ISSN 0125 - 2801

วารสารวิจัยสังคม
JOURNAL OF SOCIAL RESEARCH

ปีที่ 8 ฉบับที่ 2 2528

VOL. 8 NO. 2 1985

แบบจำลองเศรษฐกิจสังคมสำหรับสังคมไทย (1)
A SOCIO-ECONOMIC MODEL OF THAILAND (1)

สถาบันวิจัยสังคมจุฬาลงกรณ์มหาวิทยาลัย
CHULALONGKORN UNIVERSITY SOCIAL RESEARCH INSTITUTE

The Journal of Social Research publishes research works undertaken by the Chulalongkorn University Social Research Institute, as well as articles and dissertations related to the Social Sciences, for the Thai and international academic community. The Journal is published twice yearly.

The Journal is funded by Chulalongkorn University, Thailand.

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บทบรรณาธิการ

วารสารวิจัยสังคมฉบับนี้ ประกอบด้วยผลงานของกลุ่มนักวิจัย ในหน่วยพยากรณ์ทางเศรษฐกิจสังคม (Socio–Economic Forecasting Unit) ของสถาบันวิจัยสังคม งานสำคัญของหน่วยนี้คือ การสร้างแบบจำลองทางเศรษฐมิติและสังคม (Socio–Econometric Models) เพื่อสังคมไทย บทความที่เสนอเป็นการแสดงถึงผลของการใช้แบบจำลองหลัก 3 แบบของหน่วยนี้ คือ

1. แบบจำลองเศรษฐมิติสถาบันวิจัยสังคมที่ 1 (CUSRI Econometric Model I) ซึ่งแสดงในบทความ "1985 Forecasts–from the Econometric Link System for Thailand"

2. แบบจำลองเศรษฐมิติสถาบันวิจัยสังคมที่ 2 (CUSRI Econometric Model II) ซึ่งแสดงในบทความ "Macroeconometric Model for Analysis Change in Oil Prices"

3. แบบจำลองซึ่งประกอบด้วยดัชนีต่าง ๆ เพื่อการพยากรณ์ธุรกิจในระยะสั้น ซึ่งแสดงในบทความ "Short–Terms Economics Forecasting: A Case of Thailand"

บทความที่เสนอในวารสารฉบับนี้ล้วนเป็นเรื่องของการวิเคราะห์เชิงปริมาณ ซึ่งหวังว่าท่านผู้อ่านที่สนใจอาจจะได้ประโยชน์ไม่มากก็น้อย และหวังว่าจะได้รับการวิจารณ์และข้อเสนอแนะจากท่านผู้อ่านด้วย ทั้งนี้ก็เพื่อความเจริญก้าวหน้าทางวิชาการต่อไป

วารสารวิจัยสังคม

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CONTENT

สารบัญ

1985 Forecasts from the Econometric Link System for Thailand[1]

Warin Wonghanchao

1. Introduction

The forecasts shown in the present paper are essentially the results from an attempt to link an input-output table with a macroeconometric model and value added variables. The linkage process has the function of reconciling the differences emerged from projections provided by the input-output table and estimates provided by the macroeconometric model. The basis of the forecasts is, therefore, derived from the structures of the input-output table and the macroeconometric model used. An explanation of the composition of input-output table used can be found in *The Basic Input-Output Table of Thailand, 1975* and *Input-Output Table of Thailand for Analytical Uses, 1975*.[2] Hence, it is not repeated here. As for the macroeconometric model, the general description of the model is as follows:

[1] This article presents the work of a joint research team comprising the staffs of the Institute of Developing Economies (IDE), the National Economic and Social Development Board of of Thailand (NESDB), and the Chulalongkorn University Social Research Institute (CURSI), The author wishs to acknowledge the efforts of the staffs here. However, special thanks are due to Mr. Koichi Nonaka, the Director of the Statistics Department of IDE for making the necessary arrangements to enable the project to proceed smoothly; Mr. Shunichi Furukawa of IDE for providing advice on input-output table construction; Mr. Takao Sano of IDE for computer programming support: Professor Soshichai Kinoshita of Nagoya University for advice on econometrics; Dr. Charit Tingsabadh of CUSRI for developing the econometric model; Mr. Wisoot Wiseschinda of CUSRI for estimating the econometric model; Mr. Prayote Charoensul of CUSRI and Mr. Arkhom Tempittayapaisith of NESDB for estimating the input-output tables; and last but not least Mr. Wirat Wattanasiritham, the Deputy Project Director for his responsibility in monitoring the the project and providing advice on all aspects of the project. For the present article, Mr. Arkhom Tempittayapaisith should be singled out for helping the author in preparing the preliminary analysis.

[2] See *basic input-output Table of Thailand, 1975* (Bangkok NESDB, CSO and Tokyo IDE, 1980) pp. 13-18 and *Input-Output Table* of Thailand for Analytical uses 1975 (Bangkok NESDB NSO and Tokyo IBL, 1980) pp. 2-12, for Introduction on on the input-output system, see prajoek, sinsup, *Microeconomics: Mathematical Analysis*, (Bangkok: Thai Watthanaphanit, 1984), pp. 242-249.

The model consists of 102 equations and 137 variables. Twenty-one of the equations are behavioral equations and are empirically estimated from historical data. The remaining are either definitional equations or accounting identities. The variables which are exogenously determined number 55, the remaining being determined endogenously. The model is divided into distinct blocks dealing with different aspects of the economy. These blocks are described in more detail in the following paragraphs.

(1) Production

Production is disaggregated broadly into agricultural and non-agricultural production. Agricultural production is in turn divided into crop production and non-crop-livestock, fishery and forestry. Crop production is determined as a function of land, rainfall and agricultural prices. Non-crop agricultural production is assumed to have a time trend. Non-agricultural production is determined by capital and labour in a direct input-output relationship. Total gross domestic product is the sum of agricultural and non-agricultural production, expressed both in real terms and in nominal values.

(2) Wages and Employment

Non-agricultural real wage is exogenous, on the ground that the minimum wage law is in use. The demand for labour for non-agricultural production is then jointly determined by the wage rate, the capital stock and time. Surplus labour is then assumed to be absorbed in agricultural production.

(3) Prices

Prices are disaggregated to correspond with the disaggregation of output. Producers' prices are obtained by deducting taxes from the sectoral price levels. The agricultural price index is a function of the agricultural export price, which is exogenous, and the domestic Price level. Non-agricultural prices are also determined by the export prices and the domestic price level. The specification reflects the "open" nature of the Thai economy. Import prices in foreign currency are determined exogenously, and are converted into local prices through the rate of exchange and import taxes.

(4) Imports

Import demands are disaggregated into raw meterials and fuels, capital goods, consumer goods and services. In general, the demand for import is determined by domestic activity, but it is also responsive to prices: negatively to an increase in import prices, and positively to domestic prices. This indicates a degree of substitution between domestic and imported supplies. Total imports are expressed in real terms and in nominal values.

(5) Expenditures

Expenditure consists of consumption, export and investment, following the traditional Keynesian national income approach. Consumption expenditure is divided into private and government consumption. Real private consumption is a function of

household's disposable income as well as a lagged private consumption (an application of the permanent income hypothesis). Government consumption is specified to be a simple function of tax revenue.

Investment expenditures are disaggregated both by sector into agricultural and non-agricultural. Within each sector, it is further subdivided by type of spender, private business, state enterprise or government. Only private investment is defined as behavioral equations. The remaining investments are exogenously determined. Capital stocks are then adjusted by the investment, also taking into account depreciation. The total capital stock is then obtained.

Exports are exogenously fixed in foreign currency and then converted into local currency.

(6) The Domestic Price Level

The price level is determined for the disaggregated output sectors by means of the equality between supply and demand. Supply is expressed in real terms multiplied by the price index while demand is expressed in nominal values.

(7) Incomes and Transfers

Incomes are disaggregated broadly into household income, corporate income and government income.

Household incomes are derived from labour income and capital income in the non-agricultural sector, net of taxes and transfers to the foreign sector. Agricultural household income is derived from output less taxes and transfers. Components of incomes and transfers are determined separately. Non-agricultural labour income derives from employment, and capital income from the capital stock.

Tax income for the government is derived from direct and indirect taxes. Direct taxes are determined from non-agricultural household income and profit, whole indirect taxes are determined from imports, export and gross domestic output.

Transfers are made by households, private business, state enterprise and government to the foreign sector. These transfers are exogenous. The net surplus or deficit position of the households, the business sector, the government and the state enterprise are derived as accounting identities. The net balance of payments position is given in both the domestic and foreign currencies.

The model can be presented in terms of charts expressing the relations of the structural equation, the identity relation and the exogeneous variables as below:

2. The 1985 Thai Economy as Described by the Econometric Link System for Thailand.

The Thai economy of 1985 as shown in this section is based on the projections derived from the macro-econometric model and the predicted input-output table of 1985. The economy of 1985 is described by comparing with that of 1975 which is the bench-mark year of the present study.

