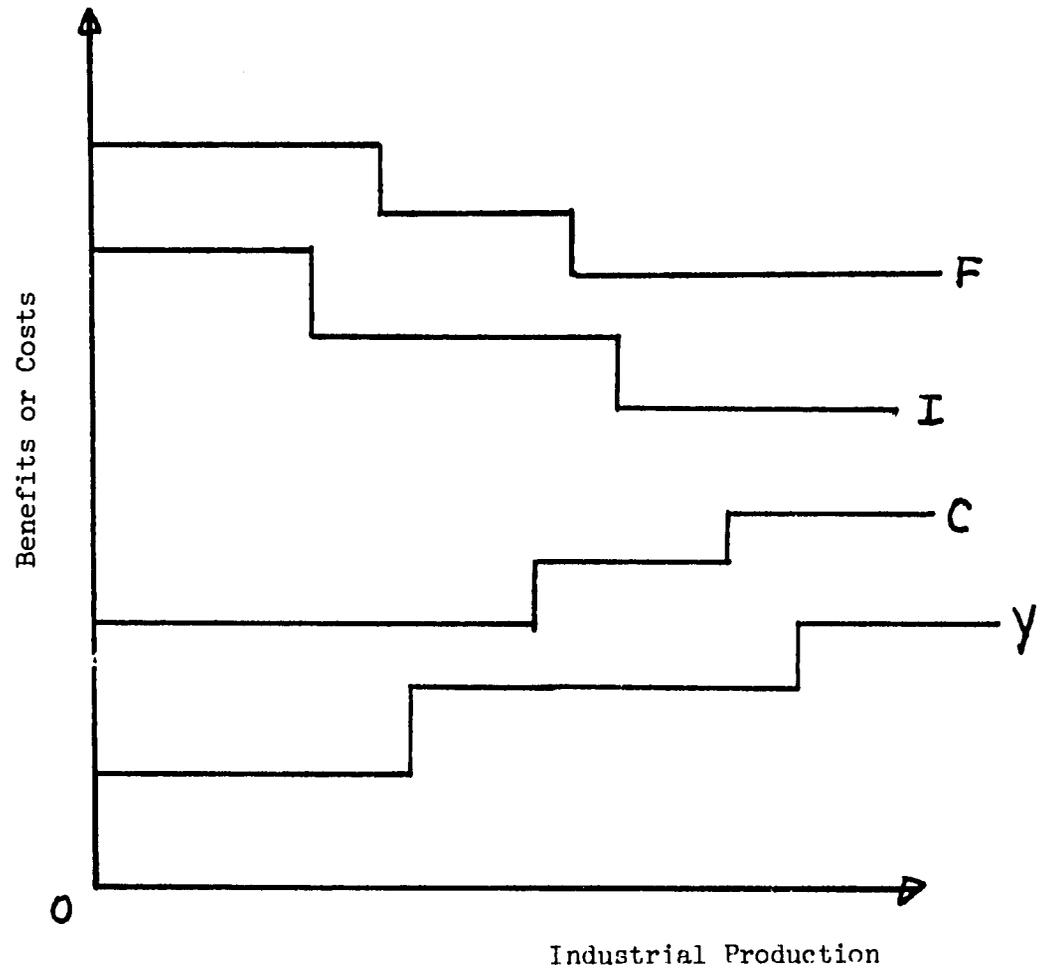
Generally speaking, it can be said that the potential gains from a customs union in the Cooper-Massell framework will be greater (a) if the marginal cost of protecting industry in the two countries rises sharply, (b) if the countries have strong preferences for domestic industry, (c) if the countries' production structures are complementary rather than competitive, and (d) if intra-union comparative advantage in the various lines of industrial production are somewhat evenly spaced over the two countries. But as noted above a satisfactory program of joint protection of industry may involve a specially scaled common external tariff so that each member experiences some industrial development. Or a program of subsidization of industry in the member with the greater comparative disadvantage or perhaps a fully-fledged scheme of industrial allocation may be required.

The Cooper-Massell theory of economic integration has been extended by Andic, Andic and Dosser [ 4 ]. In addition to reducing the cost of protecting local industrial development, economic integration among underdeveloped countries can help to save foreign exchange by replacing national import substitution with a more efficient regional import substitution scheme. If trade is diverted away from the developed countries to underdeveloped partner countries the national income lost via trade diversion may be compensated by the reduced use of valuable foreign exchange. This point has been stressed by Kitamura [68 ], Mikesell [82 ], and Linder [73 ]. Andic, Andic and Dosser add this to the Cooper-Massell scheme arguing that in principle this can be done. Added as well is a capital requirement

factor which reflects the underdeveloped country's effort to minimize capital costs per industrial activity so that as high a level of industrial development can be achieved with the given savings constraint. These additions though worthwhile do not represent a major departure from the Cooper-Massell theory. All that has been done is to incorporate a few other elements of the economic development process. Indeed, Massell and Cooper recognized some of these extensions.

The Andic-Andic-Dosser contribution make an important extension when they replace the ranking of industrial activities by cost of the Cooper-Massell approach with a ranking based upon cost-benefit considerations. Justification for the change is the following: Different import substitution industries will have different marginal benefits in terms of amount of foreign exchange saved so that the simple collective demand curve used in the Cooper-Massell analysis to represent preferences are not quite appropriate to the foreign exchange case. Indeed, the single demand curve approach representing as it does the economic planners' preferences is not quite appropriate even for industrial production because it is reasonable to suppose that there will be differential benefits from the various industrial activities. The cost-benefit ratio method of ranking allows the differential benefits and costs of the industrial activities to be taken into account.

Four factors are identified and are shown in Figure 4.2. These are the foreign exchange saving (F) and the industrial development effect (I) both viewed as net benefits. Consequently the industrial activities are ranked in descending order of benefits. The other two are the capital requirement (K) and the income(Y) sacrificed from reduced trade because of protection of domestic production. Industrial activities are ranked in

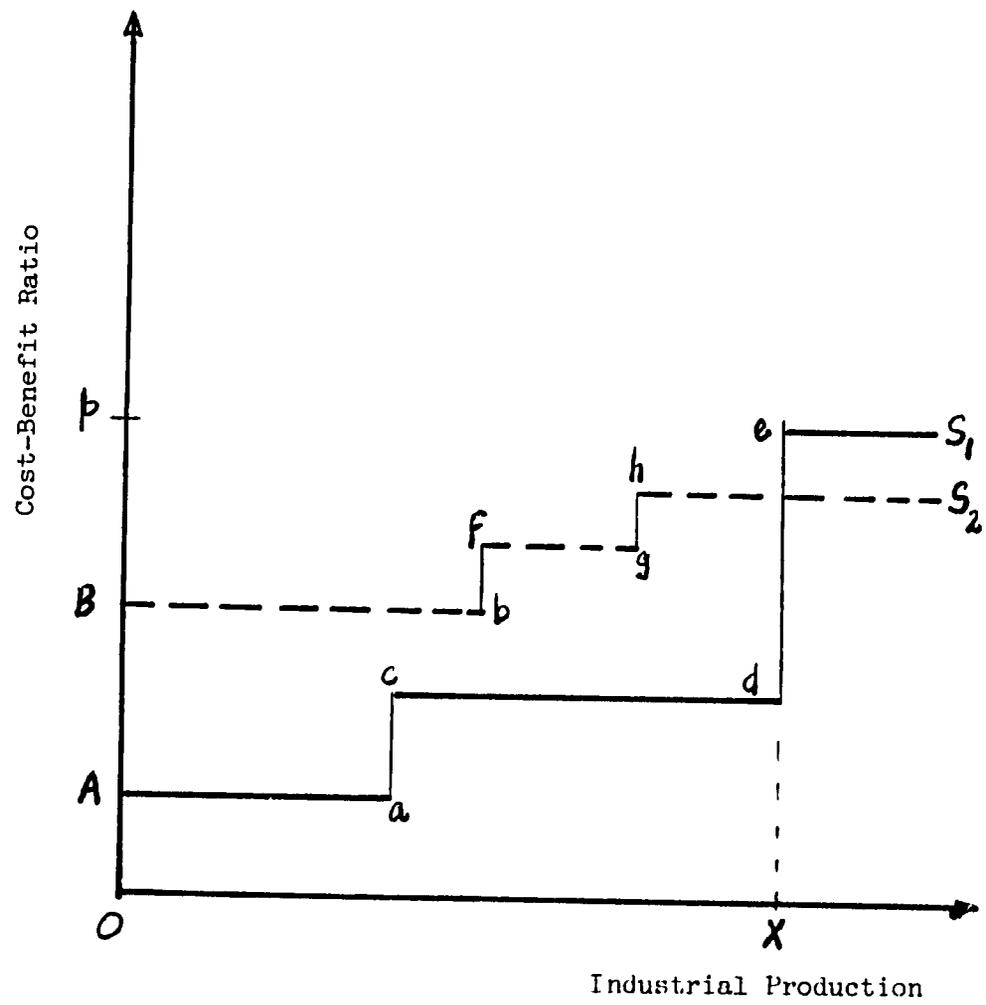


F = Foreign exchange benefit  
I = Industrialization benefit  
C = Capital requirement cost  
Y = Income forgone cost

Figure 4.2 Ranking Industrial Activities by Benefits and Costs

ascending order of net cost incurred for these. As in the Cooper-Massell case depicted in Figure 4.1 each horizontal segment represents a different industrial activity. It should be noted however, that the first segment of one of the step curves need not be the same activity for the first segment for another. Thus for example it is quite acceptable for the first segment of the F curve be the shoe industry while the first segment of the K curve is the shirt industry. The cost benefit ratio is derived by calculating the quotient of the sum of the two cost factors and of the benefit factors of Figure 4.2 for each industrial activity. The activities are then ranked according to the ratio in ascending order. Such a ranking of industrial activities based upon the cost-benefit measure is given in Figure 4.3 for the two countries of the economic integration scheme.

In Figure 4.3  $AS_1$  represents the aggregate supply curve for country A,  $BS_2$  that for country B. Unlike Figure 4.1, the industrial activities shoes and coats are common to both countries and an economic integration scheme that will protect all the industries listed will result in country A producing shoes and country B producing coats for both countries. Domestic industrial production in both countries is satisfied at lower costs because of intra-union specialization. Note that in this case countries A and B will lose their coat and shoe industries respectively. For the case depicted in Figure 4.3 the integration regime is unlikely to be based simply on minimizing the net costs of industrialization for the union as a whole. Such a rule will result in the expansion of the shoe and hat industries in country A before any industrial production takes place in country B since the cost-benefit curves of these two industries lie below the least cost-benefit industrial activity (coats) in country B. This,



Segment Aa = shoes  
 cd = hats  
 eS<sub>1</sub> = coats  
 Bb<sup>1</sup> = coats  
 fg = shoes  
 hS<sub>2</sub> = suits

Figure 4.3 Cost-Benefit Ranking of Industries

as noted earlier, is likely to be unacceptable to the latter country.

This suggests that except in cases where comparative cost advantages are reasonably spread over the various countries, the institutional arrangements of traditional customs union are likely to be inadequate for a viable regime of regional industry protection and the establishment of integration industries. In other words when the traditional institutional arrangements are likely to bestow a disproportionate amount of the benefits of economic integration to one country other countries will be reluctant to participate in the scheme unless departures are made from the standard institutional setup to assure all countries some reasonable chance of sharing in the benefits.

Two additional observations may be noted. First, it would appear that once the Cooper-Massell proposition, that within limits two (or more) countries can achieve at a cheaper cost their individual objectives if they coordinate their activities, is accepted the specific institutional mechanisms for economic integration may differ from case to case depending on the comparative structural features of the member economies. Thus, a viable integration scheme between the two countries represented in Figure 4.3 would require more than a common external tariff structure if the regional demand for regional industrial production is less than or equal to OX. For in this case country A will undertake all the industrial production for the region; country B produces zero manufacturing products. Additional provisions covering, for example, labor migration between the countries, or an explicit policy on industrial location would appear necessary. On the other hand, if regional demand for regional manufacturing output were say twice OX of Figure 4.3 a viable economic integration scheme limited only to a common external tariff could be established.

This is so since both countries share somewhat equitably in regional industrial production, country A producing shoes and hats, country B, coats and suits. Second, remarks concerning the first observation indicate that changes in the comparative structure of the participating economies, including differences in the growth of demand for various manufacturing products will affect the relative distribution of benefits among member countries. Where the latter is an important element in the viability of an economic integration scheme, the institutional mechanisms would have to be flexible and the arrangements subject to periodic review if viability is to be retained over time. This appears to be of particular importance for economic integration schemes among underdeveloped countries whose economies may experience rapid structural change.

In the Andic-Andic-Dosser scheme, the amount of industrialization that will be supported is determined by the choice of a cost-benefit ratio which both countries consider appropriate. If a ratio equal to  $O_p$  (Figure 4.3) is selected, the union would be prepared to protect any industrial production whose costs relative to benefits are not greater than  $O_p$ . Thus, the union would be prepared to protect coat production in country A. Union tariffs, quantitative restrictions or other measures are set to conform to this rate of protection. Country A, however, will not produce coats since partner country B can produce them at a lower cost-benefit ratio.

One shortcoming of the Andic-Andic-Dosser cost-benefit calculus relates to its operationality. How, in practice, does one add the foreign exchange benefit to the industrialization benefit especially when according to these authors, "industrialization is only a cipher for growth-pro-

moting activities through linkages, increase in entrepreneurship, growth of changed attitudes towards effort, etc., and may include a wide variety of activities" [ 4 p. 18] And if at the national level one could overcome the problems of measuring the latter and arrive at a cost-benefit curve for each country as in Figure 4.3 how comparable will these curves be, so that valid inferences about intra-regional specialization can be made? Put differently, since subjective judgements will be made at the country level in order to put a numerical value on the benefits of industrialization the final configuration of the integration area's cost-benefit structure (Figure 4.3) will be determined in part by such subjective valuations. It is easy to see that a country that consistently values such factors as growth in national entrepreneurship and changes in workers' attitudes towards effort substantially above other participating countries will end up in the best position in terms of the ranking of manufacturing activities. In such an event each country is tempted to overvalue its benefits. Several consequences appear likely. First, the integration scheme will be billed as having benefits above those it actually will have. Second, agreement on an acceptable scheme would appear more difficult if only because of the frequent juggling of benefits by the participating countries in efforts to acquire the most advantageous position. Third, because of the first consequence the region is likely to end up protecting industrial activities which on its criterion of a given cutoff point for protection (for example  $O_p$  of Figure 4.3) it would not be protecting were reasonable estimates of the benefits of these activities used.

The foregoing suggests that an operational and practical version of the Andic-Andic-Dosser cost-benefit approach requires that the determination of the foreign exchange, and industrialization benefits, the capital requirement and income foregone costs be carried out at the regional level and not at the national level as their analysis seems to suggest. This, we suggest, requires coordinated regional planning; planning that involves agreement on issues beyond the narrow confines of standard customs union theory and indeed even beyond those that the Andic-Andic-Dosser extension of the Cooper-Massell market swapping approach seem to indicate.

In summary, the Andic-Andic-Dosser modification of the Cooper-Massell approach is a step forward in arriving at an appropriate economic integration theory for developing countries. In particular, the emphasis on the need to weight the differential costs of various industries by their differential benefits is an important advance. However, the modification has not gone far enough in that although the inadequacy of the conventional institutional arrangements of customs union is recognized no effort is made to suggest appropriate institutional arrangements. Part of the reason for this may be an unconscious attempt to make the theory applicable to all groups of underdeveloped countries in which case the reluctance to move forward is a wise one. Further, the problems that the calculation of cost-benefit ratios at the national level would raise for an economic integration scheme are not appreciated. Thus, the need for coordinated determination of the cost-benefit values and hence the need for coordinated multi-country development planning does not form a part of the Andic-Andic-Dosser schema.

#### 4.2 An Economic Integration Theory for Small Underdeveloped Economies: The Setting

The theory of economic integration that will be suggested in this and

the following sections takes as its starting point two factors. First, an appropriate theory should not be developed in a vacuum but should draw upon the objective conditions existing at a particular place and time. This implies that a clear understanding of the prevailing conditions must be grasped not at the point of theory verification but at the stage of theory construction as well. This may mean that the widespread applicability of the theory may be compromised. In our specific case the interest is in a theory of economic integration for the Commonwealth Caribbean countries. The first factor implies that a sound grasp of the historical development of Commonwealth Caribbean society is a prior requirement for an appropriate theory. Whether the theory outlined will have relevance to other groups of countries will depend upon whether the objective conditions, both past and present, have been in the experience of other areas. No pretensions are made of the wider applicability of the theory. The second factor of crucial importance is that the objectives and goals which the theory is aimed at elucidating must be clearly understood, and preferably explicitly stated. This will minimize the danger of evaluating the theory on the basis of a criterion it was not intended to address. The nature of the two factors just mentioned in the context of the Commonwealth Caribbean will be established and the outlines of a theory of economic integration appropriate to that context suggested. Since our central concern is with the Windward and Leeward Islands discussion relating to the objective conditions, goals and objectives will, for the most part, be confined to these countries.

By virtually any standard of measurement, the economies of the Leeward and Windward Islands are extremely small. In Chapter 2 we discussed the structure of these economies but it may be recalled that

the total land area of the seven countries is a mere 1181 square miles, the size of one country (Montserrat) being only 32 square miles. The total area of lands in farms in 1961 was a meagre 365,221 acres. The population of all the countries in 1970 was estimated at less than half million; only one country (St. Lucia) had a population above 100,000 and Montserrat had only 12,000. Their combined gross domestic products in 1971 was estimated at E.C. \$304.5 million or about U.S. \$169.2 million.<sup>1</sup>

The implications of small size in economic development has been ably discussed by Demas [ 41 ] and it may be useful to note a few points. First, opportunities for economies of scale are severely limited by the small size of the domestic market. Second, the natural resources endowment is likely to be highly skewed so that the development of a wide range of industrial activities based upon local inputs is virtually ruled out. Third, because of its small size, the country is quite likely to be at a disadvantage with respect to acquiring appropriate technology. The technology it imports will be geared for large levels of output. The country is faced with the choice of adapting the technology to lower output levels or of utilizing the large-scale-output technology and exporting a substantial part of its production. Either choice poses serious problems for a small country. The former requires research and development expenditures which are likely to be beyond its means. And in any case the payoff is uncertain. The latter implies great reliance on the foreign sector and raises questions of economic dependence and instability, features which the economy is attempting to reduce. Fourth, the small size of the domestic market makes it easy for monopolies to develop.

1 - The conversion to U.S. currency is made with the foreign exchange rate of U.S. \$1 = E.C. \$2. We neglect the methodological pitfalls of such an exercise.

The consequences for resource allocation are well known. It is true, of course, that the monopoly position can be minimized by appropriate international commercial policy. Fifth, the inability to exploit economies of scale are also felt in the provision of basic government services, the government bureaucracy, and the public utility services such as electricity. Consequently the per capita cost of such services are likely to be much greater than for larger economies and cause a severe strain on the government budget.

The above factors point to a choice of economic activities in which economies of scale are insignificant in an economic development program for small countries. The economic development program may also include ways of collaborating with other countries to overcome the limitations of size. Regional economic integration is one form in which such collaboration can take place.

Another feature of the economies of the Leeward and Windward Islands is that they are structurally dependent economies. Several characteristics combine to give them this feature.<sup>2</sup> First, there is a wide disparity between the pattern and structure of domestic production and the pattern and structure of domestic demand. The import domestic expenditure coefficient which compares the value and composition of imports for domestic use to the value and composition of domestic expenditure has been introduced by Brewster and Thomas [ 17 ] to measure this characteristic. They suggest that the ratio may be as high as 0.7. Given the strong reliance on imports to satisfy domestic demand, import coefficients are very high. Mirroring the high import coefficients are high export coefficients. Though part of

2 - For an extended discussion on this point in the wider Caribbean context, see Girvan [ 60 ].

the extreme reliance on exports may be due to efforts to overcome the limitations of the small size of the domestic market, by far the greater part is to be explained in terms of the perpetuation, through inappropriate policy choices, of the historical legacy of metropolitan colonial exploitation of Caribbean resources to meet the needs and requirements not of the Caribbean economies but of metropolitan businesses. In other words, functional economic dependence as expressed in the uncritical pursuit of economic policies and the use of policy instruments passed down from an earlier era is an important determinant of the state of structural economic dependence that exists in Caribbean economies.<sup>3</sup> The export sector is further characterized by one or two agricultural products (sugar and bananas) accounting for a substantial part of export receipts. This skewness in the commodity composition of exports is further compounded by a skewness in the country distribution of trade. Three countries, Great Britain, Canada and the United States account for the bulk of their exports. Again the retention of past imperial and quasi-imperial arrangements albeit in modern garb, rather than other factors appear to account for the almost total reliance on the markets of these countries.

The feature of skewness and heavy reliance on the export sector which are evident in the established agricultural staples appear to afflict emerging industries as well. Thus in the Leeward and Windward Islands, the tourist industry which has emerged as a major economic activity in the past ten years or so depends for its survival effectively upon the three metropolitan countries mentioned earlier. Virtually all of the hotels are owned and controlled by business concerns from one of these countries and the lion's share of the tourists are residents of these countries. Even the type of

3 - For an excellent discussion of this aspect as it relates to international trade policy, see McIntyre [17].

tourist services offered is skewed towards the high-priced luxury variety, thereby frustrating the development of a tourist industry which is more broadly based and diversified, capable of providing for greater linkages within the national and regional economies.<sup>4</sup>

Another characteristic of the structurally dependent economies of the Leeward and Windward Islands is that the larger part of aggregate private investment is undertaken in those industries that produce almost exclusively for metropolitan markets. Also, most of the investment funds come from foreign and not domestic savings. The financial institutions through which much of the local savings is mobilized are by and large, branches of metropolitan financial and banking concerns. The nature of the regulations under which they operate provide no assurance that the savings that are mobilized will be used locally. Thus, the results of the generally accepted low savings effort can be dissipated in overseas investment in line with the metropolitan companies' global investment strategy and profit maximization goal, rather than be used in the national development effort. This, of course, intensifies the country's dependence on foreign sources for investable funds.

A further characteristic of structural economic dependence as manifested in the Leeward and Windward Islands is the existence of technological dualism and a bifurcated labor market. The plantation-type agricultural activities, mainly sugar, and the tourist facilities have access to modern technology and are provided with adequate infrastructure quite often at substantial government cost while the needs of other sectors of the economies, for example, non-plantation agriculture, go unrecognized. Wage rates in the former sectors rise way above levels consistent with labor's social valuation in view of the

4 - Bryden [ 18 ] provides an analysis of tourism in these and other Commonwealth Caribbean countries.

presence of massive unemployment and underemployment sometimes reaching to one-quarter of a country's work force.

Finally, we may note the characteristic of the ever increasing need of the governments of these countries to finance their growing fiscal deficits by foreign borrowing creating serious problems of public debt management. Myopic solutions of these problems center on further foreign borrowing which most often complicates the original problems. The crisis in government budgetary management is of course due to other structural characteristics some of which were noted above and to functional economic dependence. The traditional agricultural export sector stagnates, little revenue from the new manufacturing and tourism sectors is forthcoming due to a host of incentive legislation. This situation is combined with a much enlarged role for the public sector in the provision of infrastructure and social services. But given the low domestic savings effort there is inadequate domestic funds to support such expenditures, while the structure and performance of the financial institutions leave in doubt whether the little domestic funds are retained for local use. Hence, the continued reliance on foreign financing of government expenditures.

There are no doubt other aspects of the economies of the Leeward and Windward Islands that could be mentioned but the features of extreme small size and structural economic dependence are the two that we believe should be clearly appreciated in any attempt at an analysis of the nature of the development problem they face and approaches to meaningful solutions.

In the area of goals and objectives it is standard to postulate that the general objective is to foster and promote economic development. Given the structurally dependent and underdeveloped state of the economies this appears an acceptable normative goal. But it is essential to clarify the

concept of economic development. Such clarification will provide insights into other more specifically defined normative goals as well as suggest appropriate measures for accelerating the economic development process.

In some respected circles economic development is defined as a sustained growth in total and per capita incomes with some concern to income distribution at the occupational and regional levels.<sup>5</sup> While the growth of incomes may be a useful index of the economic development process it is quite inadequate as a characterization of the process itself. Marshall Wolfe [106] has observed that the concept of development has acquired two distinct, though not unrelated, meanings. The first interpretation sees development as "systematically inter-related growth and change processes in human societies, delimited by the boundaries of national states, but also highly interdependent on a world scale. These processes have many uniformities and predictable sequences, but also have unique characteristics in each country or society, deriving from historical patterns, cultural traits and values, territorial and population size, resource endowment, internal class structure and power relationships; place in the international system, etc." [106 p.5]. In the second sense, development "expresses an aspiration toward a better society...implies choices derived from value judgements concerning the content and characteristics of a better society...[and] also implies value judgements concerning the right of the existing society, through general consensus or through agents claiming to represent the best interests of the society, to make such choices and enforce them through developmental policies." [106 p.5].

An important feature of both conceptions of development is that it is seen as a process that involves all aspects of society; its compartmentalization into economic, political and other discipline - determined categories though useful to facilitate analysis should not obscure the societal nature

5 - See for example Higgins [62 ], p. 33.

of the process.

Among the propositions that Marshall Wolfe advances on the basis of the two notions of development the following are important for our discussion. First, various national approaches to development are legitimate, possible and unavoidable. This diversity of economic development approaches can, of course, be extended to different regional groupings of countries. Second, while all countries are limited in their choices to a certain number of approaches, the range of feasible choices varies for different countries. Third, the approach to development adopted will be constrained by the minimum requirement that it must enhance the capacity of the society to function in the long run for the benefit of all its members.

We would add that not only must the capacity of the society to function for the benefit of all its members be enhanced but that the members themselves must be active agents in this exercise. In other words, the members of the society ought to be the catalysts in the process of broadening the society's horizons in dealing with its problems. This will ensure that the process of enhancing the society's capacity will be continuous and self-generating. Fourth, each society must accept the challenge of fulfilling the above minimum requirement by continuous analyses of the alternatives at its disposal and the refinement of its decision-making techniques. Fifth, the definition of societal development cannot be confined to a set of national income objectives supplemented by some social goals. And sixth, the choices leading to an approach to development need not be comprehensive, taking into account all the conceivable inter-relationships among the various elements of society. The ability to concentrate on and to fulfill key objectives and to minimize resource use and public attention to other lesser objectives may be sufficient under certain circumstances.

On the basis of the above propositions together with the structural features of the economies of the Leeward and Windward Islands sketched earlier, the definition of economic development which appears most appropriate for these countries is that suggested by Norman Girvan and Owen Jefferson [61 ]: "The economic development of any political or geographical unit is a process by which the inhabitants continuously and creatively manipulate the natural environment for the satisfaction of the material needs." [61 p.8].

Several points are worth emphasizing. As so conceived the moving force in the transformation of a society is the members of that society. Thus, though foreign assistance in the form of capital, technology, preferential trade arrangements, etc., may be helpful to the development process they must not be allowed to dictate the strategies of development chosen. A situation in which per capita incomes double because of a massive inflow of foreign capital and technology is not development if the inhabitants have little say in the decision making processes that govern the economic activities; the inhabitants would merely be passive tools in an exercise of economic growth. A second important feature of the process of economic development, as we see it, is that it must be self-sustaining. The notion of self-sustaining economic growth is a widely used one<sup>6</sup> but the self-sustaining property of economic development is much broader. It implies the existence of an internal dynamic<sup>7</sup> in the economic system capable of critical analyses of the economic problems and putting forward solutions which are adequate and

6 - The contemporary usage of the term originates with W.W. Rostow. For a discussion, see Demas [41 ].

7 - We borrow this term from Brewster [15 ].

which can be implemented by agents of the society. A third feature that may be noted is the relation between the political or geographical unit's ability to alter its natural environment and the material needs of its inhabitants. A state of affairs characterized by a growing differential between the fruits of a society's ability to alter its environment and the needs expressed by the members of that society represents underdevelopment of the economic system insofar as the society fails to appreciate the extent of its potentialities. Havelock Brewster has noted that "the most outstanding feature of developing societies...is that they have been developing backwards in as much as their own technological knowledge and powers of invention are continuously outpaced by the technology inherent in their production and in as much as the economic structure has contributed to a growing social and psychological incohesiveness." [15 p.90]. This situation arises, we suspect, from attempts to satisfy the society's needs not by the society's own manipulation of its environment, as the economic development process as conceived would require, but by methods engineered by another society the essentials of which are not clearly absorbed by the agents of this society. The wide gap between the structure of domestic resource use and the structure of demand which characterize the economies of the Leeward and Windward Islands is a consequence of such attempts. Finally, the process of economic development involves the equitable sharing of responsibilities and rewards among the constituent parts of the economic unit in question. Thus if our economic unit of concern is a regional grouping of countries like the Leeward and Windward Islands the problem of economic polarization becomes an important matter with a declared normative goal being the minimization of economic polarization effects among the countries. In other words, the problem of distribution is to be seen as an integral part of the process of economic

development and not to be omitted through the major part of the analysis only to be tacked on after the so-called positive aspects of the problem have been handled.

With the above clarification of the concept of development we can proceed to a more specific enumeration of the normative goals that seem appropriate for the economies of the Leeward and Windward Islands. The structural transformation of these economies is one important objective. Indeed one writer has suggested that "structural transformation is the real criterion of underdevelopment and self-sustained growth" [ Demas 41 p.20], while Brewster and Thomas [17 p.115] see it as "the present critical material bottleneck" in the growth processes of underdeveloped countries.

By structural transformation is meant in the context of regional economic integration, "dynamically increasing inter-sectoral dependence in both the regional economy and that of its constituent units". [17 p.115]. As structural transformation progresses several features are observable.<sup>8</sup> The economy becomes more diversified and the proportionate share of manufacturing and services in national output increases. The economy becomes more flexible and more adaptable to external as well as internal disturbances. The volume of inter-industry transactions increases. There is a decline in the technological dualism of the economy; surplus labor gets involved in productive employment, the size of the subsistence sector declines. Finally, and most important, the gap between the structure of domestic resource utilization and domestic demand narrows.

The objective of structural transformation takes on prominence because its fulfillment will remove the condition of structural economic dependence which restricts the ability of the members of the society to effectively

8 - For a discussion, see Demas [ 41 ], pp. 17-20.

manipulate their material environment for the satisfaction of their needs.

A second normative goal is one that has been alluded to earlier. Within the context of regional economic integration the minimization of the economic polarization effects is to be pursued. This can be viewed as an extension of Wolfe's third proposition given earlier. Just as national economic development involves the society functioning for the benefit of all its members so must regional economic development involve the enhancement of regional capacities for the benefit of all the member countries of the region. If one member country were to suffer severely from economic polarization effects then whatever expansion of regional capacities and capabilities that took place would be counter-productive for this member. Also, just as significant national inequalities can lead to intra-national social conflicts so too can international conflicts be generated by the presence of marked international inequalities in a regional arrangement at economic collaboration. If the economic polarization effects are kept in check, as our objective requires, the elimination of an inequitable distribution of the benefits of regional economic cooperation is assured and with it good prospects of harmonious regional development.

In view of the conflict between the concept of development advocated and the present extreme reliance on foreign capital to finance local economic activities and government budget deficits, another normative goal is a reduction at least relatively in the amount of foreign capital assistance which the countries now receive. This goal has several facets. One facet relates to a restructuring of the banking and other financial institutions in these economies so that there will be adequate assurance that locally mobilized savings will be used to finance the economic development of these countries.

Another facet relates to the need to limit developmental expenditures within reasonable distance of the society's available resources.

We consider a final quite important objective. For a society to be able to manipulate its material environment it must have control over it. But as suggested earlier, the property relations of a significant proportion of the natural resources of these countries are such that property rights reside in the hands of foreigners. To alter these property relations so that the resources will be open to manipulation by the inhabitants of the Leeward and Windward Islands is a normative goal that must be appreciated and one whose fulfillment, in our view, must be achieved if meaningful development is to occur.

#### 4.3 Elements of an Economic Integration Theory for Small Structurally Dependent Economies

Given the structure of the economies of the Leeward and Windward Islands, the concept of economic development which is felt to be most appropriate and the set of normative goals just discussed, we wish now to establish the role of economic integration in the achievement of these goals. We shall argue that an economic integration theory comprised of the elements to be discussed can be an important tool in the development process in the Leeward and Windward Islands. A word of caution is nevertheless advisable. The implementation of the policy implications of the economic integration theory to be outlined should not be viewed as the panacea to all the ills of these economies. All that is suggested is that such proposals if energetically pursued can make a significant contribution to the resolutions of the economic problems facing these countries.

The notion of economic integration adopted here is similar to that put forward by Brewster and Thomas:

...the concept of economic integration is fundamentally organic. Its methods and patterns of development are achieved through the diffusion of attributes of strength and weakness throughout the integral parts of a regional system. It is necessary for this to take place in such a way that the compensatory balancing of these attributes destroys their localization and invests each of the components with a potential greater than that of its pre-integrated state. As such, it involves not only integrating the structures of demand but also integrating the use of resources. [ 17 pp.111-112].

It was suggested in Chapter that an appropriate approach to economic integration for underdeveloped countries should have the following features: The objectives of the countries should be identified; their individual capacities to achieve these objectives should be assessed; the alternative strategy of pooling their resources, policies and capacities, either partially or completely, to achieve their combined objectives should be evaluated, and then compared with the individualistic option. The Brewster-Thomas conception fulfills these features and because of its organic nature assures that the outcome of the strategy of collaboration is more attractive to that of individualism. It was also suggested in the previous section that the Cooper-Massell analysis of market swapping is of importance because it highlights the benefits of collaboration in achieving clearly defined objectives.

Economic integration is beneficial to small structurally dependent economies, like those of the Leeward and Windward Islands, fundamentally because it helps them to achieve the normative goals which we have specified earlier. The benefits derive from the effects of economic integration on market size, exploitation of scale economies, regional import substitution, technological research, resource combination and development of regional industries among other factors.

Economic integration leads to an expansion of the market. That "the inducement to invest is limited by the size of the market" has been forcefully argued by Ragnar Nurkse [85 Chapter 1] who noted that this hypothesis is a modern version of Adam Smith's proposition that "the division of labor is limi-

ted by the extent of the market". An enlargement of the market a la' Nurkse takes place when there is an increase in the real income of a given population. Economic integration increases the size of the market by bringing together several countries with given real incomes - a sort of horizontal expansion of the market. The Nurkse hypothesis should nevertheless be applicable.

It follows that as a greater amount of investment is induced the rate of growth of the regional economy will be greater than it would otherwise have been. Hiroshi Kitamura [ 68 ] considers the positive impact of economic integration on aggregate investment behavior in the region and the effect of the increased investment on the future structure of production in the participating economies of greater significance than the short run effects of economic integration on the members' trade patterns.

Related to the above effect, economic integration stimulates the development of the industrial sectors of the participating economies. Such stimulation arises from the fact that because of the enlargement of the market area, through the removal of tariffs and quantitative restrictions on trade, economies of scale which characterize the cost structure can be exploited. Demas [ 40 ] sees this effect as the main source of the benefits of economic integration.

Bela Balassa [ 8 Chapter IV ] distinguishes three types of economies of scale. The first relates to the use of larger plants or combination of plants which lower unit costs. This is economies of scale proper. It arises from indivisibilities in some types of machinery, from the non-proportionate relationship between capacity and costs in the case of containers, pipelines and compressors, from the non-proportionate relationship between energy loss and capacity of furnaces and electric conductors, and from a somewhat similar

relationship between output and cost in design, production management, information gathering and inventories as the level of an establishment's business expands. The use of specialized personnel may also become attractive as output levels increase. For the Leeward and Windward Islands the element of indivisibilities may be of importance. Since they do not have a capital goods industry all machinery must be imported. Given their very small size, it is quite likely that for some activities the regional market will be required to support even the smallest available size of the relevant plant and equipment. Thus regional economic integration will be crucial to the existence of economic activities for which the regional market can accommodate only one plant of minimum economic size. In this way integration industries can be established and equitably distributed among the members of the integration scheme.

The second type of economies of scale refers to a smaller range of products and longer production runs for each product variety in individual plants. That is, as market size increases horizontal specialization can take place. Average costs decline with longer production runs due to cost savings in the making of moulds, preparation of patterns and models, machine resetting, work reorganization and similar adjustments involved in a change over to another product. The possibilities of benefits from this type of economies of scale in a regional economic integration scheme comprising the Leeward and Windward Islands should not be exaggerated in view of the extreme smallness of their combined markets by international standards. It would appear, however, that some gains will be forthcoming if, as we shall advocate later in this section, a well planned industrialization program forms part of the economic integration arrangements.

The third type involves the establishment of separate plants for various activities which were previously undertaken in one plant. This vertical or

intra-industry specialization, Balassa [ 8 pp.99-101] notes, has been an important factor in the industrial development of the developed countries it being a feature of the growth of the tanning, printing, metal, machine and automobile industries of these countries. Concerning prospects for underdeveloped countries the metal manufacturing and automobile industries are given specific mention. In so far as the Leeward and Windward Islands are concerned, their size, resource base and the conception of economic development we have chosen would tend to indicate that the third type of economies of scale is unlikely to loom large in their economic integration and development.

The bulk of the literature dealing with economies of scale and economic integration has limited the former's existence to manufacturing industry. However, Brewster and Thomas [ 17 ] are of the opinion that significant economies of scale can be reaped in the agricultural sector as well, at least in economic integration schemes involving structurally dependent economies. They identify five sources of economies of scale applicable to agriculture. First, there are the scale economies to be derived from the greater flexibility in the regional location of various agricultural activities. Given heterogeneous natural environmental conditions in the region and given that pre-integration agricultural production does not optimize the use of the varying environmental conditions, reductions in social cost will result by shifting production of various agricultural products to land with the comparative best quality and size. Second, economies of scale are forthcoming in lower unit capital costs for initial capital expenditures for land preparation, water supply, access routes, transportation facilities and perhaps even for farm machinery as the size of the agricultural project increases. The third, fourth and fifth sources of scale economies derive

respectively from elimination of unnecessary regional duplication, from the increase in inter-sectoral linkages and from regional collaboration in technological research. Needless to say, these sources of economies of scale are vital to the Leeward and Windward Islands in view of the essentially agricultural nature of their economies.

In their attempts to accelerate the process of economic development many underdeveloped countries have instituted policies aimed at import substitution. For these countries expanding the exports of their traditional agricultural staples can hardly be expected to accelerate their economic growth because of the poor demand prospects due to low income and price elasticities of demand for these products in industrial countries. Add to this the significant price instability of these products and its effect on export earnings. In any case, concentrating on the expansion of these products alone will only perpetuate the undiversified nature of their economies thus making them highly vulnerable to external disturbances and most important, such a policy will accomplish very little at the structural transformation of the economies, one of the stated objectives.

Economic integration by replacing national import substitution policies with one of regional import substitution can reduce the inefficiencies of the former. The development pattern of the region can make better use of the strategy of import substitution, internalizing some of the external transactions of the members and permitting a less dependent approach to the problem of economic development. For countries the size of the Leeward and Windward Islands economic integration might not only mean a better import substitution policy but might indeed be the determinant of whether such a policy exists or not. That is, unlike larger underdeveloped economies where national import substitution effects begin to peter out at the stage of intermediate and

capital goods the process might never get started in these mini economies. But with economic integration and a regional market it may be economical to implement a program. It will be recalled that the Andic-Andic-Dosser addition of the foreign exchange benefit of economic integration is based upon the import substitution argument. Demas [ 40 ] and Kitamura [ 68 ] also consider the rationalization of the import substitution process an important consequence of economic integration.

The advantages of a regional import substitution policy made possible through economic integration vis-a-vis national import substitution has been emphasized by Brewster and Thomas [17 ] particularly as it relates to agriculture. Firstly, agricultural production is stimulated as a result of the impact effect of economic integration "which leads to a more or less guaranteed, large, concentrated and discrete increase in the size of the market for the output of the [agricultural] sector." [17 p.128] Improvements in product grading and quality control are forthcoming as are benefits "expressed in terms of the confidence and stability of expectations which integration may create for producers." [17 p.128]. The second set of advantages of regional import substitution in agriculture are the standard income and price effects that occur with market expansion. Demand should increase thereby stimulating production. Third, the high demand potential of food imports that can be replaced by domestic production is often made higher with economic integration. And fifth, a regional import substitution policy is more advantageous because it takes place in an environment of faster overall growth which as we noted above is likely to result from economic integration.

One of the features which we noted characterize small structurally dependent economies is that the economy revolves around the production and export

of a few agricultural staples. A corollary of this feature is that manufacturing output is confined mainly to a few non-tradeable commodities and exports of manufacturers are virtually non-existent. The neoclassical theory of international trade would account for this by arguing that these countries have a comparative disadvantage in manufacturing production because of the nature of their resource endowments.<sup>1</sup> This view has been challenged by Staffan Linder [ 74 ] who contends that for trade in manufactured goods the key determinant in a country's ability to export is the existence of an adequate domestic market. In other words, the export market is an extension of domestic demand. Two points follow from the above. First, the inability of the underdeveloped countries to export manufacturers hinges upon the small size of the domestic market. Second, as Jorge Sakamoto [ 92 ] has observed, trade is likely to be more intense among countries with similar demand structures and if the latter are determined by per capita incomes manufacturing trade will be greater among countries with comparable incomes. These two points exclude the peculiar neo-colonial trade relationships which still govern the trade patterns of some structurally dependent economies. That this is so is evident from the arguments Linder advances for his proposition. These are that the potential for profitable production is first observed in the domestic market after which the entrepreneur expands his horizon to foreign markets; that a product resulting from technological innovation is more likely to be related to a domestic problem or demand than to a foreign problem and that knowledge of the domestic market and changing conditions in this market are likely to be better than that of a foreign market. We may add that in any event risks of market disruption are greater for a foreign market than for the domestic market.

1-Another explanation given is that the commercial policies of the developed as well as the underdeveloped countries preclude the latter from having much success in exporting manufacturing products. The so called successes of a few underdeveloped countries, e.g., Hong Kong and Korea does detract from the generally poor manufacturing export performance of this group of countries.

If the Linder position is accepted, and we believe that it is a plausible one, then the logic of regional economic integration becomes quite clear. By expanding the domestic market, so to speak, economic integration will open up avenues for future export drives in manufactures. In the case of the Leeward and Windward Islands small differences in per capita incomes and level of economic development, the similarity of consumer tastes and historical experiences provide the basis of the development of trade in technologically simple manufacturing products. In this context the market-swapping analysis of the previous section can be integrated into the present discussion. As we saw, economic integration reduces the opportunity costs of acquiring a specified amount of manufacturing production. This price affect will, under normal conditions, lead to an increase in industrial production. Now there is an added benefit of giving each country an adequate domestic demand so that the expansion of the output of the particular manufacturing product to penetrate non-regional markets becomes a real possibility. This is a second expansionary effect. A third expansionary effect arises if the manufacturing projects which are part of the market swapping arrangement show economies of scale in their production or marketing. Though this was not included in the formal analysis of Section 4.1 it should be clear that this will cause a further reduction in costs and thus stimulate production.

With respect to the normative goals of economic integration given earlier the above discussion is significant for several reasons. In the first place, it is evident that insofar as manufacturing production is stimulated some result will be forthcoming in reducing the structural dependence and monocultural feature of the economies. In the second place, since manufacturing trade among the participating countries is fostered there will be less reliance, at least in relative terms, on the markets of the metropolitan countries. For countries whose historical association with the metropole has been far from

memorable this aspect of economic integration is invaluable. Finally, and perhaps most important, both the Linder proposition and the market swapping arrangement involve the production of manufactured products which have a local demand. As such it will reduce the wide gap between the structure and pattern of domestic (regional) production and the structure and pattern of (domestic) regional demand and consumption. And as we saw earlier this is one of the key objectives of economic integration. Thus when exports to non-regional countries occur they will be in the context of the extension of the regional market.

Another advantage of regional economic integration is the possibilities it opens for collaboration in matters of technological research. This is particularly important for small structurally dependent economies for as was mentioned earlier the available resources severely restrict the extent of such activity. But the acquisition of appropriate technology is an indispensable condition of the economic development process. It is true that technology can be acquired from the developed countries but for such technological transfer to assist and not retard the society's ability to creatively manipulate its material environment it is necessary that some adaptations be made to the imported technology. If appropriate adaptations do not occur the technology embodied in the society's production structure will be way out of line with its level of scientific maturity and this can only contribute to the economy's structural dependence rather than to its structural transformation. Girvan and Jefferson have emphasized the role of technology in development noting that "what is important is that technological development takes place within the context of an economic organization which ensures first that it transforms whatever materials the economy has into productive resources; and second, that the gains from technological progress accrue to the national economy". [61 p.88] A similar position is held by Best [ 11 ].

Economic integration makes possible the pooling of resources for technological research by regional countries. In some cases it may even be the difference between the presence or absence of such research. For the Windward and Leeward Islands this may indeed be the case. The argument may be advanced that even taken as a whole the size of these countries may be too small to reap significant gains from a common technological research effort. This is true if the comparison is made with the potential gains that a larger economic integration scheme would have.<sup>2</sup> However, if the comparison is made with the potential gains from a national technological research program the cogency of the argument should be clear. The gains are forthcoming from the fact that wasteful regional duplication of research effort and facilities and from the fact that the time of scarce research personnel will not be diluted over a large range of sometimes unrelated projects. In other words, economic integration permits the harnessing of economies of scale in technological research. The significance of the pooling of technological research effort for the development of the agricultural sectors of the economies of a Caribbean economic integration scheme it will be recalled has been noted by Brewster and Thomas [ 17 ]. For them it is a key factor in the restructuring of regional agriculture and the economy as a whole.

Perhaps the most important advantage of economic integration within an economic development context is the benefits to be derived from what McIntyre [ 77 ] calls resource combination. This permits the development of regional industries based upon the utilization of the resources of two or more of the member countries. Without regional economic integration it is very unlikely

2-Thus from this standpoint the Caribbean Common Market would be a preferable economic integration scheme than the East Caribbean Common Market. But the problems of economic polarization, as we argue below, provide sufficient basis for the ECCM.

that such industries will emerge even though there is a potential for integration. The reason lies in the structural characteristics of the underdeveloped countries discussed earlier. Specifically, the integration of a country's resource within the global activities of international companies headquartered in metropolitan countries frustrate any tendencies towards regional resource combination. Thus without economic integration the development of industries that will broaden the industrial base of the regional economy and its constituent national economies and thus contribute to structural transformation will not take place.

In the context of the Leeward and Windward Islands it may be useful to consider the implications of this aspect for the major non-human resource, namely agricultural land. Because of the small absolute size of agricultural land in each country the establishment at the national level of agro-based industrial activities of economic scale is somewhat limited. However, if the agricultural land were combined on a regional level then it would be possible to develop a regional food processing industry producing for example meat and meat products, vegetables and fruits. In terms of the structural transformation of the economies this will be of great significance for three reasons. First, important linkages between agriculture and the manufacturing sector will be established. Second, production will be more closely aligned to regional demand patterns so that the inordinately large food import bill can be reduced. Third, the growth and development potential of the region and its constituent economies will be considerably enhanced in as much as production of commodities with high income elasticities will be undertaken.

It may be noted that the above could be commenced without serious loss of production of the traditional agricultural staples by simply combining

efficiently the existing acreage under the non-traditional staples.<sup>1</sup> But in light of the comparative potential for economic transformation it is clear that in the long run a shift of agricultural resources away from traditional staples to agricultural production with high growth potential would be the rational policy decision.<sup>2</sup> In addition, regional resource combination can stimulate inquiries into additional uses for the traditional staples so that they provide linkages in the regional economy.<sup>3</sup>

The advantages of regional resource combination as discussed for agriculture are of course applicable to other resources. Thus the fisheries resources of the Eastern Caribbean can be better utilized within the framework of economic integration. Besides the arguments advanced for agriculture there are those peculiar to fisheries resources due to their common property nature. Economic integration will enhance efficient resource utilization because it can internalize the externalities resulting from individual exploitation of this common property resource.<sup>4</sup>

- 1 - Consider for example the processing of tropical fruits. With the existing acreage under mango, pineapple, guava and pawpaw and even with existing land productivity it appears that an economic size tropical fruit processing activity could be established in the Leeward and Windward Islands at the regional level. Such a project on a national level though possible in some of the countries appears less profitable. The former depends of course on adequate intra-regional transportation. See Chapters 7 and 9.
- 2 - This is further strengthened if linkages are forged between tourism and the emerging food processing sector.
- 3 - For example, research into and subsequent production of breakfast preparations and banana chips from bananas could result. As another example, the possibilities of a regional textile project based, at least in part, on the region's cotton production could be assessed.
- 4 - Obviously an economic integration scheme limited to the Leeward and Windward Islands will be suboptimal from the standpoint of internalizing the externalities of Caribbean fisheries since there are other countries involved. The fact remains, however, that some internalization of externalities will occur.

This has at least two positive effects. First, fishing catch for a given level of effort is likely to expand. Second, a more efficient rate of resource exploitation will be assured and this will reduce the chances of the biological balance being in danger because of excessive fishing. In addition, the economies of scale argument is applicable here with respect to fishing vessels and other fishing gear. In short combined fishing effort will be more productive in terms of catch or alternatively a given catch will be forthcoming with a smaller fishing effort. And regional combination of fisheries resources may provide the conditions for a regional fish processing project and related activities similar to the agriculture case.

The resource combination argument, needless to say, applies to the combination of different regional resources in addition to the spatial combination of a given resource that we have emphasized. Indeed, it was the former case that McIntyre [ 77 ] discussed when he introduced the term. The possibilities of combining the bauxite resources of Jamaica with the hydroelectric potential of Belize to develop a Caribbean aluminum industry was the example given. So far as the Leeward and Windward Islands are concerned the practical significance of this aspect is unclear and would have to await a detailed inventory of their resources. In any event the argument holds at the theoretical level. The resource combination argument is the key element of an approach to economic integration proposed by Brewster and Thomas [ 16 ] for the Caribbean.

Finally, we may note an advantage of regional economic integration from the standpoint of foreign exchange utilization. It is widely accepted that foreign exchange is a very scarce and valuable resource for underdeveloped countries. It follows that mechanisms which economize on foreign exchange use can be of value to the development process. If a regional economic integration scheme includes payments arrangements for intra-regional trade and if hard currencies previously financed such trade, then the foreign exchange thus

engaged can be set free for other uses. In short, an economic integration scheme can result in a more efficient use of the region's foreign exchange reserves if certain international and interregional payments conditions prevail.<sup>1</sup>

The foregoing discussion in this section of the benefits of economic integration has been in the context of an economic integration scheme comprised of the Windward and Leeward Islands. It should be noted that the entire discussion is applicable to a larger Caribbean economic integration regime as well. Indeed, some of the sources of benefits like regional resource combination and exploiting economies of scale are likely to be relatively more significant in a larger integration regime. It is the question of economic polarization combined with the benefits outlined above which we believe establishes the need for an economic integration arrangement like the East Caribbean Common Market. And it may be noted that such an arrangement need not preclude larger schemes in the same geographic region as actual occurrences in the Caribbean have made clear.

Economic polarization refers to the disproportionate accumulation of investment and new economic establishments in the more developed member countries of a regional integration exercise. In other words, the more developed members receive the lion's share of the benefits. In an economic integration scheme among countries exhibiting varying developmental levels, the adverse backwash effects emanating from the more developed members relative to the spread effects<sup>2</sup> are generally of high order. The backwash effects are move-

1 - For an excellent discussion of this issue, see Vanek [100].

2 - The terms backwash and spread are due to Myrdal [84].

ments of capital and skilled personnel from the less developed to the more developed members, changes in the location of industries detrimental to the less developed countries, the disproportionate allocation of new private investment favoring the more developed countries of the economic union and the increasing tendency for specialization and export of manufacturers by the more developed members, production and export of agricultural staples by the less developed members. These backwash effects occur because in the more developed countries the private marginal productivity of capital is relatively high although the social marginal productivity may be low compared to the less developed member countries. This is because social overhead capital or infrastructure as well as industry is better developed in the former group so that the private entrepreneur can make use of pecuniary external economies. The spread effects refer to the increased demand for the products of the less developed member countries and the spreading of technological knowledge to them. For a group of underdeveloped countries the imperfections of the price mechanism, poor transportation facilities and the skewed distribution of social and economic overhead capital lead to a swamping of the latter effects by the former so that within a few years the development of manufacturing industry in the less developed members may stagnate in the absence of a conscious regional policy to neutralize the harmful backwash effects. In view of the normative goals of economic integration it is clear that the disproportionate distribution of benefits is unacceptable. One approach to the problem is to commence with economic integration schemes in which on a priori evidence the extent of economic polarization will not be great.

We have insisted all along that the outlines of the theory must keep in mind the objective conditions operating in the countries for which the analysis is intended. Lloyd Best has made the following observation concerning Caribbean integration:

If regional economic integration remains a desideratum it is merely a recognition that Caribbean unity at all levels of aggregation above the firm (plantation) has always been an aspiration arising from similar experience within the various units of organization; and that economic unification requires a prior political decision to create productive units and structures of which the internal mechanisms create regional and not mercantilist links [12 p.68].

Although the similarity of experience extends to the entire Caribbean it will be admitted that the similarity is greater for the English-speaking Caribbean. Thus an economic integration scheme consisting of the Commonwealth Caribbean countries would appear a pragmatic starting point. However, lest the mercantilist relationship between the Commonwealth Caribbean countries and the metropolitan countries be exchanged for a mercantilist relationship between on the one hand the less developed countries and on the other the more developed countries of the Commonwealth Caribbean the economic integration arrangement should be so devised that the economic polarization effects are minimal.

Demas [ 40 ] has grouped the Commonwealth Caribbean countries into three convenient classes in terms of their levels of economic development. The first group consists of those countries in which the modern manufacturing sector has developed to some extent and comprises Jamaica and Trinidad and Tobago. The second comprises those countries whose modern industrial sector is in a somewhat embryonic stage. Guyana and Barbados belong to this group. The third group, consisting of the Leeward and Windward Islands and Belize, is characterized by very little development of a modern industrial sector. For our purposes, the importance of the classification is that it represents a fairly acceptable breakdown of the varying levels of economic development in the region<sup>1</sup>. Since the economic polarization effects are postulated to be

1 - This is not to say that there are not important intra-group differences, simply that inter-group differences are greater than intra-group ones.

smaller the closer the levels of development of the countries involved, it follows that a useful guide is to arrange economic integration schemes among countries with similar levels of economic development provided that, and this proviso is important, the benefits we analysed earlier will still be forthcoming. This leads us to the recommendation of an economic integration scheme comprising the Windward and Leeward Islands. Belize is excluded from the scheme on the grounds that the extremely poor existing conditions of the transportation and communication systems linking the Windward and Leeward Islands and Belize severely restrict the possibilities of benefits materializing.

One final important element of the theoretical framework of an economic integration scheme for the Windward and Leeward Islands remains to be considered in this section. This concerns the role of coordinated planning in the economic integration exercise. It should be clear from the discussion of the benefits of economic integration and the structural characteristics of the economies that although intra-regional free trade and a common external tariff are necessary they fall short of the institutional framework we have in mind. The benefits of regional resource combination, regional import substitution, regional technological research etc. can only be harnessed within a regionally coordinated development planning framework. In other words, a regional coordinated planning process must work along with the market mechanism if economic integration is to contribute to the fulfillment of the normative goals. For given the characteristics of small structurally dependent underdeveloped economies the introduction of a regional tariff policy in the form of a customs union provides only a passive stimulant to economic activity. Active stimulants in the form of a plan on the allocation of new economic establishments, a regional investment policy, a regional program for infrastructural development particularly the intra-regional transportation

network will also be required. The poor performance of the market mechanism in these economies is well known.

We have just noted that the choice of an economic integration scheme comprising the Leeward and Windward Islands is based in part on the similarity of their levels of economic development, this having the effect of minimizing the economic polarization effects. But such effects cannot be eliminated completely by this method. This requires a coordinated planning framework to assist in the distribution of benefits. The planning process will do this by outlining a program of regional industrial location and investment allocation consisting of explicit distributional guidelines.

Thus it can be seen that the regional planning process will play a key role both in the generation and distribution of the benefits of integration.

An important quality of the economic integration framework in which coordinated planning is an integral part concerns the relationship between production and distribution. Standard approaches to economic integration involve, first, the solution of the production aspect in terms of greater output, more investment, expansion of trade, etc. This is followed by attempts at making adjustments to the generally unsatisfactory distributional outcomes that arise. Thus for practical purposes the production and distributional aspects are independent processes. Or at least the former is given prominence over the latter. Peter Robson [ 91 ] for example, discusses a series of proposals to redistribute the benefits after they have essentially been produced. The solution suggested by Elkan [ 58 ] to remedy the backwash effects has this same feature. As the discussion in Section 4.2 made clear, the distributional question must be seen as an integral part of the economic integration process. Put another way, we see a more complex relationship between production and distribution than the standard approach admits. The nature of this relationship is such that there should be a continuous feedback mechani-

sm between them. This continuous interaction between the production and distribution of benefits, we believe, can be achieved within a framework of coordinated regional development planning. In other words, coordinated planning permits the simultaneous determination of the generation and distribution of the benefits of economic integration.

Finally, it may be noted that the regional planning process may even enhance the national planning systems of the member countries thereby improving the effectiveness of the overall development planning activities in the region.

#### 4.4 The Intra-Regional Transportation System in Economic Integration

In the discussion thus far, we have essentially neglected to mention transportation costs. This was to facilitate a clearer discussion of the issues involved. This aspect, however, is of great importance in the assessment of benefits of economic integration among structurally dependent underdeveloped countries. From traditional international trade theory, it is well known that transport costs can limit the gains that accrue from free trade. Viewed in a static framework, transport costs, if they are high between members of an economic union, can wipe out the potential gains from tariff elimination, a common commercial policy and other measures like regional resource combination. This is even possible in a long-run growth context. But in a dynamic framework trade and transportation are inter-related. Low transport costs can induce more trade and the expansion of trade can permit the exploiting of economies of scale in the transportation network thereby inducing a cheaper and more efficient system of transportation.

As Balassa [ 7 ] has pointed out, in analyzing the effects of distance on trade it is the economic distance and not actual mileage between countries that is the relevant consideration. For if the latter were the important indicator an economic integration scheme comprising the Leeward and Windward

Islands would hardly have a transportation problem since they are very close to one another. Economic distance is measured by geographical distance, the cost of rail, truck and sea transport and the state of existing railway and seaport facilities [ 7 pp.39-44]. Cost of air transport and the quality of existing airport facilities can, of course, be added. In fact, in the context of Caribbean economic integration it is the sea and air transport facilities that are of relevance. Where poor transport facilities exist the economic distance between two geographically close countries can be very high. The relative costs of moving products from one to the other would be high and the removal of tariffs and quantitative restrictions on intra-regional trade would not guarantee an expansion of trade and stimulate production. A favorable inter-relationship between trade and transport facilities will lead to a "virtuous circle". But a "vicious circle" could result in which case poor transport facilities result in very little trade and the small volume of trade is to account for the poor transport overhead. Balassa [ 8 p.22].

Kahnert, et al. have observed that "traditionally, the transport structure of developing countries is based on the need to move relatively bulky primary materials to a major port. Thus road and rail links normally lead from the interior to the coast while shipping routes connect ports to developed countries' markets." [65 p.35] They could have added that this structure has meant that the intra-regional transportation systems in the various geographical regions of the underdeveloped world are by and large undeveloped. This applies with particular force to the Leeward and Windward Islands, and indeed to the whole Caribbean. In recent years, the quality of airport and seaport facilities have improved immensely, but a good deal remains to be done, especially since sea and air transport are the only means of effecting intra-regional trade flows.

The above considerations imply that an appropriate economic integration scheme for the Leeward and Windward Islands must include in its provisions a clear policy on the regional transportation system. Such a policy would include specific measures geared at its improvement so that the intra-regional transport system is not a bottleneck slowing down the economic integration process. Such a policy, we believe, can best be formulated and implemented in the framework of regionally coordinated development planning advocated earlier.

## CHAPTER 5

### ECONOMIC INTEGRATION IN THE COMMONWEALTH CARIBBEAN

The present phase of efforts at economic cooperation and integration in the Commonwealth Caribbean dates from 1965 when the governments of Antigua, Barbados and Guyana signed an agreement at Dickenson Bay, Antigua to found the Caribbean Free Trade Association (CARIFTA). The free trade area was seen as a mechanism through which the economic development of the member countries could be accelerated. In this chapter, we survey the progress of the Commonwealth Caribbean integration movement to date. Section 5.1 looks at the CARIFTA Agreement. This is followed in Section 5.2 by an analysis of the East Caribbean Common Market (ECCM) Agreement. The discussion in Section 5.3 turns to some related institutions, in particular the Caribbean Development Bank and areas of functional integration such as shipping. Finally, Section 5.4 surveys the recent turning point in the integration program as reflected in the Caribbean Community and Common Market. The discussion will emphasize those aspects of the arrangements that are of special interest to the member countries of the ECCM.

#### 5.1 The Caribbean Free Trade Association

The Caribbean Free Trade Association (CARIFTA) represents the first concrete result of the recent efforts by Commonwealth Caribbean governments to foster economic cooperation and integration among their countries. The interest in economic integration derives from the belief that this strategy has great potential in accelerating the pace of economic development and structural transformation of Caribbean economies. The concern with economic development has of course been a world-wide phenomenon at least since the end of World War II. The belief that economic integration can speed up the development process is partly due to the "demonstration effect". First, the industrial countries of Europe

had formed two regional economic groupings, the European Economic Community and the European Free Trade Association and the success of the former suggested that regional economic integration could foster the growth and development of the participating countries. Second, there were attempts at regional economic integration in regions of the developing world. In Latin America, the Latin American Free Trade Association and the Central American Common Market had been founded and the early progress reports on the latter were favorable. In Africa, the East African Community was striving to foster economic cooperation between Kenya, Tanzania and Uganda. Equally or perhaps more important than the demonstration effect was the fact that emerging economic analyses of the development problem in the Caribbean (McIntyre [ 77 ], Demas [ 40 ]) isolated economic integration as the appropriate strategy to overcome the obstacles to the economic development of Caribbean countries. In December 1965, the governments of Antigua, Barbados and Guyana adopted an agreement for the creation of a Caribbean Free Trade Association. This agreement was not implemented immediately but served as the basic for further negotiations between Caribbean governments. These negotiations resulted in a Supplementary Agreement which together with the 1965 Agreement was adopted as the legal document of CARIFTA which was launched on May 1, 1968 by Antigua, Barbados, Guyana and Trinidad and Tobago. Dominica, Grenada, St. Kitts-Nevis-Anguilla, St. Lucia and St. Vincent became members on July 1, 1968, to be followed by Jamaica and Montserrat on August 1, 1968. The membership of CARIFTA increased to twelve on May 1, 1971 when Belize joined the free trade area.

