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INDUSTRIAL RESTRUCTURING PROJECT

Thailand. INDUSTRIAL PROJECTION .

Final Report.

Prepared by

Atchana Wattananukit,

1 April 1986

THE INDUSTRIAL MANAGEMENT CO., LTD.
BANGKOK,THAILAND

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Atchana Wattananukit

April 1985

INTRODUCTION

The preparation of the Sixth Economic and Social Development Plan (1986-1991) requires a medium to longer term industrial development strategy. In the Fifth plan, medium term projections of industrial growth were made within the framework of a computable general equilibrium model which integrated the aspects of national economic development and the expected transformation process in the industrial sector. This project was named "SIAM project on Macro economic Management of the Thai economy or SIAM II project".

According to the "SIAM II"'s projection for the Fifth Plan, annual industrial output will grow at 7.6 per cent during the period 1982-1986. This projected growth rate was based on an overall macro economic projection of the Thai economy that did not involve any consideration of the optimal structure of the industrial sector itself. In addition, no systematic forecast of the growth of industrial subsectors has been attempted. Industrial restructuring generally implies a move towards a more balanced and efficient industrial growth, it is, therefore, necessary to define the balance growth trajectory of the manufacturing subsectors in the development period between 1985-1991.

In the SIAM II model, the manufacturing activities are divided into five sectors. Apart from fertilizer, pesticide and food processing sector, the rest of manufacturing sector is subdivided into two major categories--light and heavy industries according to their corresponding capital-output ratios. Such divisions are perhaps suitable in treating the manufacturing sector as part of an investigation and forecasting of overall economic development within a general equilibrium process. Howe ver, it may be too broad when a focus is to be on structural changes and projections of the industrial sector itself.

Consequently, this research has three main objectives.

1. To examine structural changes in the industrial sector which have taken place since 1970 and identify this sector in terms of its production pattern, trade activities, location, size and technology.
2. To develop a statistical model for projecting the industrial sector growth and structure during the Sixth Plan (1986-1991).
3. To recommend a specific industrial structure attained by 1986 and 1991 based on the criteria of feasibility and consistency with the development objectives.

This report consists of seven chapters. The first chapter is the introduction providing the overall objective.

Chapter 2 identifies and analyses the trends in industrial growth, industrial structure, manufacturing, trade and employment. The analysis is intended to serve as a basis for understanding the nature and direction of recent structural changes in the Thai manufacturing sector and to pro ıde a global perspective for projecting industrial growth throughout the Sixth plan. Chapter 3 is devoted to a presentation of a methodology for industrial projection. Chapter 4 and 5 discuss empirical results of final demand projections. Chapter 6 presents a discussion of the empirical results for industrial projection. Finally, the policy implications and recommendations are presented in Chapter 7.

MANUFACTURING SECTOR IN THAILAND

Although Thailand is still an agricultural-based economy where agriculture plays a very significant role in the contributing to GDP, employment and export earnings, the last two decades have witnessed a very rapid change in the structure of Thai economy. From an economy dominated by the agricultural sector during the late fifties and the early sixties, it has been transformed into a more diversified economy where the share of agriculture in GDP was reduced from 40 per cent in 1960 to 21.86 per cent in 1983 as shown in Table 2.1. The manufacturing sector has become increasingly more important in the Thai Economy. Thus, the share of the manufacturing value added in total GDP increased from 12.52 per cent in 1960 to 16.03 per cent in 1970 and reached 20.13 per cent in 1981. Industrial output grew at an average annual rate of 12.2 per cent during the 1975-1978 period compared to a 7.5 per cent of GDP growth rate over the same period.

In spite of the ups and downs of the domestic economy and the fluctuations in private investment, the manufacturing sector expanded at an average annual rate of 14% until 1974; a slight increase from the 12% rate achieved in 1964-69. In the early period 1960-1969, industrialization progressed within a policy framework which gave a higher priority to import-substituting industries. In contrast to the earlier period of import substitution, the 1970-73 expansion was export led. With very favorable international markets in 1970-73,

Table 2.1 : INDUSTRIAL SECTOR IN THAILAND

	1960	1965	1970	1975	1980	1981	1982	1983
GDP. (at current prices, mil. baht)	53,984	84,303	136,060	298,816	684,930	786,166	846,136	928,548
GDP. (at 1972 prices, mil. baht)	68,286	96,807	145,969	203,514	292,852	311,270	324,052	342,878
Annual growth rate (%)		7.23	8.56	6.87	7.55	6.29	4.10	5.82
Agricultural V.A. (at current prices, mil. baht)	21,463	29,383	38,493	94,063	173,806	187,886	188,742	202,797
Agricultural V.A. (at 1972 prices, mil. baht)	25,204	31,872	42,619	62,081	72,784	77,701	78,502	80,940
Share of agricultural V.A. (% of GDP)	39.76	34.85	28.29	31.48	25.38	23.90	22.31	21.86
Manufacturing V.A. (at current prices, mil. baht)	6,759	11,978	21,814	53,910	134,515	158,272	164,659	172,532
Manufacturing V.A. (at 1972 prices, mil . baht)	7,810	13,181	21,441	36,787	60,597	64,490	67,317	71,947
		11.0	10.2	11.2	10.5	6.4	4.4	6.9
Share of manufacturing V.A. (% of GDP)	12.52	14.21	16.03	18.04	19.64	20.13	19.45	18.58
Total imports (Mil. baht)	9,622	16,185	27,009	66,835	188,686	216,746	196,616	236,361
Total imports (% of GDP)	17.82	19.20	19.85	22.37	27.55	27.57	23.24	25.45
Manufacturing imports (Mil. baht)	7,175	12,014	20,849	44,952	104,565	126,543	113,142	153,115
Rate of growth of manufacturing imports (%)		10.86	11.65	16.61	18.39	21.02	-10.59	35.33
Share of manufacturing imports (% of total imports)	74.57	74.23	77.19	67.26	55.42	58.38	57.54	64.78
Total export (Mil. baht)	8,614	12,941	14,772	48,438	133,197	153,001	159,728	146,472
Total export (% of GDP)	15.96	15.35	10.86	16.21	19.45	19.46	18.88	15.77
Manufacturing export (Mil. Baht)	119	651	2,295	8,817	46,495	47,525	49,537	50,821
Rate of growth of manufacturing export		40.48	28.66	30.89	39.45	2.22	4.23	2.59
Share of manufacturing export (% of total export)	1.38	5.03	15.54	18.59	34.91	31.06	31.01	34.70
Manufacturing employment (person)	470.0	603.0	711.5	1,355.8	1,788.7	1,741.6	2,006.5	n.a.
Manufacturing employment (% of total employment)	3.4	4.1	4.2	7.5	7.9	7.2	8.1	n.a.
Share of manufacturing output (% of total output) /1								
Northern	10.19	9.07	7.94	6.67	3.97	3.25	4.36	n.a.
Northeastern	8.89	9.19	8.54	7.30	4.78	4.37	4.97	n.a.
Central	37.74	38.39	37.60	41.43	39.73	41.25	40.73	n.a.
Southern	7.74	7.30	6.56	5.83	3.26	2.79	2.65	n.a.
Bangkok - Thornburi	34.90	36.06	39.37	38.75	48.25	47.78	47.29	n.a.

/1 The share of manufacturing output in 1960-1975 can not be compared with those of 1980-1983 due to the different economic sector classification used during the two periods.

Sources : NESDB, MOF and BOT

several major established import-substituting industries were able to expand their outputs and to exports rapidly by utilizing the excess capacity created during the 1965-69 investment boom. Output of textiles, processed foods and cement expanded very rapidly during this period.

In the middle of 1974, the manufacturing sector was affected by a worldwide recession. This slowdown was brought about by the combination of an increase in import prices caused by a high inflation rate, a drop in export demand, shortages of some imported raw materials especially petro-chemical products, synthetic fibres and paper pulp, as well as by a decline of domestic demand and, finally, by an accumulation of excessive inventories by the end of 1973 and early 1974 in anticipating for rapid price increases. As a consequence, many industries have experienced weakening demand far more than was expected, and the expansion of manufacturing sector was markedly slow down. Manufacturing output grew by only 2.5 per cent in 1974 and about 4 per cent in 1975. /1

In 1979-1980, the growth rate of the industrial sector was interrupted again because of the second oil shock. Between 1978-1980, the average annual growth rate of the industrial sector was about 7 per cent. Although the rate has decelerated, it was still regarded to be higher than the overall GDP rate of growth.

/1 see Thailand: "Current Economic Prospects and Selected Development Issues" Document of IBRD, International Development Association, 1975.

In short, despite two interruptions, the last two decades have witnessed an impressive growth performance in the Thai manufacturing sector. There have been many factors contributing to the rapid expansion of industrial output. Apart from government promotional policies in term of successive establishment of physical and institutional infrastructure constructions, and policy measures including investment promotion, protection and control of imports, the private sector played a role in this development process. The private sector made several appropriate decisions at critical junctures and adjusted smoothly and flexibly to changing circumstance domestically and in the international economy.

The Structure of Industrial Outputs

Thailand has experienced not only a very high rate of growth of industrial output but a rapid structural change in the manufacturing sector as well.

The food processing industry including slaughtering, dairy products, rice milling, flour, sugar and other processed agricultural products is the most important industrial subsector in Thailand. As shown in Table 2.2, the food processing industry accounted for 36.26 per cent of total manufactured output and 29.11 per cent of total industrial value added in 1975. Although its share has declined to 21 per cent in 1980, it continues to be the leading sector in Thailand's manufactures. In 1975, exports of this industry accounted for more than a half of the total manufactured exports and about 39

Table 2.2 : GDP SHARES AND GROWTH RATES BY INDUSTRY IN THE MANUFACTURING SECTOR

(Thousands of Baht)

INDUSTRIAL CLASSIFICATION	Output							Value Added						
	VALUE OF OUTPUT		Share of GDP.		Share of Total manufacturing		rate of growth 1975-80 (%)	VALUE ADDED		Share of GDP.		Share of Total manufacturing		rate of growth 1975-1980 (%)
	1975	1980	1975 (%)	1980 (%)	1975 (%)	1980 (%)		1975	1980	1975 (%)	1980 (%)	1975 (%)	1980 (%)	
FOOD	87,309,276	153,397,897	29.22	22.39	36.26	27.24	11.93	23,027,411	37,134,112	7.71	5.42	29.11	20.78	10.02
BEVERAGES	8,335,692	16,191,250	2.79	2.37	3.46	2.88	14.20	5,638,876	10,866,338	1.89	1.59	7.13	6.08	14.02
TOBACCO	8,022,711	14,217,833	2.68	2.08	3.33	2.53	12.12	3,786,040	6,787,194	1.27	0.99	4.79	3.80	12.38
TEXTILES	33,769,193	88,492,742	11.30	12.92	14.02	15.72	21.24	11,321,877	28,701,715	3.79	4.19	14.31	16.06	20.44
LEATHER	2,208,444	4,978,162	0.74	0.73	0.92	0.88	17.65	832,073	1,814,434	0.28	0.26	1.05	1.02	16.87
WOOD & WOOD PRODUCTS	8,611,023	23,024,990	2.88	3.36	3.58	4.09	21.73	3,507,739	10,691,348	1.17	1.56	4.43	5.98	24.96
PAPER & PAPER PRODUCTS	6,323,766	23,213,082	2.12	3.39	2.63	4.12	29.70	2,404,824	9,147,196	0.8	1.34	3.04	5.12	30.62
BASIC INDUSTRIAL CHEMICALS	3,316,138	5,014,496	1.11	0.73	1.38	0.89	8.622	1,116,204	1,691,305	0.37	0.25	1.41	0.95	8.666
CHEMICAL PRODUCTS	6,620,507	18,242,236	2.22	2.66	2.75	3.24	22.47	2,520,529	7,587,887	0.84	1.11	3.19	4.25	24.65
REFINERIES & PETROLEUM PRODUCTS	16,839,197	50,467,719	5.64	7.37	6.99	8.96	24.54	4,149,291	12,007,019	1.39	1.75	5.25	6.72	23.67
RUBBER & RUBBER PRODUCTS	6,016,858	16,471,931	2.01	2.40	2.50	2.93	22.31	2,289,867	5,158,349	0.77	0.75	2.89	2.89	17.63
PLASTIC PRODUCTS	2,455,638	5,332,239	0.82	0.78	1.02	0.95	16.77	1,281,598	2,214,444	0.43	0.32	1.62	1.24	11.55
CERAMIC & EARTHERN WARE	420,019	1,905,855	0.14	0.28	0.17	0.34	35.32	221,738	1,003,136	0.07	0.15	0.28	0.56	35.23
GLASS & GLASS PRODUCTS	1,424,485	2,153,268	0.48	0.31	0.59	0.38	8.61	642,828	993,128	0.21	0.14	0.81	0.56	9.08
OTHER NON - METALLIC PRODUCTS	3,840,770	12,547,795	1.29	1.83	1.60	2.23	26.71	1,406,798	4,163,876	0.47	0.61	1.78	2.33	24.23
IRON & STEEL	6,497,678	11,103,921	2.17	1.62	2.70	1.97	11.31	2,103,051	3,037,390	0.70	0.44	2.66	1.70	7.62
NON - FERROUS METALS	4,153,327	19,203,992	1.39	2.80	1.72	3.41	35.83	928,629	2,993,883	0.31	0.44	1.17	1.68	26.38
FABRICATED METALS	4,813,027	8,276,264	1.41	1.21	1.75	1.47	14.45	1,489,158	3,008,520	0.50	0.44	1.88	1.68	15.10
MACHINERY	4,824,966	13,365,402	1.62	1.95	2.01	2.37	22.51	1,631,339	4,357,000	0.55	0.64	2.06	2.44	21.71
ELECTRICAL IND.MACHINERY & APP.	4,275,872	20,732,088	1.43	3.03	1.78	3.68	37.12	1,407,859	6,531,573	0.47	0.95	1.78	3.65	35.92
TRANSPORT EQUIPMENTS	15,783,221	44,908,715	5.28	6.56	6.55	7.98	23.26	4,388,887	14,206,773	1.47	2.07	5.55	7.95	26.48
OTHER MANUFACTURED PRODUCTS	5,508,740	9,823,746	1.84	1.43	2.29	1.74	12.26	3,001,647	4,625,847	1.00	0.68	3.79	2.59	9.035
TOTAL	240,788,568	563,065,623	80.58	82.21	100.00	100.00	18.51808	79,098,263	178,724,467	26.47	26.09	100.00	100.00	17.70730

Source : NESDB and MOF.

per cent of the total exports. However, during the last few years, the share of processed food export has been reduced to about 45 per cent of the total manufactured exports or 37 per cent of the total exports due to rapid increases in other manufactured exports. During 1975-1980, the output of this sector grew at the annual rate of 11 per cent compared to 18.5 per cent rate of the total export growth. Nevertheless, the food processing industry plays a very significant part in terms of strong production and employment linkages with the agriculture and other subsectors.

Apart from the food processing industry, other important industries are textile, beverage and tobacco, basic chemicals and chemical products, petroleum refining, rubber and industries in the groups of engineering industries including metal products, machinery, electrical and electronics, and transport vehicles.

The textile industry includes all products at every stage of fabrication such as fibre manufacturing, spinning, weaving, knitting and apparel making. During 1975-1980, textile output and value added accounted for 14.87 per cent and 15.19 per cent of the corresponding totals respectively.

For beverages and tobacco, their combined share of value added accounted for about 10 per cent of the total manufacturing value added. This sector includes all alcoholic and non-alcoholic beverages such as blended whiskey, white whiskey, soft drinks, carbonated water, beer and malt; and cured tobacco

and cigarettes.

Basic chemicals and chemical products contribute about 4 per cent of the total manufactured output. The basic chemical industry is important in terms of inter-industry linkages since its products are not sold to final consumers but mainly to other industries to be used as intermediate inputs for producing final or other intermediate products. Productions of this subsector are used in many important industries such as textile, food processing, pulp and paper, petroleum refinery, steel and metal products.

The petroleum refinery subsector constituted about 9 per cent of the total manufactured output in 1980. This sector includes oil processing refineries whose final products are gasoline, diesel, kerosene, fuel oil, asphalt, grease and lubricating oil.

The rubber and rubber product subsector includes rubber sheet, block rubber, tyres and tubes and other rubber products. During the period 1975-1980, the output of this industry accounted for 3 per cent of total manufactured output, over one half of which was exported.

Engineering industries group has been growing gradually in the past few years. Its combined share in total value added increased from 15.1 per cent in 1975 to 19.1 per cent in 1980. The key industries in this group are transport equipments , electrical and electronics, and machinery.

Import of Manufacturing Sector

The changing structure of production in Thailand has been accompanied by a change in the country's trade structure. The share of consumer goods (durable and non-durable) has been reduced from 35.6 per cent in 1960 to 11.6 per cent in 1982 (see table 2.3).

Table 2.3: PERCENTAGE DISTRIBUTION OF IMPORTS BY ECONOMIC CLASSIFICATION

Type of Imports	1960	1970	1980	1981	1982	1983 /1
Consumer goods						
Non-durable	27.1	13.2	6.5	6.3	6.6	6.8
Durable	8.5	6.6	3.7	4.3	5.0	5.9
Total	35.6	19.8	10.2	10.6	11.6	12.7
Intermediate Products and Raw material						
Chiefly for consumer goods	10.9	15.7	14.8	15.6	15.5	15.8
Chiefly for capital goods	7.6	9.8	9.0	9.2	9.2	9.4
Total	18.5	25.5	23.8	24.8	24.7	25.2
Capital goods						
Machinery	14.4	23.3	16.6	16.9	16.4	20.7
Others	10.7	12.2	7.6	9.3	7.9	8.6
Total	25.1	35.5	24.2	26.2	24.3	29.3
Others						
Vehicles and parts	8.0	8.3	3.7	4.4	2.4	4.8
Fuel and Lubricants	10.9	8.8	30.9	30.0	30.9	24.1
Others	1.9	2.1	7.2	4.1	6.1	4.0
Total	20.8	19.2	41.8	38.5	39.4	32 9

Note: /1 Preliminary figures

Source: Bank of Thailand, Quarterly Review, Various issues.

Imports of intermediate products, raw materials and capital goods have increased over time reflecting an expansion in manufacturing production.

While the Thai economy has moved towards industrialization, imports of manufactured goods continue to grow. Manufacturing imports increased from 7,175 million baht in 1960 to 104,565 million baht in 1980 representing an average annual growth rate of 14.4 per cent. The value of manufacturing imports reached 153,115 million baht in 1983. In contrast, the share of industrial imports to total imports has gradually declined from 74.57 per cent in 1960 to 55.42 per cent in 1980. The declining trend of the manufactured import share has been brought about by an increasing value of crude oil imports that resulted from the two energy crises. The share of petroleum imports increased from 4.78 per cent in 1975 to 14.06 per cent in 1980 at the expense of reducing import share of machinery from 23.45 per cent to 14.49 per cent and of transport equipment from 13.88 per cent to 10.27 per cent in the same period. One other important manufacturing import has been that of basic industrial chemicals whose share accounted for 11.4 per cent of the total manufacturing imports in 1980.

The value of manufacturing import increased from 48,705 million baht in 1975 to 134,998 million baht in 1980, representing an average annual growth rate of 22.6 per cent. As a consequence, Thailand has experienced a deficit in her balance of trade in the past two decades. However, the deficit has been

narrowing down due to successive increases in the manufacturing exports.

Exports of Manufacturing Sector

The importance of the manufactured exports has been recognized in recent years not only in terms of the balance of paymentsbut as a significant factor for industrialization in many ways. First, exports ensure lower costs through an increased market size and economies of scale as well as a high productivity of both capital and labor. Second, it promotes a continuous product improvement to enable domestic industry to produce commodities of sufficient quality and performance to compete in the international markets. Third, export industries make efficient use of modern technologies and management techniques. Forth, it has a wider access to information on the world market conditions, capital, marketing and consulting expertise.

The growth trend of manufacturing value added and output in Thailand in the past has been the result of the expansion of the manufacturing exports. During the period 1975-1978, about 30 per cent of the increase in total sales of the manufactured product was due to the growth of manufactured exports. /1

While Thai exports have still been mainly agricultural or primary products, the past decade has witnessed

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/1 Narongchai Akrasanee, "Industrial Development Policy in Thailand's Fifth Plan," paper prepared for the Conference on "Industrial Restructuring in Thailand and Japan in 1980's", 1982, mimeograph.

Table 2.4 : MANUFACTURING IMPORTS

INDUSTRIAL CLASSIFICATION	Value of Imports (thousand baht)		Share of Total Output		Share of Total Manuf. Import		Share of Total Import	
	1975	1980	1975	1980	1975	1980	1975	1980
Food	1,457,694	6,830,590	1.67	4.45	2.99	5.06	2.27	3.11
Beverages	230,028	937,903	.36	5.79	0.47	0.69	0.36	0.50
Tobacco	700,160	1,098,735	8.73	7.73	1.44	0.81	8.09	0.59
Textiles	2,162,934	3,927,581	6.41	4.44	4.44	2.91	3.37	2.10
Leather	39,999	93,394	1.81	1.88	0.08	0.07	0.06	0.05
Wood & wood products	117,482	1,044,221	1.36	4.54	0.24	0.77	0.18	0.56
Paper & paper products	1,405,143	3,741,954	22.22	16.12	2.89	2.77	2.19	2.00
Basic industrial chemicals	5,438,804	15,378,942	164.01	306.69	11.17	11.39	8.47	8.24
Chemical products	2,884,596	7,614,068	43.57	41.74	5.92	5.64	4.49	4.08
Refineries & petroleum products	2,329,843	18,980,780	13.84	37.61	4.78	14.06	3.63	10.17
Rubber & rubber products	222,206	610,021	3.69	3.70	0.46	0.45	0.35	0.33
Plastic products	299,571	609,705	12.20	11.43	0.62	0.45	0.47	0.33
Ceramic & earthern ware	180,377	137,509	42.94	7.22	0.37	0.10	0.28	0.07
Glass & glass products	211,067	473,196	14.82	21.98	0.43	0.35	0.33	0.25
Other non-metallic products	398,077	2,040,398	10.36	16.26	0.82	1.51	0.62	1.09
Iron & steel	4,164,151	12,515,747	64.09	112.71	8.55	9.27	6.48	6.70
Non-ferrous metals	1,345,944	4,176,768	32.41	21.75	2.76	3.09	2.09	2.24
Fabricated metals	2,445,291	4,516,094	58.04	54.57	5.02	3.35	3.81	2.42
Machinery	11,420,343	19,555,621	235.81	146.32	23.45	14.49	17.78	10.47
Electrical ind. machinery & app.	3,443,360	13,340,116	80.53	64.35	7.07	9.88	5.36	7.15
Transport equipments	6,762,638	13,858,844	42.85	30.86	13.88	10.27	10.53	7.42
Other manufactured products	1,245,341	3,515,773	22.61	35.79	2.56	2.60	1.94	1.88
Total	48,705,009	134,997,960	884.33	957.93	100.00	100.00	100.00	100.00

Sources: NESDB and MOF.

an increasing diversification of exported commodities. In 1960s, primary products constituted over 80 per cent of the country's export value. Their share has declined to 45.4 per cent in 1983. Table 2.5 reveals this trend of a marked increase in the share of the manufacturing exports. The prominent trend of the manufacturing exports is obvious. From 1975 to 1980, Thai manufactured exports increased very rapidly in terms of value, from 33,185 million baht in 1975 to 112,718 million baht in 1980 representing an average annual growth rate of 27.71 per cent. Thailand has witnessed not only a rapid expansion of manufactured exports but also its diversification of products. As shown in Table 2.6, her dependence on 2 major industries in total manufacture exports--food processing and textile industries--has been decreasing. The combined share of two major industries accounted for 65.68 per cent of the total manufactured exports in 1975 and reduced to 54.86 per cent in 1980. The growth rate of the food processing industry was at 21.12 per cent, slighty below the average growth rate of the manufactured exports. In the category, rice milling, tapioca milling, canning of fish and other seafoods, and sugar are the main sources of export earnings. These growth rates ranged from 26 to 33 per cent.

Besides traditional and processed agriculture and primary products, there have been many other important exported commodities which show significant growth performances in the 1970s. Among these are textile, jewelry and integrated circuits, wood products, furniture, rubber etc. These exported items are either labour-intensive or resource-based. By and large,

Table 2.5 : PERCENTAGE DISTRIBUTION OF EXPORTS BY DIFFERENT ECONOMIC SECTORS

Economic Sector	Year					
	1961	1970	1980	1981	1982	1983
Agriculture	84.38	67.50	46.93	47.74	45.80	45.30
Fishery	0.41	2.49	4.16	4.33	4.78	5.60
Forestry	1.33	1.48	0.05	0.09	0.06	0.07
Mining	6.69	13.93	11.58	7.72	6.15	4.65
Manufacturing	2.44	6.10	32.33	35.78	39.57	41.89
Others 1/	4.74	8.50	4.95	4.36	3.64	2.38
Total	100.00	100.00	100.00	100.00	100.00	100.00

1/ Other unclassified goods and re-exports

Source : Bank of Thailand, Various issues.

resource-based and labor intensive products have invariably occupied significant shares in the industrial exports, and achieved a high growth rate (see Table 2.6).

As shown in Table 2.7, among the most important trading partners of Thailand are Japan, the United States and EC countries. Although Japan is still the most important trading partner of Thailand, the share of exports to Japan has dropped significantly in recent years, namely from 26.04 per cent in 1975 to 15.31 per cent in 1980. The EC countries as a group appear to be important importers of Thai products recently with the Netherlands contributing the most significant share in this group due to an expansion of tapioca exports to this country since the 1960s.

Employment in Manufacturing Sector

As a traditional agriculture based economy, the extent of under-employment has been substantial, especially in the agriculture sector. One major objective of industrial development is to increase employment opportunities to absorb surplus labor in the agriculture sector. This section is devoted to presenting an overview of employment in the manufacturing sector. However, due to the lack of detailed data on employment by individual industries, data presented here draw heavily on previous studies on medium and small scale industries which provide analysis related to employment issues.

Table 2.6 : MANUFACTURING EXPORT BY INDUSTRY

INDUSTRIAL CLASSIFICATION	Value of Export (thousand baht)		Share of Total Output		Share of Total Manuf. Export		Share of Total Export	
	1975	1980	1975	1980	1975	1980	1975	1980
Food	19,076,343	49,725,227	21.85	32.42	57.48	44.11	39.38	37.33
Beverage	8,573	98,069	2.85	0.006	0.03	0.09	0.02	0.07
Tobacco	571,744	1,125,304	7.13	7.91	1.72	1.00	1.18	0.84
Textiles	2,721,997	12,122,674	8.06	13.70	8.20	10.75	5.62	9.10
Leather	129,076	1,123,148	5.84	22.56	0.39	1.00	0.27	0.84
Wood & wood products	1,473,227	2,017,601	17.11	8.76	4.44	1.79	3.04	1.51
Paper & paper products	82,430	403,812	1.30	1.74	0.25	0.36	0.17	0.30
Basic industrial chemicals	41,380	434,075	1.25	8.66	0.12	0.39	0.08	0.33
Chemical products	167,366	546,093	2.53	2.99	0.50	0.48	0.34	0.41
Refineries & petroleum products	252,118	89,889	1.50	0.002	0.76	0.08	0.52	0.07
Rubber & rubber products	3,546,292	13,238,867	58.94	80.37	10.69	11.75	7.32	9.94
Plastic products	138,012	615,697	5.62	11.55	0.42	0.55	0.28	0.46
Ceramic & earthern ware	18,457	311,905	4.42	16.36	0.06	0.28	0.04	0.23
Glass & glass products	30,914	137,905	2.17	6.40	0.09	0.12	0.06	0.10
Other non-metallic products	592,777	142,452	15.43	1.14	1.79	0.13	1.22	0.11
Iron & steel	104,666	1,035,763	1.61	9.33	0.32	0.92	0.21	0.78
Non-ferrous metals	2,396,035	15,933,162	57.69	82.97	7.22	14.14	4.95	11.96
Fabricated metals	215,735	1,201,569	5.12	14.52	0.65	1.07	0.44	0.90
Machinery	80,700	682,106	1.67	5.10	0.24	0.61	0.17	0.51
Electrical ind. machinery & app.	464,362	6,776,954	10.86	32.69	1.40	6.01	0.96	5.09
Transport equipments	24,838	145,138	0.002	0.003	0.07	0.13	0.05	0.11
Other manufactured products	1,048,331	4,820,592	19.03	49.07	3.16	4.28	2.16	3.62
Total	33,185,373	112,718,002	13.78	20.02	100.00	100.01	68.48	84.61

Sources: NESDB and MOF.

Table 2.7 : EXPORTS OF THAILAND BY DESTINATION

($US thousands)

Destination	1960		1965		1971		1975		1980	
	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%
Japan	20,467	16.95	52,788	19.64	202,935	25.30	607,058	26.09	974,857	15.3
United States	6,488	5.37	16,457	5.28	103,184	12.86	231,305	9.92	816,114	12.8
Netherland	3,669	3.04	10,992	3.53	66.204	8.25	222,873	9.56	860,775	13.5
Singapore	-	-	24,999	8.02	56,426	7.03	192,056	8.24	468,860	7.4
Hong Kong	16,816	13.92	30,329	9.74	54,313	6.77	296,297	12.71	316,057	4.9
Malaysia	301	0.25	31,922	10.25	31,512	3.93	99,955	4.29	286,824	4.5
Germany	6,871	5.69	15,138	4.86	30,497	3.80	53,990	2.32	267,243	4.2
United Kingdom	5,444	4.51	6,441	2.07	19,612	2.45	24,458	1.05	120,287	1.9
Rest of the Worls	60,714	50.27	122,460	39.31	237,430	29.60	602,995	25.87	2,258,320	35.4
Total	120,770	100	311,526	100	802,113	100	2331,017	100	6,369,169	100

Source : "Promotion of manufactured Exports : Destination and Barries to Importing countries, Volumn II" NESDB

The changing structure of the Thai economy has resulted in an increasing share of employment in the manufacturing sector. As a consequence, the agriculture's share in the total employment declined from 82.4 per cent in 1960 to 78.77 in 1971 and to 70.61 in 1980 while the share of employment in the manufacturing sector increased from 3.4 per cent in 1960 to 3.95 per cent in 1971 and reached 7.9 per cent in 1980. However, when compared to the share of GDP in the manufacturing sector, the employment of the manufacturing sector is not significant. The share in total employment of this sector in 1980 was 7.9 per cent compared to the share of total GDP of 19.64 per cent. The share of the manufacturing sector's employment is more or less the same as that of the other non-agriculture sectors.

