

IMPORT SUBSTITUTION POLICY AND EXPORT
PROMOTION POLICY IN THAILAND:
A MULTIOBJECTIVE LINEAR
PROGRAMMING APPROACH

By

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Dedicated to Mr. Charoon and Mrs. Thongchan Oonjitt

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CHAPTER I

INTRODUCTION

International trade is considered to be important for a country that aspires to economic development. It has two important implications. First, it relieves a nation from the necessity to balance, sector by sector, production with domestic consumption. Second, it makes it possible to reallocate resources in production along the lines of comparative advantage, thereby making an additional contribution to GNP. The developing countries' trade policies have fallen into two distinct categories, namely, import substitution or inward-looking policy, and export promotion or outward-looking policy. Import substitution may be loosely defined as the process of producing goods which were previously imported while export promotion is the production of goods which have not been exported. Both policies represent ways in which developing countries may industrialize.

Import substitution policy was highly recognized in the 1950s and early 1960s when several less developed countries began to realize the necessity to ease their balance of payments and to promote their industries. The logic of this policy was that the market for the commodity concerned already existed, therefore, to substitute imports of that particular commodity with a domestic source of production should save the nation's foreign exchange. To do so, a system of protection, such as tax barriers, was erected in order to protect domestic

production from competition from abroad. Also, the foreign exchange rates were often artificially overvalued in order to encourage local manufacturing through importation of cheap capital and intermediate goods. Prebisch (45), one of the most influential scholars in promoting the adoption of import substitution policy by numerous developing countries, in particular the Latin American countries, points out that:

. . . the plea for technical advance in primary production as an alternative to industrialization . . . will usually be transferred from the peripheral countries to the outer world, unless it is buttressed by a vigorous process of industrialization and increasing productivity in industry. . . . Import substitution is the only way to correct the effects on peripheral growth of disparities in foreign trade elasticity (pp. 252-253).

A major success of import substitution policy is that it helped several developing countries, such as Brazil, Colombia, Peru, Malaysia, and Thailand, establish a large number of new industries. However, it has for the most part been a failure. Specifically, three undesirable outcomes have emerged. First, the balance of payments has not improved because the government's policy to encourage investment also stimulates importation of capital goods and intermediate products. Furthermore, the policy tends to shift the distribution of income in favor of the urban sector and the high income group, whose expenditure pattern typically has the highest component of imports. Second, it results in the construction of plants of less than efficient minimum size since domestic markets are fairly small in most developing countries. The policy also biases toward the adoption of capital intensive type of production. Third, the policy discourages exports due to artificially high exchange rates.

Because of these disadvantages, a new trade policy, namely export promotion, has emerged. Export promotion policy is believed to perform better than import substitution policy for several reasons. First of all, under the export policy, the trade balance tends to improve because exporters may not have to rely heavily on capital goods and raw materials imports. Foreign exchange also tends to be undervalued in order to make exports cheaper. Second, since the size of domestic market is no longer a binding constraint, investors can capture economies of scale in production. Finally, exporters are expected to compete in international markets, to impose any comprehensive system of license or controls would entail delays and other costs. Consequently, export promotion policy is considered to be less distortive.

However, a country adopting export promotion policy may face some obstacles such as protection barriers from other countries and inefficient industries which make their exports less competitive in the world market. Solutions to these problems may be cooperation among developing countries and/or cooperation between developed and developing countries as suggested by the fourth and the fifth sessions of the UNCTAD.

Studies on import substitution and export promotion can be grouped into two categories. The first group concerns the concept and measurement of import substitution, export promotion, as well as rates of protection. In general, the measurement of export expansion is straightforward. It is simply measured by an increase in exports. The measurement of import substitution, on the other hand, is more complicated. It has at least three variants. First is to take the difference between the directly observed import-total supply ratios in

the two periods. One can take either the absolute change or the percentage change of the ratios. Second is to take the difference between actual growth and expected growth of imports. This method, introduced by Chenery (8), assumes that imports will grow at the same rate as total supply. The third method is similar to the second method except that imports are expected to grow at the same rate as total domestic demand. These measures will provide similar interpretations but their magnitudes will not be identical.

The main idea of the effective rate of protection is to estimate the excess of value added under the protection situation over the value added under the free trade situation. The measurement of this rate can be of two different types depending upon two different definitions of value added. One is Balassa's method which excludes value added of non-traded inputs by assuming that these inputs are subject to constant cost, thereby they are not affected by any distortion. Therefore, value added is defined as total receipts less expenditures on all materials and non-traded inputs. The other is Cordon's method which includes value added of non-traded inputs in total value added. Consequently, Cordon's value added is larger than that of Balassa.

The second group is planning models which incorporate foreign trade and external resource inflows. Several models have been developed for several less developed countries. For instance, Weisskopf (61) develops a highly disaggregated, single period, linear programming model for India which is programmed to solve for the pattern of production and imports in the target year 1975 which could minimize a cost function made up of weighted sum of domestic resource costs, namely labor costs, and foreign exchange costs. Inequality

constraints include the typical distribution constraint, capacity constraint and lower bounds on competitive imports as a proportion of domestic availability. Estimates of exports are specified exogenously on the basis of an independent projection for the target year. Weisskopf induces increasing import substitution by increasing the weights, that is the rates of exchange between rupees and dollars. Therefore, the results involve a wide range of substitution possibilities between domestic production and imports.

The comparative advantage is seen by ranking the industries according to the exchange rate at which the domestic production activity first becomes profitable. The higher the exchange rate has to be set before it is optimal to have domestic production of a commodity, the less desirable it is from the point of view of comparative advantage and, hence, import substitution. An alternative ranking of sectors is obtained by minimizing foreign exchange costs alone. The shadow prices of each sectoral distribution constraint reflect the additional foreign exchange cost associated with a unit increase in the output of the sector, or, in other words, the marginal import content of domestic production. Therefore, for each sector, the ratio of the shadow price of domestic production to import price represents the relative foreign exchange content of domestic production as compared to imports. As such, the higher the ratio, the lower the net saving of foreign exchange afforded by import substitution, and the less attractive the sector is from the point of view of import substitution.

Tendulkar (51) also presents a multisectoral, single period, optimizing programming model for India. He considers two variants of the model. First, an open-loop variant is considered where the

optimization process is carried out unconstrained by the availability of domestic resources and subject only to the availability of foreign exchange. This gives rise to the purely trade-limited growth process. Second, a closed-loop variant is relevant where the availability of both domestic saving and foreign exchange are limited. This is a case of a simultaneous trade-and-savings limited growth process. His objective function is aggregate consumption in the target year and his inequality constraints include commodity balance constraints, upper and lower bounds on export activities, capacity constraints, lower bounds on competitive import activities, and a balance of payment constraint.

The sensitivity analysis consists in varying the level of exogenously specified external resource inflow. It is observed that an additional foreign resource releases only the trade bottleneck in the open-loop system whereas it breaks both the savings and the trade bottlenecks in the closed-loop system. Consequently, the marginal productivity of foreign assistance is higher in the latter system than in the former system.

Clark (11) develops a static linear programming model which is used to evaluate the impact of the import substitution policy on future growth of the Nigerian economy. He defines import substitution as the increase in the domestic share of total supply. A number of objective functions have been tried in his study. These functions are optimized subject to balance constraints, capacity constraints, replacement constraints, and resource constraints. Clark concludes that the import substitution policy will not increase Nigeria's share of domestic output to total supply. To grow faster, Nigeria has to increase her investment and her dependence upon foreign supply. To do this a larger share of value added must be saved and exports should expand.

MacEwan (32), in his regional linear programming planning model for Pakistan, illustrates the dependence of the region's productivity upon the structure of demand in that region when trade opportunities are limited, and the dependence of regional comparative advantage upon the regional distribution of resources as well as political preferences as to the regional allocation of welfare. He considers production processes and demand in East Pakistan and West Pakistan separately, but ties together the two regions by tariff free trade. His objective function is the maximization of the weighted sum of 1964-65 to 1974-75 increments to regional per capita consumption. These weights are population shares and political valuations. By varying the assumptions about the economy and about political preferences, the alternative solutions are obtained and compared.

Bruno (7) provides an interesting study in which he incorporates the foreign exchange constraint together with limitations on both physical and human capital in rational decisions on the planning of trade. His model and his analysis are based upon data for the Israeli economy. Optimal programs are obtained by maximizing total consumption subject to a foreign exchange constraint, labor constraint, skill constraint, and a trade activity constraint for alternative values of total foreign capital inflow. He classifies trade activities into import substitutes and export activities. He finds that having only one type of skilled labor in the model is an oversimplification of reality. That is, ranking of trade activities will be different under different factor endowments.

Studies on foreign trade of Thailand, in particular, include the studies by the Thai government, the World Bank, UNCTAD, ESCAP,

dissertations and books written by Thai and foreign scholars. Several aspects have been explored. For instance, a report by the World Bank in 1978 deals with industrial development policies related to import substitution and export promotion, and the performance of industrial exports. Akrasanee (1) presents estimates of the magnitude of import substitution and export promotion from domestic production, and of effective rates of protection. He also calculates effective rates of protection. However, none of them develops a planning model which incorporates foreign trade possibilities and external resource inflows. It is the attempt of this study to present another view of the impact of foreign trade policies on the Thai economy by developing an optimizing model for Thailand.

Statement of the Problem

Thailand is an agrarian nation in which the agriculture sector provides the largest share of the gross domestic product, foreign exchange earnings, and employment. Unfortunately, the sector has faced several obstacles which makes it slow to develop. They include a heavy dependence on the weather, a deterioration of land, forest, water and marine resources, as well as an increase in competition in the world market. As a result, the Thai government has tried to develop the manufacturing sector as a second most important sector. This began in 1961 with the adoption of an import substitution policy which aimed at promoting domestic production through the erection of import substitution industries. The Thai government has used several measures to encourage both domestic and foreign investors to set up plants and factories in Thailand. These measures included a special tax system of

foreign trade and domestic production, which provided a certain degree of protection, an investment promotion scheme, which facilitated the establishment of private enterprises, and an industrial control which regulated entry and expansion, import and export controls, and credit assistance. It turned out that during 1960-72, import substitution industries grew considerably. Since 1960, the processed food, beverages, primary goods such as petroleum products, and durable goods such as construction materials were produced. After 1966, the industries expanded in the area of paint, automobiles, electronics, and textiles. The government accorded high priority to consumer goods.

The export promotion policy was emphasised in 1972 after the government realized some undesirable outcomes of the import substitution policy. To promote import substitution policy, the government increased tariffs on imported finished products and reduced import duties on raw materials. Consequently, the content of imports was changed from finished products to raw materials. The balance of trade, therefore, did not obviously improve. Furthermore, the benefit from this policy did not accrue to the majority of the Thai people. The benefit was kept in the manufacturing sector, especially in the urban areas.

The export promotion policy was used with a hope to increase simultaneously agricultural exports as well as manufactured exports. The main export promotion measures included a tax refund to producers for imported inputs used in the production of exports, the upgrading of port and handling facilities and the development of new export markets, etc.

After 21 years of experience in the planned economy, the overall GDP real growth rate of about seven percent in Thailand was satisfactory. There were structural changes in production, which occurred mainly in the nonagriculture sector. Modern technology has been applied, but it biased toward the use of capital. There were the expansion and diversification of production and exports of agricultural and nonagricultural goods. By contrast, if the benefits of the planned development which accrued to each sector of the economy are compared, the agriculture sector seems to benefit the least. (The neglect of the agriculture sector at the beginning of the economic development plan which was started in 1960 has caused a great income disparity between this sector versus the nonagriculture sector. It is likely that the per capita income of the nonagriculture sector is approximately ten times higher than that of the agriculture sector. The country still has a problem of a trade deficit even though the government attempts to promote export growth and retard import growth. This problem may arise from the fact that Thailand relies heavily on imports and there is not an effective demand side management policy, such as a reduction in private and public consumption growth, in order to control the expansion of domestic demand. Merely the supply side management policy, such as the import substitution policy and the export promotion policy, may not be strong enough to cure the problem.

Any policies which affect exports and imports will have a great impact on the Thai economy. This is because the goods and services market in Thailand are closely related to the international market. The economy is very open as exports and imports of goods and services accounting for about 45 to 50 percent of the GDP. Therefore, it is

essential to examine the effects of import substitution and export promotion on the major economic problems of Thailand, which are income disparity, balance of trade deficit, and overall economic growth.

Purpose and Nature of the Study

The purpose of this study is to evaluate quantitatively the effects of the import substitution policy and the export promotion policy on the Thai economy, in particular on the distribution of income, the balance of trade, and the overall economic growth. The strategies of the two policies will be briefly discussed, but the target growth rates of imports and exports are vital to the study.

This study is formulated as a detailed empirical application of multiobjective linear programming in which exports and imports play a major role. The model is comparative static. That is, variables are defined as changes taking place between 1975, the year of Thailand's first official input-output table, and 1986, the terminal year of Thailand's Fifth Economic and Social Development Plan. The solution of the model, therefore, yields a comparison of 1986 with 1975. The model is mainly based on the data from the 1975 Input-Output Table.

The model consists of 38 sectors which can be classified into nine major groups, namely the agriculture sector, the mining sector, the manufacturing sector, the public utilities sector, the construction sector, the trade sector, the transportation and communication sector, the services sector and the unclassified sector. Each group has only one sector, except the manufacturing sector which is divided into 30 sub sectors. For the sake of simplicity, each sector is assumed to produce only one product and use only one process of production.

The objective of the model is to optimize simultaneously the three objectives which are (1) minimization of income disparity, defined as the difference between per capita income in agriculture sector versus that in nonagriculture sector, (2) minimization of balance of trade deficits, and (3) maximization of per capita income. Inequality constraints consist of the typical supply demand constraint, investment-saving constraint, upper and lower bounds on exports, and foreign exchange constraint. This study classifies imports into several categories according to different uses. This means that the total value of imports of a specific product consists of several uses to satisfy intermediate transaction, and/or private consumption, public consumption, investment demand, and export requirements. The effect of the import substitution policy is examined by varying a sectoral import to total supply ratio whereas the effect of alternative export possibilities is examined by parametric variation of exogenously given export levels. Whenever the import substitution policy is assumed to be effective, the import to total supply ratio as well as the upper bound on exports are set to be lower than the case of export promotion. The assigned values for each policy will be the target values indicated in the economic development plans of Thailand. Besides the separate evaluation of the two policies by using a different set of policy parameters, an additional effort will be made to study a combination of both import substitution and export promotion. This is an ideal case for most of the developing countries. The weighting method will be employed to solve this three objective optimization problem.

The 310 endogenous variables consist of gross outputs, value added, private consumption expenditures, domestic saving, imports and

exports. The 236 exogenous variables, on the other hand, are investment demands, public consumption expenditures, foreign capital inflow, and limits on exports. Every projection in this study is made simple by using the compounding growth formula $A_t = (1 + g)^t A_0$ whereas A_t is the terminal year value, A_0 is the base year value, g is the assigned growth rate and t is the number of years involved. Most of the parameters in this study are obtained from the input-output table. They are assumed to be constant from 1975 to 1986. This assumption may be too strong but it is the only way to deal with the disaggregated data, given the fact that there is only one official input-output table of Thailand.

The result of this study reveals the fact that the export promotion policy performs better than the import substitution policy in generating higher level of output, and thereby value added, consumption, and saving. The export policy also provides faster economic growth than does the import policy. However, a rapid rate of growth results in wider disparities of income and wider balance of trade deficit. These are the consequences of existing unequal distribution of growth and income in Thailand.

Organization of the Study

This dissertation is organized into five chapters. Chapter II presents the economic structure of Thailand as well as the economic and social development plans of the country. This chapter also discusses the economic problems, in particular the problem of income distribution and the balance of trade deficit, that has endured in Thailand for a long period of time. The strategies of import substitution and export promotion are as well briefly discussed.

Chapter III develops a three objective linear programming model which is the heart of this study. The structure of the model, the technique that will be used, and the sources of data can be found in this chapter.¹ The results of the optimization problem based on the model presented in Chapter III are discussed in Chapter IV.

A restatement of the research objectives and a summary of the major findings are provided in Chapter V. This chapter also includes policy recommendations.

¹The unit of all variables is presented in baht, which is the name of the local currency. Approximately 20.2 baht equals one U.S. dollar.

CHAPTER II

ECONOMIC STRUCTURE AND ECONOMIC DEVELOPMENT

POLICY OF THAILAND

Introduction

This chapter will discuss performance of economic sectors in Thailand in terms of their importance and contribution to growth of the national economy. Attention is also placed upon the discussion of the previous economic development plans and policies, as well as on the economic problems of the country.

Thailand, formerly Siam, is an independent country occupying an area of 198,455 square miles, which is approximately the size of France. The country, situated in the center of Continental Southeast Asia, is bounded by Laos to the north and northeast, Cambodia to the east, the Gulf of Thailand to the southeast, Malaysia to the south, the Andaman Sea to the southwest, and Burma to the west. It lies in a portion of the world affected by the tropical monsoon climate. Temperatures below 18°C (64°F) and above 38°C (100°F) are rare. Bangkok is the nation's capital and the largest city.

Thailand is predominantly a Buddhist kingdom. A large majority of the people are culturally Thai who enjoy their own culture, language and cuisine. In 1981, the population of Thailand was about 47.5 million. The population growth rate was approximately 2.5% and the sex ratio was nearly equal.

The economy of Thailand is dominated by the agriculture sector which provides the largest share of the gross domestic product (GDP), the foreign exchange earnings, as well as employment. In 1979, for example, more than 25% of the total GDP came from this sector, and approximately 55% of the total exports was agricultural goods. Furthermore, there was more than 71% of the total labor force engaged in this sector.

The economy is very open as exports and imports of goods and services accounting for about 40 to 50% of the total GDP. Consequently, the domestic prices of most commodities depend very much upon the world prices, provided that there are no export and import quotas to insulate both prices. Major exports consist of agricultural goods and agriculture-based goods, whereas most of imports are capital goods and intermediate inputs.

Sector Performance

The Thai economy can be classified into eight sectors, namely agriculture, mining and quarrying, manufacturing, public utilities, construction, trade, transportation and communication, and services. The agriculture sector was the only dominant sector for a long period of time, but since 1960 the manufacturing sector and the services sector have begun supplementing the agriculture sector as significant income and employment generators.

In growth terms (see Table I), the public utilities sector enjoyed the highest annual average real growth rate of 18.8%, followed by the manufacturing sector with 10.7%, whereas the agriculture sector had the lowest rate of 5.1%. The relatively high growth rate of the public

TABLE I

GROSS DOMESTIC PRODUCT BY INDUSTRIAL ORIGIN AND
ITS GROWTH RATES AT 1972 PRICES, 1960-79

Year	GDP		Agriculture		Mining and Quarrying		Manufacturing		Public Utilities	
	Millions of Baht	Growth Rates	Millions of Baht	Growth Rates	Millions of Baht	Growth Rates	Millions of Baht	Growth Rates	Millions of Baht	Growth Rates
1960	70,139	-	28,227	-	860	-	8,389	-	210	-
61	73,856	5.3	29,135	3.2	930	8.1	9,197	9.6	284	35.2
62	79,838	8.1	31,330	7.5	1,068	14.8	10,341	12.4	330	16.2
63	86,544	8.4	34,110	8.9	1,142	6.9	11,269	9.0	337	2.1
64	92,256	6.6	34,610	1.5	1,332	16.6	12,258	8.8	417	23.7
65	99,544	7.9	35,931	3.8	1,692	27.0	14,249	16.2	532	27.6
66	111,688	12.2	40,873	13.8	2,009	18.7	15,911	11.7	707	32.9
67	120,389	7.8	39,834	-2.5	2,235	11.2	17,895	12.5	921	30.3
68	130,598	8.5	43,706	9.7	2,465	10.3	19,209	7.3	1,263	37.1
69	140,941	7.9	47,018	7.6	2,577	4.5	21,805	13.5	1,365	8.1
70	150,092	6.5	48,332	2.8	2,555	-0.8	23,320	6.9	1,638	20.0
71	157,088	4.7	50,537	4.6	2,856	11.8	25,202	8.1	1,879	14.7
72	164,626	4.8	49,919	-1.2	2,886	1.0	27,864	10.6	2,251	19.8
73	180,146	9.4	56,237	12.6	2,683	-7.0	31,523	13.1	2,626	16.6
74	189,950	5.4	56,962	1.3	2,918	8.8	34,403	9.1	2,786	6.1
75	203,514	7.1	62,081	9.0	2,485	-14.8	37,146	8.0	3,181	14.2
76	221,225	8.7	65,898	6.1	2,906	16.9	42,529	14.5	3,642	14.5
77	237,173	7.2	65,537	-0.6	3,526	21.3	48,071	13.0	4,144	13.8
78	261,097	10.1	72,513	10.6	4,104	16.4	52,521	9.3	4,500	8.6
79	276,907	6.1	71,408	-1.5	4,531	10.4	57,841	10.1	5,178	15.1
Average		7.5		5.1		9.6		10.7		18.8

TABLE I (Continued)

Year	Construction		Transportation and Communication		Trade		Services		Ownership of Dwellings	
	Millions of Baht	Growth Rates	Millions of Baht	Growth Rates	Millions of Baht	Growth Rates	Millions of Baht	Growth Rates	Millions of Baht	Growth Rates
1960	3,343	-	4,827	-	11,123	-	11,097	-	2,063	-
61	3,514	5.1	4,861	0.7	11,926	7.2	11,888	7.1	2,121	2.8
62	4,018	14.3	5,305	9.1	12,478	4.6	12,783	7.5	2,185	3.0
63	4,439	10.5	5,489	3.5	13,793	7.9	13,793	7.9	2,243	2.6
64	5,109	15.1	6,130	11.7	15,270	11.3	14,816	7.4	2,314	3.2
65	5,688	11.3	6,444	5.1	16,220	6.2	16,397	10.7	2,391	3.3
66	6,908	21.4	6,906	7.2	17,868	9.9	18,023	9.9	2,483	3.8
67	8,212	18.9	7,643	10.7	21,166	18.4	19,896	10.4	2,587	4.2
68	8,591	4.6	7,859	2.8	22,489	6.3	22,317	12.2	2,699	4.3
69	8,724	1.5	8,408	7.0	23,817	5.9	24,385	9.3	2,842	5.3
70	8,705	-0.2	9,195	9.4	26,524	11.4	26,823	10.0	3,000	5.6
71	7,689	-11.7	9,373	1.9	27,189	2.5	29,257	9.1	3,106	3.5
72	7,168	-6.8	10,514	12.2	29,881	9.9	30,944	5.8	3,199	3.0
73	7,221	0.7	11,320	7.6	33,396	5.1	33,827	9.3	3,313	3.6
74	7,459	3.3	12,109	7.0	34,249	9.1	35,611	5.3	3,453	4.2
75	8,514	14.1	12,444	2.8	35,774	4.5	38,334	7.6	3,555	3.0
76	10,022	17.7	13,366	7.4	38,821	8.5	40,377	5.3	3,664	3.1
77	11,996	19.7	14,474	8.3	41,213	6.2	44,389	9.9	3,823	4.3
78	13,583	13.2	16,205	12.0	43,658	5.9	49,961	12.6	4,052	6.0
79	14,547	7.1	17,663	9.0	45,497	4.2	55,953	12.0	4,289	5.8
Average		8.4		7.1		7.8		8.9		3.9

Source: Unpublished Computer Printouts, Bangkok: Office of the National Economic and Social Development Board.

utilities sector was a result of a heavy public investment in creating infrastructural facilities for the expansion of national production and for providing basic services to the people. On the other hand, the relative low growth rate of the agriculture sector was a consequence of long neglect in this sector and ineffective agricultural development programs.

Agriculture

Thailand is predominantly an agriculture-based country in which she has the agriculture sector as the largest and the most important sector. More than 70% of total labor force was engaged in this sector even though progress in expanding the nonagriculture sector is indicated by agriculture's diminishing share of the GDP. In 1960, this was about 40%, but in 1979, this contribution had been reduced to 26% (see Table II). Nevertheless, agricultural commodities continue to provide more than half of the country's export income.

The agriculture sector consists of four major subsectors which are crops, livestock, fisheries and forestry. Crops is the most significant subsector which generated in the range of 68 to 77% of total GDP generated in this sector (see Table III). Major crops include rice, rubber, sugar cane, maize, sorghum, and cassava. Rice is the principal crop and its production has been the main economic activity of the Thai people from time immemorial. In 1979, for example, rice represented approximately 37% of total crop output and some 14% of total export earnings. It has always been the number one income generator of Thailand, and the country is sometimes referred to as a rice economy. Thailand ranks among the top five countries in rice

TABLE II
GROSS DOMESTIC PRODUCT BY INDUSTRIAL ORIGIN AND ITS PERCENTAGES SHARE
AT CURRENT MARKET PRICES

	1960	1966	1971	1976	1979
Agriculture	21,464 (39.76)	37,005 (36.50)	40,786 (28.20)	104,657 (31.00)	147,076 (26.44)
Mining and Quarrying	565 (1.05)	1,946 (1.92)	2,963 (2.05)	5,174 (1.53)	12,614 (2.27)
Manufacturing	6,759 (12.52)	13,910 (13.72)	24,908 (17.22)	63,025 (18.67)	109,740 (19.73)
Public Utilities	227 (0.42)	892 (0.88)	1,904 (1.32)	3,745 (1.11)	6,075 (1.09)
Construction	2,461 (4.56)	6,177 (6.09)	7,327 (5.07)	15,784 (4.68)	29,240 (5.26)
Trade	8,145 (15.09)	17,052 (16.82)	26,269 (18.17)	59,391 (17.59)	102,853 (18.49)
Transportation and Communication	4,044 (7.49)	6,326 (6.24)	8,955 (6.19)	21,828 (6.46)	37,844 (6.80)
Services	8,777 (16.26)	15,881 (15.67)	28,395 (19.64)	59,191 (17.53)	104,501 (18.79)
Ownership of dwellings	1,542 (2.85)	2,186 (2.16)	3,100 (2.14)	4,840 (1.43)	6,297 (1.13)
Total Value Added	53,984 (100.00)	101,375 (100.00)	144,607 (100.00)	337,635 (100.00)	556,240 (100.00)

Note: Values in Millions of Baht, () = Percentages share

Sources: National Income of Thailand (Bangkok, 1960, 1976, 1979, and 1980), Table 2.

TABLE III

GROSS DOMESTIC PRODUCT ORIGINATING FROM AGRICULTURE
AT CURRENT MARKET PRICES

	1960	1966	1971	1976	1979
Crops	15,664 (72.98)	28,789 (77.80)	28,084 (68.86)	77,509 (74.06)	107,980 (73.42)
Rice	6,880	16,152	10,967	25,650	39,813
Maize and Sorghum	384	1,090	1,712	4,812	6,350
Cassava	294	658	1,203	4,725	8,365
Sugar cane	389	390	812	7,062	4,491
Rubber	1,671	1,142	1,467	3,684	8,272
Vegetables and Friuts	2,700	4,290	5,678	14,831	21,662
Other Crops	3,346	5,067	6,245	16,745	19,027
Livestock	2,973 (13.85)	3,865 (10.44)	5,474 (13.42)	12,354 (11.80)	16,954 (11.53)
Cattle and Water buffaloes	828	1,172	1,486	4,003	4,497
Swine	746	1,099	1,409	2,132	4,091
Poultry	838	980	1,534	3,368	4,077
Others	561	614	1,045	2,851	4,289
Fishery	979 (4.56)	1,975 (5.34)	4,489 (11.01)	9,792 (9.36)	13,017 (8.85)
Marine fish	370	1,268	3,548	7,388	9,529
Fresh water fish	690	707	941	2,404	3,488

TABLE III (Continued)

	1960	1966	1971	1976	1979
Forestry	1,848 (8.61)	2,376 (6.42)	2,739 (6.71)	5,002 (4.78)	9,125 (6.20)
Teak	253	339	418	794	760
Other Logging	233	474	504	1,769	3,094
Charcoal and Firewood	1,120	1,350	1,537	1,968	4,507
Other Forest products	<u>242</u>	<u>213</u>	<u>280</u>	<u>471</u>	<u>764</u>
Total Value Added	21,464 (100.00)	37,005 (100.00)	40,786 (100.00)	104,657 (100.00)	147,076 (100.00)

Note: Values in Millions of Baht, () = Percentages share

Sources: National Income of Thailand (Bangkok, 1960, 1976, 1979, and 1980), Tables 10, 12, 13, and 16.

exports. The method of planting, harvesting, and milling have changed little from the past. The entire cycle of rice cultivation depends heavily upon a favorable rainfall. Therefore, the Thai government has made strenuous efforts to reduce this dependence by building more dams and irrigation projects, introducing better seeds and fertilizers, and using more mechanized agricultural equipment. It has also tried to diversify the economy by promoting other products and thereby reducing the heavy dependence on rice.