Table 1: Gross Value Added

(million baht, current prices)

	180-Sector I/O Codes	1975		1985		Compound Annual Growth Rate, %
		Amount	%	Amount	%	
1. Agriculture		84,252	24.2	191,529	16.8	8.6
1.1 Crops	001-017, 024	63,580	18.2	155,742	13.7	9.4
-Paddy	001	26,230	7.5	57,766	5.1	8.2
-Maize	002	4,443	1.3	9,426	0.8	7.8
-Rubber	016	1,520	0.4	19,108	1.7	28.8
-Cassava	004	2,892	0.8	15,048	1.3	17.9
-Sugarcane	009	4,050	1.2	10,407	0.9	9.9
-Others		24,445	7.0	43,987	3.9	6.1
1.2 Livestock	018-023	7,153	2.1	9,581	0.8	3.0
1.3 Fishery	028-029	7,747	2.2	14,686	1.3	6.6
1.4 Forestry	025-027	5,772	1.7	11,520	1.0	7.2
2. Non-Agriculture		264,204	75.8	947,221	83.2	13.6
2.1 Mining and Quarrying	030-041	5,222	1.5	34,708	3.1	20.9
2.2 Industry		79,096	22.7	228,989	20.1	11.2
2.2.1 Light Industry		59,361	17.0	152,738	13.5	9.9
-Food, Beverages and Tobacco	042-066	32,452	9.3	76,089	6.7	8.9
-Textile	067-074	11,322	3.2	27,877	2.5	9.4
-Leather Products	075-077	832	0.2	1,959	0.2	8.9
-Wood Products	078-080	3,508	1.0	11,593	1.0	12.7
-Paper Products and Printing	081-083	2,405	0.7	8,933	0.8	14.0
-Non-metal Products	099-104	2,271	0.7	15,011	1.3	20.8
-Rubber and Plastic Products	095-098	3,571	1.0	6,478	0.6	6.1
-Others		3,000	0.9	4,803	0.4	4.8
2.2.2 Heavy Industry		19,735	5.7	76,251	6.7	14.5
-Chemical Products	084-092	3,637	1.0	10,963	1.0	11.7
-Petroleum Refineries	093-094	4,149	1.2	24,206	2.1	19.3
-Basic Metal	105-107	3,032	0.9	5,251	0.5	5.6
-Metal Products	108-111	1,489	0.4	7,599	0.7	17.7
-Machinery	112-122	3,039	0.9	10,719	0.9	13.4
-Motor Vehicles and Transportation Equipment	123-128	4,389	1.3	17,515	1.5	14.8
2.3 Public Utilities	135-137	3,268	0.9	10,030	0.9	11.9
2.4 Construction	138-144	15,385	4.4	72,141	6.3	16.7
2.5 Trade	145-146	65,277	18.7	314,608	27.6	17.0
2.6 Transportation and Communication	149-159	17,755	5.1	50,390	4.4	11.0
2.7 Banking	160-163	24,253	7.0	36,429	3.2	4.2
2.8 Public Administration	165	17,173	4.9	99,166	8.7	9.2
2.9 Services	147, 148, 164 166-178	36,775	10.6	100,755	8.8	10.6
3. Gross Value Added	209	348,456	100.0	1,138,750	100.0	12.6

(1) Sectoral Income

Income of the economy can be expressed in terms of gross value added. In 1985, the gross value added of Thailand was expected to reach 1,138,750 million baht from the 1975 total of 348,456 million baht. The expansion can be estimated at an compound growth rate of 12.6% per year. The sectoral composition of gross value added also changes significantly. In 1975, the agricultural sector contributed 24% of the total gross value added. By 1985, it was expected that the agricultural share of gross value added would reduce to only 17% of the total gross value added. The most rapidly expanding sector of the Thai economy is trade. The trade sector will cover 27.6% of the total gross value added by 1985, a jump from 18.7% of 1975. (see Table 1 for details).

(1.1) Agricultural Sector. During the period 1975–1985, the growth rates of most crops except rubber and cassava were low. The main reason for the low growth rates is that by the early 1980's almost all the arable land of Thailand had been put into use. In the early 1970's, it was still possible for the farmers to open up new land for growing crops. This is no longer possible now. Furthermore, modern technology has not been applied to Thai agriculture extensively. The application of fertilizer, the practice of farm mechanization and proper water management are hardly found in the Thai agricultural sector. Comparing the shares in gross value added of 1975 and 1985, the drops in relative importance of paddy, maize and sugarcane can easily been seen. Other sub-sectors of agriculture such as livestock fishery and forestry all performed poorer than crops. Livestock has grown at only 3.0% per year due mainly to the inability of the economy to increase large livestock such as cattle. The slow growth of fishery gross value added is caused mainly by the problem of over-fishing in the past. As for gross value added of forestry, the expansion has been low due to the practice of deforestation and the government's policy of counter-insurgency by cutting down the forest areas.

(1.2) Trade Sector. The trade sector serves other sectors and facilitates their growth. At the same time, the growth of other sectors, in turn, contributes to the expansion of the trade sector. The best example in this case is the growth of the industrial sector which provides the forward linkages to wholesale and retail trades and causes the trade sector to grow significantly. The expansion of the trade sector during the decade under study is also a result of development within the trade sector itself. During the period, selling techniques have developed rapidly and the number of trade centers and department stores both in Bangkok and up-country have increased. The trade sector has grown at an compound rate of 17.0% per year during 1975-1985 and its share in the total gross value added has increased from 18.7% in 1975 to 27.6% in 1985.

(1.3) Industrial Sector. Within the industrial sector, heavy industries' growth is quite high. These industries provide capital goods and raw materials for high-technology industries. The share of the heavy industries in the total gross value added has increased from 5.7% in 1975 to 6.7% in 1985. The average compound growth rate of the heavy industries is 14.5% per year. As for light industries, the growth rate is lower than that of heavy industries, i.e. 9.9%. However, in terms of share in the total gross value added, the share has dropped from 17% in 1975 to 13.5% in 1985. Among light industries, those which have a gross value added more than 5 billion baht and have high growth rates are food, beverages and tobacco, paper products and printing, textile, wood products, and non-metallic products. In the case of heavy industries, those which have a high gross value added and growth rate are chemical products, petroleum refineries, machinery, and motor vehicles and transportation equipment.

(1.4) Mining and Quarrying Sector. The mining and quarrying sector is one of the fastest growing sectors. Its growth is high at 20.9% per year and its share in total gross value added has increased from 1.5% in 1975 to 3.1% in 1985.

(2) Composition of Gross Value Addee.

It is found that the ratio of wages and salaries to other primary inputs such as operating surplus, depreciation and indirect taxes has changed slightly from 1975. In 1975 the ratio of wages and salaries to other primary inputs was (see Table 2) 27 : 73 and by 1985 the ratio was be 33 : 67. The change of the ratio is due mainly to the effect of the annual increase of minimum wage in the industrial sector. Concurrent with the increases of the share of wages and salaries, the share of operating surplus which is composed of profit, rent, and interest fell from 55.5% of the total gross value added in 1975 to 52.5% in 1985.

(3) Gross Output

By 1985, the total gross output of Thailand will reach 2,534,384 million baht from the level of 621,800 million baht of 1975. In terms of compound growth rate, the growth of gross output is 15.1% per year. As for sectoral gross output, agriculture has reduced its share of 17% of total gross output in 1975 to only 12% in 1985 while those of trades and manufacturing have increased. The share of trade was 12.6% of the total gross output in 1975 and became 14.8% in 1985. The share of manufacturing was 38.7% and was 39.6% in 1985 (see Table 3 for details) In the case of gross output of commodities, those which have an compound growth rate over 24% per year are construction of plants for electricity generation, fluorite, oil palm, photographic and optical goods, other electrical apparatus, non-ferrous metal, cement, ruber latex, concrete and cement products, office and household machinery, breweries, rubber sheets, electric accumulators, and other fabricated metal products (see Table 4 for details).

(4) Intermediate Inputs Ratios

The over-all intermediate inputs ratio was 44% in 1975. This ratio was 55.2% in 1985 (see Table 5). There are two important factors which cause the changes in intermediate inputs ratios. One concerns the changes in technology of production, the other is the changes in the price of factor inputs such as those of energy and raw materials. In fact the changes in energy price and prices of raw materials have been related. As a consequence of the second oil crisis in 1976, the prices of fuel and gas increased several times in the country and gave rise to the increases in prices of raw materials. Such increases were usually higher than the increases in prices of finished products. A careful study of the input coefficients can establish that the upward changes of the coefficients were due mainly to the changes in the energy prices, such as those of oil and electricity as well as changes in the prices of raw materials. However, in some cases such as cement production, production of iron products, sugar milling and rice milling, there have been changes in the production technique to some extent. The changes are mainly for the purpose of reducing oil consumption in order to minimize fuel cost. For downward changes in input coefficients, these are commonly found in the cases where output prices rise faster than the prices of inputs. For example, in printing and advertising businesses, the increases in the prices of paper and printing materials were lower than the service charges of printing and advertising. Conseqently the ratios of intermediate inputs to total output decreased.