In terms of the classification of levels of economic integration discussed in Chapter 3, CARIFTA is closest to a free trade area. It is mainly concerned with trade liberalization among the member countries. However, it does have a few provisions relating to industrial development in the less developed member

countries and rationalization of incentive legislation geared to foster industrialization. Also, special consideration is given to intra-area trade in some agricultural products. We deal first with the trade liberalization aspects of the Agreement and then turn to the other features.

The emphasis of CARIFTA on the liberalization of intra-area trade is spelt out clearly at the very beginning of the Agreement.<sup>1</sup> Of the five objectives of the free trade area given in Article 2 four of these emphasize expansion and diversification of intra-Caribbean trade under "conditions of fair competition" and measures to ensure an equitable distribution of the benefits. The other objective is the more general one "to encourage the balanced and progressive development of the economies of the Area".

In order to qualify for Area tariff treatment commodities must satisfy one of the following area-origin rules (Article 5):

- (i) the commodities are wholly produced in the free trade area;
- (ii) the description of the commodities indicates that they have undergone in the free trade area one or more manufacturing processes that are listed in a Process List to be subsequently established by the CARIFTA Council of Ministers, the governing body of the association;
- (iii) the commodities are produced in the region and the value of the non-regional inputs in the export price of the product is no more than 50 per cent. Raw materials given in a Basic Materials List are considered of regional origin.

Subject to a few exceptions to be noted presently, the CARIFTA Agreement provides for immediate elimination of import and export duties and quantitative (import and export) restrictions imposed on the intra-area trade in commodities

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1 - The complete Agreement is reproduced in ECLA [47 ].

that qualify under the above rules (Articles 4, 9, 13, 14). This provision is unlike similar provisions of other integration schemes where the elimination of artificial barriers to trade takes place over a five to ten year period.

The important exception to the immediate removal of tariffs and quotas on area-origin products are some seventeen product groups which are on a so-called Reserve List (Annex B). The product groups are in two classes. The first consisting of three product groups<sup>2</sup> will have the immediate removal of trade restrictions by the more developed members of CARIFTA (Barbados, Guyana, Jamaica, Trinidad and Tobago) while tariffs and quantitative restrictions imposed by the less developed member countries will be phased out over a 10-year period ending May 1, 1978, with fifty percent of the reduction taking place by May 1, 1973. The second class comprises fourteen product groups.<sup>3</sup> Tariffs and quotas on these will be phased out over a five-year period and a ten-year period by the more developed and by the less developed member countries respectively. The gradual elimination for the more developed countries will be on the basis of annual reductions of twenty percent of the tariffs and quotas existing at the beginning of the free trade area.

Another important exception is that products which are produced in the member countries under special agreements between the governments and the manufacturers are excluded from the Agreement (Article 3). The special agreements and the products affected must, however, be registered with the Council of Ministers and the governments of the participating countries must endeavor to

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2 - The products are: biscuits, sweetened and unsweetened; coir products, mats and matting; brushes made with plastic bristles, except paint and artists brushes.

3 - The products groups are: fruits preserved and fruit preparations, unmanufactured tobacco, manufactured tobacco except cigars, prepared paints and varnishes, cleansing preparations without soap, crates and wooden containers, radio and television sets, accumulators, wood and metal furniture, mattresses, shirts and underwear, outerwear of non-knitted textile fabrics, leather slippers and house footwear, and leather footwear.

prevent these special agreements from frustrating the objectives and smooth functioning of CARIFTA.<sup>4</sup>

Other exceptions to the immediate removal of artificial trade barriers are: (i) export duties may be retained on ten products<sup>5</sup> for a ten-year period provided that the Council of Ministers is notified (Article 9; Annex E); (ii) quantitative restrictions on agricultural imports and exports are subject to the provisions of the Agricultural Marketing Protocol (Articles 13 and 14)<sup>6</sup>.

In order to promote the expansion of intra-regional trade "under conditions of fair competition" the CARIFTA Agreement provides that a commodity can lose its area tariff treatment status if it benefits from export drawbacks<sup>7</sup> (Article 8). In addition, fiscal charges such as revenue duties and internal taxes cannot be applied to imports at rates different from those applicable to the same goods domestically produced. In the event that a member does not produce a commodity, its fiscal charges on the imports of this commodity and on domestically produced close substitutes should be such that there is no effective discrimination in favor of the domestic products (Article 7). Further, if an industry of a member country "is suffering or is threatened with material injury as the result of the import of dumped or subsidized products" the Agreement provides for consultation between the member countries involved to rectify the situation (Article 12). The CARIFTA agreement prohibits member governments from giving aid to exporters (Article 7). The government aids outlawed include direct subsidies, bonus on exports, export credits and export

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4 - For the products affected, see Commonwealth Caribbean Regional Secretariat, [33 ], pp. 141-142.

5 - These are copra, sugar, coconut oil, nutmeg and mace, cocoa, sweet potatoes, arrowroot, eddoes, peanuts and bauxite.

6 - See below, p. 117.

7 - Export drawbacks refer to arrangements to refund import duties applicable to imported inputs if the resulting output is exported.

credit guarantees at subsidized rates, and remission of direct taxes based on export performance (Annex F). Exception with respect to government aids is made for intra-area trade in agricultural products until the member countries "shall agree upon the regional policy with respect to the production and marketing, including the subsidization, of agricultural products" (Article 17). The Agreement also makes provisions for restrictive business practices. It contends that "agreements between enterprises, decisions by associations of enterprises and concerted practices between enterprises which have as their object or result the prevention, restriction or distortion of competition within the Area" and "actions by which one or more enterprises take unfair advantage of a dominant position within the Area or a substantial part of it" are inimical to the trade liberalization objective of the free trade area. Consequently, if such practices are alleged, the allegations are to be examined and appropriate provisions made to deal with the restrictive business practices if any is shown to exist (Article 19). Finally, the Agreement stipulates that nationals of the member countries should be given equal treatment in the establishment of economic enterprises in any member country (Article 20).

If the trade liberalization goal of CARIFTA is not to be frustrated it is important that the individual customs administrations in the region cooperate in their activities. The Agreement provides for this (Article 10) as well as for the freedom of transit of area-origin products throughout the region (Article 11).

The member countries of CARIFTA, consistent with the definition of a free trade area given in Chapter 3 and in line with other existing free trade areas, are free to devise and implement their own commercial policies as they relate to non-member countries. Specifically, they are free to set their own rates of tariffs and levels of quotas on goods that do not meet the area-origin rules

and indeed on all imports from non-area sources. Such freedom in non-regional commercial policy can give a member country an advantage over other members. A case in point would be where the former imposes on imported (non-regional) raw materials and intermediate products used in the manufacture of products that subsequently qualify as "of area-origin", rates of duties which are significantly below those charged by the latter and consequently increasing its share of trade in those products. Such deflections of trade are to be kept under review by the Council of Ministers which may amend the rules of origin and may recommend temporary measures to mitigate the effects of "a deflection of trade of a particularly urgent nature." In exercising its freedom in non-area commercial policy the Agreement requires each member to notify the Council of Ministers of any reductions in tariffs on non-area-origin products, and to consider representations from other members on its decision to effect such changes (Article 6).

The common feature of the provisions of the CARIFTA Agreement discussed so far is that they are aimed at stimulating intra-area trade by removing artificial barriers on the regional flow of goods that qualify as area-origin and in effect protecting area-origin production from non-area-origin production. At the same time they attempt to eliminate measures which might protect area-origin production in one member from similar area-origin production in another member. Essentially then, they are the provisions relating to the standard aims of a free trade area.

We turn now to the provisions of the CARIFTA Agreement as they relate to agriculture. Special consideration for agricultural trade in CARIFTA is justified on the basis of the important position of the agricultural sector of the CARIFTA economies, particularly the less developed members. The provisions affecting agricultural trade may conveniently be considered by two types. The first are the general provisions governing trade in area-origin products dis-

cussed above. The second are those provisions embodied in various Protocols to the main Agreement. The first can be dealt with summarily. For intra-regional trade in agricultural products not covered by any of the Protocols, all tariffs and quantitative restrictions must be removed on the day CARIFTA began operations. However, governments may subsidize domestic agricultural production by various measures, including the establishment of government corporations to assist in agricultural production and marketing.

Of the second class of provisions we deal first with the Agricultural Marketing Protocol. This sets down rules governing the trade (both intra- and extra-regional) in twenty agricultural commodities.<sup>8</sup> For each of these commodities, the Commonwealth Caribbean Regional Secretariat, the administrative body of CARIFTA, will make estimates of annual demand and production by the region on the basis of information provided by individual member countries. The Secretariat allocates the projected exports of the surplus members to the projected imports of the deficit members, with the allocation of exports from a less developed member having priority over its more developed counterpart. Until regional supplies are allocated member countries cannot import from non-regional sources, and in any event, importation must be sanctioned by the Secretariat<sup>9</sup> which will only do so when it has determined that a region-wide excess demand exists. In addition, the Protocol provides for an annual conference which sets f.o.b. prices for the commodities for the subsequent year.

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8 - The commodities are carrots, peanuts, tomatoes, red kidney beans, black pepper, sweet pepper, garlic, onions, sweet potatoes, potatoes (not sweet), string beans, cinnamon, cloves, cabbage, plantains, pork and pork products, poultry, eggs, okra, oranges, pineapples and pigeon peas.

9 - There are two cases where Secretariat permission is not required. First, in each of the initial three years of the Agreement's operation a member may import from outside the region without approval up to 30 percent of the amount (whether volume or value is not specified) imported from outside the region during 1966. Second, each member's imports of the commodity for planting material or for breeding purposes is unrestricted.

A second Protocol deals with intra-area trade in sugar. This permits a sugar-producing member of CARIFTA to impose quantitative restrictions on sugar imports from other members provided the Council of Ministers is notified.

When the CARIFTA Agreement came into force in 1968 its provisions did not apply to vegetable oils and fats, the trade of which was covered by the Oils and Fats Agreement between seven of the member countries. Subsequently, this agreement was revised, its membership enlarged to include all CARIFTA countries and made a Protocol to the CARIFTA Agreement. This Agreement sets f.o.b. prices for regional exports of copra, raw (coconut) oil, and refined oil. It also matches projected copra exports of some members to projected copra imports of importing members. Exporting members may choose to provide up to two-thirds of their excess supply of copra in the form of raw oil. As such it provides a guaranteed market for the raw material and the semi-manufactured product.

In embarking upon a strategy of Caribbean regional economic integration the signatories of the CARIFTA Agreement were "mindful of the different levels of development attained by the territories of the Caribbean" (Preamble of CARIFTA Agreement). Partly for this reason, but primarily because the present study concentrates on the less developed members of CARIFTA it is appropriate to look at the Agreement in the light of the "unequal partners" that comprise the free trade area. We have seen that with respect to the products of the Reserve List the less developed countries have a longer time to phase out their tariffs on area-origin products. This gives them a longer time than the more developed countries to adjust to the new regime brought about by the trade liberalization effects of CARIFTA. In the event that the prescribed period for phasing out tariffs has elapsed and a less developed member thinks that

"serious injury may be done to an industry" it may request the Council of Ministers to lengthen the phasing-out period for the affected commodity. In addition, the less developed countries acting collectively can phase out the duties on Reserve List products at a faster rate among themselves than on imports from the more developed countries (Annex B). In other words, the less developed members may create a free trade area among themselves. As we shall see in the next section, the less developed member countries went much further and laid the basis for a common market among themselves.

In the discussion of the Agricultural Marketing Protocol and the Oils and Fats Protocol it was indicated that guaranteed prices and markets are provided for various agricultural products. These provisions are of particular importance to the less developed countries since their economies, with perhaps one exception (Antigua), rely heavily on the products covered by the two Protocols.

Two other provisions of special relevance to the less developed members may be noted. First, the Council of Ministers may temporarily suspend the area-tariff treatment status of a product if the less developed members collectively decide to commence production in one of their countries. This permits them to develop on a coordinated basis industries which are already established in the more developed countries (Article 39). It is, in effect, an application of the infant industry agreement for protection by one group of free trade area members against other members. Second, a resolution of Caribbean Heads of Governments which appears in Annex A of the Agreement has recognized the special position of the less developed member countries in projected plans for regional industrial location and a regional policy on industrial incentives. It states in part:

The principle of seeking to establish more industries in the less developed countries should be accepted and...feasibility studies immediately [undertaken] with a view to identifying industries which should be located in the less-developed countries and to devising special measures for securing the establishment of such industries in these countries. These studies should be submitted to governments no later than one year after the commencement of free trade.

It further notes that:

Subject to existing commitments a regional policy of incentives to industry should be adopted as early as possible on the basis of studies [to be undertaken]...bearing in mind the special needs of the less-developed countries for preferential treatment, such as soft loans.

Finally, brief mention should be made of the Agreement's provisions for the coordination of economic policies of the member countries. On this question the two quotations just given should be noted. A regional policy on incentives to industry is envisaged, as is a policy for the setting up of industries in the less developed members. The Agreement also envisages a common policy of industrial location for industries that may require the entire CARIFTA market to profitably operate one enterprise (Annex A). The exchange of views on all aspects of their economic and financial policies is provided for as well (Article 24).

## 5.2 The East Caribbean Common Market

The problem of economic polarization in economic integration schemes among underdeveloped countries at different levels of economic development was discussed in Chapter 4. This problem was considered a real one in CARIFTA given the wide disparities in economic development between on the one hand Barbados, Guyana, Jamaica, and Trinidad and Tobago and on the other the Leeward and Windward Islands. As we have seen in the previous section, some attempts were made in the CARIFTA treaty to deal with this issue. It appears that the policymakers of the Leeward and Windward Islands felt that concerted action on the part of these islands was essential in minimizing the harmful economic polarization effects which their countries would suffer within CARIFTA.

Consequently the East Caribbean Common Market (ECCM) was founded and became operative at the same time as CARIFTA<sup>9</sup>. The ECCM consists of Antigua, Montserrat, St. Kitts-Nevis-Anguilla (the Leeward Islands), Dominica, Grenada, St. Lucia and St. Vincent (the Windward Islands).

The objectives and principles governing the ECCM reflect the goal of economic development and strategy of economic integration cum industrial programming to achieve this goal (ECCM Agreement, ARTicles 2, 3)<sup>10</sup>. Along the traditional lines of customs union theory, tariffs and quantitative restrictions on trade between the members are to be eliminated; a common commercial policy including a common external tariff is to be introduced to replace the individual country policies; artificial barriers impeding the movement of labor and capital are to be removed. Along non-traditional lines the agreement envisages "the progressive harmonization of investment and development policies, including industrial development, treatment of non-resident business establishments and development planning". Separate mention is made of the harmonization of incentive legislation aimed at promoting national industrial development to ensure an equitable distribution among members of new industrial activities. Infrastructure and agriculture are given special attention. A cooperative approach in the development of the former, particularly in transport and communication, is to be pursued while a common policy for the latter is to be followed. Finally, the ECCM agreement calls for "the coordination of currency and financial policies" of the member countries (Article 3). The above features of the East Caribbean Common Market, it is felt, will increase economic intercourse among the member countries and promote their economic development, increase their economic stability and provide an equitable distribution of the

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9 - CARIFTA came into effect between May 1, 1968 and August 1, 1968. The ECCM came into force on June 15, 1968.

10 - The full Argument Establishing the East Caribbean Common Market is reproduced in ECLA [ 47 ].

gains of the economic integration scheme. In the remainder of this section a closer look is made at the provisions of the ECCM agreement together with an assessment of its potential in achieving the objective of harmonious economic development of the member countries.

We deal first with the provisions relating to trade restrictions. Import duties are eliminated on the trade of goods that qualify for common market area tariff treatment. Goods that qualify for such treatment are those that are (i) wholly produced within the Common Market or (ii) produced within the Common Market and have undergone one or more processes which are set out in a Process List, or (iii) produced in the Common Market and the local value added is at least 50 percent of their export price. As regards the Process List mentioned in the second qualifying condition it should be pointed out that five years after the inception of the ECCM little progress has been made in compiling it, so that this criterion for intra-union free trade in commodities is inoperative. In the calculation of the percentage criterion of condition (iii) some materials which are of foreign origin will be considered to be of local origin. These are the products listed in a Basic Materials List annexed to the Common Market Treaty. The list reflects the economic development objective of the member countries for it contains primary products which are considered to be essential for the establishment and expansion of a manufacturing sector. In a long run context condition (iii) may well prove to be of great significance.

The agreement provides for the introduction of a common external tariff structure applicable to imports from non-member sources. The initial intention expressed in the treaty was that such a common external tariff would be put into effect by 1971. However, it did not take effect until October 1972 and even at this time two members of the common market, Antigua and Montserrat, did not adhere to it. These two members have recently (early 1974) begun to implement the common external tariff.

The imposition of discriminatory internal taxes on imports which qualify for common market area treatment is prohibited. Thus internal taxes on imports must be identical to taxes imposed on domestically produced similar products or their close substitutes. Where differing tax rates exist on similar products of domestic and common market origin such differences are to be eliminated as soon as possible.

Another article of the treaty aimed at removing trade restrictions deals with export drawbacks (Article 9). Export drawbacks which refer to any provisions to refund the import duties paid on imported inputs may cause a product to lose its common market tariff treatment status. Presumably, the intention is to discourage this form of protection of local production over similar activity in another member of the common market.

An important and potentially far reaching feature of the ECCM is the provision covering "the phased removal of the obstacles to the freedom of movement of persons within the Common Market". (Article 12). The Council of Ministers, the chief body of the common market is charged with reviewing and evaluating the measures taken by individual member countries to eliminate the artificial barriers that impede the intra-union movement of labor. In addition, it is to prepare and submit to the member countries a plan to remove these obstacles within three years after the ECCM came into effect. Of equal significance are the agreement's provisions concerning capital movements. "Member States shall, on the coming into force of this Agreement immediately abolish as between themselves, restrictions on the movement of capital belonging to persons resident therein. Current payments connected with movements of such capital between Member States shall not be subject to any restrictions." Furthermore, the member countries have decided to "adopt a common policy towards movement of capital between Member States and elsewhere, and current payments associated with such capital" within three years, that is, by July 1971 (Arti-

cle 13). In other words, the ECCM not only allows for the free movement of the common market's products but also for the free movement of the common market's factors of production. As such it provides for the fusion of the members' factor markets as well as their product markets. It is perhaps unique in this regard among economic integration schemes among groups of underdeveloped countries. It should be pointed out however that the similar level of economic development and similar economic structural features of their economies make such a provision appropriate in a common market comprising the Leeward and Windward Islands.

We turn now to a third class of provisions of the ECCM agreement, those covering the coordination of economic development policies of the member countries. In this area the ECCM Agreement is quite progressive. In addition to the policy on the movement of capital discussed in the previous paragraph there is to be "a common policy towards development planning, [and] industrial development (including fiscal and other incentives to industry)". (Article 13). With respect to the common policy on development planning the ECCM Agreement envisages a coordination of the development plans of the member countries so that complementarity of production can be enhanced and costly and unnecessary duplication of economic activity avoided. Within the broad common policy of development planning a common policy on industrial development is to be pursued. Integral to the common policy on industrial development will be "the introduction of special measures of securing the establishment and distribution of industries equitably among Member States, taking into account all relevant factors including the need for the continued and progressive development of each Member State." (Article 13). The common industrial policy will be aimed specifically at (i) efficient utilization of the natural and human resources of the region; (ii) expansion of industrial production in optimum plant sizes; (iii) an efficient and selective program of import substitution on a common

market-wide basis; and (iv) "ensuring that a fair proportion of the returns to industry accrue to residents of the Member States". (Article 13).

Since the 1950's each island has had its own policy on fiscal incentives to industry in an attempt to seek the help of foreign entrepreneurs with their capital and know-how in its industrial development. Invariably cut-throat competition among the islands for the foreign investor's dollar led to concessions that resulted in very little benefits to the country that won out. The ECCM agreement in providing for a coordinated approach to industrial development should minimize the excessive competition for the foreign capital. The agreement in fact provides for "the harmonization of incentives extended to encourage industrial activity" within the first three years of the common market's existence (Article 13).

The economies of the ECCM countries are mainly agricultural. It would have been an unfortunate and serious omission were agriculture left out of the integration scheme as with some other integration experiments. The great emphasis on coordinated planning that is evident with manufacturing industry is, fortunately, also applied to agriculture. A common agricultural and fisheries policy to come into effect two years after the common market goes into operation is provided for. A committee including technical staff is to be set up by the member countries to work out the details of the common agricultural policy (Article 17).

Intra-union transportation in the ECCM is underdeveloped and in dire need of improvements. The ECCM agreement recognized the poor transportation infrastructure and makes provision for a common transportation policy, which will "lay down common rules governing the operation and development of interterritorial transport within the Market Area," and try to effect "improvement and expansion of the transport service" while ensuring that the inadequacies of the intra-union transportation system do not lead to de facto discrimination of

some common market products (Article 13).

The provisions of the ECCM agreement in the areas of fiscal and monetary policy are also worthy of note. The agreement provides for the coordination of the monetary policies of the member countries. It should be pointed out that the members have a common currency and may therefore be said to have been in a monetary union before the economic integration scheme. However the common currency did not automatically lead to a common approach to monetary questions. The ECCM agreement allows for this. Specifically, policies governing foreign exchange will be coordinated in an attempt to get maximum benefit from its use (Article 14). Similar coordination of policies is to take place in the fiscal field, in particular taxation policy governing companies and individuals.

Finally, some exceptions of the agreement may be noted. It was recognized that a rapid phasing-in of the provisions of the ECCM agreement could lead to dislocation of economic activity in some of the member countries. Consequently, the agreement (Article 22) permits the temporary imposition by a member country of quantitative restrictions if "an appreciable rise in unemployment in a particular sector of industry or region is caused by a substantial decrease in internal demand for a domestic product" consequent upon trade creation occurring in that domestic product due to "the progressive reduction or the elimination of duties, charges and quantitative restrictions". Obviously, if this provision is over-used the free trade objectives of the common market will be frustrated. Two features of the provision are therefore of importance since their impact will be to minimize misuse of the provision. The first, and more important one, is its temporary nature. The imposition of quantitative restrictions to cushion the disruptive effects of the trade liberalization aspects of the agreement cannot normally be maintained for more than eighteen months. Further, the application of the provision ceases at the end of five

years after the ECCM begins operation. Secondly, during the five year period in which the provision is applicable, a maximum limit, equal to the amount of imports from other member countries during a previous twelve-month period, is set on the amount of allowable quantitative restrictions. Overall, the provision appears to deal satisfactorily with a real problem. It seems unreasonable to ask an underdeveloped country to sacrifice some existing industrial activity which it most likely acquired after considerable effort and cost simply for trade liberalization purposes. The provision gives the member enough time to make the necessary adjustments in light of the economic integration regime but allows incremental demand for the product to be met by the most efficient common market source. The emphasis then is on the efficient allocation of additional resources, the appropriate emphasis if the objective of the economic integration scheme is the economic development of the participating countries.

In addition to the above exception, the ECCM agreement does not apply to trade in vegetable oils and fats. This however is not a serious exclusion since a regional policy on trade in these products exists in the Oils and Fats Protocol of the CARIFTA Agreement, to which all the ECCM member countries are signatories.

What can we conclude about the ability of the ECCM in transforming the structurally dependent economies of the Leeward and Windward Islands? What are its chances of changing the state of underdevelopment of these countries and accelerating the process of their economic development? Needless to say, complete answers to these and related questions cannot be provided by this study. In what follows, partial answers will be suggested from two levels of analysis. On the one hand, the ECCM can be evaluated on the basis of a comparison of its provisions with the general features of an appropriate theory of economic integration for structurally dependent underdeveloped countries as

outlined in Chapter 4. On the other hand, insights into answers to the questions posed can be gathered by reviewing the progress of the ECCM in the six years it has been in operation.

On the basis of the theory outlined in Chapter 4 it must be admitted that the ECCM fulfills and in some respects surpasses the key features of an appropriate economic integration scheme. It may be noted that all the participating countries are at about the same level of economic development. This fact should minimize the dangers of economic polarization within the common market. We have seen that the ECCM agreement provides for the removal of artificial restrictions on intra-regional trade as well as a common external tariff. In other words, through the ECCM the Leeward and Windward Islands have introduced a common commercial policy which provides them with a uniform regime for the protection of their industries. This is an important element in an economic integration strategy for structurally dependent underdeveloped countries.

The provisions governing the movement of labor and capital are noteworthy. The effect of these, when they come into effect, will be to cause a fusion of the countries' factor markets into one regional factor market. This will help to ensure the efficient utilization of the region's resources. Given the comparable level of development of the ECCM countries the unrestricted movement of factors of production should not result in serious economic polarization effects. In any event, the emphasis of development planning in the common market implies that the factor movements among the countries is likely to be planned. Indeed, the agreement refers to "the phased removal of obstacles to the freedom of movement of persons" and "a common policy towards movement of capital". These measures should strengthen those dealing with trade liberalization and they fit in quite well with the features of an acceptable integration approach.

The provisions governing the regional coordination of development planning and a program for distributing new economic activities among the participating countries are the most significant ones from the point of view of appropriateness. As we saw earlier, the coordination of the development plans of the member countries is necessary if the potential benefits made available by the trade liberalization properties of economic integration are to be properly harnessed. And a program to allocate new economic activities is required to deal with the problem of economic polarization. The agreement, as we saw, deals specifically with regional plan coordination in agriculture and livestock development, fisheries, and manufacturing industry. A possible weakness of the provisions is that they do not spell out precisely the level of planning detail that is involved. But with no detailed studies on the sectors of the ECCM economies available the generality of the pronouncements on coordinated regional development planning is to be expected. It should be pointed out however that the agreement does provide for indepth analysis of several of the region's economic sectors. In summary, the provisions of the ECCM covering "a common policy towards development planning, industrial development (including fiscal and other incentives to industry), non-resident persons and movement of capital" provide the common market with the core requirements of an economic integration scheme appropriate for the structurally dependant Leeward and Windward Islands.

Removal of tariff and quantitative restrictions, together with freedom of movement of capital and labor would be meaningless if regional transportation facilities were in such poor condition that they acted as strong impediments to intra-regional trade and inter-country factor movements. The transportation network in the ECCM countries calls for special attention because of its poor quality. The importance of a common policy for the development of adequate inter-territorial transportation that is to be established by the ECCM cannot there-

fore be over-emphasized. The common regional transportation policy, needless to say, strengthens the ECCM as a meaningful scheme for fostering the economic development of the participating countries.

Finally, mention was made earlier to the harmonization of monetary and fiscal policies that is envisaged in the common market. Such harmonization further makes the ECCM agreement quite appropriate for the Leeward and Windward Islands. In sum, from a comparison of the provisions of the ECCM agreement with the important features of an appropriate theoretical framework of economic integration, the East Caribbean Common Market has great potential in accelerating the economic development of its member countries. But the key word here is potential. To ascertain whether this potential is being actualized we turn to an assessment of the ECCM on the basis of its progress from its founding to the present time. But first a note of caution. It should be emphasized that economic integration though a necessary condition for the economic development of these small structurally dependent economies is by no means a sufficient condition of economic and social progress. Questions such as the organization of production, for example capitalist or worker-managed enterprises, the extent of mass participation in the economic and political processes, to mention only two, are vital areas of concern. We simply abstract from these issues and concentrate on economic integration.

Since its inception in June 1968 it must be admitted that progress in implementing the provisions has been rather slow up to July 1974. With a renewed resolve to speed up the implementation of the economic integration process coming out of the Commonwealth Caribbean Heads of Government Conference of July 1974 it is expected that the process of implementation will accelerate its pace.

The removal of tariffs and quantitative restrictions in 1968 freed immediately a large part of intra-regional trade from artificial barriers. It

should be noted that the trade liberalization provisions of the ECCM are almost identical to those of CARIFTA of which the Leeward and Windward Islands are members. For the ECCM countries the proportion of their CARIFTA imports freed ranged from 68.7 percent for St. Vincent to 99.3 percent for St. Kitts-Nevis-Anguilla. The figures for all members are shown in Table 5.1. The immediate trade liberalization effect appears impressive. However it should be pointed out that for each ECCM country imports from its partners as a proportion of total imports are extremely small ranging in 1967 from 0.3 percent for St. Kitts-Nevis-Anguilla to 2.5 percent for Dominica. Intra-ECCM imports were a meagre 0.9 percent of the total imports for the ECCM countries in the same year. In other words, extra-ECCM trade dominate the trade of the ECCM countries. Indeed, trade of the ECCM countries within the wider CARIFTA framework is small relative to their total trade; CARIFTA countries accounted for only 18.1 percent of their total imports for the three years 1965-1967. Thus the impact of trade liberalization on the total trade of the members is negligible. It should be recalled also that the third criterion to determine common market origin of products is yet to be implemented.

In Table 5.2 the growth of the trade of ECCM countries is presented. For three of them (Dominica, St. Kitts and St. Vincent), the rate of growth of imports from ECCM sources since the inception of the common market exceed the growth rate of imports from the MDCs of CARIFTA and from all countries. This represents a reversal of the pre-common market import growth patterns for Dominica and St. Kitts. For the ECCM as a whole, the post-common market import growth performance reflects significant relative growth in intra-regional imports. While imports from all sources expanded at an annual rate of 15.3 percent the growth of intra-regional imports was 28.6 percent per annum. The latter more than trebled in value within four years rising from

TABLE 5.1

Intra-Regional Trade Subject to Liberalization under  
CARIFTA Agreement\*

<u>Importing Country</u>	<u>Total CARIFTA Trade</u>	<u>Non-Liberalized Trade<sup>+</sup></u>	<u>Liberalized</u>	<u>Trade</u>
	<u>\$000</u>	<u>\$000</u>	<u>\$000</u>	<u>% of Total</u>
Antigua	5591	498	5093	91.1
Barbados	13051	1657	11394	87.3
Dominica	3107	481	2626	84.5
Grenada	4439	278	4161	93.7
Guyana	22633	901	21732	96.0
Jamaica	7604	40	7564	99.5
Montserrat	1354	94	1260	93.1
St. Kitts	3053	20	3033	99.3
St. Lucia	5348	564	4784	89.4
St. Vincent	3930	1231	2699	68.7
Trinidad	15790	1865	13925	88.2
TOTAL	85900	7630	78270	91.1

Source: Commonwealth Caribbean Regional Secretariat, CARIFTA and the New Caribbean

Notes: \* 1967 imports figures, c.i.f.

+ imports of sugar, copra and new coconut oil, Agricultural Marketing Protocol products and products excluded under Article 3.

TABLE 5.2  
Growth<sup>a</sup> of Imports of ECCM Countries

<u>Country</u>	<u>Period</u>	<u>Origin of Imports</u>		
		<u>ECCM</u>	<u>CARIFTA MDCS</u>	<u>ALL COUNTRIES</u>
Antigua	1960-67	21.6	14.3	13.1
	1968-72	1.8	8.0	
Dominica	1960-67	-1.1*	8.0*	7.8
	1968-72	49.0	13.0	12.2
Grenada	1960-67	5.3	4.1	6.9
	1968-72	10.2	19.2	12.1
Montserrat	1960-67	5.8	19.0	17.9
	1968-72	1.6	10.7	11.2
St. Kitts	1960-67	-2.5	5.3	4.2
	1968-72	45.0	1.0	14.6
St. Lucia	1960-67	25.7	14.0	12.7
	1968-72	-8.2	18.7	21.2
St. Vincent	1960-67	35.2	7.4	2.8
	1969-72	46.8	17.8	14.2
ECCM	1960-67	9.3*	8.4*	8.9
	1968-72	28.6	13.8	15.3 <sup>+</sup>

a - Annual compounded growth rates between years shown

\* - Annual growth rate for 1963-67

+ - Excludes Antigua

Source: Computed from figures in Annual Trade Reports for various years and unpublished data at Statistical Offices of ECCM countries.

\$1.5 million in 1968 to \$4.8 million in 1972.

It should also be noted that the substantial growth of intra-regional imports compared to the growth of total imports is accompanied by a faster growth rate of total imports in the post-common market period. The annual growth rate for this period (1968-72) is 15.3 percent while for the pre-common market period (1960-67) the annual growth rate was 8.9 percent. It is worth noting as well that the 28.6 percent growth rate of intra-regional imports since the inception of the ECCM is more than three times the 9.3 percent annual growth rate of intra-regional imports prior to the formation of the common market.

In summary, it may be said that despite varying results for individual ECCM countries, substantial relative growth has occurred since the coming in force of the ECCM. This means that the share of intra-regional trade in the total trade of the Leeward and Windward Islands is increasing. How much of this is due to the ECCM can be ascertained only after the contributions of the main determinants (including the trade liberalization effect of the ECCM) of import growth are determined. Such an analysis is beyond the scope of the present study.<sup>11</sup>

It should be recalled that intra-regional trade is an insignificant proportion (less than 1 percent in 1967) of the total trade of the ECCM countries. Thus the early post-common market growth performance of intra-regional trade will have to be sustained over several years for intra-ECCM trade to acquire importance. Such sustained growth would seem to require not only trade liberalization impulses but changes in the underlying supply conditions in the constituent economies. In other words, changes in the structural characteristics of the economies are an important ingredient in any sustained relative growth of intra-regional trade. This is why regional development planning and indus-

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11 - The question of the effects of the ECCM on the trade of its members could be approached following the methodology of Aitken [ 1 ] and Aitken and Lowry [ 2 ].

trial programming are critical to the economic integration and development processes in the ECCM. For without them the structural transformation of the ECCM economies will not be achieved and the provisions for free movement of goods and factors of production within the common market will accomplish very little in the long run.

In the area of coordination of development planning within the ECCM virtually nothing has been accomplished to date. No plan has been formulated for "the establishment and distribution of industries equitably among Member States" as called for in the agreement. The harmonization of fiscal incentives to industry promised within three years of the agreement coming into effect has not been achieved. The progress made on this question has been within the wider CARIFTA framework. (This is discussed in Section 5.4). Likewise, not even the broad outlines of the common agricultural and fisheries policy that should have been formulated by 1971 have been established. Similar inactivity applies to the proposed coordinated regional transportation policy. Thus in the most important areas of coordinated regional development planning and industrial programming the ECCM remains virtually a framework of intentions and projections and not of actions. Consequently, from a practical standpoint the progress of the economic integration movement among the ECCM countries has been negligible.

Finally, it may be useful to look at the sectoral composition and growth performance of the gross domestic product of the regional economy. In Table 5.3 the sectoral contributions to GDP for the years 1967 and 1972 are given. The export agriculture sector declined in relative size from 15.9 percent to 9.8 percent. In absolute terms the contributions in the two years were \$32.0 million and \$32.6 million with erratic annual growth performance during the

TABLE 5.3  
Sectoral Contribution of GDP of ECCM

Sector	<u>1967</u>		<u>1972</u>	
	\$m.	%	\$m.	%
Export Agriculture	32.0	15.9	32.6	9.8
Domestic Agriculture	22.5	11.1	29.2	8.8
Manufacturing	7.8	3.9	12.1	3.6
Construction & Engineering	25.6	12.7	51.3	15.4
Distribution	27.1	13.4	60.2	18.1
Hotels	8.0	4.0	24.3	7.3
Government	38.5	19.1	61.4	18.4
Other*	40.3	19.9	62.0	25.9
TOTAL	201.8	100.0	331.1	100.0

\* - Financial services, professional and personal services, transportation, rent of dwellings.

Source: ECLA, CARIFTA Countries Overview of Economic Activity, 1971, 1973, Port of Spain, 1972, 1974.

period.<sup>12</sup> Domestic agriculture also fell in relative importance, its share moving from 11.1 percent to 8.8 percent. It grew steadily during the 1967 to 1972 period from \$22.5 million to \$29.2 million. This translates into an annual compounded rate of growth of 5.2 percent. The contribution of manufacturing to GDP rose steadily from \$7.8 million in 1967 to \$12.1 million in 1972, reflecting an annual compounded growth rate of 8.8 percent. However, its relative share experienced little change, declining from 3.9 percent to 3.6 percent. As for the hotels sector, its relative contribution rose substantially from 4.0 percent to 7.3 percent. Its absolute trend from \$8.0 million to \$24.3 million implies an annual growth rate of 22.2 percent.

With respect to structural transformation of the regional economy the sectoral performance since the ECCM's inception suggest that very little has been achieved in reducing the strong dependence on non-regional demand. The favorable relative decline in the export agriculture sector is accompanied by a large increase in the relative contribution of the hotels sector. Also, the estimated shares of the manufacturing and domestic agriculture sectors fell. Of course, the role of the ECCM in the poor performance in structural transformation can only be estimated by an analysis which isolates the determinants of the sectoral growth patterns of the ECCM economies. Such an exercise is beyond the confines of this study. It may be observed however, that the sector to experience the highest relative growth (hotels) is by its nature virtually unaffected by the free trade features of the ECCM. The figures seem to suggest that the trade liberalization provisions of the ECCM are inadequate for structural transformation of the participating economies. What appears necessary is the speedy implementation of the coordinated development planning and industrial programming features of the common market.

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12 - Export agriculture expanded by 10.3 percent and 7.4 percent in 1968 and 1969 respectively but declined by 16.9 percent and 1.0 percent in 1970 and 1971 respectively. It grew by 4.5 percent in 1972.

### 5.3 Supporting Institutions and Functional Collaboration in the Economic Integration Program

The need for coordinated development planning in an economic integration scheme comprising underdeveloped countries was emphasized in Chapter 4. Despite the very slow start in coordinated development planning and industrial programming in the ECCM, the common market does provide for such a policy. When the regional planning process accelerates its pace the question of the source of financing the regional development program assumes importance. It is in this context that the Caribbean Development Bank must be seen as one of the key supporting institutions of the economic integration movement in the Caribbean.

The main objective underlying the establishment of the Caribbean Development Bank (CDB) which began operations in 1970, is to provide the Caribbean area with a financial institution that can contribute to the structural transformation and economic development of the countries of the region and assist in promoting economic integration among them, while paying special regard to the needs of the less-developed member countries of the region.<sup>1</sup> Among the functions of the Caribbean Development Bank are:<sup>2</sup>

- (i) To assist regional members in the coordination of their development plans, with a view to efficient use of regional resources increasing the complementarity of the economies and promoting the growth of their international trade, particularly intra-regional trade.
- (ii) To finance projects and programs contributing to the economic development of the region or any of the regional members.

1 - The less-developed regional members of the bank are the ECCM countries, Belize, British Virgin Islands, Cayman Islands, and Turks and Caicos Islands. The more developed regional members of the bank are Bahamas, Barbados, Guyana, Jamaica, and Trinidad and Tobago.

2 - The following discussion relies upon CDB [ 24 ], [ 25 ], [ 26 ], [ 27 ] and Lewis [ 71 ].

- (iii) To mobilize regional and non-regional financial resources and to allocate them to the regional development effort.
- (iv) To provide appropriate technical assistance to regional members, by helping to identify and prepare proposals of development projects.
- (v) To promote public and private investment in development projects.
- (vi) To cooperate in efforts aimed at establishing regional and locally controlled financial institutions and a regional market for credit and savings and to encourage the development of regional capital markets.

The bank has desired to give priority in its lending operations to productive enterprises and closely related infrastructure. Its loans will be concentrated on investment projects in agriculture, livestock, fisheries, manufacturing, mining, tourism, and transportation. In its early years of operation its concern for the special needs of the less developed members of the region led to a policy of soft loans being made only to these member countries while loans at market rates of interest are available to both less developed and more developed members.

The bank has an initial authorized share capital of U.S. \$50 million divided into 10,000 shares each of par value U.S. \$5,000. Fifty per cent of the authorized capital are in paid up shares the remainder in callable shares. The contribution of the two non-regional members Canada and the United Kingdom is U.S. \$10 million each. The distribution of shares among the members is shown in Table 5.4. In 1972 the share capital was increased to U.S. \$100 million.

Since the founding of the Caribbean Development Bank its membership has

TABLE 5.4

Distribution of Initial Share Capital of CDB.

<u>Member</u>	<u>No. of Shares</u>	<u>% of Total</u>	<u>Value U.S. \$000</u>
Jamaica	2240	22.4	11,200
Trinidad and Tobago	1540	15.4	7,700
Bahamas	660	6.6	3,300
Guyana	480	4.8	2,400
Barbados	280	2.8	1,400
Antigua	100	1.0	500
Belize	100	1.0	500
Dominica	100	1.0	500
Grenada	100	1.0	500
St. Kitts-Nevis-Anguilla	100	1.0	500
St. Lucia	100	1.0	500
St. Vincent	100	1.0	500
Montserrat*	25	.25	125
British Virgin Islands*	25	.25	125
Cayman Islands*	25	.25	125
Turks & Caicos Islands*	25	.25	125
REGIONAL MEMBERS	6000	60.0	30,000
Canada	2000	20.0	10,000
United Kingdom	2000	20.0	10,000
NON-REGIONAL MEMBERS	4000	40.0	20,000
TOTAL	10000	100.0	50,000

\*These countries are considered a single member of the bank.

Source: CDB, Annual Report 1971

increased by the admission of Colombia and Venezuela as regional members in 1973. As can be seen from Table 5.4.1 the initial distribution of shares was such that the regional members (which initially were all Commonwealth Caribbean countries) held the majority. The two new members were admitted under the condition that the majority of the voting power and Directors of the bank will be held by Commonwealth Caribbean members. In addition, the borrowing privileges of the new members are somewhat circumscribed.

By 1972 the financial resources of the bank consisted of (i) ordinary capital resources, (ii) a special development fund, (iii) a Canadian agricultural fund, and (iv) a housing fund. As of December 31, 1972, the bank had available for lending U.S. \$54.3 million of ordinary capital resources and monies in the special development fund consisting of U.S., U.K. and Canadian contributions of U.S. \$10 million, £2.1 million and Can. \$ 5 million respectively. The Canadian agricultural fund had available Can. \$2.5 million, while the housing funds were U.S. \$10.3 million.

What of the financing activities of the CDB? By the end of 1972, total financial resources committed by the bank was U.S. \$25.4 million. As can be seen from Table 5.5, commitments consisted of 56 loans, one loan guarantee and a sum of U.S. \$3 million set aside for secondary mortgage financing. Of the funds committed 51.34% came from ordinary capital resources, 40.78% from the special development fund and 7.88% from the Canadian agricultural fund. Table 5.6 shows the breakdown of loans between the less developed member countries (LDCs) of the bank and the more developed member countries (MDCs). Fifty two of the fifty six loans approved were to members of the former group and they account for U.S. \$17.56 million or 79.69% of the total value of U.S. \$22.04 million. It should be noted also that U.S. \$12.35 million or 70.33% of the \$17.56 lent to the LDCs came from special funds carrying the low interest rate of 4%. The loans received by the MDCs

TABLE 5.5

Sources of Funds for CDB Commitments at December 31, 1972

	<u>Value U.S. \$</u>	<u>% Value</u>
Ordinary Resources -----	13,027,717	51.34
23 Loans -----	9,686,632	
1 Loan Guarantee -----	341,085	
Secondary Mortgage -----	3,000,000	
Special Development Fund -----	10,349,915	40.78
24 Loans		
Canadian Agricultural Fund -----	2,000,000	7.88
9 Loans		
TOTAL -----	25,377,632	100.00

Source: CDB, Annual Report 1972

TABLE 5.6

Country Distribution of CDB Commitments in Loans at December 31, 1972

Loans to

	No	<u>Value U.S. \$</u>	<u>% Value</u>
LDCs*	52	17,560,147	79.69
MDCs**	4	4,476,400	20.31
TOTAL	56	22,036,547	100.00

\*Less developed member countries

\*\*More developed member countries

Source: CDB, Annual Reports: 1970, 1971, 1972

are from ordinary resources and carry rates of interest between 7.25% and 8.5%. The sectoral distribution of the loans is shown in Table 5.7. The table indicates that loans for agriculture (industry, livestock and fisheries) and processing of agricultural products were the most numerous though they accounted for only 7.69% of the value of loans. However, if the value of loans for agricultural credit is also considered it is evident that the CDB is giving the agricultural sector much attention with 21.85 percent of its commitments going to that sector. In terms of value, loans for seaports top the list being just over U.S. \$5 million or 23 percent. It may be noted that all three loans for seaports are to LDCs. Of significance is the fact that loans for infrastructural development (ports, water supplies, roads, electricity, telephones) account for over 50 percent of the value of loans.

In addition to its lending activities, the CDB has performed technical assistance for the less developed member countries. This has permitted these countries to refine some of their proposals of development projects. Thus, besides financing acceptable development projects, the bank tries to identify them as well. Consequently, it should play an important role in the economic integration movement in the Caribbean.

We turn now to a discussion of some areas of functional cooperation in the Caribbean integration movement. There are many fields in which regional cooperation occurs<sup>3</sup> but we limit the discussion to meteorology, shipping and industrial standards and research.<sup>4</sup>

3 - The Commonwealth Caribbean Regional Secretariat [ 33 ] describes eleven specific fields: shipping, air transport, broadcasting and information services, general education, university education, health, legal matters, technical assistance, meteorology, industrial standards and research, and tourism.

4 - This discussion draws upon, Commonwealth Caribbean Regional Secretariat [ 33 ], Chapters 6, 14, 15; [ 34 ], Chapters 2, 3, 4; [ 19 ], Chapter 7.

TABLE 5.7  
Sectoral Distribution of CDB Loan Commitments  
at December 31, 1972

	<u>No.</u>	<u>U.S. \$ Value</u>	<u>% Value</u>
Sea Ports	3	5,080,000	23.05
Agricultural Credit	2	3,120,000	14.16
Water Supplies	4	3,067,863	13.92
Industrial Estates	7	2,310,635	10.49
Roads	2	2,006,160	9.10
Agriculture and Processing	23	1,694,089	7.69
Electricity	1	1,528,320	6.93
Small industry credits	7	1,275,000	5.79
Hotels*	2	886,000	4.02
Telephones	1	718,080	3.26
Student loans	3	300,000	1.36
Airport	<u>1</u>	<u>50,400</u>	<u>0.23</u>
TOTAL	<u>56</u>	<u>22,036,547</u>	<u>100.00</u>

\*In addition, the CDB guaranteed a loan of \$341,085 by a German bank to one of the hotel projects.

Source: CDB, Annual Reports: 1970, 1971, 1972

Regional collaboration in meteorology is carried out through the Caribbean Meteorological Council comprised of ministerial representatives of the CARIFTA countries. Member countries operate their own meteorological services but facilities for training, research, data analysis and information dissemination are provided on a regional basis in the Caribbean Meteorological Institute. The institute carries out research in hurricane tracking and warning techniques, hydrometeorology and agrometeorology with the help of a regional weather radar network and twenty-one agrometeorological stations located in the participating countries. Such regional cooperation will help to improve the reporting procedures in hurricanes and the establishment of adequate precautionary measures.

Given the fact that the members of CARIFTA are separated from one another by sea, adequate sea transport becomes a critical requirement for a successful integration program. Efforts at regional cooperation in shipping began in 1961. The West Indies Shipping Corporation established by the now defunct West Indies Federation operated two multi-service (cargo-passenger) ships between the islands. Regional cooperation on shipping matters continues at the ministerial level in the Regional Shipping Council which has representatives from all CARIFTA countries. The council has set up machinery for examining the unilateral freight rate increases of extra-regional shipping lines which handle the trade of CARIFTA countries with non-member countries. In addition, the feasibility of setting up their own shipping line to handle extra-regional trade is being studied by the governments. For intra-regional trade the council through the West Indies Shipping Corporation has begun to restructure the intra-regional shipping service so that inefficiencies can be eliminated and adequate sea transportation made available for the expanding intra-regional trade. Specifically, it has decided to phase out the use of the multi pur-

pose ships and replace them with specialized cargo ships with refrigerated capacity to handle the trade. The introduction of specialized passenger service is also being considered. The performance of the small owner-operated inter-island schooners are also under review. These schooners ply a very useful trade among the islands of the Eastern Caribbean. But their irregular schedules and inadequate capacity does curtail intra-regional trade in fresh fruits and vegetables. It is expected that the CDB funds will be made available to improve the service. Finally, steps are being taken to achieve some measure of uniformity in shipping legislation in the region.

The importance of formulating a set of regional standards governing certain specifications of manufactured products is recognized by the CARIFTA Secretariat. It notes that:

"As the manufacturing and processing sectors of Commonwealth Caribbean economies develop, it becomes increasingly clear that there is need for the creation of industrial standards, not only as a basis for building the confidence of purchasers in exports markets, but also as a means of defeating national prejudices against locally manufactured products and ensuring minimum standards of health and safety." [33 p. 82].

Since 1968 discussions relating to regional cooperation in industrial standards have centered around the institutional framework that should be used. It has been agreed that representatives of national bureaus of standards should meet regularly to exchange ideas on their activities. Consideration has also been given to the establishment of a regional industrial standards organization which would designate regional testing facilities and help to formulate industrial standards.

Cooperation in industrial research takes place between Trinidad and

Tobago and the ECCM countries. The latter can make use of the research facilities of the Caribbean Industrial Research Institute located in the former. This makes it possible for the ECCM countries to have access to research results on the utilization of local raw materials, new production techniques, and local adaptation of foreign technology without incurring the high overhead costs in setting up industrial research facilities.

As can be seen from the discussion of the three areas the extent of functional cooperation may differ from field to field. Most are institutionalized in the form of region ministerial councils; some, like cooperation in industrial research, involve only some of the countries in the formal institutional structure; some, like shipping, provide a regionally subsidized economic service to the region while others, such as industrial standards, are limited to the exchange of official views. All, however, are aimed at complimenting the economic integration programs of CARIFTA and have been formally integrated into a Caribbean Community.

#### 5.4 The Caribbean Community and Common Market

It has been seen that the economic integration movement in the Commonwealth Caribbean as reflected in the CARIFTA is basically a free trade area. At the outset, the Caribbean governments recognized that a higher degree of economic integration would be more appropriate for the Caribbean and CARIFTA was therefore seen as a step towards the establishment of a more comprehensive economic integration regime. The Caribbean Community launched in August 1973 and comprising the twelve CARIFTA countries represents this more encompassing economic integration framework.

The activities of the Caribbean Community will be concerned with three areas. First, through the Caribbean Common Market the economic integration among the member countries begun in CARIFTA will be intensified. Second, the Caribbean Community will streamline the functioning of common services such as the University of the West Indies and the West Indies Shipping Service and various areas of functional cooperation such as health, tax administration and legal education. Third, the Caribbean Community will be the machinery through which the independent member countries coordinate their foreign policies. From the standpoint of the ECCM countries the first area of activity is the most important.

The Caribbean Common Market which has replaced CARIFTA may be viewed as the transformation of the latter from a free trade area into a common market. The expressed objectives of the Caribbean Common Market<sup>1</sup> are "the strengthening, coordination and regulation of the economic and trade relations among Member States in order to promote their accelerated, harmonious and balanced develop-

1 - The text of the Caribbean Common Market treaty is reproduced in Caribbean Community Secretariat [20]. The common market went into operation on August 1, 1973 among the four more developed members. The less developed countries (ECCM countries and Belize) became members on May, 1974.

ment", the achievement by the member countries of a greater degree of economic independence, and "the sustained and continuing integration of economic activities, the benefits of which shall be equitably shared taking into account the need to provide special opportunities for the less developed [member] countries." (Article 3).

In the area of intra-regional trade liberalization the Caribbean Common Market provisions are similar to those of CARIFTA discussed in Section Except for certain products which are subject to contractual arrangements between member countries and manufacturers and temporarily not subject to tariff reductions (Article 13, Schedule 1) and some special transitional arrangements for phasing out tariffs on some products by the less developed member countries (Schedules III, IV), all import duties are eliminated on goods that are of common market origin (Article 15). The origin criteria are the same as for CARIFTA except for the percentage criterion. In the Caribbean Common Market a good produced in a less developed member is considered of common market origin if regional value added is at least 40 percent of its export price; for a good produced in a more developed member regional value added must be at least 50 percent (Article 14). The 50 percent rule applied for all members in CARIFTA. The Caribbean Common Market agreement also provides for the immediate elimination of export duties on goods that are of common market origin except for some eighteen product groups on which export duties may be applied for a period of five years (Article 18, Schedule V). Quantitative export and import restrictions on common market origin products are normally prohibited as well (Articles 21, 22). To assure that the intra-regional trade liberalization process is non-discriminating as regards member countries products which benefit from export drawbacks may lose their common market origin status (Article 16) and remedial action for dumped and

subsidized imports may be agreed upon by the member countries affected (Article 19). Restrictive business practices which restrict competition in the region are considered incompatible with the objectives of the Caribbean Common Market and the Common Market Council, the supreme body of the common market, is empowered to investigate allegations of such practices. In addition, member countries are to introduce uniform legislation to control restrictive business practices by business enterprises within the region (Article 30). Government assistance, subsidies or export credits at subsidized rates are to be abolished for non-agricultural products (Article 25, Schedule VI), and government agencies in non-agricultural fields are prohibited from pursuing policies the effect of which is to protect domestic production from production in other member countries<sup>2</sup> (Article 26). Also, member countries cannot apply differential rates of internal taxes on domestic products and imports of the same commodity or its close substitutes (Article 17). As in the case of CARIFTA, national customs administrations are expected to cooperate and common market goods are allowed freedom of transit in the region to facilitate intra-regional trade. One final condition on intra-regional trade liberalization may be noted. As noted above, quantitative import restrictions are not normally permitted. However, if a member country has balance of payment difficulties or if, because of intra-regional trade liberalization, a particular industry encounters serious problems due to a substantial decline in internal demand for a domestic produce the member country may introduce quantitative import restrictions on a temporary basis (Articles 28, 29). The rationale appears to be to ensure orderly rather than disruptive intra-regional trade expansion.

2 - But see below, p.158 for exception relating to the LDCs.

The provisions governing intra-regional trade in agricultural products in the Caribbean Common Market (Article 48, Schedules VII, VIII and IX) are similar to those of CARIFTA discussed in Section 5.1 above. Essentially, guaranteed prices and markets are provided for regional production of the commodities covered and imports from extra-regional sources are permitted only when there is a region-wide excess demand.

The foregoing provisions of the Caribbean Common Market relate essentially to intra-regional trade liberalization. As such they do not represent a major departure from CARIFTA which it supercedes. Three points of significant departure may be noted. First, by introducing a common external tariff structure for the member countries the Caribbean Common Market has introduced a common regional protective policy. Industries in member countries will be offered a protected regional market. Second, by establishing a framework for the coordination of the non-trade economic policies of the member countries the Caribbean Common Market has moved the economic integration movement in the Caribbean away from the narrow confines of trade liberalization to include some features of multi-country development planning. Third, by providing a special set of provisions for the less developed member countries the Caribbean Common Market has addressed itself to the question of economic polarization.

The common external tariff structure of the Caribbean Common Market has taken into account the theory of effective protection. As the Caribbean Community Secretariat notes:

The basic principle in structuring the Caribbean Common Market Common External Tariff has been to charge low rates on the capital goods and raw materials which the Common Market needs for its industries, then slightly higher rates on semi-manufactured articles and the highest rates on the final and completely manufactured commodity. This way of structuring the tariff is to encourage more and more of the production process to take place within the Common Market rather than outside. ...Another basic principle has been to put relatively high rates on commodities whenever the region produces adequate quantities of the same or substitute products. [19 pp. 31-32].

The introduction of the common external tariff schedule by the more developed member countries began on August 1, 1973 at which time part of the schedule was adopted. The remainder of the schedule will be phased in over periods ranging from three years to eight years. Guyana and Trinidad and Tobago will phase in the remainder of the schedule over a three year period ending in 1976. Jamaica will also complete the phasing in by 1976, while Barbados is allowed until 1981 to introduce the common external tariff on some products. For the less developed member countries a longer time period is allowed before they are required to introduce the common external tariff with a phasing-in period of five years ending in 1981.<sup>3</sup>

In addition to the common external tariff a protected regional market is to be assured by the rationalization of the quantitative restrictions on non-regional imports imposed by the member countries. The member countries are expected to review those restrictions and make appropriate adjustments. New quotas on non-regional imports will be imposed on a regional rather than a national basis. The common external tariff structure and the regionally coordinated policy of import restrictions is intended to stimulate industrial and agricultural development in the member countries.

The Caribbean Common Market provides for the coordination of the economic policies of the member countries in several fields. In the area of fiscal incentives to industry there is a regional scheme which sets maximum levels

3 - One of the less developed members, Montserrat, need not begin phasing-in the common external tariff until 1981 with completion in 1985. The other less developed members need not begin the phasing-in process until 1977 while the more developed members began the phasing-in process in 1973 (Jamaica) and 1974 (Barbados, Guyana, Trinidad and Tobago).

4

of incentives to industrial enterprises . The benefits allowed are directly related to the contribution the enterprise makes to a member country and to the region as a whole in terms of number of persons employed, utilization of regional raw materials and the enterprises' export performance. The incentives to industry are in the form of exemption from income tax and from customs duties on imported machinery and raw materials. Longer periods of relief are given to those enterprises that contribute proportionately more to the regional economy or are located in the less developed member countries. In Table 5.8 the incentives structure of the regional scheme is shown. It will be noticed that approved enclave enterprises<sup>5</sup> and (Group 1) enterprises in which at least half of their value-added is attributed to regional resources receive the best terms. The regional fiscal incentives scheme permits the granting of tax credits on export profits in lieu of income tax and customs duties relief. The schedule of maximum allowable tax credit on export profits tax is given in Table 5.9. Enterprises that derive a greater proportion of their profits from exports to non-regional countries are eligible for proportionately greater benefits.

The present regional fiscal incentives scheme is limited to manufacturing industry. However, the common market agreement envisages similar schemes to cover agriculture and tourism (Article 40). The member countries are to investigate the possibility of rationalizing their income tax systems (Article 40). Other areas in which the member countries will coordinate their policies are monetary, foreign exchange and payments policies, industrial standards, patents, trademarks, company law, double taxation agree-

4 - The scheme is outlined in Agreement on the Harmonisation of Fiscal Incentives to Industry.

5 - An enclave enterprise is an enterprise that is eligible for fiscal incentives and that exports all of its output to non-member countries.

TABLE 5.8

## Schedule of Fiscal Incentives to Industry

Classification of an Approved Enterprise	Maximum Number of Years Relief from Income Tax and Customs Duties in respect of an Approved Enterprise located in:-		
	More Developed Countries (other than Barbados)	Barbados	Less Developed Countries
Group I Enterprise <sup>1</sup>	9	10	15
Group II Enterprise <sup>2</sup>	7	8	12
Group III Enterprise <sup>3</sup>	5	6	10
Enclave Enterprise <sup>4</sup>	10	10	15

Notes: 1 - Group I enterprise is an enterprise whose regional value added is at least 50 percent. 2 - Group II enterprise has a regional value added between 25 and 50 percent. 3 - Group III enterprise has regional value added of 10 to 25 percent. 4 - An enclave enterprise produces exclusively for the non-regional market. Regional value added is weighted by income accruing to regional labor.

Source: Caribbean Community Secretariat, "Agreement on the Harmonization of Fiscal Incentives to Industry."

TABLE 5.9

## Industrial Incentives Scheme: Maximum Tax Credits on Export Profits Tax

<u>Export Profits as % of Total Profits</u>	<u>Tax Credit as % of Tax on Export Profits</u>
10% - 20%	25%
21% - 40%	35%
41% - 60%	45%
61% - 100%	50%

Source: Caribbean Community Secretariat, "Agreement on the Harmonization of Fiscal Incentives to Industry."

ments with non-member countries and the promotion and development of tourism (Articles 41, 42, 43, 50). In addition, the countries have adopted a scheme between the more developed and the less developed members to eliminate double taxation of income in the common market<sup>6</sup>. This it is believed, will promote the orderly movement of capital within the region and in particular will direct capital from the more developed members to the less developed members where government investment incentives are more generous.

An important area in which the Caribbean Common Market represents a significant improvement over CARIFTA is in development planning and regional industrial programming. A long-term regional perspective development plan is to be formulated and this will provide the framework for coordinating the development policies and programs of the member countries (Article 45). Member countries will consult one another in the preparation of their national medium-term development plans so that opportunities for increasing complementarity among industries of the member countries can be identified and utilized. A committee of national development planning officials has been established for this purpose (Article 45)<sup>7</sup>. In addition, member countries "undertake to promote a process of industrial development through industrial programming aimed at achieving the following objectives:

- (a) the greater utilization of the raw materials of the Common Market;
- (b) the creation of production linkages both within and between the national economies of the Common Market;
- (c) to minimize product differentiation and achieve economies of large scale production, consistent with the limitations of market size;
- (d) the encouragement of greater efficiency in industrial production;

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6 - The scheme is outlined in an Agreement for the Avoidance of Double Taxation and the Prevention of Fiscal Evasion with Respect to Taxes on Income and for the Encouragement of International Trade and Investment.

7 - For a discussion of approaches to development planning, see Section 6.1 below.

- (e) the promotion of exports to markets both within and outside the Common Market;
- (f) an equitable distribution of the benefits of industrialization paying particular attention to the need to locate more industries in the Less Developed Countries." (Article 46).

Special mention is made of the development of joint industrial projects which will increase the utilization of the region's natural resources.

For agriculture there is to be a scheme to rationalize production in the region. The scheme includes the formulation of a regional development plan for the agricultural sector. This regional development plan will ensure that regional agricultural resources are optimally allocated and will replace national import substitution with a regional import substitution program (Article 49).

The Caribbean Common Market fulfills all but one of the requirements of a common market as defined in the traditional theory of economic integration. The exception concerns the movement of capital and labor. The Caribbean Common Market does not permit the free movement of capital and labor among member countries though it envisages the establishment of a scheme "for the regulated movement of capital within the Common Market." (Articles 37, 38)<sup>8</sup>. The absence of free factor movements within the region is important particularly for the less developed ECCM countries which would most likely lose their skilled manpower if unrestricted factor movements were permitted. In other words, in an economic integration scheme among countries with varying levels of economic development it is important to regulate factor movements if the less developed members are not to suffer harmful economic polarization effects.

We turn now to a discussion of the special regime in the Caribbean Common Market for the less developed members, Belize and the ECCM countries.

8 - See discussion of the Caribbean Investment Corporation below , p. 159.