Data on the relative size of employment in different manufacturing subsector are quite inaccurate and sparse. In fact, the number of employment of an industry depends on the size of the industry in terms of production and investment and on the intensity of labor utilization in the process of production. It is rather difficult to draw any conclusion without determining industries' capacity and output first. One possible way of assessing the employment is to consider how much employment is generated by a given amount of output. The study by Narongchai Akrasanee and Rachain Chintayarangsarn on factor proportion in trade used the number of workers employed in 1 million baht value added. /1 They found that confectionary,

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/1 Narongchai Akrasanee and Rachain Chintayarangsarn, "Factor Proportions in Trade", CAMS Discussion paper (Manila: Council of Asian Studies, 1976).

Table 2.8 : EXPLOYMENT BY ECONOMIC SECTORS

Economic Sector	Percentage Distribution 1971	Percentage Distribution 1980	Percentage growth 1971 - 1980
Agriculture, Forestry and Fishery	78.77	70.61	1.81
Mining and Quarrying	0.57	0.44	0.60
Manufacturing	3.95	7.90	10.33
Construction	1.13	1.93	8.59
Electricity and Water Supply	0.17	0.26	7.09
Commerce and Trade	7.07	8.47	4.81
Transportation and Communication	1.27	2.02	7.76
Service	7.02	8.36	4.75
Others	0.05	0.01	-25.40
Total	100.00	100.00	

Source : Somsak Tambunlertchai "Manufactured Exports and Employment in Thailand", Council of Asian Manpower Studies, Manila, 1984, p. 103

pottery, china and earthernware and products of various stages of production in the textile industry are among the most labor-intensive, whereas products as alcoholic beverages, tobacco and cement are the least labor-intensive industries (see Table 2.9). Various industrial surveys confirm that the food processing and textile related industries have the highest share of employment.

Nevertheless, the study by Saeng Sanguanruang, Somsak Tambunlertchai and Nit Sammapan[/1] presents the a contradictory evidence. In terms of the ratio of fixed assets to labor it was found that textile and food processing industries normally thought to be labour intensive turned out to be relatively capital intensive. Moreover, iron and steel industries which were normally thought to be capital intensive turned out to be relatively labour intensive (see Table 2.10). Such results, as explained in this study, are due to the fact that there are large firms in the textile and food industries whose fixed assets are valued rather high while firms in iron and steel industries are mostly small workshop with low value of fixed assets. It should be noted that the coverage of different sizes of firm and different types of product in each industrial group has an impact on average capital intensity. Industries indicating a high degree of labor intensity consist mostly of small-scale firms.

/1 Saeng Sanguanrung, Somsak Tambunlertchai and Nit Sammapan, "A Study of Small and Medium Scale Industries in Thailand," National Institute of Development Administration and Thammasat University, 1977.

Table 2.9: DEVELOPMENT OF LABOUR INTENSIVE INDUSTRY

Labour Requirements by Industries According to the Trade Categories, 1973

(Number of Workers per one millon baht of value added)

Industries	$\frac{L}{VA}$[1]	Rank[2]	$\frac{L}{VAT}$[1]	Rank[2]
Alcoholic beverage	4.9	1	12.2	2
Cigars and Cigarettes	5.3	2	6.4	1
Cement, concrete	8.8	3	20.4	4
Passenger car assembly	9.5	4	22.5	7
Iron and Steel	10.7	5	23.2	9
Bus and truck assembly	11.5	6	23.0	8
Electric wires and cables	11.7	7	19.5	3
Rubber tyres and cables	13.8	8	26.5	17
Glass, glass products	14.3	9	24.5	12
Vegetable oils and fats	14.3	10	20.5	5
Non-alcoholic beverages	14.4	11	34.0	30
Dairy product	14.8	12	25.8	15
Textile yarn and thread	16.1	13	21.6	6
Essential oils, perfume and toiletries	16.2	14	26.8	19
Materials of rubber	18.0	15	24.3	11
Sugar	18.1	16	24.2	10
Chemical products	19.5	17	3.7	35
Tapioca flour	20.0	18	26.5	18
Paper and paper board	20.1	19	27.4	20
Paper products	21.6	20	25.9	16
Motorcycle and non-motorized vehicles	22.7	21	28.7	22
Wood products	23.4	22	25.6	13
Pharmaceuticals	24.1	23	29.3	23
Misc. mfg. art's nes.	24.5	24	32.1	26
Monosodium glutamate	24.9	25	25.8	14
Chemical materials	25.2	26	28.4	21
Agricultural machinery	28.1	27	36.6	32
Shaved wood	25.5	28	30.6	24
Textile fabrics	29.4	29	32.3	28
Printed matter	30.1	30	21.1	25
Plastic material	31.4	31	32.3	27
Non-ferrous metal	33.2	32	33.2	28
Furniture	34.4	33	35.9	31
Non-metallic construction material	34.6	34	37.6	33
Vehicle parts	36.7	35	38.4	34
Radio, TV. & elec,household app.	37.4	36	40.1	36
Metal products	42.0	37	47.5	37
Matches	45.5	38	45.7	38
Rubber products	49.2	39	47.9	39
Non-electrical machinery	61.8	40	48.4	41
Cereal preparations	61.9	41	57.7	40
Clothing	72.3	42	66.1	43
Leather products	80.2	43	58.8	42
Footwear	84.4	44	74.3	46
Textile articles	84.4	45	71.8	44
Cordage and rope	86.5	46	71.9	45
Pottery, chins and earthenware	89.3	47	74.9	47
Confectionery	118.2	48	101.3	48

[1] L/VA = Workers per one million baht of value added, direct.

L/VAT = Workers per one million baht of value added, direct plus indirect of home goods.

[2] Ranking from the least to the most labour-intensive industries.

Source: Akrasanee and Chintavaranusan, op. cit.

Table 2.10: FIXED ASSETS /a TO LABOUR RATIO BY INDUSTRY, 1977

Industry	Fixed Assets/Worker (฿ 000)
Food	112.6
Beverage	81.0
Tobacco	29.4
Textiles	296.1
Wearing apparel	50.1
Leather products	98.5
Footwear	45.2
Wood products	21.6
Furniture	50.6
Paper products	86.8
Industrial chemicals	400.5
Other chemical products	82.3
Rubber products	50.7
Plastic products	85.2
Pottery	34.6
Glass products	127.7
Non-metallic mineral products	110.9
Iron and steel products	42.1
Non-ferrous metal	51.9
Fabricated metal products	88.8
Machinery	114.7
Electrical appliance	61.5
Transport equipment	63.7
Scientific equipment	105.1
Miscellaneous	48.6
Total	112.5

Note: /a at replacement cost

Source: Saeng Sanguangrung, Somsak Tambunlertchai, Nit Samanapan, op. cit.

In this study, an attempt is made to identify factor intensity in the manufacturing sector. In general, there are many indices to be used for measuring the labour intensity. The basic one is the ratio of capital to labor (K/L) which is commonly used as a measure for capital intensity. However, due to the difficulty of obtaining capital data, some turn to use L/Y ratio or I/Y ratio. In this study, we follow some earlier studies which use labor as a percentage of value added as an index for labor intensity to rank industries. To utilize this concept, we assume that factor and product markets are quite perfect and wages are determined by the influence of demand and supply and not affected by minimum wage imposed by labor union.

Table 2.11 shows the volume of employment by 17 subsectors based on the data obtained from 1980 labor force survey conducted by the National Statistic Office. It is obvious that the number of employment in each industrial group presented in the Table is influenced by the number and the size of the firms included in each sub group. Moreover, considering that the sample included in the survey are mainly large sized, the reported figures tend to be biased against the industrial groups with large proportion of small firms.

To examine employment generating capacity of a given industry, at any given level of output, we measure the ratio of number of workers employed per one million baht value added. The findings, as shown in Table 2.11, are that machinery, beverage, tobacco, basic chemical and chemical products are capital-intensive activities, whereas leather and leather

Table 2.11: LABOUR INTENSITY BY INDUSTRIES

	Total number of workers / 1 million baht value added	Rank
Leather and Leather products	134.65	1
Fabricated metal	20.045	2
Metallic mineral products	17.620	3
Other manufactured products	16.294	4
Textile	15.957	5
Rubber and rubber products	13.668	6
Transport equipment	10.726	7
Basic metal	9.528	8
Food processing	8.466	9
Electrical and electronics	7.055	10
Wood and wood products	6.862	11
Petroleum refineries	6.716	12
Pulp,paper and paper products	4.903	13
Basic chemical and chemical products	2.6407	14
Tobacco	2.454	15
Beverages	2.292	16
Machinery	1.524	17

Source: Data for computation are obtained from:

1) 1980 Labour Force Survey conducted by the NSO.

2. 1980 Input-Output Table.

products, textiles, rubber, non-metallic product and fabricated metal are labor intensive activities.

In fact, this measure of labor intensity in any given industry is subject to many limitations. Firstly, accurate and complete data on employment are not available at present. Secondly, industries with high profits in the observation period may appear to be relatively more capital-intensive than others. Thirdly, already mentioned, the calculated figures tend to be biased against industrial group containing large proportion of small firms.

It is commonly believed that large firms have better chances to change their production process towards capital-intensive technology than that of small firms. The use of capital and labor in any industry depends on many factors: size, type of production, degree of technology transfer, flexibily of production process for adjusting to new technology, relative price of inputs, share of capital and labor cost in total production cost and so on. The existing labor market in Thailand where wages have been distorted by the legal minimum wage rate must lead to an inefficient utilization of resources.

Skill composition of Industrial Workforce

Consistent time-series data on the skill composition of industrial work force are not available in Thailand. A report on employment situation in Thailand by the World Bank based on the labor force survey indicates that

unskilled workers employed in the industrial sector declined from 88 per cent in 1960 to 79 per cent in 1970.[/1] In terms of cross-section analysis, a study by Narongchai Akrasanee and Siri-Luksana Chutikul reveals that skilled workers for all firm covered in the industrial survey have accounted for 15.7 per cent of the total labor force in 1970 and 17.8 per cent in 1973. High skilled labor force ratios are apparent in cement, chemical, glass, metal and beverage industries.[/2] However, due to a very high variation in the skilled labor's wage rates across industry, the reliability of computed skill index is doubtfully reduced.

Another attempt to analyse skilled workers composition in the total industrial labor force is done by Saeng Sanguaruang, and et.al.[/3] In their study, workers are classified into 6 categories, namely family workers, managerial personnel, sale personnel, technicians, general factory workers and others. Skilled workers, according to this study, include managerial personnel, sales personnel, technicians and engineers. The proportion of skilled workers in total workers varies from one industry to the other. They surprisingly, find that the smaller firms employed a higher proportion of skilled workers than the larger firms which seems to contradict to general beliefs. (See Table 2.12).

/1 "Thailand Special Report on Employment," World Bank Discussion Paper, October 1977.

/2 Narongchai Akrasanee and Siri-Laksana Chutikul "Wage Differentials in Manufacturing Industries," Discussion Paper No. 77-02, Manila: Council for Asian Manpower Studies, February, 1977.

/3 op.cit.

An attempt is made in this study to examine capital intensity and skill intensity of industry utilizing the measure of number of workers employed per one million baht, per non wage value added and per one million baht wage value added. Utilizing the data on employment for 1980 NSO's labor force survey and value added from NESDB, the findings are reported in Table 2.12. The findings show that the capital indices are similar to those presented in Teble 2.11. Industries which generate more employment capacity are leather and leather product, fabricated metals, non-metallic and textiles whereas machinery, beverage, tobacco and basic chemicals are relatively more capital intensive.

For the skill intensity indices as measured by the ratio of number of workers per wage value added, the findings are correlated with capital intensity to the extent that industries which are relatively capital intensive use highly skilled labor in their production process. These industries include machinery, basic chemicals and chemical products, beverage and tobacco. Industries which are relatively more labor-intensive employ relatively more unskilled labor. These are leather and leather product, refinery, fabricated metal, non-metallic and textile.

Again, it should be noted that simple measurements of intensity of input usedin industries is subject to many limitations.

Table 2.12 : CAPITAL AND SKILL INTENSITY BY INDUSTRIES

	Capital Intensity		Skill Intensity	
	$L/_{NW\ VA}$ [1]	Rank [2]	$L/_{WVA}$ [3]	Rank [4]
Machinery	2.137	1	5.348	1
Beverage	2.632	2	16.273	3
Tobacco	2.793	3	20.234	4
Basic chemical and chemical products	3.401	4	15.385	2
Paper and paper products	5.348	5	30.377	7
Refineries and petroleum	7.042	6	166.67	15
Wood and Wood products	8.621	7	33.659	8
Electrical and Electronic	9.276	8	29.464	6
Food processing	12.048	9	28.570	5
Basic metal	12.50	10	40.016	9
Transport equipment	14.286	11	42.319	10
Other manufactured	22.220	12	61.237	12
Export				
Textile	22.222	13	57.068	11
Metallic products	23.810	14	71.429	13
Fabricated metal	26.316	15	88.028	14
Leather and Leather products	166.67	16	588.230	16

Note : 1) $L/_{NWVA}$ = number of workers employed per one million baht of non-wage value added

2) Ranking from the least to the most labour intensive.

3) $L/_{WVA}$ = number of workers employed per one million baht of wage value added

4) Ranking from the least to the most skill intensive.

Pattern of Manufacturing Distribute by Scale of Industries

An important characteristic of the manufacturing sector is the prominent small and medium scale industrial establishments. The study by Saeng Sanguanruang and others in 1975 indicated that firms which employed 10-49 workers were from nearly all types of industry despite the bias in government policies towards large scale industries.[/1] Industries with relatively a higher proportion of medium scale firms are those engaging in tobacco and chemical products, whereas industries with a higher proportion of large scale firms are food, textile and rubber products. However, the difference in scale is formed within the same industry producing different products.

Another attempt to identify pattern of manufacturing distributed by scale of industries was done by Narongchai Akrasanee and Associates[/2] using the 1980 NSO's survey. As expected, the study indicates that small scale industries are formed in almost every type of manufacturing activities, particularly food, tobacco, textiles, wood furniture, paper, leather, rubber, chemical, non-metallic, basic metal, machine, electronic and transport equipment (see Table 2.13). Industries with relatively a high proportion of medium scale firms are found in those engaging in beverage, tobacco, footwear,

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/1 Saeng Sanguanruang and others, op.cit.

/2 Narongchai Akrasanee and Associates, Small and Medium Scale Industries in Thailand, World bank Report, 1982.

Table 2.13 SAMPLED FIRMS: NUMBER OF RESPONDING FIRMS CLASSIFIED BY MANUFACTURING SECTORS AND SIZE OF WORKERS IN 1979

Manufacturing	Number of Workers								Total	%
	0-9	%/a	10-49	%/a	50-199	%/a	>200	%/a		/b
Food	12	12.1	38	38.4	26	26.3	23	23.2	99	12.9
Beverage	1	5.0	2	10.0	12	60.0	5	25.0	20	2.6
Tobacco	2	4.2	18	37.5	23	47.9	5	10.4	48	6.3
Textile	14	11.2	46	36.8	32	25.6	33	26.4	125	16.4
Footwear	6	40.0	0	0.0	7	46.7	2	13.3	15	2.0
Wood Production	5	20.0	10	40.0	8	32.0	2	8.0	25	3.3
Furniture	2	33.3	3	50.0	1	16.7	0	0.0	6	0.0
Paper	0	0.0	8	47.1	1	5.9	8	47.1	17	2.2
Leather	2	40.0	1	20.0	1	20.0	1	20.0	5	0 0
Rubber	1	3.2	12	38.7	10	32.3	8	25.8	31	4.1
Chemical	3	3.3	40	44.4	33	36.7	14	15.6	90	11.8
Petroleum	0	0.0	0	0.0	2	100.0	0	0.0	2	0 0
Non-metallic	7	8.3	44	52.4	24	28.6	9	10.7	84	11.0
Basic Metal	1	3.0	19	53.6	5	15.2	8	23.5	33	4.3
Metal	6	12.5	24	50.3	13	27.1	5	10.4	48	6.3
Machine	7	21.2	22	66.7	4	12.1	0	0.0	33	4.3
Electrical	1	4.0	6	24.0	10	40.0	8	32.0	25	3.3
Transport equipment	4	12.9	8	25.8	7	22.6	12	38.7	31	4.1
Miscellaneous	2	8.0	18	72.0	5	20.0	0	0.0	25	3.3
Total	76	10.0	319	41.9	224	29.4	143	18.8	762	100.0

/a Row percentages.

/b Column percentages.

Source : NSO

petroleum and electrical industries. Small firms appear to be engaging in footwear, wood product, furniture, leather and machinery industries while large firms are formed in food, beverages, textile, paper, rubber, basic-metal, electricals and transport equipments.

Regional Distribution

Many studies aimed at identifying the regional distribution of the Thai manufacturing sector indicate that manufacturing activities are highly concentrated in Bangkok Metropolitan and the Central region. /1 The recent study by Narongchai Akrasanee and Associates conclude the same result of excessive concentration of economic activities in Bangkok and the central region. /2 Using the data on number of established firms during 1969 to 1980, the figures reveal high proportions of small scale enterprises and excessive concentration in Bangkok and the central region.

/1 World Bank, Industrial Sector Background Report, Volume I, Industrial Development and Finance Division Project Department, August 1982.

Mingsan Santikarn and others, Industrialization and Rural Employment in Thailand, Chiengmai University, March, 1981.

Somsak Tambunlertchai and Chesada Loohawunchit, "Labor Intensive and Small Scale Manufacturing Industries in Thailand", in Rashid Amjad (editor), The Development of Labor Intensive Industry in ASEAN countries, Asian Employment Program, ARTEP, 1982.

/2 Narongchai Akrasanee and Associate, op.cit

Table 2.14 shows the distribution of registered factories in different employment sizes by region. Firms with less than 10 employees obtained 63.17 per cent share and those with 10-49 workers 30.22 per cent of the total. The figures presented in the table also indicate a high degree of geographical concentration. There were 13,874 firms or 45.8% locating in Bangkok, 7,704 firms or 25.4% in the central region, 3,770 or 12.4% in the Northeast, 2,654 firms or 8.8% in the North and 2,286 firms or 7.5% in the South. In addition, most of the large sized firms were located either in Bangkok or the Central Region. However, the figures are probably overestimated since firms in Bangkok and the Central region are likely to be registered with the Factory Control Division more than firms in the other regions.

Sectoral Growth

As already mentioned, the growth of manufacturing sector has contributed significantly to the GDP increase over the past two decades. In addition, the growth trends are not uniform across all industrial branches. It is worth going through briefly the important sectoral growth of the manufacturing sector. In this section, we shall discuss the elasticities of sectoral manufacturing value added of certain industries to total manufacturing value added. In fact, this simple calculation can be used as a tool for forecasting industrial growth in the future.

Table 2.14 : CONSOLIDATED TABLE ON OVERVIEW OF THE INDUSTRIES BY MANUFACTURING SECTORS AND SIZE OF WORKERS IN 1979

Items	Size of workers				
	0 - 9	10 - 49	50 - 199	200 and over	Total
Number of existing firms in 1980	19,134	9,154	1,610	390	30,288
	(63.2)	(30.2)	(5.3)	(1.3)	(100.0)
Number of existing firms by regions:	19,134	9,154	1,610	390	30,288
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)
Bangkok	9,209	4,081	470	114	13,874
	(48.1)	(44.6)	(29.2)	(29.2)	(45.8)
Central	4,591	2,279	647	187	7,704
	(24.0)	(24.9)	(40.2)	(47.9)	(25.4)
Northern	1,544	909	159	42	2,654
	(8.1)	(9.9)	(9.9)	(10.8)	(8.8)
Northeastern	2,332	1,180	229	29	3,770
	(12.2)	(12.9)	(14.2)	(7.4)	(12.4)
Southern	1,458	705	105	18	2,286
	(7.6)	(7.7)	(6.5)	(4.6)	(7.5)
Value of outputs (B million)/a	9,939.40	24,834.33	37,269.83	70,578.09	142,621.65
	(7.0)	(17.4)	(26.1)	(49.5)	(100.0)
Average value of output per firm, (B million)/a	0.60	3.09	24.83	194.43	5.38

Source : Narongchai Akrasanee, op,cit.

The calculation of elasticity of manufacturing value added with respect to total manufacturing value added has been made for the period of 1970-1983. However, due to the two oil crises occured in the period covered in the study, these calculations may not capture the realistic picture of the future. If they are to be used for the simple forecasting, the period over which these calculation should be made must be the one that is likely to be duplicated or stable in the future.

The elasticity measures are calculated over an interval using the regression analysis presented below.

$$MVA = \alpha_i MVA_t^{\beta_i}$$

or $$\log MVA_{it} = \log \alpha_i + \beta_i \log MVA_t$$

where MVA_{it} = manufacturing value added of sector i in period t

MVA_t = total manufacturing value added in period t

β_i = elasticity of manufacturing value added of sector i with respect to total manufacturing value added.

The estimated elasticities by industries are presented in Table 2.15. Among industries with very high elastictities of the total manufacturing value added are chemical products, ceramics, transport equipment, electrical and electronics and textiles industries. Industries with considerably low elasticities with respect to the total manufacturing value

Table 2.15 : ELASTICITIES OF MANUFACTURING VALUE ADDED BY INDUSTRIES, 1970-1983

		Elasticity of manufacturing value added /1
1.	Foods	0.7330
2.	Beverage	0.8728
3.	Tobacco	0.5634
4.	Textiles	1.3247
5.	Leather and leather products	0.3860
6.	Wood and wood products	0.1859
7.	Paper and paper products	1.2106
8.	Basic chemicals	0.8908
9.	Chemical products	1.5070
10.	Refineries and petroleum products	0.4702
11.	Rubber and rubber products	1.1627
12.	Plastic products	0.6505
13.	Ceramic	1.6413
14.	Glass	1.1515
15.	Other non-metallic mineral products	0.9613
16.	Iron & steel	0.2873
17.	Non-ferrous metals	0.3956
18.	Fabricated metals	0.1492
19.	Machinery	1.0229
20.	Electrical industrial machinery	1.3952
21.	Transport equipment	1.4485
22.	Others	1.6381

/1 $\frac{\partial \log MVA_i}{\partial \log MVA_t}$

added are wood and wood products, fabricated metal, iron and steel and non-ferrous metals.

These calculated elasticities reflect the non-uniform growth trend across industrial subsectors. The estimated elasticities could be used to forecast the structure of production in the future. However, the very important assumption underlying this procedure is that the historical values of $\hat{\alpha}_i$ and $\hat{\beta}_i$ would remain constant in the future. Since, the calculation is made over the period of the two oil shocks, the use of estimated $\hat{\alpha}_i$ and $\hat{\beta}_i$ for forecasting industrial growth will be subject to limitations.

Analysis of Structural Change in Industrial Sector

The preceding section is a discussion on the past and present structural changes in Thailand's manufacturing sector. This section presents an analysis of structural changes taken place in the industrial sector.

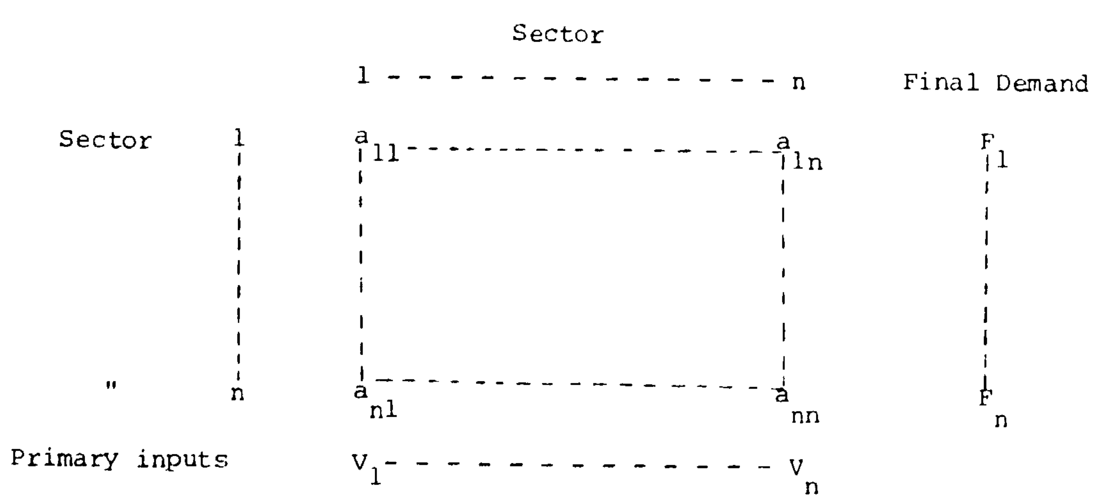
There are many factors responsible for a rapid growth and structural changes witnessed since the last decade. Those include agricultural production, intensity of energy use, productivity of primary factors of production, import substitution and even long run propensity to import. Variations in these parameters can contribute to the process of structural changes in industrial sector.

The useful source of information for analysing the structural changes resulting from the above conditions is a technical coefficient matrix. From the input-output table constructed by NESDB in 1980, the matrix of technical coefficient $(a_{ij}'s)$ is derived. After regrouping 93 industries classified in the Input-Output scheme into the 22 industrial sub-sectors and other non-manufacturing subsectors shown in Appendix 2, the matrix of technical coefficient a_{ij} is newly constructed. The procedure is to divide each column by column total the computed technical coefficients, $a_{ij}'s$ described the pattern of outlays for each account in 1980. They are consequently, a valuable source of information on the structu e of the economy.

The technical coefficients a_{ij}, provide information on the structure of the manufacturing sector. This section discusses an analysis of the Thai manufacturing sector by making use of the available input-output table.

1. Classification of sectors. The square nature of the input-output table provides a simple framework of interdependence among economic units resulting from the sales of commodities from one sector to another and from the use of primary factors. To sell its product, each industry can sell its product to household, firm and government or foreign countries. Therefore, on the output side, sectoral output is used either as intermediate products or for final demand. On the other hand, to process its product, each industry will purchase goods from other industries as materials or inputs. Inputs, therefore, are either processed products of other sectors or drawn directly from the primary sector as labour or capital. These inter-industry transactions can be shown in the following diagram.

<u>Output Distribution</u>



As shown, along each row, it shows the extent of the proportion of output of each industry from a given industry is distributed among other industries. Along each column, the proportion of inputs to each industry from a given industry is shown.

We define λ_i as the proportion of output i that is distributed to intermediate use and θ_i as the proportion of inputs that are drawn from other sectors. Algebraically. is written

$$\lambda_i = \sum_{j=1}^{n} a_{ij}$$

$$\theta_i = \sum_{i=1}^{n} a_{ij}$$

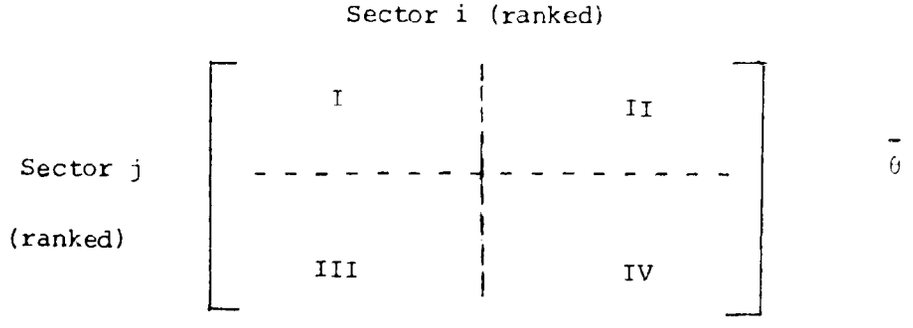
where a_{ij} is technical coefficient of input used to produce the output of i.

The arithmatic means of λ_i's and θ_i's are

$$\bar{\lambda} = \frac{1}{n} \sum_{i=1}^{n} \lambda_i$$

$$\bar{\theta} = \frac{1}{n} \sum_{i=1}^{n} \theta_i$$

Each industry is ranked according its calculated λ and θ . The arithmatic means ($\bar{\lambda}$ and $\bar{\theta}$) partition the set of ranked industries into 4 sub regions as follows.



It could be seen that sectors falling in the region I where λ and θ smaller than overall arithematic means ($\bar{\lambda}$ and $\bar{\theta}$) are sectors that use mostly primary inputs and sell their output primarily to final demand. Alternatively, sectors with λ and θ greater than $\bar{\lambda}$ and $\bar{\theta}$ (falling in region IV) are sectors that are designated as intermediate-manufacturing. They sell most of their outputs as intermediate products or to other sectors and, at the same time, draw on basically non-primary inputs. Sectors falling in region III with $\lambda < \bar{\lambda}$ and $\theta > \bar{\theta}$ refer to those which are designated as intermediate-final. They sell most of their outputs for final demand but drew manufacturing inputs from other sector. Finally, sectors in region II (or with $\lambda > \bar{\lambda}$ and $\theta < \bar{\theta}$ are designated as primary-manufacturing. They sell most of their outputs as intermediate inputs to other sectors but drew basically primary inputs.