Rubber is the second most important crop of Thailand. Almost all rubber produced in the country is exported. The foreign exchange earning from rubber is usually second only to rice. Even though Thailand is among the top three rubber exporting countries, its future is very uncertain due to an increasing competition from synthetic rubber.

Sugar cane has long been grown in Thailand, and it comprised the major export to Europe during much of the nineteenth century. However, an increasing competition on the world market reduced its commercial production at the turn of the twentieth century, and it was not revived until after the Second World War. In the 1960s the country became largely self sufficient in sugar production, and some of it was left for export.

Other than rice, rubber, and sugar cane, maize, sorghum, and cassava are increasingly significant to the Thai agriculture sector. This is a result of crop diversification in response to price incentives which makes farmers ultimately switch from crops with relative lower returns to those with relative higher returns. The GDP values from maize, sorghum, and cassava were more than tripled from

1960 to 1971 (see Table III).

Livestock production is the second in importance in the agriculture sector. Its share in the total agricultural output ranged from 10 to 14% (see Table III). The major livestock are cattle and water buffaloes which are used mainly as draft animals, especially for rice cultivation. Nevertheless, the Thai government is trying to improve beef and dairy production, as well as indigenous breeds of swine through cross-breeding with pure breeds from abroad.

Of all livestock raised for the market, poultry has improved the most. Pure bred chickens are popular among poultry raisers and research in breeding and management with the aim of improving egg production and the feed conversion rate is being conducted with great success. Consequently, frozen chicken has become an important export.

Since 1970, fishery has ranked next to livestock in importance. In the past, rice growing and fresh water fishing had been essential activities for a Thai farmer who had two basic foods, namely rice and fish. However, starting in 1951 the fishing industry has been developed through an exploration of new fishing grounds and an improvement of fishing methods as well as market operation. Thereafter, marine fishery has become more significant and this industry, at present, is dependent upon marine catches. Furthermore, the expansion of refrigeration and storage capacity has made it possible for Thailand to export several kinds of frozen sea foods.

Forestry is one of the main economic activities for Thai people even though its importance has been diminished due to excessive cutting and insufficient replanting. Thai teak, which has long been famous as the finest timber in existence and is recognized as the best in the

world for shipbuilding, was one of the major exports, yet it plays only a modest role today. Besides teak, the forests in Thailand also produce other types of timber, such as rosewood, ebony, and sapan trees which are used to meet the growing domestic demand for building material. Bamboo is utilized for scaffolding in the construction of large buildings as well as for a number of household products. Other types of trees are employed in the production of paper, firewood, and charcoal.

Mining and Quarrying

Mining and quarrying has historically constituted approximately 2% of the GDP (see Table II). This sector is dominated by tin mining which accounted for about 36 to 62% of the total mining output (see Table IV). Tin, which is located mainly in the southern peninsula of Thailand, is a major source of foreign exchange earning. It is classified among the top ten of the country's principal exports and among the top five of the world's production. Recent developments have made other minerals, such as tungsten, fluorite, lignite, etc., become more prominent. Their expansion, however, depends upon foreign demand as domestic consumption remains low. The production of these minerals can be found in Table IV.

Manufacturing

Prior to World War II, the manufacturing sector was relatively small and insignificant. It was limited to the processing of agricultural goods and the fabrication of consumer products and building materials. Most of the major industries, such as the

production of paper, textiles, sugar, and tobacco, were publicly owned. The performance of these public enterprises was rather poor due to corruption, inefficiency, and excessive political interference. Therefore, early in the 1950's the Thai government decided to switch from its unsuccessful efforts in public ownership to a policy promoting industrial development primarily by private enterprise.

TABLE IV
GROSS DOMESTIC PRODUCT ORIGINATING FROM MINING AND QUARRYING
AT CURRENT MARKET PRICES

	1960	1966	1971	1976	1979
Tin	306 (54.16)	1,206 (61.97)	1,092 (36.85)	1,973 (38.13)	7,143 (56.63)
Tungsten	10 (1.77)	20 (1.03)	349 (11.78)	556 (10.75)	591 (4.68)
Fluorite	1 (0.18)	17 (0.87)	355 (11.98)	123 (2.38)	169 (1.34)
Lignite	7 (1.24)	10 (0.52)	27 (0.91)	27 (0.52)	12 (0.10)
Others	241 (42.65)	693 (35.61)	1,140 (38.48)	2,495 (48.22)	4,699 (37.25)
Total Value Added	565 (100.00)	1,946 (100.00)	2,963 (100.00)	5,174 (100.00)	12,614 (100.00)

Note: Values in Millions of Baht, () = Percentages share

Sources: National Income of Thailand (Bangkok, 1960, 1976, 1979, and 1980), Table 18.

The result of industrial development in Thailand is a rapid changing industrial scene. From 1960 to 1979, the manufacturing sector grew at an annual average rate of about 10.7%, whereas that of the Thai economy was 7.5% (see Table I). The growth of this sector ranked next to the public utilities sector which had the highest annual

average growth rate of about 19%. The percentage share of GDP from this sector also increased from approximately 13% in 1960 to 20% in 1979 (see Table II), which made it gradually become the second largest sector after agriculture.

In 1960, industrial activity was concentrated on the food industry which was made up of food (59.7%), beverages (15%), tobacco and snuff (25.3%). This industry accounted for over one half of the total manufactured products. In the early 1970's, the relative importance of the food industry declined and the structure of industrial production became more evenly distributed among several groups of industries which consisted of chemical, rubber, and petroleum industries, textile industry, and metal industry. In 1979, the GDP share in the manufacturing sector derived from the food industry was 29.5% whereas that from the chemical, rubber, and petroleum industries, the textile industry and the metal industry were 19.3%, 18.8%, and 16.4%, respectively. The GDP values and the percentages share of manufacturing's subsectors are shown in Table V.

In terms of the growth rates, there are four major industries, namely the chemical, rubber, and petroleum industries; the textile industry; the metal industry; and the non-metallic industry which had relatively high growth rates. From 1960 to 1966, and 1976, to 1979, the chemical, rubber and petroleum industries ranked at the top in achieving the highest growth rate of 44.4% and 36.4%, respectively. They ranked second from 1966 to 1971. The textile industry which mainly consisted of textiles and textile products had the highest growth rate of 25.4% during the period 1966-71 and it ranked second from 1971 to 1976. From 1960 to 1971, the metal industry which

included the basic metal industries, the metal products and machinery, ranked third, but it rose to the top during the period 1971-76. The non-metallic industry had the second highest growth rate of 32.5% and 35.5%, from 1960 to 1966 and 1976 to 1979, respectively. The growth rates of the manufacturing's subsectors for the four periods (1960-66, 1966-71, 1971-76, and 1976-79) which correspond to the years of the four economic development plans of Thailand are presented in Table VI.

With the development in manufacturing output, the structure of manufactured imports and exports has changed. In the early 1960's, most of the manufactured imports were machinery, transport equipment, and consumer goods. Since then the shift has been away from consumer goods to intermediate products as well as capital goods. The concentration on manufactured exports is also changed and diversified. Several textile items and small electronic equipments are exported in addition to food (63, p. 2).

Public Utilities

The public utilities sector consists of electricity and water supply. From 1960 to 1979, approximately 75 to 90% of the total GDP generated by this sector came from electricity, whereas water supply accounted for the rest (see Table VII). The Thai government has invested heavily in power development, especially in the development of electric energy in order to provide basic infrastructure facilities for rapid growth and diversified development of the economy. During that period, the average growth rate of the public utilities sector was the highest of all the sectors (see Table II).

TABLE V
GROSS DOMESTIC PRODUCT ORIGINATING FROM MANUFACTURING
AT CURRENT MARKET PRICES

	1960	1966	1971	1976	1979
Food Industry	3,873 (57.30)	6,516 (46.84)	9,892 (39.71)	24,142 (38.30)	32,379 (29.51)
Food	2,309	3,909	5,272	14,053	16,094
Beverages	583	1,264	2,179	5,277	9,264
Tobacco and Snuff	981	1,343	2,441	4,812	7,021
Textile Industry	855 (12.65)	1,744 (12.54)	3,962 (15.91)	10,418 (16.53)	20,683 (18.85)
Textiles	319	898	2,318	5,301	9,707
Textile Products	536	846	1,644	5,117	10,976
Paper Industry and Printing	284 (4.20)	513 (3.69)	816 (3.28)	2,054 (3.26)	3,764 (3.43)
Paper and Paper Products	18	52	195	476	1,258
Printing and Publishing	266	461	621	1,578	2,506
Chemical, Rubber and Petroleum Industries	550 (8.14)	2,014 (14.48)	4,216 (16.93)	10,125 (16.07)	21,185 (19.30)
Chemical	491	779	1,599	3,343	6,862
Rubber	56	140	480	1,503	2,792
Petroleum	3	1,095	2,137	5,279	11,531

TABLE V (Continued)

	1960	1966	1971	1976	1979
Non-Metallic Products	268 (3.97)	791 (5.69)	1,490 (5.98)	3,404 (5.40)	7,026 (6.40)
Metal, Metal Products and Machinery	483 (7.15)	1,370 (9.85)	2,853 (11.45)	8,831 (14.01)	17,977 (16.38)
Basic Metal Industries	26	64	327	1,236	2,695
Metal Products	51	176	602	1,002	2,152
Machinery	406	1,130	1,924	6,593	13,130
Saw Mills and Wood Products	349 (5.16)	749 (5.38)	934 (3.75)	2,263 (3.59)	3,781 (3.45)
Wood and Cork	257	497	640	1,666	2,671
Furnitures and Fixtures	92	252	294	597	1,110
Other Manufacturing	97 (1.43)	213 (1.53)	745 (2.99)	1,788 (2.68)	2,945 (2.68)
Total Value Added	6,759 (100.00)	13,910 (100.00)	24,908 (100.00)	63,025 (100.00)	109,740 (100.00)

Note: Values in Millions of Baht, () = Percentages share

Sources: National Income of Thailand (Bangkok, 1960, 1976, 1979, and 1980), Table 22.

TABLE VI
GROWTH RATES OF GDP ORIGINATING FROM MANUFACTURING
AT CURRENT MARKET PRICES

	Percentages			
	1960-66	1966-71	1971-76	1976-79
Food Industry	11.4	10.4	28.8	11.4
Food	11.5	7.0	33.3	4.8
Beverages	19.4	14.5	28.4	25.2
Tobacco and Snuff	6.2	16.4	19.4	15.3
Textile Industry	17.3	25.4	32.6	32.8
Textiles	30.3	31.6	25.7	27.7
Textile Products	9.6	18.7	42.3	38.2
Paper Industry and Printing	13.4	11.8	30.3	27.8
Paper and Paper Products	31.5	55.0	28.8	54.8
Printing and Publishing	12.2	6.9	30.8	19.6
Chemical, Rubber and Petroleum Industries	44.4	21.9	28.0	36.4
Chemical	9.8	21.0	21.8	35.1
Rubber	25.0	48.6	42.6	28.6
Petroleum	-	19.0	29.4	39.5
Non-Metallic Products	32.5	17.7	25.7	35.5
Metal, Metal Products and Machinery	30.6	21.6	41.9	34.5
Basic Metal Industries	24.4	82.2	55.6	39.3
Metal Products	40.8	48.4	13.3	38.3
Machinery	29.7	14.1	48.5	33.1
Saw Mills and Wood Products	19.1	4.9	28.5	22.4
Wood and Cork	15.6	5.8	32.1	20.1
Furnitures and Fixtures	29.0	3.3	20.6	28.6
Other Manufacturing	<u>19.9</u>	<u>50.0</u>	<u>28.0</u>	<u>21.6</u>
Total Value Added	17.6	15.8	30.6	24.7

Source: Calculated from Table V.

Construction

Since 1960, construction has contributed approximately 5% to the GDP (see Table II). It grew at an average annual rate of 8.4% (see Table I). This sector is divided into private construction and public construction. From 1966 to 1979, private construction shared in this sector's GDP of about 53 to 60% whereas the share from public construction was about 40 to 47% (see Table VIII). The major construction for the private sector are residential housing, office and factory buildings, whereas the public construction is mainly directed toward constructing irrigation facilities which are used for agricultural development and power generating purposes, and public buildings which are used for the expansion of education and health services.

TABLE VII

GROSS DOMESTIC PRODUCT ORIGINATING FROM PUBLIC UTILITIES
AT CURRENT MARKET PRICES

	1960	1966	1971	1976	1979
Electricity	169 (74.45)	780 (87.44)	1,730 (90.86)	3,201 (85.47)	5,440 (89.55)
Water Supply	58 (25.55)	112 (12.56)	174 (9.14)	544 (14.53)	635 (10.45)
Total Value Added	227 (100.00)	892 (100.00)	1,904 (100.00)	3,745 (100.00)	6,075 (100.00)

Note: Values in Millions of Baht, () = Percentages share

Sources: National Income of Thailand (Bangkok, 1960, 1976, 1979, and 1980), Table 24.

Trade

Both domestic trade and foreign trade are vital to the Thai economy. On the production side, the wholesale and retail trade constituted from 15 to 18% of the total GDP, (see Table II), whereas on the expenditures side, the demand for imports and exports accounted for about 45 to 50% of the GDP, (see Table XVI). The trade sector used to be the second largest sector of Thailand, but since 1960 its position has been reduced to between the third and the fourth, due to higher growth of some other sectors.

TABLE VIII

GROSS DOMESTIC PRODUCT ORIGINATING FROM CONSTRUCTION
AT CURRENT MARKET PRICES

	1960	1966	1971	1976	1979
Private	1,886 (76.64)	3,624 (58.67)	3,886 (53.04)	8,672 (54.94)	17,490 (59.82)
Public	575 (23.36)	2,553 (41.33)	3,441 (46.96)	7,112 (45.06)	11,750 (40.18)
Total Value Added	2,461 (100.00)	6,177 (100.00)	7,327 (100.00)	15,784 (100.00)	29,240 (100.00)

Note: Values in Millions of Baht, () = Percentages share

Sources: National Income of Thailand (Bangkok, 1960, 1976, 1979, and 1980), Table 19.

The entire system of trade in Thailand is influenced by at least two major factors. First is the presence of the Chinese, who dominate every aspect of trade, and who have set their imprint upon its structure, organization, and practices. Second is Thailand's vast

network of rivers and streams, plus a growing railroad and highway system which has made possible the economic transportation of goods. The trade center of Thailand is Bangkok which is clustered by firms engaged in exports, imports, and wholesaling. These firms deal directly with retailers in Bangkok but sell to towns and villages through a middleman. Several kind of products do not have uniform retail prices, therefore, bargaining is the widely used method of arriving at a transaction.

Transportation and Communication

Transportation in Thailand is mainly composed of land transport, waterways, and air. It was primitive for many centuries, but since the beginning of the twentieth century, the system has changed quickly. The Thai government has launched a vast road building program in order to join the four regions of the country and to accelerate economic growth. Most major national highways were completed during the First and the Second Economic Development Plans, while the Third, the Fourth, and the Fifth Plans have concentrated on developing farm-to-market road networks which consist of feeder roads, rural roads and local roads. In addition to the road system, railways, which is the first major transport system to open up the interior, also plays an important role in developing Thailand. The main task of the State Railways of Thailand (SRT), which is a state enterprise, is to provide passenger and freight services.

Inland waterways are the oldest and still an essential means for domestic trade, e.g., moving the produce throughout the country. They consist mostly of the Chao Phraya River and its large tributaries.

Coastal waterways and ports, on the other hand, handle the bulk of the nation's foreign trade.

Modern air transport is increasing its role in the Thai economy. The Don Muang Airport in Bangkok, which is the largest airport in Thailand, serves as the center for both international and domestic travel. The government owns both of the Thai Airways, which handles daily flights to major provincial cities, and the Thai International Airways which operates international flights. Both of them have succeeded during their career, especially the Thai International Airways which ranks among the world's elite airlines.

Starting in the twentieth century, communication in Thailand has rapidly developed. The press has become a major means of distributing information and influencing opinions. Newspapers, magazines, and scholarly journals are published in Thai, Chinese and English languages. The Post and Telegraph Department provides services to all parts of the country, and the telex facilities have been available to the general public. Furthermore, in 1966, Thailand joined the International Telecommunications Satellite Consortium (INTELSAT) and, in addition to telephone communication, regularly receives international television broadcasts. Modern domestic telephone operation is also promoted. The radio and television broadcasting have exerted an increasing effect on the public as well. Today there are over 100 radio stations and over 10 television stations scattered throughout the country.

Since 1960, the transportation and communication sector has generated approximately 7% of the total GDP (see Table II). The transportation accounted for about 92 to 97% of the total GDP

generated in this sector whereas the communication caught up the rest. Values of the GDP from each of these sectors are shown in Table IX.

Services

The services sector is a combination of several sub sectors which include banking, insurance and real estate, restaurants and hotels, education, medical and health, public administration and defense, and other services. Public administration and defense, and banking generated the highest share to this sector's GDP during 1960 to 1971, and 1971 to 1979, respectively (see Table X). The services sector always ranks third in importance to the Thai economy.

TABLE IX
GROSS DOMESTIC PRODUCT ORIGINATING FROM
TRANSPORTATION AND COMMUNICATION
AT CURRENT MARKET PRICES

	1960	1966	1971	1976	1979
Transportation	3,900 (96.44)	6,009 (94.99)	8,253 (92.16)	20,369 (93.32)	34,860 (92.11)
Communication	144 (3.56)	371 (5.01)	702 (7.84)	1,459 (6.68)	2,984 (7.89)
Total Value Added	4,044 (100.00)	6,326 (100.00)	8,955 (100.00)	21,828 (100.00)	37,844 (100.00)

Note: Values in Millions of Baht, () = Percentages share

Sources: National Income of Thailand (Bangkok, 1960, 1976, 1979, and 1980), Table 25.

Financial markets in Thailand consist of organized financial institutions, such as commercial banks, finance companies, insurance

TABLE X
GROSS DOMESTIC PRODUCT ORIGINATING FROM SERVICES
AT CURRENT MARKET PRICES

	1960	1966	1971	1976	1979
Banking	908 (10.35)	2,346 (14.77)	5,514 (19.42)	14,497 (24.49)	27,946 (26.75)
Insurance and Real Estate	142 (1.62)	476 (3.00)	737 (2.60)	1,578 (2.67)	3,450 (3.30)
Restaurants and Hotels	1,560 (17.77)	3,319 (20.90)	5,799 (20.42)	9,981 (16.86)	19,346 (18.51)
Education	1,315 (14.98)	2,020 (12.72)	3,602 (12.69)	8,330 (14.07)	14,683 (14.05)
Medical and Health	384 (4.38)	619 (3.90)	1,370 (4.82)	3,255 (5.50)	5,883 (5.63)
Public Administration and Defence	2,493 (28.40)	3,814 (24.01)	6,664 (23.47)	13,571 (22.93)	21,623 (20.69)
Other Services	1,975 (22.50)	3,287 (20.70)	4,709 (16.58)	7,979 (13.48)	11,570 (11.07)
Total Value Added	8,777 (100.00)	15,881 (100.00)	28,395 (100.00)	59,191 (100.00)	104,501 (100.00)

Notes: 1. Values in Millions of Baht, () = Percentages share
2. The definition of the services sector in the above table corresponds to that described in the 1975 Input-Output Table of Thailand.

Sources: National Income of Thailand (Bangkok, 1960, 1976, 1979, and 1980), Table 25.

companies, and unorganized financial markets, such as local shopkeepers, landlords, and money lenders. Within the organized financial markets, commercial banking is the most important with regard to the outstanding amounts of extended credit. Banking is one of the fastest growing industries in Thailand. In 1979, there were 16 Thai

commercial banks with a total of 1,309 branches, compared to the same number of commercial banks with a total of 759 branches in 1973.

Information concerning the unorganized markets is fairly little because of their outside official control. Yet it is believed that these markets conduct quite a large amount of financial transactions.

Tourism has become one of major industries in Thailand. To serve these visitors, Thailand has developed a wide range of facilities including a good variety of hotel accommodations at attractive prices, and numerous first class restaurants serving typical Thai food and several types of international cuisine.

The Thai government has invested quite a large amount on education and health care in order to improve the quality and efficiency of the population. These services are expected to provide improvement, particularly in rural areas which lack easy access to schools and hospitals. Furthermore, the government tries to promote educational and health services in the private sector by encouraging the establishment of private schools and hospitals. At present, there are 12 universities, all are publicly owned, about 37,000 schools, and over 330 hospitals. More than 40% of these schools and above 60% of the hospitals belong to the government.

According to the national budget, the expenditures on public administration and defence is always the highest. This is a result of political instability in the Southeast Asia region that makes the Thai government understand the needs of national security. Moreover, the stronger the country is, the faster the growth of the economy will be. This can be explained in the sense that political unrest of a country

would possibly discourage private investment, and also would absorb a large part of the government's spending.

In summary, Thailand is predominantly an agrarian nation in which the agriculture sector plays a major role in generating the GDP, the foreign exchange earnings, as well as the employment. Nevertheless, the performance of this sector is relatively poor due to an inactive agricultural development in the past. Its growth is the lowest among every sector. By contrast, the nonagriculture sector grows rather quickly as a consequence of the governmental desire to decrease its dependency on the agriculture sector. At present, the manufacturing sector is the second most important sector with increasing significance. Some other sectors, especially the trade sector and the services sector also contribute to the development of the economy of Thailand.

Economic Development Policies

The economic development policies of Thailand are presented in the economic and social development plan which was started in 1958 following the recommendation of the World Bank Mission. The first plan was put to use in 1960. At present, Thailand is in the beginning period of the fifth plan. Each plan, covering approximately five years each, frequently cite three main objectives which can be identified as: (1) to maintain economic and financial stability, (2) to preserve national security, and (3) to promote social justice (41, pp.1-4). All of these plans will be briefly discussed in this section, but the economic problems which arose during the plan periods will be discussed in the next section.

The First National Economic and Social
Development Plan, 1960-66

The First Economic Development Plan followed closely the report by the World Bank Mission to the Thai government. Its principal objective was to foster economic growth in the private sector in order to increase per capita output of goods and services as well as to raise the living standard of the people. This plan also aimed to launch commercial competition. The public development program was directed to provide basic infrastructure facilities necessary for this promotion.

Measures to raise agricultural production and of higher quality were assigned first priority. During this plan period, the government invested heavily in irrigation, land development, fishery and livestock development, and agricultural research, with a hope to improve and expand the agriculture sector. In addition, the government erected the Bank for Agriculture and Co-Operatives, and the cooperative societies, to provide national agricultural credits as well as to encourage the farmers to help themselves.

The promotion of industrial expansion was an important objective in this development plan. The government tried to stimulate industrial investment in the private sector by domestic and foreign entrepreneurs through the provision of several incentives, such as low import taxes on capital goods, a high tax on competitive imports, technical and market services for small scale industries, a guarantee against arbitrary nationalization of any private industrial activity, and provision of industrial loans, etc. To accelerate the implementation of industrial development programs, the government established three major organizations, namely the Department of Industrial Promotion, the

Industrial Finance Corporation of Thailand (IFCT), and the Board of Investment (BOI). They have one common objective, that is, to encourage and assist investors in Thailand. The state would not engage in activities competing with private enterprise, but would interfere only in regard to quality control.

Besides these two fields, the government aimed to develop other sectors, in particular the transportation and the public utilities sectors. It spent a large amount on constructing new highways and developing power system.

During the period of the First Plan, the Thai economy established a satisfactory record of economic growth, the increase in GDP was approximately 7.2% per year. There was an increase in per capita output at an annual average rate of about 4%. Thailand's international trade had grown successfully. Rapid economic growth had increased the demand for imports, especially of capital goods, and since 1960 Thailand had balance of trade deficit on current account. However, the substantial net inflows of private and public investment exceeded the current deficits and the overall balance of payments was favorable. There was considerable progress in every sector, particularly the manufacturing sector, except the agriculture sector which grew fairly slowly due to delay in some agricultural development programs. As a result, there was inequality of income among the people in different sectors, specifically in the agriculture sector and the nonagriculture sector. The people had migrated from rural areas to urban areas, and the problems of congestion and urban unemployment were eventually developed (21, pp. 11-21).

The Second National Economic and Social
Development Plan, 1967-71

Basically, the Second Development Plan was a continuation of the First Plan which was no more than an operational programme of action for the government's development expenditures. But the scope of the Second Plan was broadened to permit more realistic assessment of the potential of the economy as a whole and the measures necessary to realize development objectives. While the central part of the plan continued to be the estimation of public sector resources and the sectoral programmes of development expenditures, special emphasis was placed upon social development to assure that the benefits of economic growth resulted in improved living standards for all groups in the society. Regional planning was introduced to accelerate development in the remote areas and private sector policies as well as manpower considerations became an integral part of the planning process. Overall planning evolved a mechanism for obtaining clearer guidance as to the basic strategy of the plan and as a check of its consistency, both during the period of the plan and the longer term perspective (21, pp. 1-5).

Economic progress during the first part of the Second Plan, 1967-69, maintained its pace due to the rapid expansion of both agricultural and industrial production. Increases in foreign investment and U.S. expenditures in Thailand contributed to the high growth rate achieved in this period. In the latter part of the plan period, 1970-71, however, the rate of economic growth was slowed down as a consequence of changes in the demand for and prices of major Thai export products, notably rice, rubber, and tin, and also the decline in

the U.S. spending and foreign investment in Thailand. These factors affected the Thai economy in many ways, including the level of national income and expenditure, foreign exchange reserves, private investment, and governmental revenue and expenditure. The growth rate of GDP in real terms was 8% per year from 1967 to 1969, but it dropped to 6% from 1970 to 1971.

This economic slowdown not only gave rise to economic problems but also to social problems. The decline in demand for agricultural producers in particular affected the income of the majority of the people living in the rural areas, thereby generating further regional disparities, migration, and urban unemployment. Furthermore, the duration of high population growth rate, which was about 3%, made it more difficult for the government to provide sufficient social services, leaving little room for the poor to improve their standard of living (22, pp. 1-2).

The Third National Economic and Social
Development Plan, 1972-76

The Third Plan began at the time when economic conditions were not too bright for Thailand. Major problems which arose at the end of the Second Plan period related to balance of payments, manpower, income distribution, and national security. The Third Plan strategy, therefore, aimed at presenting measures to overcome these problems, while accelerating the growth of the high priority sectors in order to construct a firm foundation for future economic growth.

The government set the following important policies for economic and social development during this plan period. First, promote exports

and improve import structure to solve the balance of payments problem. Exports of all kinds, as well as private investment in export infrastructures, such as warehousing, handling equipment, etc, would be promoted. The import plan was directed to stimulate domestic production to substitute for imported raw materials and consumer goods imports. Second, promote family planning, education and training, as well as new economic activities to solve manpower problem. A family planning project was extended to both urban and rural areas by providing family planning services through the health stations. The emphasis on educational development was to provide more opportunity for the people to receive education in conformity with the increasing number of school age children and the improvement and expansion of secondary education in the provinces. Out-of-school training programmes especially designed to suit the specific professional requirements of each locality would be implemented. The training of technocrats for the fields in which manpower shortages were apparent, such as engineers and doctors, would be accelerated. The government would also support labor intensive industries in order to create employment opportunities. Third, promote a better income distribution by increasing agricultural production and utilizing the rural labor force. The government would stress the use of existing infrastructure facilities. The construction of big dams would be reduced, but the construction of on-farm water delivery systems would be improved and expanded. Small investment programmes in the rural areas, such as ditches and dikes, feeder roads, etc, would be increased as a means to provide more employment opportunities. Agro-industries located in rural areas would be encouraged (22, pp. 41-42).

However, the performance evaluation of the Third Plan revealed several unsatisfactory results. The country continued to face the same problems. There was a slow economic recovery which resulted from changes in the world economic situation, as well as political and social transition in Thailand in the years 1975-76. The past economic growth and structural changes had brought about increasing disparities in income and living standards among various regions of the country. This phenomenon could be explained by the fact that most of the product expansion and diversification took place mainly in the Central region, and most industrial activities were concentrated in and around Bangkok Metropolitan area. These unbalanced growth and associated income disparities had brought about many basic social problems, particularly mass poverty of people in rural areas, the congested and deteriorated urban social conditions in the urban areas as well as an increasing urban unemployment. Furthermore, the problem of the deterioration of environmental conditions of major natural resources, mainly forest, land, water, and mineral resources was intensified during this plan period, as a consequence of population growth and the lack of clear cut policy on resource management and ecosystem preservation.