Throughout the main agreement establishing the Caribbean Common Market reference is made to the special position of the ECCM countries and Belize and the need to provide special provisions for them so that they share equitably in the benefits of economic integration. The foregoing discussion has mentioned some of these provisions but it is useful to look at the special provisions as a whole. First, in the area of intra-regional trade liberalization the less developed members have until 1983 before all import duties are removed from a list of common market products (Schedule III) and for the removal of the protective element of revenue duties on imports of rum (Schedule IV). We have seen above that the less developed countries have until 1977 before they begin phasing in the common external tariff with completion in 1981. This gives them a longer time to make adjustments in their economies. Indeed, the Georgetown Accord<sup>9</sup> which sets out the timetable for implementing the common market and associated agreements provides annual reviews of the common external tariff of the Caribbean Common Market during the initial years to take account of "the prevailing economic situation" in the less developed members. Provision is also made for the temporary suspension of common market tariff treatment of imports of goods from the more developed members by the less developed countries acting as a group if production of these goods are being undertaken in one of the latter countries and if their efficient production in the less developed countries is deemed to require the entire sub-market. This permits the less developed countries to temporarily protect an industry from competition from the more developed countries. Quantitative

9 - The Georgetown Accord was signed by all the member countries except Antigua and Montserrat on April 12, 1973. The text is reproduced in Caribbean Community Secretariat [ 20 ].

restrictions may also be sanctioned on imports from the more developed countries to effect the temporary protection of the sub-market. Significantly, the more developed countries, except Barbados, are not permitted to close off their market neither by tariffs nor quotas from imports from the less developed members in the commodities in question (Article 56). We have noted earlier the more favorable percentage criterion afforded the less developed countries in determining whether products are eligible for common market tariff treatment. Such differential percentages will afford commodities produced in the less developed countries easier access to the regional market. We have also noted above that the imposition of government aids such as direct subsidies, rebates of indirect taxes and export credit guarantees at preferential rates are prohibited. The special regime for the less developed countries provides that these countries can offer such government aids for exports to the more developed members excluding Barbados (Article 57, Schedule VI). Government undertakings in the less developed countries are similarly exempted from the common market provision that requires the elimination of measures that discriminate in favor of domestic production (Article 58). Thus government agencies in the less developed member countries may buy from domestic suppliers even though the cost (including transportation) from a more developed country is cheaper.

In the coordination of economic policies of the member countries the less developed members are singled out for special consideration. Recall that in the scheme of regional incentives to industry as given in Tables 5.8 and 5.9 and the surrounding discussion greater investment incentives are given to approved industrial enterprises locating in a less developed country. In fact, the more developed countries are prohibited from giving

income tax relief on some thirty-five commodities the production of which all the member countries have agreed to promote in the less developed countries. In addition, the agreement between the less developed and the more developed member countries for the avoidance of double taxation of income has certain advantages for the former group. The latter group of countries have set low tax rates on income earned by their residents from investment in the less developed countries. There is, as well, tax credit for such income taxed by the less developed countries. The effect of these preferential provisions is to encourage residents of the more developed countries to invest in the less developed countries and thus assist in their industrial development.

The transfer of resources from the more developed members to the less developed group is another aspect of the special regime for the latter. The previous section has indicated that by far the greater part of funds committed by the Caribbean Development Bank is for projects in the less developed members. One limitation on the CDB's financial activities is that it cannot purchase shares and must thus confine itself to the loan market. An agreement among the Caribbean Community members has established a Caribbean Investment Corporation (CIC) to provide equity capital for projects located in the less developed member countries.<sup>10</sup> According to this agreement the CIC will "ensure the promotion of the industrial development including the development of agro-based industries and of integrated agricultural and industrial complexes of the less developed countries" of the Caribbean Common Market (Article 3). The CIC is authorized to issue shares worth up to \$15 million, \$5 million of which will be

10 - The objectives and structure of the Caribbean Investment Corporation are given in Agreement Establishing the Caribbean Investment Corporation.

issued in the first five years of its operation. Each share will have a par value of \$100. The CIC is a joint government-private sector undertaking with regional governments acquiring 60 percent of the shares, the private sector 40 percent. Thus of the 50,000 shares to be issued in the first five years 30,000 will be held by the governments. Of this 30,000 the more developed countries will acquire 27,000, the less developed members 3,000. Consequently while the governments of the more developed countries will provide 90 percent of the government share of the capital it should be emphasized that all the industrial projects in which the CIC will participate will be located in the less developed countries. Furthermore, the less developed countries will have substantially greater power than their proportionate contribution to the equity capital of the corporation would normally allow. It is to be noted also that the CIC will be headquartered in St. Lucia, a less developed member. In view of the provisions governing avoidance of double taxation of income it is expected that the greater part of the private sector contribution to the share capital of the CIC will come from the more developed member countries.

The transfer of skilled personnel is institutionalized in a Caribbean technical assistance program. Through this program governments of the more developed countries provide technical experts to their counterparts in the less developed members. The transfer of technology is facilitated by the less developed members having access to the technological and research facilities of the more developed members at a nominal charge.

Finally, it should be recalled that the less developed countries, except Belize, have in the ECCM a very progressive and far-reaching framework for ensuring that they benefit from the Caribbean economic integration movement. The Caribbean Common Market and associated agreements do not pre-

clude these countries from implementing the provisions of the ECCM.

To summarize, it must be admitted that the Caribbean Community and Common Market provides several important measures that are aimed at ensuring the equitable distribution of benefits in the Caribbean economic integration exercise. The establishment of the Caribbean Investment Corporation geared exclusively to industrial and agricultural development in the less developed members will complement the work of the Caribbean Development Bank. The coordination of policies in various areas should be beneficial to them and the longer transitional period for implementing intra-regional free trade and the common commercial policy vis-a-vis non-member countries should provide their industries with adequate time to make the necessary adjustments. It appears that the onus is now on the governments of these countries. For the governments of the ECCM countries it seems that new initiatives must now be taken. In particular, a more resolute attempt at implementing the provisions relating to coordinated development planning and regional industrial programming is necessary if the opportunities opened by the new departures of the Caribbean Community and Common Market are to be seized.

## CHAPTER 6

### COORDINATED REGIONAL INDUSTRIAL PROGRAMMING: THEORETICAL FRAMEWORK

This chapter is concerned with the theoretical framework for coordinated regional development planning and industrial programming. The theoretical arguments for the need to incorporate the planning process in economic integration schemes among underdeveloped countries were established in Chapter 4. Suffice it to recall that a coordinated integration-wide policy is necessary to minimize the economic polarization tendencies of economic integration and to ensure that all member countries share equitably in its benefits.

The chapter is organized as follows. In Section 6.1 a brief survey of the various approaches to development planning in economic unions is presented. Section 6.2 sets out a model of nationalistic development planning, nationalistic in the sense that the country does not coordinate any of its development planning activities with other countries that are members of the economic integration exercise. In other words, the cooperation among member countries is limited to the narrow confines of the removal of tariffs and quantitative restrictions from trade, and possibly the imposition of a uniform tariff structure on extra-regional trade. Each country sets its own development targets, plans and implementation procedures for economic growth, investment allocation, structural transformation of the economy, etc. This model provides the takeoff for an aggregative multi-sector model of coordinated region-wide development planning for the economic integration scheme outlined in Section 6.3. The latter model establishes how regional investment funds are optimally allocated among the member countries, the particular sectors in which investment is undertaken, the particular export sectors that will expand, whether investment spending in the international transportation system is incurred, given certain target levels of aggregate magnitudes some

of which are set on a regional basis. The model in Section 6.3 is extended in Section 6.4 to deal with the question of the optimum allocation of new development projects in the economic integration scheme. The multi-sector programming approach of Section 6.3 is retained and the case of projects characterized by economies of scale handled. The question of optimum project allocation among partner countries is further pursued in Section 6.5. Here the general equilibrium multi-sector framework of the two previous sections is dropped in favor of a partial equilibrium framework. Each project is analyzed separately to determine its optimum location in the common market. The final section of the chapter raises some questions concerning the shortcomings and real-world applications of the model as well as comment on some of the assumptions underlying the models.

#### 6.1 Approaches to Development Planning in Economic Integration Scheme

Economic development planning has, at least since the 1950's, been widely recognized as a crucial activity of the governments of underdeveloped countries if the level of development of these countries is to improve significantly in the medium run. As a result, many developing countries have had some experience with national development planning. When the need for multinational development planning in economic integration schemes among underdeveloped countries was appreciated the approaches to planning within the regional context drew upon the approaches that were tried and tested at the national level. It will be useful therefore, to discuss the approaches to national development planning for, as we shall see later, they constitute the range of approaches applied to planning for economic integration regimes.

The development planning process involves elements of forecasting, coordination and the efficient attainment of stated objectives. The process is carried forward through the preparation and implementation of development plans

The practice of development planning has in no way been uniform among countries. Albert Waterston [103, p.5] reports that the planning experiences of countries indicate that national development planning is a diverse phenomenon, the diversity arising from the different aims of planning, the differences in the political, social and economic milieu and the various stages of economic development, all of which have an impact on the planning process.

Tinbergen [ 98 ] classifies development plans as long-term or perspective plans, medium-term plans and short-term plans. This classification has now become standard. The long-term or perspective plan sets out in broad outline the long term economic objectives of the society, the fundamental institutional changes that are thought necessary, the general path to development that will be pursued, for example, capitalistic or socialist development. It provides projections of the resources that will be available to the economy, long-term estimates of economic magnitudes that show a strong degree of regularity, and analyses of development projects whose planning and implementation will span periods longer than the duration of a medium-term plan. The perspective plan indicates the extent of the structural transformation that is envisaged for the national economy and provides a general guide to the priorities that should be followed in the medium and short-term plans. It recognizes the long-term nature of the economic development problems and forms an institutionalized link between adjacent medium-term plans to emphasize the continuous and long-term characteristic of the development planning solution.

The medium-term plan covers a period of about five years. It contains more detail than the perspective plan and in a sense presents the concrete proposals of achieving the long-term objectives of the perspective plan in addition to some medium-term objectives. The latter are of course related and sometimes derived from the former. At times however, long-term and medium-

term objectives may come into conflict. When this occurs in practice, the latter tends to prevail. To quote Waterston [103, pp.133-4]:...

in countries with mixed economies, the medium-term plan is the mainstay of development planning. While the medium-term plan is often formally binding to some extent, the perspective plan almost never is. It is often considered to be only a forecast based on a series of assumptions concerning domestic and international development. In theory, each medium-term plan is expected to be so formulated as to reach the goals in the long term plan. But in practice, concessions are made to short-run objectives.

The medium-term plan will set investment levels to achieve target growth rates in aggregate output. The aggregate investment levels will also be broken down to meet sectoral investment requirements. The medium term plan will also contain details of investment projects whose implementation takes more than one year.

Finally, the short-term plan is usually a one-year plan and its government sector component corresponds to the development projects in the government's annual budgetary proposals. Compared to the perspective and medium-term plans it outlines in great detail the actual investment projects that the government proposes to pursue during the fiscal year in question. It normally gives estimates of the impact of the projects on growth of output, employment and unemployment, and the balance of payments position. The private sector component of the short-term plan is less precise but it reflects what projects the government expects the private sector to undertake. The list of such projects and the estimated investment spending involved are normally decided at the plan preparation stage by way of consultation between the economic planning agency and representatives of the private sector. The short-term plan is the institutional framework for phasing in the investment projects outlined in the medium-term plan. As such, some development planners argue that it should "include detailed descriptions of both the administrative measures to be employed in carrying out the public sector program and the

instruments of economic policy [monetary, credit, wage and fiscal] to be used to stimulate private investment to conform with plan objectives." [Waterston p. 144]. The short term plan permits adjustments in timing project implementation to compensate for previous shortfalls or over-fulfillment of medium-term targets and incorporates in the planning process changes in the domestic or international economy not foreseen and hence not accounted for in the medium-term plan. In short, the annual plan transforms the goals and targets of the medium-term plan into an operational program for action.

Paralleling the three types of plans in terms of their time horizon there are three stages of planning related to the degree of aggregation or disaggregation of the economic agents within the national economy. These are the macrophase, middle phase and microphase of development planning.<sup>1</sup> The macrophase, as the term suggests, is concerned with aggregate magnitudes such as national income, aggregate investment, national capital stock, aggregate consumption, total imports and total exports. Correspondingly, economic development targets of the macrophase are global in nature, such as a specified rate in the growth of consumption, aggregate investment or national production. No attention is paid to the composition of these magnitudes or to the distribution of these magnitudes among the regions of the country. In addition, the factors of production available to the economy are not heterogeneous; there is so much capital with no distinction between plant, equipment and social overhead capital. There is so much labor without any reference to the obvious differences among professional, technical, skilled and unskilled manpower. The purpose of the macrophase of development planning, according to Tinbergen [ 98], is to find answers to the following fundamental question:

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1 - The terminology is due to Tinbergen. See [ 98 ] Chapters 6-8.

Given 1) the laws of production, 2) the scale of preferences with the population for various levels of consumption and for postponement of consumption, 3) the growth of the population and 4) the initial capital stock, how much must be invested annually in order to obtain maximum satisfaction (or value) from all future consumption?

Theoretical solutions are to be found in the numerous models on optimal economic growth while several econometric exercises on one-sector economies based on national accounts data provide practical attempts at solutions.

The middle phase allows for some amount of disaggregation. The economy is divided into several sectors each of which has special features. For example the sectoral division may include agriculture, mining, manufacturing and tourism.<sup>2</sup> Also, the middle phase of development planning allows for the subdivision of the country in several geographical areas. Planning in the middle phase consequently deals with the specification of local as well as national goals. These goals are achieved by explicitly considering both spatial and sectoral aspects of investment allocation. Thus it is possible, for example, to plan for a growth rate of the manufacturing sector higher than the overall growth rate, as well as to implement special measures to bestow relatively more economic benefits on a depressed area of the country.

Tinbergen [98 , pp.92-4] has found the distinction of national and international sectors useful in development planning models of the middle phase. National sectors are those whose output cannot be traded internationally because of prohibitive transport costs, while international sectors are those which produce internationally traded commodities. Obviously, the classification is not rigid since technological progress in international transportation systems can shift a sector from the national to the international category. The multi-sector, multi-area character of a middle phase development planning model com-

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2 - In the models of Clark, et al [ 31 ], [ 32 ], the middle-phase development plan has 15 sectors.

pliments and elaborates on the macrophase plan. The former indicates how the aggregate investment of the latter is proportioned to equipment, plant and social overhead, and whether the investment goes into the manufacturing, mining or tourism sector. It shows the sectoral origin of the growth in national product as well as the sectors which supply the increased consumption.

The microphase of development planning permits an even greater amount of disaggregation at both the spatial and industrial dimensions. The analysis in this phase is of well-defined projects or groups of interrelated projects. The projects are carefully evaluated to determine the best choice based upon their relative abilities to fulfill the development objectives and their relative use of scarce resources. As such, this phase of planning requires detailed and reliable data and among the analyses carried out are market demand analyses of narrowly defined commodities, cost estimates, studies on the availability of raw materials, trends in product and input prices, marketing problems, skilled personnel availability and requirements, the terms of financing fixed and working capital and technical studies on plant design and layout. These are used to ascertain the profitability of potential projects. In short, the core of microphase planning is project appraisal using mainly cost-benefit analysis. For the most part project profitability is determined from a social or societal calculus though for projects that will be implemented by the private sector their profitability along private or market lines must also be established.<sup>3</sup> It is at the microphase stage of development planning that the detailed administrative aspects of plan implementation become important. Consequently, it sets out procedures for scheduling the implemen-

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3 - Little and Mirrelees [ 76 ] and UNIDO [108] provide comprehensive discussion of project appraisal emphasizing social cost-benefit analysis. For project appraisal along private cost-benefit lines, see, Development Centre of OECD [42 ]

tation of projects and pays special attention to the synchronization of the various parts of each project or of the interrelated projects. Also, it pinpoints the specific location of the various projects since the middle phase only determined the region of the country in which they are located.

It will be apparent that there is some correspondence between the two classifications of development planning. It should be clear that the macro-phase stage of planning is most appropriate for a perspective development plan and that microphase planning would rarely be used for such a plan. A medium-term development plan would normally utilize, probably with equal weight, the three phases of development planning. The short-term plan would rely heavily on the microphase.

With the foregoing review of approaches to national development planning we may proceed to a discussion of approaches to regional harmonization of development planning. A conceptual framework suggested by Kitamura and Bhagat [ 69 ] is the following:

As a concept the harmonization of national development plans may be defined as partial or comprehensive extension of national economic planning to the regional or subregional plane in the allocation of productive resources. It will sooner or later lead to the formulation of an investment and production program and policy from the point of view of the region as a whole. In the absence of a supra-national authority, however, the approach to a regional investment planning and policy will aim at a conscious and deliberate harmonization of national production efforts and investment policies and involve inter-governmental agreements on specialization and joint efforts preceded by an exchange of information, consultations and negotiations. [ 69 ,p. 15].

Within the above framework the first approach to multi-national development planning is a loose informal method of coordination of national development planning among the members of an economic integration scheme. This arrangement normally carries no legal force but, in principle, member countries endeavor to ensure that the specified goals of the economic integration scheme are not frustrated by any procedures or activities arising from their national development plans. In practice, little or no coordination of development plan-

ning takes place, the preparation of national development plans pays minimal attention to the regional integration objectives. Clearly this approach is quite unsatisfactory for underdeveloped countries. The early experience of CARIFTA reflected this approach.

A second approach calls for regional perspective planning. This would involve the preparation of an integration-wide perspective plan having features similar to those of a national perspective plan. A survey of the long-term supply of natural, human and financial resources of the region and of foreign resources available to it would be undertaken together with rough long-term projections of demand for broadly defined commodity groups. An analysis to ascertain the dynamic or long-run comparative advantage of the region as a whole and of each country in the economic integration scheme would also be carried out. The regional perspective plan would therefore provide rough estimates of the long-run growth potential of the region, would suggest broad strategies for the structural transformation of the regional economy, would identify the broad commodity groups in which regional import substitution and regional export promotion should be concentrated and the position of each member country in this drive. Implicit in this approach is the expectation that each member country will gear its medium-term and short-term plans to fit into the contours of the regional perspective plan.

This approach has recently been adopted by the CARICOM countries and preparations have already begun to prepare such a plan. It will take some time to know how effective this approach will be. One advantage of this approach may however be suggested. It minimizes the amount of inter-country consultation on development planning at the medium-term and short-term levels. Given that the perspective plan (with appropriate modifications) is accepted by all members, each one can prepare its medium-term and short-term plans knowing in

general terms what areas each will concentrate its investment. Consultation can be limited to specific matters. An obvious disadvantage of this approach is that because it does not establish concretely the benefits of economic integration and coordinated regional planning the problem of the equitable distribution of benefits will not be adequately resolved.

Regional sectoral planning has been advocated by Brewster and Thomas [ 16 ] and by an ECAFE group of development planning experts [ 44 ]. This approach involves working out a development program for a sector, for example agriculture, of the regional economy. By definition its coverage is much narrower, and of necessity its analysis more detailed than regional perspective planning. Coordinated regional planning of the agriculture sector, for example, would involve detailed analysis of the agriculture resources of the region, estimates of regional and non-regional demand for the region's agricultural products, feasibility studies of plants to process agricultural products, including their locational aspects. Such planning would cover both the medium-term and short-term horizon. Consequently the level of detail would be at the middle and micro phases of planning. In other words, the plan would have estimates of the growth over the medium run of agricultural commodity groups as well as details of well-defined projects in the agricultural sector (including first-stage processing of agricultural commodities) giving their optimal and second best countries of location. As with national microphase planning, it would provide procedures for implementing the well-defined agricultural projects. This approach to the harmonization of national development plans in economic integration schemes is thought to be attractive since benefits to be derived will be more observable and directly quantifiable, thereby permitting a smoother bargaining among the members of the distribution of the benefits of economic integration cum regional planning [Brewster and Thomas 16 pp. 19-28]. Also, abstracting from inter-sectoral relationships, sectoral planning can be

viewed as comprehensive economy-wide planning in a number of stages. Regional sectoral planning is attractive because it can be implemented without the "great practical difficulties [that] would be encountered in any attempt to achieve comprehensive harmonization of national development plans at one stroke..." [ECAFE p.5]. Sidney Dell [38 p.142] has argued that "it would be an error to wait upon the elaboration of a fully consistent set of goals for all sectors within a comprehensive framework. It would be much better to begin immediately by setting targets for the strategic sectors and by adopting the measures required for their achievement. This should not prevent work on more thorough-going lines from being initiated."

Among the weaknesses of sector-by-sector coordinated regional planning may be mentioned (i) the absence of compensating arrangements in sectors not covered, (ii) the possibility of inefficient global resource allocation because of the partial equilibrium nature of this method, and (iii) the likelihood that disturbances and costs of adjustments will be borne by only one or two sectors. While these shortcomings detract from the attractiveness of this method the following observation of the earlier mentioned group of ECAFE planning experts should be noted.

With the experience and habits of mutual cooperation implanted during the process of negotiations, the commodity or sectoral coordination at the sub-regional level might lead to a recognition of the need for overall plan harmonization and thus pave the way for coordination of the development plans of the sub-region as a whole [ECAFE p.5].

A third approach is regional project programming. Member countries decide to plan and implement on a regional basis the production of one or several narrowly-defined products within well-defined projects. Unlike the second approach, these projects may span several of the sectors of the regional economy and may not be interrelated. Thus, for example, there is no regional harmonization of plans for the manufacturing sector while there is a regional program covering the production of one or more manufacturing commodities. It

will be evident that this commodity approach to planning utilizes detail comparable to that of microphase planning. Analysis of the region's market potential with regard to the selected products, detailed and systematic comparative cost studies to determine the profitability and optimal points to locate production will be carried out. Of course, in depth analysis of the availability and cost of raw materials, capital, skilled labor and entrepreneurial talent, transport and marketing facilities would be required. Normally, the plan also has rules covering a pricing policy for the commodities covered. The studies are translated into agreements covering the production of the specified products among the member countries of the economic integration scheme.

This approach has been practiced among the countries of the Regional Cooperation for Development (Iran, Pakistan, Turkey). Carnoy and his associates [ 28 ] have developed a regional plan covering fourteen products for a Latin American common market. The Integration Industries Regime of the Central American Common Market also falls under this approach.<sup>4</sup> The more developed countries of CARICOM have initiated work on a similar plan for the production of aluminum and cement.

The theoretical weakness of the partial equilibrium method noted for sectoral planning is applicable to commodity-by-commodity planning as well. The attractiveness of the commodity-by-commodity approach lies in the fact that it is operational; also, its benefits and their distribution are readily identified. Its comparative lack of administrative and technical complexities was pinpointed by the group of ECAFE planning experts [ 44 ] when they recommended its adoption by regional groupings in Asia.

Finally, there is the thorough-going approach of comprehensive coordina-

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<sup>4</sup> - For a review of the early experience of plan harmonization in the Regional Cooperation for Development and of the Integration Industries Regime, see respectively, ECAFE [ 45 ] and [ 90 ].

ted regional development planning. From a theoretical standpoint this approach is the most satisfactory since it takes into account the inherent interdependence of economic activities. As such it highlights the intersectoral, inter-industry and inter-commodity relationships which are obscured by the second and third approaches. The level of planning detail corresponds to both middle-phase and micro-phase planning. From a practical point of view and given the present level of political commitment to economic integration this approach to multi-national development planning by regional groups of underdeveloped countries is perhaps not appropriate. For one thing, it requires an extremely large amount of reliable data which is not available for most of these countries. For another, the degree of plan harmonization called for by this method is administratively unwieldy given the administrative resources of the planning institutions in these countries. Even a supra-national regional planning authority is likely to find the administrative aspects of comprehensive planning too complex. In any case, few if any, countries have reached the level of commitment to economic integration that would make a supra-national planning authority with more than advisory status acceptable at the present time.

The foregoing survey of approaches to regional development planning indicates that these approaches are closely related to the approaches to national development planning. It may be noted that the project approach has dominated the actual attempts at regional plan harmonization to date. This is not surprising in view of a similar position of project or commodity-by-commodity planning in the experiences of development planning at the national level.

## 6.2 A Model of Nationalistic Development Planning

In a regional integration scheme, each participating country is involved in the experiment because it expects to benefit. Stated another way, in its

concern for economic development it is convinced that the specific goals such as a higher growth rate in aggregate or in manufacturing output will be achieved at a smaller sacrifice. It seems reasonable to presume that each member will join in a program of regional development planning only if its planning objectives are more easily achieved with coordinated regional planning instead of via nationalistic development planning. Further, each member may decide to reassess its participation in the coordinated regional planning process periodically. Consequently, in the presentation of a model of coordinated regional planning, it would be useful to have a model of nationalistic development planning which each country could use to evaluate the former. In other words, a question that is always in the background for each member country is: In terms of benefits received, or objectives achieved, is it preferable to participate in the coordinated planning process, or plan on its own?

Before presenting in Section 6.3 the development planning model for the integration scheme, we first outline a comparable model of nationalistic development planning. This is done in the present section.

The following notation is used in the nationalistic planning model:

$X_i^*$  = the increase in production in sector  $i$  during the plan period.

$C_i^*$  = the increase in consumption of commodity (produced in sector)  $i$  during the plan period.

$K_i^*$  = the increase in demand for investment goods of type  $i$  during the plan period.

$E_i^*$  = the increase in exports of commodity  $i$  during the plan period.

$M_i^*$  = the increase in imports of commodity  $i$  during the plan period.

$Y^*$  = the increase in aggregate income during the plan period.

$Z$  = value of the objective function.

$a_{ij}$  = input-output coefficient; input of commodity  $i$  needed to operate production activity  $j$  at the unit level.

$a_{oj}$  =  $(1 - \sum_i a_{ij})$  = value-added coefficient of sector  $j$ .

$b_i$  = marginal propensity to consume commodity  $i$ .

$c_{ij}$  = the partial incremental capital-output ratio between capital goods  $i$  and sector  $j$ .

$e_{ij}$  = sectoral incremental capital-output ratio relating to exports of commodity  $j$  and capital goods  $i$ .

$m_{ij}$  = sectoral incremental capital-output ratio relating to imports of commodity  $j$  and capital goods sector  $i$ .

$r_j$  = tariff rate on exports of commodity  $j$ .

$T$  = length of the plan period in years.

$\bar{Y}$  = an exogenously determined value of  $Y^*$ .

$K_{it}$  = the level of investment demand of type commodity  $i$  at time period  $t$ ;  $t = 0, 1, \dots, T$ .

$E_{jt}$  = the level of exports of commodity  $j$  in year  $t$  of the plan period;  $t = 0, 1, \dots, T$ .

$M_{jt}$  = the level of imports of commodity  $j$  in year  $t$  of the plan period;  $t = 0, 1, \dots, T$ .

The model is of the input-output programming type and considers planning on an economy-wide basis. The goal of the planning process is given by the objective or criterion function and the structure of the economy is given by the input-output production relations and by relations for consumption, investment and import demand. As is well known the economic development process involves several (sometimes conflicting) objectives such as growth in aggregate or in manufacturing output, maximum possible growth in employment and a less skewed income distribution. In the present model, as in others of similar structure

such as Mennes [80], and Westphal [104], a single objective is assumed. In Section 6.6 we comment briefly on the specific choice made here and on the implications of alternative objectives for the model.

The planning mechanism is set the problem of minimizing the objective function

$$(6.1) \quad z = \sum_{t=1}^T \sum_{i=1}^I K_{it}$$

subject to several constraints.

The first group of constraints are those of the material balances and are given by

$$(6.2) \quad X_i^* + M_i^* \geq \sum_{j=1}^I a_{ij} X_j^* + C_i^* + K_i^* + E_i^* \quad i = 1, \dots, I$$

Equation (6.2) specifies that for each sector  $i$  the increase in the supply of its output from domestic and foreign sources must exceed or be equal to the increase in demand over the plan period for the sector's output.

The increase in aggregate income over the plan period is constrained by conditions (6.3) and (6.4) which state that it is equal to the sum of sectoral value-added but cannot fall below an exogenously set value  $\bar{Y}$ .

$$(6.3) \quad Y^* = \sum_{j=1}^I a_{0j} X_j^*$$

$$(6.4) \quad Y^* \geq \bar{Y}$$

The specification for the consumption functions is given by (6.5).

$$(6.5) \quad C_i^* = b_i Y^* \quad i = 1, \dots, I.$$

Finally we have the non-negativity constraints

$$(6.6) \quad X_i^* \geq 0, \quad E_i^* \geq 0, \quad M_i^* \geq 0, \quad K_i^* \geq 0, \quad Y^* \geq 0, \quad C_i^* \geq 0.$$

From the statement of the model given in equations (6.1) to (6.6) it is clear that capital is the only source factor of production. Labor does not

appear in the model. It is assumed that capital goods are of infinite durability.<sup>1</sup> Obviously, given the input-output relationships in the model the assumptions of input-output analysis apply.<sup>2</sup>

As formulated so far the model has as the investment variable  $K_i^*$ , the increase in investment demand for commodity  $i$  over the entire plan period. If  $K_{i0}$  equals the level of demand for investment for good  $i$  in the base year (year 0) of the plan period then  $K_i^*$  is defined as in (6.7)<sup>3</sup>.

$$(6.7) \quad K_i^* = K_{iT} - K_{i0}$$

It follows that (6.2) can be rewritten as

$$(6.8) \quad X_i^* + M_i^* \geq \sum_{j=1}^J a_{ij} X_j^* + C_i^* + K_{iT} - K_{i0} + E_i^*$$

$i = 1, \dots, I$

where the value of  $K_{i0}$  is predetermined.

By specifying a relationship between the level of investment and changes in output and by assuming a certain time path of either investment or output during the plan period, (6.8) can be written in another form.

Consider the case where capital goods do not depreciate and changes in investment outlays lead immediately to output changes. In other words, output responds instantaneously to changes in investment levels. In this case

$$(6.9) \quad \sum_{t=1}^T K_{it} = \sum_{j=1}^J c_{ij} X_j^*$$

$i = 1, \dots, I.$

1 - In order to keep the model simple, we will not discuss the problem of depreciation and capital replacement expenditures. For two approaches, see Clark [110 pp. 80-87] and Mennes [80 pp. 80-86].

2 - For these, see Chenery and Clark [30].

3 - This is immediately obvious for a planning period of one year, i.e.,  $t=0, 1$ . For a planning period longer than one year we have  $K_i^* = K_{i1}^* + K_{i2}^* + \dots + K_{iT}^*$  where  $K_{it}^*$  is the increase in investment demand for commodity  $i$  during  $t$ ,  $t=1, \dots, T$ , of the plan. By definition  $K_{it}^* = K_{it} - K_{i,t-1}$ . Therefore  $K_i^* = (K_{i1} - K_{i0}) + (K_{i2} - K_{i1}) + \dots + (K_{iT} - K_{i,t-1})$  which on simplification gives (6.7).

where  $c_{ij}$  is the partial increment capital-output ratio between capital goods  $i$  and sector  $j$ .

With respect to the time-path of either output or investment two simple cases used in the literature on economy-wide planning models are first, that output expands during the plan period according to an arithmetical progression, and second, that investment increases during the plan period according to an arithmetical series. The former is used by Mennes [80], the latter by Sandee [93]. The first means that

$$(6.10) \quad X_{i,t+1}^* = X_{i,t}^* \quad t = 1, \dots, T - 1$$

where  $X_{i,t}^*$  is the increase in production in sector  $i$  during year  $t$ . It can be shown<sup>4</sup> that this implies the following relationship for investment in the terminal year  $T$  of the plan period:

$$(6.11) \quad K_{iT} = \frac{1}{T} \sum_{j=1}^J c_{ij} X_j^*$$

Using (6.11) we can rewrite (6.8) as

$$(6.12) \quad X_i^* + M_i^* \geq \sum_{j=1}^J a_{ij} X_j^* + \frac{1}{T} \sum_{j=1}^J c_{ij} X_j^* + C_i^* + E_i^* - K_{i0} \quad i = 1, \dots, I.$$

The second states that the annual increase in investment demand during the plan period is the same for each year. That is,

$$(6.13) \quad K_{i,t+1}^* = K_{i,t}^* \quad t = 1, \dots, T - 1$$

<sup>4</sup> - The assumption that output responds instantaneously to investment outlays implies for each sector  $i$  (1)  $K_{i,t} = \sum_j c_{ij} X_{jt}^*$ ,  $t = 1, \dots, T$ . Thus (2)  $K_{iT} = \sum_j c_{ij} X_{iT}^*$ . From (6.10) it follows that (3)  $X_{jT}^* = X_{jt}^*$ ,  $t = 1, \dots, T - 1$ , and by definition (4)  $X_j^* = \sum_{t=1}^T X_{jt}^*$ . Using (3) and (4) we get (5)  $X_j^* = T \cdot X_{jT}^*$  which implies (6)  $X_{jT}^* = \frac{1}{T} X_j^*$ . Substituting (6) into (2) gives equation (6.11).

where  $K_{it}$  is the increase in investment demand for sector  $i$ 's output during year  $t$  of the plan. The relationship for investment in the terminal year implied by (6.13) is<sup>5</sup>:

$$(6.14) \quad K_{it} = \frac{2}{T+1} \left( \sum_{j=1}^J c_{ij} X_j^* \right) - \frac{T-1}{T+1} K_{io}.$$

Substituting (6.14) into (6.8) gives

$$(6.15) \quad X_i^* + M_i^* \geq \sum_{j=1}^J a_{ij} X_j^* + \frac{2}{T+1} \left( \sum_{j=1}^J c_{ij} X_j^* \right) + C_i^* + E_i^* - \frac{2T K_{io}}{T+1}.$$

$$i = 1, \dots, I.$$

In addition to reformulating the balance equations (6.8) as either (6.12) or (6.15) the objective function (6.1) requires respecification using (6.9) to give

$$(6.16) \quad \text{Minimize } Z = \sum_{i=1}^I \sum_{j=1}^J c_{ij} X_j^*$$

The revised model now consists of objective function (6.16), balance equations (6.12) or (6.15) and the additional conditions (6.3), (6.4), (6.5) and (6.6).

In the operational version of the model it is convenient to specify the balance equations such that they refer to the terminal year  $T$  of the planning period. This implies that we formulate them such that (6.17) is satisfied.

$$(6.17) \quad X_{iT} + M_{iT} \geq \sum_{j=1}^J a_{ij} X_{jT} + C_{iT} + K_{iT} + E_{iT}$$

$$i = 1, \dots, I.$$

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5 - The derivation is as follows: From (6.13), (1)  $K_{iT}^* = K_{it}^*$   $t=1, \dots, T-1$ .

This implies that the path of investment demand  $K_{it}$ ,  $t=1, \dots, T$  over the plan period follows an arithmetical series. Summation of this series gives

$$(2) \quad \sum_{t=1}^T K_{it} = \frac{T+1}{2} (K_{io} + K_{iT}) - K_{io}. \quad \text{Also, from (6.9), (3) } \sum_{t=1}^T K_{it} = \sum_j c_{ij} X_j^*;$$

therefore, (4)  $\sum_j c_{ij} X_j^* = \frac{T+1}{2} (K_{io} + K_{iT}) - K_{io}$ . Solving (4) for  $K_{iT}$  gives result (6-14).

This simply states that the level of demand (intermediate and final) for each sector's output in the terminal year T of the planning period is equal to or less than the level of supply (domestic production plus imports) in that year.

By assuming that production and consumption increases over the period follow the form of an arithmetical series, it can be easily shown that<sup>6</sup>:

$$(6.18a) \quad X_{it} = X_{io} + X_i^*$$

$$(6.18b) \quad C_{iT} = C_{io} + C_i^*$$

Substituting (6.18) into (6.17) gives

$$(6.19) \quad X_i^* + M_{iT} \geq \sum_{j=1}^J a_{ij} X_j^* + C_i^* + K_{iT} + E_{iT} - X_{io} + C_{io} + \sum_{j=1}^J a_{ij} X_{jo}$$

which will be the operational form of the balance equations.

In the model specified above, two shortcomings may be noted at this juncture. The model deals with international trade in a very general way by including sectoral export and import variables. But, in the first place, it does not consider explicitly transport costs for international trade flows. Secondly, tariffs and quantitative restrictions are an important variable and policy instrument in regional economic integration and the model fails to incorporate the tariff question. We address ourselves to these two weaknesses.

Following Mennes [80] transport costs are viewed as investment expenditures that the country will have to undertake in order to realize the endogenously determined increases in exports and imports of the industrial sectors which have positive trade flows. These investment expenditures are used

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6 - Consider the verification of (6.18a). By definition (1)  $X_i^* = X_{i1}^* + X_{i2}^* + \dots + X_{iT}^*$ . Expansion of (1) gives (2)  $X_i^* = (X_{i1} - X_{io}) + (X_{i2} - X_{i1}) + \dots + (X_{iT} - X_{i, T-1})$ . Simplifying (3)  $X_i^* = X_{iT} - X_{io}$ . Solving (3) for  $X_{iT}$  gives (6.18a). (6.18b) is verified similarly.

to expand the capital stock in the country's international transport network and may involve, for example, improvements of seaport and airport facilities and the purchase of cargo ships. The transport costs for international trade flows are accordingly presented in terms of sectoral incremental capital output ratios between international trade flows and the sectors that produce capital goods used in the international transportation system.

Consider the demand for investment goods of type  $i$  in this situation with transportation costs for international trade flows. From earlier discussion we know that<sup>7</sup>:

$$(6.20) \quad \sum_{t=1}^T K_{it} = \sum_j c_{ij} X_j^*$$

in the absence of transport costs and no investment lags. In this case the level of investment in year  $t$ ,  $K_{it}$  is used to increase capacity in the productive sectors as well as the international transportation network. Consequently, instead of (6.20) we have

$$(6.21) \quad \sum_{t=1}^T K_{it} = \sum_{j=1}^J c_{ij} X_j^* + \sum_{j=1}^J e_{ij} E_j^* + \sum_{j=1}^J m_{ij} M_j^*$$

$$i = 1, \dots, I$$

where

$e_{ij}$  = sectoral incremental capital-output ratio relating to exports of commodity  $j$  and capital goods sector  $i$ ;

$m_{ij}$  = sectoral incremental capital-output ratio relating to imports of commodity  $j$  and capital goods sector  $i$ .

For equation (6.21) it is assumed that investment expenditures in the international transport system are directly proportional to the amount of export and imports that take place. Also the response of exports and imports to an expansion of the transport system is instantaneous. Equation (6.21) is there-

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<sup>7</sup> - Recall equation (6.9).

fore simply an expansion of (6.20) to incorporate the export and import variables.

If the time-paths of exports and imports during the plan period are arithmetical series then <sup>8</sup>

$$(6.22a) \quad E_j^* = E_{jT} - E_{j0}$$

$$(6.22b) \quad M_j^* = M_{jT} - M_{j0}$$

where  $E_{j0}$  and  $M_{j0}$  are respectively the level of exports and imports in the base year (year 0) of the plan period. By substitution of (6.22) into (6.21), we get:

$$(6.23) \quad \sum_{t=1}^T K_{it} = \sum_{j=1}^J c_{ij} X_j^* + \sum_{j=1}^J e_{ij} E_{jT} + \sum_{j=1}^J m_{ij} M_{jT} \\ - \sum_{j=1}^J e_{ij} E_{j0} - \sum_{j=1}^J m_{ij} M_{j0}$$

$$i = 1, \dots, I.$$

With (6.23) we can turn to a derivation of the objective function by recalling (6.1). The result is:

$$(6.24) \quad Z = \sum_{i=1}^I \sum_{j=1}^J c_{ij} X_j^* + \sum_{i=1}^I \sum_{j=1}^J e_{ij} E_{jT} + \sum_{i=1}^I \sum_{j=1}^J m_{ij} M_{jT} \\ - \sum_{i=1}^I \sum_{j=1}^J e_{ij} E_{j0} - \sum_{i=1}^I \sum_{j=1}^J m_{ij} M_{j0}.$$

Consider now the introduction of tariffs. We follow Mennes' convention [80] of viewing tariffs as an obstacle which the exporting country must overcome if it is to sell in foreign markets. The costs incurred by the exporting country in neutralizing the obstacles are a given proportion of the c.i.f. export price of the product. The c.i.f. price is taken to be the sum of production and transport costs. Thus tariff costs are only relevant for exports so that the direct benefits of the trade liberalization effect of economic integration derive from a country being able to increase its exports to partner countries. The tariff costs of a unit export of commodity  $j$  is

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8 - The verification is similar to that of equations (6.18). See footnote 6 above.

$$(6.25) \quad r_j \left( \sum_i c_{ij} + \sum_i e_{ij} \right)$$

where  $r_j$  is the tariff rate on exports of commodity  $j$ .

As with other variables it is assumed that the time path of exports follow an arithmetical series. By applying the rule for the summation of an arithmetic progression, total exports during the planning period is given by:

$$(6.26) \quad \sum_{t=1}^T E_{jt} = \frac{T+1}{2} (E_{j0} + E_{jT}) - E_{j0}$$

$$= \frac{T+1}{2} E_{jT} + \frac{T-1}{2} E_{j0}$$

It is on the value of exports given in (6.26) to which the tariff relation (6.25) must be applied. For exports of commodity  $j$  the total tariff costs,  $R_j$  are:

$$(6.27) \quad R_j = \frac{(T+1)}{2} r_j \left( \sum_i c_{ij} + \sum_i e_{ij} \right) E_{jT}$$

$$+ \frac{(T-1)}{2} r_j \left( \sum_i c_{ij} + \sum_i e_{ij} \right) E_{j0}$$

The manner in which tariff costs enter the problem implies the use by the exporting country of its scarce resources to overcome artificial trade barriers of other countries. Accordingly, (6.27) must be added to the objective function which now becomes:

$$(6.28) \quad Z = \sum_{i=1}^I \sum_{j=1}^J c_{ij} X_j^* + \sum_{i=1}^I \sum_{j=1}^J e_{ij} E_{jT} + \sum_{i=1}^I \sum_{j=1}^J m_{ij} M_{jT}$$

$$- \sum_{i=1}^I \sum_{j=1}^J e_{ij} E_{j0} - \sum_{i=1}^I \sum_{j=1}^J m_{ij} M_{j0}$$

$$+ \sum_j \frac{(T+1)}{2} r_j \left( \sum_i c_{ij} + \sum_i e_{ij} \right) E_{jT} + \sum_j \frac{(T-1)}{2} r_j \left( \sum_i c_{ij} + \sum_i e_{ij} \right) E_{j0}$$

The investment equations corresponding to (6.11) or the earlier formulation can be easily derived by noting (6.23) and recalling the assumption that increases in production as well as international trade flows are of an arith-

metric series. The resulting investment equations are given by:

$$(6.29) \quad K_{iT} = \frac{1}{T} \left\{ \sum_{j=1}^J c_{ij} X_j^* + \sum_{j=1}^J e_{ij} E_{jT} + \sum_{j=1}^J m_{ij} M_{jT} - \sum_{j=1}^J e_{ij} E_{j0} - \sum_{j=1}^J m_{ij} M_{j0} \right\}$$

$$i = 1, \dots, I$$

The explicit introduction of international transport costs and tariff costs, as has just been demonstrated, leads to a reformulation of the investment functions and the criterion function. To undertake international trade investment expenditures must be made in the international transport system in addition to the usual investment outlays to expand productive capacity. Transport costs and tariff costs as they are specified in the model imply the use of the country's scarce capital resources. It is natural that these two variables should alter the objective function which is aimed at minimizing the country's investment outlays in arriving at an income target.

With regard to the balance equations which equate sectoral supplies with demand, inspection of (6.2), (6.8) and (6.12), and in particular the derivation of (6.12) from the other two, will reveal that the balance equations as specified in (6.12) will also be modified. The derivation of the counterpart to (6.12) is straight forward - substitution of (6.29) into (6.8) - and is omitted since, as we have indicated earlier, the operational form of these equations will be (6.19). As specified in (6.19) the balance equations are unaffected by the introduction of international transport costs and tariffs. Of course, the value of  $K_{iT}$  will be determined by (6.29) instead of by (6.11). The equations for the income targets (6.3), (6.4) and the consumption functions (6.5) are likewise unaltered.

It is appropriate at this stage to comment on the number of sectors over which the various summations take place. It should be recognized that the model is still at the level of generality and that when the model is operationalized

the sectors over which summation is carried out will vary. Suppose that the economy is divided into seven sectors and one sector has the property that its output is not traded internationally. For example, some services and construction output are not tradeable. For this sector it is clear that the value of the import and export variables is zero. In such a case the summation may be interpreted in one of two equally satisfactory ways. First, summation is applied over all seven sectors with the value of the autarkic sector being zero. Second, summation can be taken over only those sectors that produce commodities that are internationally tradeable. A similar argument applies to consumption and investment. Thus if sector one produces only capital (consumer) goods, the summation for consumption (investment) will exclude sector one, or alternatively sector one is included in the summation but has a zero value.

As a form of summary of the preceding discussion the key relations of the model of nationalistic development planning are repeated.

Objective function:

(6.28) Minimize

$$\begin{aligned}
 Z = & \sum_i \sum_j c_{ij} X_j^* + \sum_i \sum_j e_{ij} E_{jT} \\
 & + \sum_i \sum_j m_{ij} M_{jT} - \sum_i \sum_j m_{ij} M_{j0} \\
 & - \sum_i \sum_j e_{ij} E_{j0} + \frac{\sum_j (T+1)}{2} r_j (\sum_i c_{ij} + \sum_i e_{ij}) E_{jT} \\
 & + \frac{\sum_j (T-1)}{2} r_j (\sum_i c_{ij} + \sum_i e_{ij}) E_{j0}
 \end{aligned}$$

Aggregate income relations:

$$(6.3) \quad Y^* = \sum_j a_{0j} X_j^*$$

$$(6.4) \quad Y^* \geq \bar{Y}$$

Material balance constraints:

$$(6.19) \quad X_i^* + M_{iT} \geq \sum_j a_{ij} X_j^* + C_i^* + K_{iT} + E_{iT} - \\ - X_{i0} + C_{i0} + \sum_j a_{ij} X_{j0} \\ i = 1, \dots, I.$$

Consumption functions:

$$(6.5) \quad C_i^* = b_i Y^* \quad i = 1, \dots, I.$$

Investment equations:

$$(6.29) \quad K_{iT} = \frac{1}{T} \{ \sum_j c_{ij} X_j^* + \sum_j e_{ij} E_{jT} + \sum_j m_{ij} M_{jT} \\ - \sum_j e_{ij} E_{j0} - \sum_j m_{ij} M_{j0} \} \\ i = 1, \dots, I.$$

Non-negativity constraints:

$$(6.6) \quad X_i^* \geq 0, C_i^* \geq 0, Y^* \geq 0, M_{it} \geq 0, E_{it} \geq 0, K_{it} \geq 0, X_{it} \geq 0, C_{it} \geq 0 \\ i = 1, \dots, I; j = 1, \dots, J; T = 1, \dots, T.$$

### 6.3 A Model of Coordinated Development Planning in an Integration Scheme

The discussion in Section 6.2 has set the background for the model of coordinated development planning in the integration scheme. Each participating country will have a nationalistic planning alternative along the lines outlined there. Here we assume that the member countries have decided to harmonize their individual planning processes. Some or all planning objectives will now be pursued on a region-wide basis.<sup>1</sup>

The notation used for the present model draws upon that used in the previous section. For ease of reference it is given below:

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1 - For an alternative model of multi-country plan harmonization, see Mycielski [83].

- $X_{ip}^*$  = the increase in production in sector  $i$  of member country  $p$  during the plan period.
- $C_{ip}^*$  = the increase in consumption of commodity (produced in sector)  $i$  in country  $p$  during the plan period.
- $K_{ip}^*$  = the increase in demand in country  $p$  for investment goods of type  $i$  during the plan period.
- $E_{ip}^*$  = the increase in exports of commodity  $i$  by country  $p$  to non-member countries during the plan period.
- $M_{ip}^*$  = the increase in imports of commodity  $i$  by country  $p$  from non-member sources during the plan period.
- $E_{ipp'}^*$  = the increase in exports of commodity  $i$  by country  $p$  to partner country  $p'$  during the plan period.
- $M_{ipp'}^*$  = the increase in imports of commodity  $i$  by country  $p$  from partner country  $p'$  during the plan period.
- $C_p^*$  = the increase in aggregate consumption in country  $p$  during the plan period.
- $Z$  = value of the objective function.
- $a_{ijp}$  = input-output coefficients for country  $p$ ; input of commodity  $i$  needed to operate production activity  $j$  at the unit level in country  $p$ .
- $a_{ojp} = (1 - \frac{I}{\sum_{i=1}^I a_{ijp}})$  = value-added coefficient of sector  $j$  in country  $p$ .
- $b_{ip}$  = marginal propensity to consume commodity  $i$  in country  $p$ .
- $c_{ijp}$  = the partial incremental capital-output ratio between capital goods  $i$  and sector  $j$  in country  $p$ .
- $e_{ijp}$  = sectoral incremental capital-output ratio relating to nonregional exports of commodity  $j$  and capital goods  $i$  in country  $p$ .
- $m_{ijp}$  = sectoral incremental capital-output ratio relating to nonregional imports of commodity  $j$  and capital goods  $i$  in country  $p$ .

- $u_{ijpp'}$  = the partial incremental capital-output ratio of the intra-regional trade flow  $j$  from partner country  $p$  to partner country  $p'$  with respect to capital good  $i$ .
- $r_{jp}$  = tariff rate imposed by other countries on country  $p$ 's exports of commodity  $j$ .
- $T$  = length of the plan period in years.
- $P$  = number of countries in the economic integration scheme.
- $Y_p^*$  = the increase in aggregate output in country  $p$  during the plan period.
- $\bar{Y}_p, \bar{Y}$  = exogenously determined values of  $Y_p^*$  and  $Y^*$  respectively.
- $Y^*$  = the increase in aggregate income of the entire integration region over the planning period.
- $X_{jpt}$  = level of output of sector  $j$  in country  $p$  during year  $t$ ;  $t = 0, 1, \dots, T$ ;  $p = 1, \dots, P$ .
- $C_{ipt}$  = level of consumption demand of commodity  $i$  in country  $p$  during year  $t$  of planning period.
- $K_{ipt}$  = the level of investment demand for commodity  $i$  in partner country  $p$  at time period  $t$ .
- $E_{ipt}$  = the level of exports of commodity  $i$  by country  $p$  to non-member countries during year  $t$  of the plan.
- $M_{ipt}$  = the level of imports of commodity  $i$  by country  $p$  from non-member sources during year  $t$ .
- $E_{jpp't}$  = the level of exports of commodity  $j$  by country  $p$  to partner country  $p'$  during year  $t$  of the plan period.
- $M_{jpp't}$  = the level of imports of commodity  $j$  by country  $p$  from partner country  $p'$  during year  $t$ .
- $\bar{C}_p$  = exogenously determined value of  $C_p^*$ .

In the discussion that follows the assumptions made in the previous section regarding time-path of the variables and the nature of international transport costs and tariffs apply. The aim of the planning model for the integration area is to minimize the total investment costs incurred by all member countries in attempting to arrive at their set targets.

Consider first the investment equations of the model of regionally coordinated development planning. The investment expenditures, as we have seen before, are used to increase productive capacity in the various sectors of each economy and to expand where appropriate the international transportation network. If, for the moment, it is assumed that transportation costs are zero, then investment in the integration area during the terminal year of the plan period is given by:

$$(6.30) \quad K_{ipT} = \frac{1}{T} \sum_j c_{ijp} X_{jp}^*$$

$$i = 1, \dots, I; p = 1, \dots, P.$$

A comparison of (6.30) and (6.11) will reveal that the former is simply the latter extended over the P partner countries of the regional grouping.

Two types of trade flows are distinguished in the present case, intra-regional trade flows and trade with countries not belonging to the economic integration scheme. Investment costs for the transportation system must be related to these two types of trade flows. The specification of investment outlays for extra-regional trade flows is on the basis of transport costs in the single-country model of the previous section as reflected in equation (6.29). For intra-regional trade it is assumed that the two partner countries involved in a trade transaction each undertake investment spending on the transportation system. As in the previous case such investment costs are proportional to the amount of trade taking place. Appropriate adjustment of the single-country planning investment equation (6.29), or alternatively, expansion of

(6.30) to account for transport costs of the two types of trade flows, gives equation (6.31) for investment outlays in the terminal year of the plan.

$$\begin{aligned}
 (6.31) \quad K_{ipT} = & \frac{1}{T} \left\{ \sum_j c_{ijp} X_{jp}^* + \sum_j e_{ijp} E_{jpt} + \sum_j m_{ijp} M_{jpt} \right. \\
 & + \sum_{p'} \sum_j u_{ijpp'} E_{jpp'T} + \sum_{p'} \sum_j u_{ijp'p} M_{jpp'T} \\
 & - \sum_j e_{ijp} E_{jpo} - \sum_j m_{ijp} M_{jpo} \\
 & \left. - \sum_{p'} \sum_j u_{ijpp'} E_{jpp'o} - \sum_{p'} \sum_j u_{ijp'p} M_{jpp'o} \right\}
 \end{aligned}$$

$$i = 1, \dots, I; \quad p = 1, \dots, P; \quad p \neq p'.$$

In equations (6.31) the first term on the right of the equality sign represents investment to expand productive activity of the various sectors, while the second and third terms account for expansion of the transportation system to facilitate trade with non-regional countries. The investment necessary to undertake trade among the members of the economic union is given by the fourth and fifth terms. The remaining terms incorporate some initial conditions for international trade. They are required to make the specification consistent since as given in (6.31) the investment is for the terminal year of the plan. It may be noted also that, excluding transport costs,  $E_{jpp't}$  is identical to  $M_{jp'pt}$  for all time periods  $t = 0, 1, \dots, T$  of the plan and for all partner countries,  $p \neq p'$ .

Consider next the objective function of the model of coordinated development planning. For the case of zero transport costs for international trade flows and no tariffs the objective function is given by:

$$(6.32) \quad \text{Minimize} \quad Z = \sum_p \sum_i \sum_j c_{ijp} X_{jp}^* .$$

Equation (6.32) is simply equation (6.16) summed over the member countries of the regional economic integration scheme. Thus some of the adjustments required to change the objective function of the nationalistic planning model to its

counterpart for the integration area are quite straightforward.

If tariffs are taken into account it is reasonable that tariff costs related to intra-regional trade will be zero since artificial barriers have been removed from such trade by the integration regime. But tariff costs will obviously remain on each member's trade with non-regional countries. Thus the objective function will include two terms similar to those given in equation (6.27).

In the case of transport costs, the investment outlays incurred to facilitate trade are broken down, as noted earlier, into those related to intra-regional trade and those related to trade with non-member countries. In summary, the objective function, which is to be minimized, consists of investment outlays to (i) increase productive capacity in each member country, (ii) make improvements in that part of the transportation system used to carry on trade with non-member countries, (iii) facilitate intra-regional trade by expanding the transport system geared for this purpose, and (iv) absorb the tariff costs involved in extra-regional trade. The objective function is:

$$\begin{aligned}
 (6.33) \text{ Minimize } Z = & \sum_p \sum_i \sum_j c_{ijp} X_{jp}^* + \sum_p \sum_i \sum_j e_{ijp} E_{jpT} \\
 & + \sum_p \sum_i \sum_j m_{ijp} M_{jpT} + \sum_p \sum_{p'} \sum_i \sum_j u_{ijpp'} E_{jpp'T} \\
 & + \sum_p \sum_{p'} \sum_i \sum_j u_{ijpp'} M_{jpp'T} \\
 & + \frac{(T+1)}{2} \sum_p \sum_i \sum_j (c_{ijp} + e_{ijp}) r_{jp} E_{jpT} \\
 & - \sum_p \sum_i \sum_j e_{ijp} E_{jpo} - \sum_p \sum_i \sum_j m_{ijp} M_{jpo} \\
 & - \sum_{pp'i} \sum_j u_{ijpp'} E_{jpp'o} - \sum_{pp'i} \sum_j u_{ijpp'} M_{jpp'o} \\
 & - \frac{(T-1)}{2} \sum_p \sum_i \sum_j (c_{ijp} + e_{ijp}) r_{jp} E_{jpo} \quad p \neq p.
 \end{aligned}$$

The terms on the right hand side of (6.33) can be identified with the four types of investment outlays just mentioned. The first term corresponds to (i), the second and third to (ii), the fourth and fifth terms to (iii)<sup>1</sup>, while the sixth term represents (iv). Note that the variables in all these terms except the first apply to the terminal year T of the planning period. The base year values (which are predetermined) corresponding to (ii), (iii) and (iv) are given in terms seven and eight, terms nine and ten, and term eleven respectively. As noted earlier, these initial conditions are necessary to make the model specification consistent.

The sectoral material balance constraints require little discussion. It suffices to recall equation (6.19) which ensures that for the nationalistic planning model the total supply of each sector (domestic production plus imports) will be at least as equal to total sectoral demand. For regionally coordinated development planning the same requirement must be satisfied for each sector in every member country. Whereas in the former case there is need for only one set of variables for exports and imports ( $E_{it}$ ,  $M_{it}$ ) the present situation necessitates two sets of trade variables ( $E_{ipt}$ ,  $M_{ipt}$ ;  $E_{ipp't}$ ,  $M_{ipp't}$ ). This is because of the distinction between intra-regional and extra-regional trade made in the integration model. Equation (6.34) gives the sectoral material balance constraints.

$$(6.34) \quad X_{ip}^* + M_{ipT} + \sum_p M_{ipp'T} \geq \sum_j a_{ijp} X_{jp}^* + C_{ip}^* + K_{ipT} \\ + E_{ipT} + \sum_p E_{ipp'T} \\ - X_{ipo} + C_{ipo} + \sum_j a_{ijp} X_{jpo}$$

$$i = 1, \dots, I; p = 1, \dots, P.$$

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1 - The fourth and fifth terms indicate that total intra-regional trade is included twice - exports and imports. This may seem to involve double counting. The specification of (6.33) however, implies that to undertake a particular intra-regional trade transaction both the importing and the exporting country incur transportation investment costs.

We turn now to the income growth targets. Where the country decides to pursue its economic development planning on its own, its economic growth target over the planning period is given by equations (6.3) and (6.4). Where the country adopts a strategy of regional economic integration, whether it aims at an individual growth target for aggregate income or at a combined regional economic growth target with its partners depends upon the level of economic integration chosen. (Recall the various stages of economic integration discussed in Chapter 3.) Also, we have argued in Chapter 4 that an appropriate economic integration scheme for small underdeveloped countries should include coordinated global development planning as well as industrial programming of new productive activities. In addition the analysis of the ECCM Agreement in Chapter 5 clearly revealed that the planning approach just mentioned is intended to be an integral part of the ECCM. Nevertheless, it must be admitted, as we did in Chapter 5, that at its present stages of evolution the ECCM is more accurately described as a customs union. With the above factors in mind it seems appropriate that the planning model of the economic integration area should have two variants. In the first, the economic growth targets for the members are specified individually and in the other a common economic growth target for the economic integration scheme is formulated. The first would be consistent with the present structure of the ECCM. The second would be in line with the avowed intention of the participating countries of the ECCM to have regional coordinated planning, including a common regional policy for the allocation among members of new industrial enterprises and a scheme to equitably distribute the benefits of regional integration. Stated another way, the first variant would correspond to the planning process in a customs union while the other would reflect the planning regime in a complete economic union.

For the first variant the income-increase targets are given by equations (6.35) and (6.36).

$$(6.35) \quad Y_p^* = \sum_j a_{ojp} X_{jp}^* \quad p = 1, \dots, P.$$

$$(6.36) \quad Y_p^* \geq \bar{Y}_p \quad p = 1, \dots, P.$$

The income growth target for the case of complete economic union or common market cum coordinated planning is given by equation (6.37) and (6.38).

$$(6.37) \quad Y^* = \sum_p Y_p^* = \sum_p \sum_j a_{ojp} X_{jp}^*$$

$$(6.38) \quad Y^* \geq \bar{Y}$$

The consumption function for the customs union variant of the economic integration model are similar to those in the nationalistic planning model. The partner countries coordinate their commercial policies but pursue independent policies relating to the target values of growth in domestic consumption and income. The consumption functions are given in (6.39).

$$(6.39) \quad C_{ip}^* = b_{ip} Y_p^* \quad i = 1, \dots, I; \quad p = 1, \dots, P.$$

In fact, the form of the consumption functions is taken to be the same irrespective of the particular development planning regime; that is, irrespective of whether an economic integration scheme exists, and if so whether it is a customs union or a common market cum coordinated planning. Consequently, the consumption functions for the complete economic union variant of the model are given as well by (6.39). Member countries coordinate their commercial, development planning and industrial location policies but establish independent consumption relations which in the specific formulation of (6.39) are related to realized magnitudes of income growth achieved through the common integration area planning process.

For political or other reasons it might be necessary to ensure that the consumption of a commodity, or more realistically aggregate consumption, is at least equal to that level of consumption that would occur without an inte-

gration scheme or an integration scheme without coordinated development planning. In such an event a second relation is required to force the solution for consumption above or equal to the minimum value. If the constraint is on aggregate consumption it may be formulated as:

$$(6.40) \quad \sum_i C_{ip}^* = C_p^* \geq \bar{C}_p$$

$$p = 1, \dots, P$$

where  $\bar{C}_p$  is the minimum increase in consumption allowed over the planning period.

An alternative specification of the consumption relations is to use a linear approximation of the constant expenditure elasticity demand function:

$$(6.41) \quad C_i = d_i' C^w$$

where  $C_i$  is consumption demand of commodity  $i$  during a given period,  $C$  is aggregate consumption demand,  $d_i'$  is a constant and  $w_i$  is the expenditure elasticity, the percentage change of the  $i$ -th consumption good with respect to the percentage change in aggregate consumption. The linear approximation is

$$(6.42) \quad C_i = d_i + w_i C$$

where  $d_i$  is a constant and  $w_i$  is the proportionate change in consumption of commodity  $i$  as aggregate consumption increases.<sup>2</sup> Recalling that consumption functions are specified as change in consumption over the planning period we derive from (6.42) the alternative consumption formulation (6.43).

$$(6.43) \quad C_{ip}^* = w_{ip} C_p^*$$

$$i = 1, \dots, I; \quad p = 1, \dots, P.$$

An equation for aggregate consumption in each partner country,  $C_p^*$  is now re-

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2 - The inverse of  $w_i$  is the weight for deriving the aggregate marginal propensity to consume from the marginal propensity to consume commodities of a particular sector. That is, from (6.39) and (6.43) it can be easily shown that  $\frac{\Delta C_i}{\Delta Y} = b_i$  and  $\Delta C = \frac{b_i}{w_i} \Delta Y$

quired to complete the specification. It is given by:

$$(6.44) \quad C_p^* = \sum_i C_{ip}^*$$

$$p = 1, \dots, P.$$

It may be noted that the discussion concerning the imposition of a minimum value on  $C_p^*$  also applies to this formulation of the consumption functions.

Finally we have the non-negativity constraints on the variables of the model:

$$(6.45) \quad X_{ip}^*, C_{ip}^*, K_{ip}^*, E_{ip}^*, M_{ip}^*, E_{ipp}^*, M_{ipp}^*, C_p^*, Y_p^*, Y^*, \\ X_{ipt}, C_{ipt}, K_{ipt}, E_{ipt}, M_{ipt}, E_{jpp}^t, M_{jpp}^t, \geq 0.$$

To recapitulate, the model of multi-country development planning consists of objective function (6.33), aggregate income relations (6.35) and (6.36) or (6.37) and (6.38), material balance constraints (6.34), consumption relations (6.39) and (6.40) or (6.43) and (6.44), and the non-negativity constraints (6.45).

#### 6.4 Industrial Programming and Economic Integration

The development planning model outlined in Section 6.3 suggests an approach to region-wide planning for an economic integration grouping. The sectors of the member economies are permitted to increase their productive capacity based upon the solution of the multi-sector linear programming model. The solution of the model also indicates how much investment should be undertaken in the international transportation system to facilitate the increase in trade - intra-regional and extra-regional - that may result.