An investigation of the partitioned matrix into 4 subregions from our re-grouped Input-Output Table (1980) based on 32 subsectors reveals some interesting characteristics of Thailand's manufacturing sector. As shown in Table 2.16 and Table 2.17 , there are 8 industrial subsectors falling into region I; these are glass and glass products, fabricated metal, ceramics, tobacco, beverage, chemical products, plastic products and other manufactured products. These industries whose λ and θ are below averages ($\bar{\lambda}$ and $\bar{\theta}$) use mostly primary inputs and sell most of their outputs to final demand. The value added originated from these industries constituted about 5.42 per cent of the total GDP in 1980. The outputs of these industries accounted for 16.51 per

Table 2.16 : CALCULATED θ_i BY INDUSTRIES, 1980

		$\theta_i = \sum_{i=1}^{n} a_{ij}$	
1.	Unclassified	1.0	
2.	Nonferrous metals	.826953	
3.	Foods	.751912	
4.	Rubber & rubber products	.662813	
5.	Other non-metallic mineral products	.630016	
6.	Textiles	.627797	
7.	Construction	.617838	
8.	Iron & steel	.615748	
9.	Leather & leather products	.604700	
10.	Transport equipment	.581886	
11.	Electrical industrial machinery	.563505	
12.	Machinery	.543357	
13.	Basic chemicals	.530958	
14.	Transportation & communication	.509277	
15.	Wood & wood products	.509159	
16.	Palp & paper	.48872	$\bar{\theta} = 0.47522$
17.	Glass & glass products	.467724	
18.	Fabricated metals	.462321	
19.	Ceramic	.455895	
20.	Tobacco	.45400	
21.	Other manufactured products	.44260	
22.	Electricity & water supply	.44000	
23.	Chemical products	.429574	
24.	Plastic products	.394807	
25.	Services	.332661	
26.	Banking & insurance	.286028	
27.	Beverages	.265196	
28.	Agricultures	.231824	
29.	Refineries	.206712	
30.	Trade	.149768	
31.	Mining	.12417	
32.	Public administration	0.0	

Source : Data for computation are drawn from 1980 Input-Output Table.

Table 2.17 : CALCULATED λ_i BY INDUSTRIES, 1980

		$\lambda_i = \sum_{j=1}^{n} a_{ij}$	
1.	Trade	2.13411	
2.	Agricultures	1.68075	
3.	Refineries & petroleum products	1.49969	
4.	Textiles	.99849	
5.	Mining	.94289	
6.	Transportation & communication	.86799	
7.	Electricity & water supply	.77305	
8.	Services	.66523	
9.	Foods	.66174	
10.	Iron and steel	.59016	
11.	Pulp & paper & paper products	.58708	$\bar{\lambda} = 0.47526$
12.	Wood & wood products	.37114	
13.	Transport equipment	.34070	
14.	Besic chemicals	.32416	
15.	Non-ferrous metals	.31576	
16.	Banking & insurance	.28251	
17.	Other non-metallic mineral products	.26488	
18.	Construction	.25197	
19.	Machinery	.21927	
20.	Electrical industrial machinery	.18109	
21.	Rubber and rubber products	.18031	
22.	Leather & Leather products	.15992	
23.	Tobacco	.14437	
24.	Fabricated metals	.14035	
25.	Chemical products	.12818	
26.	Plastic products	.12258	
27.	Other manufactured products	.10585	
28.	Glass & glass products	.10165	
29.	Unclassified	.07122	
30.	Beverages	.06906	
31.	Ceramic	.03235	
32.	Public administration	0.0	

Source : Data for computation are drawn from 1980 Input-Output Table.

cent of the total manufactured outputs.

The sectors falling in region IV or with λ and θ greater than the averages ($\bar{\lambda}$ and $\bar{\theta}$) include processed food, textiles, iron and steel and paper and paper product industries. These sectors are designated as intermediate-manufacturing. Outputs of these industries are used mainly in other subsectors including themselves. At the same time, inputs to these sectors are mainly drawn from other sectors as well. Consequently, industries fell into this region are mostly resource-based where their main inputs are drawn from other sectors especially agriculture. The combined share of value added originated from these industries was 11.39 per cent of the country's total value added in 1980 and combined outputs accounted for 43.66 per cent of the total manufactured outputs in the same period.

Industries which are designated as intermediate-final are those which fall into region III. These industries are non-ferrous metal, rubber and rubber products, other non-metallic, leather and leather product, transport equipment, electrical industrial machinery and appliance, machinery, basic chemicals and wood and wood products. These sectors sell most of their output for final demand but drew manufacturing inputs from other sectors. The value added originated from these industries to the country's GDP was 7.53 per cent in 1980 and their combined output accounted for 28.89 per cent of the total manufactured output in the same period.

Finally, the sectors falling into region II are designated as primary-manufacturing. Thesesectors sell most of their products as intermediate inputs and heavily require primary inputs in their production process. Those sectors are mainly non-manufacturing subsectors; for instance, trade, agriculture, mining, electricity and water supply and service. Only one industrial subsector falls into this group, and that is refineries and petroleum products.

Table 2.18 demonstrates the manufacturing output and value added, originated from these 4 industrial subgroups. Judging from the number of industries falling into the 4 categories, most of the industries are producing their outputs to meet the final demand. In other words, there are 17 out of 22

Table 2.18: MANUFACTURING VALUE ADDED AND OUTPUT ORIGINATED BY 4 INDUSTRIAL SUBGROUPS IN 1975 AND 1980

per cent

Group	No. of Industries	Value added to total GDP	Output to total manufacturing
I. Primary-final	8	5.42	16.51
II. primary-manufacturing	1	1.75	6.72
III. intermediate final	9	7.53	20.89
IV. intermediate-manufacturing	4	11.39	43.66
Total	22	26.09	

industries whose main outputs are used for satisfying domestic and foreign markets. Among these 17 industries, about one half intensively use primary inputs in their production process. There are 5 industries which most of their products are intermediate inputs to other sectors. In fact, we wish to see the majority of industries falls into the fourth category which was usually experienced in the industrialized countries. In the Thai case, only 4 out of 22 industries are producing products for intermediate inputs and using other sectors' outputs in their production. However, since this subgroups includes food processing and textile industries--the two most important subsectors--its combined share to GDP and total manufacturing output the largest among the 4 subgroups. However, the unbalanced growth in the industrial sector seems to exist in the sense that most industries are still in the first, second and third regions.

Backward and Forward Linkages

It may be true that the coefficient of a_{ij}'s (hence, λ_i's and θ_i's) can somehow reveal further information on forward and backward linkages. However, the industrial sectoral linkages are not necessarily direct. It is often the case where sectors are tightly related to one another in an indirect way. As a consequence, linkage coefficients should not be judged from the direct a_{ij} coefficients. In fact, they have to be identified by elements in the inverse (I-A) matrix.

The intensity of the linkage as indicated by coefficients discussed here is only one dimension of linkage. In general, it is misleading if we take into account of the fact that a sector may show a large value for the linkage coefficient but it may be, at the same time, be linked to only a few sector.

We firstly define linkage coefficient as U_i and U_j as follow :

$$U_i = \sum_{j=1}^{n} b_{ij} \Big/ \frac{1}{n} \sum_{i=1}^{n} \sum_{j=1}^{n} b_{ij}$$

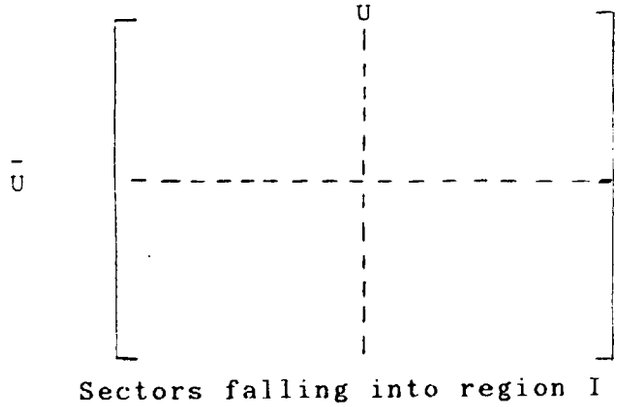
and

$$U_j = \sum_{i=1}^{n} b_{ij} \Big/ \frac{1}{n} \sum_{i=1}^{n} \sum_{j=1}^{n} b_{ij}$$

where b_{ij}'s are the elements of the inverse matrix $(I-A)^{-1}$ and where the average of

$$\frac{1}{n} \sum_{i=1}^{n} U_i = \frac{1}{n} \sum_{j=1}^{n} U_j = \bar{U} = 1$$

These coefficients would partition the inverse matrix (i.e. the matrix of total effects) into 4 regions:



Sectors falling into region I are those with $U_i < \bar{U}$ and $U_j < \bar{U}$. These sectors are designated to be low forward and backward linkages. Region II includes sectors with $U_i > \bar{U}$ and $U_j < \bar{U}$ or with high forward linkages but low backward linkages. Sectors

included in Region III are those with $U_i < \bar{U}$ and $U_j > \bar{U}$ or with low forward linkages but high backward linkages. Finally, sectors falling in the region IV are those with $U_i > \bar{U}$ and $U_j > \bar{U}$, indicating both high forward and backward linkages.

An investigation of the inverse matrix from the reconstructed 1980 input-output table reveals some interesting facts on industrial linkages in the Thai manufacturing sector. As shown in Table 2.19 and 2.20, there are 8 industries out of 22 with low forward and backward linkages. Those industries are wood and wood products, ceramics, glass and glass products, chemical products, tobacco, beverages, plastic and other manufactured products. These industries's outputs accounted for 25.06 per cent of the total manufactured outputs and their combined value added constituted about 6.54 of the GDP in 1980.

There is only one sector with high forward linkages but low backward linkages ($U_i > \bar{U}$ and $U_j < \bar{U}$) and that is refineries and petroleum products. The output of this sector accounted for 6.72 per cent in the total manufactured outputs and the value added originated from this sector was 1.75 per cent of the GDP in 1980.

Industries with low forward linkage but high backward linkage ($U_i < \bar{U}$ and $U_j > \bar{U}$) are leather and leather products, non-ferrous metal, transport equipment, other non-metallic products, rubber and rubber products, machinery, electrical industrial machinery, basic industrial chemicals and fabricated metals. Industries fall into this category had a

Table 2.19 :CALCULATED U_i BY INDUSTRIES, 1980

$$U_i = \frac{\sum_j b_{ij}}{\frac{1}{n}\sum_i \sum_j b_{ij}}$$

1.	Wholesale & retail trade	2.476371
2.	Agriculture	2.148229
3.	Refineries and Petroleum	2.046121
4.	Textiles	1.735844
5.	Transportation & communication	1.334467
6.	Electricity & water supply	1.308886
7.	Mining	1.286853
8.	Service	1.188657
9.	Iron and steel	1.141133
10.	Foods	1.133506
11.	Pulp and paper product	1.088687
12.	Transport equipment	0.921376
13.	Banking and insurance	0.914015
14.	Wood and Wood product	0.853488
15.	Basic industrial chemicals	0.830946
16.	Construction	0.790657
17.	Non-ferrous metals	0.782139
18.	Other Non-metallic products	0.766883
19.	Machinery	0.762523
20.	Rubber and rubber products	0.712241
21.	Unclassified	0.710264
22.	Electric industrial machinery	0.709314
23.	Fabricated metals	0.674515
24.	Chemical products	0.669014
25.	Leather and leather product	0.667381
26.	Plastic product	0.659425
27.	Tobacco	0.650966
28.	Beverage	0.634634
29.	Other manufactured products	0.630897
30.	Glass and glass products	0.628731
31.	Ceramic and earthern wears	0.584870
32.	Public administration	0.556947

$\bar{U} = 1$

Source : Data for computation are drawn from 1980 Input-Output Table.

Table 2.20 : CALCULATED U_j BY INDUSTRIES, 1980

		$U_j = \sum_i b_{ij} / \frac{1}{n} \sum\sum_{ij} b_{ij}$
1.	Unclassified	1.526153
2.	Iron and steel	1.320136
3.	Textiles	1.256241
4.	Leather and leather products	1.237857
5.	Foods	1.164100
6.	Construction	1.157893
7.	Non-ferrous metals	1.157619
8.	Transport equipment	1.129692
9.	Other Non-metallic products	1.114702
10.	Rubber and rubber products	1.106342
11.	Machinery	1.091196
12.	Electrical industrial machinery	1.084832
13.	Basic Industrial chemicals	1.035262
14.	Fabricated metals	1.022736
15.	Pulp paper and paper products	1.007368
		$\bar{U} = 1$
16.	Transportation & communication	0.999274
17.	Wood and wood products	0.996269
18.	Other manufactured products	0.991526
19.	Ceramic and earthern wears	0.959321
20.	Glass and glass products	0.951451
21.	Chemical products	0.947484
22.	Tobacco	0.941515
23.	Electricity & water supply	0.920125
24.	Plastic products	0.908557
25.	Banking and insurance	0.863168
26.	Services	0.858127
27.	Beverage	0.820518
28.	Agriculture	0.766114
29.	Petroleum product	0.737141
30.	Wholesale & retail trade	0.697086
31.	Mining	0.673232
32.	Public administration	0.556947

Source : Data for computation are drawn from 1980 Input-Output Table.

combined share of value added in total GDP about 6.41 per cent and their outputs accounted for 24.59 per cent of the total manufactured output in 1980.

Industrial sectors included in the fourth region are those with high forward and backward linkages. Among these are food processing, textile, iron and steel, paper and paper products industries. Outputs of these industries constituted about 38.54 per cent of the total manufactured outputs and their combined value added was 10.05 per cent in total GDP in 1980.

In sum, judging by number of industries falling into the 4 regions, most of the industries have limited connections with other sectors in terms of backward and forward

Table 2.21: MANUFACTURING VALUE ADDED AND OUTPUTS BY LINKAGE CRITERIA

Category	No.of Industries	Share of Value added in Total GDP	Share of Output in total manufacture
low backward low forward	8	6.54	25.06
low backward high forward	1	1.75	6.72
high backward low forward	9	6.41	24.59
high backward high forward	4	11.39	43.63
Total	22	26.09	100.00

linkages. There are only 4 out of 22 industries, namely food processing, textile, iron and steel, paper and paper products, in which extensive linkages to other sectors exist.

METHODOLOGY

The Model

The following model is developed in connection with Thailand's Sixth Plan (1986-1991) and aims to provide a consistent framework for the investigation of industrial growth related to the selection of a feasible growth target for the economy as a whole and the implication of industrial growth for such a target.

Theoretically, a manufacturing growth output is obtained from a production function. However, due to the lack of data on capital stock and inconsistency of employment data, the use of production function is not possible or advisable. Alternatively the growth of industrial output is projected using the interindustry technique. This technique is appropriate to the extent that the structure of interindustry transaction is a very important factor in the industrial growth. It is, therefore, assumed that industrial outputs depend on their intermediate and final demands. For instance, the demand for steel is likely to be more dependent on the level of output in the steel using industries than on its own price. It implies that a manufacturing output will partly adjust to the demand as in the Keynesian model. Consequently, production in the manufacturing sector depends on the level of domestic (both intermediate and final) demands as well as on the external demand (i.e. exports).

The interindustry technique is considered to be appropriate in this case. On the one hand, an income analysis is deficient since it does not take into consideration bottlenecks which may take place as a result of rapid changes in the composition of demand and supply. On the other hand, an aggregrate model of the Keynesian type may not be sufficient for the analysis in which changes in the composition of production is a significant factor.

When demand increases, production in the sector whose capacity is underutilized will increase holding other things fixed and others with full or nearly full capacity will remain unchanged in the very short run but will finally adjust to an increase in demand. Consequently, an industrial projection obtained from the study will be further interpreted whenever information on capacity utilization of each industrial sub-sector is available. However, due to the fact that recently many industries exhibit excess capacities thus, an increase in the industrial output in most of the sectors may not lead to serious capital bottlenecks.

The methodology here developed consists of two parts. The first part is the method of industrial projection using an input-output model. The second part is the methodology for internal and external demand projections.

Methodology of Industrial Projection

The method of industrial projection is based on a simple kind of interindustry technique or Leontief input-output model. The method is concerned with interactions or interdependence among various economic units resulting from the sales of commodities from one sector to another and from the use of primary factors. Flows of goods and services from one production sector to another can be traced. Each sector appears in the input-output table twice (in a row and a column), i.e., as a purchaser of inputs and a producer of outputs.

For the sake of simplicity, there are three basic assumptions that underlie the model as follows:

1) Each commodity (or group of commodities) is supplied by a single industry or sector of production.
2) Inputs purchased by each sub-sector are a function of output produced in that sector only.
3) The total effect of carrying out several types of production is the sum of seperate effects.

These assumptions simplify the model as they imply that each industry produces only one good and uses one process of production. In other words, it is assumed that the input-output table should have homogeneous outputs and a homogeneous structure of inputs. In fact, this system of classification is seriously

limited by the availability of data. In practice, the criterion of regrouping is that all activities in each sector should have the same primary products. In addition, to solve the problem of several secondary products, they are simply added in the output in value units. As in the input-output table shows, each industry processes a product using purchased products from other sectors as raw materials or inputs. In addition, it sells its product to other industries and to households, firms, government and foreign countries. As a consequence, the demand for goods and services in the manufacturing sector are classified into 2 parts: intermediate and final demand. These inter-industrial transactions can be expressed in algebraic form as follows:

$$X_i = d_i (W_i + D_i) + E_i \qquad (1)$$

where x_i = total output of industry i

d_i = domestic share of total supply of industry i.

W_i = intermediate demand for output of industry i.

D_i = final demand for industry i's output.

E_i = export or foreign demand for industry i's output.

$$M_i = m_i (W_i + D_i) \qquad (2)$$

where M_i = import of output of industry i.

m_i = import share of total supply of industry i's output.

$$m_i + d_i = 1$$

Since $$W_i = \sum_{j=1}^{n} a_{ij} x_j \qquad (3)$$

where a_{ij} is input coefficient or amount (or value) of output of industry i used to produce one unit of output j.

The solution of the level of output in the j^{th} industry can be expressed in terms of

$$x_j = \sum_{i=1}^{n} r_{ij} (U_j D_j + E_j) \qquad (4)$$

where coefficients, r_{ij}'s, are the elements of the inverse of a Leontief domestic matrix in which the coefficient $(u_i a_{ij})$ represents the amount supplied from domestic sources.

Equantion 4 makes it possible to solve for the increase in internal and external demands in all sectors (i.e. ΔD_j and ΔE_j). In other words, the core of this analysis is a set of input-output accounts that permits changes in the structure of demand, trade and production.

Methodology of Domestic Demand Projection

Since an attempt is made for projecting balanced growth of industrial sectors in 1986-1991, internal and external demands have to be determined first. As mentioned earlier, the idea is based on the fact that industrial outputs are demand-determined. Sustained growth in the industrial sector requires a transformation of the structure of production which is compatible with the evolution of both domestic demand and the opportunity

for international trade.

All components of final demands, namely consumption, investment, government expenditure, are projected first and then inserted into the social accounting matrix (SAM) as an exogenously determined variable to simulate for balanced growth of industrial output. This section will discuss the methodology used in the final demand projection.

Domestic Consumption Demand Projection

The basic tool for projecting consumption demand for commodity (or group of commodities) is ELES (Extended Linear Expenditure System). The difference between the welknown LES (Linear Expenditure System) /1 and ELES is that, in LES, total private consumption is exogenously given and the model describes how to allocate the given amount of total expenditure among various commodities. ELES developed by Lluch is one of many possible approaches to solve the problem of endogenizing total private consumption expenditures /2. ELES, therefore, allows for total expenditure to be endogenously determined.

/1 See Klein L.R. and H. Rubin, "A Constant Utility Index of the Cost of Living", Review of Economic Studies, 15, 1947-1948.

Geary R.C., "A Note on A Constant Utility Index of the Cost of Living", Review of Economic Studies, 18, 1950-1951.

Sanmulson P.A., "Some Implications of "Linearity"", Review of Economic Studies, 15, 1947-48.

Stone R., "Linear Expenditure Systems and Demand Analysis: An Application to the Pattern of British Demand", Economic Journal, 64, 1954.

/2 Lluch C, "The Extended Linear Expenditure System", European Economic Review, 4, 1973.

To begin with, in order to develop formulae for ELES, all possible explanatory variables of saving and expenditure apart from income and prices are initially ignored. Other relevant variables such as household size, age, education, occupation, location are put aside by assuming that there is no dramatic change in the composition of population throughout the period of study.

According to ELES, household decision is assumed to be made on a per capita basis. Households or individuals face the problem that, given their per capita disposable income (Y) and a set of n commodities or groups of commodities ($q_1, q_2, \ldots q_n$) with corresponding prices ($p_1, p_2, \ldots p_n$), how much is actually spent on each commodity or group of commodities. If total expenditure on the $i^{\underline{th}}$ commodity is v_i or $p_i q_i$ ($i = 1, 2, \ldots, n$) and $\sum_{i=1}^{n} v_i$ is total expenditure out of disposable income, saving is, therefore, equal to $Y - \sum_{i=1}^{n} v_i$.

It is assumed that the answer to the above problem is given by

$$v_i = p_i \gamma_i + \beta_i^* \left(Y - \sum_{j=1}^{n} p_j \gamma_j \right) \qquad (5)$$

where γ_i and β_i^* are parameters to be estimated.

Adding all the expenditure equation v_i, we obtain

$$\sum_{i=1}^{n} v_i = \sum_{i=1}^{n} p_i \gamma_i + \sum_{i=1}^{n} \beta_i^* \left(Y - \sum_{j=1}^{n} p_j \gamma_j \right) \qquad (6)$$

or $$V = (1 - \mu) \sum_{j=1}^{n} p_j \gamma_j + \mu Y \qquad (7)$$

where $V = \sum_{i=1}^{n} v_i$, $\mu = \sum_{i=1}^{n} \beta_i^*$

The ELES shown in equation(5) can be compared to the original LES model where the solution of expenditure on the ith commodity is given by

$$V_i = p_i \gamma_i + \beta_i (V - \Sigma_j p_j \gamma_j)$$

where β_i is the marginal budget share of the i^{th} commodity. That is, marginal propensity to consume out of the total expenditure, $(\frac{\partial V}{\partial V}i)$ so that $\Sigma \beta_i = 1$. In ELES, the β_i^* is marginal propensity to consume out of income so that $\sum_{i=1}^{n} \beta_i^* = \mu$ or the aggregrate marginal propensity to consume. It is obvious that β_i in LES is equal to β_i^*/μ . ELES is "extended" from LES and is apparent that ELES allows for the endogenous determination of consumption expenditures (V).

The other parameter γ's in equation (6) may be interpreted as basic needs or subsistence levels of consumption of commodity i's, if they are possitive and $\sum_{j=1}^{n} p_j \gamma_i$ is totally committed or subsistence expenditure. The expression $(Y - \sum_{j=1}^{n} P_j \gamma_j)$ can be considered as a supernumerary income.

The consumption demand of commodity i or groups of commodities is projected first using the ELES model. Then the projected results are inserted into the input-output model as one component of the final domestic demand.

Investment Demand Projection

To investigate the behavior of private investment expenditures, one has to formulate the relationship between

investment expenditure and other relevant economic variables. In fact, many attempts have been made to specify this relationship, for instance, with the cash flow model, the security value model, the Forgensen model etc. In this study, the generalized acceleration model is utilized due to its suitability of Thai data. The model is based on the concept of acceleration which postulates a relationship between net investment and changes in output. It is found in the Bischoff's study that the model performs fairly satisfactorily, especially in predicting the behavior of investment expenditures.

According to the generalized accelerator model, the gross investment (I_t) is equal to the sum of net investment (I_{nt}) and replacement investment (I_{rt}).

$$I_t = I_{nt} + I_{rt} \qquad (9)$$

Net investment is a linear stochastic function of changes in expected level of output (ΔY^*).

$$I_{nt} = \alpha + \beta \Delta Y_t^* + \varepsilon_t \qquad (10)$$

The value of expected output depends on the past and present levels of actual output.

$$Y_t^* = \sum_{i=0}^{\infty} W_i Y_{t-1} \qquad 0 < W_i < 1 \qquad (11)$$

It is also assumed that replacement investment is a constant ratio of existing capital stocks (K) or

$$I_{rt} = aK_{t-1} \qquad (12)$$

By substituting equation (10) - (12) in (9), one obtains

$$I_t = \alpha + \sum_{i=0}^{\infty} \beta_i \Delta Y_{t-1} + aK_{t-1} + \varepsilon_i \qquad (13)$$

The relationship stated in equation (13) is called the generalized accelerater model. It postulates that investment expenditures are linear stochastic function of past and present levels of output and the unobservable capital stock. /1

Due to unavailability of data on capital stock, value of capital stock has to be derived first. It is assumed that a change in capital stock is the sum of two components, depreciation component ($\beta_0 K_{t-1}$) where $0 < \beta_0 < 1$ and increasing component (I_t). Therefore

$$K_t - K_{t-1} = I_t + \beta_0 K_{t-1} \qquad (14)$$

$$K_t - (1 - \beta_0) K_{t-1} = I_t \qquad (15)$$

By substituting equation (15) in to equation (13), it yields the following result /2

$$I_t = \gamma_0 + \gamma_1 GNP_t - \gamma_2 (1+ \beta_0) \sum_{i=0}^{t-1} \eta^t I_{t-1-i} - \gamma_2(1+ \beta_0) a_0 \eta^t \qquad (16)$$

where η is $(1 + \beta_0)$ and a_0 is $\sum_{i=0}^{\infty} (1 + \beta_0)^i I_{0-1-i}$

/1 The model can be furtherly modified by including other variables which may explain investment expenditure such as interest rate (r_t), changes in bank loan and overdraft (ΔLOD_t), relative price (p_t) and the pressure of demand (POD_t) eg.

$$I_t = \alpha + \sum_{i=0}^{\infty} \beta_1 \Delta Y_{t-1} + aK_{t-1} + \beta_2 \Delta LOD - \beta_3 r_t - \beta_4 P_t + \beta_5 POD_t + \varepsilon_t$$

/2 See Siri Garncharoendee, "A Model of Thailand's Economy: An Econometric Approach", Ph.D. dissertation, Monash University, 1975, p. 115-122.

Investment demand is thus projected using equation (16). Once projected, the investment values are inserted into the input-output model using fixed-coefficient of each sub-sector as a transformer.

Government Expenditure

Government expenditures, appear as a column of final domestic demand in the model. Due to the lack of time-series data government expenditures are projected using time trend analysis. The major source of data is the National Income of Thailand where government expenditures data on time-series basis are available . After the projection of the total government expenditure throughout the planning period is made, the projected values are then transformed into each economic sub-sector using the fixed coefficient of 1980 input-output table. This method is only acceptable provided that there will be no dramatic change in the component of government expenditure throughout the plan. In the absence of other information, this assumption must be held.

External Demand Projections

There is a little doubt that an expansion of export has contributed to a rapid growth of manufacturing goods since 1970's. Recently, an explanation for the process of export propelled growth has been offered by W. Beckerman who established a technological link between export and GDP. /1 He argues that if

/1 Beckerman W., "Projecting Europe's Growth", Economic Journal, Dec. 1962, p. 912-925.

a country has a comparative advantage at some point in its history, an expansion of its export will give rise to new investment embodying advanced large scale technology. However, the ensueing increase in labor productivity resulted from new investment will be accompanied by a wage increase of a small magnitude. As a consequence, prices tend to decline. The decrease in price will then further stimulate export so that a cumulative expansion of export, investment and output is further generated.

For the past few years, the exportation of manufactured goods played an increasingly important role in the industrial growth in Thailand. In this section, we present the method of projecting external demand as a one major component of the industrial growth.

Export demand is projected either by time trend or, if data are available, by formulating of an export function. In the latter case, total value of export is expressed explicity as a function of world price, exchange rate and income per capita of major importing countries. The function is formulated in a Cobb-Douglas like function as follows:

$$X_t = A_0 e^{\lambda t} (E_t W_t)^{\epsilon} (Y_t)^{\gamma}$$

where X_t = total export at time t.

E_t = foreign exchange rate at time t.

W_t = world price at time t.

Y_t = weighted income per capita of major importing countries.

ε = price elasticity

γ = income elasticity

The first term on the right hand side ($A_0 e^{\lambda t}$) is intended to capture all sources of export growth other than exchange rate, world price and income per capita of major importing countries.

PROJECTION OF FINAL DEMAND

In the preceding chapter, the methodologies of final demand projections have been discussed. This chapter is devoted to a presentation of the empirical results of projections of the final demand components.

Private Consumption Expenditure

For the period under study, 1965-1983, private consumption expenditures increased from 68,355 million baht from 1965 to 217,618 million baht in 1983, representing an increase of 6.64 per cent per annum. The estimated GNP at constant prices was 96,792 million baht as compared to 328,382 million baht in 1983 representing an increase of 7.0 per cent per year. On per capita basis, the private consumption expenditure increased from 2,135 baht in 1965 to 4,400 baht in 1983 or at an annual growth rate of 4.1 per cent while GNP per capita grew annually at the rate of 4.5 per cent. The difference between these two growth rates implies a gradual increase of savings which financed the economic growth process during the past 2 decades. Table 4.1 demonstrates the detailed growth of both private consumption expenditure and gross national product at constant (1972) prices in the aggregrate and on per capita basis.