A significant achievement during this plan period, other than the expansion of exports and industrial outputs, was an even decline in the population growth rate, from 3.1% in 1971 to 2.6% in 1976 (23, p. 9).

The Fourth National Economic and Social
Development Plan, 1977-81

The Fourth Economic Development Plan was problem oriented which incorporated the spatial dimension rather than a conventional macro

sectoral programming exercise. Its nature and scope were shifted toward more flexibility instead of the rigid allocative plan. Particular emphasis was stressed on the decentralization of public investments to rural areas and less developed regions in order to upgrade the living standard of the poor.

The main objective of the plan was to accelerate economic recovery from the recession which started during the second half of the Third Plan period. Several strategies were proposed in order to improve agricultural production, industrial production, and employment creation. On the agricultural side, policy emphasized structural changes in this sector through land reform, expansion of credit to rural areas, promotion of on farm development, i.e., crop intensification and agricultural diversification. On the industrial side, emphasis was placed on export oriented industries, small scale import substitution industries, and agro industries. Furthermore, the government stimulated the decentralization of industries away from the Bangkok area through special incentives and provision of basic facilities as well as financial assistance.

In addition to the above plan, the government implemented several integrated development strategies such as the provision of education, public health, social welfare, and nutrition services to rural and remote areas. The government also undertook some measures to manage the utilization of basic natural resources such as land, water resources, forest areas and minerals in such a way as to prevent rapid depletion and to promote more efficient use and returns to the public. Potential in the field of science and technology was also mobilized to support the achievement of the Fourth Plan targets on productivity

increase, exports, and production diversification. Finally, the government improved the coordination among various machineries responsible for the overall management of national planning, budgeting and personnel administration (23, pp. 30-40).

There are six main characteristics of the plan. First, it emphasizes the adjustment of economic structure rather than overall economic growth as in the past. Particular attention will be placed on economic efficiency and productivity. The problems of overspending and vast trade and budget deficits will be tackled by an austerity programme cutting down government spending and encouraging more economic discipline by all, especially in the conservation of energy. In order to earn more foreign exchange, export promotion will have high priority. Second, it stresses equality in national economic and social development effort by aiming to disperse income and economic activities to the provincial areas, to provide for more social justice, and to redistribute the land ownership patterns. At the same time, the plan also emphasizes better balance among production sectors, regions, and target groups. Third, it aims to reduce poverty for people in rural areas to enable them to help themselves. Fourth, there will be closer coordination between economic and social development efforts, and national security management in order to achieve maximum national stability. Fifth, closer coordination of the planning, budgeting, and manpower allocation processes will be given higher priority. The public development administration system, both at the central and local levels, will be reformed to enable implementation of major policies and development programmes. At the same time, development responsibilities will be decentralized to provincial areas and local authorities in

order to encourage greater participation and promote more self help development activities in rural areas. Sixth, there is an emphasis on the role and cooperation of the private sector in restructuring agriculture, industry, energy, and in the promotion of exports. The government will review various laws and regulations in order to reduce government interference in the market. Private business organizations will be launched to play a greater role in solving the country's economic problems and in sharing the task of national development (53, pp. 130-135).

In summary, during the past 22 years the Thai government has drawn up five consecutive national economic and social development plans to be used as guidelines for the mobilization and allocation of economic, financial and manpower resources. The government has developed infrastructural facilities needed for the expansion of production, trade, and for the well-being of the people. The economic development plan has been improved from being a government's development expenditures plan to a policy plan which gives clear policy direction. It has been broadened and permits more realistic assessment of the potential for the economy as a whole.

Economic Problems

As frequently cited in the economic development plans, unequal distribution of income and balance of trade deficit seem to be the two major economic problems of Thailand. Both of them will be discussed in this section. Furthermore, these two problems will later be assumed to be the two objectives of the model constructed in Chapter III.

Distribution of Income

The question of economic growth versus income distribution is a major concern for most of the less developed countries which previously have experienced a high rate of growth but a slow improvement for their poor. The relationship between economic growth and distribution of income is a two-way process in which growth leads to redistribution of income, and vice versa. Both cases can be illustrated by applying the Harrod-Domar growth model which states that the rate of growth of GDP, g , is determined jointly by the national saving ratio, s , and the national capital/output ratio, v . The growth rate of national income will be positively related to the saving ratio, but negatively related to the economy's capital/output ratio, i.e., $g = s/v$. If the saving ratio of the rich is assumed to be higher than that of the poor, then inequality distribution of income, bias toward the rich, would generate more economic growth, due to a higher national savings. On the other hand, if the rich are assumed to consume luxuries which are highly capital intensive, and the poor are assumed to consume necessity goods which are highly labor intensive, redistribution of income in favor of the poor, therefore, would increase the economic growth because of a lower national capital/output ratio. Nevertheless, there is no clear-cut result regarding these two relationships.

A more equitable distribution of income, however, is one of the major desires of the Thai government. In the Second National Economic and Social Development Plan, the number one objective indicates that:

Mobilization of human and natural resources for optimum utilization in expanding the productive capacity and national income of the country, so that the benefits of development can be shared equitably by all classes of people (21, p. 23).

During the Second Plan period, the above objective was not completely successful due to two reasons. First, the government lacked information at the local level and coordination among various implementing agencies. Second, the income of the agriculture sector declined as a result of changes in world demand for Thai agricultural products. Consequently, the effort to improve the income distribution was stressed in the later plan. The number five objective of the Third Plan asserts that:

The growth of the economic system depends largely on the economic power of the majority of people who live in rural areas. To spread evenly the fruits of development, the income of rural people must be raised. This is an important objective that must be attained as rapidly as possible (22, p. 40).

Information of income distribution in Thailand is relatively scarce. The main sources of information on household expenditures and income are the four socio-economic surveys conducted by the National Statistical Office in the years 1958, 1962/63, 1968/69, and 1971/73. The first survey is relatively useless since it covers a very narrow range. Therefore, the result shows a more equal distribution of income than it really is. The last three surveys have much wider ranges. Thepthana (54) uses the results from these surveys, which are presented separately for urban areas and rural areas, to estimate the Gini Coefficient, which is a shorthand summary measure of the relative degree of income inequality.¹ He finds that except from 1968/69 to 1971/73, income of both urban and rural households shows a tendency toward more equality. The distribution of income among rural households was more unequal than among urban households during those

¹The Gini Coefficient can vary anywhere from zero (perfect equality) to one (perfect inequality).

three period of study. His calculations are listed in Table XI and Table XII.

TABLE XI
INCOME SHARE OF PERCENTILE GROUPS:
HOUSEHOLD INCOME IN URBAN AREAS

Percentile Group in Ascending Order (%)	Percentage Share of Income		
	1962-63	1968-69	1971-73
0-10	1.8	2.0	2.0
11-20	1.0	3.8	3.0
21-30	3.2	4.2	3.6
31-40	4.0	4.8	5.4
41-50	6.0	6.0	6.0
51-60	7.0	8.2	8.0
61-70	9.0	9.0	9.2
71-80	12.0	10.0	10.8
81-90	16.0	16.0	16.0
91-100	<u>40.0</u>	<u>36.0</u>	<u>36.0</u>
All Groups	100.0	100.0	100.0
Bottom 20	2.8	5.8	5.0
Bottom 40	9.0	14.8	14.0
Top 20	56.0	52.0	52.0
Top 10	40.0	36.0	36.0
Gini Coefficient	.508	.436	.449

Source: Somchai Thepthana, "Government Expenditures, Taxes, and Income Distribution in Thailand" (unpub. Ph.D. dissertation, University of Kentucky, 1979), p. 13.

It appears from Table XI that the Gini Coefficient decreases from .508 in 1962/63 to .436 in 1968/69 which indicates a more equal distribution of income. The income shares of the bottom 20% and 40% of households in the income ranks increase from 2.8% to 5.8%, and 9.0% to 14.8%, respectively, whereas the top 10% and 20% experience a reduction in their income shares by 4%. The pattern of income distribution

slightly changes from 1968/69 to 1971/73. The Gini Coefficient increases from .436 to .449, and the income shares of the bottom 20% and 40% of households decrease from 5.8% to 5%, and from 14.8% to 14%, respectively. This shows a less equal income distribution in 1971/73, as compared to the preceding period.

Table XII reveals that the change in the pattern of income distribution among rural households is similar to urban households. That is, income is more equally distributed from 1962/63 to 1968/69, but it is more unequally distributed from 1968/69 to 1971/73. However, the Gini Coefficients indicate a more unequal distribution of income in rural areas as compared to urban areas.

Besides the study below, the problem of income distribution can be viewed by examining the different values of per capita income generated by different economic sectors, in particular the agriculture sector versus the nonagriculture sector. Due to insufficient data of population by sectors, the ratio of each sector's population to the total is assumed to be the same as the ratio of the corresponding sector of employment to the total employment. Then, the number of population in different sectors as well as the values of their per capita income can be estimated and compared. This study will compare the value of per capita income generated by the agriculture sector versus that generated by the nonagriculture sector. To minimize the difference of per capita income between these two sectors will be an objective of the model constructed in the next chapter. The figures of total population in Thailand, and of employment by sectors from 1960 to 1979 are presented in Table XIII and Table XIV.

TABLE XII
INCOME SHARE OF PERCENTILE GROUPS:
HOUSEHOLD INCOME IN RURAL AREAS

Percentile Group in Ascending Order (%)	Percentage Share of Income		
	1962-63	1968-69	1971-73
0-10	1.5	2.0	1.2
11-20	0.7	2.2	0.8
21-30	3.0	3.6	3.0
31-40	3.6	4.2	3.0
41-50	4.2	5.0	5.0
51-60	6.0	7.0	5.0
61-70	8.8	9.8	8.0
71-80	10.2	12.4	10.2
81-90	18.0	16.8	16.4
91-100	<u>44.0</u>	<u>37.0</u>	<u>48.4</u>
All Groups	100.00	100.00	100.00
Bottom 20	2.2	4.2	2.0
Bottom 40	8.8	12.0	8.0
Top 20	62.0	53.8	64.8
Top 10	44.0	37.0	48.4
Gini Coefficient	.520	.474	.593

Source: Somchai Thepthana, "Government Expenditures, Taxes, and Income Distribution in Thailand" (unpub. Ph.D. Dissertation, University of Kentucky, 1979), p. 20

The information from Table XIII and Table XIV are used to calculate per capita income in the agriculture sector, as well as in the nonagriculture sector as indicated in Table XV. This table roughly shows that there is a wide disparity in per capita income between both sectors. The per capita income in the agriculture sector is less than 15% of the per capita income in the nonagriculture sector. Income distribution is slightly improved from the past as indicated by a slight increase in the ratio of per capita income in the agriculture

TABLE XIII
POPULATION AND ITS GROWTH RATES

Year	Quantity (persons)	Growth Rates (%)
1960	26,257,916	-
1971	36,820,097	3.7
1972	38,359,008	4.2
1973	39,950,306	4.1
1974	41,334,152	3.5
1975	42,391,454	2.6
1976	43,213,711	1.9
1977	44,272,693	2.5
1978	45,221,625	2.1
1979	46,113,756	2.0
Average 1960-71		3.7
1972-76		3.3
1977-79		2.2

- Sources: 1. Year Book of Labor Statistics
(Geneva, 1970), p. 42
2. Yearly Bulletin of Statistics
(Bangkok, 1981), Table 2.

sector and in the nonagriculture sector from about .12 to about .14. However, the problem of unequal income distribution can be said to exist in Thailand.

International Trade

Thailand is an open economy in which international trade accounts for a major portion of the national product. Its importance has grown substantially over the past 20 years as its share in the national income increased from about 36% in 1960 to about 53% in 1979 (see Table XVI). Thailand has made several trade agreements with both

non-communist and communist countries in order to improve her international economic relations and to extend markets for her exports.

TABLE XIV
EMPLOYMENT BY SECTOR

	1960	1971	1976	1979
Agriculture	11,334,382 (82.300)	13,750,069 (78.767)	14,353,065 (75.558)	15,747,600 (71.573)
Mining and Quarrying	29,568 (0.215)	98,869 (0.566)	83,819 (0.441)	91,974 (0.418)
Manufacturing	471,027 (3.420)	688,764 (3.946)	1,178,605 (6.204)	1,722,700 (7.830)
Public Utilities	15,535 (0.113)	30,202 (0.173)	42,582 (0.224)	52,900 (0.240)
Construction	68,813 (0.449)	197,415 (1.131)	242,774 (1.278)	408,700 (1.858)
Transportation and Communication	165,939 (1.205)	1,234,025 (7.069)	336,115 (1.769)	424,200 (1.928)
Trade	779,904 (5.663)	1,224,746 (7.016)	1,335,992 (7.033)	1,740,300 (7.910)
Services	655,271 (4.758)	9,666 (0.055)	1,421,986 (7.486)	1,813,600 (8.243)
Unclassified	251,665 (1.827)	9,666 (0.055)	1,255 (0.007)	-
Total	13,772,104 (100.00)	17,456,701 (100.00)	18,996,193 (100.00)	22,001,974 (100.00)

Note: Employment in persons, () = Percentages share

- Sources: 1. Year Book of Labor Statistics (Geneva, 1970), p. 125
 2. Direk Patmasiriwat, Industrial Growth and Employment (Bangkok, 1980), Table I.
 3. Adjusted Labor Force Surveys by Man Power and Population Division, (Bangkok, 1981).

TABLE XV

PER CAPITA INCOME IN AGRICULTURE SECTOR VERSUS NONAGRICULTURE SECTOR

	1960	1971	1976	1979
GDP (current, 1,000 ² baht)				
Agriculture	21,464	40,786	104,657	147,076
Nonagriculture	37,005	103,821	232,978	409,164
Employment (%)				
Agriculture	82.3	78.767	75.558	71.573
Nonagriculture	17.7	21.233	24.442	28.427
Population (persons)				
Agriculture	21,610,265	29,002,086	32,651,416	33,004,998
Nonagriculture	4,647,651	7,818,011	10,137,072	13,108,758
Per Capita Income (Baht)				
Agriculture	993.23	1,406.31	3,205.28	4,456.17
Nonagriculture	7,962.09	13,279.72	22,057.52	31,213.03
Ratio	.124	.106	.145	.143

Exports. Exports from Thailand consist largely of natural products. Since the country was opened up to international trade on a significant scale in 1855, the export trade in rice had grown steadily until early in the twentieth century, half of Thailand's rice production was exported. Rice has been overwhelmingly the main export. In recent years, it has accounted for about 15% of the total exports, but for considerably more in earlier years. Thailand sells rice mainly in Asia markets which principally are Indonesia, Malaysia, Singapore, HongKong, Japan, Saudi Arabia, and the Philippines. She is among the top three of the world's largest rice exporters.

Before the First World War, tin was Thailand's second export. All of it was sent in the form of concentrates mainly to Malaysia for smelting. At present, Thailand has her own smelter, and export of

TABLE XVI

COMPOSITION OF EXPENDITURES ON GROSS DOMESTIC PRODUCT
AT CURRENT MARKET PRICES

	1960	1966	1971	1976	1979
Consumption	44.6 (82.6)	76.0 (75.0)	116.1 (80.3)	262.1 (77.6)	420.2 (75.5)
Investment	8.5 (15.7)	23.9 (23.6)	34.8 (24.1)	78.5 (23.3)	160.3 (23.7)
Export	9.5 (17.6)	19.3 (19.0)	25.2 (17.4)	71.2 (21.1)	131.8 (23.7)
Import	10.2 (18.9)	19.7 (19.4)	29.7 (20.5)	79.4 (23.5)	165.8 (29.8)
Statistical Discrepancy	1.6	1.9	-1.8	5.2	9.7
Expenditures on GDP	54.0	101.4	144.6	337.6	556.2

Note: Values in Billions of Baht, () = Percentage share

Sources: National Income of Thailand (Bangkok, 1960, 1976, 1979, and 1980), Account 1.

concentrates is prohibited. The relative importance of tin has declined from 16% of the total exports in the late 1930s to 7% in the 1970s. In the 1950s, rubber replaced tin as Thailand's second export as a result of heavy tapping during the Korean War. Its share thereafter decreased with the broadening of the country's export earnings.

The development in the agriculture sector has brought the growth in the production and exports of two new crops, namely maize and cassava. Neither was significant in exports before 1958. The growth in the maize industry was in response to a growth in demand from Japan,

whereas the growth in cassava which is exported in the form of tapioca products was in response to a strong demand from the United States and Europe. Table XVII shows the average percentages share of these four major exports, plus the export of teak which once was one of the major export earners.

TABLE XVII
AVERAGE PERCENTAGE SHARE OF SELECTED MAJOR EXPORTS

Year	Rice	Rubber	Tin	Teak	Maize	Tapioca Products
1920-29	68.6	1.6	8.8	4.1	-	-
1930-39	59.5	7.5	16.2	4.1	-	-
1940-49	52.3	10.2	8.7	3.5	-	-
1950-59	46.8	22.2	5.9	3.4	-	-
1960-69	30.8	17.3	8.8	1.7	-	-
1970-79	15.3	10.1	7.2	0.7	7.9	10.1

- Sources: 1. James C. Ingram, Economic Change in Thailand 1850-1970 (Stanford, 1971), p. 94, 312.
2. Statistical Bulletin (December 1979) (Bangkok, 1979), Table III.7.
3. Monthly Bulletin (April 1981) (Bangkok, 1981), Table III.7.

The past 20 years has seen dramatic improvements in the structure of Thai exports, most notably in the diversification of export commodities. The share in total exports held by the country's five major products declined from about 57.4% in 1971 to about 48.7% in 1979. Meanwhile, exports of prawns, sugar, mung beans, canned fruit, garments and precious stones increased from only 7.1% in 1971 to 14.5% in 1979 (see Table XVIII). An impressive rate of growth has also occurred for electronic equipment and orchids.

TABLE XVIII
TOTAL VALUE OF EXPORTS

	1971		1976		1979	
Principal Exports	12,705	(73.55)	42,256	(69.50)	63,806	(58.98)
Rice	2,909	(16.84)	8,603	(14.15)	15,592	(14.41)
Rubber	1,905	(11.03)	5,297	(8.71)	12,351	(11.42)
Tin	1,569	(9.08)	2,972	(4.89)	9,253	(8.56)
Maize	2,286	(13.23)	5,676	(9.33)	5,643	(5.22)
Tapioca products	1,240	(7.18)	7,527	(12.38)	9,891	(9.14)
Jute and Kenaf	935	(5.41)	579	(.95)	391	(.36)
Prawns	247	(1.43)	1,347	(2.22)	2,372	(2.19)
Tobacco Leaves	236	(1.37)	699	(1.15)	1,243	(1.15)
Sugar	382	(2.21)	6,843	(11.26)	4,797	(4.43)
Mung beans	255	(1.48)	945	(1.55)	1,375	(1.27)
Fluorite	311	(1.80)	267	(.44)	252	(.23)
Sorghum	157	(.91)	374	(.62)	495	(.46)
Cements	90	(.52)	378	(.62)	33	(.03)
Teak	183	(1.06)	749	(1.23)	118	(.11)
Other Exports	4,570	(26.45)	18,541	(30.50)	44,373	(41.02)
Fruit (canned)	44	(.25)	630	(1.04)	1,272	(1.18)
Garments	65	(.38)	1,514	(2.49)	3,577	(3.31)
Wood products	75	(.43)	744	(1.22)	1,335	(1.23)
Precious stones	228	(1.32)	879	(1.45)	2,250	(2.08)
Others	4,158	(24.07)	14,774	(24.30)	35,939	(33.22)
Total Exports	17,275	(100.00)	60,797	(100.00)	108,179	(100.00)

Note: Values in Millions of Baht, () = Percentages share

Sources: 1. Statistical Bulletin (December 1979) (Bangkok, 1979),
Table III.7.

2. Monthly Bulletin (April 1981) (Bangkok, 1981),
Table III.7.

Imports. In the early period, Thailand's imports consisted mainly of manufactured articles, and most were consumption goods, especially clothing. Information on the volume of imports was scarce, but it seemed that the value of total commodity imports was smaller than the

value of total exports, the difference being made up by the import of treasure. Crawford (13) described Thailand's trade with several different countries and regions, and from all of them came imports of cotton and silk textiles, and of gold, silver, or copper.

In the early twentieth century, Thailand has come to rely on railway transportation, trucks, buses, electricity, and irrigation works, the import of material and supplies to operate, maintain, and replace this equipment has become more and more necessary. The imports of capital goods, therefore, have been increasingly essential to the economy. Furthermore, a result of the government's industrial development in the 1960s has accelerated imports of raw materials and capital goods, particularly machinery. Consequently, the composition of imports has continued to change in the direction toward a larger proportion of raw materials and capital goods, and a smaller proportion of consumer goods. For instance, consumer goods imports accounted for about 27.4% of the total imports in 1963-65, but its share reduced to 11.7% in 1976-79. By contrast, the share of intermediate goods import chiefly for capital goods, such as crude minerals and base metals, to the total imports increased from 6.6% in 1963 to 11.5% in 1979. The values of average percentages share of imports by economic classification from 1963 to 1979 are listed in Table XIX.

To date, Thailand's major trade partners are Japan and the United States. Her value of imports exceeds that of exports. Most of the increase in the imports bill was experienced after 1960 when the country began her industrialization and petroleum prices started to rise substantially.

TABLE XIX
AVERAGE PERCENTAGES SHARE OF IMPORTS BY ECONOMIC CLASSIFICATION

	1963-65	1966-70	1971-75	1976-79
Consumer goods	27.4	22.1	13.9	11.7
Materials chiefly for consumer goods	12.7	14.1	17.8	17.0
Materials chiefly for capital goods	6.6	8.3	10.4	11.5
Capital goods	30.8	34.1	31.8	27.2
Other Imports	22.5	21.4	26.1	32.6

Source: Calculated from data in Table III.6 of Bank of Thailand's Statistical Bulletin, December 1979 and Bank of Thailand's Monthly Bulletin, April 1981.

Balance of Trade. In ancient times, foreign trade appeared to have been of relatively small importance to Thailand. Exports were a small part of total production while imports represented only a tiny fraction of total consumption. Whenever exports fall, thus reducing incomes, imports tended to fall immediately in the same degree. The country had normally an export surplus.

As early as 1952, the traditional export surplus on merchandise account had given way to an import surplus (reversed only in 1955), which steadily increased thereafter. Although industrial investment was creating a manufacturing capacity and replacing imports of certain finished goods, it was also generating a demand for imports of raw materials, parts, and capital goods. In the meantime, exports were lagging behind, and the market prospects for several export products, especially agricultural exports, were uncertain. As a result, a deficit in merchandise trade balance in Thailand has developed. Even if the country has consistently shown a surplus in its trade in

services, the deficit on current account has increased sharply in recent years. Table XX shows a summary of current account balance from 1951 to 1979. This table confirms the previous discussion that imports increased greatly since the country started to develop along the line of the economic development plans. Furthermore, increases in oil prices started in 1973 have worsened the position of the balance of trade in Thailand. Information from Table XX is used to estimate average growth rates of exports, imports, deficits in the balance of trade and in the current account balance in Table XXI.

The growth rate of exports increased from 4.2% in 1950s to 23.9% in 1970s as a result of exports diversification and the promotion in exports. The growth rate of imports also rose from 10.8% in 1950s to 20.9% in 1970s which was a sequence of heavy dependence on imports for economic development in Thailand. The result, therefore, was a slower growth in deficits of the balance of trade. Receipts from services are always greater than payments in this sector. However, the growth rate of revenues from services has shown a tendency to decline since the 1950s whereas the growth rate of expenditures on services has increased since the 1960s. Even though the growth rates of deficits on current account balance and trade balance have a tendency to decline, the growth rate of 38.5% and 23.9%, respectively, seem to be too high.

In addition, by looking at exports and imports of the same given commodity, a comparison between them confirms that the major exports from Thailand are food and crude minerals. The export of manufactured goods is increasingly important. By contrast, the major imports in Thailand are machinery, chemicals and manufactured goods (see Table XXII).

TABLE XX

CURRENT ACCOUNT BALANCE

Year	Merchandise		Trade Balance	Services		Net Services	Current Account Balance
	Exports (f.o.b)	Imports (c.i.f)		Receipts	Payments		
1951	4,918.4	4,184.6	733.8	112.6	176.3	-63.7	670.1
1952	5,983.0	6,126.8	-143.8	275.1	481.3	-206.2	-350.0
1953	5,800.8	6,474.8	-674.0	235.0	604.9	-369.9	-1,043.9
1954	6,021.8	7,043.5	-1,021.7	167.3	521.6	-354.3	-1,376.0
1955	7,160.4	7,155.8	4.6	517.6	926.0	-408.4	-403.8
1956	7,481.7	7,515.2	-33.5	553.5	845.2	-291.7	-325.2
1957	8,067.3	8,473.5	-406.2	739.3	1,105.6	-366.3	-772.5
1958	6,412.7	8,075.7	-1,663.0	854.0	835.7	18.3	-1,644.7
1959	7,533.5	8,946.9	-1,413.4	793.4	854.8	-61.4	-1,474.8
1960	8,541.9	9,498.2	-956.3	1,037.9	923.7	114.2	-842.1
1961	9,922.7	10,191.8	-269.1	1,332.9	1,012.8	320.1	51.0
1962	9,434.5	11,397.1	-1,962.6	1,617.6	1,109.2	508.4	-1,454.2
1963	9,577.7	12,694.7	-3,117.0	1,848.4	1,162.2	686.2	-2,430.8
1964	12,165.0	14,125.6	-1,960.0	2,262.1	1,529.5	732.6	-1,228.0
1965	12,663.5	15,219.8	-2,556.3	3,249.1	1,805.3	1,443.8	-1,112.5
1966	13,817.2	18,296.6	-4,479.4	6,200.3	2,093.2	4,107.1	-372.3
1967	13,808.1	21,958.3	-8,150.2	8,432.3	2,519.2	5,913.1	-2,237.1
1968	13,227.6	23,877.6	-10,650.0	9,421.2	3,272.7	6,148.5	-4,501.5
1969	14,390.0	25,460.0	-11,070.0	9,101.0	3,530.0	5,571.0	-5,499.0
1970	14,269.7	26,514.5	-12,244.8	10,094.8	4,058.6	6,036.2	-6,208.6
1971	16,692.1	26,633.0	-9,940.9	9,899.6	4,495.5	5,404.1	-4,536.8
1972	21,750.2	30,634.8	-8,884.6	11,322.7	4,739.7	6,583.0	-2,301.6
1973	31,252.5	42,054.9	-10,802.4	12,723.1	5,886.7	6,836.4	-3,966.0

TABLE XX (Continued)

Year	Merchandise		Trade Balance	Services		Net Services	Current Account Balance
	Exports (f.o.b)	Imports (c.i.f)		Receipts	Payments		
1974	49,002.4	63,304.6	-14,302.2	15,634.2	8,033.5	7,600.7	-6,701.5
1975	44,364.5	64,525.7	-20,161.2	16,551.6	10,390.8	6,160.8	-14,000.4
1976	60,361.2	71,446.1	-11,084.9	13,993.3	12,350.8	1,642.5	-9,442.4
1977	70,462.8	96,061.6	-25,598.8	14,771.7	12,366.5	2,405.2	-23,193.6
1978	82,250.8	110,790.8	-28,540.0	22,123.9	17,844.8	4,279.1	-24,260.9
1979	106,881.2	153,934.3	-47,053.1	29,163.6	25,925.7	3,237.9	-43,815.2

- Notes: 1. Values in Millions of Baht.
 2. Merchandise exports is equivalent to total value of exports adjusted for the balance of payment purpose. Same to merchandise imports.
 3. Services include 1). freight and insurance on merchandise, 2). other transportation, 3). travel, 4). investment income, 5). government (military services and other governmental services), and 6). other services.

- Sources: 1. James C. Ingram, Economic Change in Thailand 1850-1970 (Stanford, 1971), pp. 315-316.
 2. Statistical Bulletin (December 1979) (Bangkok, 1979), Table III.12.
 3. Monthly Bulletin (April 1981) (Bangkok, 1981), Table III.12.

TABLE XXI
GROWTH RATES OF EXPORTS AND IMPORTS

	Percentages		
	1951-59	1960-69	1970-79
Merchandise			
Exports	4.2	7.1	23.9
Imports	10.8	11.1	20.9
Trade Balance	334.3	76.9	23.9
Services			
Receipts	44.9	29.6	13.5
Payments	32.8	15.6	23.0
Current Account Balance	54.0	336.9	38.5

Source: Table XX.