One weakness of the model of Section 6.3, in terms of its relevance to economic integration among underdeveloped countries, is that it fails to consider explicitly new productive activities. Strictly speaking, the growth of output in each member country and the region as a whole is limited to existing productive activities. This means that the structural transformation of the

regional economy can only be accomplished through varying sectoral growth rates. A more realistic model of planning must explicitly allow for new productive activities. The model of the previous section does allow for new activities implicitly. This derives from the broad interpretation of sector. Thus, for example, a solution of the model which says that the manufacturing sector should expand may mean expanding the output of existing manufacturing products or commencing production of a new manufacturing product. But the model does not indicate which one. A satisfactory distribution of the benefits of economic integration and coordinated planning requires that the new projects be identified. The model presented in this section will explicitly distinguish the new productive activities in the economic integration planning regime.

Another feature of the model to be presented is that it retains the general equilibrium input-output framework of the previous two sections. As is well known, if there is little or no interdependence among projects and existing sectors the partial equilibrium tools of project analysis using rate of return or present value criteria are satisfactory for investment decisions. However, when the projects under scrutiny are likely to have important inter-industry ramifications or significantly affect aggregate magnitudes general equilibrium analysis is the appropriate method. Given the extremely small size of the ECCM countries, individually and collectively, it is very likely that investment decisions that can legitimately be dealt with by partial equilibrium analysis in larger underdeveloped countries would warrant general equilibrium analysis since the impact of the new projects is quite probably significant. In any event a partial equilibrium approach to regional industrial programming is presented in the following section.

The discussion in the previous two sections have provided the general features of the models used in this study. Consequently, the model specifica-

tion in this section will be accompanied by a minimum amount of discussion. Indeed the present model is simply extensions of those presented earlier. Accordingly, except for new variables and parameters the notation used here is identical to those used in Sections 6.2 and 6.3. The model of coordinated industrial programming for the economic integration scheme is discussed first, its nationalistic surrogate afterwards.

Consider first the investment equations. The investment equations for the present model for project programming and allocation are similar to those in the model of Section 6.3. Here, in addition to the investment costs to increase productive capacity in established activities and in the international transportation network, there is also investment outlays for new projects. This formulation assumes that economies of scale are characteristic of the new projects. It was seen in an earlier chapter that the existence of economies of scale is an important reason for economic integration and coordinated planning of industries. The investment equations are given by relation (6.46).

$$\begin{aligned}
 (6.46) \quad K_{ipT} = & \frac{1}{T} \left\{ \sum_j^{J+J'} c_{ijp} X_{jp}^* + \sum_j^{J'} u_{jpp} A_{ijp} + \sum_j^{J+J'} e_{ijp} E_{jppT} \right. \\
 & + \sum_j^{J+J'} m_{ijp} M_{jppT} + \sum_{p',j}^{J+J'} u_{ijpp'} E_{jpp'T} + \sum_{p',j}^{J+J'} u_{ijp'p} M_{jpp'T} \\
 & - \sum_j^J e_{ijp} E_{jpo} - \sum_j^J m_{ijp} M_{jpo} \\
 & \left. - \sum_{p',j}^J u_{ijpp'} E_{jpp'o} - \sum_{p',j}^J u_{ijp'p} M_{jpp'o} \right\} \\
 & i = 1, \dots, I; p = 1, \dots, P; p \neq p.
 \end{aligned}$$

where in addition to the variables and parameters defined earlier,  $u_{jpp}$  represents zero-one variables,  $A_{ijp}$  is the fixed requirement of capital goods  $i$  required for new productive activity  $j$  in member country  $p$ , and  $J$  is the number of new projects.

It is clear that equations (6.46) bear a close resemblance to (6.31) of the model in Section 6.3. Indeed the differences between them concern the number of sectors and projects over which summation is taken and the inclusion in (6.46) of the term  $\sum_{jp} u_{jp} A_{ijp}$  to account for the fixed requirement cost component of the new projects. It will be useful to identify the terms of (6.46). First it should be noted that the investment equations are specified for the target year T of the planning period. Also, it should be obvious that the assumption, made in the previous sections, that production, exports and imports increase over the plan period according to arithmetic series, applies here as well. The first term within the brackets on the right hand side of (6.46) accounts for demand for capital goods i by all of the productive sectors, including the variable investment cost component of the new projects. Hence the summation over J + J' productive activities. The second term gives the fixed requirement cost component of the new projects, so that summation is carried over the new J' projects only. Together with the variable cost component in the first term, the fixed requirement formulation is one way of accounting for the economies of scale in new projects. This point will be elaborated presently. The third and fourth terms of (6.46) give the investment demand in year T to cover improvements in the transport network used for extra-regional trade, while the fifth and sixth terms relate to investment for the intra-regional transportation system. The remaining terms stipulate initial (base year) conditions in the transportation system.

The investment relations for the new integration projects implied by equations (6.46) are given by:

$$(6.47) K_{ipT} = \frac{1}{T} \left\{ \sum_j^{J'} c_{ijp} X_{jp}^* + \sum_j^{J'} u_{ip} A_{ijp} \right\}$$

$$i = 1, \dots, I; p = 1, \dots, P.$$

Equations (6.47) are derived by utilizing a linear approximation to the constant

elasticity capacity cost function which incorporated the assumed economies of scale. This approach has been used by Kendrick [67 ], Mennes [80 ], Westphal [104] and Vietorisz and Manne [101]. Abstracting from inter-industry relationships, the constant elasticity investment cost function for a new project is of the form

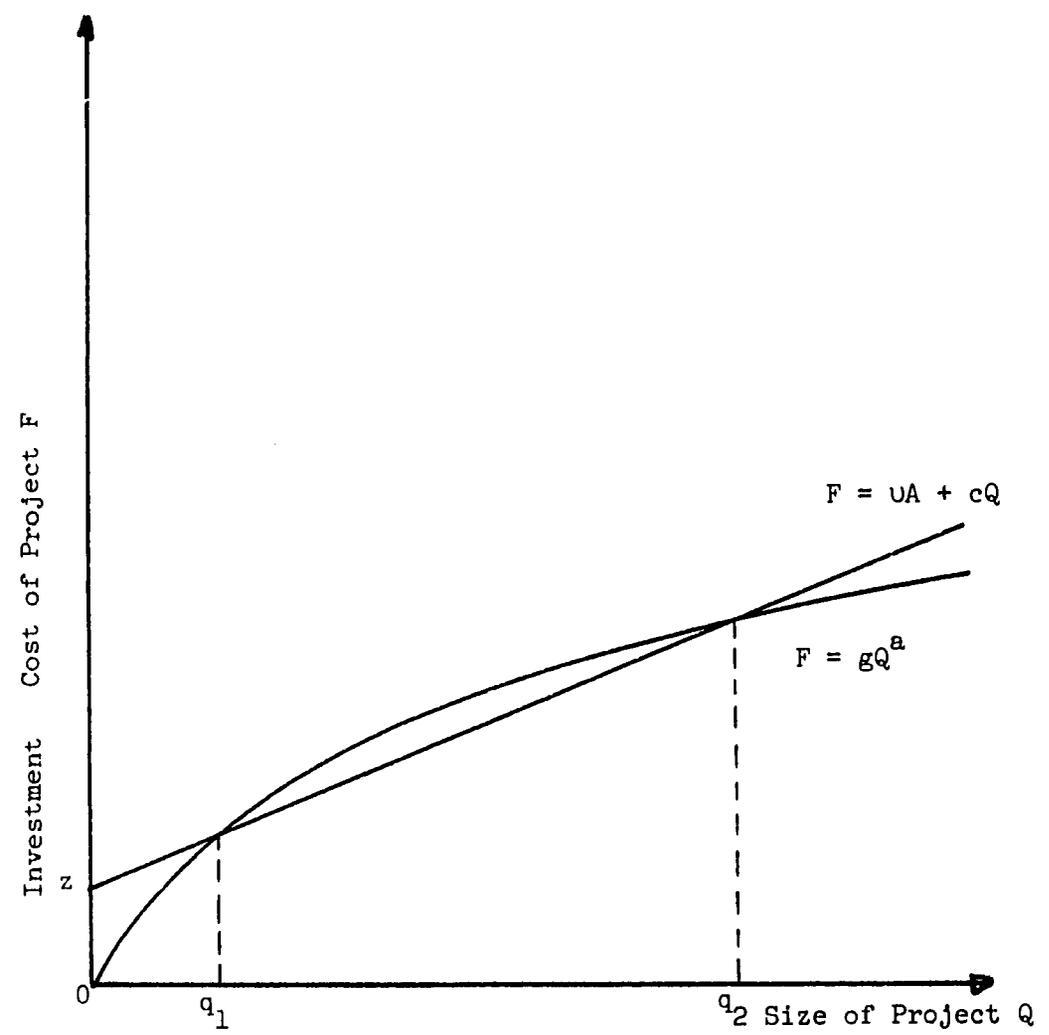
$$(6.48) \quad F = gQ^a$$

where  $F$  is total investment costs,  $g$  is a factor of proportionality,  $a$  is the elasticity of investment costs relative to scale, and  $Q$  is the capacity or size of the project constructed. The linear fixed requirement approximation for (6.48) is

$$(6.49) \quad F = uA + cQ$$

where  $A$  is the fixed cost of establishing the project,  $c$  is variable investment cost, and  $u$  is a zero-one variable which takes on a value of zero if the project is not undertaken and a value of one if the project is carried out. If the project is not undertaken fixed investment costs are not incurred. Equation (6.47) is simply (6.49) with  $J$  new projects and taking into account assumptions made earlier. A graphical formulation of (6.48) and (6.49) is shown in Figure 6.1.

It should be noted, as Westphal [104, pp. 39-40] has made clear, that although the fixed requirement approximation is very satisfactory over a wide range of project scale ( $q_1, q_2$  in Figure 6.1), the optimal solution for the programming model using the fixed requirement approximation need not be the same as the optimal solution of the programming model with the constant elasticity cost function. The choice of the fixed requirement approximation relates to the fact that given existing programming techniques it "can be used in a numerically solvable, multi-sectoral optimization model" unlike the constant elasticity function [Westphal p. 39]. Also, it is obvious that the average



$F = gQ^a$ : Constant Elasticity Cost

$F = UA + cQ$ : Fixed Requirement Cost

Figure 6.1: Investment Cost Functions

costs of a project,  $c + A/Q$  will decline as project size  $Q$  increases.

Finally, the introduction of the zero-one variables  $u_{jp}$  transforms the problem to one of mixed integer programming from standard linear programming.

The objective function of the programming problem is given in (6.50).

$$\begin{aligned}
 (6.50) \quad Z = & \sum_p \sum_i \sum_j c_{ijp} X_{jp}^* + \sum_p \sum_i \sum_j u_{jp} A_{ijp} + \sum_p \sum_i \sum_j e_{ijp} E_{jpT} \\
 & + \sum_p \sum_i \sum_j m_{ijp} M_{jpT} + \sum_p \sum_{p'} \sum_i \sum_j u_{ijpp'} E_{jpp'T} \\
 & + \sum_p \sum_{p'} \sum_i \sum_j u_{ijp'p} M_{jpp'T} + \frac{T+1}{2} \sum_p \sum_i \sum_j (c_{ijp} + e_{ijp}) r_{jp} E_{jpT} \\
 & - \sum_p \sum_i \sum_j e_{ijp} E_{jpo} - \sum_p \sum_i \sum_j m_{ijp} M_{jpo} - \sum_p \sum_{p'} \sum_i \sum_j u_{ijpp'} E_{jpp'o} \\
 & - \sum_p \sum_{p'} \sum_i \sum_j u_{ijp'p} M_{jpp'o} + \frac{(T-1)}{2} \sum_p \sum_i \sum_j (c_{ijp} + e_{ijp}) r_{jp} E_{jpo} \quad p \neq p'.
 \end{aligned}$$

The objective function states that the task is to minimize the total investment costs, while achieving the income growth targets. The total investment costs on the right hand side of (6.50) are comprised of (i) the investment costs to expand established productive capacity and the variable investment costs of new projects (the first term), (ii) the fixed requirement investment costs of new projects (second term), (iii) the investment costs to expand the transportation system for extra-regional trade (third and fourth terms), (iv) the investment outlays to improve the transportation network for intra-regional trade (fifth and sixth terms), and (v) the financial costs involved in exporting to non-member countries which impose import duties or quantitative restrictions on their imports from the integration countries (seventh term). The remaining terms (terms eight to twelve) represent conditions for the extra-regional and intra-regional transportation networks and for tariff costs in the base year of the planning period.

An important feature of the model should be noted. Intra-regional trade is not subject to any tariffs or quantitative restrictions; project programming

takes place within the framework of a full customs union. This explains the absence of a term for tariff costs on intra-regional trade in equation (6.50). The only tariff costs are those on extra-regional exports. For partner country  $p$  and exports of commodity  $j$  they are given by (recall equation (6.27)):

$$(6.51) \quad R_{jp} = \frac{T+1}{2} \sum_i (c_{ijp} + e_{ijp}) r_{jp} E_{jpT} \\ + \frac{T-1}{2} \sum_i (c_{ijp} + e_{ijp}) r_{jp} E_{jpo} \\ j = 1, \dots, J \\ p = 1, \dots, P.$$

where  $R_{jp}$  = total tariffs costs incurred by country  $p$  in exporting commodity  $j$  to non-regional countries. Relation (6.51) summed over  $J$  export commodities and  $P$  partner countries appears as terms eight and twelve in (6.50).

Note that in specifying the tariff costs the assumption, made in Section 6.2, that these costs are directly proportional to the cost of exports is not strictly followed for the new projects. Specifically, the fixed requirement costs of new projects are excluded; tariffs are assumed to be proportional to the sum of variable production costs and transport costs. For projects with small levels of output, the exclusion of fixed investment costs, which weigh heavily in unit costs, will lead to average production costs being seriously underestimated. This in turn will understate the tariff costs. However, for projects of large size the underestimation will not be serious since average investment costs,  $c + A/Q$  (from (6.49)) will asymptotically approach average variable investment costs,  $c$ , as project size increases.

The sectoral material balance constraints are similar to those of the model of the previous section. Hence very little need be said about them. As in (6.34) they are specified for the term year  $T$  of the planning period and they ensure that sectoral supply is at least equal to sectoral demand. The constraints appear in relation (6.52).

$$\begin{aligned}
 (6.52) \quad X_{ip}^* + M_{ipT} + \sum_{p'} M_{ipp'T} &\geq \sum_{j \in J+J'} a_{ijp} X_{jp}^* + C_{ip}^* + K_{ipT} \\
 &+ E_{ipT} + \sum_{p'} E_{ipp'T} + C_{ipo} \\
 &- X_{ipc} + \sum_j^J a_{ijp} X_{jpo}
 \end{aligned}$$

$$i = 1, \dots, I, \dots, I'; p=1, \dots, P.$$

Two points should be noted. First, there are constraints for  $I + I'$  sectors and projects,  $I$  being the number of established sectors and  $I'$  the number of new projects. Since initial (base year) domestic production for each of the  $I$  projects is by definition zero the second to last term of (6.52),  $X_{ipo}$  disappears for the  $I'$  projects. Also, the summation for the last term is over the  $J$  established sectors only. Second, on similar reasoning the summation of the first term to the right of the inequality sign is over  $J + J'$ , the established sectors and new projects. Of course, the optimal solution of the model may indicate that some new projects are not undertaken, in which case their solution production levels will be zero.

The form of the income growth targets depends upon the level of economic integration within which development planning and programming of new projects takes place. For a customs union each participating country will retain its individual targets for growth in aggregate output. The income increase targets would take the form:

$$(6.53) \quad Y_p^* = \sum_j^{J+J'} a_{ojp} X_{jp}^*$$

$$p = 1, \dots, P$$

$$(6.54) \quad Y_p^* \geq \bar{Y}_p$$

$$p = 1, \dots, P.$$

Except for the fact that growth may result from one or more of the  $J'$  new development projects being established in partner country  $p$ , the present specification

is identical to that in Section 6.3.

For the common market or complete economic union case, income growth targets for the countries are set collectively. The income growth targets are given by (6.55) and (6.56).

$$(6.55) \quad Y^* = \sum_p Y_p^* = \sum_p \sum_{J+J'} a_{ojp} X_{jp}^*$$

$$(6.56) \quad Y^* \geq \bar{Y}$$

The formulation (6.55) and (6.56) differ from (6.37) and (6.38) only in that for the former, summation of value-added is taken over the new projects as well as the established sectors. It should be noted that in both types of economic integration schemes the income targets are given in terms of increases over the entire planning period. The assumption, made in earlier sections, that output follows the path of an arithmetic series during the planning period applies here. This permits the determination of aggregate income levels for the terminal year of the plan from the predetermined base year level and the optimal value of  $Y_p^*$  or  $Y^*$  given by the solution of the model.

In relations (6.57) and (6.58) two alternative specifications of the consumption functions are given. They correspond to (6.39) and (6.43) respectively.

$$(6.57) \quad C_{ip}^* = b_{ip} Y_p^*$$

$$i = 1, \dots, I, \dots, I; p = 1, \dots, P.$$

$$(6.58) \quad C_{ip}^* = w_{ip} C_p^*$$

$$i = 1, \dots, I, \dots, I; p = 1, \dots, P.$$

Equations (6.59) which give the aggregate consumption functions for the  $p$  countries of the economic integration scheme is required to complete the specification of (6.58).

$$(6.59) \quad c_p^* = \sum_i^{I+I'} c_{ip}^*$$

$$p = 1, \dots, P.$$

Three other sets of constraints complete the general model of coordinated planning and project programming. These are (i) the fixed requirement constraints, (ii) the integrality constraints, and (iii) the non-negativity constraints. The first set of constraints is given by relation (6.60):

$$(6.60) \quad B_{jp} u_{jp} - X_{jp}^* \geq 0$$

$$j = J' \text{ new projects}$$

where  $B_{jp}$  is the maximum possible scale of new project  $j$  that can be constructed in country  $p$ . Condition (6.60) is required in order that the fixed requirement for capacity expansion, as given in (6.47), will be met if capacity is constructed in a new sector; that is, if a new project is undertaken. As Westphal [p. 42] points out:

The fixed requirement variable must be at least as large as the fraction given by the size of the plant constructed over the size of the largest permissible plant. Depending upon market size and plant design technology, these constraints may be purely fictitious (as is likely in applications to less developed countries) in the sense that they do not reflect technologically imposed limits to plant scale but rather are required for correct mathematical specification.

When  $B_{jp}$  is fictitious it is given a large enough value so that the constraint will not be a binding one on the optimal solution.<sup>1</sup>

The integrality constraints concern the zero-one variables,  $u_{jp}$ . If the project in question is undertaken  $u_{jp}$  assumes the value of one; if the project is not carried out  $u_{jp}$  is set equal to zero. Note that a project is defined both in terms of its sectoral ( $j$ ) and locational ( $p$ ) features. The integrality constraints appear as (6.61).

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1 - In certain cases it may be appropriate to impose binding constraints even though they are fictitious in a strict technological sense. For example, a postulated resource bottleneck in skilled or managerial personnel can be accommodated in this fashion.

$$(6.61) \quad u_{jp} = 0 \text{ or } 1$$

$j = \text{all new } J' \text{ projects; } p = 1, \dots, P$

The final set of constraints, the non-negativity condition on the variables, is given in (6.62)

$$(6.62) \quad X_{ip}^*, E_{ipt}, M_{ipt}, E_{ippt}, M_{ippt}, K_{ipt}, C_{ip}^*, C_{ipt}, C_p^*, X_{ipt}, Y_p^*, Y^* \geq 0$$

$i = 1, \dots, I \dots I; p = 1, \dots, P$

$t = 1, \dots, T$

In summary, the model of coordinated industrial programming and project allocation for the economic integration scheme is: Minimize (6.50) subject to the conditions set out in (6.46), (6.52), either (6.53) and (6.54) (customs union variant) or (6.55) and (6.56) (common market variant), either (6.57) or (6.58) and (6.59) (alternative formulations of consumption demand), (6.60), (6.61) and (6.62).

The nationalistic surrogate of the above model can be formulated by taking into account the relationship between the nationalistic and integration models of Sections 6.2 and 6.3. The model of nationalistic industrial programming is related to the model of coordinated integration area-wide industrial programming in a similar fashion and its specification is the following:

Minimize:

$$(6.63) \quad Z = \sum_i \sum_j c_{ij} X_j^* + \sum_i \sum_j u_j A_{ij} + \sum_i \sum_j e_{ij} E_{jT} \\ + \sum_i \sum_j m_{ij} M_{jT} + \frac{T+1}{2} \sum_i \sum_j (c_{ij} + e_{ij}) r_j E_{jT} \\ - \sum_i \sum_j e_{ij} E_{j0} - \sum_i \sum_j m_{ij} M_{j0} + \frac{T-1}{2} \sum_i \sum_j (c_{ij} + e_{ij}) r_j E_{j0}$$

subject to:

$$(6.64) \quad K_{iT} = \frac{1}{T} \left\{ \sum_j^{J+J'} c_{ij} X_j^* + \sum_j u_j A_{ij} + \sum_j e_{ij} E_{jT} \right.$$

$$+ \sum_j^{J+J'} m_{ij} M_{jT} + \sum_j^J e_{ij} E_{j0} - \sum_j^J m_{ij} M_{j0}$$

$$i = 1, \dots, I, \dots, I'.$$

$$(6.65) \quad X_i^* + M_{iT} \geq \sum_j^{J+J'} a_{ij} X_j^* + C_i^* + K_{iT} + E_{iT} + C_{i0} + X_{i0} + \sum_j a_{ij} X_{j0}$$

$$i = 1, \dots, I, \dots, I'.$$

$$(6.66) \quad Y^* = \sum_j^{J+J'} a_{0j} X_j^*$$

$$(6.67) \quad Y^* \geq \bar{Y}$$

$$(6.68) \quad C_i^* = b_i Y^* \quad \text{or}$$

$$(6.69) \quad C_i^* = w_i C^* \quad \text{and}$$

$$(6.70) \quad C^* = \sum_i C_i^*$$

$$(6.71) \quad B_j U_j - X_j^* \geq 0 \quad j = \text{all new } J' \text{ projects}$$

$$(6.72) \quad U_j = 0 \text{ or } 1 \quad j = \text{all new } J' \text{ projects}$$

$$(6.73) \quad X_i^*, E_{it}, M_{it}, K_{it}, C_i^*, C^*, C_{it}, X_{it}, Y^*, \geq 0$$

where, in addition to the variables and parameters defined in Section 6.2:

$C^*$  = the increase in aggregate consumption over the entire planning period.

$U_j$  = zero-one variable; equal to one if the project is undertaken, equal to zero if it is not.

$B_j$  = the maximum possible scale of new project  $j$  that can be constructed.

$A_{ij}$  = the fixed requirement cost of capital goods  $i$  needed for new productive activity  $j$ .

$w_i$  = the proportionate change in consumption demand for commodity  $i$  as aggregate consumption increases.

## 6.5 Project Location in an Economic Integration Scheme

In this section we depart from the general equilibrium approach of

earlier sections and consider the question of the optimal location of development projects within an economic integration scheme using partial equilibrium analysis. One advantage of this method is that each project can be evaluated in greater detail and its direct benefits and costs in the various alternative locations estimated. Statements about the economic feasibility of well-defined projects can be made without solving the multi-sector programming model. The attraction of each member country to a programme of coordinated regional development planning will derive primarily from the number of well-defined projects that it will receive in the regional development programs. While the multi-sectoral model can check the internal consistency of the targets given the resources available to the region, it is the partial approach discussed presently which shows the details of the development projects available for allocation among the member countries.

The partial equilibrium approach, however, does not explicitly account for the interdependence among the projects and the sectors of the economies. Consequently, the model of project allocation presented here should be viewed as complementary to the model of coordinated regional development planning in Section 6.3 and the model of coordinated regional development planning and industrial programming in Section 6.4. Taken together these three models constitute the development planning and project programming regime for the common market.

The model in its basic structure is similar to that for a Latin American Common Market reported by Martin Carnoy [ 28 ]. Like the model of Section 6.4 it is a mixed-integer programming model. The model selects the optimum production location(s) within the economic integration area to meet the demand projected in year  $t$ . The present model differs from the Carnoy model in that, unlike the latter, its projected demand consists of demand from non-regional sources (exports) as well as regional demand. In other words, it is as assumed

that the common market will be able to sell part of its output of the new projects to non-member countries. Of course, in the tradition of the models of the previous sections the tariff and transportation costs of exporting to non-common market sources (as well as within the region) will have to be considered. This assumption is reasonable for ECCM since its members, as the less developed members of the Caribbean Common Market, will be given special consideration in their export drive in the more developed members of the Caribbean Common Market. The model's solution gives the cheapest way of supplying the projected demand from within the ECCM, taking into account the transportation cost involved in shipping the product from its point(s) of production to the various points of demand, the production costs in the possible locations (the seven member countries) and the effect of economies of scale where applicable. The partial equilibrium method implies, of course, that the projects will be considered separately. We assume that no more than one plant producing the commodity in question is allowed in any country  $i$ .

The mathematical specification of the model is now developed. Consider first the case where the commodity is produced by a single-stage production process. The objective function will minimize the total costs of producing the product in question and transporting it to the various consumption points. It is given by:

$$(6.74) \text{ Minimize: } Z = \sum_i a_i W_i + \sum_i \sum_j c_{ij} X_{ij}$$

where

$Z$  = value of objective function,

$a_i$  = the fixed cost of producing the commodity at the plant located in country  $i$ ,

$W_i$  = a dichotomous (zero-one) variable,

$c_{ij}$  = variable unit production cost at plant in country  $i$  plus the unit cost of transporting the commodity from  $i$  to consumption point (country)  $j$ ,

$X_{ij}$  = amount of commodity produced at plant (located in country)  $i$  and transported to consuming country  $j$ .

The variable  $W_i = 0$  or  $1$  takes a value of one if a plant is constructed in country  $i$ , and is equal to zero if the plant is not built in country  $i$ .

The condition that the total demand in each country  $j$  is exactly satisfied implies that the sum of shipments from all producing countries must be equal to the demand in country  $j$ . This requirement is given by (6.75).

$$(6.75) \sum_i X_{ij} = D_j \text{ for all } j$$

where  $D_j$  = demand for commodity in country  $j$ .

The condition could be weakened by requiring that the amount transported to a market area is at least as equal to market area's demand. This modification would replace the equality sign of (6.75) by a greater than or equal to sign.

The plant capacity constraint given in (6.76) below ensures that the output of a plant located in country  $i$  does not exceed the maximum plant capacity that is possible with existing technology. As with the model of Section 6.4, this set of constraints may not be binding upon the solution of the model because of the small size of the total demand in the ECCM (or the assumed total market requirements) relative to the capacity of potential plants. It is required nevertheless, for an accurate mathematical specification of the model.

$$(6.76) \sum_j X_{ij} \leq Q_i \text{ for all } i.$$

where  $Q_i$  = maximum capacity possible of plant located in country  $i$ .

The model is completed by the non-negativity constraints given in (6.77) and the integrality constraints given in (6.78). The former ensures that a negative amount of goods cannot be transported from a producing point to a consuming point. The latter guarantees that fixed production costs are zero if a plant is not built.

$$(6.77) \quad X_{ij} \geq 0 \quad \text{for all } i, j.$$

$$(6.78) \quad W_i = 0 \text{ or } 1; \quad W_i = 0 \text{ implies } \sum_j X_{ij} = 0, \\ W_i = 1 \text{ implies } \sum_j X_{ij} \geq 0, \text{ for all } i.$$

Consider next the case where the commodity is produced by a multi-stage production process, with the possibility that each stage can be located in different countries. Specifically, assume that there are three stages in the production process and that the total output of the first and second (intermediate) stages are fully used in the second and final stages respectively. The mathematical specification of the model becomes the following.

The objective function is:

Minimize:

$$(6.79) \quad Z = \sum_h f_h R_h + \sum_h \sum_k g_{hk} S_{hk} + \sum_k n_k U_k \\ + \sum_k \sum_i d_{ki} V_{ki} + \sum_i a_i W_i + \sum_i \sum_j c_{ij} X_{ij}$$

where  $f_h$  = fixed cost of a first-stage plant located in country  $h$ ;

$R_h$  = dichotomous (zero-one) variable; equals one if first-stage plant located in  $h$ ;

$g_{hk}$  = variable unit production cost of a first-stage plant located in  $h$ , plus the unit cost of shipping the stage-one output from plant  $h$  to second-stage plant located in country  $k$ ;

$S_{hk}$  = units of stage-one product produced at locations  $h$  and shipped to second-stage production plant located in country  $k$ ;

$n_k$  = fixed annual cost of a second-stage plant located in country  $k$ ;

$U_k$  = dichotomous (zero-one) variable; equals one if second-stage plant is built in country  $k$ , zero if it is not;

$d_{ki}$  = variable unit production cost of a second-stage plant located in  $k$ , excluding the intermediate product input costs from stage-

one production (to avoid double counting), plus the unit cost of shipping the second-stage product from k to final-stage plant located in country i;

$V_{ki}$  = units of stage-two product produced at location k and shipped to final-stage plant located in country i.

$a_i$  = fixed cost of a final-stage plant located in country i

$W_i$  = dichotomous (zero-one) variable; equals one if final-stage plant is located in country i, zero if plant is not built in country i;

$c_{ij}$  = variable unit production cost of a final-stage plant located in i, excluding the cost of the product input from stage-two production (to avoid double counting), plus the unit cost of shipping the commodity from production location i to consuming point j.

The inter-industry conditions that must be satisfied are given in relation (6.80).

$$(6.80a) \sum_h \alpha_{hk} S_{hk} = \sum_i V_{ki} \quad \text{for all } k$$

$$(6.80b) \sum_k O_{ki} V_{ki} = \sum_j X_{ij} \quad \text{for all } i$$

where  $\alpha_{hk}$  and  $O_{ki}$  are the input-output coefficients relating output of first-stage plant h to second-stage plant k and output of second-stage plant k to final-stage plant i. Relations (6.80a) state that the output of each stage-two plant  $\sum_i V_{ki}$  is equal to the stage-one output it receives multiplied by the input-output coefficient between stage-one output and stage-two output. Relations (6.80b) specify a similar relationship between output of stage-three (the commodity) and the output of stage-two. Note that if the assumption that all output of stage t is used in stage (t+1) is relaxed, (6.80) would have a positive term on the left hand side to account for intermediate output that was not

used in the subsequent stage of the production process of the final commodity in question.<sup>2</sup>

The plant capacity constraints are given by (6.81). They require that the output of each plant cannot exceed a technologically (and in some cases fictitiously) determined limit.

$$(6.81a) \quad \sum_k S_{hk} \leq Q_{1h} \quad \text{for all } h,$$

$$(6.81b) \quad \sum_i V_{ki} \leq Q_{2k} \quad \text{for all } k,$$

$$(6.81c) \quad \sum_j X_{ij} \leq Q_{3i} \quad \text{for all } i,$$

where  $Q_{1h}$  = maximum output allowed at first-stage plant located at  $h$ ,

$Q_{2k}$  = maximum output allowed at second-stage plant located at  $k$ ,

$Q_{3i}$  = maximum output allowed at each final stage plant located at  $i$ .

The market requirements constraint to guarantee that final demand is satisfied in every consuming center is identical to that of the single-stage production model as given by (6.75). The non-negativity constraints (6.77) are also identical. The final set of constraints for the model, the integrality constraints are given in (6.82).

$$(6.82a) \quad R_h = 0 \text{ or } 1; R_h = 0 \text{ implies } \sum_k S_{hk} = 0,$$

$$R_h = 1 \text{ implies } \sum_k S_{hk} \geq 0.$$

$$(6.82b) \quad U_k = 0 \text{ or } 1; U_k = 0 \text{ implies } \sum_i V_{ki} = 0,$$

$$U_k = 1 \text{ implies } \sum_i V_{ki} \geq 0.$$

$$(6.82c) \quad W_i = 0 \text{ or } 1; W_i = 0 \text{ implies } \sum_j X_{ij} = 0,$$

$$W_i = 1 \text{ implies } \sum_j X_{ij} \geq 0.$$

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2 - This could consist of final demand to the household, government or foreign sectors (exports), in addition to output used to produce final products, different from the final good  $X$  under consideration.

## 6.6 Limitations of the Theoretical Structure

The foregoing theoretical framework makes several assumptions which deserve comment. As specified, the model assumes a single objective, that of minimizing investment costs for a given growth target in aggregate income. In view of the goal of structural transformation, the comparative growth performance of the various sectors may be of importance. As such the planning regime may want to guide sectoral growth along normatively determined lines. In such an event, the constraint on aggregate income growth is inadequate. It may be decided, for example, that the tourism sector should grow at most at a rate below that of aggregate output while manufacturing should expand by at least a certain minimum. This can be easily incorporated into the model by the addition of two constraints, relations (6.83) and (6.84):

$$(6.83) \quad X_i^* \leq \bar{X}_i \quad i = \text{tourism sector}$$

$$(6.84) \quad X_i^* \geq \bar{X}_i \quad i = \text{manufacturing sector}$$

where  $\bar{X}_i$  is the maximum (minimum) permitted in the tourism sector (manufacturing sector) over the plan period. Structural transformation is handled in this fashion in the model.

Depending upon the relative investment costs incurred in expanding the various sectors these constraints may be redundant. Accordingly, it is advisable to first solve the linear (mixed integer) programming problem with them. They are then introduced during a subsequent solution if required.

A similar procedure can be followed to handle the problem of economic polarization. The first solution results will indicate which member countries suffer adversely within coordinated planning. Minimum constraints on the income growth of the affected members can then be imposed for a modified solution.

The objective function specification implies that capital funds are the only scarce factor in the common market countries. This assumption is unsat-

isfactory particularly as regards skilled manpower. While unskilled and semi-skilled labor may be readily available in the ECCM countries, bottlenecks are likely to appear in the technical and managerial sectors of the labor market. One approach to this weakness is to utilize income growth targets which are consistent with available skilled personnel and skilled manpower requirements of the sectors of the economy.

There is no balance of payments constraint in the model. Thus if a balance of payments deficit results it is assumed that adequate financing arrangements are forthcoming. Member countries will have sufficient foreign exchange reserves or access to foreign capital inflows. To the extent that these avenues are not open to the ECCM countries, the absence of a balance of payments constraint is a shortcoming of the model.

Also absent from the model is a domestic savings constraint. Investment outlays may exceed domestic savings in which case foreign investment must make up the differential. It was suggested in Chapter 4 that foreign investment should not be relied upon too heavily. Consequently, the savings formulation is a weakness of the theoretical framework. One way of minimizing this limitation is to set income growth targets in line with normatively acceptable levels of foreign investment. An iterative planning process would appear necessary in this regard.

Capital depreciation and gestation lags are not incorporated into the model. This simplifying assumption permits the model from becoming too cumbersome. The pertinent questions relating to regionally coordinated development plan can then be addressed with greater clarity. Inclusion of capital depreciation and gestation lags could be made along lines paralleling those of Eckaus and Parikh [ 46 ] and Westphal [ 104 ].

The underlying assumptions of input-output and linear programming analyses impose certain restrictions on the performance of the economies that are modelled

by such techniques.<sup>1</sup> For underdeveloped economies undergoing rapid structural transformation such restrictions, in particular the fixed coefficient and linearity assumptions, may severely distort the perception of the development process.<sup>2</sup> However when the planning horizon is short large structural changes are less likely to occur and the distortion may not be severe. Further, as Clark [110p. 67] notes:

some of the generalized characteristics of less developed economies (imperfect market, labor redundancy, restricted information, direct government controls, indivisibilities, etc.) make the assumption of limited direct factor substitution in these economies more plausible than in developed economies.

Chenery [29 p. 25] contends that "formal programming procedures do furnish a guide to the development of more systematic pragmatic methods that allow for judgement at each step of the analysis." The approach to coordinated multi-country planning and industrial programming outlined above should be viewed in this light and not so much as an accurate depiction of the ECCM economies.

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1 - For a discussion of the assumptions of input-output and of linear programming analysis, see respectively, Chenery and Clark [30 ] and Dorfman, Samuelson and Solow [43 ].

2 - See Sengupta [94 ] and Eleish [57 ].

## CHAPTER 7

### COORDINATED PLANNING AND INDUSTRIAL PROGRAMMING: CHOICE OF INDUSTRIES AND DATA

The previous chapter presented the outlines of a theoretical framework to coordinated regional planning and industrial programming. In this and the next two chapters we try to apply this framework to the ECCM. The present chapter will discuss the data used and the criteria for making the specific choices of economic activities while Chapters 8 and 9 analyze the empirical results. In Section 7.1 the application of the multisectoral models of Sections 6.2 to 6.4 is the topic for discussion while the questions relating to the application of the partial equilibrium framework of Section 6.5 are taken up in Section 7.2.

#### 7.1 Application of the Multi-sectoral Planning Framework: Statistical Data

It should be clear from the analysis of Chapter 6 that one requirement of the multi-sectoral planning framework is that there be input-output tables for the member countries of the economic integration scheme. Given the low level of economic development and poor statistical services in the countries of the ECCM it would be normal to expect that not all members have input-output tables. This in fact is the case. However, three of them, Antigua, Dominica and St. Kitts-Nevis-Anguilla, have tables of inter-industry transactions for one or two years in the early 1960's. Consequently, the application of the multisectoral planning model was limited to these three countries.

It should be obvious therefore that the results to be presented in Chapter 8 are only illustrative at best in terms of inferences concerning the benefits of coordinated multi-sectoral planning in the ECCM. Further, given the generally accepted poor quality of statistical data in the Leeward

and Windward Islands extreme caution should be observed in taking the specific values seriously. We believe nevertheless that the qualitative conclusions implicit in the numerical results are for the most part valid.

The existing input-output table for Antigua was constructed by O'Loughlin [ 86 ] and consists of fifteen sectors including the primary household sector. For our purposes we have made some adjustments to the O'Loughlin table for 1963 and have arrived at an eight-by-eight input-output table which is given as Table 7.1. The adjustments made are primarily the exclusion of the non-directly productive sectors such as the household sector, consolidation of the export and domestic agriculture sectors and of the rent of dwellings and services sectors. It will be noticed that we include government as a productive sector. This is justified on the fact that public utilities - electricity, water, etc. - fall in this sector. These adjustments, we believe, do not distort the basic structural interrelationships of the Antiguan economy in 1963 as given in the original O'Loughlin table.

Similar adjustments are made to the 1963 inter-industry tables for Dominica constructed by Bartell [ 9 ] and for St. Kitts-Nevis-Anguilla due to Padmore [ 89 ]. One additional adjustment is made for these two countries. In view of the increasing importance of tourism in the ECCM economies it was felt appropriate to isolate the hotel industry. Unlike Antigua, the original tables for Dominica and St. Kitts-Nevis-Anguilla do not show the hotel industry separately. For the 1963 eight-sector table for Dominica given in Table 7.2 the hotel sector is based upon the structure of Antigua's hotel industry one year earlier. For St. Kitts-Nevis-Anguilla's A-matrix given in Table 7.3, the hotel industry structure is based upon the input cost structure of the hotel industry in the British Virgin Islands in 1967

TABLE 7.1

Input Output Table of Antigua: 1963 [aij] matrix

1. Agriculture	0.010640	0.054390	0.000370	0.032530	0.002680	0.024930	0.0	0.003690
2. Manufacturing	0.0	0.0	0.0	0.036090	0.0	0.0	0.0	0.000450
3. Construction	0.095670	0.008280	0.0	0.003890	0.232920	0.074800	0.065730	0.024590
4. Distribution	0.205800	0.013800	0.072260	0.015310	0.206290	0.293910	0.053640	0.084980
5. Transport	0.059520	0.003450	0.008690	0.014560	0.0	0.013300	0.002920	0.007380
6. Hotels	0.000620	0.0	0.0	0.000330	0.0	0.0	0.0	0.001840
7. Rents/Services	0.009900	0.002420	0.007420	0.002820	0.0	0.028260	0.008940	0.029470
8. Government	0.033230	0.006420	0.025230	0.125280	0.116350	0.057670	0.038540	0.0

Source: Based on 1963 inter-industry transactions table in O'Loughlin [86].

TABLE 7.2

Input-Output Table of Dominica: 1963 [aij] matrix

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
1. Agriculture	0.002600	0.212610	0.0	0.082420	0.0	0.021600	0.0	0.0
2. Manufacturing	0.0	0.0	0.0	0.107890	0.0	0.010800	0.0	0.007620
3. Construction	0.003070	0.024840	0.0	0.002890	0.118150	0.068810	0.127020	0.006990
4. Distribution	0.031550	0.063590	0.303400	0.008650	0.368700	0.306380	0.019790	0.094330
5. Transport	0.089950	0.011670	0.008520	0.011070	0.0	0.016240	0.0	0.006520
6. Hotels	0.000490	0.0	0.0	0.000370	0.0	0.0	0.0	0.001560
7. Rents/Services	0.024880	0.001840	0.000720	0.003640	0.0	0.031910	0.002320	0.002240
8. Government	0.023270	0.122340	0.035970	0.114460	0.133060	0.020670	0.014430	0.0

Source: Based on 1963 inter-industry transactions table in Bartell [ 9 ].

Note: For input-output structure of hotels sector, input cost structure of Antigua's hotel industry in 1962 is used.

TABLE 7.3

Input-Output Table of St. Kitts: 1963 [a<sub>ij</sub>] matrix

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
1. Agriculture	0.013140	0.017840	0.00510	0.131520	0.0	0.011250	0.012440	0.006090
2. Manufacturing	0.0	0.0	0.0	0.034050	0.0	0.012770	0.0	0.0
3. Construction	0.049770	0.039420	0.0	0.004670	0.101460	0.006410	0.044240	0.035870
4. Distribution	0.115200	0.263790	0.064370	0.021330	0.402970	0.216620	0.054010	0.056250
5. Transport	0.021620	0.002400	0.001250	0.016430	0.0	0.046350	0.003750	0.000360
6. Hotels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7. Rents/Services	0.006240	0.0	0.000340	0.003650	0.0	0.0	0.005960	0.006690
8. Government	0.043490	0.019180	0.007290	0.147030	0.004980	0.030310	0.027950	0.0

Source: Based on 1963 inter-industry transactions table in Padmore [89 ].

Note: For input output structure of hotels sector, input cost structure of the British Virgin Islands' hotel industry in 1967 is used; it is assumed that hotel services are not inputs in any sector.

reported by Bryden [ 18 ].

The sectoral base year values used are based on the GDP in 1970. Indeed, base year final demand is identical to the estimated sectoral contribution to GDP. Sectoral exports and imports are based upon the trade statistics which are quite reliable. However, it should be noted that the SITC classification used for reporting trade is not easily translated into the sectoral categories employed. Total production and intermediate demand figures are based upon the inter-industry relations that existed in 1963 and as reflected in Tables 7.1 to 7.3. It is well known that if there is significant change in the structure of the economy projections of total output and intermediate demand based upon earlier inter-industry relationships can be substantially in error. However, given the small number of sectors or put differently the small level of disaggregation used this problem may not be serious in our particular case. In any event, we wish to emphasize that this exercise is for illustrative purposes. Base year consumption values are based partly on the limited information on expenditure patterns in the countries and on import statistics. Finally, the base year investment figures are based upon a rough extrapolation of earlier investment performance discussed by Bartell [ 9 ], O'Loughlin [ 86 ], Padmore [ 89 ] and Bryden [ 18 ] together with a rough analysis of imports of machinery and transport equipment by the countries. However, given the poor quality of estimates of gross investment in these countries it should be clear that the likelihood of the values used being poor projections is quite real. In interpreting the values of base year sectoral magnitudes given in Tables 7.4 to 7.6 the above points concerning their generally poor quality, save perhaps for the import, export and final demand figures, should be appreciated.

TABLE 7.4

ANTIGUA: Base Year Sectoral Aggregates

\$000

	<u>Total Pro- duction</u>	<u>Intermedi- ate Demand</u>	<u>Consump- tion</u>	<u>Invest- ment</u>	<u>Exports</u>	<u>Imports</u>	<u>Final Demand (GDP)</u>
1. Agriculture	1984.8	773.8	2069.4	0	992.4	1850.8	1211.0
2. Manufacturing	1629.9	473.9	16538.8	5333.3	14199.0	34915.1	1156.0
3. Construction	11479.4	1980.4	0.0	9499.0	0.0	0.0	9499.0
4. Distribution	13012.7	5345.7	5366.9	674.2	1625.9	0.0	7667.0
5. Transport	2246.2	604.2	410.5	0.0	1231.5	0.0	1642.0
6. Hotels	7841.0	23.0	390.9	0.0	7427.1	0.0	7818.0
7. Rents/Services	5788.0	647.0	5141.0	0.0	0.0	0.0	5141.0
8. Government	9471.9	2934.9	6537.0	0.0	0.0	0.0	6537.0
<b>TOTAL</b>	<b>53453.9</b>	<b>12782.9</b>	<b>36454.5</b>	<b>15506.5</b>	<b>25475.9</b>	<b>36765.9</b>	<b>40671.0</b>

Source: See discussion in text.

TABLE 7.5

DOMINICA: Base Year Sectoral Aggregates

\$000

	<u>Total Pro- duction</u>	<u>Intermedi- ate Demand</u>	<u>Consump- tion</u>	<u>Invest- ment</u>	<u>Exports</u>	<u>Imports</u>	<u>Final Demand (GDP)</u>
1. Agriculture	12381.2	1418.2	3081.0	0.0	9394.0	1512.0	10963.0
2. Manufacturing	3601.1	866.1	14220.0	5238.0	2035.0	18758.0	2735.0
3. Construction	4508.5	1218.5	0.0	3210.0	0.0	0.0	3210.0
4. Distribution	7351.2	4151.2	2080.0	480.0	640.0	0.0	3200.0
5. Transport	2621.6	1342.6	639.5	0.0	639.5	0.0	1279.0
6. Hotels	672.2	22.2	6.5	0.0	643.5	0.0	650.0
7. Rents/Services	5774.8	398.8	5376.0	0.0	0.0	0.0	5376.0
8. Government	8621.3	2178.3	6443.0	0.0	0.0	0.0	6443.0
TOTAL	45531.9	11675.9	31846.0	8928.0	13352.0	20270.0	33856.0

Source: See discussion in text.

TABLE 7.6

ST. KITTS: Base Year Sectoral Aggregates

\$000

	<u>Total Pro- duction</u>	<u>Intermedi- ate Demand</u>	<u>Consump- tion</u>	<u>Invest- ment</u>	<u>Exports</u>	<u>Imports</u>	<u>Final Demand (GDP)</u>
1. Agriculture	10596.1	1286.1	2131.0	0.0	8457.7	1278.7	9310.0
2. Manufacturing	844.5	294.5	11937.3	2169.3	209.4	13766.0	550.0
3. Construction	3641.5	1146.5	0.0	2495.0	0.0	0.0	2495.0
4. Distribution	7746.2	3466.2	2996.0	428.0	856.0	0.0	4280.0
5. Transport	1276.0	489.0	455.0	0.0	332.0	0.0	787.0
6. Hotels	2410.0	0.0	24.1	0.0	2385.9	0.0	2410.0
7. Rents/Services	3114.0	164.0	2950.0	0.0	0.0	0.0	2950.0
8. Government	7443.9	1808.9	5635.0	0.0	0.0	0.0	5635.0
<b>TOTAL</b>	<b>37072.2</b>	<b>8655.2</b>	<b>26128.4</b>	<b>5092.3</b>	<b>12241.0</b>	<b>15044.7</b>	<b>28417.0</b>

Source: See discussion in text.

In Table 7.7 the sectoral propensities to consume for the three countries are given. These figures are derived from the relationship between base year consumption of a particular sector's output and aggregate final demands on GDP. They are calculated using the consumption column of Tables 7.4 to 7.6 and the estimated gross domestic product of each country for 1970.

The derivation of the sectoral value-added coefficients which are presented in Table 7.8 is quite straightforward given the A-matrix of each country. The sum of each column subtracted from unity gives the value-added coefficient for that sector. However, given the heavy reliance on imports by all three countries and given the omission of the direct import sector, part of the value added computed in this fashion is the direct import content of the sector's cost structure. To arrive at domestic value-added coefficients we subtract the direct import proportions, which are given in the original tables, from the gross value-added coefficients. It is the domestic value added coefficients that are reported in Table 7.8 and which are used in the empirical exercise.

The role of the partial incremental capital output ratios in the multi-sectoral multi-country planning model was established in the previous chapter. Suffice it to recall here that since the criterion function of the model is to minimize investment costs for a given income growth target the partial incremental capital output ratios are central to the analysis because they reflect the productivity of investment. Unfortunately, the partial incremental capital output ratios are perhaps the most difficult to get satisfactory estimates for. This is partly due to uncertainty regarding the gestation period for projects and the generally poor estimates of gross investment. This is a problem faced by all researchers in this area of work on underdeveloped countries and we do not pretend to have made any improvements in

TABLE 7.7  
Sectoral Consumption Propensities (b<sub>ip</sub>)

Country \ Sector	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>All Sectors</u>
Antigua	0.051	0.407	0	0.131	0.010	0.010	0.126	0.161	0.896
Dominica	0.091	0.420	0	0.061	0.019	0.001	0.158	0.190	0.941
St. Kitts	0.075	0.420	0	0.105	0.016	0.001	0.104	0.198	0.919

Source: Computed from Tables 7.4, 7.5, 7.6

TABLE 7.8

Sectoral Domestic Value-added Coefficients

Country \ Sector	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
Antigua	0.52467	0.45866	0.38511	0.18262	0.43415	0.38240	0.82565	0.73286
Dominica	0.72971	0.41317	0.40429	0.12216	0.38009	0.38607	0.79608	0.74697
St. Kitts	0.69874	0.41804	0.604	0.21341	0.47820	0.39723	0.84667	0.75947

Source: Computed from Tables 7.1, 7.2, 7.3; see discussion in text.

the estimates we provide. The basis of the partial incremental capital output ratios given in Table 7.9 is the following. Of the eight sectors that comprise the economy, we assume that three of these, manufacturing, construction and distribution produce investment goods. It is further assumed that only the distribution sector uses distribution investment goods. It may be recalled that the manufacturing sector of the three economies do not produce manufacturing investment goods. This seeming inconsistency is eliminated by the fact that the model can acquire these through imports as should be evident from a glance at the base year sectoral magnitudes. By varying the time assumed between investment and resulting change in output and using estimates of gross investment given by O'Loughlin [86], Bartell [9], Padmore [89] and Bryden [18], a sectoral distribution of gross investment based partly upon the latter and the estimates of GDP which are available, we computed several sectoral capital output ratios. As would be expected some of these differed widely. The values reported in Tables 7.9 derive from an attempt to arrive at the most plausible values from the numerous values computed. Obviously then, some arbitrariness, perhaps a good deal, is involved. Our final values were guided by knowledge of the partial incremental capital-output ratios used for other underdeveloped countries, but this of course is no assurance that the values selected are more plausible since such estimates were themselves due in part to informed guessing.

The classification of the eight sectors also have some impact on the values presented in the above tables. We have just identified the capital goods producing sectors. The additional classification is the following. The consumer goods producing sectors are agriculture, manufacturing, distribution, transport, hotel industry, rents and services sector and government.

TABLE 7.9

Partial Incremental Capital Output Ratios ( $C_{ij}$ )

Receiving Sector Country Capital goods Sector	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
<u>Antigua</u>								
2. Manufacturing	0.600	2.000	0.600	0.300	1.600	0.400	0.400	1.000
3. Construction	0.500	1.400	0.400	0.500	1.500	3.600	2.000	3.900
4. Distribution	0	0	0	0.100	0	0	0	0
<u>Dominica</u>								
2. Manufacturing	0.400	1.500	0.500	0.200	0.900	0.500	0.200	1.000
3. Construction	0.400	1.500	0.500	0.900	1.000	3.600	1.400	4.000
4. Distribution	0	0	0	0.200	0	0	0	0
<u>St. Kitts</u>								
2. Manufacturing	0.450	1.800	0.600	0.200	1.100	0.450	0.300	1.000
3. Construction	0.450	1.400	0.500	0.700	1.300	3.6001	1.700	4.000
4. Distribution	0	0	0	0.100	0	0	0	0

Source: See discussion in text.

The national sectors are construction, rents and services sector and government, while the international sectors are agriculture, manufacturing, distribution, transport and hotel industry.

The values of two coefficients remain to be discussed. These are the transport cost coefficients and the tariff coefficients. The values for the transport cost coefficients are shown in Table 7.10. It will be observed that the export cost coefficients are assumed to be twice as large as the import cost coefficients. This may be interpreted to reflect the additional costs of marketing etc. that efforts to export will incur. In other words, we assume that, excluding balance of payments considerations, it is easier for the ECCM countries to import than to export. It should be noted also that different transport cost coefficients are assumed for different planning regimes. As was indicated in Chapter 3 coordinated regional development planning in the economic integration scheme would involve planning the regional transportation network. We assume that when coordinated, as opposed to individualistic, planning occurs reductions in the transport costs on intra-regional trade, though not on extra-regional trade, take place.

It will be recalled that tariffs enter the planning model in the form of additional costs that must be incurred in order to penetrate the export market. The minimum level of economic integration discussed is a free trade area. This means that tariff costs on intra-regional trade will be zero whether or not planning takes place at the nationalistic level or at the coordinated multi-country level. However, in the model of nationalistic development planning there is no distinction between exports (imports) to (from) member countries from those of non-member countries. For exports to non-member countries a tariff cost has to be overcome whereas there are no

tariff costs involved in exports to member countries. We deal with this by assuming a specific breakdown of each member's total trade between other members and non-participating countries. The tariff costs can then be multiplied by the proportion for trade with non-member countries. The proportions assumed are agriculture 0.75, manufacturing 0.25, distribution 0.50, transport 0.60 and hotel industry 0.90. With respect to tariff rates only the first two international sectors, agriculture and manufacturing would they appear to be relevant since the exports of the other three sectors are consumed at the point of production. In line with the tariff structure of most countries we assume a higher rate for manufacturing (50%) than for agriculture (10%). Thus the tariff coefficients are 0.50 and 0.10.

TABLE 7.10

Transport Cost Coefficients

Extraregional Export Costs $e_{ij}$	0.100
Extraregional Import Costs $m_{ij}$	0.050
Intraregional Export Costs	0.075
Intraregional Import Costs	0.033

Source: See discussion text

## 7.2 Regional Industrial Programming: Choice of Projects

The realization of the potential gains of economic integration among small underdeveloped countries requires that coordinated development planning be undertaken. However, such regional planning must not be carried out only at the aggregative and multisectoral levels but at the project level as well. For only with the latter can the gains from resource combination, market swapping and the other sources of gains identified in Chapter 4 be made concrete. The framework outlined in Section 6.5 once it is operationalized provides a basis for regional industrial programming at the project level.

Perhaps the first question that arises during attempts to make the theoretical framework operational is the criteria that govern the selection of economic activities that will be analyzed and possibly implemented in the regional project-level development planning process. In the context of the ECCM several criteria suggest themselves. First, given the normative goal of the structural transformation of the regional economy and its constituent parts and given the embryonic stage of the manufacturing sector, some emphasis should be placed on manufacturing activities. The establishment of appropriate manufacturing establishments will broaden the industrial base of the regional and member economies thereby contributing to the structural transformation process.

Second, the level of technological maturity of the member countries together with the normative content of economic development as outlined in Chapter 4 suggest that in the initial years of the regional development planning exercise the choices of economic projects should be limited to activities which embody simple and not complex technology. It should be noted, however, that for some products the range of technologies may be wide so that not all products whose manufacture can be carried out by a complex set of techniques are excluded from consideration. As the regional economy and

its constituent national economies experience economic development in the sense that the term is defined in Chapter 4 the technological maturity of the society will advance opening up the way for the proper utilization of more sophisticated production techniques.

The third factor concerns the human resources of the member countries and as such is related to the second criterion. Given the relative scarcity of skilled personnel in the member countries the merits of simple techniques in an industrial development program that is broadly based should be appreciated. But equally important, the choice of projects should take into account the relatively large amounts of unskilled but easily trainable labor that exists in the ECCM countries. This suggests that labor-intensive activities should be given high priority. Also given the high levels of unemployment and underemployment in the participating countries emphasis should be given to projects whose labor employment are likely to be large. In other words both the labor-capital ratio and the absolute size of the labor variable should be high. It seems only rational that the industrial programming framework should make maximum efficient use of the region's most abundant resource - its people.

Fourth, in order that the development planning program does not result in the establishment of activities which widen the gap between the structure and pattern of regional production and the structure and pattern of domestic consumption the projects chosen should, as far as is practicable, have reasonable regional demand. This does not mean that the projects should be biased to the inward-look import substitution type. On the contrary, it is evident that given the small size even of the market of all the ECCM countries combined such a strategy has severe limitations. What the criterion suggests is that the regional market should be the base for a so-called outward-

looking strategy. The extra-regional market will then be an extension of regional demand rather than the exclusive determinant of regional production patterns. In this criterion the observations of Staffan Linder on the relationship between domestic demand and ability to export manufactures noted in Chapter 4 are given a normative extension.

Fifth, in view of the limited savings capacity of the member economies and the need to cautiously evaluate the alternative source of foreign capital for investment funds some consideration to capital costs of the projects will have to be made. Projects with relatively low capital costs should be given preference over those with high capital costs, other things equal. This criterion is of course closely related to third and in some cases is a corollary of it. It is important enough, nevertheless, to warrant separate mention. Even though the founding of the Caribbean Development Bank has removed some of the capital bottlenecks and has led its President [ 72 ] to remark that loan funds for development projects should not be a problem for the next few years, the need to not overextend the region's extremely scarce resource should be evident.

The sixth factor to be borne in mind in choosing projects for the regional industrial programming scheme relates to the utilization of the region's resources other than capital and labor. Projects that use or are likely to use raw materials from the region should, other things equal, have preference over economic activities for which there is no likelihood that local raw materials will be used in the manufacturing process. The former group of projects will generate greater linkages in the regional economy and are likely to have a larger developmental impact.

Seventh, and by no means the least important, the choice of projects for consideration will be constrained by the set of economic activities

for which satisfactory statistical data is available or can be generated at reasonable cost in a short time. Pertinent information include regional and non-regional market demand, cost structure in the member countries, range of techniques available, raw material supply conditions and labor market conditions. Put simply, meaningful planning implies the existence or easy generation of relevant information.

The growing fiscal deficits of the governments of the Leeward and Windward Islands has been noted at another point. One result of this is that the governments are limited in their ability to subsidize the establishment of economic activities. The subsidies that are made take the form of renting of factory shells at concessionary rates, tax holidays and customs duties exemption. The eight factor that is adhered to is that the projects that are to be established are to be commercially profitable. This means that the calculation of production costs makes use of market prices and not social accounting prices though the subsidies listed above are taken into consideration. Specifically, labor costs are arrived at using existing wage structures and not shadow wages. The need for commercial profitability derives from the fact that if a project is established on the basis of social profitability its commercial viability may require wage subsidies which under present government budgetary conditions appear unlikely. However, social accounting principles should not be neglected for it is well known from the literature on project evaluation that in the context of national and regional development planning social costs and benefits are the appropriate yardsticks for ranking projects.<sup>a</sup> Thus the projects that fulfill market profitability should be checked to ensure that they also satisfy social guidelines. One group of regional projects need not fulfill the market profitability requirement. These are the so-called infrastructure or social overhead capital projects. An example would be a project aimed at improving the intra-

regional transport system in the ECCM. The reasons for exempting such projects from the market profitability rule are well known and need not be repeated.

The ninth and final factor we wish to mention relates to the size of the projects to be chosen. Given the small size of the ECCM some large projects would seem to be ruled out. Fortunately, other considerations such as technological complexity and skill composition of the regional labor force would exclude some large projects. On the other end of the scale it seems reasonable that the regional industrial programming scheme should not be concerned with projects that can be established quite satisfactorily at the national level. For example, the development of some types of building supplies should be excluded from the program.

The above somewhat long list of criteria that governed the project selection process would seem to make the final choice of projects difficult. However, it should be remembered that most, if not all, of the factors mentioned are related. In any case the data availability factor does impose an upper limit that is not large.

While relying on the above criteria the selection of the actual projects for the ECCM was enhanced by the existence of three separate but overlapping lists of manufacturing projects which are believed to be suitable for the ECCM. The first list is due to the agreement establishing the Caribbean Community and Common Market and consists of manufacturing activities the establishment of which the Caribbean Common Market members have decided to promote in the ECCM countries and Belize. Specifically under the regime for fiscal incentives to industries the more developed member countries of the Caribbean Common Market have agreed not to give any concessions to these activities for a five year period commencing 1974. This list of manufacturing activities is reproduced as Table 7.11. The second list of manufactur-

TABLE 7.11

Manufacturing Activities to be Promoted in ECCM and Belize in CARICOM Agreement

Aluminum Products:	Tissue Paper Products
(1) Tubular Furniture	Umbrellas
(2) Window Frames	Wire Products: Nails
(3) Hollow-Ware	Brushes and Mops
Automobile Muffler Systems	Coir products, mats and matting
Clocks	Mattresses
Hats and Caps	Drinking straws
Shirts and Knitted Underwear	Aerated Waters
Packaging Materials:	Rum
(1) Plastic film	Beer
(2) Twine	Bakery Products
(3) Paper bags	Cigarettes
(4) Cardboard boxes	Concrete Blocks
(5) Corrugated cardboard containers	Concrete Pipes (non-asbestos)
	Concrete Tiles
	Copra
	Edible Oils and Fats from Copra
	Handicraft items
	Phonograph Records
	Pop Corn
	Printing
	Stationery (excluding continuous business forms)
	Syrups

Source: Caribbean Community Secretariat, The Caribbean Community A Guide, Georgetown, 1973.

ing projects was suggested in the report of a University of the West Indies Development Mission [109] which analyzed the economic development problems and prospects of St. Vincent, one of the ECCM member countries. This list appears as Table 7.12.

The third list is due to a study of the manufacturing potential of the ECCM countries and Belize commissioned by the Caribbean Development Bank and undertaken by the Economist Intelligence Unit Ltd. The study [110] considered a large number of manufacturing projects and classified them under the following headings: (a) projects to satisfy the wider CARIFTA market and extra-regional markets, (b) existing ECCM industries with potential for expansion, (c) possible new ECCM manufacturing activities, and (d) manufacturing projects with no present potential for profitable establishment in the ECCM. The projects under heading (a) are reproduced in Table 7.13. For these manufacturing projects the Economist Intelligence Unit Ltd. prepared feasibility studies on their establishment in the ECCM. One major weakness of these studies from the standpoint of the industrial programming framework outlined in Section 6.5 is that there is no distinction between the economics of locating the projects in the various countries. Thus they provide little guide for regional industrial location in the ECCM.