Table 2: Composition of Total Value Added.

(million baht, current prices)

	180-Sector I/O Codes	1975		1985		Compound Annual Growth Rate,%
		Amount	%	Amount	%	
1. Wages and Salaries	201	95,658	27.5	375,908	33.0	14.7
2. Other Primary Inputs		252,798	72.5	762,842	67.0	11.7
2.1 Net Indirect Taxes[1]	204	22,132	6.3	82,024	7.2	14.0
2.2 Others	202 + 203	230,666	66.2	680,818	59.8	11.4
3. Total Value Added	209	348,456	100.0	1,138,750	100.0	12.6

Note [1] Indirect taxes do not include those derived from imports such as import duty and import sale tax.

Table 3: Composition of Gross Output by Sectors

(million baht, Current Prices)

	180-Sector I/O Codes	1975		1985		Compound Annual Growth Rate, %
		Amount	%	Amount	%	
1. Agriculture		106,663	17.2	295,783	11.6	10.7
1.1 Crops	001-017,024	75,180	12.1	219,677	8.6	11.3
-Paddy	001	30,566	4.9	70,966	2.8	8.8
-Maize	002	5,713	0.9	16,410	0.6	11.1
-Rubber	016	1,642	0.3	20,840	0.8	28.9
-Cassava	004	3,321	0.5	21,121	0.8	20.3
-Sugarcane	009	5,017	0.8	14,600	0.6	11.2
-Others		28,921	4.7	75,740	3.0	10.1
1.2 Livestock	018-023	15,073	2.4	37,626	1.5	9.6
1.3 Fisheries	028-029	9,907	1.6	24,432	1.0	9.4
1.4 Forestry	025-027	6,503	1.1	14,048	0.5	8.0
2. Non-Agriculture		515,137	82.8	2,238,601	88.4	15.8
2.1 Mining and Quarrying						
2.2 Industry		240,788	38.7	1,004,453	39.6	15.3
2.2.1 Light Industry		174,246	28.0	636,786	25.1	13,8
-Food, Beverages and Tobacco	042-066	103,668	16.7	306,106	12.1	11.4
-Textile	067-074	33,769	5.4	121,092	4.8	13.6
-Leather Products	075-077	2,208	0.4	8,419	0.3	14.3
-Wood Products	078-080	8,611	1.4	32,713	1.3	14.3
-Paper Products and Printing	081-083	6,324	1.0	36,390	1.4	19.1
-Non-metal Products	099-104	5,685	0.9	50,506	2.0	24.4
-Rubber and Plastic Products	095-098	8,472	1.4	53,348	2.1	20.2
-Others		5,509	0.8	28,212	1.1	17.7
2.2.2 Heavy Industry		66,542	10.7	367,667	14.5	18.6
-Chemical Products	084-092	16,839	2.7	43,594	1.7	10.0
-Petroleum Refineries	093-094	9,937	1.6	87,652	3.4	24.3
-Basic Metal	105-107	10,651	1.7	80,748	3.2	22.5
-Metal Products	108-111	4,213	0.7	18,842	0.7	16.2
-Machinery	112-122	9,119	1.5	56,731	2.2	20.1
-Motor Vehicles and Transporation on Equipment	123-128	15,783	2.5	80,103	3.3	17.6
2.3 Public Utilities	135-137	7,608	1.2	39,932	1.6	18.0
2.4 Construction	138-144	41,788	6.7	250,240	9.9	19.6
2.5 Trade	145-146	78,647	12.6	374,891	14.8	16.9
2.6 Transporation and Communi-cation	149-159	32,544	5.2	149,279	5.9	16.5
2.7 Banking	160-163	27,989	4.5	66,747	2.6	9.1
2.8 Public Administration						
2.9 Services	147-148,164, 166-178	58,968	10.1	208,349	8.3	13.4
Total		621,800	100.0	2,534,348	100.0	15.1

(5) Energy Consumption

As indicated in the previous section, the changes in energy prices during the period 1975-1985 are the major causes for changes in intermediate inputs ratios. In Thailand there are two main energy sources. One is oil and the other is electricity.

(5.1) Changes in Oil Comsumption. The average ratio of oil consumption to output value was 2.42% in 1975. This ratio rose to 4.2% in 1985. In 1985, the sectors which had the highest ratios were electricity, road freight transport, road passenger transport, ocean water transport, air transport, and cement industry. Their ratios were respectively 42.1%, 34.2%, 34.3%, 33.4%: 29.8% and 26.4% (see Table 6). The sectors which have the highest increase in their ratios are manufacturing of motor vehicles, manufacturing of ceramics, ocean and coastal fishing, and inland water transport. The production sectors which have high oil consumption are road-water-air transport, electricity, manufacturing of basic metal, construction, and fisheries. For road, water and air transport, the shares of oil consumption in 1985 were 28.4%, 3.3% and 3.3% respectively. As for electricity, manufacturing of basic metal, construction, and fisheries the shares were 12.9%, 3.8%, 3.3%, and 3.0% respectively (see Table 7). From Table 7, it can be seen that all production sectors except nine have decreasing shares when comparing 1985 with 1975. The nine sectors which have rising shares are road transport, manufacturing of wood products, manufacturing of paper products, manufacturing of rubber and plastic, manufacturing of basic metal manufacturing of equipment, mining and quarrying, and construction. In terms of non-productive use of oil, although the government sector will be able to reduce its, share in oil consumption; the private sector will not. The government consumption expenditure on oil was 4.9% of the total oil consumption of the country in 1975 and by 1985 this percentage has dropped to 1.4. However, in the case of private consumption expenditure on oil, the percentage was increase ed 16.1% in 1985 from 7.4% of 1975.

(5.2) Electricity Consumption. Following oil, electricity is the most important input for production. It is estimated that in 1985, the ratio of electricity consumption to total inputs reached 1.8, VP from 0.72 in 1975 (see Table 8). Water supply and the manufacturing of ice are the two sectors which have the top two highest ratios of electricity consumption to total inputs. The ratios were respectively 43.96% and 19.90% in 1985 (see Table 8). The share of electricity consumption as intermediate input into production was 73.79% in 1975 and 81.04% in 1985. In 1985, the industries which used the most electricity were weaving, manufacturing of basic metal, manufacturing of motor vehicles, spinning, and manufacturing foods. Their shares of electricity consumption were respectively 6.97%, 4.73%, 4.47%, 4.35% and 4.18% (see Table 9). In the cases of final demand, the

Table 4: High Output Growth Rate

(Million baht, Current Prices)

	180-Sector I/O Code	1975 Amount	1985 Amount	Compound Annual Growth Rate, %
1. Electrical Construction	142	1,630	60,330	43.5
2. Fluorite	036	244	6,212	38.2
3. Oil Palm	011	15	378	38.1
4. Photographic and Optical Goods	130	111	2,373	35.8
5. Other Electrical Apparatus	122	763	13,537	33.3
6. Non-ferrous Metal	107	4,153	64,831	31.6
7. Cement	102	2,098	27,444	29.3
8. Rubber (Latex)	016	1,642	20,854	28.9
9. Concrete and Cement Products	103	945	11,447	28.3
10. Office and Household Machinery	116	557	6,589	28.0
11. Breweries	063	946	10,159	26.8
12. Rubber Sheets	095	2,846	30,014	26.6
13. Electric Accumulators	121	678	6,412	25.2
14. Other Fabricated Metal	111	1,082	9,481	24.2

Table 5: Intermediate Inputs Ratios of Major Sectors

	180-Sector I/O Code	1975 %	1985 %
1. Agriculture			
1.1 Crops	001-017	15.4	23.4
1.2 Livestock	018-023	52.5	74.6
1.3 Forestries	025-027	11.2	18.1
1.4 Fisheries	028-029	21.8	40.0
2. Mining and Quarrying	030-041	17.0	23.9
3. Manufacturing	042-134	67.2	77.2
4. Electricity and Water Supply	135-137	57.0	74.9
5. Construction	138-144	63.2	71.1
6. Trade	145-146	17.0	16.2
7. Postal and Telecommunication	149-159	45.4	66.4
8. Banking	160-162	20.1	25.4
9. Service	147, 148 164, 166-178	22.1	57.2
Overall		44.0	55.2

private consumption expenditure on electricity was 22.76% of the total value of electricity in 1975 and was reduced significantly to 16.16% in 1985. As for government consumption expenditure on electricity, the ratio consumption to total value of electricity was 1.85 in 1975 and was reduced to 1.35% in 1985.