TABLE XXII
TRADE BY COMMODITY GROUPS

	1971		1976		1979	
	Export	Import	Export	Import	Export	Import
Food	8,243 (47.72)	21,031 (13.85)	35,429 (58.27)	2,281 (3.13)	50,087 (46.30)	3,899 (2.68)
Beverages and Tobacco	240 (1.39)	521 (1.94)	706 (1.16)	656 (0.90)	1,266 (1.17)	1,214 (0.83)
Crude minerals	4,588 (26.56)	1,757 (6.56)	9,566 (15.73)	5,225 (7.17)	17,862 (16.51)	11,415 (7.81)
Mineral fuels and lubricant	130 (.75)	2,721 (10.16)	120 (.20)	16,695 (22.91)	33 (.03)	32,647 (22.34)
Animal and Vegetable oils and fats	18 (.11)	39 (.15)	39 (.06)	163 (.23)	22 (.02)	473 (.32)

TABLE XXII (Continued)

	1971		1976		1979	
	Export	Import	Export	Import	Export	Import
Chemicals	44 (.25)	3,723 (13.90)	268 (.44)	10,505 (14.42)	722 (.67)	21,794 (14.91)
Manufactured goods	2,508 (14.52)	5,869 (21.90)	9,336 (15.36)	11,984 (16.44)	23,532 (21.75)	26,345 (18.02)
Machinery	28 (.16)	8,949 (33.40)	1,231 (2.03)	21,427 (29.40)	3,972 (3.67)	37,742 (25.82)
Misc. manufactured goods	97 (.56)	1,448 (5.40)	2,432 (4.00)	2,867 (3.93)	6,149 (5.69)	7,919 (5.42)
Misc. transactions and commodities	781 (4.52)	708 (2.64)	1,062 (1.75)	1,074 (1.47)	2,691 (2.49)	2,242 (1.53)
Re-exports	598 (3.46)		608 (1.00)		1,843 (1.70)	
Gold		27 (.10)		-		471 (.32)
Totals	17,275 (100.00)	26,794 (100.00)	60,797 (100.00)	72,877 (100.00)	108,179 (100.00)	146,161 (100.00)

Note: Values in Millions of Baht, () = Percentages share

Sources: 1. Statistical Bulletin (December 1979) (Bangkok, 1979), Table III.4.

2. Monthly Bulletin (April 1984) (Bangkok, 1981), Table III.4

Table XXII indicates that about half of the total exports from Thailand is food. The shares of natural products in exports decrease over time. For instance, the share of crude minerals accounted for about 26.56% in 1971, but it reduced to 16.51% in 1979. On the other hand, the shares of chemicals, manufactured goods, and machinery in the total exports increased from .25%, 14.52%, and .16% in 1971 to .67%,

21.75% and 3.67%, in 1979 respectively. This is probably a result of industrialization in the 1960s and 1970s which enables Thailand to produce industrial goods. Most imports are fuels and lubricants, chemicals, manufactured goods, and machinery. The share of fuels and lubricants in the total imports increased sharply from 10.16% in 1971 to 22.34% in 1979. Most of this increase is due to higher prices of oil. The shares of the other three imports changed slightly over time. However, there was a tremendous decrease in food import which was indicated by a decrease of its share from 13.85% in 1971 to 2.68% in 1979.

Since international trade plays an important role in developing Thailand, to study policies related to it may be interesting. These policies can be classified into a policy to reduce import, namely import substitution, and a policy to increase export, namely export promotion. Both of them are frequently mentioned in Thailand. They are seen as strategies to develop the industrial sector as well.

The Import Substitution Policy

In the 1960s, the Thai government attempted to expand the industrial sector and to encourage private enterprise. The government established the three major organizations, namely the Board of Investment (BOI), the Industrial Finance Corporation of Thailand (IFCT), and the Department of Industrial Promotion, to implement industrial development programs. The measure, applied by these organizations, during the first two plans period, 1960-72, implied the policy of import substitution which aimed to increase domestic production by substituting imports, particularly manufactured imports.

The BOI was constituted under the revised Industrial Promotion Act of 1962. It has authority to grant special benefits to promote firms. Firms receiving promotion certificates are guaranteed against nationalization and competition from state enterprises. They could receive a number of tax concessions during the first five years of production, including exemption or reduction from tariff and business taxes on imported machinery, equipment and raw materials needed directly for production and not sufficiently available domestically. They are also exempted from taxes on income for the first five years of operation. Nevertheless, the degree of tax concessions for each promoted firm might be different depending upon its relative importance to the national economy.² The promoted foreign firms are permitted to own land and are granted the right to remit money abroad in foreign currency from their investment capital on foreign loan and profits. In some cases, the BOI might prohibit imports of the same kind as those produced by the promoted firm. From 1960 to mid 1981, the BOI had granted 1,300 promotion certificates.³

The IFCT was created with equity capital from domestic commercial banks, and other financial institutions. It receives subsidized loans and budgetary grants from the government. The IFCT provides low interest loans to industrial investors in amounts of 500,000 baht or more, whereas the Small Industrial Finance Office (SIFO) grants industrial loans in amounts under 500,000 baht.

²Promoted industries are classified into group A, B, and C. Group A, including industries which are said to be the most vital and necessary, is granted to receive full exemption. While groups B and C, which are defined as those with less degree and the least, receive 50% and 33% exemption, respectively.

³Unpublished data from the BOI.

The Department of Industrial Promotion, a division of the Ministry of Industry, serves as a center for providing technical knowledge, training, research, and marketing guidance in connection with cottage and small scale industries. The Ministry of Industry has equipped a number of essential services to industry. For instance, it encourages productivity improvement and product standardization. It also sets up industrial estates, etc.

During 1960-1972, import substitution industries expanded considerably. Since 1960, the processed food, beverages, cigarettes, primary goods such as petroleum products, yarn, glassware, and durable goods such as construction materials and cement were produced. After 1966, the import substitution industries expanded in the areas of textiles, paint, tires, automobiles and electronics. Nevertheless, the country faced the problems of overdependency on imports of semi-finished components, high concentration of industrial activities in and around the Bangkok area, limitation in the size of the domestic market, as well as low productivity and employment creation. Consequently, new industrial concerns have moved into the production of semi-finished products, the decentralization of industries away from Bangkok, and the promotion of export industries and import substitution industries which utilize indigenous raw material and labor.

In order to evaluate the import substitution policy quantitatively, the target growth rates of imports indicated in the Fourth Plan and the Fifth Plan will be used. The Fourth Plan classified imports into (1) consumer goods, (2) raw materials for the production of consumer goods, (3) fuel and lubricants, and (4) capital goods and raw materials for investment. Their target annual growth

rates were 5.7%, 9.0%, 14.0%, and 12.7% respectively (23, p. 219). The Fifth Plan target specifies the growth rate of imports of no more than 18.1% per annum (23, p. 126). The analysis in Chapter III and Chapter IV will assume the growth rates of consumer goods import and imports of fuel and lubricant as mentioned in the Fourth Plan, while other imports are supposed to grow at the rate suggested in the Fifth Plan. The reason behind this selection is that not every kind of imports previously grew at the rate of more than 18.1%. From 1975 to 1979, consumer goods imports grew at an average rate of 14.9% whereas capital goods import grew at an average rate of 20.7% (34, pp. 40-3). The share of consumer goods imports to total imports steadily declined, i.e., it was 27.5% in 1964, but was reduced to 10.9% in 1979. The share of capital goods import, on the other hand, was fairly stable. For instance, it was about 30% in 1964 as well as in 1979 (49, pp. 46-9). This phenomenon might possibly show that import substitution policy was effective in producing consumer goods. Therefore, if any import previously grew less than 18.1%, its target growth rate will be that indicated in the Fourth Plan. Otherwise it will assume to be 18.1%. The target growth rate of fuel import, however, is assumed to be unchanged during those two plans (59, p. 22(APX)).

The Export Promotion Policy

The promotion of manufactured exports has always been a policy of the Thai government, but it was not until 1972 that this policy was carried out more actively. It began with revision of the Investment Promotion Act and the Export Promotion Act in 1972 in order to provide special privileges, both tax and non-tax, to export investors. Thus, the policy of the BOI was shifted toward export industries.

The tax privileges include exemption of import duty and business tax on imported machinery, equipment, and raw materials used in the production of export goods. Producers of domestic raw materials for the promoted export-oriented firms are exempted from business taxes. Furthermore, the government has allowed refund of the tax incurred in the production cost of all export products. The exporters could claim this tax privilege from the Ministry of Finance.

Apart from the tax privileges discussed above, the government also has a policy of providing credit subsidization for manufactured export activities. The credit comes in two forms. One is the discount facility implemented by the Bank of Thailand, the other is the low interest loans provided by the IFCT and the SIFO.

A new government office, named the Export Service Center, was established in 1975 in order to provide information services on foreign markets and demand for Thai products. This center also undertakes studies on commodities and markets to improve product standardization. So far, the center set up four commercial centers in the major cities, namely New York, Frankfurt, Sidney, and Los Angeles.

Since 1972, exports from Thailand have been diversified. There has been a steady increase in manufactured exports, especially in garments and food processing. A number of export-oriented industries were established, but they are still few in number. Some agro-industries such as pineapple and food canning have the potential to become major export industries. However, one of the main obstacles to the expansion of Thai exports arises from the protectionist policies of importing countries. That is, many foreign countries or groups of countries have set up tariff and non-tariff barriers to protect their

domestic industries. A new strategy for the Thai government, therefore, is to join in trade and industrial projects with neighboring countries, particularly within ASEAN. Such a strategy will take into consideration the appropriate scale of industry, comparative advantages, and industrial specialization using domestic natural resources.

The target growth rates of export in the Third Plan, and the Fifth Plan will be utilized in this study in order to test the export promotion policy. If this policy is effective, exports should grow at least at the rate indicated in those Plans. The target rate was 7.0% in the Third Plan (59, p. 46). It is increased to 22.3% in the Fifth Plan (59, p. 46).

In summary, during the 1960s and early 1970s international policies related to economic development generally favored import substitution which led to manufacturing of final products based on imported intermediate and capital goods. However, at the beginning of the Third Plan in 1972, more emphasis was placed on export promotion.

CHAPTER III

METHODOLOGY

Introduction

A multiobjective linear programming model will be presented in this chapter. The first two sections of the chapter will be devoted to the discussion of the problem and the technique. The rest of the chapter is left to specification of the model designed to evaluate quantitatively the effect of either an export promotion policy or an import substitution policy, or a combination of both policies on the Thai economy. The effect of the export policy is examined by varying the exogenously determined export levels whereas the effect of the import policy is examined by varying the import to total supply ratio. The growth rates of exports and imports will correspond to the target growth rates indicated in the economic development plans.

The Problem

Following the discussion in Chapter II, it is fairly clear that both income disparity and a balance of trade deficit are the two major problems of Thailand. An import substitution policy as well as an export promotion policy are two widely used policies. It is therefore, interesting to relate these two problems and two policies in order to investigate the result of varying policy parameters on those problems. The two problems are assumed to be the two objectives,

and the two policies are assumed to be the two instruments. In addition, the third objective is included, specifically to maximize per capita income.

Since this problem deals with three objectives, constructing a three objective linear programming model is used as the tool of analysis. One major advantage of such a model is that possible trade offs among different objectives can be examined. If these objectives are complementary, the problem will be a single objective optimization problem. In this study, the three objectives can be either in conflict with each other or not depending upon how they are approached. An increase in nonagricultural exports would help the balance of trade but would worsen the income disparity. On the other hand, an increase in agricultural exports would help both the balance of trade and the income disparity. Therefore, it is the export items which would cause the conflict between the first and the second objectives. It is more likely that an increase in domestic production, either to substitute imports or to expand exports, would increase the national income, and thereby per capita income. If an increase in income results in a higher demand for consumer goods import, the balance of trade may not improve. Then the second and the third objectives conflict. By contrast, if imports do not increase greatly as a result of an increase in prosperity of the nation, the second and the third objectives do not conflict. Finally, the first and the third objectives conflict if an increase in per capita income is not equally distributed among every sector of the economy.

Another considered subject of a multiobjective optimization problem is that it will not generate a single optimal solution as in

the case of a single objective optimization problem. A solution which maximizes or minimizes one objective will not, in general, maximize or minimize any of the other objectives. A notion of optimality is dropped for multiobjective problems. A new concept called noninferiority or nondominance is used. Consequently, instead of seeking a single optimal solution, a set of noninferior or nondominated solutions which includes several alternatives is sought. It is a characteristic of this set that the objectives must be traded off against each other in moving from one noninferior alternative to another. A decision maker, therefore, will select a noninferior solution which will later be called the best-compromise solution, according to his preference.

The Technique

There are mainly two techniques to solve a multiobjective optimization problem. The first technique deals with a conversion of the problem into a single objective optimization problem. This technique will give an approximation of a noninferior set. It includes the weighting method, the constraint method, and the noninferior set estimation method (NISE). (The detail of these methods can be found in Cohon (12)). An analyst can use a computer package called the Mathematical Programming System (MPS) or the Mathematical Programming System Extended (MPSX) of the 360 or 370 series to solve the problem. The second technique is a multiobjective simplex method developed by Professor Philip (43) and Professor Zeleny (66). This method will generate an exact representation of a noninferior set without transforming the problem. An analyst has to set up his own FORTRAN program.

The choice of technique depends upon an analyst's perception of the required results, his preference for mathematical procedures, as well as computational costs. If an exact representation of a noninferior set is sought, the multiobjective simplex method is far superior to the others. By contrast, if an approximation of a noninferior set is sufficient, the multiobjective simplex method is inferior because this method is fairly expensive as compared to the other three.

Among the weighting, constraint, and NISE methods, the NISE method guarantees good coverage of a noninferior set in a manner that allows the accuracy of an approximation to be controlled. The weighting method, on the other hand, can give poor coverage of a noninferior set by getting stuck at an extreme point or in a small range of the noninferior set and by skipping over large portions of the set. The constraint method provides complete control of the spacing and coverage of a noninferior set, but it produces a rather high occurrence of infeasible solutions. Nevertheless, the weighting and the constraint methods may be the best techniques in some planning situations. If weights themselves are considered important results, then some degree of control over their values is a significant attribute of the solution method. For instance, it may be worthwhile to communicate to decision makers that this solution implies that objective Z_1 is equally as important as objective Z_2 , etc. The constraint method is a good approach, especially for display purposes, when it is desirable to show a cut through a noninferior set. That is, one may prefer to indicate the tradeoffs between, say objective Z_1 and objective Z_2 when objective Z_3 equals a given number.

Due to the required results, computational costs, and availability, this study selects the weighting method as a tool to solve the three objective optimization problem. Since the study concerns the effect of the two policies, namely export promotion and import substitution, on the three objectives, namely minimization of income disparity and balance of trade deficit, and maximization of per capita income, a comparison between any two noninferior sets, or any two noninferior solutions, each corresponding to a policy, is required. A comparison between any two noninferior sets may be difficult if one set is not everywhere superior to the other. Therefore, a comparison between any two noninferior solutions, given the same set of weights, may be logical. A different value of weights will be assigned to different objectives according to its relative importance to the Thai economy. Then, for the same given set of weights, the noninferior solutions of different policies can be compared. The weighting method will generate a number of noninferior solutions possibly equal to the number of the sets of weights, at best. Weights can be any positive values.

The Model

This study is formulated as a detailed empirical application of a multiobjective linear programming model in which exports and imports play a major role. The model is comparative static. That is, variables are defined as changes taking place between 1975, the year of Thailand's first official input-output table, and 1986, the terminal year of Thailand's Fifth Economic Development Plan. The solution of the model, therefore, yields a comparison of 1986 with 1975. The model is based on the data from the 1975 input-output table. Any projections

for the values in 1986 rely upon the target growth rates indicated in the Fifth Plan.

The model consists of 38 sectors (see Appendix A) which can be classified into nine major groups, including agriculture, mining, manufacturing, public utilities, construction, trade, transportation and communication, services, and unclassified. Each group has only one sector, except the manufacturing sector which is divided into 30 sub sectors. The difference in the degree of disaggregation is due to unavailability of disaggregated employment data. (Official data for employment by sectors is available in nine sectors as indicated above. However, disaggregated employment data for manufacturing sector is available from a study by Patmasiriwat (42). Employment is originally entered into the model as an endogenous variable, but it fails to provide any feasible solution. As a result, it is dropped from the model, but the model still consists of 38 sectors. The data for these 38 sectors are derived from the official tables of 58 and 16 sectors (see Appendix A)). For sake of simplicity, each sector is assumed to produce only one product and use only one process of production.

The model is made up of one equation for the objective function and 153 reduced form equations for the constraints. There are 76 variables which will be generated endogenously in the model given the values of 236 exogenous variables and 385 parameters plus a 38x38 matrix of input-output coefficients. Furthermore, the values of another 234 variables will be estimated from knowledge of the values of 76 endogenous variables and by use of the formulas given in the model.

The Variables

The endogenous variables in increments over 1975 are defined as follows:

- C_i private consumption expenditure on commodity in the i th sector, $i = 1, \dots, 38$
- C total private consumption expenditure
- E_i level of exports from the i th sector, $i = 1, \dots, 38$
- E total exports
- M_i level of imports in the i th sector, $i = 1, \dots, 38$
- Int
- M_i level of imports in the i th sector, used for intermediate transaction purpose, $i = 1, \dots, 38$
- C
- M_i level of imports in the i th sector, used for private consumption purpose, $i = 1, \dots, 38$
- E
- M_i level of imports in the i th sector, used for export purpose, $i = 1, \dots, 38$
- M total imports
- S total domestic savings
- V_1 total value added in the agriculture sector
- V_i total value added in the nonagriculture sector, $i = 2, \dots, 38$
- V gross domestic product
- X_1 gross output level in the agriculture sector
- X_i gross output level in the i th nonagriculture sector, $i = 2, \dots, 38$
- X total output

The values of X_1 , X_i , and E_i will be determined endogenously in the model. Then, these values will specify the values of other endogenous variables.

The exogenous variables in increments from 1975 to 1986 consist of the following variables:

- $E_{i\min}$ floor requirements on exports in the i th sector,
 $i = 1, \dots, 38$
- E_{\min} minimum exports
- $E_{i\max}$ ceiling requirements on exports in the i th sector,
 $i = 1, \dots, 38$
- E_{\max} maximum exports
- F_{\max} maximum foreign capital inflow
- G_i government consumption expenditure in the i th sector,
 $i = 1, \dots, 38$
- G total government consumption expenditure
- I_i investment demand in the i th capital producing sector,
- G
- M_i level of imports in the i th sector, used for government
consumption purpose, $i = 1, \dots, 38$
- I
- M_i level of imports in the i th sector, used for investment
purpose, $i = 1, \dots, 38$
- P_A population in the agriculture sector
- P_{NA} population in the nonagriculture sector
- P total population

These exogenous variables can be classified into policy and non-policy variables. E_{\min} , $E_{i\min}$, E_{\max} , and $E_{i\max}$ are regarded as export promotion policy variables. Whenever the export promotion policy is assumed to be effective, the E_{\min} value is set at the target level, whereas the E_{\max} value is set at the previous maximum attainable level. On the other hand, when the import substitution policy is assumed to be effective, the export levels are set at the levels at

which the export policy was ineffective. If the two policies are considered simultaneously, the Emin and Emax values will be equivalent to those assigned for the export policy. The target growth rates of exports as well as the actual growth rates will be used to calculate the values of Emin and Emax in 1975 and 1986. The difference between these two years value will be used in the analysis. A summary of the assigned growth rates for exports is presented in Table XXIII.

TABLE XXIII
ASSIGNED GROWTH RATES FOR EXPORTS

	1986	1975
<u>Export Policy Only</u>		
Emin	growth rate 22.3% (target of the Fifth Plan, 1982-86)	growth rate 7% (target of the Third Plan, 1972-76)
Emax	growth rate of 24.3% (actual of the Fourth Plan, 1977-81)	growth rate 24.5% (actual of the Third Plan, 1972-76)
<u>Import Policy Only</u>		
Emin	growth rate 10.54% (actual 1961-71 when export policy was ineffective)	growth rate 5.48% (actual of the Second Plan, 1966-71)
Emax	growth rate 17.14% (actual, 1961-81)	growth rate 10.54%
<u>A Combination of Both</u>		
Emin	similar to export promotion	similar to export promotion
Emax	"	"

Every projection in this study is made simple by using the compounding growth formula $A_t = (1 + g)^t A_0$ where A_t is the terminal year value, A_0 is the base year value, g is the assigned growth rate, and t is the number of years involved. For the approximation of the values of E_{min} and E_{max} for the year 1975 and 1986, the actual values of exports for the year 1971 and 1981 are used as the base year values respectively, along with the assigned growth rates indicated in Table XXIII. The calculated values of E_{min} and E_{max} are presented in Appendix B.

After these E_{min} and E_{max} were estimated, the formula $E_i = e_i E$, where e_i is the ratio of export in each sector to total exports, will be used to calculate $E_{i,min}$ and $E_{i,max}$, i.e., $E_{i,min} = e_i E_{min}$. This e_i ratio is computed from the 1975 input-output table. The values of $E_{i,min}$, $E_{i,max}$ and e_i are shown in Appendix B.

The maximum foreign capital inflow, F_{max} , is used to fill the gap between domestic investment and savings. Its value equals the difference between import value and minimum export value. For the year 1975, the import value of both policies is the actual value which is 79,356.14 millions baht (27). If only the export promotion policy is considered, the assigned growth rate of imports for 1986 will be the actual growth rate previously attained. If, on the other hand, the import substitution policy is considered, the growth rate of import will be the target growth rate. In both cases, the minimum export value will correspond to E_{min} value. However, when both policies are combined, the value of F_{max} is fixed at zero assuming no capital from abroad.¹ The estimations of F_{max} are in Appendix C.

¹This is a result of an experiment to combine both policies together by using import and export values at the target level. F_{max} is negative, and it produces infeasible solution.

The values of total government consumption expenditure, G , as well as government consumption expenditure in the i th sector, G_i , in 1975 are obtained from the input-output table whereas 1986 values are obtained by employing the target growth rates given in the Fifth Plan. A similar technique, as in the case of exports, is applied to transform G into G_i , i.e., $G_i = g_i G$, where g_i is the proportion of government consumption expenditure in the i th sector to total government consumption expenditures (see Appendix D).

Investment can be forced in the model by using the stock flow conversion factor to change capital stock into investment flow, or by assigning the growth rate of capital stock. However, since data on capital stock is fairly scarce in Thailand, investment has to be purposely treated as an exogenous variable. The value of investment in each sector, I_i , in 1975 is obtained from the input-output table whereas the total value of investment, I , in 1986 is acquired from a macro model projection made by the National Economic and Social Development Board. To estimate investment demand in each sector, I_i , in 1986, the formula $I_i = r_i I$, where r_i is the proportion of investment demand in the i th sector to total investment, is employed. This r_i ratio is computed from the input-output table. Appendix D reveals the values of I_i and r_i .

Since public consumption in the i th sector, G_i , as well as investment demand in the i th sector, I_i , are exogenously determined, imports in the i th sector used to satisfy public consumption, M_i^G , and investment, M_i^I , are also exogenous variables. This is a result of a linear relationship between G_i and M_i^G , i.e., $M_i^G = \theta_i^G G_i$, I_i and M_i^I , i.e., $M_i^I = \theta_i^I I_i$.

The proportion of agricultural population to nonagricultural population, P_A/P_{NA} , is assumed to be the same as the proportion of agricultural employment to nonagricultural employment. In 1975, approximately 73% of the total employed worker engaged in the agriculture sector. Given that the number of the total population in that year, P_{1975} , was 42,391,454 persons, therefore, 30,945,761 persons will be classified as agricultural population, P_A , whereas 11,445,693 persons will be classified as nonagricultural population, P_{NA} . The latest employment by sector figures are available for the year 1978. Consequently, some estimations are made in order to come up with the 1986 figures. Fundamentally, the target growth rates for population and employment are used (see Appendix E).

The Parameters

Of all 385 parameters, 190 parameters are regarded as import substitution policy parameters. The non-policy parameters are as follows:

- a autonomous consumption expenditure
- a_{ij} current input requirement from the i th sector per unit of output in the j th sector (input-output coefficient),

$$a_{ij} = X_{ij}/X_j \quad i = 1, \dots, 38, j = 1, \dots, 38$$
- b_1 marginal propensity to consume out of the GDP generated by the agriculture sector
- b_2 marginal propensity to consume out of the GDP generated by the nonagriculture sector
- c_i proportion of the private consumption expenditure in the i th sector to the total private consumption expenditures,

$$c_i = C_i/C$$

e_i proportion of the export from the i th sector to the total exports, $e_i = E_i/E$ $i = 1, \dots, 38$

g_i proportion of the government consumption expenditure in the i th sector to the total government consumption expenditures, $g_i = G_i/G$ $i = 1, \dots, 38$

s_1 marginal propensity to save out of the GDP generated by the agriculture sector

$$s_1 = 1 - b_1$$

s_2 marginal propensity to save out of the GDP generated by the nonagriculture sector

$$s_2 = 1 - b_2$$

v_1 proportion of the total value added in the agriculture sector to the total domestic output in that sector

$$v_1 = V_1/X_1$$

v_i proportion of the total value added in the nonagriculture sector to the total domestic output in that sector

$$v_i = V_i/X_i \quad i = 2, \dots, 38$$

r_i proportion of investment demand in the i th sector to the total investment

$$r_i = I_i/I \quad i = 1, \dots, 38$$

The values of a , b_1 , b_2 , s_1 and s_2 are derived from time series regression, covering from 1960 to 1979, of total consumption, C , on the GDP generated by the agriculture sector, V_1 , and the nonagriculture sector, $\sum_{i=2}^{38} V_i$. The data for this regression was obtained from the National Economic and Social Development Board. The estimated equation reveals

$$C = 6364.8565 + .619V_1 + .626\sum_{i=2}^{38} V_i$$

(1.75510) (3.30243) (11.66008)

$$R^2 = .998, \text{ DW} = 1.138.$$

The values of c_i , e_i , g_i , v_1 , v_i , and r_i are calculated from the input-output table. The structure of the economy is assumed to be unchanged from 1975 to 1986. Therefore, the values of those parameters are constant. Appendix F gives these estimations.

Appendix G provides the 38x38 matrix of the a_{ij} coefficients. They are also assumed to be constant. Their values are calculated from the input-output table.

The import substitution policy parameters are the proportion of imports used for different purposes, to total supply. They are identified as:

Int
 θ_i proportion of import in the i th sector, used for intermediate transaction purpose to total intermediate demand in that sector

$$\theta_i^{\text{Int}} = M_i^{\text{Int}} / \sum_j a_{ij} X_j \quad i = 1, \dots, 38, j = 1, \dots, 38$$

C
 θ_i proportion of import in the i th sector, used for private consumption purpose to total private consumption expenditures in that sector

$$\theta_i^{\text{C}} = M_i^{\text{C}} / C_i \quad i = 1, \dots, 38$$

G
 θ_i proportion of import in the i th sector, used for public consumption purpose to total government consumption expenditures in that sector

$$\theta_i^{\text{G}} = M_i^{\text{G}} / G_i \quad i = 1, \dots, 38$$

θ_i^I proportion of import in the i th sector, used for investment purpose to total investment demand in that sector

$$\theta_i^I = M_i^I / I_i \quad i = 1, \dots, 38$$

θ_i^E proportion of imports in the i th sector, used for export purpose to total export from that sector

$$\theta_i^E = M_i^E / E_i \quad i = 1, \dots, 38$$

The values of these θ_i s are calculated from the 1975 input-output table. They are assumed to be unchanged, from 1975 to 1986, if the export promotion policy is solely considered. In the opposite, the values of θ_i s are deflated for the year 1986, according to the target level, if only the import substitution policy is investigated. The estimations are provided in Appendix H. Table XXIV shows a summary of the values of θ s which will be used in this study.

Table XXIII and Table XXIV can be combined in order to provide the summary of export promotion policy and import substitution policy parameters. This is shown in Table XXV. Since this analysis is comparative static, the assigned values for each policy will be the difference between 1975 and 1986. That is, the changes of E_{min} from 1975 to 1986, and of E_{max} from 1975 to 1986 are required.

Weights

In order to solve this three objective optimization problem, the weighting method is applied. There are three different weights assigned for three different objectives. They are specified as w_1 for the first objective, w_2 for the second objective, and w_3 for the third

TABLE XXIV
ASSIGNED VALUES OF IMPORT SUBSTITUTION
POLICY PARAMETERS

	1986	1975
<u>Export Policy Only</u>		
Int		
θ	.165049	same
C		
θ	.042448	same
G		
θ	.027168	same
I		
θ	.263199	same
E		
θ	.017019	same
<u>Import Policy Only</u>		
Int		
θ	.164427	.165049
C		
θ	.019218	.042448
G		
θ	.008079	.027168
I		
θ	.231695	.263199
E		
θ	.003081	.017019
<u>A Combination of Both</u>		
Int		
θ , θ , θ , θ , θ		similar to import policy

Note: The values of θ_i , θ_i , θ_i , θ_i , and θ_i for the export policy are directly estimated from the input-output table whereas they are deflated for the import policy. For instance, θ reduces .38% $[(.165049 - .164427) \times 100] / .165049$ from 1975 to 1986. Therefore, every θ_i is assumed to reduce by this percent. θ_i in 1986 will be 99.2% of θ_i in 1975 (see Appendix H).