A perusal of the three tables reveals some overlapping of entries. In fact the list in Table 7.11 was partly based upon the results of the study which includes the list in Table 7.13. Using these three lists as a guide, the international trade statistics of the ECCM countries were scrutinized to determine in which projects an acceptable ECCM demand exists. As will be recalled from the fourth criterion discussed above it is felt that exports to non-regional countries should be an extension of local demand. Unlike previous attempts to assess the scope of local demand for new manufac-

TABLE 7.12Prospective ECCM Manufacturing Industries Suggested by  
UWI Development Mission to St. Vincent

Beer	Brooms and Brushes
Stock and Poultry Feeds	Jewelry
Fishmeal etc.	Cigarettes
Building Tiles	Kerosene oil stoves
Paint	Canned and Preserved Food
Insecticide	Cardboard and paper products
Garments and Hosiery	Footwear
Furniture and Mattresses	Plastic toys and products
Soap	Copra, edible oils, margarine

Source: UWI Development Mission, The Development Problem in St. Vincent, ISER, UWI, Kingston, Jamaica, 1969.

TABLE 7.13Potential ECCM Manufacturing Projects Geared for Export  
Markets Suggested by E.I.U. Industrial Survey

Bicycles	Ceramics
Builders Hardware	Canned Fruits and Vegetables
Electronics	Footwear
Garments	Toys
Jewelry	Sports Goods
Leather goods	Hand tools and cutlery
Domestic electrical accessories	

Source: E.I.U. Ltd., Eastern Caribbean and British Honduras Industrial Survey: Final Report, London 1972.

TABLE 7.14Projects for Regional Industrial Programming Framework

Footwear	Woven Fabric Outerwear
Ceramics	Knitted Fabric Outerwear
Canned Tropical Fruits	Men's Knitted Underwear

Source: See discussion in text

turing activities equal emphasis was given to the quantity and value magnitudes in the trade figures. Previous attempts have tended to concentrate on the value of imports thereby neglecting important questions such as technological minimum plant sizes.

From an analysis of the trade data together with the three lists of manufacturing activities and the criteria for choosing the projects we arrived at a list consisting of six manufacturing projects. These projects are given in Table 8.14. It will be evident that all of the projects are in at least two of the three lists given in the earlier tables. Actually, some twelve projects were scrutinized during the initial stages but fully half of these were dropped for one reason or another. For example, a project for the production of imitation jewelry was dropped primarily because of the small number of direct workers that would be involved. It will be observed that three of the projects are in garment manufacturing.

In the presentation of the empirical analysis for the six projects in Chapter 9 the particular assumptions and methodologies regarding calculation of market demand, production costs, transport costs etc. for each project will be discussed. Some general comments will however be made here. The market demand estimates for the ECCM countries are based on an analysis of their import statistics. By and large there is very little local production of commodities to be manufactured by the projects so that the import figures are a good guide of the extent of local demand. As noted above both the quantity and value figures are taken into account. Indeed the assumed market demands are in quantities. Because of the unavailability of the import statistics for some years it was not possible to estimate demand by regression techniques. Simple rule of thumb estimates are made. In any event given the narrowly defined products of the manufacturing projects considered

TABLE 7.15

Approximate Average Wage Rates in ECCM Countries, 1971

(EC\$ per day)

<u>Labor Category</u>	<u>Antigua</u>	<u>Dominica</u>	<u>Grenada</u>	<u>Montserrat</u>	<u>St. Kitts</u>	<u>St. Lucia</u>	<u>St. Vincent</u>
Farm labourer (male)	9	4	4	5	5	4	4
Farm labourer (female)	5	3	3	3	3	3	3
Unskilled building labourer	9	4	5	5	5	5	4
Semi-skilled assembly or garment worker <sup>a</sup>	6	...	4	...	4	4	...
Truck driver	11	8	6	7	8	9	7
Mason/carpenter	16	7	9	11	8	9	7
Machine operator	16	9	10	9	8	9	7
Automobile mechanic	16	8	10	9	9	10	8
Hotel waiter <sup>b</sup>	6	7	7	5	4	7	6
Shorthand typist clerk	14	10	14	9	8	10	9
Hotel desk clerk	12	10	9	10	10	7	9

Notes: a. This category applies largely to young women in labour-intensive sub-assembly or garment making.  
b. The wage rates for this category are artificially low since they exclude tipping and food.

Comparisons between countries may be subject to error because of possible different definitions of some job categories. Figures should be taken as rough averages.

Sources: E.I.U., Eastern Caribbean and British Honduras Industrial Survey  
Labour Department, Antigua, Annual Report 1971.  
Ministry of Finance, St. Kitts, Investment Incentives in St. Kitts-Nevis-Anguilla

and the existence of only one aggregate income series, namely GDP, it is doubtful whether the estimates from regression analysis will be more reliable. Also, sensitivity analysis of the optimal solution values of the mixed integer programming problems can throw some light on the stability of the optimal solutions.

The labor costs for the projects are based upon the wage rates given in Table 8.15. With regards to the cost structure and technological features of the projects the chief reference sources are the three volumes on technoeconomic characteristics of manufacturing projects produced by UNIDO [107] and the prospectuses prepared by the Economist Intelligence Unit Ltd. [51] of the projects given in Table 7.13. At all stages in the estimation of production costs of the projects some effort was made to cross check the results to ensure that the results are within reasonable margins of error. Further discussion and the presentation of the results are taken up in Chapter 9.

## CHAPTER 8

### COORDINATED DEVELOPMENT PLANNING: EMPIRICAL RESULTS

In this chapter we present illustrative empirical results of our attempts to quantify the potential benefits of coordinated multi-country development planning in an economic integration scheme. Section 8.1 discusses experiments with the multi-sectoral planning model in which each member country evaluates the options of nationalistic and regionally coordinated development planning to minimize investment costs while achieving a target rate of growth in gross domestic product. A second class of experiments attempts to assess the comparative attractiveness of nationalistic and coordinated planning when the aggregate income growth target is constrained by the need for structural transformation in the economy. These results are analyzed in Section 8.2. Some discussion of the sensitivity analyses performed on the numerical solutions of the planning models occupies Section 8.3. The final section offers a brief summary of the earlier discussion. Throughout this chapter the reader should bear in mind the discussion in the first section of Chapter 7 relating to the data used for the illustrative empirical exercises.

#### 8.1 Illustrative Empirical Results of the Multi-Country Planning Framework

In an attempt to establish some quantitative aspect of the benefits of multi-country development planning coordination, the data presented in Section 7.1 were used in the models of Sections 6.2 and 6.3. Each of the three countries, Antigua, Dominica and St. Kitts-Nevis-Anguilla, were assumed to experiment with both nationalistic and regionally coordinated planning to achieve a specific rate of growth of aggregate income. The differences in investment costs and the configuration of trade and production changes can then be observed to ascertain the advantage of the latter form of planning.

The first experiment involves a target growth rate of 5 percent per annum over a planning period of 5 years. Two variants of multi-country planning are used in line with the discussion in Chapter 6. The first maintains individual country growth targets. That is, the coordination of development planning is such that the growth of each country's GDP is 5 percent per annum for the five years. The second variant sets an income growth target of 5 percent per annum at the regional level and the comparative costs of growth in the three countries are left to determine in which country growth takes place.

In Table 8.1 the solutions for income increase and investment costs are shown. For individual country planning and variant one of coordinated planning the income increase for each country is of course predetermined in the linear programming problem to be at least equal to the values shown. These values, as we just noted, represent an annual rate of growth of 5 percent over the five-year planning period. The base year income levels were given in Section 7.1. The investment costs shown are the solutions for the objective functions of the linear programming problems.

A comparison of the investment costs of individual country planning with those of variant one of coordinated regional planning shows that the latter is preferable since it leads to lower investment expenditures to achieve the specified 5 percent target growth rate. For Antigua investment costs in the former case are \$68.3908 million, in the latter \$68.1176 million, a saving of \$273.2 thousand. For Dominica investment costs under a regime of nationalistic planning amount to \$33.2029 million while coordinated regional planning involves investment costs of \$33.1239 million. This represents a saving of \$79.0 thousand with an unchanged aggregate income growth performance. The investment costs incurred by St. Kitts-Nevis-Anguilla are \$31.8944 million under nationalistic planning and \$31.5563

TABLE 8.1

Results of Individual and Coordinated Multi-Country Planning5% Income Growth TargetAggregate Income Increase and Investment Costs\$000

	<u>Individual Planning</u>	<u>Coordinated Planning I</u>	<u>Coordinated Planning II</u>
Income Increase			
Antigua	11236.6	11236.6	12639.4
Dominica	9353.8	9353.8	9697.8
St. Kitts	7851.1	7851.1	6104.3
Common Market*	28441.5	28441.5	28441.5
Investment Costs			
Antigua	68390.8	68117.6	69814.0
Dominica	33202.9	68117.6	69814.0
St. Kitts	31894.4	31556.3	26045.1
Common Market*	133488.1	132797.8	129353.7

\*Antigua, Dominica, and St. Kitts combined.

million under the limited type of coordinated regional planning that variant one permits. This implies a saving in investment expenditures of \$338.1 thousand. For the three countries combined the savings in investment outlays total \$690.3 thousand.

Although the savings in investment expenditures are large in absolute terms for two of the countries, relative to total investment outlays the gains are small. Thus for example, Antigua's gains are less than 1% (0.4%) of investment costs. The highest relative gain is 1.1 percent of investment outlays made by St. Kitts. This would seem to suggest that the gains to be made by coordinated planning are small. Two points may be made in this connection. First, even if the gains are small it still is preferable to engage in coordinated planning provided we have not omitted any substantial additional costs of such activity in our analysis. This is so because the relatively small gains can be allocated to other productive activities in the regional economy. In other words, within a dynamic context the small gains will generate further gains.

The second point relates to the nature of the gains that are possible in the framework of the first variant of coordinated planning. Since the individual country targets are retained and since there is no change in the efficiency of investment the only gains possible are those made possible by changes in the pattern of trade. In other words, gains from production specialization are not forthcoming. As can be seen in Table 8.2 the production structure for Antigua is identical for the two planning regimes while they are virtually the same for the other two countries. Given the limited amount of trade realignment that is possible with the production structures remaining intact it is not surprising that the gains are small in relative terms.

The second variant of coordinated development planning leads to a larger amount of benefits to the regional economy. Compared to an investment

cost of \$133.4881 million under nationalistic development planning investment outlays are \$129.3537 million. This represents a saving of \$4.1344 million in investment resources of the region. This is equivalent to 3.1 percent of the investment expenditures incurred under nationalistic planning. In absolute terms this is fairly substantial particularly when viewed in a dynamic context. Although a 5 percent per annum growth for the region is maintained this solution permits this growth to be distributed over the three countries on the basis of the comparative costs of income growth. As can be seen from Table 8.1 this leads to economic growth in Antigua and Dominica at rates above the regional rate and for St. Kitts below the regional rate. The income increase of \$12.6394 million, \$9.6978 million and \$6.1043 million respectively for Antigua, Dominica and St. Kitts translates into annual compounded rates of growth of 5.6 percent, 5.2 percent and 4.0 percent. Notice, however, that the investment undertaken in St. Kitts has declined. With respect to the question of economic polarization discussed in earlier chapters it would appear that St. Kitts would have some concern even though the growth rates are not vastly different. Within the regional coordinated planning framework this can be handled by a planned allocation of the \$4.1344 million of investment funds saved. For example, a disproportionately large part of this could be invested in St. Kitts.

It will be instructive to compare sectoral production results of the three planning regimes. The sectoral output changes over the five year planning period together with the configurations of investment and consumption are shown in Table 8.2. A striking result is the fact that there is no increase in manufacturing output under the three regimes. Expansion in the international sectors is confined to agriculture and hotels. This means that if income growth is the sole criterion and if the values for sectoral incremental capital output ratios and the other parameters used are plausible,

TABLE 8.2

Results of Individual and Coordinated Multi-Country Planning5% Income Growth Target

\$000

	<u>ANTIGUA</u>			<u>DOMINICA</u>			<u>ST. KITTS</u>		
	<u>Indivi- dual Planning</u>	<u>Coordina- ted Plan- ning I</u>	<u>Coordin- ated Plan- ning II</u>	<u>Indivi- dual Planning</u>	<u>Coordina- ted Plan- ning I</u>	<u>Coordina- ted Plan- ning II</u>	<u>Indivi- dual Planning</u>	<u>Coordina- ted Plan- ning I</u>	<u>Coordina- ted Plan- ning II</u>
<u>Output Change</u>									
1. Agriculture	10944.6	10944.6	13733.8	8682.5	8687.5	9226.2	7816.3	7823.6	6158.8
2. Manufacturing	-	-	-	-	-	-	-	-	-
3. Construction	-	-	-	-	-	-	727.7	709.3	-
4. Distribution	-	-	-	-	-	-	-	-	252.2
5. Transport	-	-	-	332.8	331.1	-	-	-	-
6. Hotels	5620.3	5620.3	4558.3	15.0	5.7	-	-	-	-
7. Rents/Services	1774.5	1774.5	1958.2	1702.9	1702.8	1770.6	883.7	883.7	688.6
8. Government	2565.3	2565.3	2829.7	2048.4	2048.4	2082.8	1926.0	1924.6	1532.8
<u>Investment in Year T</u>									
2. Manufacturing	2418.0	2418.0	2735.3	1258.7	1265.0	1267.6	1335.0	1318.8	964.2
3. Construction	7851.8	7851.8	7645.8	2912.4	2913.0	2942.2	2723.5	2706.8	2101.9
4. Distribution	-	-	-	24.9	31.7	42.1	106.2	91.6	56.9
<u>Consumption Increase</u>									
1. Agriculture	573.1	573.1	644.6	851.2	851.2	882.5	588.8	588.8	457.8
2. Manufacturing	4573.3	4573.3	5144.2	3928.6	3928.6	4073.1	3297.5	3297.5	2563.8
4. Distribution	1472.0	1472.0	1655.8	570.6	570.6	591.6	824.4	824.4	641.0
5. Transport	112.4	112.4	126.4	177.7	177.7	184.3	125.6	125.6	97.7
6. Hotels	112.4	112.4	125.4	9.4	9.4	9.7	7.9	7.9	6.1
7. Rents/Services	1415.8	1415.8	1592.6	1477.9	1477.9	1532.3	816.5	816.5	634.8
8. Government	1809.1	1809.1	2034.9	1777.2	1777.2	1842.6	1554.5	1554.5	1208.6

then efficient coordinated development planning requires that Antigua, Dominica and St. Kitts concentrate on agricultural production. Indeed the results indicate that emphasis should be placed on agriculture (plus tourism in Antigua) irrespective of the planning regime. But as we have insisted earlier, income growth is not the only and indeed not the most important criterion. We will later make a partial attempt to broaden the criterion function by reporting some experiments of the linear programming model which impose side conditions on the growth of the manufacturing sector.

A comparison of the sectoral output solutions of individualistic and the first variant of coordinated planning reveals that the results for Antigua are identical and very minor differences for the other two countries. This, as noted above, arises from the fact that with the retention of individual country income growth targets production specialization is ruled out. Compared to nationalistic planning the second variant of coordinated planning leads to a greater increase in agricultural production in both Antigua and Dominica and a smaller increase in St. Kitts. There is a smaller increase in output of the hotels sector in both Antigua and Dominica, the two countries where there is some expansion of this sector. The particularly large increase in Antigua is worth noting. The national sectors to experience growth in all planning regimes are rents/services and government. Coordinated planning involving a regional income growth target (Variant II) involves larger increases in these sectors in Dominica and Antigua, a smaller increase in St. Kitts.

The investment figures given in Table 8.2 are the values of the domestic output or imports of the capital goods sectors, manufacturing, construction and distribution, used for investment purposes in the terminal year of the planning period. The assumption concerning the time path of investment was discussed in Chapter 6, it will be recalled. An observation concerning

the construction sector is in order. The solutions for investment of construction capital goods in the terminal year of the plan imply that there is excess capacity in this sector in all three countries. This is so because the values for construction under investment in Table 8.2 are less than the base year final output of construction goods given in Tables 7.4 to 7.6. Coordinated regional planning of the second variant leads to a small demand for construction capital goods in Antigua. This is primarily due to the smaller growth in the hotels sector noted earlier.

Table 8.2 also presents the solutions for consumption of the output of the consumer goods sectors. They require very little discussion except the remark that the values given represent the increase in consumption over the planning period and that the values are based upon the assumed sectoral propensities to consume given in Table 7.7 in the previous chapter.

Finally, we look at the pattern of international trade flows under the three planning regimes. In Table 8.3 the trade flows of the international sectors in the terminal year of the plan period are presented. Comparing nationalistic planning to the first variant of coordinated planning the export performance of Antigua and St. Kitts improves, the former fairly substantially, while the export performance of Dominica deteriorates. For the three countries combined total exports have expanded. An important feature of the solution is the opening up of manufacturing trade between two of the countries. The exports of \$2.0414 million of manufacturers by Antigua in the terminal year of the plan went to St. Kitts. It is not possible however, to compare intra-regional trade under the two planning regimes since the nationalistic model does not make a distinction between intra and extra-regional trade flows. A final observation concerns the balance of payments. As can be seen from Table 8.3 the balance of payments situation improves for Antigua and St. Kitts and deteriorates for Dominica. Taken as a whole the external payments for

TABLE 8.3

Results of Individual and Coordinated Multi-Country Planning5% Income Growth TargetInternational Trade Patterns in Terminal Year

\$000

	<u>ANTIQUA</u>			<u>DOMINICA</u>			<u>ST. KITTS</u>		
	<u>Indivi- dual Planning</u>	<u>Coordina- ted Plan- ning I</u>	<u>Coordin- ated Plan- ning II</u>	<u>Indivi- dual Planning</u>	<u>Coordina- ted Plan- ning I</u>	<u>Coordina- ted Plan- ning II</u>	<u>Indivi- dual Planning</u>	<u>Coordina- ted Plan- ning I</u>	<u>Coordina- ted Plan- ning II</u>
<u>Exports</u>									
1. Agriculture	9247.1	9247.1	11960.6	15690.6	15695.8	16201.9	14280.7	14787.9	12747.9
2. Manufacturing	-	2041.4	1136.3	-	-	-	-	-	-
4. Distribution	5625.5	734.9	-	-	-	-	-	-	-
5. Transport	368.8	401.2	200.4	-	-	-	-	-	-
6. Hotels	12923.6	15934.1	14851.1	641.7	632.4	626.0	32.5	32.3	93.9
Total	28165.0	28358.7	28148.4	16332.3	16328.2	16827.9	2378.0	2378.0	2379.8
							16691.2	16698.2	15221.6
<u>Imports</u>									
1. Agriculture	-	-	-	-	-	-	-	-	-
2. Manufacturing	22375.2	24416.7	24399.9	16688.1	16694.4	16841.6	16019.8	16003.5	14923.8
4. Distribution	9014.8	4124.2	3867.3	103.8	108.1	36.5	749.8	734.9	-
5. Transport	-	32.3	-	-	-	388.2	-	-	-
6. Hotels	-	2378.0	3005.8	-	-	-	-	-	-
Total	31390.0	30951.2	31273.0	16791.9	16802.5	17266.3	16769.6	16738.4	14923.8
Balance of Payments	-3225.0	-2592.5	-3124.6	-459.6	-474.3	-438.4	-78.4	-40.2	297.8

the region improves as well.

With respect to the second variant of coordinated regional planning in which a common regional income growth target is specified the results in Table 8.3 reveal that the export performance of Antigua deteriorates compared to the other two planning regimes but the balance of payments position though worse compared to the first variant of coordinated planning is better compared to nationalistic planning. It will be noticed that Antigua exports manufactures at this level of planning as well, though the amount compared to the other level of coordinated planning is significantly smaller. For Dominica, the best balance of payments position is achieved at this level of planning due to larger agricultural exports and a small reduction in manufacturing imports. A similar result applies to St. Kitts. Indeed, a balance of payments surplus is experienced at this level of planning. This is due to a comparatively smaller level of manufacturing imports combined with a lower level of agricultural exports. It will be recalled that in this planning regime the growth of aggregate income in St. Kitts is less than the regional rate. It is this lower growth rate that accounts for the smaller level of manufacturing imports.

The linear programming models of coordinated planning make a distinction between intra-regional and extra-regional trade flows. It is therefore possible to compare the value of the former in the two variants of multi-country planning. A further breakdown of the trade solutions shown in Table 8.3 indicate that total intra-regional exports (imports) under the first and second variants of coordinated planning are \$5.819 million and \$4.4364 million respectively. Thus development planning in which the individual country growth targets are maintained results in greater intra-regional trade than planning with a regional income growth target. This result combined with those concerning investment costs suggests that different levels of planning

are most appropriate for different types of issues. Optimizing the region's use of investment resources while achieving economic growth requires a different level of regional coordination of planning than the one required for maximum intra-regional trade expansion. This is an example of the problem of conflicting objectives noted in Chapter 6. Another case concerns the investment costs and balance of payments results. The point should be emphasized however that coordinated regional planning of some form is shown to be superior to nationalistic planning. Thus although the more attractive result with respect to investment costs of the second variant of coordinated planning is partly offset by a less favorable balance of payments position when compared to the first variant of coordinated planning, the two levels of coordinated planning are superior to nationalistic planning on both counts.

We now report the results of an exercise similar to the one discussed above. The only difference was that a 7 percent per annum rate of growth over the five-year planning period was used. In Table 8.4 the aggregate income growth and investment cost results are shown. The trends noted in the previous case are evident here as well. The first variant of coordinated development planning incurs lower investment costs, though only by a small amount, than nationalistic development planning. Unlike the five percent growth case investment costs in one country, Dominica, are slightly higher in the former planning regime. This means that for Variant I coordinated planning to be attractive to all member countries some transfer of part of the investment costs savings made by Antigua and St. Kitts must be made to Dominica. This empirical result supports an observation made in Section 4.2 that the distributional structure of benefits (and costs) in an integration scheme will vary depending upon the relative growth in demand and other magnitudes and that the institutional arrangements ought to be flexible enough

TABLE 8.4

Results of Individual and Coordinated Multi-Country Planning7% Income Growth TargetAggregate Income Increase and Investments Costs\$000

	<u>Individual Planning</u>	<u>Coordinated Planning I</u>	<u>Coordinated Planning II</u>
Income Increase			
Antigua	16372.2	16372.2	18489.7
Dominica	13628.8	13628.8	16774.1
St. Kitts	11439.3	11439.3	6176.5
Common Market*	41440.3	41440.3	41440.3
Investment Costs			
Antigua	74601.1	74468.8	77823.8
Dominica	45065.5	45072.2	54232.1
St. Kitts	44028.9	43969.6	26272.8
Common Market*	163695.5	163510.6	152328.7

\*Antigua, Dominica and St. Kitts combined.

As in the earlier experiment, the second variant of coordinated multi-country planning with a regional income growth target of 7 percent per year results in lower investment costs than the other two planning regimes. It is perhaps significant that the investment costs of \$158.3287 million represents a saving of 3.3 percent of the costs under nationalistic planning, a slightly higher percentage than for the 5 percent income growth target case. Also, the advantages of Variant II coordinated planning over Variant I is proportionately greater in the 7 percent income growth target case. With a 7 percent income growth target Variant II coordinated planning investment costs reflect a saving of 3.2 percent of the investment costs of Variant I coordinated planning. The corresponding figure for the 5 percent income growth target case is 2.6 percent.

As would be expected the absolute savings in investment costs are larger in this experiment. They amount to \$5.3668 million. The earlier pattern of Antigua and Dominica experiencing growth rates above the regional rate and St. Kitts showing a rate below the regional rate is maintained. Their respective compounded annual rates of growth under the second variant of regional planning are 7.8 percent, 8.4 percent and 4.0 percent. In this case the difference in the national growth rate between on the one hand Antigua and Dominica and on the other St. Kitts is quite substantial. It is here that the proposal concerning the elimination of economic polarization effects and of the equitable distribution of benefits acquires importance. As noted earlier, a disproportionately large part of the investment costs saved can be allocated to St. Kitts to bring her rate of growth closer to the regional level.

The sectoral output changes, investment outlays in the terminal year of the planning period and consumption increases over the planning period are shown in Table 8.5. On reasoning similar to that used earlier it can be determined that the construction sector in Antigua has excess capacity under all

TABLE 8.5  
Results of Individual and Coordinated Multi-Country Planning  
7% Income Growth Target  
Sectoral Output and Consumption Increases and Investment  
\$000

	<u>ANTI GUA</u>			<u>DOMINICA</u>			<u>ST. KITTS</u>		
	<u>Indivi- dual Planning</u>	<u>Coordina- ted Plan- ning I</u>	<u>Coordin- ated Plan- ning II</u>	<u>Indivi- dual Planning</u>	<u>Coordina- ted Plan- ning I</u>	<u>Coordina- ted Plan- ning II</u>	<u>Indivi- dual Planning</u>	<u>Coordina- ted Plan- ning I</u>	<u>Coordina- ted Plan- ning II</u>
<u>Output Change</u>									
1. Agriculture	2115.8	21058.4	25470.4	12141.2	12135.1	14466.3	10930.5	10966.8	6345.3
2. Manufacturing	-	-	-	-	-	-	-	-	-
3. Construction	-	-	-	1465.7	1476.6	2651.3	2398.6	2299.3	-
4. Distribution	-	-	-	-	-	-	-	-	-
5. Transport	-	239.9	-	-	-	-	-	-	-
6. Hotels	1732.4	1574.9	-	-	-	-	-	-	-
7. Rents/Services	2447.3	2442.3	2722.0	2468.8	2468.7	3027.4	1285.1	1285.3	696.3
8. Government	3533.2	3548.6	3928.1	2960.3	2960.6	3662.8	2796.1	2794.6	1518.4
<u>Investment in Year T</u>									
2. Manufacturing	3579.7	3641.2	4146.8	1935.5	1946.2	2482.5	2103.0	2100.7	987.9
3. Construction	7097.7	7062.9	6786.7	4304.2	4315.0	5406.7	4192.5	4091.4	2093.9
4. Distribution	-	6.3	87.0	126.8	136.9	206.4	195.1	201.7	71.4
<u>Consumption Increase</u>									
1. Agriculture	835.0	835.0	943.0	1240.2	1240.2	1526.4	857.9	857.9	463.2
2. Manufacturing	6663.5	6663.5	7525.3	5724.1	5724.1	7045.1	4804.5	4804.5	2594.2
4. Distribution	2144.8	2144.8	2422.1	831.4	831.4	1023.2	1201.1	1201.1	648.5
5. Transport	163.7	163.7	184.9	258.9	258.9	318.7	183.0	183.0	98.8
6. Hotels	163.7	163.7	184.9	13.6	13.6	16.8	11.4	11.4	6.2
7. Rents/Services	2062.9	2062.9	2329.7	2153.4	2153.4	2650.3	1189.7	1189.7	642.4
8. Government	2635.9	2635.9	2976.8	2589.5	2589.5	3187.1	2265.0	2265.0	1223.0

planning regimes. The only other point we wish to note is the substantially reduced role of tourism in the region at the higher rate of growth. There is no expansion of the hotels sector in Dominica while the expansion in Antigua is much smaller. Indeed, when the aggregate income growth target is set at the regional level (Variant II of coordinated planning) there is no increase output in the regional economy's hotels sector.

The last set of results for the 7 percent income growth experiment is the international trade patterns as reported in Table 8.6. For Antigua, nationalistic planning gives the best balance of payments position, slightly better than the second variant of coordinated planning. Dominica achieves its best balance of payments position under nationalistic planning as well but Variant II coordinated planning leads to its worst international payments situation, one that is significantly worse than those under the other two planning regimes. In St. Kitts' case Variant II coordinated planning is the most attractive from the balance of payments standpoint. For the region as a whole the three planning regimes generate deficits of \$5.0861 million, \$5.1377 million and \$5.1631 million respectively.

The foregoing numerical experiments relating to multi-sectoral planning in Antigua, Dominica and St. Kitts-Nevis-Anguilla indicate that coordinated development planning within the framework of economic integration can be profitable to the participating countries. Specifically, we have seen that investment costs incurred to achieve specified aggregate income growth targets are reduced in a regime of coordinated regional planning. In view of this result and in view of the limited investable funds at the disposal of small structurally dependent economies the emphasis that has been attached to such an approach in this study is well placed. The numerical results reported so far indicated that growth in the economies is concentrated in the agricultural

TABLE 8.6

Results of Individual and Coordinated Multi-Country Planning7% Income Growth TargetInternational Trade Patterns in Terminal Year\$000

	<u>ANTIQUA</u>			<u>DOMINICA</u>			<u>ST. KITTS</u>		
	<u>Indivi- dual Planning</u>	<u>Coordina- ted Plan- ning I</u>	<u>Coordin- ated Plan- ning II</u>	<u>Indivi- dual Planning</u>	<u>Coordina- ted Plan- ning I</u>	<u>Coordina- ted Plan- ning II</u>	<u>Indivi- dual Planning</u>	<u>Coordina- ted Plan- ning I</u>	<u>Coordina- ted Plan- ning II</u>
<u>Exports</u>									
1. Agriculture	19181.1	19088.0	23383.5	18751.6	18745.5	20784.4	17073.7	17109.6	12960.0
2. Manufacturing	-	-	-	-	-	-	-	-	-
4. Distribution	130.3	-	-	-	-	-	-	-	-
5. Transport	-	-	-	-	-	-	-	-	92.8
6. Hotels	8976.2	8818.7	7219.2	619.3	619.3	613.9	2374.5	2374.5	2379.7
Total	28287.6	27906.7	30602.7	19370.9	19364.8	21398.3	19448.2	19484.1	15432.5
<u>Imports</u>									
1. Agriculture	-	-	-	-	-	-	-	-	-
2. Manufacturing	25627.6	25689.1	27056.7	19167.2	19178.0	21040.6	18294.5	18292.5	14969.4
4. Distribution	5269.6	5129.7	5930.7	994.2	1007.4	1776.1	1752.5	1756.9	289.9
5. Transport	247.7	-	506.3	743.3	742.9	1026.9	96.2	96.8	-
6. Hotels	-	-	-	-	-	-	-	-	-
Total	31144.9	30818.8	33493.7	20904.7	20928.3	23843.6	20143.2	20146.2	15259.3
<u>Balance of Payments</u>	-2857.3	-2912.1	-2891.0	-1533.8	-1563.5	-2445.3	-695.0	-662.1	173.2

sector. In light of the importance of structural transformation the manufacturing sector should expand as well. In the framework of the linear programming development planning model that is used this can be achieved by imposing a side condition on the growth of manufacturing in the optimization problems. We turn to numerical experiments of this type in the following section to ascertain whether the advantages of coordinated regional planning are still in evidence. The results discussed so far also indicate the presence of economic polarization effects discussed in an earlier chapter. The results so far have suggested two ways of dealing with this problem. The first is to specify growth targets at the national level. The second and more efficient is to specify a regional income growth target accompanied by a regional investment program which allocates the investment resources saved as a result of the coordinated planning process in relation to the distribution of the backwash effects of economic integration.

## 8.2 Coordinated Planning and Structural Transformation: Illustrative Results

The illustrative empirical results of the previous section have suggested that in planning the economic growth of Antigua, Dominica and St. Kitts optimal solutions require that expansion of the international sectors of the economies be confined to agriculture and to a lesser extent to tourism. This means that a program of economic development based on these results will exclude the growth of manufacturing industry. The analysis of Chapter 4 however emphasized the goal of structural transformation of the regional economy and its constituent parts in a meaningful program of economic development. This would involve planned growth not only of agriculture and tourism but of manufacturing as well in the economic integration framework. In this section we attempt to throw some light on the relative merits of coordinated development planning among the participating countries when the results of production specialization of Section 8.1 are constrained by the structural transformation requirement.

Before we discuss the numerical results it will be useful to comment briefly on the form structural transformation enters the linear programming planning models. Since the input-output structure used for the economies of Antigua, Dominica and St. Kitts in the numerical experiments have only eight sectors the numerical model cannot deal with structural transformation within say the agricultural sector itself. This can be achieved by a greater disaggregation of the input-output structure so that agriculture can be divided into several sub-sectors. Then the diversification and structural transformation of the regional and national agricultural sectors can be analyzed. This is one direction that future research must take. A similar position applies to manufacturing as we noted for agriculture. Given this feature, structural transformation in the application of the planning models is taken to be growth of manufacturing as well as agriculture. This is accomplished

by imposing a minimum growth rate on the manufacturing sector within the framework of optimizing investment allocation. This side condition on the regional or national manufacturing sectors ensures that the regional manufacturing sector will develop and thus minimize excessive dependence on one international sector. The question to be answered is whether coordinated development planning reflects any gains over nationalistic development planning.

The side condition on the manufacturing sector can be imposed at the national or regional level. In the first case manufacturing in each national economy is required to expand at a specified minimum rate, the regional allowable minimum being the sum of the country values. In the latter case, manufacturing output in the region is constrained to grow at a specified minimum rate and the specific member countries in which such expansion takes place is endogenously determined by the comparative investment costs of manufacturing production in the constituent economies. Both specifications are used in the illustrative empirical experiments. It will be recalled from the previous section that one way of dealing with economic polarization effects is to specify the aggregate income growth targets at the national level. Combining the aggregate income growth specification with the manufacturing expansion specification gives rise to four possible coordinated planning regimes. These are (a) individual country income growth target and individual country manufacturing growth target, (b) regional income growth target and individual country manufacturing growth target, (c) regional income growth target and regional manufacturing growth target, (d) individual country income target and regional manufacturing growth target. The results of numerical experiments with the first three coordinated development planning regimes are reported and are identified in the tables as Coordinated Planning III, Coordinated Planning IV and Coordinated Planning V respectively. The solutions of the

regime of nationalistic planning are reported as well. This regime differs only slightly from Coordinated Planning III, the difference resulting from transport and tariff costs.

A final point before the presentation of the numerical results concerns the specific growth rates of aggregate income and manufacturing output chosen. Given the embryonic stage of manufacturing in the three countries considered and indeed for all the ECCM economies it seems reasonable to assume that structural transformation in the eight-sector economies used should mean manufacturing output growing at a rate at least equal to aggregate income growth during the five-year planning period. We adhere to this assumption. Also for specific growth rates of aggregate income we use the same two of the previous section. Specifically, we consider two cases. In the first case aggregate income grows at a minimum annual compounded rate of 5 percent the corresponding percentage for manufacturing output being 7 percent. In the second case both aggregate income and manufacturing output are constrained to grow at a minimum annual compounded rate of 7 percent.<sup>1</sup>

The results for aggregate income growth and investment costs under the development planning regimes identified earlier for the case of 5 percent minimum growth in aggregate output and 7 percent minimum growth in manufacturing are given in Table 8.7. The income increase value of \$29.4415 million for the common market is based upon the base year income values given in Chapter 7. For the individual country planning and coordinated planning III regimes the minimum income increases, which are identical to the solution values, were exogenously set at the country level in the linear programming problems. Thus the solutions of \$11.2366 million, \$9.3538 million and \$7.8511

1 - A third case in which aggregate income and manufacturing output were both constrained to grow at a minimum annual compounded rate of 5 percent was also tried. The results of this case are qualitatively similar to those of the second and are not reported.

TABLE 8.7

Results of Individual and Coordinated Multi-Country Planning5% Income Growth Target - 7% Growth in ManufacturingAggregate Income Increase and Investment Costs\$000

	<u>Individual Planning</u>	<u>Coordinated Planning III</u>	<u>Coordinated Planning IV</u>	<u>Coordinated Planning V</u>
<u>Income Increase</u>				
Antigua	11236.6	11236.6	14238.2	14340.1
Dominica	9353.8	9353.8	8272.0	8716.7
St. Kitts	7851.1	7851.1	5931.3	5384.7
Common Market*	28441.5	28441.5	28441.5	28441.5
<u>Investment Costs</u>				
Antigua	69394.0	69123.7	71794.5	71875.3
Dominica	36271.6	36120.2	33587.9	33294.7
St. Kitts	32670.5	32261.4	26854.0	26865.5
Common Market*	138336.1	137505.3	132236.4	132035.5

\*Antigua, Dominica and St. Kitts combined.

million for Antigua, Dominica and St. Kitts respectively represent annual growth rates of 5 percent. Under planning regimes Coordinated Planning IV and Coordinated Planning V the regional economy grows at 5 percent per annum. But under the former the solution values of \$14.2392 million, \$8.272 million and \$5.9313 for Antigua, Dominica and St. Kitts respectively translate into national growth rates of aggregate income of 6.2 percent, 4.5 percent and 3.9 percent. The solution values of aggregate income increase under the latter planning regimes translate into annual growth rates of 6.2 percent, 4.7 percent and 3.5 percent for Antigua, Dominica and St. Kitts respectively. It will be evident that if differential rates of growth are used as an index of economic polarization as we have done throughout this chapter then it is a matter for serious concern under these two regimes of coordinated development planning. But as was earlier established an appropriate allocation of the savings in investment outlays under coordinated planning can deal with the economic polarization question.

The solutions for minimum investment costs under the various planning regimes indicate that coordinated development planning is an attractive policy framework in the case where explicit provisions are made for structural transformation. In other words, the process of restructuring the structurally dependent underdeveloped small economies of the East Caribbean can be enhanced by coordinated development planning within an economic integration scheme if the results for Antigua, Dominica and St. Kitts can be extended to the entire ECCM. As can be seen from Table 8.7 the investment costs incurred by the common market under individual country planning are \$138.3361 million compared to \$137.5053 million under Coordinated Planning III. This represents a saving of \$830.8 thousand, a relatively small amount. The saving in investment costs of Coordinated Planning IV over individual planning is \$6.0997 million a substantially larger amount. It is equivalent to 4.4 percent of the invest-

ment costs under nationalistic planning. It should be noted that the individual country minimum targets for growth in manufacturing output is maintained in this case.

A comparison of the investment costs in each country under the various planning regimes may warrant an observation. In the case of Antigua it can be seen that investment costs under Coordinated Planning IV are larger than those under individual planning (and Coordinated Planning III). This should not be interpreted to mean that investment expenditures are less productive in the former regime. In fact, from a regional standpoint the opposite is the case. The larger investment outlays are due to the greater expansion in output that takes place in Antigua. Put another way, optimal allocation of regional investment funds involve a shift of growth from Dominica and St. Kitts to Antigua and with this a reallocation of investment expenditures. For Dominica and St. Kitts part of the reduction in investment expenditures is due to a smaller growth in output.

We turn now to the results relating to sectoral output increases and investment outlays in the terminal year of the plan period. These results are presented in Table 8.8. Consider first the solution values for manufacturing output growth. The values of \$0.6561 million, \$1.4496 million and \$0.34 million for Antigua, Dominica and St. Kitts respectively under the first three planning regimes correspond to a 7 percent growth in the gross output of the respective manufacturing sectors, the exogenously specified minimum. Given the comparative growth costs of the international sectors observed in Section 8.1 which resulted in expansion concentrating in agriculture and tourism it is natural that the solution values for manufacturing will not exceed the specified minimum growth target. It will be recalled that the minimum growth target for manufacturing under the first three plan-

TABLE 8.8

Results of Individual and Coordinated Multi-Country Planning5% Income Growth Target - 7% Growth in ManufacturingSectoral Output Increases and Investment

	\$000											
	ANTIGUA				DOMINICA				ST. KITTS			
	Indivi- dual Plan- ning	Coordi- nated Plan- ning III	Coordi- nated Plan- ning IV	Coordi- nated Plan- ning V	Indivi- dual Plan- ning	Coordi- nated Plan- ning III	Coordi- nated Plan- ning IV	Coordi- nated Plan- ning V	Indivi- dual Plan- ning	Coordi- nated Plan- ning III	Coordi- nated Plan- ning IV	Coordi- nated Plan- ning V
<u>Output Change</u>												
1. Agriculture	10480.0	10480.0	16448.1	17115.4	7729.5	7729.5	6913.2	7610.0	7591.0	7599.7	5776.4	4593.9
2. Manufacturing	656.1	656.1	656.1	-	1449.6	1449.6	1449.6	1034.9	340.0	340.0	340.0	1410.8
3. Construction	-	-	-	-	378.4	378.4	-	-	801.3	780.6	-	-
4. Distribution	-	-	-	-	-	-	-	-	-	-	263.8	247.2
5. Transport	-	-	-	-	-	-	-	-	-	-	-	-
6. Hotels	5518.1	5518.1	3245.8	3270.8	-	-	-	-	-	-	-	-
7. Rents/Services	1768.0	1768.0	2161.2	2181.1	1681.9	1681.9	1489.4	1576.6	882.3	882.3	667.8	602.2
8. Government	2547.9	2547.9	3113.6	3150.2	2172.3	2172.3	1931.4	1982.6	1923.3	1921.9	1489.6	1346.2
<u>Investment in Year T</u>												
2. Manufacturing	2612.5	2612.5	3291.5	3120.0	1592.8	1592.8	1433.8	1378.9	1439.3	1418.6	1030.0	1246.5
3. Construction	7899.3	7899.3	7458.6	7396.1	3299.9	3299.9	2950.1	2946.8	2797.1	2776.0	2109.9	2134.7
4. Distribution	-	-	-	-	-	-	-	-	100.0	81.2	44.4	14.9

ning regimes is set at the country level. Under Coordinated Planning V where the minimum level for manufacturing expansion is set at the regional level optimizing the region's utilization of investment funds leads to no expansion in Antigua's manufacturing sector, the growth taking place in Dominica and St. Kitts. The solution values are respectively \$1.0349 million and \$1.4108 million. This implies that for a regional income growth target of 5 percent combined with a regional manufacturing growth target of 7 percent minimizing investment costs require that St. Kitts and Dominica produce the incremental manufacturing output.<sup>2</sup> Notice also that the expansion in Dominica is less than the value for manufacturing increase under a planning regime where manufacturing expansion is set at the country level. Therefore growth in manufacturing shifts to St. Kitts from Antigua and Dominica. Thus the solution values for manufacturing increase under Coordinated Planning V translates into annual compounded growth rates of 21.7 percent, 5.2 percent and 0.0 percent respectively for St. Kitts, Dominica and Antigua compared to 7 percent for each country under the other planning regimes. In fact the manufacturing sector in St. Kitts more than doubles within the five-year planning period.

With respect to the other international sectors, agriculture expands for all three countries under all four planning regimes; expansion of the hotels sector occurs only in Antigua, but under all planning regimes; distribution expands only in St. Kitts and only under coordinated planning regimes IV and V. Relative specialization in agriculture takes place in Antigua. As can be seen in Table 8.8 coordinated regional planning compared to nationalistic planning leads to a greater expansion in agriculture in Antigua but to

2 - The background of the specific growth rates for aggregate output and of manufacturing is important, for as we shall see different numerical growth rates result in a different configuration of regional manufacturing expansion. See Table 8.11.

a smaller increase in the other two countries. Less growth is experienced by the hotels sector under coordinated planning as the solution values of \$5.5181 million and \$3.2708 million for individual planning and Coordinated Planning V respectively indicate.

For the national sectors rents/services and government there is greater expansion under coordinated regional planning in Antigua and a smaller growth in St. Kitts and Dominica. This configuration reflects the result, already discussed, of aggregate income growth rates above the regional average for Antigua and below the regional rate for the other two countries.

Table 8.8 also gives the value of investment goods of the three types available that are demanded during the terminal year of the plan period. It will be noticed that coordinated planning leads to a relatively higher demand for manufactured capital goods and a relatively smaller demand for construction capital goods in Antigua. This is due to the higher growth in agriculture and the lower growth in the hotels sector which characterize the optimal solution. Comparable arguments can be made for differences in investment demand under nationalistic and coordinated planning regimes for Dominica and St. Kitts. Finally mention may be made of the solution value for consumption increase over the planning period. These results are not shown but can be easily deduced from the aggregate income increase solution values in Table 8.7 and the sectoral consumption propensities given in Table 7.7 of the previous chapter.

The numerical solutions for the international trade of the common market members are presented in Table 8.9. An interesting result is that for all three countries, and hence for the region as a whole, coordinated regional planning compared to nationalistic planning in addition to requiring smaller investment expenditures to achieve a 5 percent annual growth rate in aggregate income combined with a 7 percent annual expansion of manufacturing output gives

TABLE 8.9

Results of Individual and Coordinated Multi-Country Planning5% Income Growth Target - 7% Growth in ManufacturingInternational Trade Patterns in Terminal Year\$000

	<u>ANTIGUA</u>				<u>DOMINICA</u>				<u>ST. KITTS</u>			
	<u>Indivi- dual Plan- ning</u>	<u>Coordi- nated Plan- ning III</u>	<u>Coordi- nated Plan- ning VI</u>	<u>Coordi- nated Plan- ning V</u>	<u>Indivi- dual Plan- ning</u>	<u>Coordi- nated Plan- ning III</u>	<u>Coordi- nated Plan- ning IV</u>	<u>Coordi- nated Plan- ning V</u>	<u>Indivi- dual Plan- ning</u>	<u>Coordi- nated Plan- ning III</u>	<u>Coordi- nated Plan- ning IV</u>	<u>Coordi- nated Plan- ning V</u>
<u>Exports</u>												
1. Agriculture	8754.4	8754.4	14560.5	15250.3	14432.2	14432.2	14477.3	14459.1	14052.3	14060.9	12376.5	11235.3
2. Manufacturing	-	4120.7	668.4	-	-	-	-	-	-	-	-	-
4. Distribution	6197.3	-	-	-	-	-	93.3	64.0	-	-	-	-
5. Transport	395.7	395.7	35.4	-	290.2	-	-	-	36.4	36.3	104.0	136.3
6. Hotels	12821.7	15297.9	12894.5	12624.0	627.0	627.0	628.8	628.0	2378.0	2378.0	2380.0	2380.5
Total	28169.1	28568.7	28158.8	27874.3	15349.4	15059.2	15199.4	15151.1	16466.7	16475.2	14860.5	13752.1
<u>Imports</u>												
1. Agriculture	-	-	-	-	-	-	760.7	-	-	-	-	-
2. Manufacturing	21913.7	26034.4	24483.0	24340.7	15573.5	15573.5	14958.2	15505.2	15784.1	15763.3	14577.4	13493.0
4. Distribution	9468.2	3270.9	4293.7	4446.8	139.8	139.8	-	-	812.0	792.8	-	64.0
5. Transport	-	-	-	3.7	558.0	267.8	169.0	235.6	-	-	-	-
6. Hotels	-	2476.2	2380.0	2085.9	-	-	-	-	-	-	-	-
Total	31381.9	31781.5	31156.7	30877.1	16271.3	15981.1	15887.9	15740.8	16596.1	16556.1	14577.4	13557.0
	-3218.8	-3212.8	-2997.9	-3002.8	-921.9	-921.9	-688.5	-589.7	-129.4	-80.9	283.1	195.1

rise to a more favorable balance of payments position. To take the case of Coordinated Planning IV Antigua experiences a deficit of \$2.9979 million compared to one of \$3.2188 million under nationalistic planning. The corresponding figures for Dominica are deficits of \$0.6885 million and \$0.9219 million. For St. Kitts coordinated planning regime IV leads to a balance of payments surplus of \$293.1 thousand while nationalistic planning generates a payments deficit of \$129.4 thousand.

The overall pattern of international trade however does not differ significantly. Exports consist predominantly of agriculture and hotel services while imports are primarily manufactured goods. As in one of the cases discussed in Section 8.1, two of the coordinated planning regimes generate intra-regional manufacturing trade. Antigua's exports of manufacturing under the first two coordinated planning regimes in Table 8.9 are to St. Kitts. Another point worth noting is the fairly large exports of hotel services by St. Kitts.

To summarize the discussion so far, coordinated development planning within a regional economic integration scheme comprising Antigua, Dominica and St. Kitts is shown to be attractive for promoting economic growth of the member countries with explicit consideration given to structural transformation. In the specific case of a growth target of aggregate income of 5 percent combined with a minimum growth rate for manufacturing output of 7 percent coordinated development planning leads to a reduction of regional investment outlays of several million dollars as well as a more favorable balance of payments position for each of the countries. In addition intra-regional manufacturing trade is stimulated. While economic polarization as measured by the differential between national growth rates emerges as a problem, and thus confirms our concern in Chapter 4, the investment funds saved if utilized in an appropriate fashion can resolve this problem. Such an investment allocation, as we argued

in the previous section, should be an integral part of the regional planning process.

The specific empirical exercise reported so far in this section is a case in which the minimum acceptable growth rate in manufacturing is greater than the growth rate of gross domestic product. In the remainder of this section we present the results of a case where both annual growth rates are equal. Specifically, we consider the case where investment outlays are minimized in achieving a minimum 7 percent per annum growth in both gross domestic product and the gross (intermediate plus final) output of the manufacturing sector. The four development planning regimes identified earlier in this section are applied. Since the results are in some aspects similar to those of the case discussed above comments will be brief.

Table 8.10 gives the solutions for income increase and investment costs. Consider first the aggregate income increment results. Unlike the case discussed above where coordinated regional planning resulted in two countries (Dominica and St. Kitts) having growth rates below the regional rate only one member (St. Kitts) is in this position of suffering considerable backwash effects of economic integration. Coordinated regional planning as represented by Coordinated Planning IV gives solutions of \$18.3968 million, \$17.0401 million and \$6.0034 million for Antigua, Dominica and St. Kitts respectively. These figures translate into annual compounded growth rates of 7.7 percent, 8.5 percent and 3.9 percent. The growth rates implied by the aggregate income increments under Coordinated Planning V are 7.6 percent, 8.5 percent and 4.0 percent respectively for Antigua, Dominica and St. Kitts.

The solutions for investment costs represent savings in investment outlays when a multi-country planning framework is adopted of \$5.5105 million (Coordinated Planning IV) or of \$7.1856 (Coordinated Planning V). The latter is equivalent to 4.3 percent of investment costs under nationalistic planning.

TABLE 8.10

Results of Individual and Coordinated Multi-Country Planning7% Income Growth Target - 7% Growth in ManufacturingAggregate Income Increase and Investment Costs\$000

	<u>Individual Planning</u>	<u>Coordinated Planning III</u>	<u>Coordinated Planning IV</u>	<u>Coordinated Planning V</u>
<u>Income Increase</u>				
Antigua	16372.2	16372.2	18396.8	18143.3
Dominica	13628.8	13628.8	17040.1	17120.4
St. Kitts	11439.3	11439.3	6003.4	6176.6
Common Market*	41440.3	44140.3	41440.3	41440.3
<u>Investment Costs</u>				
Antigua	75604.3	75345.4	78488.0	81095.6
Dominica	48591.8	48598.4	58533.1	55241.3
St. Kitts	44803.1	44730.1	26467.5	25476.7
Common Market*	168999.2	168673.9	163488.6	161813.6

\*Antigua, Dominica and St. Kitts combined.

The allocation of a disproportionately large amount of this to establish or expand economic activities in St. Kitts can neutralize the economic polarization effects while maintaining the higher growth rates in Antigua and Dominica. Thus the conclusion of the earlier empirical case that coordinated planning leads to a fairly large reduction in investment costs is confirmed.

The results for sectoral output expansion and for investment in the terminal year of the five-year plan period are given in Table 8.11. The solution value for manufacturing under Coordinated Planning V deserves comment. It will be recalled that in the case of a 5 percent growth rate in aggregate income Dominica and St. Kitts accounted for regional manufacturing expansion the latter taking the larger share (Table 8.8). Now with a 7 percent growth rate in aggregate income Antigua accounts for the entire increment of \$2.4457 million of manufactures. These substantially different specialization outcomes raise the interesting question as to whether in a dynamic context regional specialization is not significantly affected by the specific targets set for growth in gross domestic products. Since the only difference between Coordinated Planning V of Table 8.8 and that of Table 8.11 is the minimum rates of aggregate income growth an affirmative answer to the query just raised appears the only acceptable answer.<sup>3</sup> And if this is valid it implies that valid statements about regional comparative advantages cannot be made without explicit specification of growth rates and length of planning horizons.

As in the previous case the agricultural sector expands substantially under all planning regimes and in all countries, though for Antigua there is a smaller increase under Coordinated Planning V than under Coordinated Planning

3 - The significant difference in the solutions for regional manufacturing specialization could in principle be due to an inaccurate entry in the linear programming problems. After close scrutiny of the computer print-outs and data cards this explanation is rejected.

TABLE 8.11

Results of Individual and Coordinated Multi-Country Planning7% Income Growth Target - 7% Growth in ManufacturingSectoral Output Increases and Investment\$000

	<u>ANTIGUA</u>				<u>DOMINICA</u>				<u>ST. KITTS</u>			
	<u>Indivi- dual Plan- ning</u>	<u>Coordi- nated Plan- ning III</u>	<u>Coordi- nated Plan- ning VI</u>	<u>Coordi- nated Plan- ning V</u>	<u>Indivi- dual Plan- ning</u>	<u>Coordi- nated Plan- ning III</u>	<u>Coordi- nated Plan- ning IV</u>	<u>Coordi- nated Plan- ning V</u>	<u>Indivi- dual Plan- ning</u>	<u>Coordi- nated Plan- ning III</u>	<u>Coordi- nated Plan- ning IV</u>	<u>Coordi- nated Plan- ning V</u>
<u>Output Change</u>												
1.Agriculture	20691.2	20691.2	24795.3	22954.0	10903.1	10897.0	13425.4	14723.0	10705.2	10741.9	5968.1	6345.5
2.Manufacturing	656.1	656.1	656.1	2445.7	1449.6	1449.6	1449.6	-	340.0	340.0	340.0	-
3.Construction	-	-	-	-	1966.0	1976.9	3250.9	2780.7	2474.1	2373.8	-	-
4.Distribution	-	-	-	-	-	-	-	-	-	-	-	-
5.Transport	-	-	-	-	-	-	-	-	-	-	-	-
6.Hotels	1630.2	1630.2	-	-	-	-	-	-	-	-	-	-
7.Rents/Services	2440.8	2440.8	2704.0	2655.0	2441.4	2441.2	3047.2	3088.9	1283.7	1283.9	675.5	696.3
8.Government	3515.8	3515.8	3894.3	3801.9	3126.5	3126.7	3888.3	3740.1	2793.3	2791.9	1473.6	1518.4
<u>Investment In year T</u>												
2.Manufacturing	3774.2	3774.2	4298.6	4712.6	2312.8	2323.5	2905.2	2541.6	2207.2	2204.0	1055.7	987.9
3.Construction	7145.2	7145.2	6847.9	7014.7	4774.6	4785.5	5969.5	5527.0	4265.9	4163.9	2101.8	2093.9
4.Distribution	-	-	65.6	7.1	86.1	96.2	171.6	214.1	188.7	194.5	60.9	71.4

IV. The opposite holds in the earlier case. The only other solutions worth additional mention concerns the hotels sector which shows no expansion under coordinated planning and the construction sector in Dominica which experiences growth under all planning regimes.

The results for international trade patterns in the terminal year of the planning period for the 7 percent aggregate income growth case appear in Table 8.12. The overall patterns are similar to those of the previous case with exports consisting of agricultural products and hotel services and imports mainly of manufactures. With regards to the balance of payments situation coordinated planning causes an improvement for Antigua and St. Kitts, a deterioration for Dominica. Unlike the previous case, the balance of payments position for the region as a whole deteriorates.

In general the summary remarks made with respect to the previous case applies to the present in which structural transformation is represented by the manufacturing sector expanding at the same 7 percent per annum rate as gross domestic product. To repeat, coordinated planning within a regional economic integration scheme is shown to be attractive in terms of savings in regional investment expenditures.

TABLE 8.12

Results of Individual and Coordinated Multi-Country Planning7% Income Growth Target - 7% Growth in ManufacturingInternational Trade Patterns in Terminal Year

\$000

	<u>ANTIGUA</u>				<u>DOMINICA</u>				<u>ST. KITTS</u>			
	<u>Indivi- dual Plan- ning</u>	<u>Coordi- nated Plan- ning III</u>	<u>Coordi- nated Plan- ning VI</u>	<u>Coordi- nated Plan- ning V</u>	<u>Indivi- dual Plan- ning</u>	<u>Coordi- nated Plan- ning III</u>	<u>Coordi- nated Plan- ning IV</u>	<u>Coordi- nated Plan- ning V</u>	<u>Indivi- dual Plan- ning</u>	<u>Coordi- nated Plan- ning III</u>	<u>Coordi- nated Plan- ning IV</u>	<u>Coordi- nated Plan- ning V</u>
<u>Exports</u>												
1. Agriculture	18688.3	18688.3	22684.8	20779.0	17208.5	17208.5	19413.9	21008.9	16845.3	16881.5	12595.0	12960.0
2. Manufacturing	-	-	-	-	-	-	-	-	-	-	-	-
4. Distribution	729.1	-	-	-	-	-	-	-	-	-	-	-
5. Transport	-	-	-	-	-	-	-	-	-	-	-	-
6. Hotels	8874.3	9047.3	7220.6	7224.4	619.7	619.7	613.8	613.3	2374.5	2374.4	103.0	92.8
Total	28291.7	27735.6	29905.4	28003.4	17828.2	17822.2	20027.7	21622.2	19219.8	19255.9	15077.9	15432.5
<u>Imports</u>												
1. Agriculture	-	-	-	-	-	-	-	-	-	-	-	-
2. Manufacturing	25166.0	25166.0	26514.5	25035.8	18096.2	18107.0	20127.2	21245.8	18058.7	18055.8	14624.4	14969.4
4. Distribution	5749.9	5020.8	5763.3	5306.9	1173.6	1186.8	2020.5	1860.8	1814.5	1818.0	303.9	289.9
5. Transport	220.8	220.8	467.2	360.4	654.2	653.8	961.8	1058.2	92.2	92.9	-	-
6. Hotels	-	173.0	-	-	-	-	-	-	-	-	-	-
Total	31136.7	30580.6	32745.0	30703.1	19924.0	19947.6	23109.5	24164.8	19965.4	19966.7	14928.3	15259.3
<u>Balance of Payments</u>	-2845.0	-2845.0	-2839.6	-2699.7	-2095.8	-2125.4	-3081.8	-2542.6	-745.6	-710.8	149.6	173.2

### 8.3 Sensitivity Analysis Results of Coordinated Development Planning

In numerical exercises of linear programming planning models similar to these reported in the previous two sections it is standard practice to perform sensitivity analyses to determine the responsiveness of the optimal numerical solutions to changes in parameter values. It is appropriate therefore that we touch on this question: This will be the task of the present section. We take up the last case discussed, namely the one in which a 7 percent per annum minimum growth rate for aggregate income combined with a 7 percent per annum minimum growth in gross manufacturing output is specified, primarily because its results should be clearer in the reader's mind than those discussed earlier. Further, in order to simplify the discussion relating to the sensitivity analysis while at the same time presenting in some details the key implications we concentrate only two planning regimes. The two are those identified in Section 8.2 as Individual Planning and Coordinated Planning V. Most of the discussion will center on the latter.

For the latter development planning regime the linear programming problem consists of 91 rows and 240 variables (including slack variables). We consider first the sectoral output variables. In Table 8.13 the values of the input cost coefficients of these variables in the objective function, which it will be recalled minimized total investment costs, are given. For example, the input cost coefficient of increasing manufacturing output in Antigua is 3.4. Of course, those values are identical for all planning regimes reported in the previous two sections of this chapter. The solution values for increases in sectoral output over the planning period are given in Table 8.11 of the previous section.

It may be recalled from Table 8.11 that the value of agricultural output expansion in Antigua is \$22.954 million. This sector's input cost coefficient which has a value of 1.1 in the linear programming problem can be varied be-

TABLE 8.13

Input Cost Coefficients of Sectoral Incremental Output

Country			
Sector	ANTIGUA	DOMINICA	ST. KITTS
1. Agriculture	1.1	0.8	0.9
2. Manufacturing	3.4	3.0	3.2
3. Construction	1.0	1.0	1.1
4. Distribution	0.9	1.3	1.0
5. Transport	3.1	1.9	2.4
6. Hotels	4.0	4.1	4.15
7. Rents/Services	2.4	1.6	2.0
8. Government	4.9	5.0	5.0

tween 0.487 and 1.385 without affecting the optimal solution value and without changing the optimal basis. At an input cost less than 0.487 the solution value of Antigua's agricultural output increases to a maximum of \$25.3428 million at a marginal investment cost of 0.613 with no change in the variables that are in the optimal basis<sup>4</sup>. If the coefficient is greater than 1.385 the solution value can decrease to \$22.1766 million at a marginal investment cost of 8.285 again without any change in the optimal basis. At activity levels outside the range \$22.1766 and \$25.3428 for Antigua's agriculture output the optimal basis is disturbed by the entry of Antigua's distribution sector or of St. Kitts' manufacturing sector into the optimal basis, the former if Antigua's agriculture level is below the range, the latter if it is above the range.

Similar analyses can be applied to the other sectoral output variables. The results are shown in Table 8.14. Consider the result for the agricultural sector in Dominica. The optimal solution value is \$14.723 million (Table 8.11) with an input cost coefficient equal to 0.8 (Table 8.13). This latter value can increase up to 1.398 with no change in the former value. The result in Table 8.14 also shows that the input cost coefficient could go to a negative value (actually to - 0.872) with no change in the optimal solution value. Since a negative value for the input cost coefficient of a sectoral output variable has no meaningful economic interpretation the result can be interpreted in the following manner. Holding all other things constant, any reduction in the investment cost coefficient of agricultural production in Dominica from its assumed value of 0.8 will have no effect on the optimal solution value of this variable. Similarly for any increase up to 1.398. A coefficient value greater than 1.398 changes the optimal solution value from \$14.723 million to a minimum value of \$12.814 million before any change occurs in the optimal

<sup>4</sup> - That is, the value of the objective function will increase by 0.613 times the difference between \$25.3428 million (the maximum value possible without affecting the optimal basis) and \$22.954 million (the optimal solution value), or by \$1.4643 million.

TABLE 9.14

Ranges of Cost Coefficients for Unchanged Activity Levels and Maximum and Minimum Values of Activity Without Change in Optimal Basis

Selected Output Variables

Coordinated Planning, V

	ANTIGUA				DOMINICA				ST. KITTS			
	Lower Cost	Upper Cost	Maximum Value	Minimum Value	Lower Cost	Upper Cost	Maximum Value	Minimum Value	Lower Cost	Upper Cost	Maximum Value	Minimum Value
1. Agriculture	0.407	1.303	25342.8	22175.6	-	1.308	14723.0*	12814.0	0.395	1.468	8607.6	3766.5
2. Manufacturing	1.975	4.030	2663.0	124.0	1.992	∞	2445.7	-	2.570	∞	2321.7	-
3. Construction	-	∞	3776.8	-	-	2.107	2780.7*	1619.8	0.084	∞	1124.0	-
4. Transportation	0.705	∞	1136.5	-	-	∞	2074.0	-	0.370	∞	256.0	-
5. Tourism	2.222	∞	130.5	-	2.224	∞	901.8	-	1.016	∞	982.6	-
6. Hotels	2.242	∞	165.4	-	0.118	∞	14192.2	-	0.668	∞	1093.3	-
7. Banks/Services	-	10.300	2655.0*	2740.5	-	4.096	3089.9*	2631.4	-	12.322	696.3*	554.3
8. Government	2.878	12.058	3803.4	3703.7	-	6.986	3740.1*	3165.1	3.172	9.789	2143.0	1212.7

Notes: Lower cost (upper cost) gives the smallest (largest) value the input cost coefficient can take without affecting the optimal solution value of the variable and the optimal basis. Maximum (minimum) value gives the lowest (smallest) value the activity level of the variable can take without a change in the optimal basis. The variables that have an upper cost of ∞ are not in the optimal basis; their upper cost coefficient values (Table 9.13) can be increased to any finite value without affecting the optimal basis. Variables with lower cost coefficients have value with - (minus) infinity as the lower value. The negative values of course have no meaningful economic interpretation. In column 10, the number of variables of each cost coefficient value for the activities are given. In column 11, the number of variables of each value. Maximum and minimum values are in \$000.

basis. The column labelled maximum value in Table 8.14 gives the largest value the activity level of each variable can take without a change in the optimal basis. For those variables, like Dominica's agriculture sector, which have a negative value in the lower cost column the maximum values computed by the post-optimal procedures of the linear programming solution procedures do not have any meaningful economic interpretation since the input cost coefficients for the development planning model cannot be negative. This means that for variables in the optimal basis which have negative lower costs in Table 8.14, the economically meaningful maximum values for their activity levels are the optimal solution values. These cases are identified by an asterisk (\*) in Table 8.14 and the values shown are the optimal solution values and not the actual computed values using the negative lower cost coefficients.