(6) Final Demand

The final demand of the economy is composed of private consumption, government consumption, gross fixed capital formation, increase in stock, and exports. Within the framework of input-output tables, imports are included in total supply together with outputs of domestic production. The total final demand and the total

Table 6: Ratios of Cost of Oil per Output Value.

	180-Sector I/O Code	1975 %	1985 %
1. Public Utilities			
- Electricity	135	37.49	42.1
- Water Supply	137	2.51	3.3
2. Transportation			
- Railways	149	13.93	14.5
- Road Passenger Transport	150	25.76	34.2
- Road Freight Transport	151	26.85	34.3
- Ocean Water Transport	153	25.84	33.4
- Inland Water Transport	154	12.86	24.7
- Air Transport	156	20.83	29.8
3. Industry			
- Cement	102	19.30	26.4
- Iron	105	2.31	4.8
- Petroleum Products	094	14.59	19.4
- Textile Bleaching	069	8.65	12.8
- Glass	100	7.00	6.4
- Ceramic	099	4.51	11.8
- Motor Vehicles	125	2.07	7.1
- Structural Clay Products	101	4.38	6.6
- Basic Chemicals	084	3.87	4.2
- Synthetic Resin	086	2.99	4.6
4. Fisheries			
- Ocean and Coastal Fishing	028	9.83	19.2
- Inland Fishing	029	2.93	4.6
5. Average		2.42	4.2

Table 7: Shares of Oil Consumption.

	180-Sector I/OCode	1975 %	1985 %
1. Transportation		35.1	35.9
- Railways	149	1.1	0.4
- Road Transport	150-152	23.6	28.4
- Water Transport	153-155	5.6	3.3
- Air Transport	156	4.5	3.3
- Others	157	0.3	0.5
2. Electricity	135	12.3	12.9
3. Manufacturing		15.4	16.5
- Food, Beverages, Tobacco	042-066	2.1	1.0
- Textile	067-074	2.7	2.4
- Leather Products	075-077	0.1	0.0
- Wood Products	078-080	0.5	0.6
- Paper Products	081-083	0.6	0.9
- Chemical	084-092	0.9	0.3
- Oil Refineries	093-094	2.6	1.1
- Rubber and Plastic	095-098	0.8	1.0
- Cement	102	2.2	0.6
- Ceramic and Non-metallic	099-104 Except 102	0.1	0.8
- Basic metal	105-107	1.0	3.8
- Machinery	112-124	0.6	1.1
- Motor Vehicles and Transportation Equipment	125-128	0.1	2.4
- Others	108-111, 129-134	0.9	0.5
4. Agriculture		10.0	5.7
- Crops	001-017	4.7	2.4
- Livestock	018-023	0.4	0.1
- Forestry	025-027	0.4	0.2
- Fisheries	028-029	4.5	3.0
5. Mining and Quarrying	030-041	1.8	2.6
6. Construction	138-144	1.7	3.3
7. Trade	145-146	1.6	1.3
8. Postal	159	0.4	0.3

Table 7: (Con't)

	180-Sector I/OCode	1975 %	1985 %
9. Banking	160-162	0.2	0.1
10. Services	147-148, 163, 164, 166-180	3.6	2.5
11. Private Consumption	301	7.4	16.1
12. Government Consumption	302	4.9	1.4
13. Increase in Stocks	304	1.5	+
14. Exports	305 + 306	4.1	1.4
Total		100.0	100.0

intermediate transactions are combined to constitute the total demand. Hence, imports are not shown in the present section. In general, it is estimated that in 1985 the growth rate of total demand was lower than that of the growth rate of domestic outputs. This will slow down the growth rate of imports to 14.9% per year. The growth rate of total demand will be 12.6% while that of the domestic outputs will be 15.1%. Comparing 1985 the composition of the final demand to that of 1975, it can be seen that private consumption drops from 59.8% to 47.1%, government consumption increases from 8.3% to 11.2%, gross fixed capital formation increases from 15.4% to 17.7% and exports increase from 12.9% to 20.8%. The total final demand of the country was supplied by the domestic outputs to the extent of 92%. The rest of the total final demand was supplied by imports. In 1985, the total final demand was supplied by the domestic outputs to a greater extent, i.e. 94.4%, while the share of imports in supplying the total demand dropped to 5.6% (see Table 10).

(6.1) Private Consumption. The most important final demand of the Thai economy is private consumption. It constitutes about half of the total final demand. In terms of per capita consumption, the compound growth rate has been 8.0% per year during the period from 1975 to 1985. In calculating the per capita consumption, the population of 1975 was estimated as 41.388 million persons while that of the 1985 as 51.301 million persons. It is interesting to see that per capita consumption of rice has a negative growth rate which is due to the low income elasticity of rice. The six items which have the highest growth rates per year are radio and televisions, 20.9%, newspaper and magazines, 16.8%, electrical appliances, 18.2% drugs, 17.6%; fuel, 14.7% and vegetable oil, 13.9%. Besides rice, the four items which have the lowest growth rates per year are fruit and vegetables, 1.0%; real estate, 1.3% tabacco, 1.8%; and fish, 2.0% (see Table 11).

Table 8: Ratios of Electricity Consumption to Total Inputs.

	180-Sector I/O Code	1975 %	1985 %
1. Manufacturing			
- Ice	057	8.11	19.90
- Special Industry	115	1.01	3.28
- Machinery			
- Iron and Steel	105	3.17	7.75
- Pulp, paper and Paper board	081	4.08	4.82
- Spinning	067	2.64	7.28
- Cement	102	4.91	5.95
- Secondary Steel Product	106	3.88	4.91
- Plastic	098	0.67	6.05
- Basic Chemical	084	5.23	2.76
- Weaving	068	1.02	6.30
2. Public Utilities			
- Water Supply	137	15.50	43.96
3. Services			
- Hotel	147	1.07	0.36
- Restaurant	148	0.79	2.43
4. Average		0.72	1.18

(6.2) Government Consumption. The item of government consumption which has a negative growth rate per year during 1975-1985 is research, i.e. -0.5%. The highest growth rate of government consumption item is wages and salaries which is 21.3% per year. It is followed by transportation which is 17.4%. More than half of the government consumption in 1985 was spent on wages and salaries, i.e. 52.1%. In 1975, the share wages and salaries in total government consumption was only 34.8%. The second largest share of government consumption is education. In 1975 this share was 19.4% and by 1985 the share was slightly increased to 19.9% (see Table 12).

(6.3) Gross Investment. The gross investment comprises of gross fixed capital formation and increase in stock. In the period of 1975-1985, the compound growth rate of gross investment is 14.0% per year. The compound growth rate of gross fixed capital formation is 14.6% per year and that of increase in stock is 11.4% per year (see Table 13). Within the gross investment, the share of gross

Table 9: Shares of Electricity Consumption.

	180 Sector I/O Code	1975 %	1985 %
1. Intermediate Inputs		73.79	81.04
- Spinning	067	3.07	4.35
- Weaving	068	1.30	6.97
- Motor Vehicle	125-127	2.31	4.47
- Hotel and Restaurant	147-148	4.05	1.69
- Iron and Steel Products	105-106	4.02	2.50
- Basic Metal	107	1.51	4.73
- Foods	Excluding 050 042-064	2.69	4.18
- Paper	081-082	2.22	2.09
- Petroleum Refineries	093	5.59	0.12
- Textile	069-072	3.84	1.78
- Electrical Machinery	116-122	1.17	2.53
- Others		42.00	45.63
2. Final Demand		26.21	18.96
- Private	301	22.76	16.16
- Government	302	1.85	1.35
- Special Export	306	1.60	1.45
3. Total		100.00	100.00

fixed capital formation was 81.0% in 1975 and was 85.0% in 1985. The increase in stock was 19.0% of the total gross investment and was reduced to 15.0% of the total gross investment in 1985. Most of the gross investment is supplied from domestic outputs. In 1975 the domestic outputs contributed to 73.7% of the total gross investment. This contribution was increased to 88.3% by 1985. The item which will have the largest share in gross fixed capital formation is construction which will be 77.7% of the total gross fixed capital formation. Most of the gross fixed capital formation from construction will be construction of public works which will be 47.4% of the total gross fixed capital formation. In 1975 the share of construction in total gross fixed capital formation was also the highest but with a smaller percentage, i.e. 55.5%. Furthermore, the major part of the share was from building rather than from public works.

Table 10 : Composition of Final Demand.