TABLE XXV
SUMMARY OF POLICY PARAMETERS

	1986	1975	1986-75
<u>Export Policy Only</u>			
Emin growth rate	22.3	7.00	
estimated value	576,097.223	32,990.110	543,107.113
Emax growth rate	24.3	24.50	
estimated value	624,768.517	60,468.070	564,300.447
Int			
θ	.165049	same	same
C			
θ	.042448	"	"
G			
θ	.027168	"	"
I			
θ	.263199	"	"
E			
θ	.017019	"	"
<u>Import Policy Only</u>			
Emin growth rate	10.54	5.48	
estimated value	347,504.800	31,155.110	316,349.690
Emax growth rate	17.14	10.54	
estimated value	464,397.207	37,577.387	426,819.820
Int			
θ	.164427	.165049	reduces .38%
C			
θ	.019218	.042448	reduces 54.73%
G			
θ	.008079	.027168	reduces 70.26%
I			
θ	.231695	.263199	reduces 11.97%
E			
θ	.003081	.017019	reduces 81.90%

TABLE XXV (Continued)

	1986	1975	1986-75
<u>A Combination of Both</u>			
Emin, Emax			similar to export policy
Int C G I E $\theta, \theta, \theta, \theta, \theta$			similar to import policy

- Notes: 1. Growth rates are in percentages.
2. Values are in millions baht.

objective. Consequently, each set of weights, W , will have these three weights, i.e., $W = [w_1, w_2, w_3]$. The analysis is carried on ten sets of weights. The program is then submitted ten times for each set of the policy parameters.² Thus for the same given set of weights the noninferior solutions of different policies can be compared. Weights can be any positive values. This problem assigned different value of weights to different objectives according to their relative importance to the Thai economy, (i.e., $[w_1, w_2, w_3] = [1, 1, 1]$ would imply an equally importance of the three objectives). The ten sets of weights are given in Table XXVI. (These ten sets of weights are part

²The three programs called SIAMA, SIAMB, and SIAME are set up to suit the export promotion policy parameters, the import substitution policy parameters, and a combination of both policies parameters respectively. Each program consists of ten programs. The only difference among these ten programs is that it has different values of weights whereas others parameters are the same. That is, SIAMA = [SIAMA1, ... , SIAMA10] in which SIAMA1 matches export policy parameters and the first set of weights, SIAMA10 matches export policy parameters and the tenth set of weights. In aggregate, there will be SIAMA = [SIAMA1, ... , SIAMA10], SIAMB = [SIAMB1, ... , SIAMB10], and SIAME = [SIAME1, ... , SIAME10]. Parametric programming cannot be utilized in this case because all weights appear in more than one element of the objective function.

of the twenty-seven sets of weights suggested by Cohon (12) for the three objectives optimization problem.)

TABLE XXVI
TEN SETS OF WEIGHTS

w_1	w_2	w_3
1	1	1
1	0	0
0	1	0
0	0	1
1	2	1
2	2	1
3	3	1
4	3	1
3	4	1
4	4	1

The Relationships in the Model

Objective Function

There are three objectives in the model. First, Z_1 , is to minimize the difference of per capita income generated by the agriculture sector versus that generated by the nonagriculture sector. Second, Z_2 , is to minimize the balance of trade deficit. Third, Z_3 , is to maximize per capita income.

$$\text{MIN } Z = w_1 Z_1 + w_2 Z_2 - w_3 Z_3 \quad (1)$$

$$\text{where } Z_1 = (-V_1/P_A) + (\sum_{i=2}^{38} V_i/P_{NA}) \quad (2)$$

$$Z_2 = \sum_{i=1}^{38} (M_i - E_i) \quad (3)$$

$$Z_3 = \sum_{i=1}^{38} V_i/P \quad (4)$$

Assume that gross value added, V , is proportional to domestic output, X . Therefore,

$$V_1 = v_1 X_1 \quad (5)$$

$$V_i = v_i X_i \quad i = 2, \dots, 38 \quad (6)$$

Imports in the i th sector, M_i , is disaggregated into several components according to its different purposes. It can be employed to satisfy intermediate transaction, M_i^{Int} , and/or private consumption, M_i^{C} , and/or public consumption, M_i^{G} , and/or investment M_i^{I} , and/or exports, M_i^{E} .

$$M_i = M_i^{\text{Int}} + M_i^{\text{C}} + M_i^{\text{G}} + M_i^{\text{I}} + M_i^{\text{E}} \quad (7)$$

$$\text{where } M_i^{\text{Int}} = \theta_i \sum_j a_{ij} X_j \quad (8)$$

$$M_i^{\text{C}} = \theta_i C_i \quad (9)$$

$$M_i^{\text{I}} = \theta_i I_i \quad (10)$$

$$M_i^{\text{E}} = \theta_i E_i \quad i = 1, \dots, 38, j = 1, \dots, 38 \quad (11)$$

The total private consumption expenditure, C , is assumed to be a linear function of the GDP which consists of the GDP generated by the agriculture sector, V_1 , and by the nonagriculture sector, $\sum_{i=2}^{38} V_i$.

$$C = a + b_1 V_1 + b_2 \sum_{i=2}^{38} V_i \quad (12)$$

Substitute (5) and (6) into (13) to get

$$C = a + b_1 v_1 X_1 + b_2 \sum_{i=2}^{38} v_i X_i \quad (13)$$

Private consumption expenditure on commodity in each sector, C_i , is assumed to be proportional to total private consumption

expenditures, C. This procedure does not guarantee the equivalence of the sum C_i and C, but due to unavailability of certain data, this method must be used.

$$C_i = c_i C \quad i = 1, \dots, 38 \quad (15)$$

The objective function can be rewritten as

$$\begin{aligned} \text{MIN } Z = & w_1 [(-v_1 X_1 / P_A) + (\sum_{i=2}^{38} v_i X_i / P_{NA})] + w_2 \sum_{i=1}^{38} [\theta_i \sum_{j=1}^{38} a_{ij} X_j + \\ & \sum_{i=1}^{38} c_i (b_1 v_1 X_1 + b_2 \sum_{i=2}^{38} v_i X_i) + E_i (\theta_i - 1)] - w_3 (\sum_{i=1}^{38} v_i X_i / P) \end{aligned}$$

$$i = 1, \dots, 38, j = 1, \dots, 38 \quad (16)$$

The constant terms which are a, I, and G are dropped from the objective function. This objective function will be minimized subject to the following sets.

Constraint Sets

Supply-Demand Balance (DS). Sector supplies, which includes domestic production, X_i and import, M_i , are required to satisfy all demands, which are intermediate demand, $\sum_{j=1}^{38} a_{ij} X_j$, private consumption demand, C_i , investment demand, I_i , public consumption demand, G_i , and demand for export, E_i . The general form of a balance equation is

$$X_i + M_i \geq \sum_{j=1}^{38} a_{ij} X_j + C_i + I_i + G_i + E_i$$

$$i = 1, \dots, 38, j = 1, \dots, 38 \quad (17)$$

Substitute (7) through (15) into (17) and rearrange them in order to get

$$\begin{aligned}
& \overset{C}{(\theta_i - 1)c_i a} + \overset{I}{(\theta_i - 1)I_i} + \overset{G}{(\theta_i - 1)G_i} > \overset{Int}{(1 - \theta_i)} \sum_j a_{ij} X_j - X_i + \\
& \overset{C}{(1 - \theta_i)c_i} (b_1 v_1 X_1 + b_2 \sum_{i=2}^{38} v_i X_i) + \overset{E}{(1 - \theta_i)E_i} \quad (18)
\end{aligned}$$

Since the model is comparative static, that is, variables are in incremental forms, and the autonomous consumption expenditure, a , is assumed to be constant, the term $\overset{C}{(\theta_i - 1)c_i a}$ can be eliminated. The supply-demand balance can be viewed as

$$\begin{aligned}
& \overset{Int}{(1 - \theta_i)} \sum_j a_{ij} X_j - X_i + \overset{C}{(1 - \theta_i)c_i} (b_1 v_1 X_1 + b_2 \sum_{i=2}^{38} v_i X_i) + \overset{E}{(1 - \theta_i)E_i} \\
& < \overset{I}{(\theta_i - 1)I_i} + \overset{G}{(\theta_i - 1)G_i} \\
& \qquad \qquad \qquad i = 1, \dots, 38, j = 1, \dots, 38 \quad (19)
\end{aligned}$$

Saving Constraint (IS). Domestic saving, S , is assumed to be a linear function of the GDP generated by the agriculture sector, V_1 , and the nonagriculture sector, $\sum_{i=2}^{38} V_i$.

$$S = s_1 V_1 + s_2 \sum_{i=2}^{38} V_i \quad (20)$$

Substitute (5) and (6) into (20) and we get

$$S = s_1 v_1 X_1 + s_2 \sum_{i=2}^{38} v_i X_i \quad (21)$$

Investment demand, I , is constrained not to be greater than total saving which consists of domestic saving, S , and foreign capital inflow, F_{max} .

$$I \leq S + F_{max} \quad (22)$$

Investment demand in the i th capital producing sector, I_i , is assumed to be proportional to total investment demand, I .

$$I_i = r_i I \quad (23)$$

Substitute (21) and (23) into (22) and rearrange them to get

$$-r_i s_1 v_1 X_1 - r_i s_2 \sum_{i=2}^{38} v_i X_i \leq r_i F_{\max} - I_i \quad i = 1, \dots, 38 \quad (24)$$

Limit on Exports (EX). The effect of alternative export possibilities is examined in this study by parametric variation of exogenously given export levels.

Lower limit on export (EX_{iG}) is defined as

$$E_i > E_{i\min} \quad i = 1, \dots, 38 \quad (25)$$

whereas upper limit on export (EX_{iL}) is given by

$$E_i \leq E_{i\max} \quad i = 1, \dots, 38 \quad (26)$$

Foreign Exchange Constraint (ME). The demand for foreign exchange from imports, $\sum_{i=1}^{38} M_i$, must not exceed the supply from exports, $\sum_{i=1}^{38} E_i$, and the net private and public inflow of capital, F_{\max} .

$$\sum_{i=1}^{38} (M_i - E_i) \leq F_{\max} \quad (27)$$

Substitute (7) through (12), and (14) into (27) and rearrange them in order to get

$$\sum_{i=1}^{38} [\theta_i \sum_{j=1}^{38} a_{ij} X_j + \theta_i c_i (b_1 v_1 X_1 + b_2 \sum_{i=2}^{38} v_i X_i) + (\theta_i - 1) E_i] \leq F_{\max} - \sum_{i=1}^{38} \theta_i I_i - \sum_{i=1}^{38} \theta_i G_i \quad i = 1, \dots, 38, j = 1, \dots, 38 \quad (28)$$

The term $\sum_{i=1}^{38} \theta_i c_i a$ is excluded since 'a' is assumed to be unchanged from 1975 to 1986.

The above model can be conveniently summarized using a tableau format which is presented in Appendix I.

CHAPTER IV

ANALYSIS OF DATA

Introduction

This chapter will discuss the empirical results obtained by applying multiobjective linear programming to the model outlined in the preceding chapter. The results of different policies will be compared in order to examine their effects on the Thai economy. Furthermore, relationships among different objectives will be explored.

Comparison of Results

The results of this study are derived from utilizing the target growth rates of exports and imports to the model developed in Chapter III. The ten sets of weights are used to solve the three objective optimization problem, but only three different sets of solutions are obtained.¹ All of them imply that a combination of both policies performs the best. The export promotion policy performs better than the import substitution policy in generating a higher level of outputs

¹This is a disadvantage of the weighting method in that it can give a poor coverage of a noninferior set. In this study, different solutions come from the first, the second, and the fourth sets of weights whereas the rest gives exactly the same results as does the first set. The first group of solutions is obtained from optimizing the three objectives simultaneously. These objectives are assumed to have equal importance. The second group of solutions is a result of minimizing income disparity whereas the third group of solutions is an outcome of maximizing per capita income.

and exports. For instance, if every objective is assumed to be equally important, the export policy produces the total output of 3,698,012 millions baht whereas the import policy generates only 3,405,351 millions baht worth of it. The export policy also produces total export of about 137,480.8 millions baht higher than does the import policy (see Table XXVII). Furthermore, owing to a positive relationship between output and some other variables, the export policy generates a higher level of total intermediate output, X_{ij} , total private consumption, C , total saving, S , and total imports, M , than does the import policy. These solutions indicate that a policy which is aimed to increase exports may be more suitable to the economic structure of Thailand than a policy which is expected to replace imports by domestic sources of supply. This is because Thailand is basically an agrarian nation which produces and exports mostly of agricultural goods. Most of import substituting products still rely heavily upon imports of raw materials.

Due to a higher level of outputs found in the export promotion policy, the overall per capita income is higher under the export policy than the import policy. For example, the per capita income under the export policy is 95,732.5 baht while that under the import policy is 46,665.2 baht, given that the objective of the problem is to maximize the overall per capita income (see Table XXVII). However, the difference of per capita income between the agriculture sector and the nonagriculture sector is larger under the export policy than the import policy. This difference is 241,586.1 baht under the export policy but it reduces to 111,117.1 baht under the import policy. This result implies that the export promotion produces a faster economic growth

TABLE XXVII

SUMMARY OF EMPIRICAL RESULTS

	Z ₁	Z ₂	Z ₃	X	E	X _{1j}	V	C	S	M	V ₁ /P _A	$\sum_{i=2}^{38} V_i/P_{NA}$
SOLVE A1	97,399.6	-90,992.7	43,049.1	3,698,012	564,299.2	1,647,831	2,049,243	1,279,230	770,013.3	473,306.5	15,130.2	112,529.8
A2	95,736.8	-75,945.3	42,209.8	3,626,443	543,106.1	1,616,229	2,009,293	1,254,307	754,985.6	467,160.8	14,767.6	110,504.4
A4	241,586.1	157,157.4	95,732.5	7,513,168	564,299.2	2,954,182	4,557,107	2,846,460	1,710,658.0	721,456.6	26,484.0	268,070.1
M	150,272.0	1.7	62,367.8	5,097,010	564,299.2	2,126,859	2,968,861	1,853,925	1,114,942.0	564,300.9	19,293.6	169,565.0
B1	91,479.3	-26,885.4	39,476.9	3,405,351	426,818.4	1,525,297	1,879,198	1,173,227	705,970.6	399,933.0	13,255.1	104,734.4
B2	86,963.5	2,856.5	37,813.3	3,269,237	384,181.3	1,468,415	1,800,006	1,123,741	676,265.3	387,037.8	12,885.9	99,849.4
B4	111,117.1	2,857.3	46,665.2	3,929,070	426,818.4	1,706,708	2,221,381	1,387,063	834,318.3	429,675.7	14,814.4	125,931.5
N	109,234.8	6.3	45,976.2	3,878,873	426,818.4	1,689,318	2,188,583	1,366,567	822,016.0	426,824.7	14,664.8	123,899.6
E1	102,816.0	-128,332.6	45,135.3	3,888,819	564,299.2	1,739,270	2,148,554	1,341,272	807,283.3	435,966.6	15,663.9	118,479.9
E2	101,068.5	-112,694.2	44,263.1	3,814,290	543,106.1	1,706,286	2,107,033	1,315,368	791,665.6	430,411.9	15,292.6	116,361.1
E4	187,554.5	10.1	76,153.2	6,148,695	564,299.2	2,522,059	3,625,085	2,263,987	1,361,108.0	564,309.3	22,392.4	209,946.9

- Notes: 1. $Z_1 = (\sum_{i=2}^{38} V_i/P_{NA}) - (V_1/P_A)$, $Z_2 = \sum_{i=1}^{38} (M_i - E_i)$, $Z_3 = \sum_{i=1}^{38} (V_i/P)$
- Values are increments from 1975 to 1986. Unit is in millions of baht, except for Z₃, V₁/P_A, and $\sum_{i=2}^{38} V_i/P_{NA}$ which have their values in baht.
 - SOLVE A1, A2, and A4 are the name of the computer programs designed for the export promotion policy parameters with the first set, the second set, and the fourth set of weights, respectively.
 - SOLVE B1, B2, and B4 are the name of the computer programs designed for the import substitution policy parameters with the first set, the second set, and the fourth set of weights, respectively.
 - SOLVE E1, E2, and E4 are the name of the computer programs designed for a combination of both policies parameters with the first set, the second set, and the fourth set of weights, respectively. In this particular case, it is assumed that there is no foreign capital inflow. This is a result of an experiment to combine both policies and the value of foreign capital inflow becomes negative which makes the solution infeasible. Another experiment is conducted by assuming a balance of trade account. It produces an optimal solution. This happening might indicate that it is probably impossible for Thailand to export her foreign exchange. At best, the country does not rely upon the importation of foreign resource to develop her country.
 - SOLVE M and SOLVE N are the name of the computer programs designed for the export promotion policy parameters and the import substitution policies parameters respectively, given the fourth set of weights and no foreign capital inflow in both of them.

than does the import substitution, but this growth is not equally distributed. The nonagriculture sector seems to benefit more than the agriculture sector. Therefore, in order to cure and/or eliminate this problem, it may be wise for the government to pursue complementary and supportive policies, such as a policy designed to reduce the concentrated control of assets, i.e., progressive taxes on income and wealth, expansion of publicly provided consumption goods and services into the rural and less developed areas.

Even though both exports and imports are assumed to grow faster under the export policy than the import policy, the deficit in the balance of trade is likely to improve faster under the export policy. For instance, if the objective is to minimize the balance of trade deficit, the export policy generates a surplus of 90,992.7 millions baht whereas the import policy generates a surplus of only 26,885.4 millions baht (see Table XXVII). Specifically, the balance of trade is always in surplus in the sectors of food manufacturing, especially rice and other grain milling, sugar refineries, processing and preserving of foods; agriculture sector; services sector; transportation and communication sector; textile industry; rubber industry; and wood industry. These industries account for a relatively high proportion of total exports. On the other hand, the balance of trade is always in deficit in the mining sector, in particular crude oil; tobacco processing; paper and paper products; basic chemical products; fertilizer and pesticides; iron and steel; and machinery. This solution suggests that export oriented industries, in particular the agro-processing industry should be encouraged because it will help the improvement of both the agriculture sector and the manufacturing

sector. Some other industries which generate a large amount of foreign exchange earnings, such as the tourist industry, the textile industry, etc, should be developed as well. Furthermore, the development of basic industry vital to the economic development of Thailand, such as fertilizer and pesticides which are used mainly in the agriculture sector, should be encouraged.

In addition to obtaining the preceding results, an additional effort is made to examine the effect of the foreign capital inflow on the Thai economy. This is done by comparing the result of maximizing the overall per capita income when there is no foreign capital inflow and when there is an inflow of foreign capital in addition to domestic saving used to finance domestic investment. It is observed that an additional foreign resource will stimulate growth of the economy at a faster rate than does the case when the inflow of foreign resource is prohibited. For instance, if the export promotion policy is considered, the gross domestic output will be 7,513,168 millions baht when the foreign capital inflow is not limited. On the other hand, it reduces to 5,097,010 millions baht when there is no foreign capital inflow. This result indicates the importance of the foreign resource in developing the Thai economy in the sense that it adds to domestic saving, and the domestic demand of investment is no longer constrained by the domestic supply of saving.

Relationships Among Objectives

There are three objectives that need to be observed in this study. The first objective is to minimize income disparity which is defined as the difference between per capita income in the agriculture sector and

per capita income in the nonagriculture sector, $Z_1 = (-V_1/P_A) +$
 38
 $(\sum_{i=1}^n V_i/P_{NA})$. The second objective is to minimize the balance of trade deficit which is the difference between the total value of imports and exports, $Z_2 = M - E$. The third objective is to maximize the overall per capita income which is the ratio of total value added over total number of population, $Z_3 = V/P$. Different policy applications result in different values of these objectives. Therefore, their solutions can be compared, and also their relationships can be traced. In every set of weights, import substitution performs the best in minimizing income disparity despite a higher value of per capita income in the agriculture sector as well as that in the nonagriculture sector found in export promotion. This consequence can be explained in the sense that the export promotion policy provides faster economic growth than does the import substitution policy. The result of this economic growth may benefit the agriculture sector less than other sectors. Therefore, disparities among sectors become wider as the economy experiences a faster growth. In the case of Thailand, the benefit of economic growth is not equally distributed. It is kept mainly in the nonagriculture sector. As mentioned in Chapter II, there is a wide income gap between the agricultural population and the nonagricultural population. There is an unequal access to education, health care, and government services among Thai people in different regions of the country. There is a growing number of landless farmers due to the use of land in exchange for credit and loans as well as large families size found in the rural areas. Consequently, it is important for the government to reduce these disparities in order to gain more benefit from the economic growth. The government may pursue the following

policies. First, in order to modify the size distribution of income, progressive taxation on incomes and wealth should be enforced, and the provision of public goods and services in the rural and remote areas should be expanded. Second, in order to reduce the concentrated control of assets, and to provide farmer with enough land to cultivate, a policy of land reform and land development should be implemented.

On the other hand, the export promotion policy provides more favorable effects on the balance of trade and the overall per capita income than does the import substitution policy. This is a result of a higher level of outputs and exports generated by export promotion.

The relationships among different objectives can be explained with the help of Figures 1, 2, 3, and 4, which are based on the data from Table XXVII. The interpretation of these figures also depends upon this table.

Figure 1 shows the relationship between minimization of income disparity and the balance of trade deficit. It indicates that as output is slightly decreased, by moving from B_1 to B_2 , A_1 to A_2 , and E_1 to E_2 , the income gap can be minimized at a cost of a greater deficit in trade balance. This situation is possible if a lower level of output results in a lower level of export and a slow down of economic growth. On the other hand, if output is slightly increased, these circumstances will be reversed. Nevertheless, if output is tremendously increased, such as we jump from B_2 to B_3 , A_2 to A_3 , and E_2 to E_3 , we will have both wider income disparity and wider balance of trade deficit. The two objectives can be said to be complementary at this point. This will be the case whenever the effect from high economic growth is not equally spread among sectors. As experienced by

most developing countries, the benefit from economic growth is kept in the nonagriculture sector and mostly in the hands of upper-level income people who are likely to prefer to consume luxuries with large import contents. Their consumption habits always influence the overall pattern of consumption and production. Furthermore, if a country has to depend heavily on imports of raw materials for her domestic production, a higher level of production may worsen the balance of trade. This figure also shows that the import substitution policy starts with lower income gap and higher balance of trade deficit than does the export promotion policy and a combination of both policies.

The second figure reveals the relationships between minimization of the balance of trade deficit and maximization of per capita income. It shows that a slight decrease in output by moving from E_1 to E_2 , A_1 to A_2 , and B_1 to B_2 , will worsen the balance of trade and overall per capita income. This is because a low level of output may imply a low level of export as well as a low level of GDP. By contrast, a slight increase in output may improve both of them. However, a large increase in output may cause a problem with the balance of trade for the same reasons previously discussed. On the contrary, it will raise the overall per capita income since a high level of output suggests a high level of GDP. Therefore, there will be a trade off between the balance of trade deficit and increase in per capita income as the economy acquires more economic growth. In this figure, the lowest balance of trade surplus and the lowest per capita income begin with the import substitution policy.

Figure 4 is a reproduction of Figure 3 but the third point of both figures is different owing to a different assumption concerning maximum

Z1 VS Z2

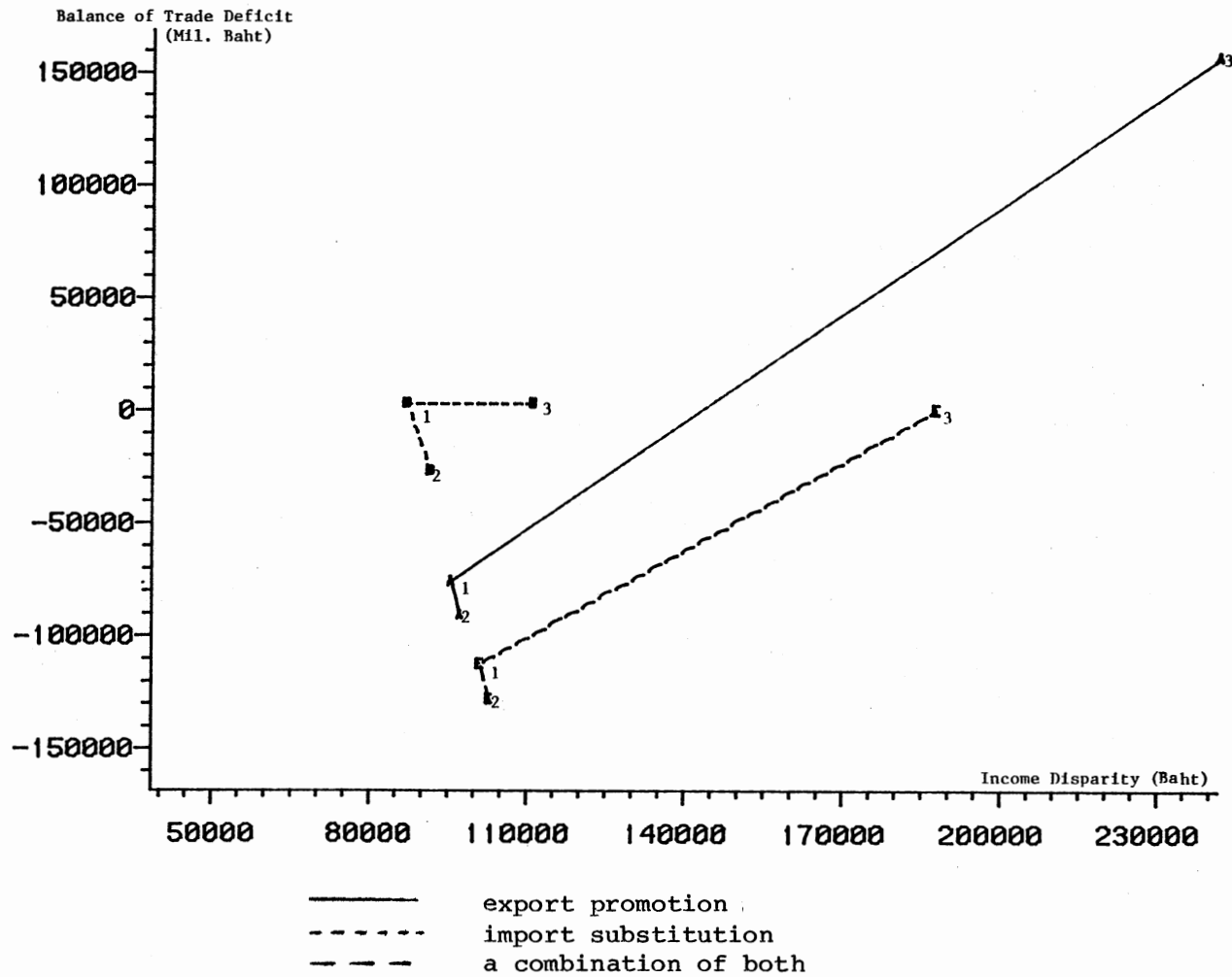


Figure 1. Minimization of Income Disparity Versus Minimization of Balance of Trade Deficit

foreign capital inflow. In particular, the third figure assumes that there is an inflow of foreign capital to finance domestic investment whereas the fourth figure assumes that foreign capital inflow is prohibited. However, both of these figures exhibit a trade off between maximization of per capita income and minimization of income disparity. This indicates that the cost of increasing overall per capita income is paid for by increasing disparity between per capita income in the agriculture sector and that in the nonagriculture sector. This condition confirms a result of unequal distribution of economic growth and income.