The sectoral output variables that are not in the optimal basis are easily distinguished in Table 8.14 by the fact that they have an upper cost equal to  $\infty$  (infinity). Take the manufacturing sector of St. Kitts as an example. It has an input cost coefficient of 3.2 and its optimal activity level is zero. Thus any increase in the former will have no economically meaningful effect on the latter. The cost coefficient can decrease down to 2.57 without any change in the zero activity level. If however, the cost coefficient fell below 2.57 then the activity level of the manufacturing sector in St. Kitts will increase to \$2.3217 million. This of course will mean that the optimal basis has changed with this variable entering the basis. The variable to leave the basis is investment demand for distribution in St. Kitts.

A comparison of the input cost coefficients used for the sectoral output variables given in Table 8.13 with the lower and upper cost values given in Table 8.14 indicate that the optimal solution values are quite stable to changes in the values of the cost coefficients. Stability of the optimal solution values is particularly strong for the national sectors as would be

expected given that international trade flows involving these sectors are by definition ruled out. But low sensitivity is also evident for the international sectors as an inspection of the results for agriculture, manufacturing and hotels will reveal. It should be pointed out however, that the above sensitivity results are based upon varying the coefficient values one at a time. This partial equilibrium-type analysis is nevertheless useful since it indicates what changes will occur in the optimal solution structure if for example investment in the manufacturing sector becomes more productive. The results indicate that such partial productivity improvements can occur without any change in the configuration of production specialization in the regional economy.

We now consider a similar analysis for the international trade variables. In the planning regime of regional coordinated planning, it will be recalled that a distinction is made between intra-regional trade and trade with non-member countries. For extra-regional exports, the cost coefficients used were 5.85, 5.25 and 5.55 for manufacturing exports of Antigua, Dominica and St. Kitts respectively, 0.72, 0.63 and 0.66 respectively for their agricultural exports and 0.30 for all other extra-regional exports. The post-optimal linear programming results indicate that for the nine extra-regional export variables that have zero activity levels in the optimal solution, only in one - exports of transport services by St. Kitts - would a reduction in the cost coefficient generate positive exports. The coefficient would have to fall below 0.174 and the result would simply be to replace intra-regional exports of transport services (exports of St. Kitts to Dominica) of \$92,900 by exports to non-regional countries of the same value. In other words, reductions in the transport and tariff cost coefficients will not result in the opening up of export trade to third countries. This result is particularly significant for extra-regional exports of manufactures in view of the large (transport and tariff) cost coefficients assumed.

For the six extra-regional export variables that are in optimal basis some results of the sensitivity analysis are shown in Table 8.15. Under the column activity level are the optimal solution values. Under lower (upper) cost is the minimum (maximum) value that the cost coefficient can take without changing the optimal solution value. Maximum (minimum) value column gives the largest (smallest) value the activity level of the variable can take if the cost coefficient takes a value outside the lower and upper costs with the optimal basis remaining intact. Finally, the input cost column gives the value of the input cost coefficient used in the linear programming problem. It can be seen from the results shown that the input cost coefficient of Antigua's exports of agricultural products to non-regional countries can take on values between 0.358 and 0.985 without affecting the optimal solution value of \$20.797 million. The value used in the problem is 0.72. However, if the coefficient value falls below 0.358 Antigua's agricultural exports to third countries can increase up to \$33.0233 million, that is by 58.9 percent, without any change in the optimal basis. If the coefficient is larger than 0.985 the activity level declines to \$19.3009 million or by 7.1 percent. Elaboration of the other results is left to the reader. The general conclusion is that partial variation of the input cost coefficients over fairly wide ranges leaves the optimal basis of the linear programming problem unchanged and even the solution values of extra-regional export variables. Inspection of the results for imports from non-regional sources suggest a similar conclusion for imports.

The results for the intra-regional trade variables may now be discussed. Given the existence of a regional economic integration scheme with an integral coordinated development planning mechanism it is obvious that the cost coefficients for intra-regional trade will be smaller than for extra-regional trade. For one thing, tariff costs are eliminated and for another, planning

TABLE 8.15

Optimal Activity Levels, Ranges of Cost Coefficients for Unchanged Activity Levels and Minimum and Maximum Values of Activity Without Change in Optimal Basis.

## Extra-Regional Export Variables in Optimal Basis

	<u>Coordinated Planning V</u>					
	<u>Input Cost</u>	<u>Lower Cost</u>	<u>Upper Cost</u>	<u>Activity Level</u>	<u>Maximum Value</u>	<u>Minimum Value</u>
<u>ANTIGUA</u>						
Agriculture exports	0.72	0.358	0.985	20779.0	33023.3	19300.9
Hotel services exports	0.30	0.027	0.629	7224.4	7838.1	5727.9
<u>DOMINICA</u>						
Agriculture exports	0.63	0.362	0.993	21008.9	22471.7	-
Hotel services exports	0.30	-	0.573	613.3	613.3*	-
<u>ST. KITTS</u>						
Agriculture exports	0.66	0.374	0.978	12960.0	14364.3	-
Hotel services exports	0.30	-	0.578	2379.7	2379.7*	-

NOTES: - Indicates a negative value; an asterisk (\*) implies that the economically meaningful maximum is the optimal solution value. For export flows with negative minimum values the economically meaningful minimum is of course zero. See notes to Table 8.14 and related discussion in text.

of the regional transport system should generation economies in transport costs. The input cost coefficient values assumed are 0.225 for intra-regional exports and 0.1 for intra-regional imports. Of the 30 possible intra-regional trade flows<sup>5</sup> only one is in the optimal basis. This is exports of transport services valued at \$92800 by St. Kitts to Dominica. Of the remaining non-basis intra-regional trade variables only for one - imports of transport services of Antigua from St. Kitts - does a smaller positive cost coefficient generate a positive trade flow, and in this case the one existing intra-regional trade flow in the optimal basis is eliminated. For intra-regional trade to develop in the products of the other international sectors the cost coefficients for the intra-regional trade variables must be negative. A possible economic interpretation of this result is that production subsidies in addition to zero intra-regional transport costs must be forthcoming to stimulate intra-regional trade.

In view of the importance of the normative goal of structure transformation of the regional economy an interesting question is whether, in spite of the need to subsidize regional transportation and production if intra-regional trade is to be stimulated, it is cheaper to stimulate intra-regional trade in manufactures or exports of manufactures to non-regional countries. The results of the sensitivity analyses show that to stimulate either type of manufacturing trade production as well as transport cost subsidies must be made. However, for all three countries the cost of generating intra-regional manufacturing trade is smaller than the costs incurred to generate extra-regional manufacturing exports. To take St. Kitts as an example, the marginal cost<sup>6</sup> of extra-regional manufacturing exports is 5.69 while the marginal cost of

5 - There are 3 countries and 5 international sectors.

6 - Marginal cost is the increase in the value of the objective function per unit increase in the activity level.

of exports of manufactures to Antigua and St. Kitts are 0.325 and 0.318 respectively. This of course is mainly due to the high tariff and marketing costs incurred in exporting to third countries and which are taken into account in the cost coefficients used in the linear programming problem.

The sensitivity analysis results presented so far in this section relate to the development planning regime identified in Section 8.2 as Coordinated Planning V. It will be recalled that under this planning regime region-wide targets of minimum annual growth rates of 7 percent are set for aggregate income and gross manufacturing output. The final set of results that we wish to present concerns the difference in the value of the objective function of this planning regime and the nationalistic planning regime which assumes the same growth targets. The input cost coefficients used in the linear programming problems of the two planning regimes are identical except that for coordinated planning a distinction is made between intra-regional trade and trade with non-member countries and the former trade flows have slightly smaller cost coefficients. Specifically intra-regional export and import variables have coefficient values of 0.225 and 0.10 respectively while the coefficient values for the extra-regional export variables are 0.30 (except for manufacturing and agriculture) and 0.15 for the import variables. In any event, since the optimal solution has very little intra-regional trade the difference in the objective function values (investment costs) are due to the regional specialization that occurs and not to the small differences in coefficient values.

Recall from Section 8.2 (Table 8.10) that the objective function value under Coordinated Planning V is \$161.8136 million compared to \$168.9992 million for nationalistic planning. This means that coordinated development planning leads to a saving of \$7.1856 million of investment outlays or 4.3

percent of the investment costs incurred under nationalistic planning. The analysis in Chapter 4 suggested several areas in which coordinated development planning in a regional economic integration scheme has the potential of reducing costs. In light of this it is clear that the gains calculated by the linear programming problems are minimum values. In order to account for all the potential gains different values for the cost coefficients would have to be used for the two planning regimes. But given virtually no empirical information on the magnitude of the changes in the coefficient values of the variables brought about by a framework of economic integration and regionally coordinated development planning any such exercise will be purely speculative. For this reason it properly belongs to the realm of sensitivity analysis.

To carry out such an exercise we assume that the coefficient values used would result after the effects of the economic integration and coordinated planning processes have been felt. The nationalistic planning coefficient values are taken to be larger than the values actually used. Thus in the sensitivity analysis the objective function value of coordinated planning will remain unchanged while that for nationalistic planning changes based upon the new coefficient values chosen. One condition that is fulfilled by the choices of the new coefficient values made is that the optimal solution values are unchanged. In other words except for the value of the objective function all the optimal solution values of the variables are the same. In particular the optimal activity levels for the variables whose cost coefficient values are changed remain unaffected. This permits a simple and straightforward comparison of the gains under the planning regimes.

Suppose that under nationalistic planning the input cost coefficients for agriculture and manufacturing in the three countries are not those given

in Table 8.13 but are 1.2, 1.2, and 1.4 for agriculture in Antigua, Dominica and St. Kitts respectively and 4.0, 3.5 and 3.7 for their manufacturing output. The optimal solution of the linear programming problem reflects investment costs (objective function value) of \$182.0706 million. Coordinated development planning would then generate a gain in saved investment outlays of \$20.257 million or 11.13 percent of the investment expenditures under nationalistic planning. This is substantially greater, in both absolute and relative terms, than the gains forthcoming under constant input cost coefficients. It may be objected that the increased efficiency of investment outlays brought about by the economic integration and coordinated development planning processes implied by the differential in the two sets of coefficient values is extremely large. Hence, the potential gains are exaggerated. This may indeed be the case. However, in the real world situation in structurally dependent economies the scope for restructuring the national and regional economies is quite considerable within the framework of a regional economic integration scheme consisting of elements outlined in Chapters 3 and 6. Consequently, the assumed differential in input cost coefficients and the resulting gains may not be exaggerated. Also, the sensitivity exercise assumes differential coefficients values for two sectors. To the extent that coordinated planning induces increased investment efficiency in the other sectors any exaggeration implied in the values used for agriculture and manufacturing will be offset by the omission of the former efficiency gains. In any event, it has been emphasized earlier that even small gains can be attractive to the members of an economic integration scheme once the gains are evaluated in a dynamic context.

It now suffices to summarize the results established so far. This is done in the following final section of the chapter.

#### 8.4 Regionally Coordinated Planning: Summary of Results

The illustrative empirical results and sensitivity analysis of the numerical solutions discussed in the preceding sections of this chapter indicate that for an economic integration scheme comprising three countries of the East Caribbean Common Market a regime of coordinated development planning is an attractive framework for the growth and development of the national and regional economies. The benefits of coordinated development planning over nationalistic development planning derive from the greater production specialization that is possible within the regional planning framework.

The numerical results suggest that with the same input cost coefficients the former planning regime generates gains equal to more than 4 percent of the investment costs incurred under the latter planning regime. For the case where aggregate income and gross manufacturing output are required to expand at a minimum annual rate of 7 percent over the five-year planning period, the calculated gains are \$7.2 million or 4.3 percent of total investment expenditures under nationalistic planning. The structure of the linear programming models used and the cost coefficient values assumed together with the analysis of Chapter 4 suggest that the computed gains are minimum values. Sensitivity analysis of the case just mentioned shows that the relative and absolute gains can be substantial if reasonable differentials between the input cost coefficient for the two planning regimes, to reflect the postulated increased productive efficiency of investment under coordinated planning, are used. Specifically adjusting the cost coefficients for the agriculture and manufacturing sectors led to a more than doubling of the gains.

That economic polarization effects are likely to be a real problem in an economic integration scheme comprising small structurally dependent

economies is supported by the optimal solution results. Thus the earlier stated insistence that a resolution of the problem of economic polarization should be an integral part of the regional economic integration and planning processes is well justified. The numerical results also show that by an appropriate planned allocation of the investment funds saved by coordinated planning the economic polarization effects can be neutralized while retaining the benefits of economic integration.

As regards international trade flows the numerical results reflect minimal growth in intra-regional trade. Nevertheless, the costs involved in stimulating intra-regional trade are lower than those for promoting exports to third countries. The balance of payments position of the region as a whole is more favorable under coordinated planning for most of the cases. It is not clear, however, whether this positive side effect will be evident for other numerical cases.

How applicable are these numerical results of a hypothetical integration scheme comprising Antigua, Dominica and St. Kitts to the seven-member ECCM? No doubt any inferences relating to the latter economic integration scheme will be speculative. However, given the structural features of the economies of the Leeward and Windward Islands it is felt that the main qualitative results of the empirical experiments hold for the ECCM. It should be recognized, however, that the multi-sectoral planning model on which the results are based provides only the contours of the economies. For the benefits to be actualized the planning process must cover not only this rather general phase of development planning but the planning of specific economic projects as well. The latter task is the subject of the following chapter. Even at the general multisectoral stage however we have established that it is desirable to integrate region-wide development planning in any meaningful economic integration scheme for the Leeward and Windward Islands.

## CHAPTER 9

### REGIONAL INDUSTRIAL PROGRAMMING: EMPIRICAL ANALYSIS OF PROJECTS

The manufacturing projects that are investigated in the suggested regional industrial programming scheme for the ECCM were identified in Chapter 7. In this chapter the empirical results for the six projects chosen are presented. The mathematical structure of the mixed integer linear programming model on which the empirical analysis is based was outlined in Section 6.5. It should be apparent that an actual industrial programming plan for the ECCM would include other projects as well. Thus the projects analyzed here should at best be seen as a set of projects on which the program can begin. In particular similar analyses of projects in the agricultural sector would have to form part of the scheme. Also, actual implementation of the projects would require adjustment to the results to take account of any significant changes in comparative cost structures and demand patterns in the member countries that may have occurred in the past couple of years. However such adjustments can be easily carried out since the basic model has been applied before.

The organization of the empirical analysis is as follows. In Section 9.1 the footwear project is discussed. This is followed by analyses of the ceramics and tropical fruit canning projects in Sections 9.2 and 9.3. The garment manufacturing projects are discussed in

Sections 9.4, 9.5 and 9.6. The chapter is concluded by a short summary section which discusses as well some of the sensitivity analysis carried out on the optimal solutions of the projects.

### 9.1. The Footwear Project

Consider first the question of market demand. For the ECCM countries the annual average footwear imports<sup>1</sup> for the year 1967 and 1968 was 1.4 million pairs at a cost of \$3.1 million. In determining the regional demand for footwear to be produced by the regional project it has to be recognized that the project will have to limit itself to a narrowly defined type of footwear to eliminate uneconomic production runs and to fulfill minimum economic production levels. However, the import figures cover a wide range of footwear both in terms of raw materials and techniques of production. Thus a realistic market demand for the proposed project's output will be significantly below the import figures. Although the trade statistics for footwear have as many as seven categories, each category is quite heterogeneous so that allocating the proposed project to a specific category is likely to be as accurate as allocating the project to a small proportion of total footwear imports. In any case, given consumer tastes and acquaintance with imported footwear<sup>2</sup> the proposed project will be unable to fully replace imports of similar footwear. The best that can be hoped for is that it will supply the incremental demand in the particular type of

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<sup>1</sup>Standard International Trade Classification (SITC) Group 851.

<sup>2</sup>There is presently no production of footwear in any of the ECCM countries.

footwear and perhaps an insignificant part of current demand.

In Table 9.1 the available time series data on footwear imports since 1960 for the ECCM countries are given. It can be seen that the series is incomplete for some of the countries so that it was not possible to develop estimates of demand using regression analysis. The unavailability of appropriate income series should also be noted. Consequently a rather crude assumption about the amount of import substitution that can be achieved is used to determine market demand for the project's output. The assumption is that the project will be able to sell in the ECCM market output equal to 5 percent of the annual average imports of all footwear for the two years 1967 and 1968. The implied market demand for each member country is given in Table 9.2. The table also shows that total ECCM demand is 70,809 pairs of footwear. It is felt that this estimate does not overstate the potential market, provided of course that delivery costs (production plus transportation) are competitive and acceptable quality is forthcoming. It may be noted that the incremental demand for all footwear in 1968 for the ECCM was 413,584 pairs, more than five times the demand assumed.<sup>3</sup>

We turn now to a discussion of the cost estimates. Total production costs were divided into nine categories as follows: (i) material costs, (ii) direct labor costs, (iii) indirect labor costs, (iv) utilities costs, (v) building rent, (vi) other overhead costs, (vii) depreciation, (viii) interest on fixed capital, and (ix) interest on working capital. It will be evident from the above classification that it is the current

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<sup>3</sup> Incremental demand for 1968 is measured by the difference between imports in 1968 and 1967.

Table 9.1

## Footwear Imports\* of ECCM Countries

		Antigua	Dominica	Grenada	Montserrat	St. Kitts	St. Lucia	St. Vincent	ECCM
1960	pr			163,212			158,472	149,064	
	\$	352,238	282,800	308,696			393,900	302,094	
1961	pr			168,180			146,904	207,804	
	\$	405,018	221,500	424,191			390,400	354,987	
1962	pr				25,407		160,128	116,412	
	\$	477,786	353,400		66,564		436,800	265,498	
1963	pr			238,740	34,022		172,104	131,868	
	\$	458,212	307,300	359,902	80,799		402,900	284,841	
1964	pr	158,736					161,964	148,272	
	\$	393,124	379,797				439,400	350,779	
1965	pr	132,732		207,936		155,856	189,936	132,372	
	\$	357,205	398,934	417,334		340,147	484,200	287,314	
1966	pr	189,300		240,960			254,400		
	\$	434,164	416,526	526,035			573,800		
1967	pr	202,776	150,060	301,260	14,971	134,592	247,872	157,860	1,209,341
	\$	632,798	360,424	568,549	41,112	280,081	597,900	332,107	2,812,971
1968	pr	251,472	219,168	401,052	40,703	191,964	298,704	219,912	1,622,975
	\$	631,724	486,372	651,736	117,613	392,026	717,300	395,000	3,391,771
1969	pr		186,196				309,624	185,364	
	\$		477,053				779,500	307,000	
1970	pr				34,970		369,480		
	\$		480,100		136,041		888,358		

Table 9.1 (Continued)

	Antigua	Dominica	Grenada	Montserrat	St. Kitts	St. Lucia	St. Vincent	ECCM
1971				34,674	170,736	318,600		
	pr			122,006	426,078	920,455		
	\$							
1972								
	pr							
	\$							

\*SITC Group 851. For blank entries figures unavailable.

Sources: Annual Trade Reports of individual ECCM countries for 1960 to 1971.

Table 9.2  
Market Demand\* for ECCM Footwear Project

Country	Demand (pairs)
1. Antigua	11,356
2. Dominica	9,231
3. Grenada	17,558
4. Montserrat	1,392
5. St. Kitts	8,164
6. St. Lucia	13,664
7. St. Vincent	<u>9,444</u>
ECCM	<u>70,809</u>

\*5 percent of annual footwear imports for 1967-68;  
see discussion in text.

cost of fixed capital as reflected in allowances for its depreciation and opportunity cost that is included in production costs. The latter is given by interest on fixed capital and a 12 percent rate of interest is assumed. It can be observed also that it is assumed that building for the project will be rented. As noted in Chapter 7 the governments of all the ECCM countries make available factory shells for manufacturing establishments. The project is assumed to make use of this at the rent charged. The breakdown of total labor costs in direct and indirect is quite familiar and requires no comment except to recall that the costs particularly for direct operatives are based on the wage rates in Table 7.15. The category, other overhead, consists mainly of maintenance

expenses, office supplies, insurance etc. Finally it will be observed that the cost to the project of working capital is the interest rate paid for its use. The rate of interest assumed is 14 percent.

The cost structure or more loosely the technology of the project is based upon an Economist Intelligence Ltd. prospectus [52] on a footwear project for the Eastern Caribbean and Belize and profiles of three footwear establishments by UNIDO [108]. The production costs in the seven member countries were estimated for four production levels<sup>4</sup> and a linear approximation of these made to determine the production costs. The resulting estimates of the production costs in the various countries are shown in Table 9.3.

The mixed integer programming model also requires values for transportation costs in moving the product from production points to the consuming (demand) centers. The calculations assume that sea transport will be used. The freight rates of the West Indies Shipping Service and the landing, storage and handling charges at the various ports are used. It turns out that the differences in transport costs for the various flows are minor. This results from the fact that intra-regional freight rates are the same for all routes, leaving only the landing, storage and handling charges to account for any differences.

Finally, there are the capacity constraints that must be imposed on the project in each possible location. Two constraint sets were used. The first assumes that each potential project produces a maximum 48,000 pairs (per annum). The second constraint set assumes that the potential

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<sup>4</sup>The production levels were 33,600, 48,000, 60,000 and 96,000 pairs per annum.

Table 9.3  
Production Costs of Footwear Project

Producer	\$ Fixed Costs	\$ Unit Variable Costs
1. Antigua	154,060.13	7.18
2. Dominica	141,966.46	6.23
3. Grenada	144,514.60	6.26
4. Montserrat	143,038.51	6.27
5. St. Kitts	141,409.38	6.21
6. St. Lucia	144,445.00	6.24
7. St. Vincent	139,765.64	6.17

projects in Montserrat, Dominica and St. Vincent have maximum capacities of 48,000 pairs while those in the other countries have capacity constraints of 60,000 pairs. An observation regarding the effect of the specific capacity constraints used on the optimal solution is in order. Given the total market demand the assumed capacity constraints imply that two footwear plants will be established. Capacity constraints greater than the market demand would have led to one plant. It should be recognized also that the constraints used are not to be interpreted in a technological sense since they are well below existing plant sizes. They are to be interpreted in a broader sense of plausible output levels in the countries given the overall stage of development. Also while efforts are made to minimize costs through regional collaboration the question of equitable distribution of benefits must be kept in mind. It was the latter consideration which in part led to the particular values chosen. In any event we comment briefly later on a solution which has only one plant.

In Table 9.4 the optimal solution results for the first capacity constraint set are presented. The mixed integer linear programming problem consists of 22 rows and 78 variables, 7 of which are constrained to have values of zero or unity. It should be recalled that we assume a maximum of one plant in each country. The minimum total costs (production plus transportation costs) of supplying the estimated demand in the seven markets are \$733,015 (activity level of ZVALUE) as shown in Table 9.4a. This table also shows that production takes place in two member countries, St. Kitts (OUTPUT5) and St. Vincent (OUTPUT7). The plant in the former country manufactures 22,809 pairs of shoes (activity level of OUTPUT5) while the factory in St. Vincent produces its maximum capacity of 48,000 pairs. The DEMAND variables represent the assumed market requirements in the seven consuming centers.<sup>5</sup> Their activity levels are identical to the values given in Table 9.2. The optimal results for the trade flows are shown in Table 9.4b. St. Kitts supplies Grenada with 13,253 pairs (activity level of X53), 75 percent of the latter's requirements. It supplies Montserrat with its entire needs (X54 = 1392 = DEMAND4) as well as provide for its own requirements (X55 = 8164 = DEMAND5). St. Vincent fulfills its own requirements (activity level of X77 = 9444 = DEMAND7) as well as supplies the entire needs of Antigua (X71 = 11356 = DEMAND1), Dominica (X72 = 9231 = DEMAND2) and St. Lucia (X76 = 13664 = DEMAND6) and the remaining 25 percent of Grenada's requirements (X73 = 4305).<sup>6</sup>

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<sup>5</sup>Country numbers are as given in Table 9.2. Thus DEMAND2 is the market demand in Dominica (country 2).

<sup>6</sup>X<sub>ij</sub> is the amount of commodity produced in country i and transported to country j. Producer country numbers are as given in Table 9.3 and

TABLE 9.4a

Optimal Solution of Footwear Project:  
Total Costs, Output and Demand Results

NUMBER	ROW	AT	ACTIVITY	SLACK ACTIVITY	LOWER LIMIT	UPPER LIMIT	DUAL ACTIVITY
1	ZVALUE	BS	733015,20999	733015,20999	NONE	NONE	1,00000
2	OUTPUT1	BS	.	48000,00000	NONE	48000,00000	.
3	OUTPUT2	BS	.	48000,00000	NONE	48000,00000	.
4	OUTPUT3	BS	.	48000,00000	NONE	48000,00000	.
5	OUTPUT4	BS	.	48000,00000	NONE	48000,00000	.
6	OUTPUT5	BS	22809,00000	25191,00000	NONE	48000,00000	.
7	OUTPUT6	BS	.	48000,00000	NONE	48000,00000	.
8	OUTPUT7	BS	48000,00000	.	NONE	48000,00000	.
9	DEMAND1	EQ	11356,00000	.	11356,00000	11356,00000	6,50000
10	DEMAND2	EQ	9231,00000	.	9231,00000	9231,00000	6,47000
11	DEMAND3	EQ	17558,00000	.	17558,00000	17558,00000	6,47000
12	DEMAND4	EQ	1392,00000	.	1392,00000	1392,00000	6,47000
13	DEMAND5	EQ	8164,00000	.	8164,00000	8164,00000	6,21000
14	DEMAND6	EQ	13664,00000	.	13664,00000	13664,00000	6,46000
15	DEMAND7	EQ	9444,00000	.	9444,00000	9444,00000	6,21000
16	ZERO01	UL	.	.	48000,00000	.	3,20959
17	ZERO02	UL	.	.	48000,00000	.	.24000
18	ZERO03	UL	.	.	48000,00000	.	.21000
19	ZERO04	UL	.	.	48000,00000	.	2,97497
20	ZERO05	BS	25191,00000	25191,00000	48000,00000	.	.
21	ZERO06	UL	.	.	48000,00000	.	.22000
22	ZERO07	UL	.	.	48000,00000	.	.04000

Optimal Solution of Footwear Project:  
 Producer-Consumer Combinations

NUMBER	COLUMN	AT	ACTIVITY	INPUT COST
23	x11	LL	.	7,18000
24	x12	LL	.	7,44000
25	x13	LL	.	7,44000
26	x14	LL	.	7,44000
27	x15	LL	.	7,44000
28	x16	LL	.	7,43000
29	x17	LL	.	7,44000
30	x21	LL	.	6,52000
31	x22	BS	.	6,23000
32	x23	LL	.	6,49000
33	x24	LL	.	6,49000
34	x25	LL	.	6,49000
35	x26	LL	.	6,48000
36	x27	LL	.	6,49000
37	x31	LL	.	6,55000
38	x32	LL	.	6,52000
39	x33	BS	.	6,26000
40	x34	LL	.	6,52000
41	x35	LL	.	6,52000
42	x36	LL	.	6,51000
43	x37	LL	.	6,52000
44	x41	LL	.	6,56000
45	x42	LL	.	6,53000
46	x43	LL	.	6,53000
47	x44	LL	.	6,27000
48	x45	LL	.	6,53000
49	x46	LL	.	6,52000
50	x47	LL	.	6,53000
51	x51	LL	.	6,50000
52	x52	LL	.	6,47000
53	x53	BS	13253,00000	6,47000
54	x54	BS	1392,00000	6,47000
55	x55	BS	8164,00000	6,21000
56	x56	LL	.	6,46000
57	x57	LL	.	6,47000
58	x61	LL	.	6,53000
59	x62	LL	.	6,50000
60	x63	LL	.	6,50000
61	x64	LL	.	6,50000
62	x65	LL	.	6,50000
63	x66	BS	.	6,24000
64	x67	LL	.	6,50000
65	x71	BS	11356,00000	6,46000
66	x72	BS	9231,00000	6,43000
67	x73	BS	4305,00000	6,43000
68	x74	LL	.	6,43000
69	x75	LL	.	6,43000
70	x76	BS	13664,00000	6,42000
71	x77	BS	9444,00000	6,17000

Closer scrutiny of the trade flows solutions of the mixed integer program reveals the existence of multiple optima. An alternative equivalent cost trade flow configuration to that shown in Table 9.4b would involve the St. Kitts plant supplying the Antigua, Dominica and St. Lucia markets, while the St. Vincent plant supplies the Montserrat requirements. The two producing countries would however continue to supply their own domestic needs. This multiple trade result is due to the already mentioned fact that intra-regional transport cost differences are minor.<sup>7</sup>

Several comparative questions can be raised about the optimal solution. First, how do the minimum costs of \$733,015 compare with the costs of supplying the member countries' assumed requirements. An extreme alternative method and one that is important in assessing the relative merits of the program of regional industrial programming is for each country to supply its requirements by a nationalistic program of industrial programming. Results of the mixed integer program show that the combined costs for all the countries would be \$1,458,117. This is almost twice the costs (actually 99 percent more) incurred under the regional scheme. It may be objected that this comparison is inappropriate since it is unlikely that any of the countries would undertake the project to supply their small domestic needs alone. The observation regarding the unlikelihood of establishing such a project is

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consuming country numbers are as given in Table 9.2. Example: X42 is the amount produced in Montserrat and shipped to Dominica. Values under column ACTIVITY in table are the optimal solution values.

<sup>7</sup>The unit transport costs for intra-regional shipments of footwear range from 25 cents to 29 cents. The costs for 30 of the 42 possible flows are identical.

somewhat plausible. However, rather than questioning the comparison made it underscores the significance of the regional strategy if the development of a manufacturing sector is to be achieved.

A second comparison would be between the unit costs implied by the optimal solution and the unit costs of importing the product. Standard neoclassical comparisons of this sort assume that the regional labor employed in the project would be otherwise productively engaged if the project is not undertaken. Obviously, for the Leeward and Windward Islands with upwards of 15 percent unemployment such an assumption cannot be entertained. Thus the direct comparison of unit costs neglects the local value added generated by the project and which is unlikely to be forthcoming in its absence. Recent economic trends in the ECCM countries suggest that the effective options open to the policymakers more closely border that implied by the first comparison than by domestic and import costs. It is sufficient to note that average unit costs of \$10.35 implied by the results are substantially below the retail prices of footwear in the medium price range, the type of footwear the project would manufacture.

A third type of comparison is the costs of the optimal solution with the costs of other regional production patterns. This type of comparison is important because for the overall regional industrial programming scheme it may be necessary to establish a particular project in second-best locations so that all countries benefit from the scheme. For this reason several second-best solutions were calculated to determine how much more costly they are. The costs and production location configuration of these results are shown in Table 9.5. A comparison of

**Table 9.5**  
**Costs and Production Locations of Second-Best**  
**Solutions of Footwear Project<sup>a</sup>**

Solution Number	Total Costs <sup>b</sup>	Unit Costs	Producers <sup>c</sup>
1	\$733,751	\$10.36	St. Vincent, Dominica
2	\$734,818	\$10.38	St. Vincent, Grenada
3	\$735,442	\$10.39	St. Vincent, St. Lucia
4	\$737,648	\$10.42	St. Kitts, Dominica
5	\$737,774	\$10.42	St. Vincent, Montserrat
6	\$738,715	\$10.43	St. Kitts, Grenada
7	\$739,338	\$10.44	St. Kitts, St. Lucia
8	\$739,954	\$10.45	Dominica, Grenada
9	\$740,578	\$10.46	Dominica, St. Lucia
10	\$741,670	\$10.47	St. Kitts, Montserrat
11	\$741,897	\$10.48	St. Lucia, Grenada
12	\$742,910	\$10.49	Dominica, Montserrat
13	\$744,733	\$10.52	Grenada, Montserrat
14	\$744,852	\$10.52	St. Lucia, Montserrat
15	\$766,620	\$10.83	St. Vincent, Antigua
16	\$770,517	\$10.88	St. Kitts, Antigua
17	\$771,756	\$10.90	Dominica, Antigua
18	\$773,579	\$10.92	Grenada, Antigua
19	\$773,699	\$10.93	St. Lucia, Antigua
20	\$776,786	\$10.97	Montserrat, Antigua

- a. Capacity constraints for each of the possible seven plants is 48,000 pairs.
- b. Total production costs plus transportation costs from producing to consuming countries.
- c. First country produces 48,000 pairs, second country 22,809 pairs.

the objective function value (total costs) of the optimal solution and these solutions indicates that it is important to have knowledge of the latter as well. Establishing the plants in Dominica and St. Vincent involve costs of \$733,751 (solution no. 1) a negligible \$736 above the optimal solution costs. For practical purposes therefore establishing the second plant in Dominica as opposed to its optimal location in St. Kitts makes little difference. This information would be valuable in cases where locating another project in one or other of these countries involved greater gains and for reasons of equity the projects had to be shared. Then the second-best location may be chosen over its slightly better optimal counterpart.

As noted above a second set of capacity constraints was experimented with in efforts to determine the optimal solution. The potential footwear establishments in Dominica, Montserrat, and St. Vincent were assumed to have a maximum capacity of 48,000 pairs, while for the other countries 60,000 pairs were assumed. The results of this case still require two plants. In particular the optimal solution is identical to the previous case, as are the first three second best solutions given in Table 9.5. Solutions in which St. Kitts and another member except St. Vincent are the producers show lower costs due to the fact that St. Kitts output increases to the higher 60,000 pairs capacity.

The optimal solution of the programming problem gives a single producing country if the capacity constraints of the potential plant in each country is set above total demand. This results from the fact that at a total demand of 70,809 pairs the fixed costs weigh heavily in total costs. The optimal and the two most attractive second-best

solutions assuming a capacity constraint of 96,000 pairs for each of the seven possible plants are shown in Table 9.6. The optimal solution is to locate one plant in St. Vincent which would supply the requirements for the entire ECCM at a total cost (production plus transport) of \$592,816. The implied unit cost is \$8.37. The next least cost solution is to establish a single footwear factory in St. Kitts. The total cost and implied unit cost for this case are \$597,625 and \$8.44 respectively.

Table 9.6

Optimal and Second-Best Solutions of Footwear Project  
with Capacity Constraints of 96,000 Pairs

	Total Costs*	Unit Costs	Producer
Optimal solution	\$592,816	\$8.37	St. Vincent
Second-best solution 1	\$597,625	\$8.44	St. Kitts
Second-best solution 2	\$599,321	\$8.46	Dominica

\*Total production costs plus transportation costs from producing to consuming countries.

A comparison of this result and those discussed earlier indicate the significance of the capacity constraint on the optimal solution. But more important the differences in the results indicate the substantial gains that can be made if regional duplication of manufacturing plants is avoided. Compared to the first set of optimal results which involve two plants in the region the second optimal solution which implies a single regional plant incurs total costs that are smaller by \$140,199 or 19 percent. The unit costs implied by the two sets of optimal solutions are \$10.35 and \$8.37. Since the cost estimates used for the

mixed integer programming problem are applicable for a footwear project up to a capacity of 96,000 pairs (per annum) the computed gains are reasonable estimates of the additional savings that can be forthcoming to the region if a single plant instead of two is established.

In conclusion it may be said that the implied unit cost of footwear of the optimal solution of the regional footwear project is well below retail prices of footwear comparable to output of the proposed project. The results indicate that substantial savings in costs can be made by a regional project as opposed to a nationalistic project which in any case would be impracticable for most of the members. A comparison of the costs for the optimal solution involving two plants and the optimal solution involving one plant suggests that the distributional aspects of the regional industrial programming scheme may best be handled by including many manufacturing projects in the scheme rather than having two plants per project since significant cost savings are sacrificed in the latter arrangement. Discussion relating to sensitivity analysis is taken up in Section 8.7.

#### 9.2. The Ceramics Project

The ceramics project for the suggested regional industrial programming framework for the ECCM involves the manufacture of tableware in one of the member countries to satisfy estimated demand in the member countries as well as the more developed member countries (MDCS) of the Caribbean Common Market. The product mix used is that suggested by the Economist Intelligence Unit [54] in its prospectus of a ceramics project for the ECCM countries and Belize. It comprises cups, saucers, plates and castware in approximate ratios of 7:6:6:5. As in the previous

section the discussion of market demand is taken up first, followed by the estimates of costs.

In Table 9.7 the imports of pottery by the ECCM countries and Trinidad-Tobago, one of the MDCS of the Caribbean Common Market, are shown. The market demand estimates used in the mixed integer problem for the ceramics project are based on these import figures. It should be expected that given the incompleteness of the import statistics estimates of demand using regression analysis would be hazardous. Consequently crude demand estimates are made. These estimates can at a later stage be refined once adequate time series for all countries become available. For the moment some accommodation was made to the crudeness of the estimates by finding the optimal solution under three sets of market demand estimates.

Except for Montserrat the quantity figures of pottery imports in Table 9.7 are given in pounds. Since the project is analyzed in terms of number of pieces of tableware we need to get import estimates in the latter units. This is done by using a conversion factor of 1 lb. = 1.263 pieces of tableware. This conversion factor is implied by the Economist Intelligence Unit study referred to above. In Table 9.8 average annual imports of pottery (in pounds) together with the estimated number of pieces are given. The total estimated annual imports of pottery for the eight Caribbean countries considered is 1.47 million pieces. It should be noted that the years used for calculating the annual average imports vary for the different countries, a procedure made necessary because of the limitations of the data. The available import figures in Table 9.7 do not indicate any clear trend

Table 9.7  
Pottery Imports<sup>a</sup> of ECCM Countries and Trinidad

		Antigua	Dominica	Grenada	Montserrat	St. Kitts	St. Lucia	St. Vincent	Trinidad
1960	1b <sup>b</sup>						29,229	27,388	
	\$						21,694	21,538	
1961	1b			59,656				64,070	
	\$			27,369				26,862	
1962	1b				46,844			43,149	
	\$				9,472			17,899	
1963	1b			20,276			39,030		
	\$			17,882			25,250		
1964	1b	--					71,224	49,255	
	\$	57,417					32,322	30,407	
1965	1b	--		29,898		30,388		76,419	
	\$	86,181		25,710		25,136		39,044	
1966	1b	--		82,926			66,543		1,157,920
	\$	109,595		50,565			37,777		476,820
1967	1b	--	--	43,572	10,008	11,572	71,219	33,625	930,336
	\$	81,371	10,370	42,345	10,954	9,860	38,746	27,068	468,638
1968	1b	--	--	66,620	11,532	12,645	38,059		753,532
	\$	88,271	15,560	47,704	10,926	8,407	57,157		482,650
1969	1b		--				67,452		646,561
	\$		12,137				88,783		599,271
1970	1b				13,896		78,020		826,527
	\$				17,288		118,177		669,329

Table 9.7 (Continued)

		Antigua	Dominica	Grenada	Montserrat	St. Kitts	St. Lucia	St. Vincent	Trinidad
1971	1b				10,464	8,677			
	\$				21,955	13,424			
1972	1b								
	\$								

b. All quantity figures for Montserrat are number of pieces.

a. SITC Group 666.

Sources: Annual Trade Reports of the individual countries for 1960 to 1971.

Table 9.8  
Average Annual Pottery Imports<sup>a</sup> of ECCM  
Countries and Trinidad

Country	Imports (lb)	Imports (pieces) <sup>b</sup>	Years Used
1. Antigua	c	116,839	1964-68
2. Dominica	c	17,531	1967-69
3. Grenada	55,754	70,417	1965-58
4. Montserrat	d	11,475	67,68,70,71
5. St. Kitts	15,821	19,981	65,67,68,71
6. St. Lucia	64,259	81,159	1966-70
7. St. Vincent	53,100	67,065	64,65,67
8. Trinidad	862,975	1,089,937	1966-70

a. SITC Group 666.

b. A conversion factor 1 lb = 1.263 pieces is used; see text.

c. For Antigua and Dominica no quantity statistics are available; estimates of number of pieces are derived by using the value/quantity proportion for Grenada and St. Lucia combined together with the average annual imports (in value) for each country for the years shown. The respective values are \$84,567 and \$12,689.

d. Montserrat trade statistics give number of pieces.

Source: Annual Trade Reports of the individual countries for various years.

in the quantity of pottery imports and this makes it extremely difficult to make reasonable projections. There is a clear upward trend however in the value of the imports.

Given problems noted above it was felt that the best that could be done for the present is to use three sets of demand figures. For the first the average annual import estimates given in Table 9.8 are used. For the second and third, 70 percent and 50 percent respectively of these estimates are assumed. Evidently the first market demand set takes

a very optimistic view of the proposed project's ability to replace imports. Even if the growth of pottery imports since 1971 (the most recent year used in calculating the averages) are taken into account this demand set appears an unlikely reality in view of the wide range of the products imported and the narrow range of the output of the proposed ceramics project. We include it nevertheless to indicate the magnitude of costs likely for the project if such a high market demand could be assured with no significant differences in transportation costs.<sup>8</sup> The comments made about the first demand set are applicable though obviously with less force to the second set which assumes that the proposed project will have a market equal to 70 percent of the average annual imports. The third demand set appears the most realistic. When the growth in pottery imports since 1970 is taken into account the quantities assumed can be achieved by a conscious regional policy of import substitution which the regional industrial programming scheme presupposes.

The technology of the ceramics project is based upon the E.I.U. ceramics prospectus [54]. The plant will have an annual capacity of 2.45 million pieces of ceramic products. Total annual production costs are divided into the following nine components: (i) material costs, (ii) direct labor costs, (iii) indirect labor costs, (iv) utilities costs, (v) building costs, (vi) other overhead, (vii) depreciation, (viii) interest on fixed capital, and (ix) interest on working capital.

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<sup>8</sup>For example if the other MDCS of the Caribbean Common Market are included in the potential market then the assumed demand estimates will be more realistic. Since intra-regional transportation costs in the Caribbean Common Market differ slightly for different routes this cost estimate should be satisfactory.

Except for category (v) the classification is identical to that used for the footwear project so that the comments made in that regard are applicable here. Category (v), building costs are the depreciation allowances for the project's structures and the interest and amortization payments for the capital costs of the structures. The above nine categories were classified into fixed costs and variable costs. Fixed costs comprise categories (iii), (v), (vi), (vii) and (viii), the remainder being variable costs. Using factor prices applicable to the seven ECCM countries the production costs of the project with a maximum capacity of 2.45 units of tableware were computed. These are shown in Table 9.9. The difference between the highest fixed cost (Antigua) and the lowest (St. Vincent) is \$102,158. The extreme positions for unit variable costs are taken by the same two countries the differential being 5.1 cents. The cost category that determines the predominant part of this differential is direct labor costs. The labor costs are based upon the wage rates given in Table 7.15 from which it can be seen that significant differences exist between the rates in Antigua and St. Vincent. Since the project employs 103 production workers at capacity the differential in unit variable production costs should be understandable.

The transportation costs involved in moving the product from its potential production centers to the market demand points are presented in Table 9.10. These costs are different only with respect to destination points. Thus for example, transport costs from any of the seven producing countries except Antigua to Antigua's market are \$0.036. Transport costs to the Antigua market are zero if production takes place in

Table 9.9  
Production Costs of Ceramics Project

Producer	Fixed Cost \$	Unit Variable Cost \$
1. Antigua	464,006	0.271
2. Dominica	442,426	0.223
3. Grenada	448,666	0.222
4. Montserrat	445,806	0.244
5. St. Kitts	443,466	0.225
6. St. Lucia	449,446	0.232
7. St. Vincent	361,848	0.220

Table 9.10  
Transport Costs for Ceramics Project

Destination	Unit Transport Costs (\$)
1. Antigua	0.036
2. Dominica	0.035
3. Grenada	0.033
4. Montserrat	0.035
5. St. Kitts	0.036
6. St. Lucia	0.033
7. St. Vincent	0.034
8. MDCS	0.034

Antigua itself. It will be noticed that the transport costs are virtually the same. This derives from the fact that the only differences in intra-regional sea transportation costs are the different landing, storage and delivery charges at the various ports. Intra-regional freight rates are identical for all origin-destination combinations. The calculations are based on the rates of the West Indies Shipping

Service and the rates at the main seaports of each of the consuming countries.

The optimal solution results of the mixed integer problem using the first demand set are summarized in Table 9.11. The problem consists of 23 linear programming rows and 86 variables, 7 of which are constrained to have integer (0,1) solutions. The variable ZVALUE is the objective function value or total costs incurred in supplying the entire market. The optimum solution shows that costs are minimized if St. Vincent (OUTPUT7) produces for the entire market's demand of 1,474,404 units of tableware. Given the plant's capacity of 2.45 million there is excess capacity of just under 0.98 million units as given by the value under the column SLACK ACTIVITY. The DEMAND variables give the market demand assumed for the 8 consuming countries (country numbers are those given in Table 9.10). Thus for example, the demand in St. Lucia (DEMAND6) is 81,159 units of tableware. It can be seen that the optimal solution gives zero output levels in the other possible producing centers (OUTPUT variables). The results indicate that SLACK ACTIVITY values of the plants in these countries are all equal to 2.45 million. It should be noted however that this does not mean that the plants are built in these countries but produce nothing. In fact, the solutions of the integer variables (not shown) are such that none of these plants are built. The values for the ZEROQ variables may be disregarded since the variables are necessary to insure some mathematical properties of the model discussed in Section 6.5.

The average unit cost implied by the optimum (lowest cost) solution is 50 cents. The question can be raised as to how competitive is this

Table 9.11

Optimal Solution Results of Ceramics Project  
with Market Demand I

NUMBER	ROW	AT	ACTIVITY	SLACK	ACTIVITY
1	ZVALUE	BS	734217.47600	734217.47600-	
2	OUTPUT1	BS	.	2450000.00000	
3	OUTPUT2	BS	.	2450000.00000	
4	OUTPUT3	RS	.	2450000.00000	
5	OUTPUT4	BS	.	2450000.00000	
6	OUTPUT5	RS	.	2450000.00000	
7	OUTPUT6	BS	.	2450000.00000	
8	OUTPUT7	BS	1474404.00000	975596.00000	
9	DEMAND1	EQ	116839.00000	.	
10	DEMAND2	EQ	17531.00000	.	
11	DEMAND3	EQ	70417.00000	.	
12	DEMAND4	EQ	11475.00000	.	
13	DEMAND5	EQ	19981.00000	.	
14	DEMAND6	EQ	81159.00000	.	
15	DEMAND7	EQ	67065.00000	.	
16	DEMAND8	EQ	1089937.00000	.	
17	ZERO01	UL	.	.	
18	ZERO02	UL	.	.	
19	ZERO03	UL	.	.	
20	ZERO04	UL	.	.	
21	ZERO05	UL	.	.	
22	ZERO06	UL	.	.	
23	ZERO07	BS	975595.99999-	975595.99999	

cost to prices of alternative sources. It may be said in this regard that it is substantially below the average price of comparable ceramics imports. It also compares quite favorably with an average unit ex-factory price of 60 cents which is considered reasonable by the Economist Intelligence Unit for a similar project, particularly in view of the fact that the calculated average unit cost includes the costs of delivering the product to its various consuming centers and all production costs including a rate of return of 12 percent on capital. Therefore, if the organizational and marketing aspects of the project are well planned and implemented on a regional basis and if the assumed demand can be achieved the project appears to be an economically viable one.

The implication we wish to emphasize however is the differences in costs between a regionally programmed project and a nationalistic alternative. Given the small individual country demands it is reasonable to assume that none of the ECCM countries would undertake such a project on a nationalistic basis. However it is far from improbable. In fact one of the countries (Antigua) established a ceramics project in the 1960's. That it failed is no doubt partly due to its nationalistic scope. The average unit costs implied by a nationalistic project range from \$4.24 in Antigua to \$39.09 in Montserrat. It is clear that any economically viable nationalistic problem similar to the regional project does not exist.

As we saw in Section 9.1 it is useful to have some idea of the costs involved in sub-optimal solutions so that the additional costs incurred in establishing the project in a second-best location because

of some regional distributional constraint can be determined. In Table 9.12 the total costs and the implied average unit costs of the other six possible producing countries are shown. The next best solution is for the project to be located in Dominica which leads to total costs of \$820,885, an increase over the optimum solution of \$8,668. The differential in unit costs is 6 cents.

Table 9.12  
Second-Best Solutions of Ceramics Project with  
Market Demand I<sup>a</sup>

Solution Number	Total Costs <sup>b</sup>	Unit Costs	Producer
1	\$820,885	\$0.557	Dominica
2	\$823,941	\$0.559	Grenada
3	\$824,768	\$0.559	St. Kitts
4	\$839,110	\$0.569	St. Lucia
5	\$855,440	\$0.580	Montserrat
6	\$909,644	\$0.617	Antigua

- a. Total market demand (equal to production) is 1,474,404 units. For individual market demands see Table 9.11.
- b. Total production costs plus transport costs from producer to consuming countries.

The optimal solution results of the ceramics project using the second set of demand estimates are given in Table 9.13. Total demand (and production) in this case is 1,032,084 units. The plant is established in St. Vincent as in the previous case and the costs involved are \$622,507. This translates into an average unit cost of 60 cents, a significant increase over the 50 cents of the previous case. It is clear that the particular assumptions about demand are important for the unit costs that result.

Table 9.13

Optimal Solution Results of Ceramics Project  
with Market Demand II

NUMBER	...ROW..	AT	...ACTIVITY...	SLACK	ACTIVITY
1	ZVALUE	BS	622506.92200	622506.92200-	
2	OUTPUT1	BS	.	2450000.00000	
3	OUTPUT2	BS	.	2450000.00000	
4	OUTPUT3	BS	.	2450000.00000	
5	OUTPUT4	BS	.	2450000.00000	
6	OUTPUT5	BS	.	2450000.00000	
7	OUTPUT6	BS	.	2450000.00000	
8	OUTPUT7	BS	1032084.00000	1417916.00000	
9	DEMAND1	EQ	81787.00000	.	
10	DEMAND2	EQ	12272.00000	.	
11	DEMAND3	EQ	49292.00000	.	
12	DEMAND4	EQ	8033.00000	.	
13	DEMAND5	EQ	13987.00000	.	
14	DEMAND6	EQ	56811.00000	.	
15	DEMAND7	EQ	46946.00000	.	
16	DEMAND8	EQ	762956.00000	.	
17	ZEROQ1	UL	.	.	
18	ZEROQ2	UL	.	.	
19	ZEROQ3	UL	.	.	
20	ZEROQ4	UL	.	.	
21	ZEROQ5	UL	.	.	
22	ZEROQ6	UL	.	.	
23	ZEROQ7	BS	1417915.99999-	1417915.99999	

The second-best solutions of the project assuming Market Demand II are given in Table 9.14. The results imply a unit cost differential of 9 cents between the optimum solution and the next lowest cost solution. The ranking of the countries as producers is the same as for the previous case except that St. Kitts and Grenada exchange positions so that in this case the latter ranks second among the sub-optimal producers.

Table 9.14  
Second-Best Solutions of Ceramics Project with  
Market Demand II<sup>a</sup>

Solution Number	Total Costs <sup>b</sup>	Unit Costs	Producer
1	\$707,348	\$0.685	Dominica
2	\$710,378	\$0.688	St. Kitts
3	\$711,359	\$0.689	Grenada
4	\$722,211	\$0.700	St. Lucia
5	\$732,550	\$0.710	Montserrat
6	\$775,953	\$0.752	Antigua

- a. Total market demand (equal to production) is 1,032,084 units. For individual country demands see Table 9.13.
- b. Total production costs plus transport costs from producer to consuming countries.

Finally, consider the optimal solution results of the ceramics case with the third and smallest demand estimates. As in the previous cases the mixed integer problem consists of 23 linear programming rows and 86 variables. Table 9.15 gives the summary optimal solution results. For this case minimum costs (ZVALUE) are \$540,034 and as in the previous cases St. Vincent (OUTPUT7) is the producer. Total market requirements (which is equal to production) are 737,206 units. The distribution among

Table 9.15

Optimal Solution Results of Ceramics Project  
with Market Demand III

NUMBER	...ROW..	AT	...ACTIVITY...	SLACK	ACTIVITY
1	ZVALUE	BS	548033.73900	548033.73900-	
2	OUTPUT1	BS	.	2450000.00000	
3	OUTPUT2	BS	.	2450000.00000	
4	OUTPUT3	BS	.	2450000.00000	
5	OUTPUT4	BS	.	2450000.00000	
6	OUTPUT5	BS	.	2450000.00000	
7	OUTPUT6	BS	.	2450000.00000	
8	OUTPUT7	BS	737206.00000	1712794.00000	
9	DEMAND1	EQ	58420.00000	.	
10	DEMAND2	EQ	8766.00000	.	
11	DEMAND3	EQ	35209.00000	.	
12	DEMAND4	EQ	5738.00000	.	
13	DEMAND5	EQ	9991.00000	.	
14	DEMAND6	EQ	40520.00000	.	
15	DEMAND7	EQ	33533.00000	.	
16	DEMAND8	EQ	544969.00000	.	
17	ZERO01	UL	.	.	
18	ZERO02	UL	.	.	
19	ZERO03	UL	.	.	
20	ZERO04	UL	.	.	
21	ZERO05	UL	.	.	
22	ZERO06	UL	.	.	
23	ZERO07	BS	1712793.99998-	1712793.99998	

the eight consuming countries is given by the activity levels of the DEMAND variables.<sup>9</sup> The implied average unit cost is 73 cents. Again it is evident how important the market requirements assumptions affect the unit cost. Comparing the unit cost under Market Demand III with that under Market Demand I shows that for the particular market demands assumed a doubling of the market leads to a reduction in unit costs by 32 percent. It should be noted that this solution implies the operation of the plant at an extremely low 30 percent of its capacity. Thus the project will be economical only if the assumed demand would be applicable for a very short period. In other words, if demand were to move within a few years to the levels assumed in Market Demand I then the project could perhaps be commenced at the low capacity utilization level. Although the unit cost is considerably below current retail prices it should be noted that it is significantly higher than the ex-factory price of 60 cents that is considered reasonable by the Economist Intelligence Unit. Thus before the project with this small demand is undertaken a careful and accurate determination of the prices at which its output could be sold and the amounts it could sell would be indispensable since there is very little leeway left on both the cost or demand side.

The sub-optimal solutions are summarized in Table 9.16. The ranking of these countries are identical to the Market Demand II case. The difference between the optimal cost and the next lowest is \$83,623 and implies a difference in unit costs of 13 cents.

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<sup>9</sup> For example, market requirements (assumed demand) in Dominica (DEMAND2) is 8766 units. Country numbers are as given in Table 9.10.

Table 9.16  
 Second-Best Solutions of Ceramics Project with  
 Market Demand III<sup>a</sup>

Solution Number	Total Costs <sup>b</sup>	Unit Costs	Producer
1	\$631,657	\$0.857	Dominica
2	\$634,118	\$0.860	St. Kitts
3	\$636,304	\$0.863	Grenada
4	\$644,279	\$0.874	St. Lucia
5	\$650,624	\$0.883	Montserrat
6	\$686,826	\$0.932	Antigua

- a. Total market demand (equal to production) is 737,206 units. For individual country demands, see Table 9.15.
- b. Total production costs plus transport costs from producer to consuming countries.

It will suffice now to summarize the results. For the three sets of market requirements used the optimal solution of the ceramics project involves the establishment of a plant in St. Vincent. For the highest market requirements the optimal solution translates into unit costs of 50 cents. This is substantially below what another study suggests is a reasonable ex-factory price for the product mix if it is to be competitive in the markets concerned. The unit cost is also substantially below retail prices in the region for comparable imported products. At lower demand levels the implied unit cost increases to levels which make the viability of the project much less certain. It should be emphasized that in all the solutions a substantial proportion of total production goes to a non-ECCM market. This means that the viability of the project depends upon access to the markets of the MDCS of the Caribbean Common

Market or some alternative market. The central proposition of the study however that regional industrial programming is superior to nationalistic industrial promotion is amply demonstrated by the results.

### 9.3. The Tropical Fruit Canning Project

This project involves the canning of tropical fruits (mango, pawpaw, and guava) and of a tropical fruit salad (consisting of mango, guava and pineapple). Several factors contribute to make the quantitative results of this project the least dependable of those presented. However, in view of the need to integrate agriculture with manufacturing (strictly speaking food processing) in the ECCM economies it was decided to analyze this project.

The first factor contributing to the at best ~~exploratory~~ nature of the tropical fruit canning project relates to the estimates of market demand used for the mixed integer programming problem. The import statistics of the ECCM countries do not provide a level of disaggregation from which it is possible to determine the extent of imports of canned tropical fruits. However, surveys of the range of imported canned fruits indicate that they consist overwhelmingly of temperate zone fruits, yet another manifestation of the wide gap between consumption patterns and the structure of domestic production noted in an earlier chapter. Consequently estimates of regional market potential cannot be made even on the crude basis of the two projects previously discussed. The approach taken is to relate domestic demand to the level of tourism development. It was felt that only two ECCM countries, Antigua and St. Lucia, have tourist industries that warrant inclusion in market potential. The simple hypothesis made is that the project will be able to

sell to economic establishments engaged in catering to tourists. Since the ECCM countries are all members of the Caribbean Common Market it is further assumed that the project will be able to make sales to tourist establishments in Barbados and Trinidad. Finally, it is assumed that the project will be able to establish marketing arrangements with U.K. and U.S. concerns so that it will be able to sell in these two metropolitan markets. Despite the uncertain and small regional market for the project's output it is felt that it can have significant dynamic potential if the tourist industry in the region develops in a way that will foster intersectoral links.

It is assumed that the project will produce 240,000 cases (of 24 1 pound cans each) of canned fruits and fruit salad. Of this only 426 cases is assumed to be consumed in the ECCM. Thus it is clear that as conceived the project will be producing for the non-regional market. The ECCM postulated demand is divided between Antigua (193 cases) and St. Lucia (233 cases). The figures are arrived at by assuming that 1 case of the project's output is consumed for every 1,000 population and 2 cases per every 1,000 tourist arrivals.<sup>10</sup> The market potential in Barbados is taken as 342 cases based upon 1 case per 1,000 population and 1 case for 1,000 tourist arrivals. The only other regional demand is 945 cases for Trinidad and Tobago based upon 1 case per 1,000 population. Thus of the assumed total demand only 1 percent is accounted for by the Caribbean. The assumed demand potential in the United

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<sup>10</sup> The average length of stay of tourists who had hotel accommodation was about 5 days in both countries in 1966. The average length of stay of visitors with other accommodation was higher.

Kingdom is 179,000 cases or roughly 75 percent of the total, the remaining 59,287 cases being the market potential assumed for the United States. It should again be emphasized the demand potential for the project's output in the assumed consuming centers is very uncertain. In particular the realism of the metropolitan market requirements depends crucially upon whether satisfactory marketing arrangements can be established. The results of the programming problem should be evaluated with the above comments in mind.

Of course all of the above presumes that the project can deliver its products to the consuming centers at competitive prices. Unlike the footwear project and to a lesser extent the ceramics project, the fruit canning project cannot hope to rely on variations in tariffs and quotas to help to make it competitive. It must face the world of international competition. We comment now on the cost estimates for the plants in the various possible producing countries.

The technology of the project is based upon the profiles of several fruit canning enterprises in UNIDO's Profiles of Manufacturing Establishments (3 volumes) and on a prospectus of a tropical fruit canning project for Belize and the Windward and Leeward Islands by the Economist Intelligence Unit [55]. The total costs of the project are divided into the following broad categories: (i) material costs, (ii) direct labor costs, (iii) indirect labor costs, (iv) utilities costs, (v) building rents, (vi) other overhead costs, (vii) depreciation, (ix) interest on fixed capital, and (x) interest on working capital. This classification of costs is identical to that used for the footwear project.

The main costs under the category material costs are fruit costs, syrup costs, can costs and carton and label costs. It is with the fruit costs and by extension the nature of agricultural production that doubts arise leading to the suggestion made earlier that the empirical results should be viewed as exploratory. Ideally, one would want to integrate the agricultural production and processing aspects of tropical fruit canning and it will be recalled that the model of Section 6.5 can handle this two-stage production process quite adequately. Unfortunately this could not be done because agricultural statistics of the non-traditional export crops are notoriously poor in the ECCM countries. Thus it is customary to find official references to gluts in the fresh fruit market of the tropical fruits which are inputs into the proposed project but there is very little reliable information of the magnitude of these gluts. The prices used for arriving at fruit costs reflect actual prices in the various countries but with only crude estimates of production levels of the various fruits it is not possible to get accurate estimates of the quantities of the fruits that will be forthcoming at the prevailing prices. In other words, the price-quantity nexus for the fruits in question is unclear. Some attempt is made however to take into account the likely quantities of fruits that will be forthcoming. This is done by restricting the capacity of the potential plants in the countries to the output levels implied by the quantities of fruits that are likely to be available to the plant in each country given existing acreages and productivities of the various fruits. The project's attractiveness will consequently be greater than implied by the results if the agricultural sectors of the ECCM economies experience

some structural transformation. But to the extent that fruit availability assumptions made are too optimistic the conclusions implied by the empirical results will be more favorable than they actually are. The assumptions made however are felt to be reasonable.

The costs calculations assume that fruits from one country cannot be used in the processing plant of another country. This was based on the current inadequate inter-island transport services for such products. As the intra-regional transportation system improves as a result of the coordinated development planning framework such a raw material supply will be made attractive and enhance the economic feasibility of the regional fruit canning project. The labor costs are based on the wage rates given in Table 7.15. These costs and the fruit and can costs are the major components in the project's total costs.