Over the previous two decades, private consumption expenditure has increased and the composition of consumption has changed as well. Available time series data on private

Table 4.1 : PRIVATE CONSUMPTION EXPENDITURE AT 1972 PRICES, 1965-1983

Year	Total consumption expenditure (Million Baht)	Growth rate of consumption expenditure	GNP (Million Baht)	Growth rate of GNP	Per capita consumption (Baht)	Growth rate of per capita Consumption	GNP/capita (Baht)	Growth rate of GNP per capita
1965	68,355		96,792		2,135		3,024	
1966	77,765	9.38	108,579	12.18	2,260	5.85	3,282	8.53
1967	80,744	8.00	114,719	5.65	2,362	4.51	3,355	2.22
1968	80,932	7.66	125,132	9.08	2,459	4.11	3,540	5.51
1969	97,273	11.89	136,951	9.44	2,664	8.34	3,751	5.96
1970	97,775	.5	146,429	6.92	2,686	.8	4,023	7.25
1971	104,176	6.55	157,931	7.85	2,779	3.46	4,214	4.75
1972	111,685	7.21	164,299	4.03	2,893	4.10	4,256	1.0
1973	115,827	3.71	179,751	9.40	2,918	.99	4,529	6.41
1974	127,821	10.35	190,631	6.05	3,134	7.4	4,675	3.22
1975	135,434	5.95	203,514	6.76	3.235	3.22	4,861	3.98
1976	145,548	7.47	220,205	8.20	3,388	4.73	5,126	5.45
1977	158,839	9.13	235,598	6.99	3,607	6.46	5,350	4.37
1978	169,919	6.97	257,043	9.10	3,768	4.46	5,699	6.52
1979	180,535	6.25	269,897	5.00	3,913	3.85	5,849	2.63
1980	189,821	5.14	284,573	5.44	4,086	4.42	6,125	4.72
1981	198,675	4.66	298,284	4.82	4,184	2.40	6,281	2.55
1982	204,366	2.86	309,122	3.63	4,215	.74	6,375	1.50
1983	217,618	6.48	328,382	6.23	4,400	4.39	6,639	4.14

Source: NESDB

consumption prepared by NESDB are classified into 8 commodity groups defined as follows.

1. Food: expenditure on food, beverages and tobacco.
2. Clothing: expense of clothing, footwear and other wearing apparels.
3. Housing: expenditure on rent, water, light and household operation.
4. Household: equipment expenditure on furniture and equipment.
5. Personal care: expense on personal care and health.
6. Transportation and communication: expense on personal transportation, transport equipment and communication.
7. Recreation and entertainment: expenditure on entertainment
8. Miscellaneous services.

Table 4.2 displays data on the amount of private consumption of the 8 individual categories on an aggregrative basis between 1965-1983. The computed shares of individual consumption expenditures in total per capita consumption presented in Table 4.3 show different trends markedly. The observed structural changes in consumption expenditures by individual components support the well-known hypothesis

Table 4.2 : TOTAL PRIVATE CONSUMPTION EXPENDITURE AND GNP AT 1972 PRICES, 1965 - 1983

(Millions of Baht)

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1. Food	38,712	41,663	44,500	47,284	53,363	52,878	56,156	60,016	63,256	67,290	71,243	76,502	82,372	85,375	90,775	92,911	96,021	96,388	101,429
2. Clothing and other personal effects	5,614	6,392	7,094	7,626	8,292	8,284	9,729	10,429	11,304	11,770	12,992	13,674	14,989	16,477	17,177	17,935	18,631	19,068	19,699
3. Housing	5,779	6,053	6,328	6,646	7,005	8,064	8,442	8,819	9,147	9,503	9,823	10,199	10,780	11,466	12,099	12,805	13,504	14,200	15,031
4. Household equipment	3,487	4,027	4,328	4,865	5,472	5,937	5,459	7,667	8,527	8,967	8,936	9,670	10,734	12,111	13,274	14,126	14,957	15,054	15,968
5. Personal care and health expenses	3,590	3,832	4,165	4,646	5,227	5,435	6,638	7,232	8,035	8,438	9,436	10,530	11,580	12,470	13,109	14,347	15,558	17,203	18,758
6. Transportation and communication	4,830	5,529	6,227	6,887	8,037	7,202	7,462	8,132	9,476	10,358	10,255	10,538	12,817	14,518	14,592	15,710	16,862	17,832	20,347
7. Recreation and entertainment	5,269	6,063	6,831	7,524	8,225	8,559	8,838	9,576	10,421	11,522	12,742	14,267	15,209	16,973	18,655	21,114	22,055	23,295	24,718
8. Miscellaneous services	1,074	1,206	1,271	1,454	1,652	1,416	1,452	1,502	1,715	1,659	1,749	1,860	2,154	2,467	2,701	2,860	3,112	3,408	3,683
Total	68,355	74,765	80,744	86,932	97,273	97,775	104,176	111,685	115,827	127,821	135,434	145,548	158,839	169,919	180,535	189,821	198,675	204,366	217,618
GNP.	96,792	108,579	114,719	125,132	136,951	146,429	157,931	164,299	179,851	190,631	203,514	220,205	235,598	257,043	269,897	284,573	298,284	309,122	328,382

Source : NESDB.

(Engels'Law) that as income rises, individuals shift their consumption towards semi-luxurious or luxurious items. Upon dividing the commodities into 3 different groups--the first group includes commodities whose shares in total consumption declined, the second group includes those whose shares remained constant and the last group includes those whose shares increased as income increased. Commodities belonging to the first group are foods /1 and housing. /2 As shown in Table 4.3, the shares of food and housing in total consumption expenditures fell from 55.6% and 10.8% in 1965 to 47.9% and 8.4% in 1983, respectively. Those commodities classified under group 3 (increasing shares) are clothing, transportation recreation, and, perhaps, personal care. Commodities showing quite stable shares as income rises are household equipment and miscellaneous items. The observed movement of each individual component in consumption expenditures is expected in the sense that similar experiences were gained in the development process of other countries. As an economy grows, a higher proportion of extra income received is allocated towards more luxurious goods at the expense of necessary goods.

Estimation of Private Consumption Expenditure

According to the ELES stated in the preceding chapter, expenditures on a commodity or a group of commodities are written as a function of price and income, or algebraically,

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/1 including food, beverages and tobacco.

/2 including household operation, rent and water, and fuel and light.

Table 4.3 : SHARE OF INDIVIDUAL CONSUMPTION ITEMS IN TOTAL PER CAPITA CONSUMPTION EXPENDITURE, 1965-1983

(Percentages)

	Foods	Clothings	Housing	Household equipment	Personal care	Transportation	Recreation	Miscellanous	Total
1965	55.6	8.2	10.8	3.2	5.4	7.8	7.2	1.8	100
1966	56.0	8.3	10.1	3.3	5.2	7.8	7.6	1.7	100
1967	56.6	8.1	9.6	3.0	5.3	7.6	7.8	2.0	100
1968	55.7	8.0	9.3	3.3	5.5	8.0	8.2	2.0	100
1969	55.3	8.0	9.1	3.4	5.6	8.3	8.3	2.0	100
1970	55.2	8.1	10.4	3.6	5.6	7.3	8.2	1.5	100
1971	53.3	9.5	10.4	3.2	6.4	7.2	8.6	1.4	100
1972	53.7	9.3	10.0	3.2	6.5	7.3	8.6	1.4	100
1973	54.5	9.3	9.5	3.4	5.9	7.8	8.2	1.4	100
1974	55.3	8.8	9.0	3.5	5.3	8.5	8.4	1.2	100
1975	55.9	8.6	8.7	3.1	5.7	8.1	8.7	1.2	100
1976	55.6	8.8	8.4	3.3	5.7	8.0	9.1	1.1	100
1977	54.8	9.0	8.1	3.5	5.7	8.7	9.0	1.2	100
1978	53.7	9.6	7.7	3.7	5.7	9.2	9.1	1.3	100
1979	52.2	10.2	7.7	4.1	5.4	9.6	9.3	1.5	100
1980	50.5	10.5	7.9	4.1	5.8	10.1	9.6	1.5	100
1981	49.5	10.2	8.2	4.0	5.9	11.3	9.0	1.9	100
1982	48.3	10.2	8.4	3.8	6.3	11.7	9.8	1.5	100
1983	47.9	10.2	8.4	3.6	6.5	12.2	9.7	1.5	100

Note : The item, Foods includes expenditure on beverage and tobacco.

Source: The computation is made from the statistics reported in National Income of Thailand, various years

$$v_{it} = p_{it}\gamma_i + \beta_i (Y_t - \sum_j p_{jt} \gamma_j)$$

To statistically estimate this relationship, a stochastic term is introduced, i.e.

$$v_{it} = p_{it} \gamma_i + \beta_i (Y_t - \sum_j p_{jt} \gamma_j) + \varepsilon_{it}$$

where ε_{it} is a disturbance term satisfying all the classical assumptions such that

$$E(\varepsilon_{it}) = 0$$

$$E(\varepsilon_{it} \varepsilon_{it}') = \Omega$$

$$E(\varepsilon_{it} \varepsilon_{it}') = 0 \quad \text{for } t \neq t$$

Subscript i denotes commodity or group of commodities, $i = 1, \ldots\ldots, n$; t denotes sample observation, $t = 1, 2, \ldots . T$.

The coefficients γ_i's and β_i's are to be estimated. However, since the above equation involves cross-equation restrictions on the parameters (all γ_i's occur in all equations), demand systems must be estimated simultaneously using a method which imposes the cross-equation constraints. The full-information maximum likelihood (FIML) method is appropriately used in this case.

Data

Due to unavailability of time series data on domestic consumption of the 22 industrial subsectors, we proceed to estimate the ELES function from time series data of the eight commodity groups stated above. The basic data on aggregrate and

per capita consumption of 8 commodity groups are used to estimate the ELES model. In aggregrate values, data have to be in terms of both current and constant prices in order to derive the implicit price indices. In addition, personal disposable income per capita is also required. All of these data are obtained from various issues of National Income Account of Thailand.

Parameter Estimation

The ELES model was fitted to national account data on per capita expenditures, per capita diposable income, and the (implicit) price indices of these eight commodity groups.

The maximum likelihood estimation required 16 iterations to converge. The statistical results obtained are given in Table 4.4 for the value of β's , γ's and MPC (with t-statistics given in the parentheses). Estimated β's are "highly significant" for all the commodity groups. The estimates of γ's however, are less precise and not as pronounced as β's . There are about 3 commodity groups (clothing, household equipment and transport) out of 8 which γ's are statistically insignificant by conventional t-test. In addition, among these 3 groups, there are 2 groups whose coefficients obtain negative signs. Those are household equipment and transportation categories. /1 However, the sum of estimated γ's is less than actual expenditure as required by the underlying utility theory.

/1 Only positive value of γ_i can be interpreted as "subsistence minima" level.

Table 4.4: ESTIMATED MARGINAL BUDGET SHARE (β_i) AND SUBSISTENCE MINIMA (γ_i) AND MARGINAL PROPENSITY TO CONSUME

	β_i	γ_i	D.W
1. Foods	0.4131	900.24	2.5177
	(21.84)	(11.16)	
2. Clothing	0.1381	32.63	0.2922
	(22.28)	(1.57)	
3. Housing	0.0258	237.83	1.4936
	(5.09)	(20.25)	
4. Household equipment	0.0589	-6.39	0.7372
	(16.54)	-(56)	
5. Personal care	0.0626	89.15	0.3506
	(17.53)	(7.32)	
6. Transportation	0.1630	-9.91	0.2791
	(10.70)	-(.23)	
7. Recreation	0.1250	53.07	0.3623
	(37.05)	(3.38)	
8. Miscellaneous	0.0134	18.86	0.3574
	(6.16)	(3.38)	
Marginal propensity to consume	.8079		

Note: Figures in the parenthesis are t-statistics.

The values of Durbin-Watsen statistics show fairly marked positive first order serial correlation in the residuals of individual equation.

Unfortunately, with the respect of the goodness of fit of the ELES model, available computer package used for solving maximum likehood estimates does not yield the value of R^2. We, therefore, proceeded to do two things; 1) examine the performance of the model by comparing predicted and actual values of per capita consumption and 2) compare the results obtained from this study with other previous studies.

The predicted and actual values of per capita consumption (at current prices) by commodity groups in 1983 are presented in Table 4.5. Overall, predicted value of individual equation seems to be very close to the actual values. However, the predicted values are generally higher than the actual values by about 15 per cent in 4 out of 8 commodity groups, namely, food, clothing, housing and recreation.

A comparison of our results of parameter estimation with those obtained from other previous studies of the ELES model applied to Thai data is presented in Table 4.6. There are two studies to be pointed out here, one by Lluch, Powell and Williams /1 and the other by Siri Garncharoendee. /2 The former is the application of the ELES model for international comparison among countries covering the year 1960-1969 as the period of

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/1 Lluch C., Powell A. And Williams R.,op.,cit.

/2 Garncharoendee S., op.,cit.

Table 4.5 : ACTUAL AND PREDICTED PER CAPITA CONSUMPTION IN 1983

	Actual /1 (Baht)	Predicted /2 (Baht)	Percentage of difference
1. Foods	6,105	6,907	+ 13%
2. Clothing	1,296	1,519	+ 17%
3. Housing	1,068	1,130	+ 29%
4. Household equipment	457	592	+ 6%
5. Personal care	828	865	+ 4%
6. Transportation	1,550	1,652	+ 6%
7. Recreation	1,238	1,419	+ 15%
8. Miscellaneous	196	195	- 1%

Notes: /1 Computation is made on data obtained from various issues of National Income of Thailand .

/2 Results obtained from estimated ELES model.

study. The latter following the same methodology is proceeded with 1957-1972 data. Different periods of study make a comparison rather difficult. As shown in the Table 4.6, estimates of β's in most cases are the same. However, as compared to the two previous studies, of β's are slightly overestimated in clothing and transportation group. The other 3 categories, namely foods, recreation and miscellaneous, are slightly under estimated compared to those of the previous studies. Differences in these studies are quite apparent with respect to γ's. There are 4 categoreis out of 8 where γ's are different among the three studies.

The estimated MPC is 0.8079 in this study as compared to 0.7954 and 0.7590 in other studies. Taking the period of study into consideration, MPC tends to increase as income rises.

The comparison of our results with those of Lluch, Williams and Powell and of Siri Garncharoendee points out that the three sets of estimates are compatible. However, estimated results obtained from the present study are somewhat different from those of other researchers. It has been noted that the differences in these results stem from different average budget shares due to different periods of time under study.

Elasticity

The estimated elasticity of demand for good i with respect to total expenditure can be interpreted as the product of

Table 4.6: COMPARISON OF RESULTS

Items:	β_1			γ_i		
	This study	Siri's	Lluch & Williams	This Study	Siri's	Lluch & Williams
1. Foods	0.4131	0.5018	0.482	900.24	458.26	623.5
2. Clothing	0.1381	0.0911	0.101	32.63	49.99	68.0
3. Housing	0.0258	0.0454	0.013	237.83	134.07	179.2
4. Household equipment	0.0589	0.0472	0.052	- 6.39	7.35	15.5
5. Personal care and health care	0.0626	0.0618	0.052	89.15	33.51	57.8
6. Transportation	0.1630	0.0903	0.123	- 9.91	39.08	37.9
7. Recreation	0.1250	0.1331	0.150	53.07	-14.57	6.5
8. Miscellaneous	0.0134	0.0293	0.028	18.86	0.12	8.7
MPC	0.8079	0.7954	0.7590			

Sources: 1. Siri's Ph.D. Thesis (1957 - 1972)

2. Lluch & Williams (1960 - 1969)

3. This study (1965 - 1983)

marginal budget share (β_i) and the ratio of total expenditures to the expenditures on the i th commodity. Algebraicly,

$$E_i = \beta_i \left(\frac{v_i}{p_i \; x_i}\right)$$

where E_i = elasticity of demand for good i respect to total expenditure

β_i = marginal budget share for good i

V = total expenditures

v = expenditure on good i

or $E_i = \beta_i / W_i$

where W_i is average budget share ($v_{i/V}$)

Estimates of the expenditure elasticities (E_i), calculated from the above formulae, are given in Table 4.7. The elasticities for food and housing are as expected, i.e., very low compared to the other sectors' elasticities. The total expenditure elasticities for personal care and miscellaneous items are clustered around 1. All total expenditure elasticities for the other commodities exceed unity. These results are consistent with the shifting of pattern of consumption as income increases as generally hypothesized in micro economic theory.

The elasticity of demand for good i is calculated from the following formulae.

$$\eta_i = \mu\beta_i \; (V/v_i)$$

where β_i = marginal budget share for good i

y = disposable income per capita

V_i = expenditure on good i

μ = marginal propensity to consume.

Table 4.7 : ELASTICITY OF CONSUMPTION

	Items	Elasticity respect to total expenditure	Elasticity respect to income
1.	Foods	0.783	0.7405
2.	Clothing	1.467	1.3889
3.	Housing	0.296	0.2808
4.	Household equipment	1.656	1.5675
5.	Personal care and health care	1.066	1.0107
6.	Transportation	1.851	1.7535
7.	Recreation	1.395	1.3206
8.	Miscellanous	1.017	0.9429

Table 4.8 : ESTIMATED EXPENDITURE ELASTICITIES: A COMPARISON OF ESTIMATED RESULTS

Categories	This study[1]	Siri's[2]	L.P & W.[3]
1. Foods	0.783	0.8967	0.8362
2. Clothing	1.467	1.1068	1.2019
3. Housing	0.296	0.4481	0.1604
4. Household equipment	1.656	1.4492	1.6092
5. Personal care and Health care	1.066	1.1071	0.9300
6. Transportation	1.851	1.1971	1.5659
7. Recreation	1.395	1.7790	1.9943
8. Miscellanous	1.017	1.6159	1.5475

Sources: 1. This study (1965-1983)
2. Siri's Phd Thesis (1957-1972)
3. Lluch & Williams (1960-1969)

Calculated elasticities of demand for goods with respect to income by commodity groups are presented in Table 4.7. Similar results to the above measures are observed, but the values are slightly lower than the expenditure elasticities.

Table 4.8 presents a comparison of our results with those of Siri Garncharoendee and of Lluch, Powell, and Williams. The comparison reveals the consistency of our estimates with their estimated elasticities. However, there are 3 cases out of 8, namely, housing, personal care and recreation where 3 estimators slightly deviate from each other. One possible explanation may be that the different time series data may have produced different results.

All of the studies seem to indicate that subsets of expenditure categories have expenditure elasti ities in excess of one. The group includes clothing, household equipment, transportation and recreation.

All three studies, are consistent with the hypothesis of the shifting pattern of consumption as income rises.

Projection of Consumption Demand

In projecting consumption expenditures for each commodity group between 1986-1991, using the ELES model, marginal budget shares and subsistence minima are assumed to be constant. At the macro level, some difficulties occur in projecting consumption expenditure using constant marginal budget shares. In

fact one could observe declining marginal budget shares for necessary commodities such as food as per capita income increases or that of housing or transport rises with income. /1 However, due to the lack of consistent data on income distribution, composition of population and other socioeconomic variables, we assume that there is no dramatic changes in these variables and proceed to project consumption demand based on the estimated results and the projected implicit price and disposable per capita income. Data on projected price and income are mainly obtained from NESDB and are used as a basis of consumption expenditure projection. The projected values of implicit price by commodities and per capita disposable income are presented in Table 4.9 and 4.10, respectively.

Projections of per capita consumption by commodity groups are presented in Table 4.11. Throughout the Sixth Plan (1986-1991), per capita expenditures on food and housing as projected, will grow at the annual rate of 5.38 and 5.63 per cent, respectively. Per capita expenditures by commodity group which show higher rate of growth are household equipment, clothing and transportation. The picture again, is consistent with the hypothesis of shifting consumption towards luxurious and semiluxurious commodities as income rises.

/1 International comparison by Lluch, Powell and Williams indicates that marginal budget share for food at the high income level countries is 0.18 whereas in low income level countries (<$500) is 0.39.

Table 4.9: IMPLICIT PRICES BY COMMODITY GROUPS, 1985-1991

Categories	1985	1986	1987	1988	1989	1990	1991
Food	3.1743	3.2378	3.3997	3.5663	3.7232	3.9094	4.1088
Clothing	3.0028	3.0628	3.216	3.3736	3.522	3.6981	3.8867
Housing	3.9449	4.0238	4.225	4.432	4.627	4.8584	5.1061
Household equipment	2.9821	3.0417	3.1938	3.3503	3.4977	3.6726	3.8599
Personal care	2.6413	2.6941	2.8288	2.9674	3.098	3.2529	3.4188
Transportation	3.8659	3.9432	4.1404	4.3432	4.5344	4.7656	5.0086
Recreation	2.5652	2.6165	2.7473	2.8819	3.0087	3.1592	3.3203
Miscellaneous	3.2215	3.2859	3.4502	3.6193	3.7785	3.9675	4.1698

Table 4.10: PROJECTED PER CAPITA DISPOSABLE INCOME, 1982-1991

Year	Aggregate (Million Baht)	Population	Per capita (Baht)
1982	647,062/1	48.49/1	13,344/1
1983	691,867/1	49.46/1	13,988/1
1984	733,843/1	50.396/1	14,561/1
1985	784,987	51.303	15,301
1986	834,065	52.227	15,970
1987	884,207	53.01	16,680
1988	947,310	53.80	17,608
1989	,016,002	54.612	18,604
1990	1,090,751	55.43	19,678
1991	1,172,177	56.26	20,835

Note: /1 Actual figures.

Table 4.11: PROJECTED PER CAPITA CONSUMPTION BY 8 COMMODITY GROUPS, 1986-1991

(at current prices)

	1986		1987		1988		1989		1990		1991	
	Amount (Baht)	Rate of growth %	Amount (Baht)	Rate of growth %	Amount (Baht)	Rate of growth %	Amount (Baht)	Rate of growth %	Amount (Baht)	Rate of growth %	Amount (Baht)	Rate of growth %
Food	6,652	4.0	6,953	4.5	7,359	5.8	7,735	5.1	8,173	5.7	8,645	5.8
Clothing	1,412	5.0	1,473	4.3	1,566	6.3	1,651	5.4	1,750	6.0	1,857	6.1
Housing	1,239	2.6	1,299	4.8	1,367	5.2	1,431	4.7	1,506	5.2	1,587	5.4
Household equipment	556	5.3	580	4.3	617	6.4	651	5.5	691	6.1	734	6.2
Personal care	788	4.5	823	4.4	872	5.9	918	5.3	971	5.8	1,029	6.0
Transportation	1,355	5.4	1,412	4.2	1,503	6.4	1,587	5.6	1,683	6.0	1,788	6.2
Recreation	1,282	5.0	1,337	4.3	1,421	6.3	1,498	5.4	1,587	5.9	1,684	6.1
Miscellaneous	177	4.7	185	4.5	196	5.9	206	5.1	218	5.8	230	5.5

With projected population and disposable income, aggregrate consumption by commodity groups are calculated (see Table 4.12) and inserted into the model as one component of domestic final demand, namely consumption. The aggregrate consumption for 8 commodity group is then transformed into 32 economic activities by using fixed coefficients obtained from the input-output table 1980.

Private Investment Expenditure

Private investment expenditure is considered to be a prerequisite for the process of economic growth. The very rapid growth of investment indicates a generally good prospect for the country's development. Over the period under study, 1960-1983, the total private investment expenditure increased from 8,760 million baht in 1960 to 69,273 million baht in 1983 representing an average annual growth rate of 9.4 per cent which was higher than the rate of growth of GDP. As a consequence, the share of private investment increased from 12.8 per cent of GDP in 1960 to 20.2 per cent in 1983 as shown in Table 4.13.

There are many factors that may account for this rapid increase in the investment expenditure. Apart from government efforts in providing the necessary infrastructure and the favorable policy measures for promoting private investment, investors, businessmen were the key actors that took part in this satisfactory growth performance.

The available data from NSO on private investment demand are classified into three categories, namely construction,

Table 4.12: PROJECTED AGGREGATE CONSUMPTION EXPENDITURE BY COMMODITY GROUPS, 1986-1991

(Millions of Baht)

Item	1986	1987	1988	1989	1990	1991
Food	347,429	368,599	395,924	422,426	453,032	486,342
Clothing	73,760	78,072	84,243	90,190	97,030	104,493
Housing	64,707	68,842	73,541	78,139	83,478	89,267
Household equipment	29,047	30,725	33,195	35,572	38,303	41,285
Personal care & health care	41,141	43,606	46,925	50,136	53,838	57,871
Transportation	70,781	74,875	80,885	86,669	93,313	100,569
Recreation	66,937	70,867	76,437	81,808	87,988	94,729
Miscellaneous	9,226	9,781	10,520	11,236	12,061	12,960
Total	703,029	745,367	801,672	856,176	919,043	987,517

Table 4.13 : PRIVATE INVESTMENT EXPENDITURE AND GNP AT CONSTANT 1972 PRICES

Year	Private Investment Expenditure (million baht)	% rate of growth	GNP (million baht)	% rate of growth	Share of Investment in GNP
1960	8,760		68,193		12.8
1961	9,305	6.2	71,804	5.3	12.9
1962	10,835	16.4	77,593	8.1	14.0
1963	13,176	21.6	84,156	8.4	15.6
1964	16,243	23.3	89,662	6.5	18.1
1965	17,595	8.3	96,792	7.9	18.2
1966	21,625	22.9	108,579	12.2	19.9
1967	26,104	20.7	114,719	5.6	22.7
1968	29,134	11.6	125,132	9.1	23.3
1969	32,291	10.8	136,951	9.4	23.6
1970	32,602	1.0	146,429	6.9	22.3
1971	32,682	0.2	157,931	7.8	20.7
1972	32,706	0.1	164,299	4.0	19.9
1973	36,747	12.1	179,751	9.4	20.4
1974	40,430	10.0	190,631	6.0	21.2
1975	41,151	1.8	203,514	6.7	20.2
1976	43,119	4.8	220,205	8.2	19.6
1977	57,598	33.6	235,598	7.0	24.4
1978	62,874	9.2	257,043	9.1	24.5
1979	68,262	8.6	269,897	5.0	25.3
1980	70,744	3.6	284,573	5.4	24.8
1981	72,403	2.3	298,284	4.8	24.3
1982	64,255	0.1	309,122	3.6	20.8
1983	69,273	7.8	328,382	6.2	21.1

Source: NESDB

transportation equipment and machinery. As shown in Table 4.14, investment outlays on all categories grew very rapidly in the sixties, but slowed down in the seventies. For construction, investment expenditure grew at an average annual rate of 12.95 per cent in the sixties and 5.1 per cent between 1970-1983, representing an average annual growth rate over the period of study of 7.9 per cent. Investment expenditures on transport equipment showed a similar movement. The growth rate of investment expenditures on transport equipment was 15.98 per cent between 1960-1970; it decreased to 3.9 per cent between 1971-1983. This translates into an overall annual growth rate of 7.7 over the period of 23 years. Investment expenditure on machinery grew rapidly in the sixties at an average annual rate of 21.1 per cent but decreased to 7.9 per cent in the seventies. The very rapid growth of investment on machinery leads to structural changes in investment outlays over the past 23 years. The share of machi ry increased from 26.8 per cent in 1960s to 40 per cent in 1970-1983 at the expense of investment on construction whose share decreased from 55.5 per cent in 1960s to 43.0 per cent in 1970-1983. Over the period of study the share of investment expenditures on transportation equipment remained more or less stable at 17 per cent of the total investment outlays.

Estimation of Investment Demand Function

The model for estimating investment demand function shown in the first chapter is basically derived from a general accelerator model. The model can be written compactly as

Table 4.14 : PRIVATE INVESTMENT EXPENDITURES: VALUE, SHARE AND GROWTH, 1960 - 1991

Year	Construction			Transportation equipment			Machinery			Total	
	Value	% rate of growth	% share in Total	Value	% rate of growth	% share in total	Value	% rate of growth	% share in total	Value	% rate of growth
1960	5,481		62.5	1,527		17.4	1,752		20.0	8,760	
1961	5,894	7.54	63.0	1,310	-0.1	14.0	2,101	19.9	22.5	9,350	6.7
1962	6,482	9.98	59.8	1,688	28.8	15.6	2,665	26.8	24.6	10,835	15.9
1963	7,676	18.42	58.2	2,110	25.0	16.0	3,390	27.2	25.7	13,176	21.6
1964	8,739	13.85	53.8	3,149	49.2	19.4	4,355	28.5	26.8	16,243	23.3
1965	9,517	8.90	54.1	3,129	-0.01	17.8	4,949	13.6	28.1	17,595	8.3
1966	11,247	18.18	52.0	4,126	31.9	19.1	6,252	26.3	28.9	21,625	22.9
1967	13,071	16.22	49.9	5,225	26.6	20.0	7,808	24.9	29.9	26,104	20.7
1968	14,720	12.62	50.5	5,365	2.7	18.4	9,049	15.9	31.0	29,134	11.6
1969	16,406	13.49	50.8	5,798	8.1	17.9	9,786	8.1	30.3	32,291	10.8
1970	16,707	0.01	51.2	5,112	-0.1	15.7	10,783	10.2	33.1	32,602	.9
1971	16,293	-2.48	49.8	5,388	5.4	16.5	11,001	2.0	33.6	32,682	.2
1972	15,827	-2.86	48.4	5,332	-0.01	16.3	11,547	5.0	35.3	32,706	.1
1973	14,526	-8.22	39.5	7,601	42.5	20.7	14,620	26.6	39.8	36,747	12.3
1974	13,007	-10.46	32.2	8,808	15.9	21.8	18,615	27.3	46.0	40,430	10.0
1975	15,217	16.99	37.0	8,526	-0.03	20.7	17,408	-0.06	42.3	41,151	1.8
1976	18,171	19.41	42.1	7,559	-0.1	17.5	17,389	-0.001	40.3	43,119	4.8
1977	22,281	22.62	38.7	11,945	58.0	20.7	23,372	34.4	40.6	57,598	33.6
1978	26,753	20.07	42.5	11,303	-0.05	18.0	24,818	6.2	39.5	62,874	9.2
1979	26,904	.56	39.4	11,243	-0.01	16.5	30,115	21.3	44.1	68,262	8.6
1980	31,067	15.47	43.9	11,068	-0.01	15.6	28,609	-0.05	40.4	70,744	3.6
1981	31,734	2.15	43.8	10,744	-0.03	14.8	30,525	0.07	42.1	72,403	2.3
1982	30,488	-3.93	47.4	7,729	-0.28	12.0	26,038	-0.1	40.5	64,255	-11.2
1983	31,752	4.14	45.8	8,403	8.7	12.1	29,118	11.8	42.0	69,273	7.8
		12.95			15.98			21.06			15.60

$$I_t = \gamma_0 + \gamma_1 GNP_t - \gamma_2(1+\beta_0) \sum_{i=0}^{t-1} \eta^i I_{t-1-i} - \gamma_2(1+\beta_0)a_0 \eta^t + \varepsilon_t \quad (2)$$

To estimate the function statistically, an error term ε_t which satisfies all the classical assumptions of estimator is added. The stochatic model shown in (2) is written as a nonlinear function in the parameters. A nonlinear estimation technique is applied on the time-series data on investment expenditures on each category over the period 1960-1983. The estimates of γ_0, γ_1, $\gamma_2(1+\beta_0)$ and $\gamma_2(1+\beta_0)a_0$ are determined by searching for the value of η which minimizes the standard errors of residuals.