In summary, this study implies that a slight increase in output will increase both the income gap between the agriculture sector versus the nonagriculture sector and the overall per capita income, but it will decrease the deficit in balance of trade. The opposite will be true if output is slightly decreased. However, a high economic growth would be beneficial only on the ground that it raises the level of the overall per capita income. This result is based on the fact that economic growth is not equally distributed, and the overall pattern of consumption and production is influenced by consumption habits of the rich who are likely to prefer to consume luxuries with large import contents. These solutions suggest that in order to insure the benefit of economic growth, the government should reduce disparities in income and economic development among different sectors by pursuing supportive and complementary policies designed to reduce the concentrated control of assets, to modify the size distribution of income, and to expand the provision of public goods and services into the less developed areas. Furthermore, a policy designed to curtail the expansion of

Z2 VS Z3

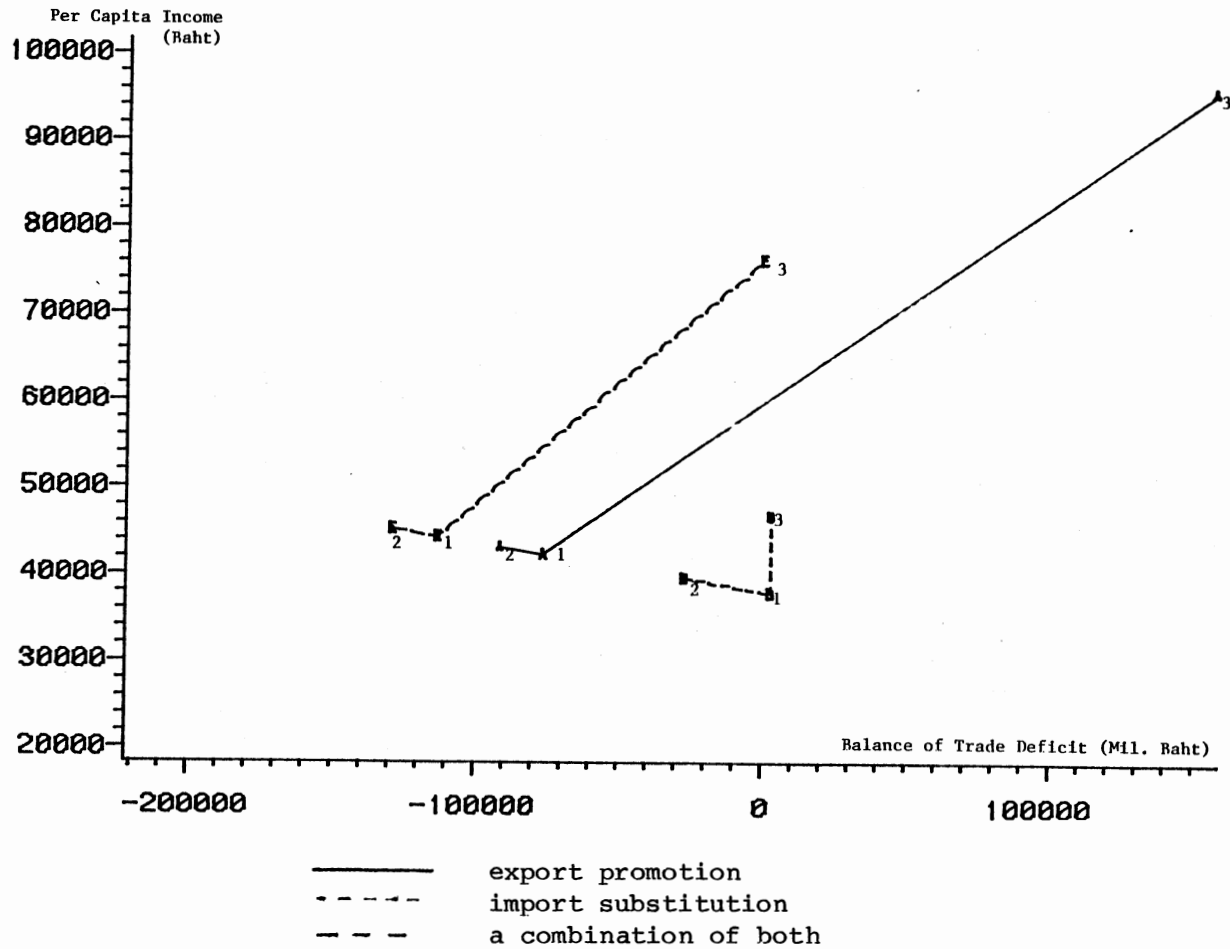


Figure 2. Minimization of Balance of Trade Deficit Versus Maximization of Per Capita Income

Z3 VS Z1

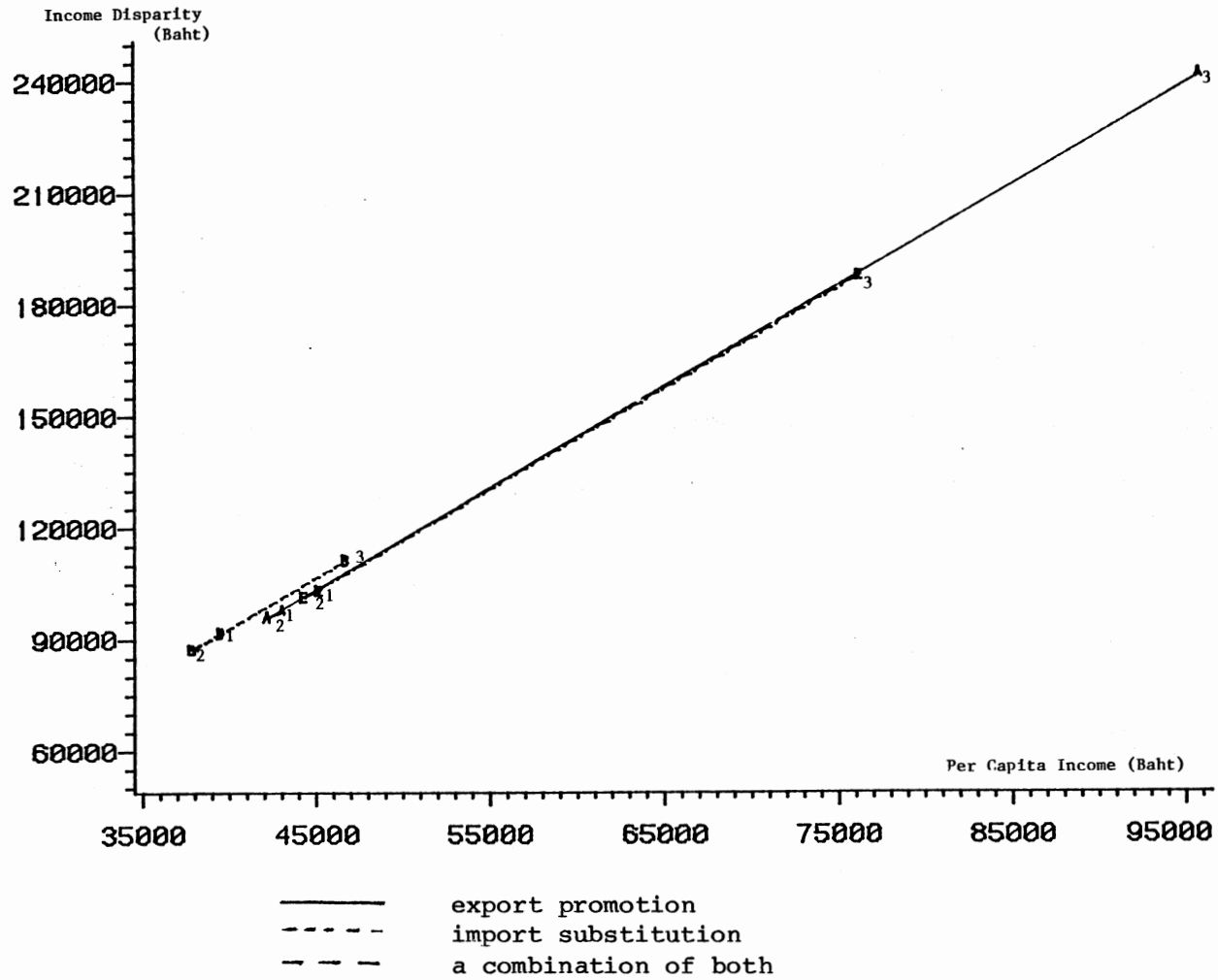
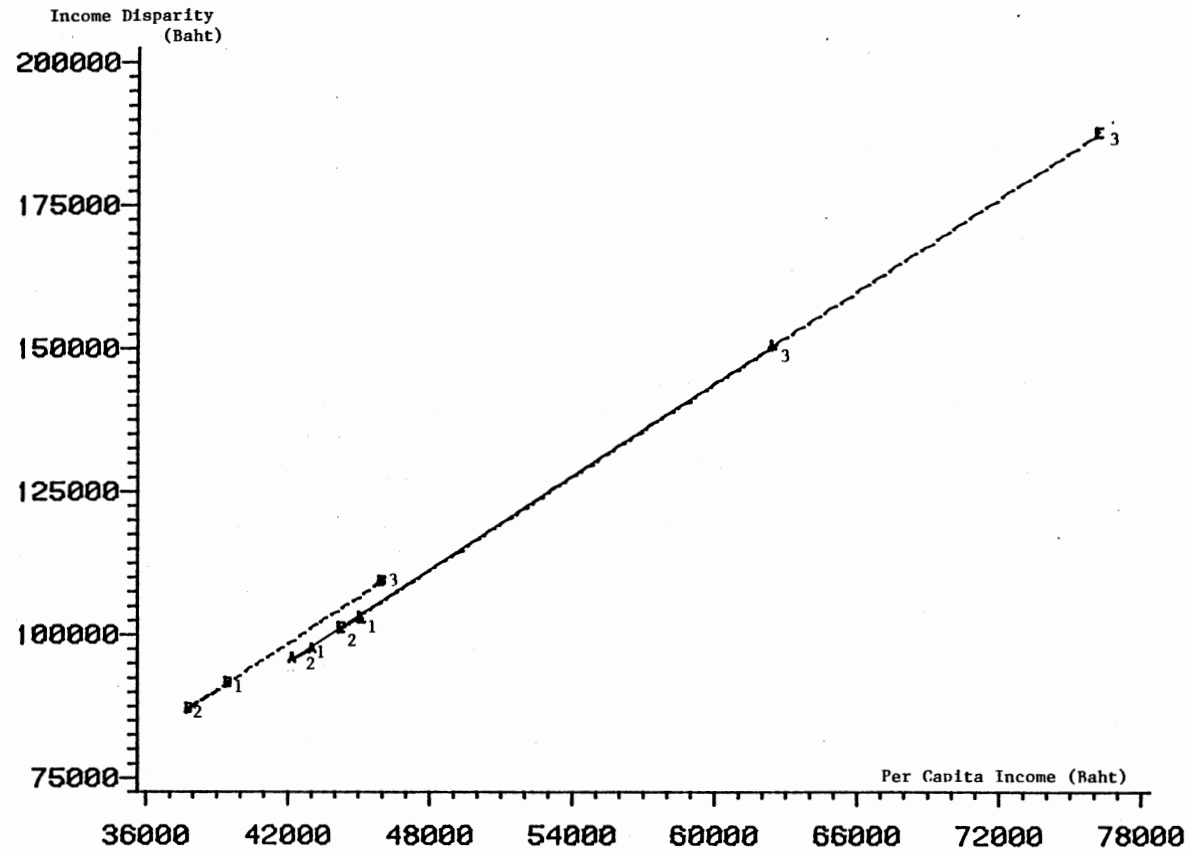


Figure 3. Maximization of Per Capita Income Versus Minimization of Income Disparity

Z3 VS Z1



- export promotion
- - - - - import substitution
- · - · - a combination of both

Figure 4. Maximization of Per Capita Income Versus Minimization of Income Disparity (assuming no foreign capital inflow)

demands for consumer goods imports, such as a high tax rate on the import of luxuries, should be enforced. If these policies are not implemented concurrently with the rapid economic development of the nation, the result of this development may not be desirable since it will benefit only a small number of the people.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Introduction

The purpose of this study are to evaluate quantitatively the effects of the import substitution policy and the export promotion policy on the Thai economy, in particular on the distribution of income, the balance of trade, and the overall economic growth. The effect of import substitution is examined by varying an import to total supply ratio whereas the effect of export promotion is examined by parametric variation of exogenously given export levels. Since the import substitution policy is aimed to reduce imports by domestic source of supply and the export promotion policy is aimed to increase exports, whenever the import substitution policy is assumed to be effective, the import to total supply ratio as well as the upper bound on exports are set to be lower than in the case of export promotion. Furthermore, a combination of both policies is included in order to examine the effects of both policies simultaneously.

A multiobjective linear programming model which was developed in Chapter III was used as a tool for the analysis. The model is comparative static in which variables are defined as changes taking place between 1975-the year of Thailand's first official input-output table and 1986-the terminal year of Thailand's Fifth Economic Development Plan. Therefore, the solution to the model yields a

comparison of 1986 with 1975. The model consists of 38 sectors, 310 endogenous variables, 236 exogenous variables, and 385 parameters.

There are three objectives in this model. First, is to minimize the income disparity, which is defined as the difference between per capita income in the agriculture sector versus that in the nonagriculture sector. Second, is to minimize the balance of trade deficit, which is the difference between imports and exports. Third, is to maximize overall per capita income, which is the ratio of total value added to total population. These objectives are optimized subject to the supply-demand balance constraint, the investment-saving constraint, the limit on exports, and the foreign exchange constraint. The weighting method is selected to solve this three objective optimization problem. Weights can be any positive value, and they reflect relative importance of each objective. The solutions from different policy applications are compared, given the same set of weights.

With ten sets of weights that are used, three of them provide different solutions. Consequently, the results of applying different policy parameters are compared at three different points. In general, a combination of both policies performs the best. The export promotion policy performs better than the import substitution policy in generating a higher level of outputs, and exports, and thereby value added, consumption, saving, and imports. As a result, the export policy provides faster economic growth than does the import policy. However, this study finds that a rapid growth increases the overall level of per capita income, the income gap, as well as the deficit in the balance of trade. Therefore, it may generate more problems than

benefits. These are the results of structural characteristic of the Thai economy which must be accounted for and addressed in future economic plans which have as their goal an improved standard of living for the poor of Thailand.

Conclusions and Recommendations

From this study the following are concluded and recommended:

1. Agricultural development should be stressed because this development will benefit the majority of the Thai people. Furthermore, the estimation from this study shows that at the margin, the agriculture sector saves more than the nonagriculture sector. A farmer can use his saving to improve his production and he can eventually help himself. Consequently, the disparity of income between the agriculture sector and the nonagriculture sector may be reduced. There are several measures to develop the agriculture sector. They include improvements in the production techniques and in the marketing process; expansion of agricultural research, education, and health services into the rural areas; provision of agricultural loan and credit; redistribution of land; as well as encouraging the cooperation among farmer groups.

2. In order to stimulate the Thai economic growth, Thailand needs an inflow of foreign capital, either in the form of foreign private investment and/or foreign aid, which will be used to supplement domestic saving to finance the expansion of domestic investment demand.

3. The export promotion policy generates a higher level of outputs, value added, consumption, saving, and exports than does the import substitution policy. Consequently, the export policy stimulates faster economic growth than does the import policy. This result is

based upon the economic structure of Thailand, that is, it is an agrarian nation which produces and exports mainly agricultural goods and agriculture-based goods. Most of import substitution products rely heavily upon importation of raw materials. However, this study indicates that a rapid economic growth will benefit Thailand in the sense that it raises the level of overall per capita income. However, it worsens the balance of trade and it produces a wider income gap between the rural and urban regions. Therefore, as the economy acquires more economic growth, the income disparity and the balance of trade deficit will complement an increase in overall per capita income. This is a consequence of the fact that the benefit from economic development in Thailand is not equally distributed. The benefit of increasing agricultural exports accrue mostly to the middleman. Furthermore, the production of some goods still depends heavily upon importation of raw materials. The overall consumption pattern is also influenced by the consumption habits of the rich who prefer to consume luxuries with high import contents. This study points out that if the level of output is doubled within ten years without any changes in the economic structure, the difference between the per capita income generated by the agriculture sector and by the nonagriculture sector will almost be doubled, and the balance of trade can change from surplus into deficit. Therefore, it is essential for the government to correct these problems as quickly as possible by pursuing a set of complementary and supportive policies designed to improve the economic structure at the same time as the economy is developed. The policies should aim to improve especially in the rural areas through progressive redistribution of asset ownership, such as land reform along with land

development to ensure that a farmer has enough land to cultivate. The government should encourage the cooperation among farmer groups as well as encourage the establishment of rice and grain milling in the rural areas which may be owned by this cooperation. This method should reduce the influence of the middleman. In addition, the government should expand the public provision of goods and services, such as education and health care, to the poor. The government should invest in a small project which is aimed to develop a certain rural area rather than invests in a big one. Furthermore, in order to moderate the size distribution at the upper level and to increase the governmental incomes used to finance the development, the government should improve an increase in tax collection efficiency, expand the tax base and introduce new taxes, such as wealth taxes on the rich.

4. A surplus balance of trade is always found in sectors of agriculture, trade, services, transportation and communication, agro-processing industries, and textile industry. These sectors have relative high shares of their exports to the total. This result implies that in order to earn more foreign exchange, the development of these industries, in particular agro processing industry, and industry which utilizes indigenous raw materials, should be encouraged. This development will improve both the agriculture sector and the nonagriculture sector. Nevertheless, this policy can be fulfilled if the markets of the Thai exports are expanded and the quality of them are improved. This can be done with the cooperation of both the public sector and the private sector.

5. A deficit balance of trade is always seen in sectors which have relative high ratios of their imports to the total. They are

mining, chemical industry, and machinery. This conclusion suggests that in order for Thailand to save her foreign exchange, some of these industries may possibly be developed. For instance, an industry of fertilizer and pesticides may be essential for the development of the agriculture sector.

In summary, this study shows that the export promotion policy provides a faster economic growth than does the import substitution policy. However, a fast economic growth seems to generate more problems than benefits. That is, it produces a higher level of overall per capita income in exchange of a wider income gap and a wider deficit in the balance of trade. This is because the past economic development was not equally distributed. The agriculture sector, which is the largest and the most important sector, seems to benefit the least. Therefore, in order to gain more benefits from the economic growth, policies which are designed to improve the existing economic structure are necessary. Furthermore, future economic development plans should stress in the development of the agriculture sector as well as the rural area.

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APPENDIXES

APPENDIX A

LIST OF 16, 38, AND 58 SECTORS

TABLE XXVIII
LIST OF 16, 38, AND 58 SECTORS

16 Sectors (1)	38 Sectors (2)	58 Sectors (3)
1 Agriculture	1 Agriculture	1 Paddy 2 Maize 3 Cassava 4 Beans and Nuts 5 Vegetable and Fruits 6 Sugar Cane 7 Rubber 8 Other Crops 9 Livestock 10 Forestry 11 Fishery
2 Mining	2 Mining	12 Crude Oil and Coal 13 Metal Ore 14 Non-Metal Ore
3 Food Manufacturing	3 Slaughtering 4 Processing and Preserving of Foods 5 Rice and Other Grain Milling 6 Sugar Refineries 7 Other Foods 8 Animal Feed 9 Beverages 10 Tobacco Processing and Products	15 Slaughtering 16 Processing and Preserving of Foods 17 Rice and Other Grain Milling 18 Sugar Refineries 19 Other Foods 20 Animal Feed 21 Beverages 22 Tobacco Processing and Products
4 Textile Industry	11 Spinning, Weaving and Bleaching 12 Textile Products	23 Spinning, Weaving and Bleaching 24 Textile Products
6 Paper Industry and Printing	13 Paper and Paper Products 14 Printing and Publishing	25 Paper and Paper Products 26 Printing and Publishing
7 Rubber, Chemical and Petroleum Industries	15 Basic Chemical Products 16 Fertilizer, Pesticides 17 Other Chemical Products	27 Basic Chemical Products 28 Fertilizer, Pesticides 29 Other Chemical Products

TABLE XXVIII (Continued)

16 Sectors (1)	38 Sectors (2)	58 Sectors (3)
	18 Petroleum Refineries	30 Petroleum Refineries
	19 Rubber Products	31 Rubber Products
	20 Plastic Ware	32 Plastic Ware
8 Non-Metallic	21 Cement and Concrete Products	33 Cement and Concrete Products
	22 Other Non-Metallic Products	34 Other Non-Metallic Products
9 Metal, Metal Products, and Machinery	23 Iron and Steel	35 Iron and Steel
	24 Non-Ferrous Metal	36 Non-Ferrous Metal
	25 Fabricated Metal Products	37 Fabricated Metal Products
	26 Industrial Machinery	38 Industrial Machinery
	27 Electrical Machinery and Apparatus	39 Electrical Machinery and Apparatus
	28 Motor Vehicles and Repair	40 Motor Vehicles and Repair
	29 Other Transportation Equipment	41 Other Transportation Equipment
10 Other Manufacturing	30 Leather Products	42 Leather Products
5 Saw Mills and Wood Products	31 Saw Mills and Wood Products	43 Saw Mills and Wood Products
10 Other Manufacturing	32 Other Manufacturing Products	44 Other Manufacturing Products
11 Public Utilities	33 Public Utilities	45 Electricity
		46 Water Works and Supply
12 Construction	34 Construction	47 Building Construction
		48 Public Works and Other Construction
13 Trade	35 Trade	49 Trade
15 Services	37 Services	50 Restaurants and Hotels
14 Transportation and Communication	36 Transportation and Communication	51 Transportation
		52 Communication

TABLE XXVIII (Continued)

16 Sectors (1)	38 Sectors (2)	58 Sectors (3)
15 Services (Cont)	37 Services (Cont)	53 Banking, Insurance 54 Real Estate 55 Business Services 56 Public Services 57 Other Services
16 Unclassified	38 Unclassified	58 Unclassified

Sources: 1. Input-Output Table of Thailand for Analytical Uses, 1975
(Tokyo, 1981).

2. Column 2 is a combination of columns 1 and 3.

APPENDIX B

EXPORT PROMOTION POLICY PARAMETERS

The export policy parameters consist of E_{min} , $E_{i\min}$, E_{max} , and $E_{i\max}$. They are estimated by using different growth rates depending upon either the export promotion policy or the import substitution policy is considered.

The Export Promotion Policy

The values of E_{min} and E_{max} can be calculated by using the formula $A_t = (1 + g)^t A_0$, where A_0 is the base year value, A_t is the terminal year value, g is the assigned growth rate, and t is the number of years involved.

For the year 1975, the actual value of total exports in 1971, which was 25,168 millions baht is used as the base year value.¹ The growth rates of 7% which is the target growth rate of export in the Third Plan, and 24.5% which is the actual growth rate during that plan period, 1972-76, are the assigned growth rates for E_{min} and E_{max} , respectively. The calculations show that E_{min} is 32,990.110 millions baht, and E_{max} is 60,468.070 millions baht.

For the year 1986, the base year value is changed to 210,554 millions baht which was the actual value of total exports in 1981.² The assigned growth rates for E_{min} is 22.3%, which is the target growth rate of the Fifth Plan, and for E_{max} is 24.3%, which is the actual growth rate of the Fourth Plan. The approximations reveal that E_{min} is 576,097.223 millions baht, and E_{max} is 624,768.517 millions baht.

¹Unpublished computer printouts from the National Economic and Social Development Board.

²Virabongsa Ramankura et al., Thailand: Long Term Prospect for Economic Development 1980-90 (Bangkok, 1981), p. 19(APX).

The differences of E_{min} between 1975 and 1986, as well as of E_{max} between the same given years will be used in this study. The formula $E_i = e_i E$, where e_i is the proportion of export from the i th sector to total exports, will be utilized in order to transform E_{min} and E_{max} into $E_{i,min}$ and $E_{i,max}$. These estimations are presented in Table XXIX.

TABLE XXIX

EXPORT PROMOTION POLICY PARAMETERS
ASSIGNED FOR THE EXPORT POLICY

Sector	e_i	$E_{i,min}$	$E_{i,max}$
1	.11879	64,515.694	67,033.250
2	.01326	7,201.600	7,482.624
3	.00230	1,249.146	1,297.891
4	.04032	21,898.079	22,752.594
5	.18028	97,911.350	101,732.085
6	.09495	51,568.020	53,580.328
7	.00291	1,580.442	1,642.114
8	.00006	32.586	33.858
9	.00122	662.591	688.447
10	.00991	5,382.191	5,592.218
11	.02063	11,204.300	11,641.518
12	.02819	15,310.190	15,907.630
13	.00281	1,526.131	1,585.684
14	.00066	358.451	372.438
15	.00059	320.433	332.937
16	.00008	43.449	45.144
17	.00446	2,422.258	2,516.780
18	.01416	7,690.397	7,990.494
19	.04549	24,705.943	25,670.027
20	.00243	1,319.750	1,371.250
21	.00725	3,937.527	4,091.178
22	.00215	1,167.680	1,213.246
23	.00181	983.024	1,021.384
24	.04263	23,152.656	24,056.128
25	.00433	2,351.654	2,443.421
26	.00450	2,443.982	2,539.352
27	.01038	5,637.452	5,857.439
28	.01294	7,027.806	7,302.048
29	.00035	190.087	197.505

TABLE XXIX (Continued)

Sector	e_i	$E_{i\min}$	$E_{i\max}$
30	.00298	1,618.459	1,681.615
31	.02482	13,479.919	14,005.937
32	.02531	13,746.041	14,282.444
33	.00174	945.006	981.883
34	-	-	-
35	.11451	62,191.195	64,618.044
36	.07601	41,281.572	42,892.477
37	.07679	41,705.195	43,332.631
38	.00800	4,344.857	4,514.404

- Notes: 1. $E_{\min} = 576,097.223 - 32,990.110 = 543,107.113$
2. $E_{\max} = 624,768.517 - 60,468.070 = 564,300.447$
3. The calculations of e_i can be found in Appendix E.
4. Values are in millions of baht.

The Import Substitution Policy

The same technique as in the above case is applied. The base year values of exports are unchanged. The new assigned growth rates for the year 1975 are 5.48% for E_{\min} , which is the actual growth rate of export in the Second Plan, and 10.54% for E_{\max} , which was the average growth rate from 1961 to 1971 when export policy was ineffective. For the year 1986, the growth rates will be 10.54% for E_{\min} , and 17.14% for E_{\max} , which was average growth rate from 1961 to 1981. The approximations of E_{\min} are 31,115.110 millions baht and 347,504.800 millions baht, whereas those of E_{\max} are 37,577.487 millions baht and 464,397.207 millions baht, in 1975 and 1986 respectively. The calculations of $E_{i\min}$ and $E_{i\max}$ are listed in Table XXX.

TABLE XXX
EXPORT PROMOTION POLICY PARAMETERS
ASSIGNED FOR THE IMPORT POLICY

Sector	e_i	$E_{i \min}$	$E_{i \max}$
1	.11879	37,579.180	50,701.926
2	.01326	4,149.797	5,659.631
3	.00230	727.604	981.686
4	.04032	12,755.219	17,209.375
5	.18028	57,031.522	76,947.077
6	.09495	30,037.403	40,526.542
7	.00291	920.577	1,242.046
8	.00006	18.981	25.609
9	.00122	385.947	520.720
10	.00991	3,135.025	4,229.784
11	.02063	6,526.294	8,805.293
12	.02819	8,917.898	12,032.051
13	.00281	888.943	1,199.364
14	.00066	208.791	281.701
15	.00059	186.646	251.824
16	.00008	25.308	34.146
17	.00446	1,410.920	1,903.616
18	.01416	4,479.512	6,043.769
19	.04549	14,390.747	19,416.034
20	.00243	768.730	1,037.172
21	.00725	2,293.535	3,094.444
22	.00215	680.152	917.663
23	.00181	572.593	772.544
24	.04263	13,485.987	18,195.329
25	.00433	1,369.794	1,848.130
26	.00450	1,423.574	1,920.689
27	.01038	3,283.710	4,430.390
28	.01294	4,093.565	5,523.048
29	.00035	110.722	149.387
30	.00298	942.722	1,271.923
31	.02482	7,851.799	10,593.668
32	.02531	8,006.811	10,802.810
33	.00174	550.448	742.666
34	-	-	-
35	.11451	36,225.203	48,875.137
36	.07601	24,045.740	32,442.574
37	.07679	24,292.493	32,775.494
38	.00800	2,530.798	3,414.558

- Notes:
1. $E_{\min} = 347,504.800 - 31,155.110 = 316,349.690$
 2. $E_{\max} = 464,397.207 - 37,577.387 = 426,819.820$
 3. The calculations of e_i are presented in Appendix E.
 4. Values are in millions of baht.

APPENDIX C

VALUES OF MAXIMUM FOREIGN CAPITAL INFLOW

The value of maximum foreign capital inflow, F_{max} , is the difference between the total value of imports, M , and the minimum exports requirement, E_{min} . For the year 1975, the value of imports will be the same no matter what policy, either the export promotion or the import substitution, is examined. This value is derived from the input-output table. Nevertheless, for the year 1986, the value of total imports will be different depending upon the assigned growth rates of imports of each policy. The approximations of F_{max} are as the follows.