In Table 9.17 the computed fixed and variable costs of the project in the six potential producing countries are presented. It will be noticed that no costs estimates are given for Antigua. Antigua is excluded as a potential producer on the grounds of inadequate fruit availability. The costs for five output levels were computed and a linear approximation made to estimate the figures shown. As in all the projects the interest rates assumed for fixed and working capital are 12 and 14 percent respectively. As can be seen from the table the lowest fixed production costs (\$86,563) are incurred in St. Vincent which has the lowest variable production costs as well. The maximum assumed output of the potential plant in each country is shown in Table 9.17 also. These constraints, as noted earlier are based upon the quantity of fruits available to each potential plant. For example

Table 9.17  
Production Costs and Capacity Constraints of  
Fruit Canning Project

Producing Country	Fixed Costs \$000	Variable Costs (per 1,000 cases)*	Capacity Constraint 000 Cases
1. Dominica	87.47376	6.43005	184.0
2. Grenada	90.21890	6.87249	230.0
3. Montserrat	90.04207	6.81320	368.0
4. St. Kitts	89.28014	6.34788	184.0
5. St. Lucia	89.75492	6.50534	184.0
6. St. Vincent	86.56314	6.30609	119.6

\*Each case consists of 24 1 lb cans.

fruit availability appears to be largest in Montserrat and the assumed quantities together with the fruit input-output relation implicit in the projects technology indicates a maximum output of 368,000 cases of canned tropical fruits and fruit salad. Although St. Vincent has the lowest costs domestic fruit availability under present agricultural production structure gives it the lowest capacity of the six potential producers.

The transport costs from each of the potential producers to a particular consuming market are identical, except of course from St. Lucia to itself where transport costs are zero. The transport costs for shipping the products of the project to the respective markets are shown in Table 9.18. For Caribbean destinations the freight rates of the West Indies Shipping Service and the port charges at the main seaport are used to calculate the costs. For the two metropolitan centers the tariff rates and port charges given in the tariff books of the main carriers of the routes are used.

Table 9.18  
 Transport Costs for Fruit Canning Project  
 \$000

<u>Destination</u>	<u>Transport Costs (per 1,000 cases)</u>
1. Antigua	0.66616
2. St. Lucia	0.54415
3. Barbados	0.54643
4. Trinidad	0.64232
5. United Kingdom	1.51000
6. United States	4.13000

We may now proceed to a discussion of the results. The mixed integer programming problem of the fruit canning project consists of 19 linear programming rows and 61 variables, 6 of which are constrained to be integers in the solutions. In Tables 9.19a and 9.19b the optimal solution results are summarized. The former table gives the solution for the minimum total costs (ZVALUE) which is \$2.2 million which translates into an average delivered price of \$9.21 or 38 cents (approximately 19 U.S. cents) per 1 lb can of tropical fruit or fruit salad. The optimal production arrangement is for two plants to be established in the ECCM. The one established in St. Vincent (OUTPUT6) will operate at the maximum capacity of 119,600 cases per annum possibility with available domestic fruit supplies. The other plant is located in St. Kitts (OUTPUT4) and produces 120,400 per annum. Since its assumed maximum capacity is 184,000 per annum it has an excess capacity (more accurately unprocessed fruits) equal to 63,600 cases as the value under the SLACK ACTIVITY column indicates. The market demand requirements

TABLE 9.19a

Optimal Solution of Fruit Canning Project:

Total Costs, Output and Demand Results

NUMBER	...ROW..	AT	...ACTIVITY...	SLACK ACTIVITY	..LOWER LIMIT.	..UPPER LIMIT.	.DUAL ACTIVITY
1	ZVALUE	BS	2210.53093	2210.53093-	NONE	NONE	1.00000
2	OUTPUT1	BS	.	184.00000	NONE	184.00000	.
3	OUTPUT2	BS	.	230.00000	NONE	230.00000	.
4	OUTPUT3	BS	.	368.00000	NONE	368.00000	.
5	OUTPUT4	BS	120.40000	63.60000	NONE	184.00000	.
6	OUTPUT5	BS	.	184.00000	NONE	184.00000	.
7	OUTPUT6	BS	119.60000	.	NONE	119.60000	.
8	DEMAND1	EQ	.19300	.	.19300	.19300	7.01404-
9	DEMAND2	EQ	.23300	.	.23300	.23300	6.89203-
10	DEMAND3	EQ	.34200	.	.34200	.34200	6.89431-
11	DEMAND4	EQ	.94500	.	.94500	.94500	6.99020-
12	DEMAND5	EQ	179.00000	.	179.00000	179.00000	7.85788-
13	DEMAND6	EQ	59.28700	.	59.28700	59.28700	10.47788-
14	ZEROQ1	BS	.	.	184.00000-	.	.
15	ZEROQ2	UL	.	.	230.00000-	.	.39226
16	ZEROQ3	UL	.	.	368.00000-	.	.24468
17	ZEROQ4	BS	63.60000-	63.60000	184.00000-	.	.
18	ZEROQ5	UL	.	.	184.00000-	.	.38669
19	ZEROQ6	UL	.	.	119.60000-	.	.04179

(in thousands) are given by the DEMAND variables<sup>11</sup> and the activity levels shown are the values assumed and discussed earlier. The ZEROQ variables are required to ensure certain mathematical properties of the programming problem and require no comment.

Table 9.19b shows which of the plants supplies the various markets in the optimal solution.  $X_{ij}$  is the amount shipped from producing country  $i$  to consuming country  $j$ . The plant in St. Kitts supplies the entire requirements of St. Lucia ( $X_{42} = .233$  thousand cases), the entire requirements of the U.S.A. ( $X_{46} = 59.287$  thousand) and a part of the U.K.'s demand ( $X_{45} = 60.88$  thousand). The plant in St. Vincent supplies the entire requirements of Antigua ( $X_{61} = .193$ ), Barbados ( $X_{63} = .342$ ), Trinidad ( $X_{64} = .945$ ) and the remaining requirements of the United Kingdom ( $X_{65} = 118.12$ ). Closer inspection of the optimal solution reveals that an alternative optimal configuration would be for the plant in St. Kitts to supply the requirements of Antigua, Barbados and Trinidad with the St. Vincent plant supplying the U.S.A., St. Lucia in addition to the U.K. The  $W$  variables are the integer variables and the values they take in the solution ensure that fixed costs are incurred only in those countries that have positive output levels.

It may be noted that the implied average delivery costs of 38 cents (19 U.S. cents) per 1 lb can is slightly above the average c.i.f. price of 36 cents in the metropolitan markets given in the Economist Intelligence Unit study [55]. Thus it appears that the project is not economically attractive. Three points may be made in this regard. First,

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<sup>11</sup>Country numbers correspond to those given in Table 9.18. For example, DEMAND5 is market demand in the United Kingdom.

TABLE 9.19b

Optimal Solution of Fruit Canning Project:  
 Producer-Consumer Combinations

NUMBER	.COLUMN.	AT	...ACTIVITY...	..INPUT COST..
20	X11	LL	.	7.09621
21	X12	LL	.	6.97420
22	X13	LL	.	6.97648
23	X14	LL	.	7.07237
24	X15	LL	.	7.94005
25	X16	LL	.	10.56005
26	X21	LL	.	7.53865
27	X22	LL	.	7.41664
28	X23	LL	.	7.41892
29	X24	LL	.	7.51481
30	X25	LL	.	8.38249
31	X26	LL	.	11.00249
32	X31	LL	.	7.47936
33	X32	LL	.	7.35735
34	X33	LL	.	7.35963
35	X34	LL	.	7.45552
36	X35	LL	.	8.32320
37	X36	LL	.	10.94320
38	X41	LL	.	7.01404
39	X42	BS	.23300	6.89203
40	X43	LL	.	5.89431
41	X44	LL	.	6.99020
42	X45	BS	60.88000	7.85788
43	X46	BS	59.28700	10.47788
44	X51	LL	.	7.17150
45	X52	BS	.	6.50534
46	X53	LL	.	7.05177
47	X54	LL	.	7.14766
48	X55	LL	.	8.01534
49	X56	LL	.	10.63534
50	X61	BS	.19300	6.97225
51	X62	LL	.	6.85024
52	X63	BS	.34200	6.85252
53	X64	BS	.94500	6.94841
54	X65	BS	118.12000	7.81609
55	X66	LL	.	10.43609
56	W1	IV	.	87.47376
57	W2	IV	.	90.21890
58	W3	IV	.	90.04207
59	W4	IV	1.00000	89.28014
60	W5	IV	.	89.75492
61	W6	IV	1.00000	86.56314

if the regional agriculture sector is restructured fruit availability will not act as a binding constraint in any of the possible plant locations so that one regional plant would be able to supply the entire market requirements. Also a restructured agriculture may reduce fruit costs which weigh heavily in total costs.<sup>12</sup> If fruit supplies are such that the St. Vincent plant could produce a maximum of 240,000 cases (the assumed total market requirements) which the assumed plant technology does permit the optimal solution gives total costs of \$2,116,219 which translates into an average delivered cost per can of 36.7 cents. Second, recall that the cost calculations exclude the shipping of fruits in one ECCM country to a plant in another. If the intra-regional transport system is improved and if such shipments can be made at reasonable transport costs then some cost reductions may be forthcoming. Third, although the poor quality of the agricultural statistics on which the fruit supplies assumption is made must be admitted conservative estimates were made so that the chances of over-stating the project's attractiveness are minimized. Therefore the project appears viable if it forms part of a plan to restructure the agricultural sectors of the ECCM economies.

In addition to fruit costs, can costs comprise a large proportion of total costs.<sup>13</sup> Therefore efforts to seek out cheaper sources of cans can have an important salutary consequence on the project's viability.

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<sup>12</sup> For example the fruit costs are 35 percent and 31 percent respectively of total costs in Montserrat and St. Vincent for plants of output of 119,600 cases per year.

<sup>13</sup> Can costs are about 30 percent of total costs.

This area would seem to justify further investigation if implementation of the project were contemplated.

Finally, as in the previous project we present the costs involved in sub-optimal locations. These are summarized in Table 9.21. The cheapest cost sub-optimal solution (solution no. 1) shifts the second plant from St. Kitts to Dominica. The total costs are \$2.22 million or an increase of \$8,089 over the optimal solution. This represents a difference in average delivered cost per case of 3 cents. As noted in the previous two sections this result may be of importance when it is necessary to establish one of the projects in sub-optimal location(s) because of a distribution criterion.

Table 9.20

Costs and Plant Locations of Second-Best Solutions  
of Fruit Canning Project

Solution Number	Total Costs <sup>a</sup> \$000	Unit Costs <sup>b</sup> \$	Producers (Output) <sup>c</sup>
1	2218.6178	9.24	Dominica (120.4), St. Vincent (119.6)
2	2221.0412	9.25	Dominica (56.0), St. Kitts (184.0)
3	2227.4118	9.28	St. Kitts (184.0), St. Lucia (56.0)
4	2229.8371	9.29	St. Lucia (120.4), St. Vincent (119.6)
5	2240.7247	9.34	Dominica (184.0), St. Lucia (56.0)
6	2241.4046	9.34	Montserrat (240.0)
7	2248.5629	9.37	Grenada (56.0), St. Kitts (184.0)
8	2258.3788	9.41	Dominica (184.0), Montserrat (56.0)
9	2261.8758	9.42	Dominica (184.0), Grenada (56.0)

a. Total production costs plus transport costs from producing countries to consuming countries.

b. Costs per case of 24 1 lb cans.

c. Output in thousand cases.

#### 9.4. The Knitwear Garment Project

The last three projects analyzed in the present study involve the manufacture of garments. The one discussed in this section is a project to manufacture knitted outer garments--shirts, suits, dresses, pants and skirts--from knitted fabrics.

In Table 9.21a the imports of knitted outer garments (SITC 841.03 outerwear, knit or of knitted fabrics) by the ECCM countries are shown. As with the previous projects the time series are incomplete so that regression analysis could not be utilized to estimate demand. Imports by the ECCM countries in 1968 (1967 figures for St. Vincent) amounted to 119,596 pieces at a value of \$256,837. The comparable figures for 1967 (1968 figures used for Dominica) are 128,829 pieces and \$229,738. It is expected that the imports will have increased substantially since that time partly because of a shift to the purchases of ready-made garments rather than the purchasing of fabrics to be made into garments by individual tailors and seamstresses. For market potential in the ECCM countries it is assumed that in view of the likely large growth in imports since 1968 the project will be able to sell quantities equal to 100 percent of average imports for the years 1967 and 1968.

In a comparative analysis of the costs of supplying the U.S. market with garments made of knitted fabrics from U.S. sources or a plant located in the ECCM or Belize the Economist Intelligence Unit [53] has shown that the ECCM or Belize plant will be able to supply the U.S. market at a lower cost. This suggests that the U.S. market may be included in the proposed project's market. However from the standpoint of the U.S. market the relevant comparison is not ECCM costs and U.S.

Table 9.21a

## Outer Knitwear Imports\* of ECCM Countries

		Antigua	Dominica	Grenada	Montserrat	St. Kitts	St. Lucia	St. Vincent	ECCM
1960	no.						1,932	23,093	
	\$						2,416	22,648	
1961	no.			51,243				14,393	
	\$			39,331				15,547	
1962	no.				10,512			8,268	
	\$				12,269			6,846	
1963	no.			44,664	19,428		5,256		
	\$			60,147	31,346		8,360		
1964	no.	18,828					6,576	7,366	
	\$	22,343					13,640	8,731	
1965	no.	14,424		85,962		4,343		8,547	
	\$	15,730		76,477		4,683		11,664	
1966	no.	23,688		55,827			5,724		
	\$	32,781		62,445			12,759		
1967	no.	11,124		78,780	4,284	3,410	12,780	12,115	
	\$	32,450		117,591	5,810	5,266	34,022	17,247	
1968	no.	19,344	6,336	49,461	4,860	12,336	15,144		
	\$	52,407	17,352	102,547	8,997	13,747	44,540		
1969	no.		7,692				20,832		
	\$		32,138				62,866		
1970	no.				4,752		34,092		
	\$				11,269		156,997		

Table 9.21a(Continued)

		Antigua	Dominica	Grenada	Montserrat	St. Kitts	St. Lucia	St. Vincent	ECCM
1971	no.				7,056	3,891			
	\$				14,606	18,509			
1972	no.								
	\$								

\*SITC 841.03 Outerwear, knit or of knitted fabrics.

Source: Annual Trade Reports of individual ECCM countries for 1960 to 1971.

costs but the former costs compared with the cost in all other potential sources of supplying demand requirements in the U.S.A. This would in practice involve comparison of ECCM delivered costs to those of say Taiwan. It appears that the crucial factor will be the marketing arrangements that an ECCM establishment can negotiate with a U.S. distributor/retailer if it wants to sell in the U.S. market. And of course its delivered costs (production, transport and U.S. import tariff costs) must be competitive. In short, the U.S. market potential for the proposed regional project cannot be easily determined. For the programming problem of the project two widely differing assumptions about demand in the U.S. market are made. These are 250,000 units and 500,000 units.

Finally we consider the project's chances of selling in the markets of the more developed members of the Caribbean Common Market. In all of these countries there are established garment industries. Consequently it appears that the ability to sell in these markets will depend mainly, as in the U.S., on the specific marketing arrangements that can be established in these countries. We make the crude assumption that the combined MDCs market potential is equal to the total ECCM market demand. Based on the above assumptions two sets of market demand for the knitwear project are used. These are shown in Table 9.21b.

UNIDO's Profiles of Manufacturing Establishments provides information on several garment manufacturing enterprises. Those given in Volume III of the Profiles were particularly useful in formulating a technology for the proposed project since some are in underdeveloped countries. The Economist Intelligence Unit's prospectus [53] was equally useful. The production cost structure of the project follows a

Table 9.21b  
Market Demand\* for ECCM Knitwear Project

	Market Demand I	Market Demand II
1. Antigua	15,234	15,234
2. Dominica	6,336	6,336
3. Grenada	64,120	64,120
4. Montserrat	4,572	4,572
5. St. Kitts	7,873	7,873
6. St. Lucia	13,962	13,962
7. St. Vincent	12,115	12,115
8. MDCs	124,212	124,112
9. U.S.A.	500,000	250,000

\*For ECCM countries 100 percent of annual imports of outer knitwear for 1967-68. MDCS equals total of ECCM countries. See discussion in text.

classification of costs identical to that used for the footwear project and needs little discussion. The only point worth emphasizing is that for this project the raw material costs include the costs of transporting the fabrics by air freight from New York to the potential production locations. Since these costs are quite large<sup>14</sup> costs savings can be made if alternative sea transport would be adequate for a project that is implemented.

The costs involved in the possible seven ECCM locations for plants of four different capacities were estimated and a linear approximation of these costs was made to arrive at the estimated fixed and unit variable costs given in Table 9.22. It will be observed that St. Vincent

<sup>14</sup>They are as high as 12.5 percent of total costs in Grenada for a plant that produces 720,000 units per annum.

has the lowest fixed cost while St. Lucia has the lowest unit variable cost.

Table 9.22  
Production Costs of Knitwear Project

Producer	Fixed Costs	Unit Variable Costs
1. Antigua	\$201,285	\$3.89
2. Dominica	\$182,681	\$3.79
3. Grenada	\$187,571	\$3.80
4. Montserrat	\$182,059	\$3.80
5. St. Kitts	\$181,360	\$3.79
6. St. Lucia	\$184,009	\$3.70
7. St. Vincent	\$170,639	\$3.79

The transport costs for the Caribbean markets are based upon the sea freight rates of the West Indies Shipping Service and the port charges of the main seaport of each country. The unit transport costs for these markets turn out to be the same and is equal to \$0.16. The transport costs to the U.S. market are based upon the air freight costs from the Caribbean to New York and transshipment costs in the Caribbean where applicable. Also included are the assumed tariff costs for the product's entry into the United States market. This is taken to be 30 percent ad valorem. The calculated unit transport and tariff costs are \$1.56 for shipments from Antigua or St. Lucia and \$1.72 for shipments originating in any of the remaining countries.

Three sets of capacity constraints are used. In the first set the potential plant in each country is assumed to have a maximum capacity of 720,000 units per annum. For the second the maximum output for the

potential factories in Antigua and St. Lucia remain at 720,000 units while those in the other countries are set at 500,000 units. The third constraint set assumes that all potential plants have maximum output each of 500,000 units. In the results (for example, Table 9.23a) these appear as the UPPER LIMIT of the OUTPUT variables.

The mixed integer programming problem of the knitwear project consists of 24 linear programming rows and 94 variables, 7 of which will have integer (0,1) solutions. We consider first the results using the first market demand set and the second set of capacity constraints. Total market requirements are 748,424 units of knit garments which is greater than the assumed maximum capacity of a plant. This leads to two plants being established in the solutions of the problem. The optimal solution results are summarized in Tables 9.23. From Table 9.23a it can be seen that minimum total costs are \$3,941,948 (activity level of ZVALUE) which translates into average unit costs of \$5.27. The two plants are located in St. Lucia (OUTPUT6) and St. Vincent (OUTPUT7) with respective output levels of 720,000 units and 28,424 units. The former plant operates at its maximum capacity. The assumed market requirements of the nine consuming countries are fulfilled as can be seen by the fact that the activity levels of the DEMAND variables are equal to their respective values given in Table 9.21b. The distribution of the output of the two plants to the various markets are shown in Table 9.23b. The plant in St. Lucia supplies the market requirements in Antigua (activity level of  $X_{61} = 15,234 = \text{DEMAND1}$ ), Dominica ( $X_{62} = 6,336 = \text{DEMAND2}$ ), Grenada ( $X_{63} = 64,120 = \text{DEMAND3}$ ), Montserrat ( $X_{64} = 4,572 = \text{DEMAND4}$ ), St. Kitts ( $X_{65} = 7,873 = \text{DEMAND5}$ ), the U.S.A. ( $X_{69} =$

Table 9.23a

Optimal Solution of Knitwear Project

with Market Demand I and Capacity Constraint II:

Total Costs, Output and Demand Results

...ROW..	AT	...ACTIVITY...	SLACK ACTIVITY	..LOWER LIMIT.	..UPPER LIMIT.	.DUAL ACTIVITY
ZVALUE	BS	3941948.47998	3941948.47998-	NONE	NONE	1.00000
OUTPUT1	BS	.	720000.00000	NONE	720000.00000	.
OUTPUT2	BS	.	500000.00000	NONE	500000.00000	.
OUTPUT3	BS	.	500000.00000	NONE	500000.00000	.
OUTPUT4	BS	.	500000.00000	NONE	500000.00000	.
OUTPUT5	BS	.	500000.00000	NONE	500000.00000	.
OUTPUT6	BS	720000.00000	.	NONE	720000.00000	.
OUTPUT7	BS	28424.00000	471576.00000	NONE	500000.00000	.
DEMAND1	EQ	15234.00000	.	15234.00000	15234.00000	3.95000-
DEMAND2	EQ	6336.00000	.	6336.00000	6336.00000	3.95000-
DEMAND3	EQ	64120.00000	.	64120.00000	64120.00000	3.95000-
DEMAND4	EQ	4572.00000	.	4572.00000	4572.00000	3.95000-
DEMAND5	EQ	7873.00000	.	7873.00000	7873.00000	3.95000-
DEMAND6	EQ	13962.00000	.	13962.00000	13962.00000	3.79000-
DEMAND7	EQ	12115.00000	.	12115.00000	12115.00000	3.79000-
DEMAND8	EQ	124212.00000	.	124212.00000	124212.00000	3.95000-
DEMAND9	EQ	500000.00000	.	500000.00000	500000.00000	5.35000-
ZERO01	UL	.	.	720000.00000-	.	.06000
ZERO02	UL	.	.	500000.00000-	.	.16000
ZERO03	UL	.	.	500000.00000-	.	.15000
ZERO04	UL	.	.	500000.00000-	.	.15000
ZERO05	UL	.	.	500000.00000-	.	.16000
ZERO06	UL	.	.	720000.00000-	.	.09000
ZERO07	BS	471576.00000-	471576.00000	500000.00000-	.	.

Table 9.23b

Optimal Solution of Knitwear Project  
with Market Demand I and Capacity Constraint II:  
Producer-Consumer Combinations

NUMBER	COMBINA.	AT	ACTIVITY...	PROFIT...	PROFIT...	PROFIT...	PROFIT...
25	X11	FS	.	3,000.00	.	0.00	.
26	X12	LL	.	3,000.00	.	0.00	.
27	X13	LL	.	3,000.00	.	0.00	1,000.00
28	X14	LL	.	3,000.00	.	0.00	1,000.00
29	X15	LL	.	3,000.00	.	0.00	1,000.00
30	X16	LL	.	3,000.00	.	0.00	1,000.00
31	X17	LL	.	3,000.00	.	0.00	1,000.00
32	X18	LL	.	3,000.00	.	0.00	1,000.00
33	X19	LL	.	3,000.00	.	0.00	1,000.00
34	X 1	LL	.	3,000.00	.	0.00	1,000.00
35	X 2	FS	.	3,000.00	.	0.00	1,000.00
36	X 3	LL	.	3,000.00	.	0.00	1,000.00
37	X 4	LL	.	3,000.00	.	0.00	1,000.00
38	X 5	LL	.	3,000.00	.	0.00	1,000.00
39	X 6	LL	.	3,000.00	.	0.00	1,000.00
40	X 7	LL	.	3,000.00	.	0.00	1,000.00
41	X 8	LL	.	3,000.00	.	0.00	1,000.00
42	X 9	LL	.	3,000.00	.	0.00	1,000.00
43	X 10	LL	.	3,000.00	.	0.00	1,000.00
44	X 11	LL	.	3,000.00	.	0.00	1,000.00
45	X 12	LL	.	3,000.00	.	0.00	1,000.00
46	X 13	FS	.	3,000.00	.	0.00	1,000.00
47	X 14	LL	.	3,000.00	.	0.00	1,000.00
48	X 15	LL	.	3,000.00	.	0.00	1,000.00
49	X 16	LL	.	3,000.00	.	0.00	1,000.00
50	X 17	LL	.	3,000.00	.	0.00	1,000.00
51	X 18	LL	.	3,000.00	.	0.00	1,000.00
52	X 19	LL	.	3,000.00	.	0.00	1,000.00
53	X 20	LL	.	3,000.00	.	0.00	1,000.00
54	X 21	LL	.	3,000.00	.	0.00	1,000.00
55	X 22	LL	.	3,000.00	.	0.00	1,000.00
56	X 23	LL	.	3,000.00	.	0.00	1,000.00
57	X 24	LL	.	3,000.00	.	0.00	1,000.00
58	X 25	LL	.	3,000.00	.	0.00	1,000.00
59	X 26	LL	.	3,000.00	.	0.00	1,000.00
60	X 27	LL	.	3,000.00	.	0.00	1,000.00
61	X 28	LL	.	3,000.00	.	0.00	1,000.00
62	X 29	LL	.	3,000.00	.	0.00	1,000.00
63	X 30	LL	.	3,000.00	.	0.00	1,000.00
64	X 31	LL	.	3,000.00	.	0.00	1,000.00
65	X 32	LL	.	3,000.00	.	0.00	1,000.00
66	X 33	LL	.	3,000.00	.	0.00	1,000.00
67	X 34	LL	.	3,000.00	.	0.00	1,000.00
68	X 35	LL	.	3,000.00	.	0.00	1,000.00
69	X 36	LL	.	3,000.00	.	0.00	1,000.00
70	X 37	LL	.	3,000.00	.	0.00	1,000.00
71	X 38	LL	.	3,000.00	.	0.00	1,000.00
72	X 39	LL	.	3,000.00	.	0.00	1,000.00
73	X 40	FS	1000,000.00	3,000.00	.	0.00	1,000.00
74	X 41	FS	1000,000.00	3,000.00	.	0.00	1,000.00
75	X 42	FS	1000,000.00	3,000.00	.	0.00	1,000.00
76	X 43	FS	1000,000.00	3,000.00	.	0.00	1,000.00
77	X 44	FS	1000,000.00	3,000.00	.	0.00	1,000.00
78	X 45	FS	1000,000.00	3,000.00	.	0.00	1,000.00
79	X 46	FS	1000,000.00	3,000.00	.	0.00	1,000.00
80	X 47	FS	1000,000.00	3,000.00	.	0.00	1,000.00
81	X 48	FS	1000,000.00	3,000.00	.	0.00	1,000.00
82	X 49	FS	1000,000.00	3,000.00	.	0.00	1,000.00
83	X 50	FS	1000,000.00	3,000.00	.	0.00	1,000.00
84	X 51	FS	1000,000.00	3,000.00	.	0.00	1,000.00
85	X 52	FS	1000,000.00	3,000.00	.	0.00	1,000.00
86	X 53	FS	1000,000.00	3,000.00	.	0.00	1,000.00
87	X 54	FS	1000,000.00	3,000.00	.	0.00	1,000.00
88	X 55	FS	1000,000.00	3,000.00	.	0.00	1,000.00
89	X 56	FS	1000,000.00	3,000.00	.	0.00	1,000.00
90	X 57	FS	1000,000.00	3,000.00	.	0.00	1,000.00
91	X 58	FS	1000,000.00	3,000.00	.	0.00	1,000.00
92	X 59	FS	1000,000.00	3,000.00	.	0.00	1,000.00
93	X 60	FS	1000,000.00	3,000.00	.	0.00	1,000.00
94	X 61	FS	1000,000.00	3,000.00	.	0.00	1,000.00
95	X 62	FS	1000,000.00	3,000.00	.	0.00	1,000.00
96	X 63	FS	1000,000.00	3,000.00	.	0.00	1,000.00
97	X 64	FS	1000,000.00	3,000.00	.	0.00	1,000.00
98	X 65	FS	1000,000.00	3,000.00	.	0.00	1,000.00
99	X 66	FS	1000,000.00	3,000.00	.	0.00	1,000.00
100	X 67	FS	1000,000.00	3,000.00	.	0.00	1,000.00

PROFIT... ESTIMATED... PRODUCTION... (faint header text)

NUMBER	COMBINA.	AT	ACTIVITY...	PROFIT...	PROFIT...	PROFIT...	PROFIT...
74	X65	FS	7000,000.00	3,000.00	.	0.00	.
75	X66	FS	15000,000.00	3,000.00	.	0.00	.
76	X67	LL	.	3,000.00	.	0.00	1,000.00
77	X68	FS	10000,000.00	3,000.00	.	0.00	1,000.00
78	X69	FS	50000,000.00	3,000.00	.	0.00	1,000.00
A	79	X70	.	3,000.00	.	0.00	1,000.00
A	80	X71	.	3,000.00	.	0.00	1,000.00
A	81	X72	.	3,000.00	.	0.00	1,000.00
A	82	X73	.	3,000.00	.	0.00	1,000.00
A	83	X74	.	3,000.00	.	0.00	1,000.00
A	84	X75	.	3,000.00	.	0.00	1,000.00
A	85	X76	.	3,000.00	.	0.00	1,000.00
86	X77	FS	10000,000.00	3,000.00	.	0.00	1,000.00
87	X78	FS	10000,000.00	3,000.00	.	0.00	1,000.00
88	X79	LL	.	3,000.00	.	0.00	1,000.00
89	X80	LL	.	3,000.00	.	0.00	1,000.00
90	X81	LL	.	3,000.00	.	0.00	1,000.00
91	X82	LL	.	3,000.00	.	0.00	1,000.00
92	X83	LL	.	3,000.00	.	0.00	1,000.00
93	X84	LL	.	3,000.00	.	0.00	1,000.00
94	X85	LL	.	3,000.00	.	0.00	1,000.00
95	X86	LL	.	3,000.00	.	0.00	1,000.00
96	X87	LL	.	3,000.00	.	0.00	1,000.00
97	X88	LL	.	3,000.00	.	0.00	1,000.00
98	X89	LL	.	3,000.00	.	0.00	1,000.00
99	X90	LL	.	3,000.00	.	0.00	1,000.00
100	X91	LL	.	3,000.00	.	0.00	1,000.00
101	X92	LL	.	3,000.00	.	0.00	1,000.00
102	X93	LL	.	3,000.00	.	0.00	1,000.00
103	X94	LL	.	3,000.00	.	0.00	1,000.00
104	X95	LL	.	3,000.00	.	0.00	1,000.00
105	X96	LL	.	3,000.00	.	0.00	1,000.00
106	X97	LL	.	3,000.00	.	0.00	1,000.00
107	X98	LL	.	3,000.00	.	0.00	1,000.00
108	X99	LL	.	3,000.00	.	0.00	1,000.00
109	X100	LL	.	3,000.00	.	0.00	1,000.00

500,000 = DEMAND9) as well as its own domestic requirements (X66 = 13,962 = DEMAND6) and 87 percent (X68 = 107,903) of the MDCs requirements. The plant in St. Vincent operates at an extremely low output level (only 4 percent of capacity) supplying domestic requirements (X77 = 12,115 = DEMAND7) and the remaining 13 percent (X78 = 16,309) of the MDCs requirements. As in the results of the previous projects the W integer variables take values such that the fixed costs (INPUT COST values of W variables) are incurred only in those countries where a plant is set up.<sup>15</sup>

One final feature of the results deserve comment. As just noted the plant in St. Vincent operates at a very low level. This means that under real world conditions this plant is unlikely to be erected given the above cost, demand and technology specifications. The capacity of the St. Lucia plant would most probably be extended to supply the additional small demand met by the other plant. Actually, the technological factors underlying the cost estimates for this study allows for such expansion without any increase in fixed costs. In other words the capacity constraints used are strictly not technological but reflect in part the skilled and managerial labor bottleneck that the project is likely to encounter in its early years. The use of non-binding capacity constraints lead to an optimal solution in which a single plant is located in St. Lucia. The costs incurred in this case total \$3,770,691 or a difference of \$171,257. The implied average unit costs

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<sup>15</sup>The country numbers for producers (OUTPUT variables) are as in Table 9.22 while country numbers for consumers are as in Table 9.21b.  $X_{ij}$  is amount of commodity produced in country i and shipped to consuming country j. It should be clear by now how to read the main results of the tables. Subsequent results will be presented without detailed identification of variables as given above.

is \$5.04, a reduction of 24 cents per unit. The difference is due to a shift of the output previously produced by the St. Vincent plant to the St. Lucia plant which has lower unit costs and the fact that the fixed costs in St. Vincent are no longer incurred.

A question posed in the analysis of the previous projects is compared to the optimal costs how much more expensive are the sub-optimal solutions. The results of most of these are summarized in Table 9.24. The next best solution is to shift the plant in St. Vincent to St. Kitts. This leads to an increase in costs of \$11,402 to \$3.95 million. The implied average unit costs are \$5.28 compared to the optimal solution unit costs of \$5.27.

The optimal solution results using the same demand set as used above (Market Demand I) but with Capacity Constraint I which assumes maximum capacities for the potential plants in all ECCM countries of 720,000 units are identical to those of the previous case. Small differences occur in the sub-optimal solutions that are at the lower end of the scale (Table 9.24) of costs and require no comment.

The optimal solutions results using Capacity Constraint III (500,000 maximum units for all potential plants) are presented in Tables 9.25. This set of capacity constraints was experimented with to determine the additional costs that would be incurred if for reasons of skill availability in all the countries the technologically determined capacity constraints are not the critical bottleneck. A comparison of the solutions in Table 9.25a and Table 9.23a show that with respect to plant locations the optimal solution is unaffected. However with the lower capacity constraints costs of the optimal solution increase to

Table 9.24

**Sub-Optimal Solutions<sup>a</sup> of Knitwear Project with  
Market Demand I and Capacity Constraint II  
Total Costs and Production Locations**

Solution Number	Total Costs	Unit Costs	Producers <sup>b</sup>
1	\$3,953,350	\$5.28	St. Lucia, St. Kitts
2	\$3,954,416	\$5.28	St. Lucia, Grenada
3	\$3,954,862	\$5.28	St. Lucia, Montserrat
4	\$3,954,917	\$5.28	St. Lucia, Dominica
5	\$3,974,940	\$5.31	St. Lucia, Antigua
6	\$4,075,344	\$5.45	Antigua, St. Vincent
7	\$4,084,769	\$5.46	St. Vincent, Grenada
8	\$4,085,074	\$5.46	St. Kitts, St. Vincent
9	\$4,086,640	\$5.46	Dominica, St. Vincent
10	\$4,088,313	\$5.46	Antigua, Dominica
11	\$4,088,785	\$5.46	St. Vincent, Montserrat
12	\$4,096,171	\$5.47	St. Kitts, Grenada
13	\$4,097,738	\$5.48	Dominica, Grenada
14	\$4,098,042	\$5.48	Dominica, St. Kitts
15	\$4,100,187	\$5.48	St. Kitts, Montserrat
16	\$4,101,754	\$5.48	Dominica, Montserrat
17	\$4,102,398	\$5.48	Grenada, Montserrat

a. All solutions are not given.

b. For solutions 6 and 10 the first country named produces 515,234 units, the second country 233,190 units. The corresponding figures for solutions 1, 3, 4 and 5 are 720,000 units and 28,424 units; for solution 2, 684,304 units and 64,120 units; for all other solutions 500,000 units and 248,424 units.

Table 9.25a

Optimal Solution of Knitwear Project with  
 Market Demand I and Capacity Constraint III:  
 Total Costs, Output and Demand Results

...ROW..	AT	...ACTIVITY...	SLACK ACTIVITY	..LOWER LIMIT.	..UPPER LIMIT.	.DUAL ACTIVITY
ZVALUE	RS	3963982.39998	3963982.39999-	NONE	NONE	1.00000
OUTPUT1	RS	.	500000.00000	NONE	500000.00000	.
OUTPUT2	BS	.	500000.00000	NONE	500000.00000	.
OUTPUT3	BS	.	500000.00000	NONE	500000.00000	.
OUTPUT4	RS	.	500000.00000	NONE	500000.00000	.
OUTPUT5	BS	.	500000.00000	NONE	500000.00000	.
OUTPUT6	BS	500000.00000	.	NONE	500000.00000	.
OUTPUT7	BS	248424.00000	251576.00000	NONE	500000.00000	.
DEMAND1	EQ	15234.00000	.	15234.00000	15234.00000	.
DEMAND2	EQ	6336.00000	.	6336.00000	6336.00000	3.95000-
DEMAND3	EQ	64120.00000	.	64120.00000	64120.00000	3.95000-
DEMAND4	EQ	4572.00000	.	4572.00000	4572.00000	3.95000-
DEMAND5	FQ	7873.00000	.	7873.00000	7873.00000	3.95000-
DEMAND6	EQ	13962.00000	.	13962.00000	13962.00000	3.95000-
DEMAND7	FQ	12115.00000	.	12115.00000	12115.00000	3.79000-
DEMAND8	EQ	124212.00000	.	124212.00000	124212.00000	3.95000-
DEMAND9	FQ	500000.00000	.	500000.00000	500000.00000	5.51000-
ZER001	UL	.	.	500000.00000-	.	.40257
ZER002	UL	.	.	500000.00000-	.	.36536
ZER003	UL	.	.	500000.00000-	.	.15000
ZER004	UL	.	.	500000.00000-	.	.36412
ZER005	UL	.	.	500000.00000-	.	.16000
ZER006	UL	.	.	500000.00000-	.	.25000
ZER007	RS	251575.99999-	251575.99999	500000.00000-	.	.

Table 9.25b  
 Optimal Solution of Knitwear Project with  
 Market Demand I and Capacity Constraint III:  
 Producer-Consumer Combinations.

PRODUCER	CONSUMER	AT	ACTIVITY	UNIT COST	LOWER LIMIT	UPPER LIMIT	PROFIT COST
25	X11	11	.	5,000.00	.	60%	30.57
26	X12	11	.	6,050.00	.	60%	30.57
27	X13	11	.	5,200.00	.	60%	30.57
28	X14	11	.	6,000.00	.	60%	30.57
29	X15	11	.	6,000.00	.	60%	30.57
30	X16	11	.	6,000.00	.	60%	30.57
31	X17	11	.	6,000.00	.	60%	30.57
32	X18	11	.	6,000.00	.	60%	30.57
33	X19	11	.	5,050.00	.	60%	30.57
34	X20	11	.	5,000.00	.	60%	30.57
35	X21	11	.	5,700.00	.	60%	30.57
36	X22	11	.	5,050.00	.	60%	30.57
37	X23	11	.	5,000.00	.	60%	30.57
38	X24	11	.	5,000.00	.	60%	30.57
39	X25	11	.	5,000.00	.	60%	30.57
40	X26	11	.	5,000.00	.	60%	30.57
41	X27	11	.	5,000.00	.	60%	30.57
42	X28	11	.	5,000.00	.	60%	30.57
43	X29	11	.	5,000.00	.	60%	30.57
44	X30	11	.	5,000.00	.	60%	30.57
45	X31	11	.	5,000.00	.	60%	30.57
46	X32	11	.	5,000.00	.	60%	30.57
47	X33	11	.	5,000.00	.	60%	30.57
48	X34	11	.	5,000.00	.	60%	30.57
49	X35	11	.	5,000.00	.	60%	30.57
50	X36	11	.	5,000.00	.	60%	30.57
51	X37	11	.	5,000.00	.	60%	30.57
52	X38	11	.	5,000.00	.	60%	30.57
53	X39	11	.	5,000.00	.	60%	30.57
54	X40	11	.	5,000.00	.	60%	30.57
55	X41	11	.	5,000.00	.	60%	30.57
56	X42	11	.	5,000.00	.	60%	30.57
57	X43	11	.	5,000.00	.	60%	30.57
58	X44	11	.	5,000.00	.	60%	30.57
59	X45	11	.	5,000.00	.	60%	30.57
60	X46	11	.	5,000.00	.	60%	30.57
61	X47	11	.	5,000.00	.	60%	30.57
62	X48	11	.	5,000.00	.	60%	30.57
63	X49	11	.	5,000.00	.	60%	30.57
64	X50	11	.	5,000.00	.	60%	30.57
65	X51	11	.	5,000.00	.	60%	30.57
66	X52	11	.	5,000.00	.	60%	30.57
67	X53	11	.	5,000.00	.	60%	30.57
68	X54	11	.	5,000.00	.	60%	30.57
69	X55	11	.	5,000.00	.	60%	30.57
70	X56	11	.	5,000.00	.	60%	30.57
71	X57	11	.	5,000.00	.	60%	30.57
72	X58	11	.	5,000.00	.	60%	30.57
73	X59	11	.	5,000.00	.	60%	30.57
74	X60	11	.	5,000.00	.	60%	30.57

PRODUCER	CONSUMER	AT	ACTIVITY	UNIT COST	LOWER LIMIT	UPPER LIMIT	PROFIT COST
76	X75	11	.	5,000.00	.	60%	30.57
77	X76	11	.	5,000.00	.	60%	30.57
78	X77	11	.	5,000.00	.	60%	30.57
79	X78	11	.	5,000.00	.	60%	30.57
80	X79	11	.	5,000.00	.	60%	30.57
81	X80	11	.	5,000.00	.	60%	30.57
82	X81	11	.	5,000.00	.	60%	30.57
83	X82	11	.	5,000.00	.	60%	30.57
84	X83	11	.	5,000.00	.	60%	30.57
85	X84	11	.	5,000.00	.	60%	30.57
86	X85	11	.	5,000.00	.	60%	30.57
87	X86	11	.	5,000.00	.	60%	30.57
88	X87	11	.	5,000.00	.	60%	30.57
89	X88	11	.	5,000.00	.	60%	30.57
90	X89	11	.	5,000.00	.	60%	30.57
91	X90	11	.	5,000.00	.	60%	30.57
92	X91	11	.	5,000.00	.	60%	30.57
93	X92	11	.	5,000.00	.	60%	30.57
94	X93	11	.	5,000.00	.	60%	30.57
95	X94	11	.	5,000.00	.	60%	30.57
96	X95	11	.	5,000.00	.	60%	30.57
97	X96	11	.	5,000.00	.	60%	30.57
98	X97	11	.	5,000.00	.	60%	30.57
99	X98	11	.	5,000.00	.	60%	30.57
100	X99	11	.	5,000.00	.	60%	30.57
101	X100	11	.	5,000.00	.	60%	30.57
102	X101	11	.	5,000.00	.	60%	30.57
103	X102	11	.	5,000.00	.	60%	30.57
104	X103	11	.	5,000.00	.	60%	30.57
105	X104	11	.	5,000.00	.	60%	30.57
106	X105	11	.	5,000.00	.	60%	30.57
107	X106	11	.	5,000.00	.	60%	30.57
108	X107	11	.	5,000.00	.	60%	30.57
109	X108	11	.	5,000.00	.	60%	30.57
110	X109	11	.	5,000.00	.	60%	30.57
111	X110	11	.	5,000.00	.	60%	30.57
112	X111	11	.	5,000.00	.	60%	30.57
113	X112	11	.	5,000.00	.	60%	30.57
114	X113	11	.	5,000.00	.	60%	30.57
115	X114	11	.	5,000.00	.	60%	30.57
116	X115	11	.	5,000.00	.	60%	30.57
117	X116	11	.	5,000.00	.	60%	30.57
118	X117	11	.	5,000.00	.	60%	30.57
119	X118	11	.	5,000.00	.	60%	30.57
120	X119	11	.	5,000.00	.	60%	30.57
121	X120	11	.	5,000.00	.	60%	30.57
122	X121	11	.	5,000.00	.	60%	30.57
123	X122	11	.	5,000.00	.	60%	30.57
124	X123	11	.	5,000.00	.	60%	30.57
125	X124	11	.	5,000.00	.	60%	30.57
126	X125	11	.	5,000.00	.	60%	30.57
127	X126	11	.	5,000.00	.	60%	30.57
128	X127	11	.	5,000.00	.	60%	30.57
129	X128	11	.	5,000.00	.	60%	30.57
130	X129	11	.	5,000.00	.	60%	30.57
131	X130	11	.	5,000.00	.	60%	30.57
132	X131	11	.	5,000.00	.	60%	30.57
133	X132	11	.	5,000.00	.	60%	30.57
134	X133	11	.	5,000.00	.	60%	30.57
135	X134	11	.	5,000.00	.	60%	30.57
136	X135	11	.	5,000.00	.	60%	30.57
137	X136	11	.	5,000.00	.	60%	30.57
138	X137	11	.	5,000.00	.	60%	30.57
139	X138	11	.	5,000.00	.	60%	30.57
140	X139	11	.	5,000.00	.	60%	30.57
141	X140	11	.	5,000.00	.	60%	30.57
142	X141	11	.	5,000.00	.	60%	30.57
143	X142	11	.	5,000.00	.	60%	30.57
144	X143	11	.	5,000.00	.	60%	30.57
145	X144	11	.	5,000.00	.	60%	30.57
146	X145	11	.	5,000.00	.	60%	30.57
147	X146	11	.	5,000.00	.	60%	30.57
148	X147	11	.	5,000.00	.	60%	30.57
149	X148	11	.	5,000.00	.	60%	30.57
150	X149	11	.	5,000.00	.	60%	30.57
151	X150	11	.	5,000.00	.	60%	30.57
152	X151	11	.	5,000.00	.	60%	30.57
153	X152	11	.	5,000.00	.	60%	30.57
154	X153	11	.	5,000.00	.	60%	30.57
155	X154	11	.	5,000.00	.	60%	30.57
156	X155	11	.	5,000.00	.	60%	30.57
157	X156	11	.	5,000.00	.	60%	30.57
158	X157	11	.	5,000.00	.	60%	30.57
159	X158	11	.	5,000.00	.	60%	30.57
160	X159	11	.	5,000.00	.	60%	30.57
161	X160	11	.	5,000.00	.	60%	30.57
162	X161	11	.	5,000.00	.	60%	30.57
163	X162	11	.	5,000.00	.	60%	30.57
164	X163	11	.	5,000.00	.	60%	30.57
165	X164	11	.	5,000.00	.	60%	30.57
166	X165	11	.	5,000.00	.	60%	30.57
167	X166	11	.	5,000.00	.	60%	30.57
168	X167	11	.	5,000.00	.	60%	30.57
169	X168	11	.	5,000.00	.	60%	30.57
170	X169	11	.	5,000.00	.	60%	30.57
171	X170	11	.	5,000.00	.	60%	30.57
172	X171	11	.	5,000.00	.	60%	30.57
173	X172	11	.	5,000.00	.	60%	30.57
174	X173	11	.	5,000.00	.	60%	30.57
175	X174	11	.	5,000.00	.	60%	30.57
176	X175	11	.	5,000.00	.	60%	30.57
177	X176	11	.	5,000.00	.	60%	30.57
178	X177	11	.	5,000.00	.	60%	30.57
179	X178	11	.	5,000.00	.	60%	30.57
180	X179	11	.	5,000.00	.	60%	30.57
181	X180	11	.	5,000.00	.	60%	30.57
182	X181	11	.	5,000.00	.	60%	30.57
183	X182	11	.	5,000.00	.	60%	30.57
184	X183	11	.	5,000.00	.	60%	30.57
185	X184	11	.	5,000.00	.	60%	30.57
186	X185	11	.	5,000.00	.	60%	30.57
187	X186	11	.	5,000.00	.	60%	30.57
188	X187	11	.	5,000.00	.	60%	30.57
189	X188	11	.	5,000.00	.	60%	30.57
190	X189	11	.	5,000.00	.	60%	30.57
191	X190	11	.	5,000.00	.	60%	30.57
192	X191	11	.	5,000.00	.	60%	30.57
193	X192	11	.	5,000.00	.	60%	30.57
194	X193	11	.	5,000.00	.	60%	30.57
195	X194	11	.	5,000.00	.	60%	30.57
196	X195	11	.	5,000.00	.	60%	30.57
197	X196	11	.	5,000.00	.	60%	30.57
198	X197	11	.	5,000.00	.	60%	30.57
199	X198	11	.	5,000.00	.	60%	30.57
200	X199	11	.	5,000.00	.	60%	30.57
201	X200	11	.	5,000.00	.	60%	30.57
202	X201	11	.	5,000.00	.	60%	30.57
203	X202	11	.	5,000.00	.	60%	30.57
204	X203	11	.	5,000.00	.	60%	30.57
205	X204	11	.	5,000.00	.	60%	30.57
206	X205	11	.	5,000.00	.	60%	30.57
207	X206	11	.	5,000.00	.	60%	30.57
208	X207	11	.	5,000.00	.	60%	30.57
209	X208	11	.	5,000.00	.	60%	30.57
210	X209	1					

\$3.96 million, or by \$22,034. Compared to the optimal solution that involves only one plant in the ECCM, costs increase by \$193,291. This results from the cheapest supplier (St. Lucia) reducing production to the low capacity level, the difference being supplied by the other plant in St. Vincent. The distribution of the output from the two plants to the nine consuming centers is shown in Table 9.25b. Discussion of these flows is left to the interested reader. A summary of the sub-optimal solutions of this case are given in Table 9.26.

The final set of results to be considered are those for the second (and smaller) market demand estimates, Market Demand II. This differs from the earlier demand set in the assumed U.S. market potential which in the present case is taken as 250,000 units. The total market demand of 498,424 units is below the plant capacity for the three sets of capacity constraints so that the latter have no effect on the solutions. Table 5.27 contains the optimal solution results. The total costs are \$2.5 million; one plant is established and is located in St. Lucia. The output level of this plant is 498,424 units which of course are the total market requirements. The average unit cost implied by the optimal results is \$4.93. This unit cost is less than those implied for the other solutions and warrants explanation. Recall that the transport cost coefficients for shipments to the U.S. market are very large compared to the coefficients for intra-regional transport flows. Specifically the former are \$1.56 or \$1.72 while the latter are \$0.16. Therefore when a substantial reduction of the flows to the U.S. market potential is made this eliminates some of the high cost demand requirements and results in a decline in average unit costs. (Compare the INPUT

Table 9.26  
 Sub-Optimal Solutions<sup>a</sup> of Knitwear Project with  
 Market Demand I and Capacity Constraints III:  
 Total Costs and Production Locations

Solution Number	Total Costs	Unit Costs	Producers <sup>b</sup>
1	\$3,975,080	\$5.31	St. Lucia, Grenada
2	\$3,975,384	\$5.31	St. Lucia, St. Kitts
3	\$3,976,951	\$5.31	St. Lucia, Dominica
4	\$3,979,096	\$5.32	St. Lucia, Montserrat
5	\$4,016,740	\$5.37	St. Lucia, Antigua
6	\$4,076,258	\$5.45	Antigua, St. Vincent
7	\$4,084,769	\$5.46	St. Vincent, Grenada
8	\$4,085,074	\$5.46	St. Kitts, St. Vincent
9	\$4,086,641	\$5.46	Dominica, St. Vincent
10	\$4,087,356	\$5.46	Antigua, Grenada
11	\$4,087,660	\$5.46	Antigua, St. Kitts
12	\$4,088,785	\$5.46	St. Vincent, Montserrat
13	\$4,089,227	\$5.46	Antigua, Dominica
14	\$4,096,171	\$5.47	St. Kitts, Grenada
15	\$4,097,738	\$5.48	Dominica, Grenada
16	\$4,098,042	\$5.48	Dominica, St. Kitts
17	\$4,100,187	\$5.48	St. Kitts, Montserrat
18	\$4,101,754	\$5.48	Dominica, Montserrat

a. All solutions are not given.

b. For all solutions, the first country named produces 500,000 units, the second country 248,424 units.

Table 9.27

Optimal Solution Results of Knitwear Project

with Market Demand II

FR	...ROW..	AT	...ACTIVITY...	SLACK ACTIVITY	..LOWER LIMIT.	..UPPER LIMIT.	.DUAL ACTIVITY
1	ZVALUE	BS	2455691.71998	2455691.71998-	NONE	NONE	1.00000
2	OUTPUT1	BS	.	720000.00000	NONE	720000.00000	.
3	OUTPUT2	BS	.	500000.00000	NONE	500000.00000	.
4	OUTPUT3	BS	.	500000.00000	NONE	500000.00000	.
5	OUTPUT4	BS	.	500000.00000	NONE	500000.00000	.
6	OUTPUT5	BS	.	500000.00000	NONE	500000.00000	.
7	OUTPUT6	BS	498424.00000	221576.00000	NONE	720000.00000	.
8	OUTPUT7	BS	.	500000.00000	NONE	500000.00000	.
9	DEMAND1	EQ	15234.00000	.	15234.00000	15234.00000	3.86000-
10	DEMAND2	EQ	6336.00000	.	6336.00000	6336.00000	3.86000-
11	DEMAND3	EQ	64120.00000	.	64120.00000	64120.00000	3.86000-
12	DEMAND4	EQ	4572.00000	.	4572.00000	4572.00000	3.86000-
13	DEMAND5	EQ	7873.00000	.	7873.00000	7873.00000	3.86000-
14	DEMAND6	EQ	13962.00000	.	13962.00000	13962.00000	3.70000-
15	DEMAND7	EQ	12115.00000	.	12115.00000	12115.00000	3.86000-
16	DEMAND8	EQ	124212.00000	.	124212.00000	124212.00000	3.86000-
17	DEMAND9	EQ	250000.00000	.	250000.00000	250000.00000	5.26000-
18	ZERO01	UL	.	.	720000.00000-	.	.27956
19	ZERO02	UL	.	.	500000.00000-	.	.07000
20	ZERO03	UL	.	.	500000.00000-	.	.06000
21	ZERO04	UL	.	.	500000.00000-	.	.36412
22	ZERO05	UL	.	.	500000.00000-	.	.36272
23	ZERO06	BS	221576.00000-	221576.00000	720000.00000-	.	.
24	ZERO07	UL	.	.	500000.00000-	.	.34127

COST coefficients of the  $X_{19}$  variables to the INPUT COST coefficients of the other  $X_{ij}$  variables in Table 9.25b.) Viewed in another way it may be said that with the smaller U.S. market potential in Market Demand II, a relatively larger proportion of the project's fixed costs are assigned to markets with low transport costs.

As for the previous case sub-optimal solutions are presented. In this case there are 6 second-best solutions. These involve locating the one regional plant in any one of the remaining 6 countries. The results are summarized in Table 9.28. The next to lowest cost solution is to locate the plant in St. Vincent. Total costs are just over \$2.5 million implying an average unit cost of \$5.07.

To conclude this section we touch on the question of economic viability of the project. For the last case considered (Market Demand II), if fixed costs are proportioned to the nine consuming centers on the basis of size the total delivered costs to the U.S. market for the optimal solution is \$1,407,295. This translates into a unit delivered cost to this market of \$5.63 (approximately U.S. \$2.81) or \$67.56 per dozen units (approximate U.S. \$33.78). This compares quite favorably with an estimated factory price of U.S. \$44.00 per dozen for the comparable product by a U.S. factory [53]. If the fixed costs are disproportionately allocated to the regional requirements the project's competitive delivered price to the U.S. market can be improved. If the larger Market Demand I case is considered and the costs of the optimal solution involving a single regional plant (located in St. Lucia) is used, allocating fixed costs in relation to market requirements leads to total delivered costs to the U.S. market of \$2,752,931, implying a

Table 9.28  
Sub-Optimal Solutions of Knitwear Project  
with Market Demand II

Solution Number	Total Costs	Unit Costs	Producer
1	\$2,527,473	\$5.07	St. Vincent
2	\$2,538,875	\$5.09	St. Kitts
3	\$2,540,442	\$5.10	Dominica
4	\$2,541,071	\$5.10	Grenada
5	\$2,545,086	\$5.11	Montserrat
6	\$2,567,465	\$5.15	Antigua

unit delivered price of \$5.50 (approximately U.S. \$2.75). This is quite attractive compared to the U.S. factory estimate of U.S. \$3.67. For the optimal solution involving two plants (Table 9.23a: Market Demand I and Capacity Constraint II) a similar calculation gives total delivered costs and unit delivered costs to the U.S. market of \$2,966,929 (U.S. \$1,433,464) and \$5.73 (U.S. \$2.87) respectively. These are competitive also. Thus a well-planned regional project which can establish marketing arrangements with a U.S. concern is economically viable according to the results of our empirical analysis.

With respect to the delivered costs in the regional demand centers a pro-rated fixed cost allocation gives average unit costs of \$4.22 for the optimal solution of Market Demand II, \$4.32 for the optimal solution of Market Demand I and Capacity Constraint II, \$4.10 for the optimal solution of Market Demand I involving one regional plant and \$4.42 for the optimal solution of Market Demand I and Capacity Constraint III. Even allowing for sizeable mark-ups these costs are competitive with

prevailing prices of the proposed project's products. Overall then, it appears that a carefully planned project can be economically viable. The importance of acquiring adequate marketing outlets in the regional and U.S. markets for the project's viability should however be recognized.

#### 9.5. The Woven Fabric Outerwear Project

The second garment manufacturing project involves manufacturing outer garments made with woven fabric. The product mix which can be adjusted to changing market conditions consists of skirts, suits, dresses, overcoats, blouses and pants. The cost analysis is based upon an approximate ratio of the above garments of 17:13:13:1:16:10. The project is intended to satisfy market requirements in the ECCM countries, as well as make sales in the MDCS of the Caribbean Common Market and the U.S.A.

The detailed foreign trade statistics of most of the ECCM countries are not disaggregated enough to give actual imports of the garment types to be produced by the proposed project. The closest classification common to all countries is imports of non-knitted outerwear (SITC 841.05 Outerwear other than knitted). The import figures of the ECCM countries for this category are given in Table 9.29. Again, the time series for the countries are incomplete. The figures indicate that for 1967 imports amounted to 805,530 pieces of non-knitted outerwear at a cif value of \$1.9 million. These figures however include garments such as men's non-knitted shirts and infants outerwear not considered in the project's production plan and consequently overstate the imports of immediate interest to the project. We use Grenada's import data which are more disaggregated to get an approximation of the relative importance of the garment types to be produced in the import category of Table 9.29. For

Table 9.29

## Imports of Non-Knitted Outer Garments\* by ECCM Countries

		Antigua	Dominica	Grenada	Montserrat	St. Kitts	St. Lucia	St. Vincent	ECCM
1960	no.						57,768	116,421	
	\$						94,439	149,085	
1961	no.			142,169				168,540	
	\$			253,117				198,809	
1962	no.				13,524			163,054	
	\$				20,347			237,791	
1963	no.			178,295	19,428		114,048		
	\$			286,426	31,346		177,381		
1964	no.	148,428		197,820			105,192		
	\$	378,914		291,310			224,365		
1965	no.	144,348		189,558		53,530		139,243	
	\$	352,520		304,684		159,717		208,869	
1966	no.	154,428		213,850			124,812		
	\$	481,238		383,986			303,975		
1967	no.	91,668	87,396	242,987	49,524	66,557	120,504	146,895	805,530
	\$	291,741	264,987	447,951	127,609	199,420	295,423	245,052	1,872,183
1968	no.	94,368	93,648	217,317	103,344	69,086	119,784		
	\$	294,912	258,414	499,286	182,077	219,427	357,102		
1969	no.		110,988				165,696		
	\$		321,004				441,189		
1970	no.				46,404		148,740		
	\$				158,273		518,687		

Table 9.29 (Continued)

		Antigua	Dominica	Grenada	Montserrat	St. Kitts	St. Lucia	St. Vincent	ECCM
1971	no.				37,032	58,112			
	\$				145,307	313,176			
1972	no.								
	\$								

\*SITC 841.05 Outerwear other than knitted.

Sources: Annual Trade Reports of individual ECCM countries for 1960 to 1971.

the three year period 1966-1968 the imports of non-knitted outer garments in the project's production mix averaged 96,134 units valued at \$251,934 or 42.8 percent in terms of quantity and 56.8 percent in terms of value of total non-knitted outerwear.<sup>16</sup> We use a 40 percent figure which is slightly below the Grenada three-year average to arrive at a rough estimate of the imports relevant to the proposed project. We assume that the project will be able to sell in the ECCM market quantities equivalent to the amounts calculated. The years used differ for the various countries and was primarily based on the availability of data when the mixed integer problem of this project was being solved. The estimated market potential of the ECCM countries together with the assumed values for the other two consuming centers appear in Table 9.30.

For the MDCS market potential we make the crude assumption that the project will be able to sell 10 percent of the ECCM requirements. As noted in Section 9.4 the MDCS have fairly well developed garment manufacturing industries. Therefore the ability of the ECCM project to sell some of its output in these markets will depend upon its establishing satisfactory marketing arrangements and of course being able to deliver to this market at a competitive price. Even greater importance attaches to the establishment of adequate marketing agreements for the U.S. market for which a market potential of 240,000 units is assumed. The project is also evaluated using a market demand of 120,000 units for the U.S. market.

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<sup>16</sup> Garment types in the project's production plan are taken to be total imports of non-knitted outerwear less shirts (men and women) and infants outer garments.

Table 9.30  
Market Demand<sup>a</sup> for Woven Fabric Outerwear Project

Country	Demand	Years Used
1. Antigua	50,659	1964-1968
2. Dominica	38,938	1967-1969
3. Grenada	82,655	1963-1968
4. Montserrat	23,630	1967-68, 1970-71
5. St. Kitts	27,129	1967-1968
6. St. Lucia	54,363	1966-1970
7. St. Vincent	57,227	1965, 1967
8. MDCS	33,460	
9. U.S.A. <sup>b</sup>	240,000	

a. For ECCM countries, 40 percent of annual average of imports of non-knitted outer garments (SITC 841.05). For MDCS 10 percent of ECCM. See text for discussion.

b. An alternative market demand of 120,000 units is also tried in the programming problems.

The sources used to establish the technology of the project analyzed in the previous section were also used to determine the technology and factor proportions of the woven fabric outerwear project. A plant with an annual capacity of 400,000 units was the basis for estimating the production costs in the seven potential locations. The production cost structure in each country has a classification identical to that of the footwear project so that the observations made there are applicable here as well. The categories (iii) indirect labor, (v) building rent, (vi) other overhead costs, (vii) depreciation, and (viii) interest on fixed capital are taken to comprise fixed costs while the other categories are variable costs. The cost calculations assume that the woven fabrics are air freighted from the U.S.A. to the potential producing

countries in the ECCM. If production management and inventory control of an actual ECCM project of similar content is such that sea transport is adequate for raw material shipments then the competitiveness of the regional project will be greater than the results that we present indicate since raw material shipping costs are as much as 11.4 percent of total production costs.

The estimated costs for the seven potential producers using factor prices appropriate for each are presented in Table 9.31. The lowest fixed costs are incurred in St. Vincent with \$232,759 followed by St. Kitts with \$236,009. For unit variable production costs the lowest location is St. Lucia followed by St. Vincent. The potential plant in Antigua has both the highest fixed and unit variable costs. The substantially lower unit variable costs in St. Lucia compared to the other locations except Antigua derive mainly from the difference in raw material transport costs. For the calculations it is assumed that transshipment costs will be incurred for the plants in the countries except Antigua and St. Lucia.

Table 9.31

## Production Costs of Woven Fabric Outerwear Project

Producer	Fixed Costs	Unit Variable Costs
1. Antigua	\$259,929	\$6.719
2. Dominica	\$237,959	\$6.630
3. Grenada	\$242,509	\$6.632
4. Montserrat	\$238,999	\$6.635
5. St. Kitts	\$236,009	\$6.627
6. St. Lucia	\$241,339	\$6.447
7. St. Vincent	\$232,759	\$6.612

The transportation costs for shipping the project's output to the demand centers are based on sea freight rates and port charges for the Caribbean centers. For reasons discussed in earlier sections the intra-regional transport costs for the various origin-destination configurations differ slightly. The costs for transporting the project's output varies from \$0.263 to \$0.268 per unit. For transport costs to the U.S. market airfreight rates are used. The calculations include transshipment costs in the Caribbean for those countries that do not have adequate direct air links with the U.S.A. In addition, the transport cost coefficients include an estimate of import tariffs costs for the product's entry into the U.S. market. A rate of 25 percent ad valorem is used.