Results

The empirical results of estimation of the investment demand functions for three categories are presented in this section.

The following symbols are used in reporting the results.

ICT = private investment expenditure on construction, current prices, million baht.

ITP = private investment expenditure on transportation equipment, current prices, million baht.

IME = private investment expenditure on machinery and equipment, current prices, million baht.

GNP = gross national product, current prices, million baht.

The estimation of (2) for private investment expenditures on construction gives a very good fit, as shown below.

$$ICT_t = -31{,}522.9 + 0.24891GNP_t - 0.2755 \sum_{i=0}^{t-1} \eta^i ICT_{t-1-i} - 4845.53\,\eta^t$$

(-2.8233) (6.9776) (3.7187) (-0.5710)

R^2 .9960 SE. = 2473.46 , DW = 2.06 , η =.80

All explanatory variables have the expected signs and these (except the last variable- η^t) are statistically significant at the 5 per cent level. The very high value of R^2 indicates that 99 per cent of the variation in investment expenditures can be explained by the explanatory variables, namely, GNP, accumulated investment in the past and depreciation component.

The estimation of (2) for transportation equipment yields the following results:

$$ITP_t = 25{,}4112 + 0.0574GNP_t - 0.0390 \sum_{i=0}^{t-1} \eta^i ITP_{t-1-i} - 260{,}438\,\eta^t$$

(3.88141) (2.0454) (2.6869) (3.9901)

R^2 = 0.6567 , SE. = 1654.11 , DW = 1.4043 , η = .99

The value of R^2 is again very high. All the explanatory variables are statistically significant at the 5 per cent level.

Using private investment on machinery and equipment to estimate (2) gives the following results:

$$IME_t = -14,684.8 + 0.2771\, GNP_t - 0.6685 \sum_{i=0}^{t-1} \eta^i\, ITP_{t-1-i} - 86,505.8\, \eta^t$$

$$(-1.8775) \quad (7.8379) \quad (5.9974) \quad (3.5625)$$

$$R^2 = .9913\ ,\ SE. = 2357.6\ ,\ DW = 3.4395\ ,\ \eta = .80$$

The goodness of fit of the equation is high indicating that the variations in investment expenditure, on machinery and equipment are explained by the chosen set of explanatory variables. The coefficients of lagged variable and η^t have the expected signs and are significant by the conventional 't' test.

In sum, the empirical results obtained from the estimation of investment expenditures on each category, namely, construction, transport equipment and machinery are satisfactory. The values of R^2 are very high. Coefficients of important explanatory variables namely, GNP and lagged variable have the expected signs and statistically significant for all categories. The coefficients of η^t have similar properties except in one case-investments in transportation.

In fact, the specification of the investment demand function should be further modified by adding other explanatory variables such as bank loans or over drafts, interest rates, prices, pressure of demand. However, due to the complicated procedure of deriving capital stock and the inconsistency of data, the above results are used for projection purposes. It is believed that the above investment demand model is adequate especially for projection purposes.

Projection of Investment Expenditure

Using the results obtained from estimating equation (2) for each category of investment, projections are made for the period 1986-1991. Table 4.15 presents the projected values of investment expenditure throughout the Sixth Plan. The overall investment demand grows at the annual rate of 6.8 per cent between 1980-1985 and 12.1 per cent during the period 1986-1991 Among these three categories, investment in machinery and equipment has the highest growth rate of, on the average, 14.17 per cent per annum during the period of 1986-1991. The growth rates of construction and transport equipment are 11.37 per cent and 4.53 per cent per annum during the same period. The results seem to indicate a rapid capital formation in the category which is likely to affect industrial growth most-investment in machinery and equipment. This source of final demand is considered to be one important engine for industrial expansion throughout the planning period.

However, these projected investment demand are obtained from historical data between 1960-1983 in which dramatic growth rates at the beginning of industrial development are embodied. Secondly, these data failed to capture the effect of the present worldwide economic recession. Thailand is no exception, investment demand in the past few years has been stagnant due to the worldwide recession, and it may take few more years, till the middle of the sixth plan, to recover. Consequently, the projected investment demand developed in the

Table 4.15: PROJECTION OF PRIVATE INVESTMENT EXPENDITURE AT CURRENT PRICES 1985 - 1991

(Millions of Baht)
(percentage)

Classification	Actual investment expenditure 1980	Projected investment expenditure													
		1985	% change	1986	% change	1987	% change	1988	% change	1989	% change	1990	% change	1991	% change
Construction	87,549	124,034	7.2	136.610	10.1	151.180	10.7	168,419	11.4	187,831	11.5	209,796	11.7	234,117	11.6
Transportation equipment	24,170	21,528	-2.3	21,255	-1.3	21,528	1.3	23,322	8.3	23,416	0.4	24,855	6.1	26,491	6.6
Machinery and other equipment	63,774	98,071	9.0	110,978	13.2	126,180	13.7	144,437	14.5	165,186	14.4	188,869	14.3	215,262	14.0
Total	175,493	243,633	6.8	268,843	10.4	298,888	11.2	336,178	12.5	376,433	12.0	423,520	12.5	475,870	12.4

study seem to be unsatisfactorily overestimated.

Government Expenditure

Over the period of study, 1960-1983, government expenditures display a secular growth trend. As shown in Table 4.16 in constant prices, government expenditures increased from 6,566 million baht in 1960 to 44,134 million baht in 1983 representing an average annual growth rate of 8.6 per cent per year, compared to 7.3 per cent rate of growth of GNP.

The increase in the absolute amount of government expenditures should be expected in an environment of expanding population, output and complexity in economic activities. However, the relative bias indicated by the higher proportion of government expenditure to GNP has been observed as well. The share of government expenditure, at constant prices, increased from 9.61 per cent in 1960 to 12.87 per cent in 1983. Thus, while resources allocated by both public and private sectors have been increasing in absolute terms, a higher proportion of total resources are now being allocated through the influence of government. This is a direct indication that a part of 'actual' resource allocation is increasing in the direction of greater relative resource allocation by the government sector.

Projection of Government Expenditure

Application of time trend analysis over 1960 and 1983 data on current government expenditure yields the following results:

Table 4.16: GOVERNMENT EXPENDITURE AT CONSTANT 1972 PRICES, 1960-1983

(Million Baht)

Year	GOVNT	growth rate	GNP	share of Govnt. Expenditure
1960	6,566		68,286	9.61
1961	6,831	4.03	71,891	9.50
1962	7,472	9.38	77,693	9.62
1963	8,173	9.38	84,187	9.71
1964	8,666	6.03	89,751	9.66
1965	9,576	10.50	96,807	9.89
1966	10,330	7.87	108,624	9.51
1967	11,487	11.20	114,616	10.02
1968	13,914	21.13	124,930	11.14
1969	15,246	9.57	136,865	11.14
1970	16,060	5.34	145,939	11.00
1971	17,577	9.44	157,861	11.13
1972	17,885	1.75	164,626	10.86
1973	19,653	9.88	180,146	10.91
1974	19,818	.84	189,950	10.43
1975	21,908	10.54	203,514	10.76
1976	25,032	14.26	221,225	11.31
1977	27,274	8.96	237,173	11.50
1978	31,816	16.65	261,097	12.18
1979	36,864	15.87	276,907	13.31
1980	37,352	1.32	292,852	12.75
1981	40,595	8.69	311,270	13.04
1982	41,850	3.09	324,032	12.91
1983	44,134	5.46	342,878	12.87

Source: NESDB

$$GOVEX = 173.1231 + 1667.446\ T$$
$$(0.1293) \quad (17.7894)$$
$$R^2 = 0.9350$$
$$N = 24$$
$$SE = 3178.626$$
$$DW = 1.1768$$

where GOVEX is the current government expenditure measured in million baht and T is time.

The results of the regression analysis indicate prominently the increasing trend of government expenditure over time. Based on the above result, projection of government expenditure (at current price) has been made and presented in Table 4.17.

As shown, government expenditures (at current price) are projected to increase from 136,006 million bath in 1986 to 184,387 million bath in 1991, representing an average annual growth of 6.28 per cent per year. The real growth rate of government expenditures is projected to be around 3.61 per cent per year between the planning period.

Table 4.17 : PROJECTED GOVERNMENT EXPENDITURE, 1985 - 1991

(Millions of Baht)

Year	Projected Government Expenditures	
	at current prices	at constant prices
1985	132,241	46,234
1986	136,006	47,621
1987	143,765	49,050
1988	153,079	50,521
1989	162,251	52,037
1990	172,960	53,598
1991	184,387	55,206

PROJECTION OF EXPORT DEMAND

It is quite difficult to project export demand in Thailand because of various factors. First, data on export from Customs are inconsistent with those appear in the Input-Output Table. Second, value of exports varies according to quantitative control imposed by importing countries such that it is difficult to establish a relationship of export on other relevant variables such as income of major importing countries or export prices. Third, exports may sometime be regarded as residual of domestic demand and production. Finally, the establishment of export trend is not easy task to perform since some exported commodites showed a slow growth in the past and can be doubled within a span of two years.

Despite many difficulties, we aim at projecting export flow for each industrial subsector in the future year. The method is either by demand function or simple time trend, whatever suitable. For export demand function, it is formulated that the world demands for Thai export are assume to respond to the export price and income of major importing countries. Symbolically, it can be written as

$$X_{it} = A_i e^{\lambda_i t} (P_{it})^{\varepsilon_i} (Y_{it})^{\eta_i} \qquad (1)$$

where X_{it} is the value of export flow of commodity i in year t. The term $A_i e^{\lambda_i t}$ is intended to capture the growth of export due to other factors apart from price and income. P_{it} is

the indices of the prices of exports in the year t and Y_t is the weighted average income of the major importing countries. ε_i and η_i are the elasticities measuring responsiveness of exports of commodity i, with respect to price and income, respectively.

Due to numerous data limitations, export projections in some industries have simply proceeded by time trend analysis or even by a simple method of taking a compound rate of growth between two periods, i.e., 1975 and 1980.

There are 14 sectors out of 22 industrial subsectors in which data are available for estimating demand for their exports using the formulation stated in (1). Since the function is non-linear in variables, transforming the function into a logarithmic form is proceeded.

$$\log X_{it} = A_i + \lambda_i t + \varepsilon_i P_{it} + \eta_i Y_{it}$$

The ordinary least square method is applied to the model for estimating manufactured export function in every commodity group, whereever data are available. For most of the regression, export price indices was used except in food processing, tobacco and textile industries where world price indices are used.

The Data

Data on exports by commodities or groups of commodities are taken from three main sources, namely Trade Statistics, the Ministry of Commerce and the Office of the

National Economic and Social Development Board. The export data are stated in terms of current baht values which, therefore, have to be converted into constant prices so that the export figures reflect the real growth of exports.

Data on export price by commodities are taken from the Ministry of Commerce. In some other cases, export price index prepared by Bank of Thailand is used.

Income data of major importing countries are based on the value of GNP per capita at constant prices. The data are obtained from various issues of UN Statistical Yearbook.

Estimation of Export Demand

Food processing industry. The commodities included under this category are generally primary products which may be either in raw or processed form. Most of these products undergo elementary processing but their natures as raw material have not changed. Major exports of this group are accorded to be rice milling, topioca, sugar, canned or preserved seafood and fruits. Exports of food processing industries are the most important export group in Thailand due to her resource endowments and comparative advantage.

Export demand function stated in (1) is applied for 6 major commodity groups namely rice, maize, cassava, canned and preserved fish and shrimps sugar and molasses. Table 5.1 presents statistical results of demand functions of these exports. As shown in the table, the coefficients of price and time in some

Table 5.1: EXPORT DEMAND FOR FOOD PROCESSING INDUSTRY

Item	c	γ	ϵ	η	R^2	DW	F
Rice	55.976	0.7161	0.4409	5.03	0.9173	3.3834	25.8705
	(1.1720)	(1.3147)	(0.8913)	(1.0425)			
Cassava	-23.6169	0.0355	-0.9831	2.2162	0.9811	2.4290	17.2935
	(-1.4933)	(0.3611)	(-2.3314)	(1.9387)			
Canned & Preserved Fish	-8.1554	0.1194	-0.2839	1.0202	0.9854	0.9726	90.1924
	(-0.9519)	(1.5421)	(-0.4310)	(1.9165)			
Canned & Preserved Shrimp	-3.9183	-0.08039	1.2366	1.2512	0.9582	2.6209	53.4219
	(-0.4521)	(-0.4102)	(1.8633)	(1.6036)			
Sugar	24.1624	0.256558	0.4759	-2.4452	0.5554	1.6953	3.831
	(1.9923	(2.8827)	(1.0993)	(-1.7576)			
Molassa	7.0834	0.0733	0.6251	-0.4953	0.2581	1.2463	1.043
	(5.0721)	(1.6073)	(1.3434)	(-1.3999)			

cases have unexpected signs. Although the income elasticity has consistently a positive sign , only two out of 5 cases are statistically significant at the 5 per cent level.

In every case, R^2 is rather high. However, there are statistical problems which should be noted here.

1). Inclusion of time variable in the export demand equation results in multicollinearity problem since time and income of major importing countries may correlate to each other. The multicollinearity can be detected in some of these demand functions, for instance, maize and rice.

2) Results of some regressions show strong serial correlation of residuals.

3) Export series seem to contain cyclical or other major disturbances which this simple statistical device is not able to isolate.

Export of other important food processing industries are projected by time trend analysis for instance canned fruit, eggs etc. The coefficients of R^2 in some commodities are unsatisfacterily low due to the fact that some exported commodities show a slow growth in the past and doubled or tripled within few years. Export of canned and preserved meat, ice, coffee, tea and animal feed showed a sharp increase during the period 1975-1980 whereas exports of coconut and palm oil and monosodium glutamate declined over the same.period.

Tobacco. Exports of tobacco increased from 569.8 million baht in 1975 to 1,125.3 million baht in 1980, representing an average annual growth rate of 14.50 per cent. Application of the export demand function stated in equation (1) yields the following result.

$$\log (TOB) = 19.6744 + 0.3340\ T + 0.2841 \log P - 1.1962 \log Y$$
$$(2.9572)\quad (4.2811)\quad (1.7763)\quad (-1.9568)$$

$R^2 = 0.9904$

$DW = 1.4115$

$F = 172.351$

The goodness of fit as measured by R^2 is satisfactory. However, the signs of price and income elasticities are contrary to expectations. Time variable is found to be significant at the 5 per cent level. When apply semi-log function to tobacco export representing a growth through time yields the following result.

$$\log (TOB) = 5.4425 + 0.2142\ T$$
$$(75.3158)\quad (16.6815)$$

$R = 0.9754$

$DW = 1.1973$

$F = 278.273$

In terms of goodness of fit, this regression seems to be unsatisfactory when compared to export demand function. The result indicates that tobacco exports expand at rate of 21.42 per cent per year.

Textile. Exports included in this group are all stages of textile activities except bleaching and finished products. Among these exports, weaved cloth and wearing apparels constituted 63.33 per cent of total textile exports in 1980. Apart from these two major exports, exports of knitted cloth, carpet and rugs, and made-up textile goods are increasingly important. Their average annual growth rates between the period 1975-1980 were 80.25, 57.46 and 43.10 per cent, respectively.

Export demand function for textile exports are seperately estimated for cloth and wearing apparel. The former includes exports of all kinds of cloth except wearing apparels. Two seperate regressions resulted from applying export demand function for cloths and wearing apparels using time series data between 1975-1982 are reported below.

$$\log (CLOTH) = \underset{}{18.8884} + \underset{(0.8411)}{0.1792}\ T + \underset{(0.9026)}{0.4474}\ \log P - \underset{(0.4620)}{0.5247}\ \log Y \quad (-0.3792)$$

$$R^2 = 0.7755$$

$$DW = 2.3132$$

$$F = 2.3029$$

where CLOTH = exports of cloths at constant price

P = export price indices for cloth

Y = average income per capita of major countries importing Thai cloth

T = time

$$\text{and } \log (WEAR) = \underset{}{-5.3197} + \underset{(-0.3518)}{0.2646}\ T - \underset{(1.1614)}{0.2639}\ \log P + \underset{(-0.2671)}{0.8437}\ \log Y \quad (0.5064)$$

R^2 = 0.9893

DW = 1.6555

F = 61.8672

where WEAR = exports of wearing apparels at constant prices

P = export price indices of wearing apparel

Y = average per capita income of major importing countries of Thai wearing apparels

T = time

The estimation of export function of cloth gives fairly fit. Unfortunately, signs of price and income elasticity coefficients are contrary to expectations. Estimation for wearing apparels is relatively more satisfactory than that of fabric export in terms of goodness of fit and expected signs. However, none of estimated coefficients appeared in these two regressions passes conventional t-test at the 5 per cent level, showing that they are not significantly different from zero. This situation may be a reflection of statistical problems arising from multicollinearity between time and per capita income.

Beverages. Exports of beverages including blended spirit, breweries and soft drink increased from 8.6 million baht in 1975 to 98.1 million baht in 1980 representing an average annual growth rate of 62.81 per cent. Due to unavailablity of data on price indices, we attempt to project export demand for beverages using a quadratic function. The statistical result is reported below.

$$BEV = \underset{(1.89848)}{0.868804} + \underset{(4.23653)}{0.74256T} - \underset{(-2.186998)}{0.03111T^2}$$

$R^2 = 0.9193$

$DW = 1.7635$

$F = 45.5686$

The estimation is fairly fit and estimated coefficients have expected signs. In addition, they pass the significance test at the 5 per cent level indicating that these coefficients are different from zero.

Wood and wood product. In the past, export of wood and wood product is of importance in the total Thai manufactured exports. Its significance has been decreasing over time due to dwindling forested areas. The share of export of wood and wood product decreased from 4.43 per cent in the total Thai manufactured exports in 1975 to 1.79 per cent in 1980. Over this period, the average annual growth rate of export of wood and wood products was 6.49 per cent which is considered to be the smallest among all other manufactured export.

An application of 1973-1980 data of export values of wood and wood product (wood), export price index (P), time and of GDP per capita of major importing countries to export demand function yields the following result.

$$\log (WOOD) = 35.4961 + 0.3773\ T + \underset{(+0.3883)}{0.0233}\ \log P \underset{(-0.8351)}{-2.7996}\ \log Y$$

$R^2 = 0.6832$

$DW = 2.3960$

$F = 2.8760$

The obtained statistical results are unsatisfactory in terms of goodness of fit, wrong signs and poor significance test. It may reflect that exports of wood and wood product are probably supply determined instead of demand determined due to its resource-based nature. We, therefore, proceed to estimate an export growth of this commodity groups by semi-log function relating growth of wood export and time. As shown below, export of wood and wood product grows at the rate of 6.15 per cent. per annum.

$$\log (WOOD) = \underset{(69.8827)}{6.9932} + \underset{(3.1039)}{0.0615}\ T$$

$R = 0.6162$

$DW = 2.1361$

$F = 9.6341$

Rubber and Rubber products. Among Thailand's manufactured exports, rubber and rubber product are the second largest group following food processing groups. Its combined share constituted about 10.69 per cent and 11.74 per cent in total manufactured exports in 1975 and 1980, respectively. The estimation of export demand function yields the results reported below.

$$\log (RUB) = \underset{(-3.4754)}{-4.1008} - \underset{(6.4681)}{0.7916} \log P + \underset{(5.4003)}{0.9092} \log Y$$

$R^2 = .92546$

DW = 1.9010

F = 55.8514

The estimated coefficients of price and income are conform to expectations, and they are statistically significant. The goodness of fit as indicated by value of R^2 is fairly high and the problem of multicollinearity can be detected again.

Iron, steel and non-ferrous metal. The share of and non-ferrous metal exports in total manufactured exports increased from 7.53 per cent in 1975 to 15.05 per cent in 1980. Among these three exports, tin is the leading item whose export value increased at an average annual rate of 46 per cent during the period 1975-1980.

An export demand function is estimated for two groups of exports exports of tin (TINEX) and of other non-ferrous metal (NONFEX), the statistical results are reported below.

$$\log (TINEX) = \underset{(-1.0876)}{-7.7785} - \underset{(-0.3904)}{0.0382}\, T + \underset{(1.3601)}{0.4806} \log P + \underset{(2.3304)}{1.4797} \log Y$$

$R^2 = 0.9573$

DW = 1.2780

F = 52.2475

$$\log (NONFEX) = -52.9560 - 0.4396T + 1.4786 \log P + 5.2560 \log Y$$
$$(0.8118) \quad (-0.5908) \quad (2.1879) \quad (0.7962)$$

$R^2 = 0.9385$
$DW = 1.9364$
$F = 35.6038$

For tin export, as shown above, estimated coefficients for price and time are contrary to expectations. However, none of estimated coefficients except income elasticity is statistically significant at the 5 per cent level. For exports of other non-ferrous metal export price is of importance in explaining variations in export value. Unfortunately, its sign is wrong. In terms of goodness of fit, the two equations have high values of R^2 demonstrating that these explanatory variables included in those regressions can explain the variations in export values fairly well.

Other exports. Apart from those mentioned exports, there are several manufactured exports which showed high growth potential. Among these are, leather and leather products (54%) paper and paper products (37.41%) ceramic and glass (55.56%), fabricated metals (40.98%), machinery (53.25%), electrical machinery and appliances (70.94%), transport equipment (42.34%) and other manufactured exports./1 (35.68%). However, due to limited data, export demand function formulated in (1) can not be estimated. We, therefore, proceed to project these export values by time trend using the semi-log function. The same procedure is

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/1 Exports fall into this group are scientific equipment, photography, watches and clocks, jewelry, recreational & athletic equipments, etc.

also applied for projecting export growth of agricultural and mining sectors. The statistical results are presented in Table 5.2. As shown, all estimated constants and coefficients are statistically significant at the 5 per cent level and the values of R^2 are fairly high in most regressions (except paper and paper product). These estimated coefficients of time are therefore used in projecting the export growth of these sectors.

There are few other manufactured exports where the use of time trend analysis is not appropriate partly because of limited time series data corresponding to our classification and partly because of rapid changes of their significance in total manufactured exports within very short time. Among these groups are refineries and petroleum products, plastic products and electrical industrial machineries and appliances. In these cases, simple compounded growth rates between two periods-1975 and 1980 are calculated and used for projecting export growth of these sectors in the future. Exports of refineries and petroleum products, plastic products, fabricated metal and electrical industrial machineries and appliances are expected to grow between the period of 1986-1991 at the rate of 6.5, 20.6, 38.8 and 33.1 per cent respectively.

Export Demand Projection

Based on the estimated export demand functions by industrial groups discussed in the preceding chapter, projected export demand between the period 1985-1991 is carried out by firstly projecting growth of GDP per capita of major importing

Table 5.2: EMPIRICAL RESULTS OF EXPORT FUNCTION:

$$\text{Log } y_i = a + bT$$

Item	a	b	R^2	DW	F
Mining	12.3232	0.1979	0.8642	2.3415	50.9155
	(71.5906)	(7.1355)			
Leather and leather products	10.7582	0.2964	0.8554	1.2419	47.3263
	(40.2344)	(6.8794)			
Paper and paper products	2.6566	0.3880	0.3007	1.6113	3.8698
	(2.4955)	(1.9672)			
Basic chemicals and chemical products	3.46	0.3157	0.9113	0.8974	92.4487
	(15.0377)	(9.6150)			
Ceramic and Glass	5.2661	0.1813	0.9147	1.2869	64.3344
	(44.3137)	(8.0809)			
Machinery	9.9624	0.3227	0.9543	1.6281	167.393
	(64.3726)	(12.9380)			
Transport equipment	10.6818	0.1585	0.7443	0.8347	70.7872
	(52.3950)	(4.8254)			

countries and export price indices throughout the planning period. The overall manufactured exports obtained from total sum of projected exports by 22 industrial sectors are estimated to grow at the average annual rate of 15.51 per cent during the period 1982-1985. In fact, the Fifth National Economic and Social Development Plan (1982-1986) calls for an overall growth of export of 22.3 per cent per year compared to 21.9 per cent per year called for in the Fourth Plan (1977-1981). Particularly, it calls for a growth rate in the range of 15 per cent to 25 per cent for processed and manufactured goods. Our estimated figure of 15.51% between 1982-1985 is lower than the target rate set in the Fifth Plan. However, by the mid of the plan, it is likely that the ambitious 22.3 per cent growth rate can not be achieved. A more realistic figure of export growth as reestimated recently is 15 per cent during 1980-1983 which is close to over projection of the export expansion between 1982-1985. The total exports in current prices as projected will rise by 15.51 per cent from 1982 to 1985 and by 24.23 per cent from 1986 to 1991. The manufactured exports (at current prices) are projected to increase from 154,377 million baht in 1982 to 237,706 million baht in 1985 and reach 693,111 million baht in 1991, representing an average annual growth rate of 15.47 per cent between the period of 1982-1985 and of 20.18 per cent between the period of 1986-1991, see Table 5.3.

However, in 1985, Thai exports were hit by the worldwide recession and increasing trend of protectionism adopted by many industrialized countries to the extent that the

Table 5.3: PROJECTED EXPORTS, 1985-1991

(Millions of Baht)

Sectors	1982 1/	1985	1986	1987	1988	1989	1990	1991
Agriculture	15,813	20,434	22,681	25,036	29,205	32,767	37,954	43,505
Mining	1,908	3,756	4,635	5,805	7,077	9,230	11,644	14,689
Food	74,210	112,292	129,562	152,235	180,970	215,708	258,520	310,610
Beverages	263	344	331	300	256	206	154	110
Tobacco	2,563	4,824	5,954	7,349	9,074	11,199	13,825	17,065
Textiles	16,419	22,360	23,159	24,054	24,882	25,402	25,668	25,632
Leather and leather products	1,525	3,711	4,991	6,714	9,030	12,146	16,336	21,972
Wood and wood products	2,171	2,610	2,777	2,953	3,140	3,339	3,551	3,776
Pulp, paper and paper products	295	947	1,395	2,057	3,032	4,469	6,587	9,710
Basic chemicals	760	1,959	2,686	3,684	6,951	6,926	9,497	13,022
Chemical products	581	1,498	2,054	2,816	3,862	5,295	7,260	9,955
Refineries	38	46	48	51	55	59	62	66
Rubber and rubber products	10,876	13,641	14,217	15,019	15,988	16,996	18,091	19,239
Plastic Products	726	1,273	1,536	1,852	2,234	2,694	3,250	3,919
Ceramic	376	643	771	924	1,108	1,328	1,592	1,908
Glass	203	384	424	508	609	730	875	1,049
Other non-metallic products	354	611	732	878	1,052	1,261	1,512	1,813
Iron and steel	741	1,556	1,939	2,426	3,047	3,843	4,869	5,952
Non -ferrous metals	8,407	18,033	22,473	28,113	35,312	44,539	56,424	68,969
Fabricated metals	1,210	3,235	4,491	6,233	8,652	12,009	16,668	23,136
Machinery	797	1,113	1,186	1,260	1,326	1,372	1,397	1,400
Electrical machinery	7,375	10,411	13,847	18,417	24,494	32,577	43,328	57,626
Transport equipment	140	245	290	350	424	514	623	756
Other manufactured products	6,626	11,780	14,270	17,288	20,943	25,370	30,734	37,232
Total	154,377	237,706	276,449	326,322	392,723	469,979	570,421	693,111

Note /1 Actual figures

value of export increased by only 8 per cent from 1984. As a consequence, our estimated growth rate of 18.83 per cent seems to be unrealistically high and has to be adjusted to reflect a more realistic export expansion in the current situation. We believe that the projected overall export growth rates obtained from the macro-model developed by Thailand Development Research Institution at 5.2 per cent in 1986 and around 9 per cent between 1987-1991 more or less reflect the current economic situation. We therefore proceeded to adjust our empirical results using projected trend of total exports. Adjusted projected exports at current price are reported in Table 5.4. The adjusted results reveal that demand for manufactured exports will increase from 160,725 million baht in 1985 to 277,199 million baht in 1991 representing an annual growth rate of 10.12 per cent.