	180-Sector I/O Code	1975 %	1985 %
1. Private Consumption	301	59.8	47.1
- Supplied by domestic outputs		57.3	44.2
- Supplied by imports		2.5	2.9
2. Government Consumption	302	8.3	11.2
- Supplied by domestic outputs		8.1	11.0
- Supplied by imports		0.2	0.2
3. Gross Fixed Capital Formation	303	15.4	17.7
- Supplied by domestic outputs		11.4	16.1
- Supplied by imports		4.0	1.6
4. Increase in Stock	304	3.6	3.3
- Supplied by domestic outputs		2.5	2.3
- Supplied by imports		1.1	0.9
5. Export	305-306	12.9	20.8
- Supplied by domestic outputs		12.7	20.8
- Supplied by imports		0.2	0.0
6. Total Final Demand	309	100.0	100.0
- Supplied by domestic outputs		92.0	94.4
- Supplied by imports		8.0	5.6

Table 11 : Composition of per Capita Private Consumption.

(Baht per person, Current Prices)

	180 Sector I/O Code	1975		1985		Compound Annual Growth Rate, %
		Amount	%	Amount	%	
1. Food						
- Rice	001-003, 049	589	9.5	568	4.2	-0.4
- Meat	018-021, 042-043	275	4.4	524	3.9	6.7
- Fish	028-029, 046	277	4.5	339	2.5	2.0
- Milk. Butter	022, 044	157	2.5	209	1.6	2.9
- Vegetable Oil	047-048	16	0.3	59	0.4	13.9
- Fruit, Vegetable	007-008, 045	423	6.9	467	3.5	1.0
- Sugar, Confectionery	055-056,	68	1.1	176	1.3	10.0
- Tea, Coffee	059	15	0.2	23	0.2	4.4
- Other Food	005-006 010-011 052-054, 057-058, 060	168	2.8	340	2.5	7.3
2. Beverages						
- Non-Alcoholic	064	31	0.5	65	0.5	7.7
- Alcoholic	062-063	77	1.3	246	1.8	12.3
3. Tobacco	065-066	164	2.7	196	1.5	1.8
4. Wearing Apparels						
- Footwear	077	20	0.3	62	0.5	12.0
- Clothing	067-072	359	5.8	755	5.6	7.7
5. Real Estate	163	421	6.8	479	3.6	1.3
6. Water Supply	137	18	0.3	26	0.2	3.7
7. Fuel	093-094	39	0.6	154	1.2	14.7
8. Electricity	135	33	0.5	116	0.9	13.4
9. Furniture, Fixtures	080-109	39	0.6	97	0.7	9.5
10. Medical Care						
- Drugs	088	63	1.0	319	2.4	17.6
- Hospital	169	149	2.4	266	2.0	6.0

Table 11 : (Con't)

(Baht per person, Current Prices)

	180 Sector I/O Code	1975		1985		Compound Annual Growth Rate, %
		Amount	%	Amount	%	
11. Transportation, Communication						
- Transportation	149-157	367	5.9	1,303	9.7	13.5
- Communication	159	13	0.2	42	0.3	12.4
12. Durable Goods						
- Motor Vehicles	125-127	154	2.5	493	3.7	12.3
- Radio, Television	118	22	0.3	147	1.1	20.9
13. Recreation						
- Theatre, Broad casting	172-174	21	0.4	29	0.2	3.3
- Hotel, Restaurant	147-148	519	8.4	1,241	9.3	9.1
- Newspaper, Magazine	083	26	0.4	139	1.0	18.2
- Others	175-176	30	0.5	84	0.6	10.8
14. Services	160-162, 164-168, 177-178,	247	4.0	757	5.7	11.9
15. Others[1]	-	1,355	22.0	3,527	26.5	10.0
16. Population (million person)		41.388	-	51.301	-	
Total		6,178	100.0	13,371	100.0	8.0

Note : 1 Including I/O Code 004, 009, 012-017, 023-027, 030-041, 050-051, 061, 073-076, 078-079, 081-082, 084-087, 089-092, 095-108, 110-115, 120-124, 128-134, 136, 138-146, 158, 170-171, and 179-180.

Table 12: Government Consumption.

(Million Baht, Current Prices)

	180 Sector I/O Code	1975		1985		Compound Annual Growth Rate, %
		Amount	%	Amount	%	
1. Wages and Salaries	165	12,321	34.8	85,106	52.1	21.3
2. Depreciation	165	4,852	13.7	14,059	8.8	11.2
3. Fuel, Oil	093, 094	1,000	2.8	3,874	2.4	14.5
4. Electricity	135	111	0.3	501	0.3	16.3
5. Transportation	149-156	1,146	3.2	5,713	3.5	17.4
6. Postal	159	193	0.5	813	0.5	15.5
7. Education	167	6,877	19.4	32,531	19.9	16.8
8. Research	168	991	2.8	940	0.6	-0.5
9. Trade	145-146	890	2.5	3,834	2.3	15.7
10. Repairing of Motor Vehicles	127	748	2.1	816	0.5	0.9
11. Repairing of Construction	139	430	1.2	1,557	1.0	13.7
12. Other Manufacturing goods	-	3,271	9.2	7,492	4.6	8.6
13. Banking	160	1,205	3.4	1,535	0.9	2.5
14. Hospital	169	326	1.3	741	0.4	8.6
15. Other Service	147, 148, 164 170-180, 166	1,005	2,8	3,592	2.2	13.6
Total		35,366	110.0	163, 104	100.0	16.5

Table 13: Gross Investment.

(Million Baht, Current Prices)

Title	180 Sector I/O Code	1975		1985		Compound Annual Growth Rate, %
		Amount	%	Amount	%	
1. Gross Fixed Capital Formation	303	66,121	81.0	257,519	85.0	14.6
- Supplies by domestic outputs		49,199	60.3	234,139	77.2	16.9
- Supplies by imports		16,922	20.7	23,380	7.8	3.3
2. Increase in Stock	304	15,521	19.0	45,665	15.0	11.4
- Supplies by domestic outputs		10,955	13.4	33,723	11.1	11.9
- Supplies by imports		4,566	5.6	11,942	3.9	10.1
3. Total (1+2)		81,642	100.0	303,184	100.0	14.0
- Supplies by domestic		60,154	73.7	267,821	88.3	16.1
- Supplies by imports		21,488	26.3	35,332	11.7	5.1

Table 14: Gross Fixed Capital Formation

(Million baht, Current prices)

	180 Sector I/O Code	1975		1985		Compound Annual Growth Rate, %
		Amount	%	Amount	%	
1. Machinery		20,607	31.2	30,369	11.8	4.0
- Agriculture	113	638	1.0	1,741	0.7	10.6
- Industry	112, 114, 115	7,733	11.7	16,076	6.2	7.6
- Office Machinery	116	1,396	2.1	2,092	0.8	4.1
- Electrical Machinery	117	13,204	1.8	2,216	0.9	6.3
- Household Machinery	118-119, 121-122	1,168	1.8	1,557	0.6	2.9
- Transportation Equipment	123-128 (Excluding 127)	8,094	12.2	5,940	2.3	-3.0
- Scientific Equipment	129-130	374	0.6	747	0.3	7.2
2. Construction		36,683	55.5	200,111	77.7	18.5
- Building	138-139	23,647	35.8	77,929	30.3	12.7
- Public Work	140-144	13,036	19.7	122,182	47.4	25.1
3. Others		8,831	13.3	27,039	10.5	11.8
4. Total		66,121	100.0	257,519	100.0	14.6

In 1975 the share of machinery in gross fixed capital formation was 31.2% which is higher than the 11.8% of 1985. In 1975, as well as in 1985, machinery is mainly for transportation and industry. (see Table 14). From Table 13, it can be seen that both demand for gross fixed capital formation and demand for increase in stock are satisfied mainly by domestic outputs. Gross fixed capital formation was supplied by domestic outputs to the extent of 60.3% of the total gross investment in 1975. This became 77.2% in 1985. As for increase in stock, the contribution of domestic outputs was 13.4% of the total gross investment in 1975 and was 11.1% in 1985. In total, the contribution of imports to gross investment was only 26.3% in 1975 and was reduced to 11.7% in 1985.

(6.4) Exports It is estimated that in 1985 the exports of Thailand reached 303.328 million baht. The compound growth rate of exports from 1975 to 1985 is 18.6% per year. The five export goods which have top growth rates are electrical appliances, leather products, non-ferrous metal products, and metal products. Their respective annual growth rates are 34.8%, 31.8%, 31.6% and 30.3% (see Table 15). In general, the share of exports from total outputs increased to 12.0% in 1985. The 1975 share was 0.9%. In terms of outputs, 6.10% of agricultural production was exported in 1975. This export share will increase to 7.81% by 1985. In the case of the mining sector, the share of exports in the sectoral output was 11.60% in 1975 and became 12.79% in 1985. As for the manufacturing sector, in 1985 the agro-industries generally had high ratios of export to output. For example, the share of export of canned food will be 82.7% of the output and that of tapioca industry was 86.55% while the share of rice industry was 45.31%. For other types of industry the highest share is that of non-ferrous metal which will be 56.79 by 1985. The industries besides those already mentioned which had the export shares from output higher than 20% in 1985 were sugar (31.80%), animal feed (29.34%), textile (21.58%), chemicals (20.70%), rubber products (32.27%), machinery (23.48%) and leather products (12.98%). For details on the contribution to exports by the respective outputs from agricultural, mining and manufacturing sectors (see Table 16).