With respect to the capacity constraints for the potential plants in the seven possible locations, the maximum output assumed for each is 340,800 units. This is less than the assumed total market requirements of 608,061 units (488,061 units for the case with U.S. requirements of 120,000 units). This means that the programming solutions of the project will have two plants in the ECCM.

Tables 9.32 present the optimal solution results of the mixed integer programming problem of the woven apparel project with the first market demand set (Table 9.30). From Table 9.32a it can be seen that the minimum total costs of supplying all market requirements are \$5,039,646. This translates into average unit costs of \$8.29. The solution involves the establishment of two plants in the region, one located in St. Lucia which produces at maximum capacity (340,800 units), the other in St. Vincent which produces at 78.4 percent (267,261 units) of maximum capacity. The solution results of the distribution of the

Table 9.32a

Optimal Solution of Woven Fabric Outerwear Project

with Market Demand I:

Total Costs, Output and Demand Results

NUMBER	...RUM...	AT	..ACTIVITY..	SLACK ACTIVITY	..LOWER LIMIT..	..UPPER LIMIT..	TOTAL COSTIVITY
1	ZVALUE	RS	5039045.99194	5039045.99194			1.00000
2	OUTPUT1	RS		340501.00000			
3	OUTPUT2	RS		340501.00000			
4	OUTPUT3	RS		340501.00000			
5	OUTPUT4	RS		340501.00000			
6	OUTPUT5	RS		340501.00000			
7	OUTPUT6	RS	340500.00000				
8	OUTPUT7	RS	267261.00000	73539.00000			
9	DEMAND1	EQ	50659.00000		50659.00000		5.00000
10	DEMAND2	EQ	38959.00000		38959.00000		5.00000
11	DEMAND3	EQ	82655.00000		82655.00000		5.00000
12	DEMAND4	EQ	23630.00000		23630.00000		5.00000
13	DEMAND5	EQ	27129.00000		27129.00000		5.00000
14	DEMAND6	EQ	54363.00000		54363.00000		5.00000
15	DEMAND7	EQ	57227.00000		57227.00000		5.00000
16	DEMAND8	EQ	33460.00000		33460.00000		5.00000
17	DEMAND9	EQ	240000.00000		240000.00000		5.00000
18	ZEM01	UL					5.00000
19	ZEM02	UL					5.00000
20	ZEM03	UL					5.00000
21	ZEM04	UL					5.00000
22	ZEM05	UL					5.00000
23	ZEM06	UL					5.00000
24	ZEM07	RS	73539.99999	73539.99999			5.00000

output of the two plants to the nine consuming centers are shown in Table 9.32b. The St. Lucia plant supplies the entire requirements of Dominica, St. Lucia and the U.S.A. and 9 percent (7,499 units) of Grenada's requirements, while the St. Vincent plant supplies the full requirements of Antigua, Montserrat, St. Kitts, St. Vincent, and the MDCS together with the remaining 91 percent (75,156 units) of Grenada's requirements.

How competitive are the implied delivered unit costs of the optimal solution? Allocating total fixed costs of the regional project to the consuming centers on the basis of relative size of demand gives delivered unit costs for the U.S. market of \$10.64, approximately U.S. \$5.32. (Total costs are \$2,554,418, roughly U.S. \$1,277,209.) A reasonable ex-factory price that a comparable U.S.-based plant can hope to receive is U.S. \$6.30 according to one estimate by the Economist Intelligence Unit [53]. It appears then that the project can be competitive with respect to the U.S. market. Two of several factors that can enhance its competitiveness in the U.S. market may be noted. First, if the project's production and delivery schedules and its inventory management can be such that raw materials can be shipped to the plants by sea rather than by air as assumed in the cost calculations, unit costs will be lower. Second, an allocation of fixed costs such that regional demand absorbs a disproportionately large amount will reduce unit costs for the U.S. market.

With respect to regional demand the proportionate distribution of fixed costs gives total costs of \$2,485,227 for supplying the region (including MDCS demand) with the 368,061 units required. The implied

Table 9.32b  
 Optimal Solution of Woven Fabric Outerwear Project  
 with Market Demand I:  
 Producer-Consumer Combinations

NUMBER	COLUMN	AT	ACTIVITY	UNIT COST	UNIT PRODUCTION	UNIT PRICE	NET GAIN
25	X11	NS	.	0,71500	.	NS	.
26	X12	LL	.	0,90000	.	NS	.
27	X13	LL	.	0,90000	.	NS	20500
28	X14	LL	.	0,90000	.	NS	20500
29	X15	LL	.	0,90000	.	NS	20500
30	X16	LL	.	0,90000	.	NS	20500
31	X17	LL	.	0,90000	.	NS	20500
32	X18	LL	.	0,90000	.	NS	20500
33	X19	LL	.	0,90000	.	NS	20500
34	X21	LL	.	0,90000	.	NS	20500
35	X22	NS	.	0,90000	.	NS	20500
36	X23	LL	.	0,90000	.	NS	20500
37	X24	LL	.	0,90000	.	NS	20500
38	X25	LL	.	0,90000	.	NS	20500
39	X26	LL	.	0,90000	.	NS	20500
40	X27	LL	.	0,90000	.	NS	20500
41	X28	LL	.	0,90000	.	NS	20500
42	X29	LL	.	0,90000	.	NS	20500
43	X31	LL	.	0,90000	.	NS	20500
44	X32	LL	.	0,90000	.	NS	20500
45	X33	NS	.	0,90000	.	NS	20500
46	X34	LL	.	0,90000	.	NS	20500
47	X35	LL	.	0,90000	.	NS	20500
48	X36	LL	.	0,90000	.	NS	20500
49	X37	LL	.	0,90000	.	NS	20500
50	X38	LL	.	0,90000	.	NS	20500
51	X39	LL	.	0,90000	.	NS	20500
52	X41	LL	.	0,90000	.	NS	20500
53	X42	LL	.	0,90000	.	NS	20500
54	X43	LL	.	0,90000	.	NS	20500
55	X44	LL	.	0,90000	.	NS	20500
56	X45	LL	.	0,90000	.	NS	20500
57	X46	LL	.	0,90000	.	NS	20500
58	X47	LL	.	0,90000	.	NS	20500
59	X48	LL	.	0,90000	.	NS	20500
60	X49	LL	.	0,90000	.	NS	20500
61	X51	LL	.	0,90000	.	NS	20500
62	X52	LL	.	0,90000	.	NS	20500
63	X53	LL	.	0,90000	.	NS	20500
64	X54	LL	.	0,90000	.	NS	20500
65	X55	LL	.	0,90000	.	NS	20500
66	X56	LL	.	0,90000	.	NS	20500
67	X57	LL	.	0,90000	.	NS	20500
68	X58	LL	.	0,90000	.	NS	20500
69	X59	LL	.	0,90000	.	NS	20500
70	X61	LL	.	0,90000	.	NS	20500
71	X62	NS	3494,00000	0,71500	.	NS	20500
72	X63	NS	7499,00000	0,71500	.	NS	20500
A	X64	LL	.	0,71500	.	NS	.

MPSX-PIFIN. EXECUTIO. MPSX RELEASE I TO LEVEL 4

NUMBER COLUMN AT ACTIVITY UNIT COST UNIT PRODUCTION UNIT PRICE NET GAIN

A	74	X65	LL	.	0,71500	.	NS	.
	75	X66	NS	5436,00000	0,90000	.	NS	.
	76	X67	LL	.	0,71500	.	NS	20500
A	77	X68	LL	.	0,71500	.	NS	20500
	78	X69	NS	24000,00000	0,90000	.	NS	.
	79	X71	NS	5059,00000	0,90000	.	NS	.
A	80	X72	LL	.	0,71500	.	NS	.
	81	X73	NS	75156,00000	0,90000	.	NS	.
	82	X74	NS	23030,00000	0,90000	.	NS	.
	83	X75	NS	27129,00000	0,90000	.	NS	.
	84	X76	LL	.	0,71500	.	NS	20500
	85	X77	NS	57221,00000	0,90000	.	NS	.
	86	X78	NS	33460,00000	0,90000	.	NS	.
	87	X79	LL	.	0,71500	.	NS	20500
	88	X1	IV	.	25000,00000	1,00000	20500	19499
	89	X2	IV	.	23700,00000	1,00000	20500	18499
	90	X3	IV	.	24250,00000	1,00000	20500	19499
	91	X4	IV	.	23000,00000	1,00000	20500	18499
	92	X5	IV	.	23000,00000	1,00000	20500	18499
	93	X6	IV	1,00000	24150,00000	1,00000	20500	19499
	94	X7	IV	1,00000	23275,00000	1,00000	20500	18499

average unit costs are \$6.75. Using this as an ex-factory price for the project's output destined for the regional market should permit it to be competitive with alternative sources. The first cost reducing factor noted in the previous paragraph would help to reduce this ex-factory price.

It may be noted also that the total ECCM demand (334,601 units) for this project is quite large compared to demand for the other two consuming centers and is large enough to support one of the plants. This means that the tariff policy of the ECCM could be used to guarantee the project regional demand. The costs results of the optimal solution suggest that extreme use of this tool is not required to ensure the project's economic viability. Finally on the basis of calculations similar to those analyzed in Sections 9.1 and 9.2 the regional project can be shown to be substantially cheaper than any similar project undertaken on nationalistic lines by any one of the ECCM countries.

As in the previous cases we present the costs and production locations results of some of the sub-optimal solutions. This is done in Table 9.33. The next least cost solution gives total costs of \$5,048,058 implying average unit costs of \$8.30. The two plants are located in St. Lucia and Grenada in this second-best solution.

We turn now to the optimal solution results of the project with Market Demand II, which as noted before is identical to Market Demand I except that for the U.S. market 120,000 units are assumed. In Tables 9.34a and 9.34b the results are summarized. As in the optimal solution with Market Demand I the two plants are located in St. Lucia and St. Vincent. The first plant produces at maximum capacity (as in the

Table 9.33  
 Sub-Optimal Solutions<sup>a</sup> of Woven Fabric Outerwear  
 Project with Market Demand I

Solution Number	Total Costs	Unit Costs	Producers <sup>b</sup>
1	\$5,048,058	\$8.30	St. Lucia, Grenada
2	\$5,054,425	\$8.31	St. Lucia, Dominica
3	\$5,054,799	\$8.31	St. Lucia, St. Kitts
4	\$5,060,889	\$8.32	St. Lucia, Montserrat
5	\$5,097,001	\$8.38	St. Lucia, Antigua
6	\$5,146,289	\$8.46	St. Vincent, Antigua
7	\$5,155,976	\$8.48	Grenada, Antigua
8	\$5,156,043	\$8.48	St. Vincent, Grenada
9	\$5,161,971	\$8.49	Dominica, Antigua
10	\$5,162,410	\$8.49	St. Vincent, Dominica
11	\$5,162,784	\$8.49	St. Vincent, St. Kitts
12	\$5,168,873	\$8.50	St. Vincent, Montserrat
13	\$5,172,146	\$8.51	Dominica, Grenada
14	\$5,172,326	\$8.51	St. Kitts, Grenada
15	\$5,178,666	\$8.52	St. Kitts, Dominica
16	\$5,178,756	\$8.52	Grenada, Montserrat
17	\$5,184,976	\$8.53	Dominica, Montserrat
18	\$5,185,130	\$8.53	St. Kitts, Montserrat

a. All solutions are not given.

b. For solutions 6, 7 and 9 the first country named produces 317,402 units, the second country 290,659 units. For all other solutions the first country named produces 340,800 units, the second country 267,261 units.

Table 9.34a

Optimal Solution of Woven Fabric Outerwear Project

with Market Demand II:

Total Costs, Output and Demand Results

NUMBER	...ROW..	AT	...ACTIVITY...	SLACK	ACTIVITY	..LOWER LIMIT.	..UPPER LIMIT.	..DUAL ACTIVITY
1	ZVALUE	RS	3979685.99198	3979685.99198-		NONE	NONE	1.00000
2	OUTPUT1	RS	.	340800.00000		NONE	340800.00000	.
3	OUTPUT2	RS	.	340800.00000		NONE	340800.00000	.
4	OUTPUT3	RS	.	340800.00000		NONE	340800.00000	.
5	OUTPUT4	RS	.	340800.00000		NONE	340800.00000	.
6	OUTPUT5	RS	.	340800.00000		NONE	340800.00000	.
7	OUTPUT6	RS	340800.00000	.		NONE	340800.00000	.
8	OUTPUT7	RS	147261.00000	193539.00000		NONE	340800.00000	.
9	DEMAND1	FQ	50659.00000	.		50659.00000	50659.00000	6.88000-
10	DEMAND2	FQ	38938.00000	.		38938.00000	38938.00000	6.87900-
11	DEMAND3	FQ	82655.00000	.		82655.00000	82655.00000	6.87600-
12	DEMAND4	FQ	23630.00000	.		23630.00000	23630.00000	6.87900-
13	DEMAND5	FQ	27129.00000	.		27129.00000	27129.00000	6.88000-
14	DEMAND6	FQ	54363.00000	.		54363.00000	54363.00000	6.61200-
15	DEMAND7	FQ	57227.00000	.		57227.00000	57227.00000	6.61200-
16	DEMAND8	FQ	33460.00000	.		33460.00000	33460.00000	6.87700-
17	DEMAND9	FQ	120000.00000	.		120000.00000	120000.00000	8.83300-
18	ZER001	UL	.	.		340800.00000-	.	.16100
19	ZER002	UL	.	.		340800.00000-	.	.24900
20	ZER003	UL	.	.		340800.00000-	.	.24400
21	ZER004	UL	.	.		340800.00000-	.	.70129
22	ZER005	UL	.	.		340800.00000-	.	.69251
23	ZER006	UL	.	.		340800.00000-	.	.16500
24	ZER007	RS	193538.99999-	193538.99999		340000.00000-	.	.

previous case, while the second plant produces at 43.2 percent (147,261 units) of maximum capacity. The total costs are \$3,979,686, which translate into average unit costs of \$8.15. This is lower than the average unit costs of \$8.29 noted earlier for the case with the larger U.S. demand. The explanation for this is comparable to that given in Section 9.4 for a similar occurrence with the knitwear project and need not be repeated.

If the fixed costs of the project are allocated to the various markets in proportion to demand the total delivered costs for the U.S. requirements are \$1,156,727; unit costs are \$9.64 or approximately U.S. \$4.81, which is quite attractive compared to the previously quoted U.S. \$6.30 ex-factory price for a comparable U.S. based establishment. A similar allocation of costs leads to total delivered costs to the Caribbean markets of \$2,822,959 or average unit costs of \$7.67.

The distribution of the production of the two plants to the nine consuming centers is shown in Table 9.34b. Interpreting the table should be by now straightforward and is left to the interested reader. The final set of results presented refer to sub-optimal solutions and are summarized in Table 9.35. Again we omit discussion of these results.

In summary it can be said that on the basis of the results of the mixed integer problem of the regional project to manufacture outerwear from woven fabrics, an economically viable project can be established in the ECCM. If the non-ECCM market requirements assumed can in fact be attained the project can support two plants, but even without these a smaller regional project which has one plant could produce clothing for the ECCM market at competitive costs. Nationalistic programming of a comparable project will involve higher costs and hence is less attractive.



Table 9.35  
 Sub-Optimal Solutions<sup>a</sup> of Woven Fabric Outerwear  
 Project with Market Demand II

Solution Number	Total Costs	Unit Costs	Producers <sup>b</sup>
1	\$3,985,711	\$8.17	St. Lucia, Grenada
2	\$3,992,305	\$8.18	St. Lucia, Dominica
3	\$3,993,039	\$8.18	St. Lucia, St. Kitts
4	\$3,998,169	\$8.19	St. Lucia, Montserrat
5	\$4,024,201	\$8.25	St. Lucia, Antigua
6	\$4,063,083	\$8.32	St. Vincent, Grenada
7	\$4,070,424	\$8.34	St. Vincent, St. Kitts
8	\$4,073,489	\$8.35	St. Vincent, Antigua
9	\$4,075,553	\$8.35	St. Vincent, Montserrat
10	\$4,079,186	\$8.36	Dominica, Grenada
11	\$4,079,366	\$8.36	St. Kitts, Grenada
12	\$4,083,176	\$8.37	Grenada, Antigua
13	\$4,085,436	\$8.37	Grenada, Montserrat
14	\$4,085,946	\$8.37	St. Kitts, Dominica
15	\$4,089,171	\$8.38	Dominica, Antigua
16	\$4,091,656	\$8.38	Dominica, Montserrat
17	\$4,091,810	\$8.38	St. Kitts, Montserrat

a. Not all solutions are given.

b. For solutions 8, 12 and 15 the first country named produces 317,402 units, the second country 170,659 units. For all other solutions the first country named produces 340,800 units, the second country 147,261 units.

#### 9.6. The Men's Knitted Underwear Project

The final project to be considered in this study is a garment manufacturing project to produce men's knitted underwear. The discussion of market demand is taken up first, followed by the cost estimates of the potential producing countries. Finally, an analysis of these results of the mixed integer programming problem of the project is presented.

In Table 9.36 the imports of knitted underwear (SITC 841.02) by the ECCM countries is given. In 1967 883,762 pieces of knitted undergarments were imported by these countries at a c.i.f. value of \$526,603. The import figures in Table 9.36 however include women and girls underwear. For Grenada, knitted underwear import statistics are sufficiently disaggregated to show the imports of men and boys knitted underwear. For 1968 these amounted to 95,880 units at a c.i.f. value of \$55,997. This represents 41.7 percent of total knitted under imports in terms of quantity and 40.3 percent in terms of value. For the previous year (1967) men and boys knitted underwear imports were 127,784 units valued at \$62,728. The relative quantity and value percentages are 51.2 and 47.9 respectively. Thus the average annual imports for the two years are 112,332 units valued at \$59,363 which translates into relative proportions of 46.7 percent and 44.0 percent of the quantity and value respectively of total knitted undergarment imports.

For demand in the ECCM countries it is assumed that the Grenada proportions are rough approximations for the composition of their knitted underwear imports. The market demand potential is taken as 45 percent of the average annual imports for 1967-1968 of knitted underwear.

Table 9.36

## Knitted Underwear Imports\* of ECCM Countries

		Antigua	Dominica	Grenada	Montserrat	St. Kitts	St. Lucia	St. Vincent	ECCM
1960	no.						154,080	34,594	
	\$						58,291	20,670	
1961	no.			169,728				31,047	
	\$			72,136				12,705	
1962	no.				9,912			13,984	
	\$				5,129			5,224	
1963	no.			200,748	14,316		212,400		
	\$			75,591	6,244		101,020		
1964	no.	126,636					274,236	32,916	
	\$	51,784					142,419	12,745	
1965	no.	11,964		200,448		55,704		33,806	
	\$	5,022		82,137		23,382		10,854	
1966	no.	194,112		240,672			371,892		
	\$	97,010		112,544			197,221		
1967	no.	286,680	33,432	251,784	41,484	85,308	171,180	13,994	883,762
	\$	172,099	18,124	131,081	65,668	26,480	106,783	6,368	526,603
1968	no.	130,020	68,196	229,752	57,312	113,220	118,908		
	\$	102,512	38,386	139,000	27,817	35,537	96,610		
1969	no.		156,192				278,952		
	\$		91,366				206,537		
1970	no.				46,788		430,212		
	\$				51,570		357,439		

Table 9.36 (Continued)

		Antigua	Dominica	Grenada	Montserrat	St. Kitts	St. Lucia	St. Vincent	ECCM
1971	no.				27,948	130,500			
	\$				36,063	57,158			
1972	no.								
	\$								

\*SITC 841.02.

Sources: Annual Trade Reports of individual ECCM countries for 1960-1971.

The results are shown in Table 9.37. Also in this table are the assumed market potential of the proposed project output in the MDCS of the Caribbean Common Market and the U.S.A. For the former a potential equal to the total ECCM specified demand is used, for the latter three times the ECCM demand. For these two markets the comments made in the previous two sections regarding appropriate marketing arrangements apply for the present project as well.

Table 9.37

## Market Demand\* for Men's Knitted Underwear Project

Country	Demand (units)
1. Antigua	93,758
2. Dominica	22,866
3. Grenada	108,346
4. Montserrat	22,229
5. St. Kitts	44,669
6. St. Lucia	65,270
7. St. Vincent	6,252
8. MDCS	363,390
9. U.S.A.	1,090,170

\*For ECCM countries 45 percent of annual average (1967-68) of knitted under imports. For MDCS and U.S.A., total ECCM demand and three times total ECCM demand respectively. See discussion in text.

The technology of the project is based primarily on the Economist Intelligence Unit's prospectus [53] but also draws upon profiles of garment manufacturing establishments in UNIDO's Profiles of Manufacturing Establishments. The cost structure and calculations are based upon the classification of costs used for the footwear project of Section 9.1.

Of the nine cost categories, (i) material costs, (ii) direct labor costs, (iv) utilities costs, and (ix) interest on working capital are taken as variable costs while the remainder comprise fixed costs. The estimated raw material costs used in the cost calculations include sea freight transport costs from New York to the various potential producing countries.

The estimated production costs of the proposed project are given in Table 9.38. Antigua has both highest fixed and unit variable production costs while St. Vincent has both the lowest fixed and unit variable production costs. The costs are applicable to a plant which has a capacity of 2.5 million units of men's underwear. This is the capacity constraint used in the mixed integer programming problem of the project.<sup>17</sup>

Table 9.38

## Production Costs of Men's Knitted Underwear Project

Producer	Fixed Costs	Unit Variable Costs
1. Antigua	\$433,630	\$0.765
2. Dominica	\$403,470	\$0.718
3. Grenada	\$409,190	\$0.712
4. Montserrat	\$404,510	\$0.727
5. St. Kitts	\$400,350	\$0.717
6. St. Lucia	\$406,850	\$0.711
7. St. Vincent	\$395,930	\$0.703

<sup>17</sup> In the solution of the mixed integer problem capacity constraints of 2.2 million was used instead of 2.5 million for the potential producers except Antigua and Dominica. However given that total demand is only 1.8 million units this substitution has no effects on the results. See Table 9.39 below.

The costs of delivering the project's output to the various demand points are based on sea freight rates and landing, storage and delivery charges at the respective ports for the Caribbean markets. For the U.S. market, the delivery costs include air freight charges and customs duties (assumed to be 26 percent ad valorem) at the U.S. port of entry together with transshipment costs in the Caribbean where relevant. For the Caribbean flows the unit transport coefficients range from \$0.036 to \$0.038. For the U.S. market it is \$0.317 (from Antigua and St. Lucia) or \$0.357 (from other ECCM countries).

The results of the optimal solution of the project are summarized in Table 9.39. The producer-consumer flows are not shown since the solution involves only one plant. The mixed integer programming problem consists of 24 linear programming rows and 94 variables 7 of which have integer (0,1) solution values. The total costs of the project are \$2,068,855 implying an average unit cost of \$1.14. The one plant is located in St. Lucia.

To determine the delivered cost to the various demand points an assumption regarding the allocation of fixed costs must be made. If fixed costs are distributed in relation to the size of demand the average total costs for supplying the eight Caribbean markets is \$704,049. This translates into an average unit cost of 97 cents. For the ECCM market the total costs are \$350,864, implying average unit costs of 97 cents. The total delivered costs for the U.S. market of 1.1 million units are \$1,364,805; unit costs are \$1.25 (approximately U.S. 63 cents). Of course the unit costs for the Caribbean and U.S. markets can be adjusted upwards and downwards respectively if fixed costs are disproportionately allocated to Caribbean demand.

Table 9.39

Optimal Solution Results of Men's Underwear Project

NUMBER	...ROW..	AT	...ACTIVITY...	SLACK ACTIVITY	..LOWER LIMIT.	..UPPER LIMIT.	.DUAL ACTIVITY
1	ZVALUE	BS	2068854.96798	2068854.96798-	NONE	NONE	1.00000
2	OUTPUT1	BS	.	2496000.00000	NONE	2496000.00000	.
3	OUTPUT2	BS	.	2184000.00000	NONE	2184000.00000	.
4	OUTPUT3	BS	.	2184000.00000	NONE	2184000.00000	.
5	OUTPUT4	BS	.	2184000.00000	NONE	2184000.00000	.
6	OUTPUT5	BS	.	2184000.00000	NONE	2184000.00000	.
7	OUTPUT6	BS	1816950.00000	679050.00000	NONE	2496000.00000	.
8	OUTPUT7	BS	.	2184000.00000	NONE	2184000.00000	.
9	DEMAND1	EQ	93758.00000	.	93758.00000	93758.00000	.74900-
10	DEMAND2	EQ	22866.00000	.	22866.00000	22866.00000	.74800-
11	DEMAND3	EQ	108346.00000	.	108346.00000	108346.00000	.74800-
12	DEMAND4	EQ	22229.00000	.	22229.00000	22229.00000	.74800-
13	DEMAND5	EQ	44669.00000	.	44669.00000	44669.00000	.74800-
14	DEMAND6	EQ	65270.00000	.	65270.00000	65270.00000	.71100-
15	DEMAND7	EQ	6252.00000	.	6252.00000	6252.00000	.74800-
16	DEMAND8	EQ	363390.00000	.	363390.00000	363390.00000	.74800-
17	DEMAND9	EQ	1090170.00000	.	1090170.00000	1090170.00000	1.02800-
18	ZERO01	UL	.	.	2496000.00000-	.	.17373
19	ZERO02	UL	.	.	2184000.00000-	.	.18474
20	ZERO03	UL	.	.	2184000.00000-	.	.03600
21	ZERO04	UL	.	.	2184000.00000-	.	.18522
22	ZERO05	UL	.	.	2184000.00000-	.	.03100
23	ZERO06	BS	679049.99998-	679049.99998	2496000.00000-	.	.
24	ZERO07	UL	.	.	2184000.00000-	.	.04500

With respect to the project's economic viability its competitiveness in the U.S. market may be discussed first. The Economist Intelligence Unit [53] has suggested that a reasonable ex-factory price that can be expected by a comparable U.S.-based plant is U.S. \$8.30 per dozen units or U.S. 69 cents per unit. On the proportionality assumption of fixed cost allocation, the ECCM project could deliver to the U.S. market at U.S. \$7.50 per dozen units or U.S. 63 cents per unit. It appears then that subject to adequate marketing arrangements the project could sell to the U.S. market. And as just noted the plant could adjust downwards its delivered costs to this market.

The implied delivered costs to the Caribbean markets are such that, subject to acceptable quality standards, the project's output should be able to hold its own against imports. As in the previous project, the need to impose excessively high tariff rates to ensure a regional market for the project's output does not appear necessary.

Table 9.40 summarizes the results of the six sub-optimal solutions which involve establishing the plant in one of the other ECCM countries. The second-best solution is to locate the plant in St. Vincent which increases total costs by \$20,270. With total output of 1.8 million units this increases average unit costs by only 1 cent to \$1.15. The highest cost solution is to locate the plant in Antigua. The total costs for this solution are \$2,192,537 an increase of \$123,682 or 6.0 percent over the optimal solution costs. Average unit costs are \$1.21 an increase of 7 cents (3.5 U.S. cents) over the optimal solution average unit costs of \$1.14.

In the garment manufacturing projects analyzed in this study

Table 9.40

## Sub-Optimal Solutions of Men's Knitted Underwear Project

Solution Number	Total Costs	Unit Costs	Producer
1	\$2,089,125	\$1.15	St. Vincent
2	\$2,114,960	\$1.16	Grenada
3	\$2,117,560	\$1.17	St. Kitts
4	\$2,123,304	\$1.17	Dominica
5	\$2,140,720	\$1.18	Montserrat
6	\$2,192,537	\$1.21	Antigua

extra-regional demand prospects play a significant role in the total demand assumed for the mixed integer programming analysis. The argument may be advanced that given this feature of the project there is very little to be gained from regionally coordinating the development of these economic activities. This argument would be reasonable were it not for the discussion in Chapters 4 and 7, particularly the former. The importance of having a domestic base for export industries was emphasized within an appropriate concept of economic development. In particular, the need to remove the wide gap between the pattern of domestic demand and domestic production as one of the normative goals of economic development and integration of small economies was indicated. Regional programming provides this domestic base. Thus for example, ECCM demand represents a minimum of 55.0 percent (maximum 68.6 percent) of the various total demand estimates for the woven fabric outerwear project. For the men's underwear project ECCM demand is 20.0 percent of total demand. Projects of the scale analyzed if carried out under nationalistic programming would not have any significant domestic base.

Also as the analysis of the footwear project indicated manufacturing establishments based solely on regional demand can be part of the regional industrial programming scheme. It will be recalled that the gains of this approach vis-a-vis nationalistic planning can be substantial.

#### 9.7. Comments on Sensitivity Analysis and Conclusion

The analysis of the preceding sections have by and large indicated that a regional industrial programming scheme for the ECCM comprising manufacturing activities that can supply their markets at competitive costs can be devised. The specific projects analyzed should be viewed as only a few of several projects that could be established in the ECCM under a regional policy. Needless to say actual implementation of these projects would require rechecking of the cost estimates to take into account any changes in wage rates, raw material prices, etc. Perhaps more important, detailed and concrete determination of the marketing arrangements for the U.S. market would have to be established.

In the results presented so far we have implicitly dealt with some issues that are answered by sensitivity analysis. In determining the costs involved for a particular project for several demand sets some insight into the viability of the project if demand conditions change are provided. Similarly, by using different sets of capacity constraints for some of the projects the effect on the project's attractiveness if bottlenecks occur in some of the potential producing centers can be ascertained. Again, the analysis of the sub-optimal solutions can in certain conditions provide information as to the effect on the costs of the optimal solution if certain cost coefficients increase.

Consequently, we will not provide any detailed sensitivity analysis of each of the results. It will suffice to present some results of the sensitivity analysis of the footwear project. As noted above, any actual implementation of the projects analyzed above ought to be preceded by a revision of the results presented in this study.

It will be recalled from Section 9.1 that the optimal solution for the footwear project gives total costs of \$733,015 and that the two plants are established in St. Kitts and St. Vincent. Consider the effect on the optimal solution of changing one at a time the market demand estimates. Table 9.41a reproduces summary print-outs of the sensitivity analysis relating to the DEMAND variables. The optimal solution value of market demand in Antigua (DEMAND1) is 11,356 as can be seen under the column ACTIVITY. Since it is a fixed value its LOWER LIMIT and UPPER LIMIT are identically equal to the activity level. However DEMAND1 could fall to as low as zero (value of LOWER ACTIVITY) without any change in the optimal basis of the problem. Thus St. Kitts and St. Vincent will continue to have the two plants, though of course total production would be less by the decline in Antigua's demand. The value of the objective function (total costs) will increase by the change in DEMAND1 times - 6.50, the value under UNIT COST. Thus if DEMAND1 falls to zero total costs will decline by \$73,814 to \$659,201. This will result in average unit delivery costs of \$11.09 compared to \$10.35 of the optimal solution. It is clear then that although Antigua's demand has no impact on the optimal production locations it plays an important role in the project achieving low unit costs. The optimal solution basis is also unaffected if DEMAND1 increases

Table 9.41a

Sensitivity Analysis Results of Optimal Solution of  
Footwear Project: Market Demand Variables

NUMBER	...ROW...	AT	...ACTIVITY...	SLACK	ACTIVITY	...LOWER LIMIT...	LOWER ACTIVITY	...UNIT COST...	...UPPER COST...	LIMITING AT	AT
						...UPPER LIMIT...	UPPER ACTIVITY	...UNIT COST...	...LOWER COST...	PROCESS	
9	DEMAND1	EQ	11355.99807	.	.	11355.99807	15660.99705	6.50000-		X71	LL
						11355.99807		6.50000		X73	LL
10	DEMAND2	FO	9230.99665	.	.	9230.99665	13535.99563	6.47000-		X72	LL
						9230.99665		6.47000		X73	LL
11	DEMAND3	EQ	17557.99693	.	.	17557.99693	4304.99898	6.47000-		X53	LI
						17557.99693	42748.99348	6.47000		OUTPUT5	UL
12	DEMAND4	FO	1391.99989	.	.	1391.99989	26582.99644	6.47000-		X54	LL
						1391.99989		6.47000		OUTPUT5	UL
13	DEMAND5	EQ	8163.99809	.	.	8163.99809	33354.99465	6.21000-		X55	LI
						8163.99809		6.21000		OUTPUT5	UL
14	DEMAND6	EQ	13663.99732	.	.	13663.99732	410.99937	6.46000-		X53	LI
						13663.99732	17968.99629	6.46000		X73	LI
15	DEMAND7	EQ	9443.99695	.	.	9443.99695	13748.99593	6.21000-		X77	LL
						9443.99695		6.21000		X73	LI
16	ZERO01	UL	.	.	.	47999.96971-	.	3.20959		W1	LI
								3.20959-		W1	LI
17	ZERO02	UL	.	.	.	47999.97804-	.	.24000		X22	LL
							9230.99282	.24000-		X72	LI
18	ZERO03	UL	.	.	.	47999.98659-	.	.21000		X33	LI
							13252.99370	.21000-		X53	LI
19	ZERO04	UL	.	.	.	47999.99011-	.	.20000		X44	LL
							1391.99934	.20000-		X54	LI
21	ZERO06	UL	.	.	.	47999.97914-	.	.22000		X65	LI
							13252.99069	.22000-		X53	LI
22	ZERO07	UL	.	.	.	47999.99827-	4304.99863-	.04000		X73	LL
								.04000-		OUTPUT7	UL

up to 15,661 (value of UPPER ACTIVITY). Marginal costs are \$6.50 (value of UNIT COST) so that an increase to the maximum level (without change in optimal basis) will increase total costs by \$27,983 to \$760,998. This translates into average unit costs of \$10.13 to supply the ECCM with 75,114 pairs of footwear. Again the significant impact on delivered unit costs of changes in market requirements can be observed.

If DEMAND1 increases to more than 15,661 units the optimal basis of the problem will be affected. Specifically X73 (variable under LIMITING PROCESS) will leave the optimal solution basis so that the St. Vincent plant will no longer supply the market requirements of Grenada. In addition the marginal cost of supplying the Antigua market (DEMAND1) will increase beyond the \$6.50 value given under UNIT COST.

For the market requirements of Grenada (DEMAND3) the assumed amount of 17,558 pairs can be decreased to as low as 4,305 (value of lower ACTIVITY) without any change in the optimal solution basis. The objection function value (total costs) will decline by \$6.47 per unit reduction (coefficient under UNIT COST is -6.47). Thus if Grenada's market requirements are 4,305 pairs the two regional footwear projects will be located in the same two countries (St. Vincent and St. Kitts) as in the original optimal solution given in Section 9.1. However total costs will decline by \$85,747 to \$647,268. Average unit costs for the projects' optimal solution will now be \$11.25 for the new total market requirement of 57,556 pairs. Again the significant increase in unit costs should be noted. The upper limit on Grenada's demand requirements (DEMAND3) without any change in the optimal solution basis is 42,749 (value of UPPER ACTIVITY) and the marginal cost is \$6.47 (coefficient of

UNIT COST). Thus minimum total costs increase to \$896,001 or by 22.2 percent if this higher demand for Grenada is assumed in the mixed integer programming problem. Thus an increase in total demand requirements in this fashion of 35.6 percent leads to an increase in the optimal solution costs of 22.2 percent. The implied average unit costs are \$9.33.

If Grenada's demand falls below 4,305 pairs, the optimal basis will be affected with X53 (variable under LIMITING PROCESS) leaving the basis, implying that the St. Kitts plant will no longer supply a part of Grenada's requirements. On the other hand, if Grenada's demand increases to more than 42,749 (value of UPPER ACTIVITY) the variable OUTPUT5 (variable under LIMITING PROCESS) leaves the basis of the optimal solution. This means that at such market demand requirements the optimal solution of the footwear project will not involve a factory being established in St. Kitts. It should be noted however that the new Grenada demand would be more than twice the amount assumed in the project. It is very unlikely that our Grenada estimates relative to the others could be that much off target. Hence the optimal production locations appear quite stable for fairly substantial variations in the market demand requirements of the individual countries.

Similar analysis of the demand requirements of the other countries (DEMAND2, DEMAND4, DEMAND5, DEMAND6 and DEMAND7) can be carried out to determine the changes in total costs that result from using the extreme values (LOWER ACTIVITY and UPPER ACTIVITY) of the market requirements that maintain the original optimal solution basis. Also, similar analysis reveals that the market requirements have wide ranges (LOWER

ACTIVITY-UPPER ACTIVITY) over which the assumed levels (ACTIVITY) can vary without any change in the marginal cost (UNIT COST) and in the production location results of the optimal solution presented in Section 9.1.

In Table 9.41b a summary of the sensitivity analysis of the OUTPUT variables are presented. It will be recalled that the optimal solution involves a plant in St. Kitts (OUTPUT5) which produces 22,809 pairs and a plant in St. Vincent (OUTPUT7) which produces 48,000 pairs. These values appear under the column ACTIVITY in Table 9.40b. The output of the St. Kitts factory (OUTPUT5) can increase up to 27,114 pairs (value of UPPER ACTIVITY) with no change in the optimal solution basis. The marginal cost of such expansion is \$0.046 (coefficient of UNIT COST). Similarly output of the St. Vincent factory (OUTPUT7) can be as low as 43,695 pairs (a reduction of 9.0 percent in production) without any change in the optimal basis. For the countries which do not have a factory (OUTPUT1, OUTPUT2, OUTPUT3, OUTPUT4, OUTPUT6 have ACTIVITY values of zero) they cannot begin to produce without a change in the optimal basis. Hence the LOWER ACTIVITY and UPPER ACTIVITY values are zero. The alternative (sub-optimal) solutions which would result if one of these countries were to get a factory were analyzed in Section 9.1.

Finally we consider the sensitivity analysis results of the transport flow variables that have positive values in the optimal solution. These are X53, X54, X55, X71, X72, X73, X76 and X77. For the first: of these the optimal solution value is 13,253 (ACTIVITY value). However X53 can have values between 1,897 and 14,645 (LOWER ACTIVITY and UPPER ACTIVITY values) without any change in the optimal basis. The marginal

Table 9.41b

Sensitivity Analysis Results of Optimal Solution of  
Footwear Project: Output Variables

NUMBER	...ROW..	AT	...ACTIVITY...	SLACK ACTIVITY	..LOWER LIMIT..	LOWER ACTIVITY	...UNIT COST..	..UPPER COST..	LIMITING	AT
					..UPPER LIMIT..	UPPER ACTIVITY	...UNIT COST..	..LOWER COST..	PROCESS.	
2	OUTPUT1	RS	.	47999.99881	NONE	.	INFINITY		NONE	
					47999.99881	.	3.88958		X11	LI
3	OUTPUT2	RS	.	47999.99881	NONE	.	.24000		ZERO02	UL
					47999.99881	.	INFINITY		NONE	
4	OUTPUT3	RS	.	47999.99881	NONE	.	.21000		ZERO03	UL
					47999.99881	.	INFINITY		NONE	
5	OUTPUT4	RS	.	47999.99881	NONE	.	.20000		ZERO04	UL
					47999.99881	.	INFINITY		NONE	
6	OUTPUT5	RS	22809.00226	25190.99655	NONE	22809.00226	3.88958		X11	LI
					47999.99881	27113.99762	.04000		ZERO07	UL
7	OUTPUT6	RS	.	47999.99881	NONE	.	.22000		ZERO06	UL
					47999.99881	.	INFINITY		NONE	
8	OUTPUT7	RS	47999.99881	.	NONE	43695.00344	.04000		ZERO07	UL
					47999.99881	47999.99881	INFINITY		NONE	
20	ZERO05	RS	25190.98380-	25190.98380	47999.97400-	25190.98380-	3.88958		X11	LI
						20885.98941-	.04000		ZERO07	UL

cost is zero (value of UNIT COST) so that the minimum total costs (value of the objective function) remain at the optimal solution result of \$733,015. This is due to the multiple optima of the transport flows because of the virtually identical intra-regional se. transport costs. More important, if the assumed cost coefficient is increased above its assumed value of 6.47 (INPUT COST value) the activity level of X53 will decrease to 1,897. This arises from the fact that the highest cost that the coefficient can take without a change in the optimal solution value of the variable is that assumed as shown under the column UPPER COST/ LOWER COST of Table 9.41b.

For X54 its optimal solution value of 1,392 will fall to zero<sup>18</sup> if the coefficient input cost increases above its assumed value of 6.47. The minimum total costs to supply the market requirements of the seven countries will however remain at its value in the original optimal solution. This is shown by a zero coefficient under UNIT COST. Also the coefficient value of X54 can decline down to 6.27 without any change in its optimal solution value of 1,392. Thus the optimal result is quite stable for unit cost reduction of the St. Kitts plant supplying the Montserrat market of up to 20 cents (\$6.47-\$6.27). The minimum coefficient value which leaves all the optimal solution results intact is shown under LOWER COST.

We select X76 as the final transport flow on which we comment. As can be seen in Table 9.41c its optimal solution value is 13,664 (ACTIVITY LEVEL) and its assumed coefficient cost is 6.42 (INPUT COST).

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<sup>18</sup>The actual figure given in Table 9.40c is -2,913. However trade flow values below zero do not have an economically meaningful interpretation.

Table 9.41c

Sensitivity Analysis Results of Optimal Solution of  
Footwear Project: Transport Flows Variables

NUMBER	COLUMN	AT	...ACTIVITY...	..INPUT COST..	..LOWER LIMIT. ...UPPER LIMIT..	LOWER ACTIVITY UPPER ACTIVITY	...UNIT COST.. ...UNIT COST..	..UPPER COST.. ..LOWER COST..	LIMITING PROCESS	AT
31	x22	RS	.	6.23000	.	4304.99536-	.24000 INFINITY	6.47000 INFINITY	ZERO02	UL
39	x33	RS	.	6.26000	.	25190.99294-	.21000 INFINITY	6.47000 INFINITY	ZERO03	UI
47	x44	RS	.	6.27000	.	25190.97488-	.20000 INFINITY	6.47000 INFINITY	ZERO04	UI
53	x53	RS	13252.99795	6.47000	.	1897.00349 14644.99762	.	6.47000 6.47000	X51	LL
54	x54	RS	1391.99989	6.47000	.	2912.99909- 1391.99989	.	6.47000	X74	LL
55	x55	RS	8163.99809	6.21000	.	3859.00273 8163.99809	.26000 INFINITY	6.47000 INFINITY	X75	LL
63	x66	RS	.	6.24000	.	4304.99536-	.22000 INFINITY	6.46000 INFINITY	ZERO06	UL
65	x71	RS	11355.99807	6.46000	.	1896.99627- 11355.99807	.	6.46000 INFINITY	X51	LL
66	x72	RS	9230.99665	6.43000	.	4021.99769- 9230.99665	.	6.43000	X52	LI
67	x73	RS	4304.99898	6.43000	.	2912.99931 15660.99344	.24000 .	6.19000 6.43000	ZERO02	UL
70	x76	RS	13663.99732	6.42000	.	411.00298 13663.99732	.	6.42000 6.20000	X56	LL
71	x77	RS	9443.99695	6.17000	.	3808.99739- 9443.99695	.26000 INFINITY	6.43000 INFINITY	ZERO06	UI
72	w1	RS	.	154060.22465	.	. 1.00000	INFINITY 154060.22465	INFINITY	NONE	UI

The latter could decline to as low as 6.20 (value of LOWER COST) without any change in the results of the optimal solution. Here again the optimal solution is shown to be stable for unit cost reductions up to 22 cents. At the other end, if the coefficient cost rises above 6.42 (value of UPPER COST) the solution value of X76 falls to 411 (LOWER ACTIVITY). This is a significant change from the optimal solution value. What is of greater importance however is that such a significant reduction does not affect the minimum total costs involved (value of UNIT COST is zero) and the locations of the two plants are the same as in the optimal solution. What occurs is a simple shift from one plant to the other in supplying St. Lucia's (country 6) demand requirements.

It should be pointed out that the above sensitivity analysis is in the mould of partial equilibrium analysis. Only the value of one variable or a coefficient cost value is allowed to vary at a time. Thus the results do not answer questions about changes in the optimal solution if several factors change at the same time. However, such general equilibrium-type changes are likely to occur somewhat proportionately,<sup>19</sup> and the main result of the programming solutions, namely the optimal locations of the plants<sup>20</sup> are likely to be unaffected. Obviously such changes if they occur in the cost coefficients will affect the minimum total costs but such changes are likely to affect not only the projects in the programming scheme but the entire economies.<sup>21</sup>

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<sup>19</sup>Or conceptually the changes could be divided into two components, a proportionate shift and a partial equilibrium-type shift as discussed in this section.

<sup>20</sup>And for the sub-optimal solutions, the ranking of the various location possibilities.

<sup>21</sup>An exception might be the cost of imported raw materials which are specific to a project.

In summary, it may be said that on the basis of the sensitivity analysis of the footwear project the key result of the optimal location of the plants for the various projects appear stable under reasonable variations in market demand requirements and cost coefficients. Although any across the board increases in the cost coefficients will push up the minimum total costs for the various projects it is felt that such increases are not likely to be specific to the projects analyzed or more importantly to the ECCM economies. Thus the relative competitiveness of the various projects should not be severely impaired.

In conclusion, it is hoped that the analysis of this chapter has demonstrated in quantitative terms the relative merits of a regional scheme of industrial programming for the ECCM countries compared to nationalistic schemes of industrial development. It is worth re-emphasizing that any actual scheme of industrial programming for these countries would have to have a broader scope than the projects selected for analysis suggest. In particular, regional programming of agriculture and the linking of agricultural projects with manufacturing activities would have to be pursued.

## CHAPTER 10

### CONCLUSION

Regional economic integration among the Windward and Leeward Islands should be viewed as one aspect of a comprehensive strategy geared at transforming these Eastern Caribbean societies from their present state of dependent underdevelopment. The present study, looking as it did at a few features of economic integration can hope, at best, to be no more than a partial guide to approaches to the economic development problem of the ECCM countries. In applying the results of this study its limited scope in the context of overall development should be borne in mind.

#### 10.1 Summary Results of Study

The central argument of this work is that regional economic integration within the setting of the Leeward and Windward Islands should incorporate arrangements for coordinated regional development planning and the programming and allocation among member countries of new production activities. The argument is based upon the fact that given the structural features of the ECCM economies, standard trade liberalization provisions of customs unions will do very little at structural transformation. The extremely heavy reliance of each of the ECCM economies on non-regional markets and sources of supply, noted in Chapter 2, gives rise to fragmentation of the regional economy. The generation of interconnecting links among the constituent economies will require the fusion not only of their product markets but their factor markets as well. This implies the existence of the usual features of a common market, free movement of labor and capital within the region. In addition, it implies a conscious regional effort at development planning since, given the structural characteristics of the ECCM economies (discussed in Chapters 2 and 4), which appear more

conducive to regional economic disintegration than to integration, market forces alone are unlikely to transform the regional economy.

In our attempt to establish the outlines of a theoretical structure of economic integration appropriate to the Leeward and Windward Islands, a survey of the traditional theory of economic integration built around the Vinerian analysis of customs unions was undertaken in Chapter 3. The traditional approach was seen to be of limited relevance. First, its excessive emphasis on the static economic welfare effects of trade diversion and trade creation leads to inadequate attention being given to the economic development potential of economic integration. Second, the standard assumptions of the orthodox theory, perfect competition, full employment, absence of externalities and perfect mobility of factors nationally, fail to correspond even to the stylized operative features of underdeveloped economies. Consequently, the policy implications of the theory must be suspect so far as underdeveloped countries are concerned.

For underdeveloped countries, the positive points of the traditional theory revolve around its analysis of the terms of trade effects and of economies of scale. The analysis of the latter indicated that if economies of scale are exploited, the balanced operation of the cost-reduction and trade-suppression effects, identified by Corden [ 37 ], together with the trade diversion and trade creation effects can result in the expansion of desired production at a cost below that incurred under a nationalistic economic regime. More important, the methodology of the analysis of the two concepts suggested an approach to economic integration which seems appropriate for underdeveloped countries. This approach attempts to ascertain the goals and objectives of the prospective participating countries of a regional economic integration exercise. The conditions under which these countries can fulfill their objectives are investigated with a view

to determining the relative attractiveness of nationalistic versus regionally oriented solutions. Such a methodology permits the evaluation of economic integration in terms of its impact on, for example, the structural transformation of the constituent national economies, on their agricultural and industrial development or on their program of import substitution, rather than on somewhat nebulous concepts such as global economic welfare.

The suggested theoretical approach to economic integration among the Leeward and Windward Islands presented in Chapter 4 contends that a key preliminary to theory formulation is clear understanding of the objective conditions existing in the environment, some aspect of which the theory attempts to elucidate. Further, the goals and objectives of the operative agents of the environment should be made clear. Several important characteristics of the ECCM economies were identified in Chapters 2 and 4. First their extremely small size gives rise to a highly skewed natural resources endowment, limits the opportunities for economies of scale, creates difficulties for the acquisition of appropriate technology and fosters monopolistic market structures.

Second, they are structurally dependent in the sense that the structure and pattern of domestic production diverge sharply from the structure and pattern of domestic demand. The structural dependent character is evident even if the economies are taken as a single unit. Import propensities are very high and domestic production is dominated by a few export agricultural staples which are shipped to a handful of metropolitan countries. Tourism, the sector that has experienced the highest growth rates in recent years, is primarily financed by foreign capital, caters almost exclusively to non-regional customers and its enterprises are managed chiefly by foreign nationals.

Third, the continuing structural dependence of these economies derives partly from functional economic dependence as expressed in the uncritical pursuit of economic policies, use of policy instruments and retention of economic organization forms inherited from an earlier era.

In terms of goals and objectives, structural transformation of the economies of the Leeward and Windward Islands was taken as appropriate. This involves, among other things, increasing inter-sectoral links in the regional economy as well as the individual economies. The underlying concept of economic development as a process in which the members of the society in question use their own creativity to manipulate their environment for the fulfillment of their needs, implies that active popular participation is an essential feature of the transformation process.

The theoretical outlines establish the a priori superiority of regional economic integration over a nationalistic policy given the environment of the Leeward and Windward Islands and the stated normative goals. Economic integration leads to cost reductions for participating countries in pursuing a particular goal such as industrial development, as the market-swapping analysis of Cooper and Massell [ 36] indicated. The benefits of economic integration also arise from its market expansion effect which induces a higher rate of investment and stimulates the development of the manufacturing and agricultural sectors of constituent economies by opening up economies of scale opportunities.

In addition, regional economic integration permits the replacement of national import substitution by a more efficient regional import substitution program. By expanding the effective domestic market to include the entire region, economic integration lays the foundation for a regional effort at exporting manufactures. For according to the Linder hypothesis

a key determinant in a country or region's ability to export manufactured products is an adequate domestic demand.

Two other sources of benefits may be recalled. First, regional economic integration opens possibilities for the participating countries to collaborate in matters of technological research. Although foreign technology can be imported it is necessary that adaptations be made if the technology embodied in domestic production is not far removed from the society's level of scientific development. For small structurally dependent economies, the costs and uncertain outcomes of technology research may mean that a regional approach is the only way of acquiring appropriate technology. Second, economic integration permits regional resource combination thus making possible the establishment of regional industries based upon the use of the resources of two or more of the member countries. This will increase inter-country and inter-sectoral linkages thereby promoting structural transformation.

Economic polarization and bottlenecks in the intra-regional transportation system were seen as two problems which, if not properly handled, will weaken the economic integration strategy. If some member countries suffer adversely within the economic integration scheme, major frictions are likely to develop and result in continuing fragmentation of the ECCM economies. The realization of the benefits identified presupposes an adequate intra-regional transportation and communication network. Since regional transportation in the Leeward and Windward Islands is unsatisfactory, the economic integration regime must consciously take its improvement as a matter of top priority.

Finally, the theoretical outlines consider coordinated regional development planning as an important part of an appropriate economic integration

framework. Given the structural features of the ECCM economies and the necessity to minimize economic polarization effects of region-wide planning, the benefits of economic integration cannot be realized by passive inducements. Active policies have to be relied upon especially as the generation and distribution of the benefits are seen to be fundamentally inter-related.

The theoretical framework of regionally coordinated development planning discussed in Chapter 6 represents a possible approach to region-wide planning in the Leeward and Windward Islands. The framework involves three levels of plan coordination. The first level is aggregative multi-sectoral planning utilizing linear programming techniques and the input-output structure of the economics. Regional investment outlays are minimized given specific economic growth targets. Structural transformation occurs by ensuring that a specific configuration of differential sectoral growth rates is achieved.

Structural transformation in the second level of coordinated regional planning occurs through the introduction, within an input-output mixed integer programming structure, of new economic activities in addition to the differential sectoral growth rates of the first level of planning. Optimization of the use of the region's investment resources, given target rates of economic growth is the formal objective used.

The third level of regional coordination of planning consists of partial equilibrium programming of manufacturing projects to ascertain the optimum production locations to fulfill demand requirements at specified consuming centers.

The review of economic integration schemes in the Commonwealth Caribbean carried out in Chapter 5 indicated that the provisions governing the East Caribbean Common Market which is comprised of the Leeward and Wind-

ward Islands acknowledge the need for regional coordinated development planning and industrial programming. The review also noted that, unfortunately, no important achievements beyond trade liberalization matters had been made six years after the common market was launched. Substantial relative growth in intra-regional trade have resulted since the ECCM's inception but starting as it did from a relative size of less than 1 percent, intra-regional trade continues to be comparatively insignificant. More important, the structural features of the ECCM economies noted above have remained essentially unchanged. This however is not surprising since none of the important provisions of the ECCM agreement, in particular those calling for the free movement of labor and capital and for regionally coordinated development planning and programming in several areas, has been implemented.

The illustrative empirical results of the first level of regional development planning confirm the usefulness of the region-wide planning approach, though the computed gains are not overwhelming in relative terms. The results, presented in Chapter 8, are based on statistical data for three of the ECCM countries, Antigua, Dominica, and St. Kitts-Nevis-Anguilla. Appropriate information for the other members was unavailable. The numerical values should be taken with caution in view of the poor quality of the statistical base. It is felt however, that the qualitative features of the results are plausible.

The investment costs incurred in achieving a 5 percent per annum growth rate in output over a five-year plan period with one variant of multi-country planning compared to nationalistic planning are \$68.1176 million and \$68.3908 million for Antigua, \$33.1239 million and \$33.2029 million for Dominica and \$31.5563 million and \$31.8944 million for St. Kitts-Nevis-

Anguilla. For the three countries combined the savings in investment outlays total \$0.6903 million, less than 1 percent of total investment costs. Hence the gains, if any, are small. However, the above gains derive from a very limited type of coordinated planning which allows no changes in the economic structure of the member countries and in which benefits arise only from adjustments in trade patterns.

A second variant of multi-country planning leads to regional investment outlays of \$129.3537 million for the same 5 percent regional growth target. This represents a saving of \$4.1344 million or 3.1 percent in investment resources from the \$133.4881 million incurred under nationalistic planning. In addition, the balance of payments position of the region improves with that for Antigua and St. Kitts improving and for Dominica deteriorating.

Variant II coordinated planning incurs regional investment costs of \$158.3287 million for a regional growth target of 7 percent per year over a five-year plan period. Compared to nationalistic planning which involves total investment expenditures of \$163.6955 million, it represents a saving of \$5.3668 million or 3.3 percent. With the 7 percent aggregate income growth target the second variant of multi-country planning leads to a worsening of the regional balance of payments position.

In the empirical exercises of multi-country planning, structural transformation is represented as manufacturing output growing at a rate at least equal to that of aggregate output. Under one version of coordinated planning incorporating structural transformation (referred to as Coordinated Planning IV in Chapter 8), the saving in investment outlays is \$6.0997 million or 4.4 percent of the expenditure under nationalistic planning for target growth rates of 5 percent for aggregate income and 7 percent for manufacturing. Under Coordinated Planning V the gains are

\$6.3006 million or 4.6 percent. Thus growth and structural transformation of the regional economy is less costly under a regionally coordinated development planning regime.

That economic polarization is likely to be an important problem is confirmed by the empirical analysis. For Coordinated Planning II, a regional aggregate growth rate of 5 percent is accompanied by national rates of 5.6 percent, 5.2 percent and 4.0 percent for Antigua, Dominica and St. Kitts. The same variant of coordinated planning leads to national growth rates of 7.8 percent, 8.4 percent and 4.0 percent when a regional aggregate income growth rate of 7 percent is achieved. Thus St. Kitts suffers from harmful economic polarization effects. The analysis indicates however, that the savings in investment resources are adequate to neutralize the backwash effects of economic integration.

The conclusion to be drawn from the illustrative empirical results is that if they can be extended to the seven-member ECCM, a regime of coordinated development planning is an attractive framework for the growth and development of the regional economy and its constituent parts.

The empirical analysis of the third level of planning, reported in Chapter 9, covers the programming of a footwear project, a ceramics project, a tropical fruit canning project and three garment projects.

The footwear project is programmed to supply 70,809 pairs of shoes to the ECCM countries. For the case in which plant capacity constraints are 48,000 pairs, the optimum solution involves plants in St. Kitts and St. Vincent and total costs of \$733,015. The implied average unit costs are \$10.35 which is substantially below retail prices in the region of comparable footwear. Were each country to satisfy its assumed demand by nationalistic production, total regional costs would be \$1,458,117. This is almost twice those of the optimum and implies average unit costs of \$20.59. If plant capacity constraints are

set above total demand, the optimal solution calls for one plant in St. Vincent. Total costs are \$592,816 which translate into average unit costs of \$8.37. Thus it can be seen that regional programming of the footwear project generates substantial gains.

Three sets of demand estimates are used in the analysis of the ceramics project. The most optimistic assumes that the project can dispose of 1.5 million units of tableware in the ECCM and Trinidad. The average unit costs implied by the optimal solution, which involves a single plant located in St. Vincent, is 50 cents. This is a competitive cost. Similar projects undertaken along individual country lines to satisfy national demand appears highly unlikely. Their implied unit costs range from \$4.24 in Antigua to \$39.09 in Montserrat, that is, at least 8 times the regional cost. The second largest market demand set totals 1.0 million units. The single regional plant of the optimal solution is again established in St. Vincent. Total costs are \$622,507. Average unit costs are 60 cents indicating a substantial unit cost increase as production level declines. Regional programming again reveals significant gains.

The tropical fruit canning operation is based upon extra-regional demand. The optimal solution calls for two plants in the ECCM, one located in St. Vincent, the other in St. Kitts. Total costs of supplying to the specified markets 240,000 cases of tropical fruit and fruit salad are \$2.2 million. Average unit costs are 38 cents per 1 lb. can which is slightly above average c.i.f. prices obtaining in the main demand centers. Improved fruit supply conditions, made possible by a restructured regional agriculture, can result in significant cost reductions.

Regional programming of garment manufacturing consists of a knitwear project, a woven fabric apparel operation and the making of men's undergarments. For the first, the optimal solution, given market requirements of 498, 424 units, requires one plant in St. Lucia. Total costs are \$2.5 million, average unit

costs \$4.93. These costs make the project economically viable. The woven fabric apparel project has an optimal solution showing total costs of \$4.0 million to supply market requirements of 488,061 units. Two plants are established in the region, one in St. Lucia, the other in St. Vincent. Average unit costs of \$8.15 can assure economic viability of the project. National programming of the project generates higher unit costs and foregoes the larger domestic market of the regional approach. The third garment manufacturing project is programmed to fulfill total market requirements of 1.8 million units. The optimal solution involves a single regional plant, located in St. Lucia. Total and average unit costs are \$2.1 million and \$1.14 respectively. Again, the project appears economically viable.

The empirical analysis also provides second-best solutions of the projects. These are useful when, because of distributional considerations, it is decided not to locate the project along optimum rules. The additional costs incurred by the region for such allocation arrangements can be determined from the results. In general, the analysis indicates that substantial gains are forthcoming from regional programming of manufacturing activities compared to a nationalistic alternative.

#### 10.2 Limitations of Study

With respect to its applicability to the ECCM, the empirical analysis of coordinated development planning has among its weaknesses the fact that it is confined to only three member countries. This limitation is due to unavailability of data for the other member countries. A further shortcoming, also related to data problems, concerns the aggregative nature of the economies. Only eight sectors were identified in the input-output structure used in the analysis.

In the area of regional programming of projects, the market demand requirements in the ECCM countries are rule of thumb estimates based on their import statistics. Though domestic demand of the projects analyzed are met primarily by imports, the estimates used would seem to require some refinement before

any implementation of plans. Estimates based on regression analysis could not be made for this study in view of the absence of adequate statistical data such as household expenditure surveys and appropriate aggregate income series. As such data become available the solutions can be easily revised.

A feature of the empirical analysis of regional project programming is that some member countries do not appear in any of the optimal solutions. Given this feature and the necessity of an equitable distribution of benefits for a viable and effective economic integration regime, the analysis is incomplete in that it does not provide any second-level criteria to ensure that each member is allocated some manufacturing activity. The analysis does indicate however, the costs incurred for various sub-optimal locations of each of the projects. This information will be useful for decisions relating to the particular sub-optimal production arrangement chosen.

The study provides optimal (least-cost) production configurations of the projects but does not suggest a specific regional allocation of the projects. It is felt that the regional allocation scheme will take other factors besides production and transportation costs into account. Employment effects, initial capital costs, skilled personnel requirements, use of local raw materials and prestige value of the projects, to enumerate a few factors, may be of importance to the individual country ranking of the projects. Even after the economic dimensions of the programming scheme are analyzed, the ultimate decision on regional allocation of manufacturing activities will be a political one, involving negotiations among the members of the common market.

Finally, we may note another important shortcoming. Nothing is said of the particular economic organizational forms the projects are to take if implemented. If they are regional state enterprises, an appropriate regional pricing policy covering the commodities produced may be more easily negotiated than if the projects are organized along private capitalistic lines. Region-

al state enterprises may be preferable to national state enterprises with respect to an equitable distribution of the benefits of industrial programming. The underlying objective of the industrial programming scheme is to help transform the structurally dependent ECCM economies. Since active mass participation in the economic transformation process is considered important, self-managed enterprises, in which workers collectively manage and control the firms in which they work, may be superior to other forms of economic organization. This area would require critical analysis before a meaningful regional industrial programming scheme can be formulated.

### 10.3 Concluding Remarks

The problems of economic development faced by the Leeward and Windward Islands are numerous and quite complex. Satisfactory resolution of these problems does not appear to reside in simple proposals. More important, correct answers would seem to transcend purely economic bounds. Consequently, the approach to multi-country planning and industrial programming within the framework of the East Caribbean Common Market, suggested in this study is, at best, a small contribution to the strategies that are primarily of an economic complexion.

A successful program of economic integration and coordinated development planning is by no means a sufficient condition for the economic progress of the ECCM countries. The study does reveal however, that a regional approach to planning can generate significant gains and help promote the structural transformation of the ECCM economies. Therefore, a resolute attempt at clarifying and elaborating the development planning provisions of the ECCM agreement, together with a serious effort at implementing the provisions can make an important contribution to the economic development of the Leeward and Windward Islands.

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