The pattern of industrial sector contributions to the total export expansion as projected will change over times. The contribution of food processing industries which are more-mature and resource-based is projected to decline from 25.36 per cent in 1980 to 30.78 per cent in 1991. The theoretical reason for the decline in exports of processed food is that the income elasticity for most food stuff is relatively low. In addition, there will be more competition and protection in the world market in the coming decade.

The export of textile products which share similar characteristic with processed food continues its upward trend throughout the Sixth Plan. Export of beverage as projected, may

Table 5.4: ADJUSTED EXPORTS, 1985-1991

(Millions of Baht)

Sectors	1985	1986	1987	1988	1989	1990	1991	Growth rate 1985-91	Growth rate 1986-91
Food	72,942	73,612	77,495	81,559	85,699	89,864	94,296	4.37	5.08
Beverages	223	188	153	115	82	54	33	-27.15	-29.23
Tobacco	3,134	3,383	3,741	4,089	4,449	4,806	5,181	8.74	8.90
Textiles	20,052	22,984	27,113	31,861	37,512	44,032	51,835	17.15	17.66
Leather & leather products	2,411	2,836	3,418	4,070	4,825	5,679	6,670	18.49	18.66
Wood & wood products	1,695	1,578	1,503	1,415	1,327	1,234	1,146	-6.31	-6.19
Paper & paper products	615	793	1,047	1,366	1,775	2,290	2,948	29.84	30.04
Basic chemicals	1,273	1,526	1,875	2,276	2,752	3,301	3,953	20.78	20.97
Chemical products	973	1,167	1,434	1,740	2,103	2,524	3,022	20.79	20.97
Refineries	30	27	26	25	23	22	20	-6.44	-5.98
Rubber & rubber products	25,382	27,851	31,304	34,767	38,449	42,202	46,237	10.51	10.67
Plastic products	827	873	943	1,007	1,070	1,130	1,190	6.25	6.39
Ceramic	418	438	470	499	528	553	579	5.60	5.75
Glass	230	241	259	274	290	304	318	5.58	5.74
Other non-metallic products	397	416	447	474	501	526	550	5.60	5.76
Iron & steel	1,011	1,102	1,235	1,373	1,527	1,693	1,807	10.17	10.40
Non-ferrous metals	11,714	12,768	14,311	15,914	17,695	19,613	20,938	10.16	10.40
Fabricated metals	2,101	2,552	3,173	3,899	4,771	5,794	7,024	22.28	22.45
Machinery	723	674	641	598	545	486	425	-8.47	-8.81
Electrical machinery	6,763	7,867	9,375	11,038	12,943	15,061	17,494	17.16	17.33
Transport equipment	159	165	178	191	204	217	230	6.29	6.85
Other manufactured products	7,652	8,108	8,800	9,439	10,079	10,683	11,303	6.72	6.87
Total	160,725	171,149	188,941	207,989	229,149	232,455	277,199	9.5	10.12

reduce by 29 per cent during the sixth plan. Other high-growth export is seen in the group of paper and paper product; the exports are projected to grow at the rate of 30.04 per cent per annum. Other exports with good growth potential are basic chemical, chemical products, fabricated metal, leather and leather product and electrical appliance and electronics.

Manufactured exports with below the average growth rate are wood and wood products, petroleum refineries, fabricated metal, and machinery.

In fact the performance of each export group in the total manufactured exports depends heavily on the world market and competitiveness. These projected export values are based primarily on the past data. The future performance will be mainly attributable to their competitiveness which are in turn derived from low costs of labor and material inputs. Although the projected figures are ambitious when compared to recent export performance, still there will be a room for an improvement their competitiveness and markets in the future.

The projections of export demand are relatively difficult compared to domestic demand projections. Export projection, in general, includes a greater margin of error in terms or data and relationship of exports with the domestic economy and other economies as well. Any projection of exports usually depends on the assumption made with regard to the principle variables affecting export demand. The export function in this study is based on a relationship between GDP per capita

and export price which are assumed to be exogenous. In fact, it is worth exploring the "feedback" effect of export expansion on GDP per capita and the price level.

In this study the projected export growth appears to be based on historical data and extrapolation of recent past. In fact, substantial export growth in the past is based on a series of special circumstances which can not be expected to repeat in the future. The target rate appears to be considerably high since the 1982 data showed a declining trend of manufactured and agricultural exports. The projection based on the coefficients from export demand regressions will, therefore, tend to overestimate the probable'path in view of the current situation.

Estimates from a time trend taken at different time periods yield different results, i.e., different rates of growth. The projection based on the coefficients from these regression, will, therefore, tend to be either under or over-estimated compared to the current situation.

Finally, there are statistical problems which should be noted here: 1) problem of multicollinearity between time and GDP per capita which may reduce precision of one of the estimated coefficients; 2) results of some regressions show strong serial correlation of residuals; and 3) the export data series contain cyclical or major disturbances (caused by, perhaps tariff and non-tariff barrier) which cannot be isolated by this simple statistical least square technique.

Comments

Overall, unadjusted export projections appear to be overly optimistic. In fact, manufactured exports seem to have been influenced by increasing protectionism in the major importing countries. The performance of each export group, therefore, depends heavily on the world market and its competitiveness. These projected export values carried out in this study are based excessively on the past data. At present, we find that the growth rates of many export items face serious quota restrictions. For instance, the growth of tapioca products is a function of the EEC's. Agricultural exports are now facing serious quota restrictions and protectionism; e.g., Farm Act (1985). The growth of textile exports also faces quota restrictions. At the same time, many resource-based manufactured exports are now facing supply problems. Among these are frozen and canned seafood, canned pineapple, wood and wood product, leather and leather products. Some other manufactured exports face increasing competition from other countries. In addition, the wide world economic recession of the past few years lead us to conclude that the target growth rate is unrealistic.

Although the projected figures of some manufactured exports between the period of 1985-1991, are somewhat optimistic compared to the current export performance, there will still be

a room for improving manufactured export performance in the future. The projected export growth suggested in this study could be achieved by appropriate export promotion policies designed to reducing both tariff and non-tariff barriers to exports. The overwhelming responsibility for adoping such policies continues to rest with the Thai government.

EMPIRICAL RESULTS

This chapter is a presentation of empirical results of industrial projections during the period 1985-1991. Industrial projections and prospective structural changes under basic and high scenarios will be discussed first. Then, our attention will turn to the analysis of relevant aspects of industrial growth including 1) sources of growth and 2) comparative adventage in the manufacting sector.

In the preceding chapters, relationships of final demands namely consumption, investment expenditures, government expenditures and exports are estimated saperately for every recognized group of commodities. The estimated demand functions are used as a basis for projections throughout the Sixth Plan. These projected final demand components which facilitate industrial growth are then inserted into the model discussed in chapter 3 as exogenously determined variables, and gross industrial outputs are subsequently determined.

Data

In this excercise, two major sources of data are Input-Output Table (1980) constructed by NESDB and the National Income Account of Thailand. The Input-Output Table divides all economic activities into 180 sub-sectors and the manufacturing sector is classified into 93 groups, from I-O # 042 to I-O # 134. In this study, these 93 groups are further aggregrated into 22

major industrial sectors according to our classifications by subsumming certain items under single heading (see Appendix 1). The reconstructed Input-Output Table classified into 32 sub-sectors (22 of which are industrial activities) is served as a basis for the calculation [/1] (see Appendix 2).

The second source of data --- the National Income Account of Thailand--provides required statistics for the estimatation of final demand components.

Basic Run

The industrial projection model presents its results in terms of "scenarios". This implies that, among other things, a lot of details is left out and also that the future is described in a simplified manner. The basic projection is based on certain simplified assumptions. Among these, two of the most important assumptionsis on the future overall growth of the Thai economy and on the rate of inflation. It is assumed that the overall real growth rate of the Thai economy will be in the range of 3.21 to 4.29 per cent per year during the period 1985-1991, as shown in Table 6.1 and that the inflation rate will be in the range of 2 to 5.2 per cent per year during the same period. Based on these assumed overall growth and inflation rates each component of the final demands is firstly determined and inserted into the model as a vehicle for industrial growth. Industrial

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/1 It should be noted that according to this type of classification, a number of primary products with little processing such as rice milling, tapioca pellets, rubber sheet are treated as manufactured products.

Table 6.1: PROJECTED OVERALL ECONOMIC GROWTH:
1986 - 1991

Years	Projected GDP growth rate	Inflation rate	Disposable income (Baht)	Population (Million)
1985	4.22	5.2	15,301	51.303
1986	3.21	2.0	16,123	52.227
1987	3.49	5.0	17,082	53.01
1988	3.92	4.9	18,117	53.80
1989	4.07	4.4	19,233	54.612
1990	4.26	5.0	20,439	55.43
1991	4.29	5.1	21,743	56.26

Source : NESDB

gross outputs between 1986-1991 are therefore estimated based on another important assumption that an industrial output can keep pace with the final demands.

Table 6.2 shows at the macro level, that the industrial sector will become increasingly more important in the next five years relative to other economic sectors. The dominant position of agriculture which was pronounced in the past will be outpaced by the manufacturing sector. The share of agriculture to GDP which was 24.85 per cent in 1980 is projected to decline to 17.54 percent in 1985 and to 17.10 per cent in 1991. The growth of the manufacturing sector which contributed significantly to the GDP increase in the recent past seems to continue until the end of the Sixth Plan. The share of the manufacturing GDP is projected to increase from 20.69 per cent in 1980 21.03 per cent by 1991 at the expense of reductions in the other sectors.

Industrial outputs at constant price are projected to grow at an average annual rate of 5.61 per cent between the period 1986-1991, compared to the 7.27 per cent growth during the period of 1980-1985. It is expected that the industrial output, which was stagnant due to the overall economic recession at the beginning of this decade, will maintain an average annual growth rate of about 4 per cent throughout the Sixth Plan which seems to be relatively low compared to the previous performance.

Table 6.2: PROJECTED VALUE ADDED, 1985-1991 : THE BASIC CASE, AT CONSTANT 1972 PRICES

(Millions of Baht)

Classification	Actual 1980	%	1985	%	1986	%	1987	%	1988	%	1989	%	1990	%	1991	%
Agriculture	72,784	24.85	64,212	17.54	66,606	17.33	68,736	17.29	71,183	17.27	73,319	17.20	75,769	17.27	78,360	17.10
Mining	4,780	1.63	10,314	2.82	10,833	2.82	11,342	2.85	11,870	2.88	12,425	2.91	13,006	2.96	13,567	2.96
Manufacturing	60,597	20.69	73,162	19.99	76,870	20.00	80,315	20.20	84,110	20.40	87,864	20.61	88,876	20.26	96,385	21.03
Construction	16,576	5.66	18,937	5.17	19,613	5.10	20,393	5.13	21,210	5.14	22,055	5.17	22,936	5.23	23,854	5.20
Electricity & water supply	5,560	1.90	7,624	2.08	8,026	2.09	8,395	2.11	8,805	2.14	9,217	2.16	9,666	2.20	10,146	2.21
Transportation & communication	18,811	6.42	33,908	9.26	35,342	9.19	36,467	9.17	37,823	9.17	39,096	9.17	40,536	9.24	42,079	9.18
Wholesale and retail trade	48,227	16.47	67,170	18.35	69,913	18.19	72,286	18.18	74,930	18.17	77,442	18.17	80,207	18.28	83,169	18.15
Banking and Insurance	17,419	5.95	31,617	8.64	33,070	8.60	34,145	8.59	35,437	8.60	36,620	8.59	37,962	8.65	39,393	8.60
Public administration	12,423	4.24	16,577	4.53	16,694	4.34	16,656	4.19	16,443	3.99	16,286	3.82	16,097	3.67	15,894	3.47
Service	35,675	12.18	45,504	12.43	47,464	12.35	48,843	12.29	50,467	12.24	51,966	12.19	53,662	12.23	55,469	12.10
Unclassified	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	292,852	100.00	366,025	100.00	384,431	100.00	397,578	100.00	412,278	100.00	426,290	100.00	438,717	100.00	458,316	100.00

Besides the gradual increase of the manufacturing sector, there will probably be a change within the manufacturing sector in the next five years. As shown in Table 6.3, among 22 industrial subsectors, although food processing industries will still be the most important sector accounting for 27.26 per cent of total industrial output in 1980, its importance will probably decline to the 26.01 per cent level by 1991. The manufacturing sector which in the past concentrated on food processing and textile will become more diversified. Increasing importance will pronounce in many subsectors, other sectors will become more significant; for instance, petroleum refineries, iron and steel, basic chemicals and transport equipment. The projected performances of some important industries are to be discussed here.

Food processing. This sector including, rice milling, sugar, frozen and canned seafood and others constitutes 27.26 per cent of total industrial output or 13.94 of GDP in 1980. In the next five years, we expect it to maintain its importance as being the leading sector in the manufacturing sector due to Thailand's resource endowment and its comparative advantage. Throughout the 1986-1991, food processing industries, as projected, will grow at an average annual rate of 3.03 per cent which is considerably lower than the projected overall industrial growth. This is seen as a natural growth rate of established industries. Within the food processing industries, there may be some potential areas to be explored further for increasing the overall subsector's growth rate, for instance

Table 6.3 PROJECTED OUTPUT, 1985-1991 AT CONSTANT PRICES : THE BASIC CASE

(Millions of Baht)

(Percentages)

Classification	Actual 1980	%	1985	%	1986	%	1987	%	1988	%	1989	%	1990	%	1991	%
Food	65,587	27.26	97,513	28.53	100,579	28.04	103,656	27.65	106,957	27.26	109,944	26.83	113,245	26.41	116,765	26.01
Beverage	6,923	2.88	8,710	2.55	9,085	2.53	9,358	2.50	9,684	2.47	9,976	2.43	10,318	2.41	10,686	2.38
Tobacco	6,079	2.53	12,486	3.65	13,086	3.65	13,582	3.62	14,122	3.60	14,611	3.57	15,153	3.53	15,725	3.50
Textiles	37,837	15.72	59,072	17.28	63,230	17.62	66,847	17.83	71,115	18.12	75,500	18.42	80,378	18.75	85,846	19.12
Leather and leather products	2,128	0.88	2,055	0.60	2,268	0.63	2,505	0.67	2,754	0.70	3,024	0.74	3,317	0.77	3,642	0.81
Wood and wood products	9,845	4.09	9,176	2.68	9,490	2.65	9,772	2.61	10,089	2.57	10,399	2.54	10,741	2.51	11,109	2.47
Paper and paper products	9,925	4.12	11,935	3.49	12,564	3.50	13,098	3.49	13,723	3.50	14,347	3.50	15,061	3.51	15,859	3.53
Basic chemicals	2,144	0.89	15,985	4.68	16,922	4.72	17,814	4.75	18,801	4.79	19,796	4.83	20,890	4.87	22,088	4.92
Chemical Products	7,800	3.24	9,233	2.70	9,749	2.72	10,171	2.71	10,670	2.72	11,154	2.72	11,700	2.73	12,295	2.74
Refineries	21,578	8.97	30,123	8.81	31,536	8.79	32,766	8.74	34,158	8.70	35,507	8.66	36,998	8.63	38,573	8.59
Rubber and rubber products	7,042	2.93	11,358	3.32	12,232	3.41	13,263	3.54	14,159	3.61	15,073	3 68	15,934	3.72	16,822	3.75
Plastic	2,280	0.95	2,564	0.75	2,695	0.75	2,816	0.75	2,945	0.75	3,070	0.75	3,205	0.75	3,350	0.75
Ceramic	814	0.34	959	0.28	1,002	0.28	1,039	0.28	1,079	0.28	1,117	0.27	1,157	0.27	1,199	0.27
Glass	920	0.38	1,153	0.34	1,209	0.34	1,262	0.34	1,317	0.34	1,373	0.33	1,432	0.33	1,495	0.33
Other non-metallic products	5,365	2.23	4,922	1.44	5,101	1.42	5,304	1.41	5,513	1.40	5,729	1.40	5,953	1.38	6,186	1.38
Iron and Steel	4,748	1.97	14,441	4.22	15,126	4.22	15,872	4.23	16,659	4.25	17,479	4.27	18,355	4.28	19,253	4.29
Non-ferrous metals	8,211	3.41	7,453	2.18	7,961	2.22	8,579	2.29	9,154	2.33	9,773	2.38	10,407	2.43	10,822	2.41
Fabricated metals	3,538	1.47	4,756	1.39	5,077	1.42	5,438	1.45	5,828	1.49	6,250	1.53	6,714	1.57	7,232	1.61
Machinery	5,714	2.37	6,928	2.03	7,183	2.00	7,432	1.98	7,704	1.96	7,971	1.94	8,260	1.93	8,564	1.91
Electrical Machinery	8,736	3.63	12,038	3.52	12,881	3.59	13,770	3.67	14,721	3.75	15,711	3.83	16,769	3.91	17,918	3.99
Transport Equipment	9,202	7.98	14,977	4.38	15,624	4.36	16,149	4.31	16,759	4.27	17,338	4.23	17,980	4.19	18,658	4.16
Other manufactured products	4,200	1.74	3,969	1.16	4,151	1.16	4,363	1 16	4,521	1.15	4,670	1.14	4,795	1.12	4,917	1.09
Total	240,616	100.00	341,808	100.00	358,749	100.00	374,856	100.00	392,431	100.00	409,811	100.00	428,761	100.00	449,005	100.00

Table 6.3 (continued)

Classification	1980-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1986-91
Food	8.25	3.74	3.06	3.18	2.79	3.00	3.11	3.03
Beverage	4.70	4.31	3.00	3.48	3.01	3.43	3.57	3.30
Tobacco	15.49	4.81	3.79	3.98	3.46	3.71	3.78	3.74
Textile	9.32	7.04	5.72	6.38	6.71	6.46	6.80	6.31
Leather and leather products	-0.69	10.36	10.46	9.94	9.81	9.67	9.81	9.94
Wood and wood products	-1.39	3.42	2.97	3.25	3.07	3.29	3.43	3.20
Paper and paper products	3.71	5.27	4.25	4.77	4.55	4.98	5.30	4.77
Basic chemicals	49.45	5.86	5.27	5.54	5.29	5.53	5.73	5.47
Chemical products	3.43	5.59	4.33	4.91	4.54	4.89	5.09	4.75
Refineries and petroleum products	6.90	4.69	3.90	4.25	3.95	4.20	4.26	4.11
Rubber and rubber products	10.03	7.69	8.43	6.75	6.46	5.72	5.57	6.58
Plastic products	2.38	5.10	4.50	4.58	4.27	4.40	4.51	4.45
Ceramic	3.33	4.48	3.72	3.87	3.50	3.54	3.69	4.57
Glass	4.63	4.84	4.36	4.40	4.20	4.32	4.41	5.33
Other non-metallic products	-1.71	3.63	3.97	3.95	3.91	3.91	3.91	4.68
Iron and Steel	24.92	4.74	4.93	4.96	4.93	5.01	4.89	5.92
Non-ferrous metals	-1.92	6.81	7.76	6.69	6.76	6.50	3.98	7.74
Fabricated metals	6.10	6.75	7.11	7.17	7.24	7.42	7.72	8.74
Machinery	3.93	3.68	3.48	3.65	3.47	3.63	3.68	4.33
Electrical machinery	1.62	7.00	6.90	6.90	6.73	6.73	6.85	8.28
Transport equipment	-4.85	4.32	3.36	3.78	3.45	3.70	3.77	4.49
Other manufactured products	-1.13	4.59	5.12	3.63	3.29	2.67	2.54	4.38
Total	7.27	4.95	4.49	4.69	4.43	4.62	4.72	5.61

maize processing and livestock industries.

Textile and Wearing Apparels. The empirical results reveal that real outputs of textile industry will increase from 37,837 million baht (at 1972 price) in 1980 to 59,072 million baht in 1985 and to 85,846 million baht in 1991. The real growth rate of this subsector averages about 6.31 per cent between the period of 1986-1991. Regarding this high growth rate, there may not be a bottleneck occurring in the expansion process due to the current excess capacity of this industry. The textile industry will increase its share from 15.72 per cent of total industrial outputs in 1980 to 19.12 per cent in 1991. However, this projected growth rate hinges partly on the rapid growth in the past. The situation will depend heavily on our export markets and future quota restrictions of the major importing countries.

Wood and wood products. The Wood based industries appear to be lagging behind a "normal" growth pattern. Throughout the period of 1986-1991, wood and wood products industries will grow at a moderate rate of growth of 3.20 per cent. Resource endowments of the country particularly forestry, appear to have a great effect on this sector. The share of this sector in the total manufactured outputs will decline slightly from 4.09 per cent in 1980 to 2.47 per cent by 1991.

Paper and paper products. Paper and paper products subsector is projected to grow at an average annual rate of 4.77 per cent in the period of 1986 and 1991. This estimated growth rate could be achieved provided that programs for afforestration

and reforestration on which this industry heavily relies are successful.

Refineries and Petroleum products. This subsector is projected to grow at an average annual rate of 4.26 per cent. This projected growth rate is realistic after taking into consideration of natural gas exploitation in the future. However, the expansion of this sector depends heavily on an export possibility of LNG and successful utilization of natural gas. In addition, with an appropriate pricing of natural gas, the growth of this sector may also induce an expansion of a petrochemical complex which is planned to be undertaken in the near future.

Rubber and rubber products. Due to its resource-based nature, this industrial subsector will grow at a considerably high growth rate of 6.58 per cent throughout the Sixth Plan. The share of the sector's output will increase from 2.93 per cent of the total manufactured output in 1980 to 3.75 per cent in 1991. A good growth potential will definitely rely on an expansion of export markets.

Engineering Industries. The combined share of output in engineering industries is projected to decrease from 15.45 per cent in the total manufactured output in 1980 to 11.67 per cent in 1991. The key industries in this group are electrical and electronics and transport equipment. Between the period of 1986 and 1991, electrical machinery and appliance will enjoy a considerably high growth rate of 8.28 per cent while fabricated

metal will expand at the rate of 8.74 per cent. Other subgroups (machinery and transport equipment) are projected to grow at the rates of 4.33 and 4.49, respectively. The overall performance in the engineering industries will also depend on the successes of international marketing efforts as well as the restructuring effort in the industry itself.

Other smaller industries with a projected good growth potential are non ferrous metal (7.74 per cent), rubber and rubber product (6.58 per cent), leather and leather product (9.94 per cent), basic chemicals and chemical products (5.47 per cent and 4.75 per cent respectively).

High Growth Rate Scenario

The industrial projection carried out in this section is based on the high scenario of the projected GDP growth prepared by NESDB. The industrial projection excercise is conducted on different assumptions of GDP growth and inflation rate. As Table 6.4 shows, the growth rate of GDP is expected to increase at an average annual rate of 4.20 per cent between the period of 1986-1991 compared to 3.87 per cent in the basic scenario. /1

As shown in Table 6.5 and Table 6.6, the empirical results of industrial projection of the "high scenario" is quite similar to the basic scenario in terms of industrial

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/1 The final demand projections inserted in the high scenario model are presented in Appendix 3.

Table 6.4: PROJECTED ECONOMIC GROWTH

1985 - 1991 : THE HIGH CASE

Year	Projected GDP growth rate (%)	Disposable per capita income (Baht)
1985	4.22	15,301
1986	3.21	16,276
1987	3.71	17,407
1988	4.10	18,636
1989	4.52	19,970
1990	4.71	21,422
1991	4.97	23,003

Source : NESDB

Table 6.5: PROJECTED VALUE ADDED, 1985-1991 : THE HIGH CASE

AT CONSTANT 1972 PRICES

(Millions of Baht)

Classification	Actual 1980	%	1985	%	1986	%	1987	%	1988	%	1989	%	1990	%	1991	%
Agriculture	72,784	24.85	64,212	17.54	67,769	17.36	71,086	17.35	74,151	17.30	77,350	17.22	80,738	17.14	84,336	17.07
Mining	4,780	1.63	10,314	2.82	11,034	2.83	11,735	2.86	12,412	2.90	13,195	2.94	14,004	2.97	14,811	3.00
Manufacturing	60,597	20.69	73,162	19.99	78,220	20.04	83,068	20.27	87,790	20.48	93,074	20.72	98,668	20.95	104,771	21.21
Construction	16,576	5.66	18,937	5.17	19,720	5.05	20,523	5.01	21,544	5.03	22,620	5.04	23,749	5.04	24,935	5.05
Electricity & water supply	5,560	1.90	7,624	2.08	8,157	2.09	8,663	2.11	9,168	2.14	9,734	2.17	10,339	2.20	10,991	2.22
Transportation & communication	18,811	6.42	33,908	9.26	35,772	9.17	37,414	9.13	38,991	9.10	40,747	9.07	42,585	9.04	44,558	9.02
Wholesale and retail trade	48,227	16.47	67,170	18.35	70,991	18.19	74,465	18.17	77,775	18.15	81,309	18.10	85,193	18.09	89,250	18.06
Banking and Insurance	17,419	5.95	31,617	8.64	33,447	8.57	35,030	8.55	36,513	8.52	38,142	8.49	39,843	8.46	41,657	8.43
Public administration	12,423	4.24	16,577	4.53	17,207	4.41	17,723	4.33	18,255	4.26	18,802	4.19	19,366	4.11	19,947	4.04
Service	35,675	12.18	45,504	12.43	47,955	12.29	50,042	12.21	52,021	12.14	54,179	12.06	56,429	11.98	58,811	11.90
Unclassified	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	292,852	100.00	366,025	100.00	390,272	100.00	409,749	100.00	428,620	100.00	449,152	100.00	470,914	100.00	494,067	100.00

Table 6.6: PROJECTED OUTPUT, 1985-1991 AT CONSTANT PRICES : THE HIGH CASE

(Millions of Baht)
(Percentages)

Classification	Actual 1980	%	1985	%	1986	%	1987	%	1988	%	1989	%	1990	%	1991	%
Food	65,587	27.26	99,183	27.99	104,366	27.54	109,454	27.18	113,936	26.76	118,763	26.30	123,719	25.84	129,005	25.38
Beverage	6.923	2.88	9,300	2.62	9,790	2.58	10,212	2.54	10,589	2.49	11,002	2.44	11,438	2.39	11,906	2.34
Tobacco	6.079	2.53	12,517	3.53	13,293	3.51	14,002	3.48	14,624	3.43	15,295	3.39	15,986	3.34	16,720	3.29
Textiles	37,837	15.72	60,641	17.11	66,266	17.49	71,576	17.77	76,896	10.86	83,115	18.41	89,860	18.77	97,552	19.19
Leather and leather product	2,128	0.88	2,165	0.61	2,457	0.65	2,775	0.69	3,104	0.73	3,484	0.77	3.903	0.82	4,384	0.86
Wood and wood product	9,845	4.90	9,509	2.68	9,952	2.63	10,352	2.57	10,765	2.53	11,216	2.48	11,688	2.44	12,195	2.40
Paper and paper product	9,925	4.12	13,409	3.78	14,295	3.77	15,119	3.75	15,934	3.74	16,863	3.73	17,878	3.73	19,021	3.74
Basic cnemicals	2,144	0.89	16,562	4.67	17,879	4.72	19,168	4.76	20,443	4.80	21,883	4.85	23,432	4.89	25,151	4.95
Chemical Products	7,800	3.24	9,665	2.73	10,343	2.73	10,964	2.72	11,565	2.72	12,247	2.71	12,974	2.71	13,780	2.71
Refineries	21,578	8.97	32,270	9.11	34,272	9.04	36,124	8.97	37,926	8.91	39,939	8.85	42,054	8.78	44,314	8.72
Rubber and rubber product	7,042	2.93	11,735	3.31	13,174	3.48	14,673	3.64	16,053	3.77	17,546	3.89	19,039	3.98	20,635	4.06
Plastic product	2,280	2.95	2,692	0.76	2,883	0.76	3,064	0.76	3,238	0.76	3,428	0.76	3,627	0.76	3,844	0.76
Ceramic	814	0.34	991	0.28	1,052	0.28	1,108	0.28	1,161	0.27	1,217	0.27	1,275	0.27	1,336	0.26
Glass	920	0.38	1,232	0.35	1,311	0.35	1,387	0.34	1,461	0.34	1,543	0.34	1,629	0.34	1,721	0.34
Other non-metallic	5,365	2.83	5,003	1.41	5,224	1.38	5,447	1.35	5,718	1.34	6,004	1.33	6,302	1.32	6,615	1.30
Iron and Steel	4,748	1.97	14,871	4.20	15,780	4.16	16,710	4.15	17,739	4.17	18,873	4.18	20,086	4.20	21,359	4.20
Non-ferrous metal	8,211	3.41	7,663	2.16	8,493	2.24	9,376	2.33	10,234	2.40	11,200	2.48	12,223	2.55	13,021	2.56
Fabricated metals	3,538	1.47	4.915	1.39	5,346	1.41	5,811	1.44	6,318	1.48	6,899	1.53	7,544	1.58	8,285	1.63
Machinery	5,714	2.37	7,162	2.02	7,514	1.98	7,846	1.95	8,199	1.93	8,581	1.90	8,979	1.88	9,402	1.85
Electrical Macninery	8,736	3.63	12,289	3.47	13,411	3.54	14,578	3.62	15,798	3.71	17,173	3.80	18,655	3.90	20,305	4.00
Transport Equipment	19,202	7.98	16,406	4.63	17,288	4.56	18,070	4.49	18,853	4.43	19,708	4.36	20,598	4.30	21,541	4.24
Other manufactured goods	4,200	1.74	4,222	1.19	4,591	1.21	4,950	1.23	5,247	1.23	5,557	1.23	5,846	1.22	6,143	1.21
Total	240,616	100.00	354,404	100.00	378,982	100.00	402,766	100.00	425,800	100.00	451,534	100.00	478,735	100.00	508,235	100.00

performance. Value added originated from the manufacture will outpace the agriculture in the near future. Thereis a marked difference between the growth of manufacturing and non-manufacturing value added. The manufacturing value added will generally grow faster than the overall GDP as the basic scenario indicates. This high manufacturing growth will be accompanied by relatively low growth in other non-manufacturing sectors, resulting in an upward crawl in the share of total GDP. The economic slowdown at the beginning of this decade will recover slowly and maintains a growth rate of 5 per cent throughout the plan.