(7) Balance of Trade

The balance of trade of Thailand in 1985 was in a deficit of 16.384 million baht. Comparing to 1975, the 1985 deficit was less than that of 1975 which was 24.252 million baht. The trade deficit was 1.4% of gross domestic product in 1985 which is a substantial drop from the 6.76% of 1975. It is estimated that the compound growth rates of exports and imports during the period from 1975 to 1985 were 18.6% and 14.9%. As a result, the trade deficit would be reduced by a negative growth rate of 3.8% per year (see Table 17). As shown in Table 15, in 1985, the products which had the largest share in total export were rice and flour. This was followed by non-ferrous metal products and food products. In the case of imports, the products which had the largest share were metal products, followed by chemicals and crude oil and minerals (see Table 18). Classified by usage, imports have been used mainly as raw materials. The imported raw materials has been 74.59% of the total imports while imported consumer goods and capital goods were 14.25% and 11.16% of the total imports respectively.

(8) Degree of Self-Sufficiency

Degree of self-sufficiency can be measured by a self-sufficiency ratio which is defined as gross output multiplied by 100 and divided by gross output plus import and minus export. The self-sufficiency ratio of Thailand in 1975 was 96.2

and was increased to 99.36 in 1985. Hence, for 1985, it is estimated that Thailand would almost be self-sufficient. The highest individual ratio, i.e. 743.41, will be for tapioca, its high export performance indicating the high export potential of tapioca. Similarly maize, basic metal products, and output of rice milling will also have relatively high export ratings. The self-sufficiency ratios of maize, basic metal products, and output of rice milling in 1985 were estimated to be 617.60, 182.75, and 182.74 respectively (see Table 20). The outputs which have had low self-sufficiency ratios are crude oil and minerals, chemicals, and metal products (except non-ferrous metal products) The major part of these products was imported in 1975 and still was imported in 1985. These products are the main cause of the inability of the Thai economy to achieve self-sufficiency, i.e. their self-sufficiency ratio is less than 100.

Table 15: Main Export Goods.

(Million Baht, Current Prices)

	180 Sector	1975		1985		Compound Annual Growth Rate, %
		Amount	%	Amount	%	
1. Rice and Flour	049-052	9,934	18.0	67,740	22.3	21.2
2. Non-Ferrous Metal Products	107	2,349	4.3	36,653	12.1	31.6
3. Rubber	095-097	2,507	4.5	12,944	4.3	17.8
4. Food Products	042-046	2,222	4.0	26,474	8.7	28.1
5. Electrical Applicances	116-122	572	1.0	11,365	3.7	34.8
6. Textile	069-074	1,553	2.8	11,925	3.9	22.6
7. Spinning and Weaving	067-068	1,137	2.1	9,311	3.2	23.4
8. Leather Products	075-077	164	0.4	2,590	0.8	31.8
9. Metal	108-111	239	0.5	3,368	1.2	30.3
10. Jewelry	132	907	1.6	8,064	2.6	24.4
Sub-total(1+2+....10)		21,584	39.2	190,434	62.8	24.3
11. Others export goods		20,903	37.9	48,322	15.9	8.7
12. Special Exports	306	12,617	23.9	64,572	21.3	17.7
13. Total Exports	305-306	55,104	100.0	303,328	100.0	18.6

Table 16: Share of Export from Output by Sector and Commodity.

	180 Sector I/O Code	1975 %	1985 %
1. Agriculture	001-029	6.10	7.81
2. Mining	030-041	11.60	12.79
3. Manufacturing			
- Meat	042	1.40	2.92
- Canned Food	043-046	25.10	82.70
- Rice	049	15.80	45.31
- Tapioca	050	92.10	86.55
- Flour	052	14.30	19.67
- Sugar	055	60.00	31.80
- Other Food	047-048, 051 053-054, 059-060	5.00	14.07
- Animal	061	0.08	29.34
- Beverages	062-064	0.80	1.24
- Tobacco	065-066	6.81	12.65
- Textile	067-074	8.50	21.58
- Paper	081-083	3.69	4.80
- Chemicals	084, 086 087-092	1.26	20.70
- Fertilizer and Pesticides		0.63	3.24
- Petroleum	093-094	4.63	3.76
- Rubber Products	095-097	41.66	32.27
- Plastic Products	098	5.46	9.64
- Cement and Concrete	102-103	13.12	1.19
- Non-metalic Products	099-101, 104	4.40	11.05
- Iron & Steel	105-106	1.54	13.46
- Non-ferrous Metal	107	56.55	56.79
- Fabricated Metal Products	108-111	5.67	15.42
- Machinery	112-115	5.79	23.48
- Leather Products	075-077	7.43	22.19
- Wood Products	078-080	15.88	12.98
4. Average		8.90	12.00

Table 17 : Trade Deficit.

(Million baht, Current Prices)

	180 Sector I/O Code	1975 Amount	1985 Amount	Compound Annual Growth Rate, %
1. Exports (f.o.b.)	305, 306	55,104	303,328	18.6
2. Imports (c.i.f.)	401, 404	79,356	319,712	14.9
3. Trade Deficit (1-2)		-24,252	-16,384	-3.8
4. Gross Domestic Product	209, 402, 403	358,741	1,172, 601	12.6
5. Trade Deficit per GDP (%)		6.76	1.40	

Table 18: Composition of Imports.

	180 Sector I/O Code	1975 %	1985 %
1. Agriculture	001-129	3.2	2.5
2. Crude Oil and Minerals	030-041	15.8	20.5
3. Food	042-046	4.1	4.2
4. Textile	067-074	3.6	2.6
5. Wood Products	078-080	0.2	0.7
6. Paper & Paper Products	081-083	2.1	2.3
7. Chemicals	084-098	17.3	26.6
8. Non-metal Products	099-104	1.2	1.8
9. Metal Products	105-128	44.5	31.0
10. Other goods	075-077, 129-134	2.7	0.7
11. Electricity & Water Supply	135-137	0.0	0.1
12. Transportation & Communication	149-159	0.9	1.1
13. Services	147-148 160-178	3.3	4.2
14. Others	180	1.1	0.7
Total		100.0	100.0

(9) Impact of Final Demand on Supply

The supply of the economy consists of domestic products and imports. The supply of the economy is created mainly because of the requipment of final demand. In 1975 the total domestic production was 621,800 million baht at current prices. In 1975 the major part of the domestic production i.e. 61.6%, was induced by the requirements of private comsumption. In 1985 the inducement of private consumption reached 51.10% of the total domestic production. The second largest impact on the expansion of domestic production is exports. In 1975, exports accounted for 14.40% of the production of domestic products and in 1985 the exports accounted for 24.70% of the production of domestic products. The other significant inducement for generating domestic production is gross fixed capital formation. In 1975, gross fixed capital formation induced 13.90% of the production of domestic products and in 1985 the percentage became 15.20% (see Table 21). In terms of value added of domestic production the inducement of private consumption, exports and gross fixed capital formation on domestic production in 1975 were respectively 63.40%, 13.60% and 11.30% of the total value added. In 1985, inducement of such items was 47.4%, 21.6% and 15.4% respectively (see Table 22). On the imports side, the inducement from private consumption is also strong. It is estimated that in 1985, the imports induced by private consumption was 51.20% of the total imports as compared with that of 44% of 1975. In addition to private consumption, imports in 1975 were induced by a gross fixed capital formation of 23.80% of the total imports and in 1985 that inducement was 18.70% of the total imports. The rest of the inducement on imports is from government consumption, increase in stock and exports. The total of these final demands accounted for 22.20% of the total imports in 1975 and accounted for 30.10% of the total imports in 1985 (see Table 23).

(10) Backward and Forward Inter Industrial Linkages

The backward and forward inter-industrial linkages are estimated by using the formula indicated in the previous work on input-output table of Thailand, The backward linkage is explained by an index which shows the effect of an industry on other industries through its need for raw materials from those industries. On the contrary, the forward linkage index shows the effect of the industry in question on other industries which are buyers of the raw material produced by the said industry. In 1985, the ten economic activities which have had the highest backward linkage indices were industries producing (1) leather products; (2) non-ferrous metal products; (3) other transport equipment; (4) slaughter-house products; (5) animal feed; (6) textile products; (7) other food products; (8) products for processing and preserving foods; (9) other manufacturing products; and (10) livestock (see Table 24). The ten

Table 19 : Composition of Imports by Usage.