The Export Promotion Policy

$$\begin{aligned}
 F_{max} &= M - E_{min} \\
 1975 &= 79,356.140 - 32,990.110 = 46,366.030 \\
 1986 &= 779,617.140 - 576,097.223 = 203,519.917 \\
 1986-1975 &= 157,153.887
 \end{aligned}$$

$$\begin{aligned}
 \text{where } M(1986) &= M(1981) (1 + g)^5 \\
 &= 248,223 (1 + .2572)^5 = 779,617.140
 \end{aligned}$$

The value of total imports in 1981, which was 248,223 millions baht, is the actual value and the actual growth rate of imports from 1977 to 1981 is 25.72%.¹ This growth rate is assumed to carry over until 1986.

¹Unpublished computer printouts from the National Economic and Social Development Board.

The Import Substitution Policy

$$\begin{aligned}
 F_{\max} &= M - E_{\min} \\
 1975 &= 79,356.140 - 31,155.110 = 48,201.030 \\
 1986 &= 398,556.630 - 347,504.800 = 51,051.830 \\
 1986-1975 &= 2,850.800
 \end{aligned}$$

$$\text{where } M(1986) = M_{(86)}^{\text{Int}} + M_{(86)}^{\text{C}} + M_{(86)}^{\text{I}} + M_{(86)}^{\text{G}} + M_{(86)}^{\text{E}}$$

$$\begin{aligned}
 M_{(86)}^{\text{Int}} &= M_{(75)}^{\text{Int}} (1 + g_{\text{Int}})^{11} \\
 &= 45,115.137 (1 + .1646)^{11} = 241,139.390
 \end{aligned}$$

$$\begin{aligned}
 M_{(86)}^{\text{C}} &= M_{(75)}^{\text{C}} (1 + g_{\text{C}})^{11} \\
 &= 10,854.007 (1 + .057)^{11} = 19,971.700
 \end{aligned}$$

$$\begin{aligned}
 M_{(86)}^{\text{I}} &= M_{(75)}^{\text{I}} (1 + g_{\text{I}})^{11} \\
 &= 21,488.194 (1 + .181)^{11} = 133,951.870
 \end{aligned}$$

$$\begin{aligned}
 M_{(86)}^{\text{G}} &= M_{(75)}^{\text{G}} (1 + g_{\text{G}})^{11} \\
 &= 960.844 (1 + .057)^{11} = 1,767.980
 \end{aligned}$$

$$\begin{aligned}
 M_{(86)}^{\text{E}} &= M_{(75)}^{\text{E}} (1 + g_{\text{E}})^{11} \\
 &= 937.858 (1 + .057)^{11} = 1,725.690
 \end{aligned}$$

The value of imports in 1975 in each category is the actual value derived from the input-output table.² Its growth rate is the target rate indicated in the Fifth Plan. Values are in millions of baht.

²Input-Output Table of Thailand for Analytical Uses, 1975 (Tokyo, 1981), Tables 5.7 and 5.9.

APPENDIX D

VALUES OF INVESTMENT (I) AND
PUBLIC CONSUMPTION (G)

The values of investment ,I, and public consumption expenditures, G, in 1975 come directly from the input-output table, whereas they are forecasted for the year 1986 by a macro model developed by the National Economic and Social Development Board (see Appendix H). The differences between these values will be used in this analysis. They are listed in Table XXXI and Table XXXII.

TABLE XXXI
VALUES OF INVESTMENT (I)

Sector	r_i (1)	I_i (1986) (2)	I_i (1975) (3)	I_i (1986-1975) (4)
1	.03264	18,870.392	2,664.841	16,205.551
2	.01767	10,215.681	1,442.932	8,772.749
3	-	-	-	-
4	.00140	809.392	114.537	694.855
5	.02294	13,262.463	1,872.601	11,389.862
6	.00146	844.080	119.231	724.849
7	.00050	289.069	40.658	248.411
8	.00265	1,532.063	216.167	1,315.896
9	.00386	2,231.609	315.071	1,916.538
10	-	-	.073	-
11	.00394	2,277.860	321.870	1,955.990
12	.00667	3,856.174	544.110	3,312.064
13	.00036	208.129	29.517	178.612
14	.00008	46.251	6.217	40.034
15	-	-	-	-
16	.00201	1,162.055	164.106	997.949
17	.00701	4,052.740	572.417	3,480.323
18	.00396	2,289.423	323.421	1,966.002
19	.00324	1,873.164	264.215	1,608.949
20	.00074	427.821	60.008	367.813
21	.00043	248.600	34.997	213.603
22	.00276	1,595.658	225.616	1,370.042
23	.00285	1,647.690	232.873	1,414.817
24	.00330	1,907.852	269.660	1,638.192
25	.02603	15,048.906	2,125.083	12,923.823
26	.11970	69,203.000	9,772.985	59,430.015
27	.05371	31,051.738	4,384.756	26,666.982

TABLE XXXI (Continued)

Sector	r_i (1)	$I_i(1986)$ (2)	$I_i(1975)$ (3)	$I_i(1986-1975)$ (4)
28	.07668	44,331.545	6,260.658	38,070.887
29	.03201	18,506.165	2,613.388	15,892.777
30	.00085	491.416	69.650	421.766
31	.01165	6,735.296	950.752	5,784.544
32	.01635	9,452.540	1,334.987	8,117.553
33	-	-	-	-
34	.44931	259,762.735	36,682.858	223,079.877
35	.08020	46,366.587	6,547.421	39,819.166
36	.01287	7,440.623	1,051.095	6,389.528
37	.00017	98.283	13.541	84.742
38	-	-	-	-
Total	1.0	578,137.000	81,642.312	496,494.688

- Notes: 1. (2) = (1) x 578,137
2. (4) = (2) - (3)
3. The calculation of r_i can be found in Appendix E.
4. Values are in millions of baht.

TABLE XXXII

VALUES OF PUBLIC CONSUMPTION (G)

Sector	g_i (1)	$G_i(1986)$ (2)	$G_i(1975)$ (3)	$G_i(1986-1975)$ (4)
1	.00228	498.895	80.795	418.100
2	.00030	65.644	10.784	54.860
3	.00136	297.587	48.197	249.390
4	.00079	172.863	27.882	144.981
5	.00236	516.400	83.343	433.057
6	.00014	30.634	4.881	25.753
7	.00059	129.100	21.031	108.069
8	-	-	-	-
9	-	-	-	-
10	-	-	-	-
11	.00297	649.877	104.932	544.945
12	.01435	3,139.976	507.572	2,632.400

TABLE XXXII (Continued)

Sector	g_i (1)	G_i (1986) (2)	G_i (1975) (3)	G_i (1986-1975) (4)
13	.00991	2,168.444	350.456	1,817.988
14	.00729	1,595.152	257.794	1,337.358
15	.00207	452.944	73.325	379.619
16	.00023	50.327	8.023	42.304
17	.00717	1,568.894	253.737	1,315.157
18	.02829	6,190.239	1,000.396	5,189.843
19	.00205	448.568	72.365	376.203
20	.00180	393.865	63.562	330.303
21	.00091	199.120	32.041	167.079
22	.00142	310.715	50.313	260.402
23	.00015	32.822	5.423	27.399
24	.00004	8.753	1.387	7.366
25	.00073	159.734	25.954	133.780
26	.00262	573.292	92.748	480.544
27	.00178	389.488	62.839	326.649
28	.02776	6,074.268	981.809	5,092.459
29	.00215	470.449	75.920	394.529
30	.00292	638.936	103.280	535.656
31	.00711	1,555.765	251.579	1,304.186
32	.00302	660.817	107.007	553.810
33	.00545	1,192.535	192.600	999.935
34	.01217	2,662.962	430.399	2,232.563
35	.02518	5,509.728	890.380	4,619.348
36	.03785	8,282.098	1,338.556	6,943.542
37	.78117	170,930.677	27,626.592	143,304.085
38	.00362	792.105	127.884	664.221
Total	1.0	218,813.673	35,365.786	183,447.887

- Notes: 1. (2) = (1) x 218,813.673
2. (4) = (2) - (3)
3. The calculation of g_i can be found in Appendix E.
4. Values are in millions of baht.

APPENDIX E

POPULATION FIGURES

In 1979, the number of total population in Thailand was 46,113,756 persons.¹ It is estimated to be 48,259,382 persons in 1981 and 52,813,447 persons in 1986, provided that the target growth rates during the Fourth Plan, 1977-1981, was 2.3% and it is expected to be 1.9% and 1.5% during the Fifth Plan, 1982-1985, and 1986, respectively.²

The agricultural employment was aimed to increase by 2.2% during the Fourth and the Fifth Plans, whereas the nonagricultural employment was assumed to grow by 7.3% during the Fourth Plan and by 4.6% during the Fifth Plan.³ Given the level of agricultural employment and nonagricultural employment in 1976 were 14,353,065 persons and 4,643,128 persons, respectively, the agricultural employment and the nonagricultural employment are forecasted for 1986 to be 17,842,410 persons and 7,540,303 persons, respectively.⁴ That is, approximately 70% of the total employed worker will be engaged in the agriculture sector whereas about 30% of them will be engaged in the nonagriculture sector.

The proportion of agricultural population to nonagricultural population is assumed to be the same as the proportion of agricultural employment to nonagricultural employment. As a result, in 1986, approximately 36,969,412 persons will be classified as agricultural population, P_A , while 15,844,035 persons will be classified as

¹Yearly Bulletin of Statistics (Bangkok, 1981), p. 4.

²Outline of the Fifth National Economic and Social Development Plan (1982-1986) (Bangkok, 1981), p. 22, and Table A3.

³Ibid.

⁴Direk Patmasiriwat, Industrial Growth and Employment (Bangkok,

nonagricultural population, P_{NA} .

In 1975, about 73% of the total employment was accounted for by the agriculture sector.⁵ The total population, P , in 1975 was 42,391,454 persons.⁶ Consequently, P_A in 1975 was about 30,945,761 persons and P_{NA} in the same year was about 11,445,693 persons.

Since this study is comparative static, the averages of the agricultural population, the nonagricultural population, as well as that of the total population, between 1975 and 1986, will be used. The averages of P_A , P_{NA} , and P are calculated to be 33,957,586 persons, 13,644,864 persons, and 47,602,450 persons, respectively.

1980,) Table A.1

⁵Ibid.

⁶Ibid.

APPENDIX F

CONSTANT PARAMETERS

TABLE XXXIII
CONSTANT PARAMETERS

Sector	C_1	c_1	E_1	e_1	G_1	g_1
1	34,527.197	.13503	6,545.954	.11879	80.795	.00228
2	184.512	.00072	730.659	.01326	10.784	.00030
3	9,876.102	.03862	126.717	.00230	48.197	.00136
4	8,546.727	.03343	2,221.766	.04032	27.882	.00079
5	24,909.733	.09742	9,934.016	.18028	83.343	.00236
6	2,244.096	.00878	5,232.061	.09495	4.881	.00014
7	5,847.471	.02287	160.339	.00291	21.031	.00059
8	48.317	.00019	3.599	.00006	-	-
9	4,477.585	.01751	67.207	.00122	-	-
10	6,796.536	.02658	546.339	.00991	-	-
11	1,884.133	.00737	1,136.652	.02063	104.932	.00297
12	12,974.243	.05074	1,553.372	.02819	507.572	.01435
13	883.865	.00346	154.938	.00281	350.456	.00991
14	1,089.898	.00426	36.426	.00066	257.794	.00729
15	82.044	.00032	32.463	.00059	73.325	.00207
16	109.443	.00043	4.686	.00008	8.023	.00023
17	5,879.027	.02299	245.561	.00446	253.737	.00717
18	1,597.632	.00625	780.200	.01416	1,000.396	.02829
19	847.049	.00331	2,506.503	.04549	72.365	.00205
20	1,165.172	.00456	133.716	.00243	63.562	.00180
21	24.271	.00009	399.444	.00725	32.041	.00091
22	586.035	.00229	118.605	.00215	50.313	.00142
23	2.760	.00001	99.858	.00181	5.423	.00015
24	105.260	.00041	2,348.817	.04263	1.387	.00004
25	698.712	.00273	238.720	.00433	25.954	.00073
26	15.532	.00006	248.057	.00450	92.748	.00262
27	2,264.620	.00886	572.218	.01038	62.839	.00178
28	6,377.967	.02494	713.301	.01294	981.809	.02776
29	50.303	.00020	19.438	.00035	75.920	.00215
30	1,180.998	.00462	163.997	.00298	103.280	.00292
31	1,517.557	.00594	1,367.743	.02482	251.579	.00711
32	3,765.991	.01473	1,394.483	.02531	107.007	.00302
33	2,120.161	.00829	95.922	.00174	192.600	.00545
34	1,294.500	.00506	-	-	430.399	.01217
35	37,949.993	.14842	6,309.789	.11451	890.380	.02518
36	15,721.592	.06148	4,188.569	.07601	1,338.556	.03785
37	57,705.106	.22567	4,231.357	.07679	27,626.592	.78117
38	348.097	.00136	440.713	.00800	127.884	.00362
Total	255,700.237	1.0	55,104.205	1.0	35,365.786	1.0

TABLE XXXIII (Continued)

Sector	I_1	r_1	V_1	X_1	v_1
1	2,664.841	.03264	84,251.667	106,663.013	.790
2	1,442.932	.01767	5,222.086	6,291.833	.830
3	-	-	1,559.952	11,848.605	.132
4	114.537	.00140	4,918.628	11,258.901	.437
5	1,872.601	.02294	8,651.438	43,154.700	.200
6	119.231	.00146	2,769.268	8,662.350	.320
7	40.658	.00050	3,732.825	7,950.869	.469
8	216.167	.00265	1,395.300	4,433.851	.315
9	315.071	.00386	5,638.876	8,335.692	.676
10	.073	.00000	3,786.040	8,022.711	.472
11	321.870	.00394	4,689.228	15,504.027	.302
12	544.110	.00667	6,632.649	18,265.166	.363
13	29.517	.00036	1,578.350	4,194.045	.376
14	6.217	.00008	826.474	2,129.741	.388
15	-	-	903.028	2,570.901	.351
16	164.106	.00201	213.176	745.237	.286
17	572.417	.00701	2,520.529	6,620.507	.381
18	323.421	.00396	4,149.291	16,839.197	.246
19	264.215	.00324	2,289.867	6,016.858	.380
20	60.008	.00074	1,281.598	2,455.638	.522
21	34.997	.00043	1,165.239	3,044.446	.383
22	225.616	.00276	1,106.125	2,640.828	.419
23	232.873	.00285	2,103.051	6,497.678	.324
24	269.660	.00330	928.629	4,153.327	.223
25	2,125.083	.02603	1,489.158	4,213.027	.353
26	9,772.985	.11970	1,440.047	4,285.028	.336
27	4,384.756	.05371	1,599.151	4,833.810	.331
28	6,260.658	.07668	3,959.984	14,288.053	.277
29	2,613.388	.03201	428.903	1,495.168	.287
30	69.650	.00085	832.073	2,208.444	.377
31	950.752	.01165	3,507.739	8,611.023	.407
32	1,334.987	.01635	3,001.647	5,508.740	.545
33	-	-	3,267.996	7,608.381	.429
34	36,682.858	.44931	15,384.590	41,788.009	.368
35	6,547.421	.08020	65,276.630	78,646.579	.830
36	1,051.095	.01287	17,754.685	32,543.883	.545
37	13.541	.00017	78,200.483	104,130.821	.751
38	-	-	-	3,338.493	-
Total	81,642.312	1.0	348,456.400	621,799.580	.560

APPENDIX G

DISAGGREGATED INPUT-OUTPUT COEFFICIENTS

TABLE XXXIV

DISAGGREGATE INPUT-OUTPUT COEFFICIENTS

	x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11	x12	x13
x1	.05243	.00407	.72187	.25180	.72059	.52900	.11394	.14451	.00566	.21117	.12405	.02935	.00998
x2	.0	.0	.0	.00249	.0	.0	.00384	.00043	.00072	.0	.00010	.0	.00234
x3	.0	.0	.0	.02582	.0	.0	.00326	.0	.0	.0	.0	.0	.0
x4	.0	.0	.0	.04830	.0	.0	.00730	.06109	.00019	.0	.0	.0	.0
x5	.01477	.0	.0	.01038	.00716	.0	.13318	.33141	.05835	.0	.0	.0	.00271
x6	.0	.0	.0	.01295	.0	.01326	.04158	.0	.03100	.0	.0	.0	.00955
x7	.00312	.0	.00004	.00689	.0	.0	.01059	.0	.00349	.0	.0	.0	.0
x8	.03948	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
x9	.0	.0	.0	.00003	.00087	.00013	.00013	.00006	.03284	.00001	.0	.0	.0
x10	.0	.0	.0	.00001	.00001	.00003	.00004	.00002	.00002	.22265	.0	.0	.0
x11	.0	.0	.0	.0	.00006	.00009	.0	.0	.0	.00214	.34291	.40524	.00169
x12	.00211	.00066	.00009	.00014	.00810	.00577	.00026	.00910	.00070	.00016	.00790	.04459	.00272
x13	.00003	.00007	.00002	.00100	.00005	.0	.00230	.00289	.00499	.01127	.00130	.00394	.31826
x14	.00001	.00062	.00004	.00117	.00003	.00051	.00180	.00039	.00299	.00205	.00068	.00087	.01139
x15	.00024	.00602	.00003	.00430	.0	.00097	.01998	.0	.02925	.00498	.08252	.00977	.03010
x16	.02052	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
x17	.00102	.00042	.00009	.00035	.00002	.00550	.00048	.01124	.00189	.00004	.00862	.01101	.03331
x18	.01729	.04892	.00138	.00603	.00236	.00365	.00823	.00442	.00597	.00488	.02013	.01066	.02000
x19	.00003	.0	.0	.00006	.0	.0	.0	.0	.0	.0	.00037	.00248	.0
x20	.00100	.00035	.00012	.00411	.00032	.00039	.00497	.00148	.00162	.00045	.00077	.00155	.00284
x21	.00028	.00005	.0	.0	.0	.0	.0	.0	.00002	.0	.0	.0	.0
x22	.00042	.00032	.00001	.00208	.0	.0	.00129	.00009	.02657	.00004	.00002	.0	.0
x23	.00020	.00131	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
x24	.00001	.0	.0	.00142	.00001	.0	.00027	.0	.0	.00022	.0	.0	.0
x25	.00421	.00440	.00092	.02727	.00068	.00037	.00246	.00028	.00100	.00037	.00033	.00226	.00034
x26	.00393	.01164	.00032	.00334	.00141	.00237	.00191	.00134	.01910	.00187	.00648	.00332	.00891
x27	.00016	.00181	.0	.00023	.00027	.0	.00043	.00001	.00004	.00001	.00003	.00019	.0
x28	.00130	.01837	.00041	.00143	.00064	.00093	.00217	.00043	.00101	.00048	.00135	.00291	.00826
x29	.00038	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
x30	.0	.0	.0	.0	.0	.0	.0	.00004	.00028	.0	.00041	.00044	.0
x31	.00248	.00057	.00021	.00102	.00017	.00005	.00121	.00016	.00047	.00010	.00142	.00062	.00722
x32	.00010	.00003	.00028	.00020	.00022	.00018	.00015	.00021	.00016	.00022	.00031	.00038	.00018
x33	.00057	.00108	.00104	.00301	.00569	.00765	.02737	.00635	.01653	.00293	.01944	.01330	.03321
x34	.00222	.00807	.00056	.00104	.00623	.00234	.00249	.00227	.00461	.00196	.00354	.00534	.00584
x35	.01990	.00914	.11149	.11076	.02974	.07761	.09652	.07786	.02476	.04513	.05016	.05978	.07557
x36	.00838	.01904	.02785	.01852	.00877	.01571	.01534	.02132	.01212	.00433	.00827	.00763	.01687
x37	.01139	.02089	.00157	.01442	.00594	.01254	.01674	.00726	.02933	.00875	.01541	.02005	.01467
x38	.00214	.01218	.00002	.00258	.00020	.00129	.01031	.00065	.00786	.00189	.00104	.00119	.00772

TABLE XXXIV (Continued)

	x14	x15	x16	x17	x18	x19	x20	x21	x22	x23	x24	x25	x26
x1	.0	.0	.00010	.02065	.0	.27311	.0	.0	.01292	.00010	.00001	.00121	.0
x2	.0	.12927	.02287	.00944	.64520	.00030	.0	.08447	.13486	.00677	.54070	.00005	.0
x3	.0	.0	.0	.00033	.0	.0	.0	.0	.0	.0	.0	.0	.0
x4	.0	.0	.0	.01156	.00104	.0	.0	.0	.0	.0	.0	.0	.0
x5	.0	.0	.0	.00001	.0	.0	.0	.0	.00081	.0	.0	.0	.0
x6	.0	.0	.0	.01161	.0	.0	.0	.0	.0	.0	.0	.0	.0
x7	.0	.0	.0	.00262	.0	.0	.0	.0	.0	.0	.0	.0	.0
x8	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
x9	.0	.0	.0	.00010	.0	.0	.0	.0	.0	.0	.0	.0	.0
x10	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
x11	.01149	.01046	.00369	.00115	.00034	.06642	.00206	.00549	.0	.0	.0	.00026	.0
x12	.00219	.00498	.00514	.00425	.00032	.00873	.00248	.00860	.00482	.00036	.0	.00061	.00135
x13	.23268	.00281	.05109	.02402	.0	.00187	.00415	.02129	.00783	.00372	.0	.00148	.0
x14	.00683	.0	.00430	.00150	.00033	.0	.00050	.00078	.0	.00006	.00015	.00018	.00013
x15	.01170	.17844	.16013	.20665	.00798	.04900	.30799	.00638	.09132	.02895	.00104	.00653	.01079
x16	.0	.0	.22225	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
x17	.06083	.00519	.00682	.08083	.00080	.00892	.00292	.00003	.00241	.00011	.00003	.00953	.00229
x18	.01952	.03960	.02106	.01240	.03368	.02095	.01316	.13963	.05797	.02092	.01419	.00858	.01519
x19	.00541	.00057	.0	.00154	.0	.07068	.00117	.0	.00029	.00047	.00055	.00134	.00732
x20	.01176	.01055	.01919	.01738	.00083	.00171	.01153	.00174	.00172	.00036	.00076	.00534	.00520
x21	.0	.0	.0	.0	.0	.0	.0	.05549	.01575	.0	.0	.00062	.0
x22	.0	.00941	.00203	.01803	.00003	.0	.00069	.00033	.01774	.0	.0	.00098	.00494
x23	.0	.0	.0	.0	.0	.0	.0	.02962	.00813	.49601	.0	.29033	.08882
x24	.00101	.00067	.0	.00038	.00043	.0	.00526	.0	.0	.00017	.11931	.15431	.01918
x25	.00991	.00063	.00004	.00444	.00335	.00343	.00263	.0	.00087	.00024	.00003	.03382	.00643
x26	.01701	.00504	.00220	.00226	.00233	.00286	.00171	.02713	.02617	.01679	.00825	.00433	.28207
x27	.00011	.0	.0	.00001	.0	.00069	.00572	.0	.00160	.00131	.0	.00164	.01914
x28	.00954	.01061	.00260	.00407	.00432	.00312	.00298	.00883	.00667	.00261	.00204	.00330	.00374
x29	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
x30	.00148	.0	.0	.00002	.0	.00047	.0	.00120	.00148	.00015	.0	.00060	.0
x31	.00049	.00019	.0	.00370	.0	.00129	.00186	.00248	.00562	.00243	.0	.00541	.00049
x32	.00002	.00113	.00017	.00257	.00055	.00032	.00005	.00016	.00015	.00016	.00014	.00026	.00100
x33	.01684	.05199	.02992	.01377	.02056	.00730	.00701	.03696	.01179	.03720	.02220	.01054	.00963
x34	.03103	.01739	.01024	.01018	.00268	.00425	.00379	.00999	.01286	.00462	.00194	.00240	.00502
x35	.07461	.05520	.10548	.06859	.00436	.06932	.07358	.07152	.05239	.02271	.04561	.07305	.13710
x36	.02964	.02117	.01481	.02257	.00418	.01225	.01040	.05187	.05602	.01549	.01022	.01191	.02636
x37	.03018	.06682	.02712	.05791	.01660	.01158	.00970	.03610	.03308	.01309	.00926	.00804	.01292
x38	.02767	.02662	.00189	.00466	.00368	.00087	.00677	.01729	.01590	.00154	.0	.00990	.00483

TABLE XXXIV (Continued)

	x27	x28	x29	x30	x31	x32	x33	x34	x35	x36	x37	x38
x1	.0	.0	.00023	.01038	.29292	.01889	.0	.00689	.00003	.00045	.01756	.09275
x2	.00001	.00016	.0	.00169	.0	.01093	.00311	.04967	.0	.0	.00006	.00346
x3	.0	.0	.0	.08504	.0	.03323	.0	.0	.0	.00004	.01043	.00798
x4	.0	.0	.0	.0	.0	.0	.0	.0	.0	.00010	.00589	.00467
x5	.0	.0	.0	.00226	.00001	.0	.0	.0	.0	.00023	.00682	.19261
x6	.0	.0	.0	.0	.0	.0	.0	.0	.00001	.00001	.00086	.00336
x7	.0	.0	.0	.0	.0	.0	.0	.0	.00269	.00066	.01378	.02945
x8	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.00005	.00676
x9	.0	.0	.0	.0	.0	.0	.0	.0	.00008	.00135	.03296	.00641
x10	.0	.0	.0	.0	.0	.0	.0	.0	.00001	.00003	.0	.00003
x11	.00319	.00255	.00232	.12063	.00267	.02781	.0	.00007	.00021	.0	.00046	.06062
x12	.00466	.00320	.00528	.01397	.00283	.01171	.00131	.00087	.00709	.01023	.00535	.02985
x13	.00628	.00019	.0	.0	.00146	.01759	.0	.00278	.01283	.00150	.00282	.02001
x14	.00212	.00027	.00393	.0	.0	.00030	.00046	.00016	.00075	.00322	.00630	.00049
x15	.02584	.00530	.00882	.03088	.01399	.00608	.02160	.00245	.0	.00002	.00102	.00907
x16	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.00002	.00178
x17	.00354	.00804	.01277	.01669	.01538	.00341	.00044	.01286	.00117	.00103	.00828	.00864
x18	.01463	.01362	.01802	.00848	.01175	.00524	.30416	.01991	.00419	.20542	.00469	.02774
x19	.00695	.11771	.00395	.00371	.00520	.01076	.00016	.00026	.00030	.00549	.00052	.00160
x20	.02100	.00526	.00635	.00734	.00199	.00386	.00120	.00381	.00373	.00084	.00188	.00021
x21	.0	.0	.0	.00011	.0	.0	.00076	.05507	.0	.00001	.00002	.00122
x22	.02190	.00857	.00046	.0	.00148	.00917	.00005	.03407	.00109	.00039	.00224	.00795
x23	.05333	.04941	.06418	.0	.00039	.00949	.0	.10873	.00003	.00004	.00013	.00495
x24	.06221	.01844	.01426	.0	.0	.08368	.00054	.01236	.0	.0	.00035	.00416
x25	.03507	.00516	.00912	.00754	.00325	.00481	.00181	.04717	.00267	.00063	.00316	.02073
x26	.01194	.08214	.06345	.00275	.00510	.00296	.03482	.01785	.00006	.00106	.00026	.00595
x27	.20022	.04031	.02007	.00040	.00020	.00306	.02887	.02037	.00141	.00141	.00555	.00870
x28	.00569	.23359	.01208	.00520	.00988	.00126	.00129	.00531	.00195	.06322	.00122	.02922
x29	.0	.0	.23976	.0	.0	.0	.0	.00017	.0	.01774	.0	.00004
x30	.00032	.00089	.00116	.19277	.00172	.00120	.00020	.00003	.00303	.00019	.00031	.00403
x31	.00799	.00484	.05354	.0	.09129	.01675	.00045	.05965	.00525	.00011	.00214	.00235
x32	.00097	.00283	.00158	.00053	.00055	.05891	.00008	.00003	.00143	.00014	.00267	.02228
x33	.01495	.00991	.00539	.01362	.01634	.00414	.05285	.00414	.00361	.00603	.00804	.03816
x34	.00559	.00246	.00380	.00451	.00499	.00279	.00396	.00028	.00353	.00507	.01400	.01393
x35	.10115	.07599	.10556	.06202	.06615	.07200	.06759	.07816	.01151	.04670	.03772	.09463
x36	.02476	.01919	.02079	.00951	.02203	.00991	.01669	.06272	.01450	.03824	.01098	.04178
x37	.03140	.00743	.01471	.01786	.01489	.01131	.02262	.02179	.07240	.03320	.03628	.16249
x38	.00365	.00540	.02157	.00538	.00620	.01387	.00565	.00421	.01447	.00967	.00419	.0

APPENDIX H

IMPORT SUBSTITUTION POLICY PARAMETERS

The import substitution policy parameters consist of proportion of imports in the i th sector used to satisfy different kinds of demands. In particular, they are $\theta_i^{\text{Int}} (= M_i^{\text{Int}} / \sum_j a_{ij} X_j)$, $\theta_i^{\text{C}} (= M_i^{\text{C}} / C_i)$, $\theta_i^{\text{I}} (= M_i^{\text{I}} / I_i)$, $\theta_i^{\text{G}} (= M_i^{\text{G}} / G_i)$, and $\theta_i^{\text{E}} (= M_i^{\text{E}} / E_i)$. If the export promotion policy is merely considered, these values for the year 1975, which are derived from the input-output table, will be employed. On the other hand, if the import substitution policy is solely examined, they will be deflated according to the target level indicated in the Fourth and the Fifth Plans. If both policies are evaluated simultaneously, the parameters will be exactly the same as those assigned for the import substitution policy.