Similar to the basic scenario, an increase in growth trends is not uniform across all industrial branches. The growth of food processing industries--the most important industrial sector--tends to slow down as compared to the growth of other sectors. Still, the structure of the manufacturing sector in the next five years tends to undergo a diversification that has occurred earlier. The industries with above average growth rates during 1985-1991 are those engaging in leather, paper and paper products, basic chemicals, rubber and rubber products, textiles, plastic, non ferrous metal, iron and steel, electricals and electronics and fabricated metal.

Overall, the "high" scenario suggests the same results as the "basic" scenario does, except a higher rate of growth of the whole economy. The pattern of the manufacturing growth remains the same. The branches with the most dynamic

Table 6.7: PROJECTED GROWTH RATE BETWEEN 1980-1991 CLASSIFIED BY INDUSTRIAL SUBSECTORS : THE HIGH CASE

(Percentages)

Classification	1980-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1986-1991
Food	8.62	5.23	4.87	4.10	4.24	4.17	4.27	4.33
Beverage	6.08	5.26	4.31	3.69	3.90	3.96	4.10	3.99
Tobacco	15.54	6.20	5.33	4.44	4.59	4.52	4.59	4.69
Textiles	9.89	9.28	8.01	7.43	8.09	8.11	8.56	8.04
Leather and leather products	0.34	13.50	12.92	11.85	12.26	12.04	12.31	12.27
Wood and wood products	-0.69	4.66	4.02	3.98	4.19	4.21	4.34	4.15
Paper and paper product	6.20	6.61	5.77	5.39	5.83	6.02	6.39	5.88
Basic Chemicals	50.51	7.95	7.21	6.65	7.04	7.08	7.34	7.06
Chemical Products	4.38	7.01	6.00	5.49	5.89	5.94	6.21	5.91
Refineries	8.38	6.20	5.40	4.99	5.31	5.30	5.37	5.27
Rubber and rubber products	10.75	12.26	11.37	9.41	9.30	8.51	8.38	9.39
Plastic	3.38	7.09	6.27	5.66	5.88	5.81	5.97	5.92
Ceramic	4.01	6.19	5.32	4.77	4.88	4.75	4.77	4.90
Glass	6.01	6.43	5.78	5.37	5.59	5.57	5.70	5.60
Other non-metallic products	-1.39	4.41	4.28	4.97	4.99	4.96	4.98	4.84
Iron and Steel	25.65	6.11	5.89	6.15	6.39	6.43	6.34	6.24
Non-ferrous	-1.37	10.83	10.39	9.16	9.43	9.14	6.53	8.92
Fabricated metals	6.79	8.77	8.70	8.71	9.20	9.35	9.82	9.16
Machinery	4.62	4.91	4.41	4.51	4.65	4.65	4.71	4.58
Electrical Machinery	7.06	9.13	8.70	8.36	8.70	8.63	8.84	8.65
Transport Equipment	-3.10	5.38	4.52	4.33	4.54	4.52	4.58	4.50
Other manufactured products	0.10	8.74	7.82	6.01	5.90	5.20	5.08	6.00
Total	8.05	6.93	6.27	5.72	6.04	6.02	6.16	6.04

growth during the period under study are leather and leather products, rubber, fabricated metals and electrical machinery. Two important sectors are textiles, food processing industries which are more mature than the remaining sectors.

The Source of Growth

The high average annual growth rate between 1985-1991 projected in this study suggests a critical role of the manufacturing sector in fostering the economic growth in Thailand. It would be more meaningful to examine some elements responsible for such a growth. This section discusses the sources of industrial growth. Our task is to determine the sources of industrial growth from the demand side which ignites the process of industrial growth for this decade.

The formula needed to quantify the relative contribution of demand components-final, intermediate and export, to industrial growth has been previously proposed by Chenery. /1 With the application of the Input-Output Table (1980) we proceed to trace the growth of output by the following formulae.

$$\Delta X_i = d_i^0 \Delta W_i + d_i^0 \Delta D_i + \Delta E_i + \Delta d_i (W^t + D^t)$$

/1 Chenery H.B. "Pattern of Industrial Growth, "American Economic Review, Vol 50, September 1960.

where X_i = total value of output of sector i

W_i = intermediate demand for products of sector i

D_i = final demand for products of sector i

E_i = export of sector i

M_i = import of sector i

d_i = domestic content of product i or

$$d_i = \frac{X_i - E_i}{W_i - D_i}$$

ΔX_i = growth of output i or $X_i^t - X_i^o$

The formula stated above decomposes the growth of output into 4 components, increase in intermediate demand, expansion of final demand, expansion of exports and finally, import substitution effect. These terms are defined to trace the sources of output expansion of each sector.

The calculation has been made for the period of 1980 to 1991 in order to shed some light on the sources of growth projected in this study. As expected, almost all industrial sectors show a significant value of intermediate demand effect. The significance of intermediate demand is pronounced in iron and steel, non-metallic products (except ceramic), fabricated metal, basic chemicals, and petroleum refineries and to a lesser extent, textiles, paper, wood and transport equipment industries. The results also reveal that the increase in output of food processing, beverage, tobacco, chemical, ceramic and machinery industries are attributed mainly to domestic final demand pull. The negative effect of final demand seen in the growth of glass

industries indicates that the domestic market can not be relied upon much more for a future expansion of this sector. Tracing industrial growth from the export side, it supports the wellknown fact that the manufactured exports are mainly processed primary products. The role of export demand pull is pronounced in industries engaging in rubber and rubber products, non-ferrous metal, electrical and electronics and, to a lesser extent, food processing, leather and leather product.

Import substitution, as figures reveal, does not contribute to growth during the period of 1980-1985 and 1986-1991. Most of industries show negative impact of import substitution. Import substituting with high growth industries are machinery and basic chemical industries.

In sum, our projected results seem to suggest that, on an average, industries with a very high average rate of growth are export-led industries. Those include rubber, non-ferrous, electrical and electronic industries. Above average growth rate industries are also found in the industrial group where intermediate demand is the major source of growth, for instance petroleum products, chemicals products, paper, glass and non ferrous metals. The projected results further indicate that industries with slightly below average growth rate are those whose final demand is the main source of growth, those are tobacco, and transport equipment. More important, industries with import-substitution led growth have considerably below average growth rates; for instance, industries engaging in machinery.

Table 6.8: Projected Sources of Growth, 1980-1985

(Percentage)

SECTORS	DE	EXE	INT	IMSE	SUM
AGRICULTURE	32.10394	4.185952	63.38576	0.324336	100.0000
MINING	4.552159	0.158548	94.37261	0.916680	100.0000
FOODS	39.25526	39.51017	21.86783	-0.63328	100.0000
BEVERGES	40.26245	6.079441	57.17797	-3.51987	100.0000
TOBACCO	65.84377	2.717391	31.65506	-0.21623	100.0000
TEXTILES	47.39735	-8.00898	59.60817	0.503449	100.0000
LEATHER	31.05901	44.24007	37.05753	-12.3566	100.0000
WOOD	43.74996	7.221403	49.17165	-0.14302	100.0000
PAPER	29.44493	5.536760	65.61868	-0.60038	100.0000
BASIC CHEMICALS	2.968096	-0.42390	99.90588	-2.45008	100.0000
CHEMICAL PRODUCTS	45.81144	15.05880	47.50499	-8.37524	100.0000
PETROLEUM PRODUCTS	19.17704	13.76820	68.33875	-1.28400	100.0000
RUBBER	-12.0128	170.3181	-56.1477	-2.15758	100.0000
PLASTIC PRODUCTS	3.555808	31.09652	67.12136	-1.77369	100.0000
CERAMIC	56.86591	12.91731	35.13316	-4.91639	100.0000
GLASS	3.918204	5.997983	86.38415	3.699653	100.0000
OTHER NON-METALLIC PRODUCTS	6.447042	3.035910	90.05365	0.463392	100.0000
IRON & STEEL	2.336278	5.612654	96.57705	-4.52598	100.0000
NON-FERROUS METALS	3.572177	75.92127	24.17996	-3.67341	100.0000
FABRICATED METALS	29.55952	-16.8734	89.58991	-2.27599	100.0000
MACHINERY	75.72910	7.445794	30.80073	-13.9756	100.0000
ELECTRICAL MACHINERY	33.29154	39.93722	27.10469	-0.33346	100.0000
TRANSPORTATION EQUIPMENT	33.81141	21.26574	45.49566	-0.57282	100.0000
OTHER MANUFACTURED PRODUCTS	20.46155	79.09773	17.63254	-17.1918	100.0000
CONSTRUCTION	98.44129	0	3.317720	-1.75901	100.0000
ELECTRICITY & WATER SUPPLY	2.835786	8.411689	91.34427	-2.59175	100.0000
TRANSPORTATION & COMMUNICATION	24.25578	52.05254	25.77058	-2.07890	100.0000
TRADE	21.25765	20.34765	58.39468	0	100.0000
BANKING & INSURANCE	12.32676	15.45861	72.23459	-0.01997	100.0000
PUBLIC ADMINISTRATION	100	0	0	0	100.0000
SERVICES	38.08717	42.94722	18.40160	0.563998	100.0000
UNCLASSIFIED	29.94062	29.58155	48.15111	-7.67329	100.0000

Note:
DE = domestic final demand effect
EXE = export expansion effect
INT = intermediate demand effect
IMSE = import substitution effect

Table 6.9: Projected Sources of Growth, 1986-1991

(Percentage)

SECTORS	DE	EXE	INT	IMSE	SUM
AGRICULTURE	38.51655	2.262663	59.26711	-0.04633	100.0000
MINING	-1.93307	0.644890	40.17996	61.10822	100.0000
FOODS	33.66800	55.26682	13.66067	-2.59550	100.0000
BEVERGES	101.2436	-0.35157	-3.27533	2.383303	100.0000
TOBACCO	52.05567	9.422406	38.35943	0.162488	100.0000
TEXTILES	39.38325	10.56240	49.24796	0.806383	100.0000
LEATHER	-61.6852	129.0058	29.51089	3.168490	100.0000
WOOD	59.69650	-11.4087	47.69469	4.017533	100.0000
PAPER	11.03917	-0.52498	86.84252	2.643281	100.0000
BASIC CHEMICALS	-0.17043	2.400654	33.45575	64.31402	100.0000
CHEMICAL PRODUCTS	6.155036	2.786494	70.24506	20.81340	100.0000
PETROLEUM PRODUCTS	4.684053	-6.75475	79.85637	22.21432	100.0000
RUBBER	-5.67189	98.53519	6.217381	0.919324	100.0000
PLASTIC PRODUCTS	-38.0171	12.84686	121.7909	3.379320	100.0000
CERAMIC	40.28705	19.73039	28.73017	11.25237	100.0000
GLASS	-15.8720	8.742194	87.19601	19.93387	100.0000
OTHER NON-METALLIC PRODUCTS	-10.2571	14.73684	79.40467	16.11565	100.0000
IRON & STEEL	-1.06483	0.143860	60.88827	40.03270	100.0000
NON-FERROUS METALS	-562.947	523.5414	253.5472	-114.141	100.0000
FABRICATED METALS	-16.9173	18.33492	64.93115	33.65125	100.0000
MACHINERY	-13.6869	-1.60292	26.54696	88.74291	100.0000
ELECTRICAL MACHINERY	38.23434	-2.91827	37.77948	26.90444	100.0000
TRANSPORTATION EQUIPMENT	287.1285	59.02255	-127.040	-119.110	100.0000
OTHER MANUFACTURED PRODUCTS	-101.777	119.6948	45.79561	36.28701	100.0000
CONSTRUCTION	27.28225	0	68.93249	3.785248	100.0000
ELECTRICITY & WATER SUPPLY	-28.0249	-4.50847	137.5702	-5.03687	100.0000
TRANSPORTATION & COMMUNICATION	22.21781	196.3704	-114.286	-4.30186	100.0000
TRADE	449.0320	52.82729	-401.859	0	100.0000
BANKING & INSURANCE	118.7931	2.741598	-21.5228	-0.01193	100.0000
PUBLIC ADMINISTRATION	100	0	0	0	100.0000
SERVICES	88.35531	26.00855	-16.7801	2.416265	100.0000
UNCLASSIFIED	-9.36077	-11.5708	41.12611	79.80554	100.0000

Note:
DE = domestic final demand effect
EXE = export expansion effect
INT = intermediate demand effect
IMSE = import substitution effect

Comparative Advantage

This section discusses the comparative advantage of some major industrial activities. The analysis is intended to serve as a basis for understanding the underlying factors of industrial growth involving the comparative advantage aspect. As discussed earlier on a difference in export performance has been the most important cause of difference in growth rates. An attempt is made in this section to discuss the comparative advantage of major exported commodities. We hypothesize that the inherent comparative advantage of any industrial activity explains the export growth of that industry in the past and potential growth of such activity will depend on its comparative.

The most recent study on comparative advantage is the Study on Fiscal Implication of Investment Incentives and Promotion Efficiency which classified the manufacturing sector into 93 industrial activities (I-O 042-I-O 134).[/1] The study indicates that in 1975 Thailand's comparative advantage exists in domestic/resource-based and labor intensive industries such as textiles, wood and wood products, non-ferrous metal. However, a comparison of domestic resource costs DRC between 1975 and 1982 reveals that Thailand is now gradually losing her comparative advantage in some of the industries engaging in textile (upstream processing stages) and wood and wood product.

/1 Fiscal and Tax Policy Division, Ministry of Finance, Study on Fiscal Implication of Investment Incentives and Promotion Efficiency, Industrial Management Co.,Ltd., 1983.

An attempt is made, in our study, to identify the extent to which comparative advantage explains the rate of export growth in the manufacturing sector. Making use of the study on comparative advantage by the Ministry of Finance (MOF), we intend to investigate the relationship between the comparative advantage and the export growth. However, due to different classifications, the weighted average DRC (by the share of output to total output of that subsector) is calculated. The results are presented in Table 6.10. A method of examining an export growth potential in terms of the comparative advantage is to rank all industries with respect to their projected export growths between 1985-1991 and with respect to their weighted DRC's. To examine whether there exists a systematic relationship between these two rankings, we proceed to calculate the Spearman Rank Correlation coefficient. The calculated correlation coefficients is .1547 for the rank correlation of 1982 DRC and 1980-1985 projected export growth and is .1326 for 1982 DRC and 1986-1991 projected export growth. Our results shows that there exists a positive rank correlation between the comparative advantage and export growth. Industries whose export is projected to expand rapidly are those which are in line with Thailand's comparative advantage. Unfortunately the result is not statistically significant. However, it seems to support Wickerman in his explanation on the process of "export propelled" growth. He argued that if a country has a competitive advantage at some point of its history, an expansion of its export will give rise to new investment and will generate output further. Our results tend to support the view that industries which have comparative advantage even at some point in its

Table 6.10 : COMPARATIVE ADVANTAGE OF THAI INDUSTRIAL MANUFACTURING SECTORS

	1)DRC 1982	Rank/1	Export growth 1980-1985	Rank	Export growth 1985-1991	Rank
Food	44.80	14	9.07	11	4.31	18
Beverage	25.82	4	4.37	15	-27.15	22
Tobacco	13.81	1	22.89	2	8.74	11
Textile	77.10	19	11.41	9	17.15	7
Leather and leather products	61.31	17	13.62	5	18.49	5
Wood and wood products	166.96	22	-3.57	20	-6.31	20
Paper and paper products	32.54	7	-1.28	19	29.84	1
Basic chemicals	28.29	5	33.88	1	20.79	3
Chemical products	28.67	6	11.96	8	20.78	4
Refineries and petroleum products	20.22	3	-17.60	22	-6.44	19
Rubber and rubber products	33.11	8	20.87	3	10.51	8
Plastic products	49.45	16	7.88	12	6.25	14
Ceramic	101.39	21	10.48	10	5.60	15
Glass and glass products	87.66	20	12.09	7	5.58	17
Other non-metallic products	42.63	12	16.25	4	5.60	15
Iron and steel	34.07	9	0.87	16	10.17	9
Non-ferrous metals	17.99	2	-4.33	21	10.16	10
Fabricated metal products	43.11	13	13.57	6	22.28	2
Machinery	41.30	10	0.53	17	-8.47	21
Electrical machinery	48.50	15	-1.14	18	17.16	6
Transport equipment	41.64	11	5.44	14	6.29	13
Other manufacturing products	61.53	18	6.89	13	6.72	12

/1 Rank from the least.

Sources : Ministry of Finance, Study on Fiscal Implication of Incentives and promotion Efficiency, 1983

history (e.g., textiles) tend to grow relatively faster than those which do not. The presence of low cost domestic production in the industries with comparative advantage provides a good basis for the growth of their exports.

The analysis of relationship between projected export growth and comparative advantage by industries carried out in this section is severely subject to many limitations. Firstly, the problem of calculating DRC which involves accurate measurement the social opportunity cost of resources. Secondly, the industrial subsectors classified in this study may be too broad for a comparative advantage analysis. Thirdly, ranking industries by their comparative advantages for a given level of technology may be of limited usefulness if there is a rapid technological change within the industries in question. From a comparison of DRC calculated for 1975 and 1982, we perceive that there are number of ongoing events which led to the deterioration of Thailand's comparative advantage (see Table 6.11). Among these are deforestration, faster exploitation of mineral resources, increasing wage rates and so on.

Table 6.11

DOMESTIC RESOURCE COST OF INDUSTRIAL ACTIVITIES, 1975 AND 1982

I/O Code	Description	Domestic Resource Cost Per One U.S.Dollar	
		1975	1982
042	Slaughtering	23.18 (N)	* (N)
043	Canning and preservation of meat	33.55 (M)	57.28 (M)
044	Dairy products	21.24 (M)	37.42 (M)
045	Canning and preservation of fruits and vegetables	19.11 (E) 36.25 (M)	* (M)
046	Canning and preservation of fish and other sea foods	19.68 (E) 28.21 (M)	* (M)
047	Coconut and palm oil	21.15 (M)	18.57 (M)
048	Animal oil and fat, vegetable oil and by product	22.79 (M)	85.13 (M)
049	Rice milling	20.43 (E)	16.58 (E)
050	Topioca milling	20.14 (E)	18.36 (E)
051	Grinding of maize	n.a. (E) 28.96 (M)	19.62 (E)
052	Flour and other grain milling	19.24 (E) 28.13 (M)	702.67 (M)
053	Bakery products	34.44 (M)	155.67 (M)
054	Noodles and similar products	28.89 (M)	* (M)
055	Sugar	19.41 (E)	18.08 (E)
056	Confectionery	35.23 (M)	91.58 (M)
057	Ice	22.65 (N)	19.21 (N)
058	Monosodium glutamate	20.00 (M)	125.42 (M)
059	Coffee and tea	36.59 (M)	43.64 (M)
060	Other food products	29.24 (M)	287.10 (M)
061	Animal feeds	20.61 (M)	22.20 (M)
062	Distilling and spirits blending	18.04 (M)	25.49 (M)
063	Breweries	18.40 (M)	24.78 (M)
064	Soft drinks and carbonated	30.62 (M)	27.87 (M)
065	Tobacco processing	32.21 (M)	49.11 (M)
066	Tobacco products	15 (M)	21.45 (M)
067	Spinning	23.30 (M)	26.60 (M)
068	Weaving	27.06 (M)	225.77 (M)
069	Textile bleaching and finishing	7.16 (N)	17.25 (N)
070	Made-up textile goods	28.74 (M)	30.01 (M)
071	Knitting	23.44 (M)	96.77 (M)

Table 6.11 (continued)

I/O Code	Description	Domestic Resource Cost Per One U.S. Dollar	
		1975	1982
074	Jute mill products	18.70 (M)	29.70 (M)
075	Tanneries and leather finishing	18.57 (M)	35.92 (M)
076	Leather products	29.18 (M)	77.53 (M)
077	Footwear, except of rubber	27.63 (M)	62.88 (M)
078	Saw mills	19.20 (E)	18.11 (E)
079	Wood and cork products	18.41 (E) 24.73 (M)	45.78 (M)
080	Wooden furniture and fixtures	19.72 (M)	413.38 (M)
081	Pulp, paper and paper board	21.65 (M)	38.62 (M)
082	Paper and paper board products	27.04 (M)	40.26 (M)
083	Printing and publishing	20.93 (M)	23.83 (M)
084	Basic industrial chemicals	21.28 (M)	28.98 (M)
085	Fertilizers and pesticides	20.46 (M)	16.07 (M)
086	Synthetic resins, plastic and artificial fiber material, excluding glass	11.24 (M)	51.32 (M)
087	Paints, vanishes and lacquers	11.21 (M)	31.78 (M)
088	Drug and medicines	23.00 (M)	19.24 (M)
089	Soaps and cleaning preparations	27.13 (M)	38.38 (M)
090	Cosmetics	57.42 (M)	41.65 (M)
091	Matches	19.67 (M)	64.36 (M)
092	Other chemical products	24.72 (M)	43.52 (M)
093	Petroleum refineries	21.96 (M)	19.32 (M)
094	Other petroleum products	25.10 (M)	44.0 (M)
095	Rubber sheet and block rubber	19.83 (E)	19.30 (E)
096	Tyres and tubes	33.26 (M)	34.09 (M)
097	Other rubber products	30.53 (M)	111.25 (M)
098	Plastic ware	28.59 (M)	49.45 (M)
099	Ceramic and earthern ware	20.67 (M)	101.39 (M)
100	Glass and glass products	25.54 (M)	87.66 (M)
101	Structural clay products	22.60 (M)	68.35 (M)
102	Cement	18.98 (E)	23.13 (E)
103	Concret and cement products	19.69 (N)	61.67 (N)
104	Other non-metallic products	23.52 (M)	69.14 (M)
105	Iron and steel	18.28 (M)	36.62 (M)
106	Secondary steel products	21.31 (M)	33.11 (M)
107	Non-ferrous metals	14.25 (E)	17.99 (E)
108	Cutlery and hand tools	24.81 (M)	43.85 (M)
109	Metal furnitures and fixtures	26.64 (M)	57.32 (M)

Table 6.11 (continued)

I/O Code	Description	Domestic Resource Cost Per One U.S. Dollar	
		1975	1982
110	Structural metal products	23.61 (M)	32.60 (M)
111	Other fabricated metal products	23.66 (M)	41.36 (M)
112	Engines and turbines	22.35 (M)	24.62 (M)
113	Agricultural machinery and equipment	21.00 (M)	18.94 (M)
114	Wood and metal working machines	21.52 (M)	29.97 (M)
115	Special industrial machinery	21.61 (M)	26.00 (M)
116	Office and household machinery and appliance	22.96 (M)	74.90 (M)
117	Electrical industrial machinery and appliances	22.99 (M)	40.30 (M)
118	Radio, television, and communication equipment	27.29 (M)	66.39 (M)
119	Household electrical appliances	28.49 (M)	34.19 (M)
120	Insulated wire and cable	21.77 (M)	42.86 (M)
121	Electric accumulators and batteries	N.A.	49.33 (M)
122	Other electrical apparatus and supplies	25.47 (M)	38.62 (M)
123	Ship building and repairing	20.62 (M)	29.84 (M)
124	Railroad equipment	21.64 (M)	23.51 (M)
125	Motor vehicles	26.67 (M)	94.08 (M)
126	Motor cycles and bicycles	20.07 (M)	26.51 (M)
127	Repair of vehicles	20.21 (N)	N.A.
128	Aircraft	20.23 (M)	23.92 (M)
129	Scientific equipment	23.16 (M)	34.46 (M)
130	Photographic and optical goods	30.68 (M)	34.25 (M)
131	Watches and clocks	31.14 (M)	61.19 (M)
132	Jewelry and related articles	18.89 (M)	77.14 (M)
133	Recreational and athletic equipment	27.13 (M)	47.22 (M)
134	Other manufactured goods	27.97 (M)	46.89 (M)

Note: (1) The letter M, E, and N in the parentheses refer to importable, exportable and non-traded industrial activities respectively. The word N.A. means not available while * refers to a case with a negative value added at word prices for an effective protection.

(2) The direct DRC per one unit of foreign exchange earning is directly obtained from the 1975 Input-Output Table while the DRC for 1982 is derieved from the effective protective coefficient calculated earlier. The shadow foreign exchange rate as estimated by the formula (see text) fell between 21.97 - 22.85 baht per U.S. dollar for 1975-76 and 23.70 - 24.19 baht per U.S. dollar for 1981. The official pegged exchange against the U.S. dollar was 20.40 baht for 1975-1976 and 23.05 baht for 1981.

Source: Ministry of Finance, Study on Fiscal Implication of InvestmentIncentives and Promotion Efficiency, 1983

SUMMARY AND CONCLUSION

The picture which we perceive from our projected results is a relatively low rate of growth in the manufacturing sector compared to the latter part of the previous decade. Major conclusions of this report are as follows:

1. Under the basic scenario, the manufactured outputs are projected to increase at an average annual rate of 5.61 per cent between the period of 1986-1991. The figures are lower than 7.27 per cent rate of increase projected for the period of 1980-1985. The corresponding projection is 6.04 per cent between the period of 1986-1991 under the "high" scenario. We foresee the industrial growth to be higher than those of other economic sectors.

2. The growth in the manufacturing sector will be accompanied by structural changes as growth may not evenly distributed across 22 industries. The pace of industrial growth in some industries, namely food, wood and wood product, beverage, non metallic, mineral products, machinery and transport equipment will slow down in the future.

3. With regard to the performance of industrial subsectors, leather, rubber, fabricated metal, non ferrous metal and electrical industrial machinery and appliance and textile will grow at relatively high rates and provide the main driving force in the industrial growth. The more-mature industries such

as the food processing industry will remain stable or slightly decrease. Its share probably reduces from 27.26 per cent in the total manufactured outputs in 1980 to 26.01 per cent in 1991.

4. Exports of manufactured goods are projected to increase at relatively lower rates than they have been in the past. Total manufactured exports are projected to increase at the rate of 10.12 per cent over the planning period compared to almost 15 per cent between the period of 1980-1985. Among these, export of electrical and electronics, fabricated metal, textiles, paper and leather show very rapid expansion as their growth rates are projected to be 17.33 per cent, 22.45 per cent, 17.66 per cent, 30.04 per cent and 18.66 per cent respectively. Important exports, namely iron and steel rubber, non-ferrous metal show stable growth patterns as their growth rate are projected to be 10.40 per cent, 10.67 per cent, and 10.40 per cent respectively. Decreasing trends of exports are projected in wood and wood product (-6.19 per cent), refineries (-5.98 per cent) and machinery (-8.81 per cent). Nevertheless, the manufactured exports of Thailand in the next 5 years will still concentrate on food processing, textile and other light manufactured products.

5. Although Thailand's manufactured outputs are likely to maintain the growth rate of 4 per cent throughout the sixth plan, the major outlets for most of the industries will remain the domestic market. The investigation of empirical results in terms of sources of growth suggests that manufactured exports will play a very significant role in determining growth

in some industries. The above-average growth rates in industries engaging in non-ferrous metal, rubber, and rubber products are caused by rapidly growing export. Furthermore, industries with below average growth rate appear to be import-substituting industries, e.g., machinery and basic chemicals.

6. The result from the study of comparative advantage suggests that the nature of manufactured goods where productions are in accordance with the country's comparative advantage--either in resource-based or labor intensive determines a promising performance of growth in the next five years. The Spearman Rank Correlation index between high-export growth and comparative advantage perhaps supports the view that industries with comparative advantages and good potential to enter into the international market will achieve a high growth performance. This implies that industrialization process in the future will tend to move towards more efficient point in their production.

Policy Recommendations

The medium term industrial projection attempted in this study aims at providing a guideline for policy makers in the industrial development area. These policy guidelines have to be translated into special proposals on recommendations to be implemented for an industrial balance growth. The major industrial policy inferrences to be drawn from the study are as follows:

1. If Thai economy is to move towards more industrialization sketched out for the Sixth Plan, the emphasis will have to be on a major restructuring of the Thai industry. A major reformation of policies is needed to undergo the structural change. It is apparent that the policy reform envisaged in the Fifth Plan may not be sufficient to induce significant industrial restructuring. In fact, the programs for industrial restructuring as appeared in the Fifth Plan have to be evaluated in terms of economic and social consequences.

2. The report expects decreasing trend of industries with import-substitution or those with low comparative advantage. Thailand, therefore, should reduce her trade barriers in order to improve efficiency and allow imports from other countries. Efficiency in industrialization calls for moderate levels of protection in order to avoid high cost of import substitutes and discrimination against manufactured exports. In fact, import-substitution industrialization can be a useful strategy if inefficiency is curtailed. The appropriate policy response depends on the country's present situation.

3. The growth trends of industrial subsectors are not uniform. As a consequence, one of the main implications is there is a need to adopt an appropriate policy to fit the circumstance. Since circumstances differ among industries and over time, we can not discuss all the policy implications for all industries. In short, industrial policies to be designed should be flexible and pragmatic. The policies should be designed in such a way that they are responsive to the present circumstance

and are changable when they become impotent.

4. Despite the relatively higher growth in the manufacturing sector compared with other economic sectors, the implication is not that Thailand should foster her industrial growth at the expense of other sectors, particularly the agriculture. A successful future industrial growth should be made with a broad-based strategy including increasing attention to the agricultural sector. In fact, the agricultural sector will be served as a precondition for the industrial development. The relative smaller share of the agricultural sector is a common phenomenon in the process of economic development. However, inadequate attention paid to the agriculture may cause many negative effects in the process of such industrialization.