	1975 %	1985 %
1. Import of Raw Materials	56.8	74.59
2. Consumer Goods	16.1	14.25
3. Capital Goods	27.1	11.16
Total	100.0	100.00

Table 20 : Self-Sufficiency Ratios[1]

	180 Sector I/O Code	1975 %	1985 %
1. Primary Agricultural Goods			
- Maize	022	386.1	617.60
- Beans	006	153.6	166.12
2. Agro-Industries			
- Rice Milling	049	118.8	182.74
- Tapioca Milling	050	1,278.5	743.41
- Noodles and Similar Products	054	100.5	103.40
- Animal Feed	061	98.5	132.50
- Sugar Refineries	055	252.1	123.50
3. Manufacturing Goods			
- Rubber Products	095-096	156.7	140.12
- Basic Metal	107	127.0	182.57
- Leather Products	075-077	103.0	120 78
- Wood Products	078-080	116.4	106.77
- Textile	067-069	103.7	104.69
- Knitting	071	94.1	110.94
4. Total		96.2	99.36

Note : [1] Self-sufficiency ratio is defined as gross output multiplied 100 and divided by gross output plus import and minus export.

Table 21 : Domestic Products Induced by Each Final Demand.

(Million baht, Current prices)

	180 Sector I/O Code	1975		1985	
		Amount	%	Amount	%
1. Private Consumption	301	382,775	61.60	1,295,070	51.10
2. Government Consumption	302	45,088	7.30	136,857	5.40
3. Gross Fixed Capital Formation	303	86,412	13.90	385,226	15.20
4. Increase in Stock	304	17,173	2.80	91,238	3.60
5. Exports	305	90,352	14.40	625,999	24.70
6. Total	309	621,800	100.00	2,534,384	100.00

Table 22 : Total Value Added Induced by each Final Demand.

(Million baht, Current Prices)

	180 Sector I/O Code	1975		1985	
		Amount	%	Amount	%
1. Private Consumption	301	220,794	63.40	538,494	47.40
2. Government Consumption	302	31,200	9.00	148,956	13.10
3. Gross Fixed Capital Formation	303	39,273	11.30	174,719	15.40
4. Increase in Stock	304	9,460	2.70	28,405	2.50
5. Exports	305	47,729	13.60	245,285	21.60
6. Total	309	348,456	100.00	1,135,859	100.00

Table 23 : Import Induced by Each Final Demand.

(Million Baht, Current Prices)

	180 Sector I/O Code	1975		1985	
		Amount	%	Amount	%
1. Private Consumption	301	34,906	44.0	163,693	51.20
2. Government Consumption	302	4,165	5.20	13,748	4.30
3. Gross Fixed Capital Formation	303	26,848	23.80	59,786	18.70
4. Increase in Stock	304	6,061	7.60	21,421	6.70
5. Exports	305	7,376	9.40	61,064	19.10
6. Total	309	79,356	100.00	319,712	100.00

Table 24: Backward Linkage Indices.

	180 Sector I/O Code	1975	1985
1. Leather Products	075-077	1.3276	1.3470
2. Non-ferrous Metal Products	107	1.1965	1.3420
3. Other Transport Equipment	123, 124, 128	0.9734	1.3099
4. Slaughter-House Products	024	1.6593	1.3084
5. Animal Feed	061	1.3431	1.2967
6. Textile Products	070-074	1.2330	1.2507
7. Other Food Products	053, 054, 056-060	1.1479	1.2434
8. Products from Processing and Preservation of Food	043-048	1.1278	1.2381
9. Other Manufacturing Products	129-134	1.0033	1.2232
10. Livestock	018-023	1.2477	1.2169

Table 25: Forward Linkage Indices.

	180 Sector I/C Code	1975	1985
1. Trade	145-146	3.3467	5.4016
2. Petroleum Refineries	093-094	2.3015	2.5158
3. Transportation	149-158	1.6367	1.6991
4. Spinning, Weaving and Bleaching	067-069	1.7323	1.5592
5. Construction	138-139	0.9139	1.5696
6. Electricity Gas	135-136	1.3142	1.5480
7. Paddy	001	1.6977	1.4337
8. Other Crops	003, 005 010-015, 017, 024	1.2195	1.4113
9. Rice and Other Grain Milling	049-052	1.4712	1.2909
10. Motor Vehicles and Repairing	125-127	1.0651	1.2605

Table 26 : Grouping of Backward and Forward Linkages.

	1975 (58 Sector) I/O Code	1985 (58 Sector) I/O Code	Sector
Group 1	01	01	Paddy
	06	Group 2	Sugarcane
	08	08	Other crops
	10	Group 2	Forestry
	Group 2	12	Crude Oil and Coal
	13	Group 2	Metal Ore
	Group 2	14	Non-metal Ore
	Group 3	17	Rice and Other Grain Milling
	30	30	Petroleum Refineries
	38	Group 3	Industrial Machinery
	40	49	Trade
	53	Group 2	Banking, Insurance
Group 2	02	02	Maize
	03	03	Cassava
	04	04	Beans and Nuts
	05	05	Vegetable and Fruits
	Group 1	06	Sugarcane
	07	07	Rubber (Latex)
	Group 1	10	Forestry
	11	11	Fishery
	12	Group 1	Crude Oil and Coal
	Group 1	13	Metal Ore
	14	Group 1	Non-metal Ore
	Group 4	18	Sugar Refineries
	21	21	Beverages
	22	22	Tobacco Processing & Products
	26	Group 4	Printing and Publishing
	32	Group 4	Plastic Ware
	Group 4	39	Electrical Machinery and Apparatus
	Group 3	40	Motor Vehicles and Repairs
	Group 4	43	Saw Mills and Wood Products
	Group 3	50	Restaurants and Hotels
	52	52	Communication

Table 26 (Con't)

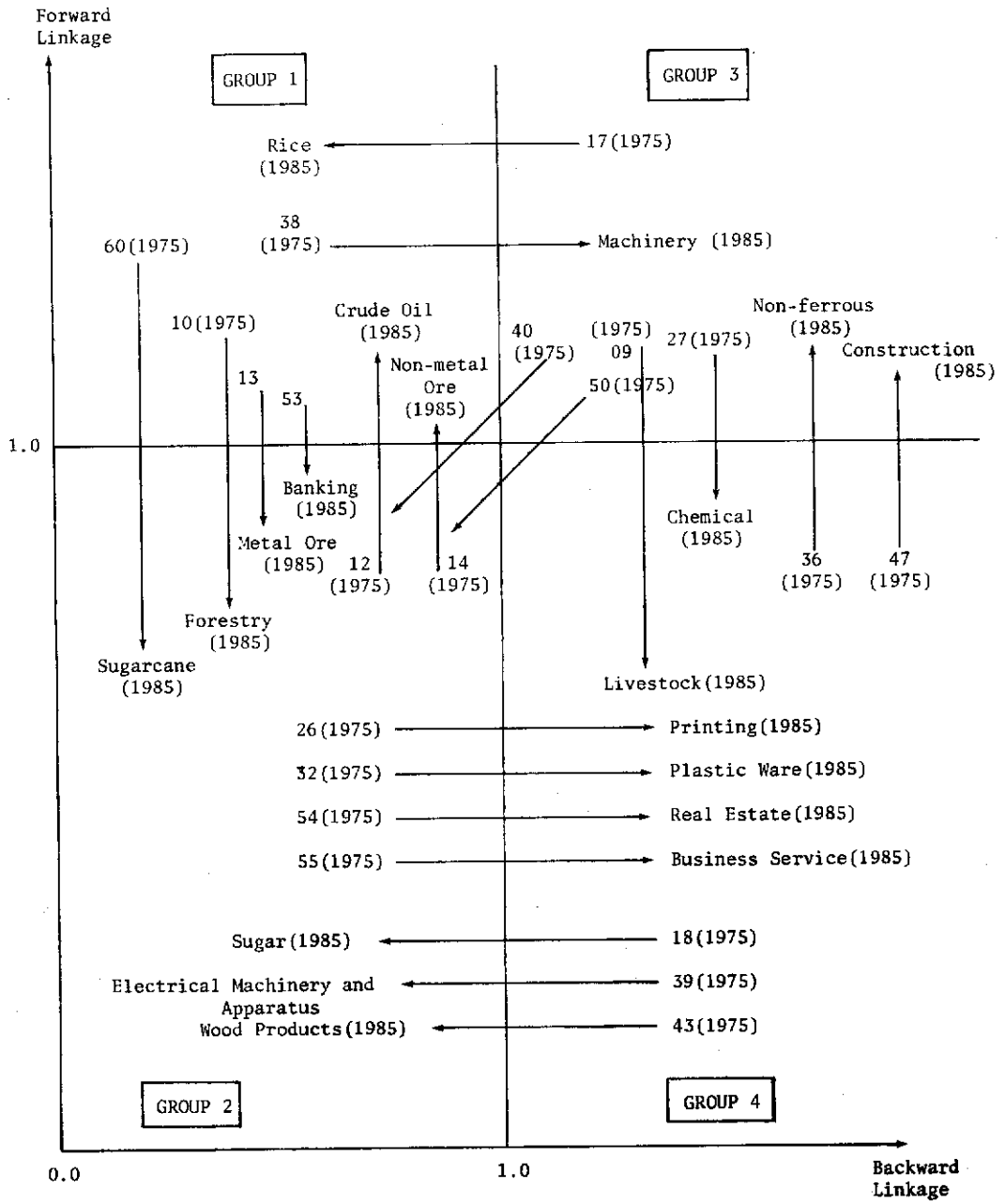
	1975 (58 Sector) I/O Code	1985 (58 Sector) I/O Code	Sector
	Group 1	53	Banking, Insurance
	54	Group 4	Real Estate
	55	Group 4	Business Services
	56	56	Public Services
	57	57	Others Services
Group 3	09	Group 4	Livestock
	17	Group 1	Rice and Other Grain Milling
	23	23	Spinning, Weaving and Bleaching
	25	25	Paper and Paper Products
	27	Group 4	Basic Chemical Products
	35	35	Iron and Stell
	Group 4	36	Non-ferrous Metal Products
	Group 1	38	Industrial Machinery
	40	Group 2	Motor Vehicles and Repair
	45	45	Electricity
	Group 4	47	Building Construction
	50	Group 2	Restaurants and Hotels
	51	51	Transportation
Group 4	Group 3	09	Livestock
	15	15	Slaughtering
	16	16	Processing and Preserving of Foods
	18	Group 2	Sugar Refineries
	19	19	Other Foods
	20	20	Animal Feed
	24	24	Textile Products
	Group 2	26	Printing and Publishing
	Group 2	27	Basic Chemical Products
	28	28	Fertilizer, Pesticides
	29	29	Other Chemical Products
	31	31	Rubber Products
	Group 2	32	Plastic Ware
	33	33	Cement and Concrete Products
	34	34	Other Non-metallic Products