Int
Import Substitution Policy Parameters (θ_i^{Int})

Approximately 40% of intermediate goods imports, M^{Int} , are fuel and lubricants which have the target growth rate of 14%. The rest are other intermediate goods imports which are expected to grow at the rate of 18.1% during the Fifth Plan. Consequently, 16.46% [= 14(.4) + 18.1(.6)] will be the target growth rate assigned for intermediate goods imports. Given M^{Int} in 1975 of 45,115.237 millions baht, M^{Int} in 1986 is estimated to be 241,139.39347 millions baht (see Appendix C).

Assuming that total intermediate product, X^{Int} , grows at the same rate as the GDP, then X^{Int} in 1986 will be 1,466,538.34082 millions baht, provided that X^{Int} in 1975 was 273,343.180 millions baht and the target growth rate of the GDP during the Fifth Plan is 16.5%.¹

¹Input-Output Table of Thailand For Analytical Uses, 1975 (Tokyo, 1981), Tables 4.2 and 4.6.

Consequently, the proportion of total imports used to satisfy intermediate transaction to total intermediate demand, θ ($= \frac{M_{Int}}{X_{Int}}$) in 1986 will be .164427 ($= 241,139.39347/1,466,538.34082$). While θ in 1975 was .165049, from 1975 to 1986, θ reduces .38%. Therefore, θ (1986) will be 99.62% of θ (1975). The estimate of θ_i for each policy are listed in Table XXXV.

TABLE XXXV
IMPORT SUBSTITUTION POLICY PARAMETERS (θ)

Sector	Int M_i (1)	$\sum_j a_{ij} X_j$ (2)	Int θ_i	
			Export Policy (3)	Import Policy (4)
1	2,237.524	65,387.035	.03422	.03409
2	11,263.437	16,442.635	.68501	.68241
3	5.486	1,803.621	.00304	.00303
4	456.286	1,601.019	.28500	.28392
5	18.322	6,395.625	.00286	.00285
6	4.579	1,068.235	.00429	.00427
7	79.791	2,308.010	.03457	.03444
8	30.000	4,238.673	.00708	.00705
9	293.961	3,818.045	.07699	.07670
10	1,092.706	1,789.529	.61061	.60829
11	1,447.692	14,003.685	.10338	.10299
12	482.972	3,581.398	.13486	.13435
13	1,275.726	4,120.584	.30960	.30842
14	91.260	1,047.938	.08709	.08676
15	4,193.525	6,670.276	.62829	.62630
16	1,839.899	2,361.409	.77915	.77619
17	1,601.775	3,420.308	.46831	.46653
18	2,036.849	16,158.286	.12606	.12558
19	178.745	2,656.968	.06727	.06701
20	319.923	1,508.504	.21208	.21127
21	3.374	2,557.091	.00132	.00131
22	632.096	2,597.680	.24333	.24241
23	4,301.765	10,660.226	.40353	.40200
24	1,198.704	2,894.655	.41411	.41254

TABLE XXXV (Continued)

Sector	Int M_i (1)	$\sum_j a_{ij} X_j$ (2)	Int θ_i	
			Export Policy (3)	Import Policy (4)
25	2,053.620	4,158.817	.49380	.49192
26	2,005.499	5,147.762	.38959	.38811
27	1,511.624	3,597.412	.42020	.41860
28	2,428.956	6,978.630	.34806	.34674
29	410.051	983.982	.41673	.41515
30	36.901	790.196	.04670	.04652
31	122.746	4,679.006	.02623	.02613
32	312.218	933.582	.33443	.33316
33	.259	5,204.967	.00005	.00005
34	-	3,380.252	-	-
35	-	26,948.996	-	-
36	4.373	10,922.893	.00040	.00040
37	300.887	17,147.553	.01755	.01748
38	841.706	3,377.697	.24920	.24825
Total	45,115.237	273,343.180	.165049	.164427

- Notes: 1. (3) = (1)/(2)
 2. (4) = 99.62% of (3)
 3. Values are in millions of baht.

Source: Input-Output Table of Thailand for Analytical Uses, 1975
 (Tokyo, 1981), Tables 4.2, 4.6, 5.7, and 5.9.

C
 Import Substitution Policy Parameters (θ_i)

C

The total imports for private consumption, M , is assumed to increase at the rate of 5.7% per year. This is the target rate indicated in the Fourth Plan. M in 1986 is forecasted to be 19,971.697 millions baht, given M in 1975 of 10,854.007 millions baht (see Appendix C). A macro model developed by the National Economic and Social Development Board predicts the value of total private

consumption expenditures, C , in 1986 of 1,039,194 millions baht.² Therefore, the proportion of total imports used to satisfy private consumption demand to total private consumption, $\theta^C (= M^C / C)$, in 1986 is estimated to be .019218 ($= 19,971.697 / 1,039,194$). θ^C in 1975 was .042448. Then, it will be decreased by 54.73%. θ^C in 1986 will be 45.27% of θ^C in 1975. The calculation of θ_i^C for the export promotion policy and the import substitution policy are presented in Table XXXVI.

TABLE XXXVI
IMPORT SUBSTITUTION POLICY PARAMETERS (θ^C)

Sector	C		θ_i^C	
	M_i (1)	C_i (2)	Export Policy (3)	Import Policy (4)
1	185.530	34,527.197	.00537	.00243
2	2.105	184.512	.01141	.00517
3	.546	9,876.102	.00006	.00003
4	757.088	8,546.727	.08858	.04010
5	22.296	24,909.733	.00090	.00041
6	1.558	2,244.096	.00069	.00031
7	342.692	5,847.471	.05861	.02653
8	31.034	48.317	.64230	.29077
9	20.616	4,477.585	.00460	.00208
10	11.391	6,796.536	.00168	.00076
11	354.459	884.133	.18813	.08517
12	270.649	12,974.243	.02086	.00944
13	60.749	883.865	.06873	.03111
14	100.003	1,089.898	.09175	.04154
15	51.803	82.044	.63141	.28584
16	8.938	109.443	.08167	.03697
17	1,754.187	5,879.027	.29838	.13508

²Virabongsa Ramangkura et al., Thailand: Long - Term Prospect for Economic Development 1980-90 (Bangkok, 1981), p. 19(APX).

TABLE XXXVI (Continued)

Sector	θ_i			
	C M_i (1)	C_i (2)	Export Policy (3)	Import Policy (4)
18	818.243	1,597.632	.51216	.23185
19	87.564	847.049	.10338	.04680
20	139.330	1,165.172	.11958	.05413
21	.024	24.271	.00099	.00045
22	253.282	586.035	.43220	.19566
23	.566	2.760	.20507	.09284
24	91.131	105.260	.86577	.39193
25	215.514	698.712	.30844	.13963
26	5.222	15.532	.33621	.15220
27	965.215	2,264.620	.42621	.19295
28	785.140	6,377.967	.12310	.05573
29	-	50.303	-	-
30	43.069	1,180.998	.03647	.01651
31	16.949	1,517.557	.01117	.00506
32	1,069.384	3,765.991	.28396	.12855
33	5.010	2,120.161	.00236	.00107
34	-	1,294.500	-	-
35	-	37,949.993	-	-
36	525.642	15,721.592	.03343	.01513
37	1,778.161	57,705.106	.03081	.01395
38	78.917	348.097	.22671	.10263
Total	10,854.007	255,700.237	.04245	.01922

- Notes: 1. (3) = (1)/(2)
 2. (4) = 45.27% of (3)
 3. Values are in millions of baht.

Source: Input-Output Table of Thailand for Analytical Uses, 1975
 (Tokyo, 1981), Tables 4.2, 4.6, 5.7, and 5.9.

I
 Import Substitution Policy Parameters (θ_i)

I

The total imports used for satisfying investment demand, M , is supposed to grow at 18.1%, which is the target growth rate of the Fifth

Plan. Given M^I in 1975 of 21,488.194 millions baht, M^I in 1986 is calculated to be 133,951.873 millions baht (see Appendix C). The macro model projects the value of investment, I , in 1986 of about 578,137 millions baht.³ As a result, the proportion of total imports used to satisfy investment demand to total investment demand, $\theta^I (= M^I / I)$, in 1986 will be .231695 (= 133,951.873/578,137), which is 88.03% of θ^I in 1975. The values of θ_i^I for both policies are shown in Table XXXVII.

TABLE XXXVII
IMPORT SUBSTITUTION POLICY PARAMETERS (θ^I)

Sector	M_i^I (1)	I_i (2)	Export Policy (3)	θ_i^I Import Policy (4)
1	114.405	2,664.841	.04293	.03779
2	1,254.147	1,442.932	.86917	.76513
3	-	-	-	-
4	6.413	114.537	.05599	.04929
5	-	1,872.601	-	-
6	-	724.849	-	-
7	.571	40.658	.01404	.01236
8	11.871	216.167	.05492	.04834
9	1.342	315.071	.00426	.00375
10	-	.073	-	-
11	145.094	321.870	-	-
12	137.010	544.110	.25181	.22166
13	.489	29.517	.01657	.01458
14	5.347	6.217	.86006	.75711
15	-	-	-	-
16	51.103	164.106	.31140	.27413
17	218.577	572.417	.38185	.33614

³Ibid.

TABLE XXXVII (Continued)

Sector	I			
	M_i (1)	I_i (2)	Export Policy (3)	θ_i Import Policy (4)
18	29.543	323.421	.09135	.08041
19	53.518	264.215	.20256	.17831
20	8.543	60.008	.14236	.12532
21	-	34.997	-	-
22	48.640	225.616	.21559	.18978
23	201.131	232.873	.86369	.76031
24	97.728	269.660	.36241	.31903
25	745.906	2,125.083	.35100	.30899
26	8,888.304	9,772.985	.90948	.80061
27	3,556.785	4,384.756	.81117	.71407
28	3,671.207	6,260.658	.58639	.51620
29	1,815.655	2,613.388	.69475	.61159
30	5.301	69.650	.07611	.06700
31	13.447	950.752	.01414	.01245
32	406.117	1,334.987	.30421	.26780
33	-	-	-	-
34	-	36,682.858	-	-
35	-	6,547.421	-	-
36	-	1,051.095	-	-
37	-	13.541	-	-
38	-	-	-	-
Total	21,488.194	81,642.312	.26320	.23170

- Notes: 1. (3) = (1)/(2)
 2. (4) = 88.03% of (3)
 3. Values are in millions of baht.

Source: Input-Output Table of Thailand for Analytical Uses, 1975
 (Tokyo, 1981), Tables 4.2, 4.6, 5.7, and 5.9.

G
 Import Substitution Policy Parameters (θ_i)

In the Fourth Plan, the target growth rate of total imports used to satisfy public consumption is 5.7%. This rate is assumed to

continue to the Fifth Plan. The value of this import, M^G , is expected to be 1,767.982 millions baht in 1986, given that M^G in 1975 equals to 960.844 millions baht (see Appendix C).

The Thai government aims to increase public consumption expenditures, G , by 20.2% per year during the Fifth Plan. Consequently, the value of G in 1986 will be 218,813.673 millions baht, provided that the budget for the year 1982 is 104,823 millions baht.⁴ In 1986, the proportion of total imports used to satisfy public consumption to total government consumption expenditures, θ^G ($= M^G / G$), will be .008079 ($= 1,767.982 / 218,813.673$), which is 29.73% of θ^G in 1975. Table XXXVIII presents the values of θ_i^G .

TABLE XXXVIII
IMPORT SUBSTITUTION POLICY PARAMETERS (θ^G)

Sector	M_i^G (1)	G_i^G (2)	θ_i^G	
			Export Policy (3)	Import Policy (4)
1	.637	80.795	.00778	.00234
2	-	10.784	-	-
3	-	48.197	-	-
4	-	27.882	-	-
5	-	83.343	-	-
6	-	4.881	-	-
7	.095	21.031	.00452	.00134
8	-	-	-	-
9	-	-	-	-

⁴Ibid., p. 34(Annex), and p. 5(APX).

TABLE XXXVIII (Continued)

Sector	G		$\frac{G}{\theta_i}$	
	M_i (1)	G_i (2)	Export Policy (3)	Import Policy (4)
10	-	-	-	-
11	-	104.932	-	-
12	2.909	507.572	.00573	.00170
13	5.346	350.456	.01525	.00453
14	77.285	257.794	.29979	.08913
15	39.131	73.325	.53367	.15866
16	2.451	8.023	.30550	.09083
17	105.240	253.737	.41476	.12331
18	136.103	1,000.396	.13605	.04045
19	8.147	72.365	.11258	.03347
20	3.860	63.562	.06073	.01806
21	-	32.041	-	-
22	1.840	50.313	.03657	.01087
23	-	5.423	-	-
24	.450	1.387	.32444	.09646
25	8.298	25.954	.31972	.09505
26	30.885	92.784	.33300	.09900
27	14.411	62.839	.22933	.06818
28	-	981.809	-	-
29	22.157	75.920	.29185	.08677
30	2.080	103.280	.02014	.00599
31	-	251.579	-	-
32	77.052	107.007	.72007	.21408
33	-	192.600	-	-
34	-	430.399	-	-
35	-	890.380	-	-
36	48.915	1,338.556	.03654	.01086
37	338.277	27,626.592	.01224	.00364
28	35.275	127.884	.27584	.08201
Total	960.844	35,365.786	.02717	.00808

- Notes: 1. (3) = (1)/(2)
 2. (4) = 29.73% of (3)
 3. Values are in millions of baht.

Source: Input-Output Table of Thailand for Analytical Uses, 1975
 (Tokyo, 1981), Tables 4.2, 4.6, 5.7, and 5.9.

E
Import Substitution Policy Parameters (θ_i)

Since the exports from Thailand are made mainly of agricultural products, and consumption goods, the growth rate of import requirement for exports is assumed to grow at the same rate as consumption goods imports. This rate is assumed to be 5.7%. Therefore, import requirement for export, M^E , in 1986 will be 1,725.687 millions baht, given M^E in 1975 of 937.858 millions baht (see Appendix C).

The macro model forecasts the value of total exports, E , in 1986 of about 559,926 millions baht.⁵ Consequently, the proportion of import requirement for export to total exports, $\theta^E (= M^E / E)$, for the year 1986 is estimated to be .003081 ($= 1,725.687 / 559,926$), which is 18.1% of θ^E in 1975. The estimation of θ_i^E is shown in Table XXXIX.

TABLE XXXIX
E
IMPORT SUBSTITUTION POLICY PARAMETERS (θ_i)

Sector	M_i^E (1)	E_i (2)	θ_i^E Export Policy (3)	Import Policy (4)
1	4.713	6,545.954	.00072	.00013
2	-	730.659	-	-
3	-	126.717	-	-
4	33.243	2,221.766	.01496	.00271
5	-	9,934.016	-	-
6	.017	5,232.061	-	-

⁴Ibid.

TABLE XXXIX (Continued)

Sector	θ_i^E			
	E M_i (1)	E_i (2)	Export Policy (3)	Import Policy (4)
7	3.491	160.339	.02177	.00394
8	-	3.599	-	-
9	26.297	67.207	.39128	.07082
10	5.669	546.339	.01038	.00188
11	-	1,136.652	-	-
12	1.989	1,553.372	.00128	.00023
13	3.005	154.938	.01940	.00351
14	34.637	36.426	.95089	.17211
15	2.748	32.463	.08465	.01532
16	.039	4.686	.00832	.00151
17	70.764	245.561	.28817	.05216
18	-	780.200	-	-
19	2.268	2,506.503	.00091	.00016
20	3.668	133.716	.02743	.00497
21	-	399.444	-	-
22	1.563	118.605	.01318	.00239
23	-	99.858	-	-
24	78.439	2,348.817	.03340	.00604
25	10.921	238.720	.04575	.00828
26	62.146	248.057	.25053	.04535
27	-	572.218	-	-
28	139.009	713.301	.19488	.03527
29	-	19.438	-	-
30	12.326	163.997	.07516	.01360
31	2.472	1,367.743	.00181	.00033
32	162.539	1,394.483	.11656	.02110
33	-	95.922	-	-
34	-	-	-	-
35	-	6,309.789	-	-
36	99.892	4,188.569	.02385	.00432
37	176.003	4,231.357	.04159	.00753
38	-	-	-	-
Total	937.858	55,104.205	.01702	.00308

- Notes: 1. (3) = (1)/(2)
 2. (4) = 18.1% of (3)
 3. Values are in millions of baht.

Source: Input-Output Table of Thailand for Analytical Uses, 1975
 (Tokyo, 1981), Tables 4.2, 4.6, 5.7, and 5.9.

APPENDIX I

DERIVATION OF THE LINEAR PROGRAMMING TABLEAU

Objective Function

There are three objectives.

1. Minimize income disparity (w_1Z_1)

$$w_1Z_1 = w_1 \left[(-V_1/P_A) + (\sum_{i=2}^{38} V_i/P_{NA}) \right] \quad (1)$$

$$= (w_1v_1X_1/P_A) + (w_1v_2X_2/P_{NA}) + \dots + (w_1v_{38}X_{38}/P_{NA}) \quad (2)$$

where $V_1 = v_1X_1$ and $V_i = v_iX_i$.

2. Minimize balance of trade deficit (w_2Z_2)

$$w_2Z_2 = w_2 \sum_{i=1}^{38} (M_i - E_i) \quad (3)$$

Disaggregate M_i into

$$M_i = M_i^{Int} + M_i^C + M_i^I + M_i^G + M_i^E \quad (4)$$

and let $\theta_i^{Int} = M_i^{Int} / \sum_j a_{ij}X_j$

$$\theta_i^C = M_i^C / C_i$$

$$\theta_i^I = M_i^I / I_i$$

$$\theta_i^G = M_i^G / G_i$$

$$\theta_i^E = M_i^E / E_i$$

$$C_i = c_i (a + b_1v_1X_1 + b_2 \sum_{i=2}^{38} v_iX_i)$$

then, equation (4) can be rewritten as

$$M_i = \theta_i^{Int} \sum_j a_{ij}X_j + \theta_i^C c_i (a + b_1v_1X_1 + b_2 \sum_{i=2}^{38} v_iX_i) + \theta_i^I I_i + \theta_i^G G_i + \theta_i^E E_i.$$

If $i = 1$,

$$\begin{aligned}
 M_1 &= \theta_1^{\text{Int}} (a_{11}X_1 + a_{12}X_2 + \dots + a_{1,38}X_{38}) \\
 &+ \theta_1^{\text{C}} c_1 (a + b_1v_1X_1 + b_2v_2X_2 + \dots + b_{2v38}X_{38}) \\
 &+ \theta_1^{\text{I}} I_1 + \theta_1^{\text{G}} G_1 + \theta_1^{\text{E}} E_1.
 \end{aligned}$$

If $i = 38$,

$$\begin{aligned}
 M_{38} &= \theta_{38}^{\text{Int}} (a_{38,1}X_1 + a_{38,2}X_2 + \dots + a_{38,38}X_{38}) \\
 &+ \theta_{38}^{\text{C}} c_{38} (a + b_1v_1X_1 + b_2v_2X_2 + \dots + b_{2v38}X_{38}) \\
 &+ \theta_{38}^{\text{I}} I_{38} + \theta_{38}^{\text{G}} G_{38} + \theta_{38}^{\text{E}} E_{38}.
 \end{aligned}$$

Consequently, equation (3) can be viewed as follows.

$$\begin{aligned}
 w_2 \sum_{i=1}^{38} (M_i - E_i) &= w_2 \left[\left(\theta_1^{\text{Int}} a_{11} + \dots + \theta_{38}^{\text{Int}} a_{38,1} \right) + \left(\theta_1^{\text{C}} c_1 + \dots \right. \right. \\
 &+ \left. \theta_{38}^{\text{C}} c_{38} \right) b_1 v_1] X_1 + \dots + w_2 \left[\left(\theta_1^{\text{Int}} a_{1,38} + \dots \right. \right. \\
 &+ \left. \theta_{38}^{\text{Int}} a_{38,38} \right) + \left(\theta_1^{\text{C}} c_1 + \dots + \theta_{38}^{\text{C}} c_{38} \right) b_2 v_{38}] X_{38} \\
 &+ w_2 \left(\theta_1^{\text{C}} c_1 + \dots + \theta_{38}^{\text{C}} c_{38} \right) a + w_2 \left(\theta_1^{\text{I}} I_1 + \dots + \theta_{38}^{\text{I}} I_{38} \right) \\
 &+ w_2 \left(\theta_1^{\text{G}} G_1 + \dots + \theta_{38}^{\text{G}} G_{38} \right) + w_2 \left(\theta_1^{\text{E}} - 1 \right) E_1 + \dots \\
 &+ w_2 \left(\theta_{38}^{\text{E}} - 1 \right) E_{38} \tag{5}
 \end{aligned}$$

3. Maximize per capita income ($-w_3Z_3$)

$$\begin{aligned} -w_3Z_3 &= -w_3 \sum_{i=1}^{38} V_i/P \\ &= (-w_3v_1X_1/P) - (w_3v_2X_2/P) - \dots - (w_3v_{38}X_{38}) \end{aligned} \quad (6)$$

These three objectives can be combined and rearranged in a form as shown below.

$$\begin{aligned} & [(-w_1v_1/P_A) + w_2(\theta_1^{Int} a_{11} + \dots + \theta_{38}^{Int} a_{38,1}) + w_2(\theta_1^C c_1 + \dots \\ & + \theta_{38}^C c_{38})b_1v_1 - (w_3v_1/P)]X_1 + \dots + [(w_1v_{38}/P_{NA}) + w_2(\theta_1^{Int} a_{1,38} + \dots \\ & + \theta_{38}^{Int} a_{38,38}) + w_2(\theta_1^C c_1 + \dots + \theta_{38}^C c_{38})b_2v_{38} - (w_3v_{38}/P)]X_{38} \\ & + w_2(\theta_1^E - 1)E_1 + \dots + w_2(\theta_{38}^E - 1)E_{38} \end{aligned}$$

The terms for constant parameter and exogenous variables are dropped from the objective function. They are $\theta_i c_i a_i$, $\theta_i I_i$ and $\theta_i G_i$.

Constraint Sets

There are four sets of constraints in this study.

1. Supply-Demand Balance

$$X_i + M_i > \sum_j a_{ij} X_j + C_i + I_i + G_i + E_i \quad (7)$$

Disaggregate M_i as well as substitute C_i , as in the previous case, then, rearrange (7) in order to get

$$\begin{aligned} (\theta_i^C - 1)c_i a_i + (\theta_i^I - 1)I_i + (\theta_i^G - 1)G_i &> (1 - \theta_i^{Int}) \sum_j a_{ij} X_j - X_i \\ + (1 - \theta_i^C)c_i(b_1v_1X_1 + b_2 \sum_{i=2}^{38} v_i X_i) + (1 - \theta_i^E)E_i \end{aligned} \quad (8)$$

Equation (10) can be written in the matrix notation as

$$\begin{bmatrix} r_{1s1v1} \\ \vdots \\ r_{38s1v1} \end{bmatrix} \begin{bmatrix} X_1 \\ \vdots \\ X_{38} \end{bmatrix} - \begin{bmatrix} r_{1s2v38} \\ \vdots \\ r_{38s2v38} \end{bmatrix} \begin{bmatrix} X_{38} \\ \vdots \\ X_1 \end{bmatrix} \leq \begin{bmatrix} r_{1fmax} \\ \vdots \\ r_{38s2v38} \end{bmatrix} \begin{bmatrix} I_1 \\ \vdots \\ I_{38} \end{bmatrix}$$

3. Limit on Exports

$$E_{imin} \leq E_i \leq E_{imax} \quad (11)$$

can be viewed as

$$\begin{bmatrix} E_{1min} \\ \vdots \\ E_{38min} \end{bmatrix} \leq \begin{bmatrix} E_1 \\ \vdots \\ E_{38} \end{bmatrix} \leq \begin{bmatrix} E_{1max} \\ \vdots \\ E_{38max} \end{bmatrix}$$

4. Foreign Exchange Constraint

$$\sum_{i=1}^{38} (M_i - E_i) \leq F_{max} \quad (12)$$

By using a similar technique, as discussed in the second objective, equation (12) becomes

$$\begin{aligned}
& \overset{\text{Int}}{[(\theta_1 a_{11} + \dots + \theta_{38} a_{38,1}) + (\theta_1 c_1 + \dots + \theta_{38} c_{38}) b_1 v_1] X_1 + \dots +} \\
& \overset{\text{Int}}{[(\theta_1 a_{1,38} + \dots + \theta_{38} a_{38,38}) + (\theta_1 c_1 + \dots + \theta_{38} c_{38}) b_2 v_2] X_{38} +} \\
& \overset{\text{E}}{(\theta_1 - 1) E_1 + \dots + (\theta_{38} - 1) E_{38}} \leq F_{\max} - \overset{\text{I}}{(\theta_1 I_1 + \dots + \theta_{38} I_{38})} - \\
& \overset{\text{G}}{(\theta_1 G_1 + \dots + \theta_{38} G_{38})}
\end{aligned}$$

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

TABLE XL

THE LINEAR PROGRAMMING TABLEAU

	x_1	...	x_{38}	E_1	...	E_{38}	RHS
DS1	$(1 - \theta_1) a_{11} + (1 - \theta_1) c_1 b_1 v_1 - 1$	...	$(1 - \theta_1) a_{1,38} + (1 - \theta_1) c_1 b_2 v_{38}$	$(1 - \theta_1)$	0	0	$(\theta_1 - 1) I_1 + (\theta_1 - 1) G_1$
⋮	⋮	⋮	⋮	0	⋮	0	⋮
DS38	$(1 - \theta_{38}) a_{38,1} + (1 - \theta_{38}) c_{38} b_1 v_1$	...	$(1 - \theta_{38}) a_{38,38} + (1 - \theta_{38}) c_{38} b_2 v_{38} - 1$	0		$(1 - \theta_{38})$	$(\theta_{38} - 1) I_{38} + (\theta_{38} - 1) G_{38}$
IS1	$-r_1 s_1 v_1$	...	$-r_1 s_2 v_{38}$	0		0	$r_1 F_{max} - I_1$
⋮	⋮	⋮	⋮				⋮
IS38	$-r_{38} s_1 v_1$	...	$-r_{38} s_2 v_{38}$	0		0	$r_{38} F_{max} - I_{38}$
EX1L	0			1	0	0	E_{1max}
EX1G	0			1	0	0	E_{1min}
⋮				0	⋮		⋮
EX38L			0			0	
EX38G			0	0		1	E_{38max}
				0		1	E_{38min}
ME	$(\theta_1 a_{11} + \dots + \theta_{38} a_{38,1}) +$ $(\theta_1 c_1 + \dots + \theta_{38} c_{38}) b_1 v_1$	...	$(\theta_1 a_{1,38} + \dots + \theta_{38} a_{38,38}) +$ $(\theta_1 c_1 + \dots + \theta_{38} c_{38}) b_2 v_{38}$	$(\theta_1 - 1)$	...	$(\theta_{38} - 1)$	$F_{max} - (\theta_1 I_1 + \dots + \theta_{38} I_{38})$ $- (\theta_1 G_1 + \dots + \theta_{38} G_{38})$
MULTI	$(-w_1 v_1 / P_A) + w_2 (\theta_1 a_{11} + \dots +$ $\theta_{38} a_{38,1}) + w_2 (\theta_1 c_1 + \dots +$ $\theta_{38} c_{38}) b_1 v_1 - (w_3 v_1 / P)$...	$(w_1 v_{38} / P_{NA}) + w_2 (\theta_1 a_{1,38} + \dots +$ $\theta_{38} a_{38,38}) + w_2 (\theta_1 c_1 + \dots +$ $\theta_{38} c_{38}) b_2 v_{38} - (w_3 v_{38} / P)$	$w_2 (\theta_1 - 1)$...	$w_2 (\theta_{38} - 1)$	

VITA ²

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