5. Our empirical results suggests that the growth in the manufacturing sector will be achieved through the growth of manufactured exports. Accordingly, export-led policy will play a major role in determining the growth performance of the manufacturing sector in the future. In addition, high inefficiency in domestic manufacturing which is common in the Thai manufacturing sector is attributable in part to the small domestic market size. In order to mount the export drive, policy recommendations are the following:

5.1 There are two groups of exports with good growth potential--traditional and new groups. For the traditional exports, due to their resource-based and/or labor-intensive traditional manufactured exports, namely food processing,

rubber, textile and non-ferrous metal will maintain or slightly decrease their significant shares in the total manufactured exports of Thailand. However, some of these traditional exports are projected to grow relatively slowly. Consequently, exports of Thailand will fall. However, some of these traditional exports are projected to grow relatively slowly. Consequently, the task falls on the government to formulate policies that will stimulate the expansion of these traditional exports to new markets.

For new exported items, Thailand should also explore the opportunity for export expansion of electrical industrial machinery and elctronics. In fact, Thailand has good potential for producing a wide variety of manufactured exports. She will probably seek to explore her new manufactured export items rather than to continue to concentrate only on her traditional exports.

5.2 Thai government should formulate a strategy for export expansion. This will lead not only to solving balance of payments problem but also expanding market bases for industrialization. The government should endeavor to offset the obstacle to entering into the international markets due to tariff and non-tariff barriers. The government, on the other hand, can not control the tariff barrier imposed by advanced industrialized countries. But for the non-tariff barriers, the government can adopt appropriate export-incentive policies to reduce the barrier to entry. This can be done through export credit, export insurance program, and other export incentives

schemes designed to overcome the difficulties caused by transportation cost, product differentiation low quality products, lack of information and so on.

6. An analysis of export-led industries and comparative advantage reveals that the crucial factor underlying export-led industries is comparative advantage. To maintain comparative advantage of industries engaging in non-ferrous metal, basic chemical or textile activities, foreign trade policy should be designed to capture changing comparative advantage in the long run.

7. The projected figures may indicate the size of the manufacturing sector compared to other sectors in term of value added or output, but it does not show how "efficient" Thai industries will be. To achive efficient industrialization, labor-intensive and foreign exchange generating industries should be given the highest priority.

Caveat

Empirical results obtained from this study must be evaluated with an awareness of the model and its data drawbacks. Indeed, the results should be taken as no more than a "scenario" for industrial growth. The conclusion of this study must be used with caution. In fact, there is indeed a number of caveats to be made regarding the data and the model used in this projection exercise.

1. Although data availability in Thailand is relatively abundant and reliability is generally high, there are still special problematic areas. The discrepancies between the value added data from National Account and those from the Input-Output Tables in both 1975 and 1980 are too large and hence questionable.

2. The transformation of expenditures on commodities from national account data into consumption demands by input-output sector, again, contributes to the data problems of the model.

3. The use of implicit prices of expenditure categories in the Extended Linear Expenditure System (ELES) to estimate the marginal consumption shares subject to the same data problem. In addition, error in the estimation procedure magnified the measurement error, but their extent is difficult to ascertain.

4. The other major source of problem is the set of assumptions made to operationalize the model used in the projection exercise. First and foremost, there are difficult assumptions imbedded in the input-output system itself. These assumptions relate to excess capacity, to one output per sector, to fixed technical coefficients, to invariance with respect to price changes, and etc. Furthermore, there are added hypotheses made to project the components of final demand. Of particular

importance here are the relevance of flexible accelerator model to predict investment behavior, the trend basis of projecting government expenditures and equations used to project exports.

5. The implication of prospective change of GDP on final demand are not considered and it is assumed that projected GDP growth rates postulated will be obtained one way or another. It may be, still, interesting to speculate the "feedback" effect of change in final demand in GDP growth by endogenizing the value of GDP into the model.

6. Data for the industrial projection exercise attempted here are between the period of 1970-1983. The effect of the 1984 devaluation which apparently affected the general price level, export prices and GDP deflation is beyond the scope of this study.

BIBLIOGRAPHY

Bibliography

Akrasanee Narongchai, Small and Medium Scale Industries in Thailand, World Bank Report, Dec. 1982.

Akrasanee Narongchai, Industrial Development and Industrial Restructuring, Paper No. 1 prepared for the Seminar on Industrial Restructuring in Thailand,October 1983.

Akrasanee Narongchai, Thamruenglerd and Eamkamala Chalermpoj, Source of Industrial growth in Thailand, Industrial Management Co., and Industrial Finance Corporation of Thailand, Bangkok, Thailand, March 1983.

Akrasanee Narongchai and Chutikul Siri-Laksana, Wage Differentials in Manufacturing Industries, Discussion Paper No. 77 - 02, Council of Asian Manpower Studies, Manila Feb. 1977.

Chenery Hollis and Elkington Hozel, Structural Change and Development Policy, New York, Oxford University Press., 1979.

IBRD, Thailand, Current Economic Prospects and Selected Development Issues, Oct. 1975.

Ganjareondee Siri,"A Model of Thailand's Economy: An Econometric Approach," Ph.D. dissertation, Monash University, 1975.

Leechor Chad, Kohli Harinder, Hur Surjin, Structural Changes in World Industry; A quantitatives Analysis of Recent Development, A World Bank Technical Paper No. 5, The World Bank, Washington, 1983.

Lluch Constantino, Powell Alan and Williams Ross, Pattern of Household Demand and Saving, 1977.

Ramangkura Virapongsa, Amranand Piyasawasti and Associates, the Long-Term Prospect for Economic Development 1980 - 1990, June 1981.

Ramangkura Virapongsa, Appropriate Macro Economic theory for Thailand, Thai Economic Journal, Vol 9 No. 1, June 1976.

Tambunlertchai Somsak, "Manufactural Exports and Employment in Thailand", Export Oriented Industrialisation and Employment Policies and Response with Special Reference to ASEAN Countries, edited by Pitou van Dijek and Harmen Verbruggen, Council of Asian Manpower Studies, Manila, 1974.

Tambunlertchai Somsak and Chesada Loohawenchit, "Labor Intensive and Small Scale Manufacturing in Thailand", the Development of Labor Intensive Industry in ASEAN Countries, edited by Rachid Amjad, Asian Employment Programme, ARTEP, 1981.

APPENDIX 1

INDUSTRIAL GROUPING

Industrial Classification	TSIC	BTN	I/O
1. FOODS	311-312	02-05, 07-09, 10-12, 16-19, 20-23, 25, 41, 67	042-061
o Rice Milling	(311)	(10.06)	(049)
2. BEVERAGES	313	11, 19, 21, 22	062-064
3. TOBACCO	314	24	065-066
4. TEXTILES	321, 322	50-56, 57-59, 60-63, 42, 46, 61, 65	067-074
o Wearing Apparel	(322)	(61, 65)	(072)
5. LEATHER	323	41, 43, 64	075-077
o Tanneries and Leather Finishing	(323)	(41.01-10, 43.02)	(075)
6. WOOD & WOOD PRODUCTS	331, 332	44-46, 68	078-080
o Saw Mills	(331)	(44, 45, 68)	(078)
7. PAPER & PAPER PRODUCTS	341, 342	42, 47-49	081-083
8. BASIC INDUSTRIAL CHEMICALS	351	25, 28, 29, 31, 34, 36, 38, 39	084-086
9. CHEMICAL PRODUCTS	352	12, 13, 15 29, 32-39, 98	087-092
10. REFINERIES & PETROLEUM PRODUCTS	353, 354	27, 36, 38, 68	093-094
11. RUBBER & RUBBER PRODUCTS	355	40, 64, 94	095-097
12. PLASTIC PRODUCTS	356	39, 42	098
13. CERAMIC AND EARTHERN WARE	361	25, 69	099
14. GLASS AND GLASS PRODUCTS	362	70	100
15. OTHER NON-METALLIC PRODUCTS	369	25, 38, 68 69	101-104
16. IRON & STEEL	371	26, 72, 73	105-106

Industrial Classification	TSIC	BTN	I/O
17. NON-FERROUS METALS	372	74-81	107
18. FABRICATED METALS	381	73-79, 80-83, 94	108-111
19. MACHINERY	382	84, 85, 87	112-116
20. ELECTRICAL INDUSTRIAL MACHINERY AND APPLIANCES	383	74, 76, 85 92	117-122
o Radio, Television & Communication Equipment and Apparatus	(383)	(85.13-.17)	(118)
21. TRANSPORT EQUIPMENT	384	85-89	123-128
22. OTHER MANUFACTURED PRODUCTS	385, 390	05, 48, 66-68, 71, 72, 84, 90-99	129-134

APPENDIX 2

Coefficient Matrix of Domestic Products at Producer's Prices, 1980

	1	2	3	4	5	6	7	8	9	10	11	12
1. Agriculture	0.078313	0.001088	0.566769	0.003415	0.154277	0.030654	0.005920	0.180843	0.006468	0.000002	0.006838	-
2. Mining and Quarrying	0.000001	0.000013	0.000150	0.000108	-	0.000005	0.000735	-	0.001027	0.036637	0.008613	0.006925
3. Foods	0.056514	-	0.055935	0.088142	-	0.000385	0.086297	0.000012	0.002831	0.000210	0.029497	0.003720
4. Beverages	-	-	0.000146	0.001815	0.000037	-	-	-	-	-	0.000145	-
5. Tobacco	0.0	-	0.000001	0.000025	0.144254	-	-	-	-	-	-	-
6. Textiles	0.006372	0.001142	0.007997	0.000700	0.002801	0.426076	0.200214	0.006064	0.014359	0.053836	0.006577	0.001510
7. Leather and leather products	-	-	0.0	0.000380	0.000001	0.000292	0.150374	0.000870	0.000335	-	0.000006	-
8. Wood and wood products	0.000728	0.001296	0.000470	0.000305	0.000128	0.000342	-	0.128758	0.001332	0.000619	0.002359	-
9. Pulp paper and paper products	0.000087	0.000713	0.004427	0.024689	0.036546	0.005647	-	0.002018	0.187159	0.025846	0.043990	0.000834
10. Basic Industrial chemicals	0.005665	0.002502	0.001204	0.011207	0.001435	0.003288	0.008945	0.004310	0.008426	0.056492	0.044597	0.012033
11. Chemical products	0.002062	0.000196	0.001086	0.000450	0.000025	0.004135	0.008804	0.009831	0.008591	0.002654	0.017188	0.001439
12. Refineries & Petroleum products	0.028092	0.031775	0.005074	0.007820	0.050619	0.025900	0.018073	0.018711	0.033968	0.067744	0.024270	0.061888
13. Rubber and rubber products	0.000023	-	0.000003	-	-	0.000633	0.003001	0.002969	0.000137	0.000296	0.000658	-
14. Plastic products	0.000871	0.000009	0.001531	0.001394	0.000473	0.002181	0.005212	0.001181	0.001576	0.016253	0.012955	0.001418
15. Ceramic and earthern weare	0.000183	-	0.000001	-	-	-	-	-	-	0.008343	0.001889	-
16. Glass and glass products	0.000040	0.000049	0.000383	0.025442	0.000014	0.000002	-	0.000896	-	0.001433	0.007470	0.000083
17. Other Non-metallic products	0.000165	0.000023	0.000160	0.000028	-	-	0.000155	-	0.001215	-	-	-
18. Iron and steel	0.000061	0.000718	-	-	-	-	-	0.000366	-	-	-	-
19. Non-ferrous metals	0.0	-	0.000096	-	0.000221	0.000064	-	-	0.002116	0.000270	0.000173	0.000707
20. Fabricated metals	0.003333	0.001810	0.002020	0.004016	0.000397	0.000438	0.004894	0.001527	0.000165	0.000351	0.003205	0.005106
21. Machinery	0.003174	0.012605	0.000603	0.007441	0.001320	0.002666	0.001099	0.002786	0.005691	0.001967	0.001061	0.003814
22. Electrical industrial machinery	0.000095	0.000192	0.000136	0.000024	0.000016	0.000015	0.000170	0.000029	0.000014	-	0.000005	-
23. Transport equipment	0.001761	0.014726	0.000498	0.001279	0.000725	0.000665	0.004599	0.010778	0.002370	0.012199	0.002630	0.007172
24. Other manufactured products	0.000035	0.000006	0.000136	0.000129	0.000311	0.000416	0.000672	0.000192	0.000292	0.000633	0.001031	0.000941
25. Construction	0.001228	0.005440	0.000406	0.000983	0.001063	0.000950	0.001396	0.001623	0.006352	0.003606	0.002968	0.004227
26. Electricity & water supply	0.000426	0.001482	0.007705	0.011592	0.004841	0.034648	0.016916	0.019213	0.045534	0.050279	0.018635	0.036721
27. Transportation & communication	0.007008	0.022717	0.018217	0.017154	0.004756	0.010059	0.007152	0.023991	0.037512	0.031164	0.038079	0.008820
28. Wholesale & retail trade	0.024146	0.008663	0.068069	0.034205	0.039235	0.064925	0.053306	0.075581	0.095507	0.102776	0.084528	0.010965
29. Banking and insurance	0.010686	0.004757	0.002805	0.006913	0.002441	0.005487	0.005320	0.004305	0.006974	0.014559	0.009845	0.023263
30. Public administration	-	-	-	-	-	-	-	-	-	-	-	-
31. Services	0.000357	0.010148	0.005341	0.013845	0.006926	0.007611	0.018587	0.010855	0.017108	0.036748	0.057528	0.014748
32. Unclassified	0.000382	0.002087	0.000516	0.001590	0.001126	0.000297	0.002846	0.001629	0.001618	0.006001	0.002821	0.000370
33. Total Intermediate Transaction	0.231824	0.124170	0.751912	0.265196	0.454000	0.627797	0.604700	0.509159	0.488720	0.530958	0.429574	0.206712
34. Wages & Salaries	0.100267	0.161554	0.074443	0.103504	0.066214	0.104092	0.093008	0.100034	0.082539	0.127968	0.120418	0.033785
35. Operating Surplus	0.640521	0.419467	0.133814	0.201145	0.068871	0.202275	0.259038	0.321010	0.319551	0.210594	0.365674	0.201755
36. Depreciation	0.020834	0.061648	0.010621	0.024981	0.022377	0.026074	0.018732	0.028146	0.049218	0.074417	0.035247	0.113218
37. Indirect taxes less subsidies	0.006551	0.233159	0.029207	0.405172	0.388535	0.039760	0.024520	0.041647	0.059971	0.056060	0.049085	0.444528
38. Total Value Added	0.768175	0.875829	0.248087	0.734803	0.545999	0.372202	0.395299	0.490840	0.511279	0.469041	0.570425	0.793287
39. Controltotal	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

	13	14	15	16	17	18	19	20	21	22	23	24
1. Agriculture	0.421614	-	0.008733	-	0.003843	0.000198	0.000003	0.000566	-	0.000006	0.000008	0.026937
2. Mining and Quarrying	0.000214	-	0.050698	0.006404	0.085606	0.004512	0.624686	0.000129	-	0.001775	0.000051	0.002770
3. Foods	-	-	-	-	0.000173	-	-	-	-	0.000438	-	0.026840
4. Beverages	-	-	-	-	-	-	-	-	-	-	-	-
5. Tobacco	-	-	-	-	-	-	-	-	-	-	-	-
6. Textiles	0.024272	0.012622	0.020123	0.003333	0.004828	0.000204	-	0.001677	0.003074	0.010249	0.005541	0.038380
7. Leather and leather products	0.000099	-	0.000508	0.000527	0.000341	0.000034	-	0.000463	-	0.000180	0.000533	0.000503
8. Wood and wood products	0.000010	0.001258	0.035549	0.011153	0.001586	0.000195	-	0.011560	0.014095	0.031116	0.014838	0.024661
9. Pulp paper and paper products	0.000720	0.033499	0.024724	0.015449	0.016096	0.000879	0.000564	0.005883	0.016873	0.026581	0.004074	0.024002
10. Basic Industrial chemicals	0.018929	0.017256	0.003186	0.059525	0.001360	0.007255	0.000511	0.003109	0.011946	0.014932	0.002986	0.002493
11. Chemical products	0.002031	0.009467	0.002885	-	0.000115	0.000409	0.000029	0.007806	0.007813	0.002805	0.010567	0.001456
12. Refineries & Petroleum products	0.029802	030112	0.119467	0.138968	0.116084	0.056498	0.030937	0.023808	0.046006	0.039516	0.044799	0.011067
13. Rubber and rubber products	0.053140	0.000941	-	0.000021	-	0.000112	0.000532	0.001156	0.004227	0.005686	0.089854	0.004441
14. Plastic products	0.000973	0.005550	0.000475	0.005011	0.000613	0.000147	0.000660	0.004485	0.010545	0.027169	0.009113	0.004184
15. Ceramic and earthern weare	-	-	0.006038	-	-	-	-	0.000022	0.007177	-	-	0.000254
16. Glass and glass products	-	0.001795	-	0.018945	-	-	-	0.000992	0.000073	0.022629	0.008775	0.002917
17. Other Non-metallic products	-	-	0.000434	0.000125	0.120627	0.008397	-	0.001847	0.001171	0.000385	0.000089	0.003251
18. Iron and steel	-	0.003507	0.000024	-	0.027618	0.370123	-	0.073338	0.013908	0.015583	0.003391	0.006803
19. Non-ferrous metals	-	0.004666	-	-	-	0.001262	0.038707	0.138419	0.016651	0.031913	0.016411	0.052972
20. Fabricated metals	0.001163	0.003952	0.002940	0.001209	0.000091	0.000074	0.000015	0.019891	0.020801	0.025602	0.006371	0.003857
21. Machinery	0.002919	0.007803	0.012935	0.006653	0.004194	0.021506	0.003764	0.001846	0.041811	0.004141	0.022583	0.001532
22. Electrical industrial machinery	0.000055	0.005163	0.000043	-	0.000269	0.000516	-	0.001173	0.024232	0.069220	0.037403	0.001258
23. Transport equipment	0.003515	0.002706	0.014254	0.001692	0.002431	0.000383	0.002219	0.002420	0.003050	0.003145	0.128876	0.000849
24. Other manufactured products	0.000593	0.005521	0.001533	0.000066	0.000171	0.000124	0.000169	0.000278	0.001469	0.000580	0.002002	0.072481
25. Construction	0.031669	0.001081	0.014604	0.003792	0.000256	0.000317	0.000832	0.000998	0.001531	0.001877	0.000533	0.000704
26. Electricity & water supply	0.010010	0.080750	0.012870	0.025441	0.031549	0.090226	0.037920	0.017193	0.033023	0.030854	0.023069	0.006487
27. Transportation & communication	0.014676	0.026006	0.057044	0.034588	0.078516	0.010417	0.014313	0.019443	0.044313	0.035121	0.032266	0.017752
28. Wholesale & retail trade	0.068586	0.105286	0.042422	0.053755	0.105924	0.034137	0.048077	0.100536	0.155961	0.104992	0.093668	0.076239
29. Banking and insurance	0.003266	0.018856	0.007030	0.009958	0.015626	0.005245	0.002709	0.002346	0.017841	0.007322	0.007447	0.003443
30. Public administration	-	-	-	-	-	-	-	-	-	-	-	-
31. Services	0.004302	0.014359	0.012233	0.006512	0.007035	0.003119	0.020076	0.012824	0.042222	0.047665	0.014210	0.016510
32. Unclassified	0.000243	0.002888	0.005111	0.004586	0.005054	0.000446	-	0.007999	0.003532	0.002072	0.002415	0.007543
33. Total Intermediate Transaction	0.662813	0.394807	0.455895	0.467724	0.630016	0.616748	0.826953	0.462321	0.543357	0.563505	0.581886	0.442600
34. Wages & Salaries	0.074707	0.209096	0.119689	0.198151	0.085497	0.074915	0.048689	0.122458	0.130756	0.104498	0.103433	0.148310
35. Operating Surplus	0.172111	0.231561	0.327947	0.204426	0.183805	0.150217	0.077830	0.351964	0.251879	0.216557	0.184049	0.363485
36. Depreciation	0.016203	0.051783	0.039255	0.072062	0.045834	0.052298	0.019772	0.027866	0.037413	0.023559	0.040704	0.019281
37. Indirect taxes less subsidies	0.074164	0.112751	0.057211	0.057635	0.054646	0.105820	0.026753	0.035388	0.036593	0.091879	0.089926	0.026322
38. Total Value Added	0.337186	0.605192	0.544104	0.532275	0.369983	0.383251	0.173046	0.537678	0.456642	0.436494	0.418113	0.557399
39. Controltotal	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

	25	26	27	28	29	30	31	32	33
1. Agriculture	0.000971	-	0.000176	0.000014	0.000429	-	0.023727	0.158913	0.097515
2. [illegible] and Quarrying	0.042028	0.006336	-	-	-	-	0.000011	0.003256	0.013324
3. Foods	-	-	0.000623	0.003876	0.000045	-	0.053137	0.253064	0.023970
4. Beverages	-	-	0.001606	0.000060	0.000197	-	0.058871	0.006186	0.005932
5. Tobacco	-	-	0.000022	0.000005	0.000002	-	0.000035	0.000029	0.001490
6. Textiles	0.001151	01001403	0.006919	0.011144	0.001775	-	0.006287	0.115859	0.034687
7. Leather and leather products	0.000013	0.000140	0.000077	0.001511	0.000022	-	0.000431	0.002282	0.000905
8. Wood and wood products	0.078663	0.000213	0.000066	0.004757	0.002083	-	0.000942	0.002062	0.010146
9. Pulp paper and paper products	0.001800	0.000750	0.007329	0.015062	0.010959	-	0.021802	0.028048	0.011451
10. Basic Industrial chemicals	0.000778	0.014799	0.000001	-	0.000034	-	0.000386	0.004401	0.003551
11. Chemical products	0.009600	0.000097	0.000512	0.000603	0.000671	-	0.008643	0.006214	0.003452
12. Refineries & Petroleum products	0.012214	0.128532	0.214246	0.004623	0.006147	-	0.010814	0.062120	0.032283
13. Rubber and rubber products	0.000110	0.000092	0.000961	0.000150	0.000017	-	0.000343	0.000808	0.004210
14. Plastic products	0.002458	0.001139	0.000277	0.002551	0.000522	-	0.001188	0.000134	0.002223
15. Ceramic and earthern wears	0.006188	0.000085	-	0.000435	0.000410	-	0.000935	0.000593	0.000745
16. Glass and glass products	0.004904	-	0.000166	0.000288	0.000128	-	0.001045	0.005183	0.001564
17. Other Non-metallic products	0.119693	0.001953	0.000016	0.000224	0.000419	-	0.000073	0.004431	0.009729
18. Iron and steel	0.067515	-	0.000474	0.000022	0.000090	-	0.000303	0.006313	0.008297
19. Non-ferrous metals	0.009582	0.000236	-	-	0.000024	-	0.000094	0.001773	0.003513
20. Fabricated metals	0.015870	0.000381	0.000296	0.000672	0.000903	-	0.002282	0.006723	0.003330
21. Machinery	0.020507	0.019467	0.000415	0.000031	0.000014	-	0.001017	0.001904	0.004329
22. Electrical industrial machinery	0.012493	0.018364	0.001332	0.000429	0.000628	-	0.002681	0.005110	0.003665
23. Transport equipment	0.005619	0.000906	0.104057	0.002987	0.001297	-	0.000883	0.000005	0.012228
24. Other manufactured products	0.000054	0.000076	0.000126	0.000512	0.002181	-	0.004001	0.009108	0.001294
25. Construction	0.000129	0.001064	0.001675	0.000799	0.182123	-	0.004761	0.002957	0.010085
26. Electricity & water supply	0.006857	0.057070	0.004283	0.003028	0.006066	-	0.017023	0.031341	0.012346
27. Transportation & communication	0.078653	0.033664	0.042807	0.015037	0.016176	-	0.014338	0.056420	0.022308
28. Wholesale & retail trade	0.101483	0.126263	0.080904	0.013444	0.006615	-	0.057782	0.096131	0.052240
29. Banking and insurance	0.008344	0.013660	0.015532	0.016917	0.014050	-	0.005077	0.010483	0.009123
30. Public administration	-	-	-	-	-	-	-	-	-
31. Services	0.008846	0.011885	0.010984	0.048792	0.030652	-	0.032871	0.120335	0.018056
32. Unclassified	0.001273	0.001412	0.001382	0.001783	0.001334	-	0.000864	-	0.001184
33. Total Intermediate Transaction	0.617838	0.440000	0.509277	0.149768	0.286028	-	0.332661	1.0	0.418992
34. Wages & Salaries	0.129902	0.254418	0.175910	0.271691	0.113741	-	0.344511	-	0.174472
35. Operating Surplus	0.216476	0.342693	0.256172	0.533816	0.289609	-	0.264855	-	0.322552
36. Depreciation	0.018068	0.086969	0.054946	0.036048	0.247060	0.909090	0.023151	-	0.040729
37. Indirect taxes less subsidies	0.017714	0.124081	0.003690	0.012674	0.063571	0.090909	0.034820	-	0.043255
38. Total Value Added	0.382161	0.559999	0.490722	0.850231	0.713971	1.0	0.667338	0.0	0.581007
39. Control total	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

APPENDIX 3

Table A1: PROJECTED PRIVATE CONSUMPTION EXPENDITURE : THE HIGH CASE

(Millions of Baht)

Items	1985	1986	1987	1988	1989	1990	1991
Food	6,395	6,707	7,097	7,515	7,959	8,444	8,968
Textiles	1,344	1,430	1,519	1,616	1,723	1,838	1,961
Housing	1,207	1,243	1,309	1,378	1,447	1,525	1,610
Household equipment	528	564	599	639	682	729	779
Personal care	754	796	843	894	950	1,010	1,075
Transportation	1,286	1,373	1,460	1,556	1,662	1,774	1,896
Recreation	1,221	1,297	1,377	1,465	1,561	1,664	1,775
Miscellaneous	169	178	189	200	213	226	240
Total	12,903	13,588	14,393	15,262	16,198	17,210	18,304

Table A2: PROJECTED PRIVATE INVESTMENT EXPENDITURE: THE HIGH CASE

(Millions of Baht)
(Percentage)

	Actual investment expenditure 1980	Projected investment expenditure 1985	% Change	1986	% Change	1987	% Change	1988	% Change	1989	% Change	1990	% Change	1991	% Change
Construction	87,549	124,034	7.2	136,610	10.1	151,732	11.1	169,487	11.7	190,262	12.2	213,788	12.4	240,670	12.6
Transportation equipment	24,170	21,632	-2.1	21,331	-1.4	21,714	1.8	22,582	4.0	23,931	6.0	25,608	7.0	27,658	8.0
Machinery and other equipment	63,774	98,071	9.0	110,978	13.2	126,803	14.2	145,634	14.8	167,905	15.3	193,324	15.1	222,573	15.1
Total	175,493	243,737	6.8	268,919	10.3	300,249	11.6	337,703	12.5	382,098	13.1	432,720	13.2	490,901	13.4

Table A3 : PROJECTED GOVERNMENT EXDENDITURE : THE HIGH CASE

(Millions of Baht)

Year	Projected Government Expenditure	
	at constant 1972 prices	at current prices
1985	46,234	131,244
1986	47,991	137,959
1987	49,430	145,988
1988	50,913	155,668
1989	52,441	165,761
1990	54,014	176,718
1991	55,634	188,395

TABLE A4 : ADJUSTED EXPORTS, 1986-1991 : THE HIGH CASE

(Millions of Baht)

SECTOR	1985	1986	1987	1988	1989	1990	1991	GROWTH RATE 1985-91	GROWTH RATE 1986-91
Food	74495	78895	85572	92621	100179	108132	116796	7.78	8.16
Beverages	228	202	169	131	96	64	41	-24.77	-27.15
Tobacco	3200	3626	4131	4644	5201	5783	6417	12.29	12.10
Textiles	20479	24634	29939	36183	43851	52983	64204	20.98	21.12
Leather & leather products	2462	3039	3774	4622	5641	6833	8262	22.36	22.14
Wood & wood product	1731	1691	1660	1607	1551	1485	1420	-3.25	-3.44
Paper & paper product	628	849	1156	1552	2075	2755	3651	34.09	33.86
Basic chemicals	2293	2886	3654	4562	5676	7009	8640	24.74	24.52
Chemical product	0	0	0	0	0	0	0	ERR	ERR
Refineries	31	29	29	28	27	26	25	-3.39	-3.22
Rubber & rubber product	25923	29850	34567	39483	44946	50781	57270	14.12	13.92
Plastic product	845	935	1041	1143	1251	1359	1474	9.72	9.52
Ceramic	427	469	519	567	617	666	717	9.05	8.85
Glass	235	258	286	312	339	366	394	9.03	8.85
Other non-metallic product	405	446	494	538	586	632	682	9.05	8.87
Iron & steel	1032	1181	1364	1559	1785	2037	2238	13.77	13.64
Non-ferrous metal	11963	13685	15802	18073	20685	23601	25934	13.76	13.64
Fabricated metal	2146	2735	3504	4428	5577	6972	8700	26.27	26.04
Machinery	738	722	708	679	637	584	526	-5.48	-6.13
Electrical machinery	6907	8432	10352	12636	15129	18123	21669	20.99	20.78
Transport equipment	163	177	197	217	239	261	284	9.77	9.99
Other manufactured product	7815	8690	9718	10719	11782	12855	14000	10.20	10.01
TOTAL	164145	183431	208633	236204	267870	303308	343344	13.09	13.36