Table 26 (Con't)

1975 (58 Sector) I/O Code	1985 (58 Sector) I/O Code	Sector
36	Group 3	Non-ferrous Metal
37	37	Fabricated Metal Products
39	Groups	Electrical Machinery and Apparatus
Group 2	41	Other Transportation Equipment
42	42	Leather Products
43	Group 2	Saw Mills and Wood Products
44	44	Other Manufacturing Products
46	46	Water Works and Supply
47	Group 3	Building Construction
48	48	Public Works and Other Construction
Group 2	54	Real Estate
58	58	Unclassified

economic activities which will give the highest forward linkages are; (1) trade; (2) petroleum refineries; (3) transportation; (4) construction; (5) spinning-weaving and bleaching; (6) electricity and gas; (7) paddy; (8) other crops; (9) rice and other grain milling; and (10) motor vehicles and repairing (see Table 25). The economic activities of the country can be arranged into four groups in accordance with the value of backward and forward linkage indices. In group 1, the activities which have a forward linkage index of above 1.0 are included. The activities in group 2 are those which have both a forward linkage index and a backward linkage index of less than 1.0. The activities in group 3 are those which have both a forward linkage index and a backward linkage index of more than 1.0. In group 3, the activities in the group have a forward linkage index of less than 10 and a backward linkage index of more than 1.0. The leading industries of the country may be defined as those which provide group-3 activities. In 1985, it was estimated that the following eight activities were leading industries: (1) spinning-weaving and bleaching; (3) production of paper and paper products; (3) production of iron and steel; (4) production of non-ferrous metal products; (5) production of industrial machinery; (6) electricity: (7) building construction; and (9) transportation. The industries which have both low backward and forward linkages are lagging industries and are group 2

Figure 1 : Shifts of Backward and Forward Linkages of Industries, 1975-1985.



type industries. In 1985 the lagging industries were production of maize, cassava, beans and nuts, vegetable of fruits, rubber, forestry products, fishery products, metal ore, sugar, beverages, tobacco, electrical machinery and apparatus, motor vehicles and repairs saw mills and wood products, restaurant and hotel services, communication services, banking and insurance services, public sevices, and other services as defined by I/O sector code 57. For details see Table 26. In Figure 2, the shifts of backward and forward linkages of industries from 1975 to 1985 are illustrated.

(11) Main Inputs Requirement per One Unit of Production

For the Thai economy, there are three important input contents in the production processes, i.e. labor, energy and import. The input content is expressed in terms of input requirement for producing one baht of the output in question. The requirement is divided into direct and indirect requirements. The direct requirement is the amount of the input required to produce the output directly. The indirect requirement is the amount of the input required to produce outputs which are the inputs of the output in question. In 1985, the activities which required high labor input were public administration, education, sanitary and similar services, research and scientific services, and rubber production (see Table 27). The energy requirement is examplified here by the requirement for petroleum. The activities which will require high energy input in 1985 were electricity generation, transport services, production of cement and secondary steel products, and ocean and coastal fishing (see Table 28). The highest import-content in 1985 were iron and steel products, electrical and industrial machinery, secondary steel products, products from spinning, and dairy products. The production which will require high imported inputs are listed in Table 29.

(12) Net Foreign Exchange Earnings

Net foreign exchange earnings shows the amount of foreign exchange obtained by exporting a product after the deduction of the amount of foreign exchange used for purchasing the imported inputs for the production of that product. In 1975, the net foreign exchange earnings of the total gross output of Thailand was 68.1 % of the total exports. It was estimated that in 1985, this percentage was reduced to 80.9 % due to the increases in prices of imports of raw materials and capital goods. Products with high net foreign exchange earnings, i.e. more than 93 % of the exported value, in 1985 were charcoal and firewood, coconut, other forestry products, silk worm, kenaf and jute, other cereals, salt, cattle and buffaloes, coconut and palm oil, beans and nuts, products from rice milling, and products from sugar refineries (see Table 30). As for products with low net foreign exchange earnings i.e. lower than 66 % of the exported value were basic industrial chemicals, plastic products, electricity, special industrial machinery fertilizer and pesticides, electrical industrial machinery, secondary steel products, and products from petroleum refineries (see Table 31).

(13) Indirect Taxes

Indirect taxes consist of domestic indirect taxes and import taxes. In 1975 the domestic indirect taxes and import taxes were respectively 22.132 and 10.285 million baht. In 1985, the domestic indirect taxes reached the level of 82.024 million baht while import taxes were 34,021 million baht. Hence, for the period from 1975 to 1985, the compound growth rates of domestic indirect taxes and import taxes were respectively 14.0% and 12.7% per year. In terms of total indirect taxes, the 1975 level was 32.417 million baht and the 1985 level was 116.045 million baht. The compound growth rate of total indirect taxes, therefore, is 13.6%. The total indirect tax rate defined in terms of ratio of total indirect taxes to total gross output was 5.21 in 1975 and was 4.58 in 1985 (see Table 32).

Table 27: Labor Requirement Per One Unit of Selected Production.

(Baht)

	180 Sector I/O Code	Direct	Indirect	Total
1. Rubber	016	0.42	0.01	0.43
2. Matches	091	0.12	0.13	0.25
3. Rubber Sheets and Block Rubber	095	0.03	0.35	0.38
4. Non-residential Building	139	0.19	0.11	0.30
5. Retail Trade	146	0.27	0.04	0.31
6. Hotels and Lodging	148	0.09	0.23	0.32
7. Postal and Telecommunication	159	0.32	0.07	0.39
8. Life Insurance Service	161	0.02	0.11	0.31
9. Non-life Insurance Service	162	0.23	0.09	0.32
10. Public Administration	165	0.86	0.00	0.86
11. Sanitary and Similar Services	166	0.72	0.03	0.75
12. Education	167	0.79	0.04	0.83
13. Research and Scientific Services	168	0.58	0.07	0.65

Table 28: Petroleum Requirement per One Unit of Selected Production.

(Baht)

	180 Sector I/O Code	Direct	Indirect	Total
1. Electricity	135	0.42	0.02	0.44
2. Ocean and Coastal Water Transport	153	0.33	0.11	0.44
3. Road Freight Transport	151	0.34	0.02	0.36
4. Road Passenger Transport	150	0.34	0.01	0.45
5. Water Transport Service	155	0.30	0.01	0.31
6. Air Transport	156	0.29	0.02	0.31
7. Cement	102	0.26	0.03	0.29
8. Secondary Steel Product	106	0.23	0.04	0.27
9. Inland Water Transport	154	0.24	0.01	0.25
10. Ocean and Coastal Fishing	028	0.19	0.01	0.20

Table 29: Import Requirement per One Unit of Selected Production.

(Baht)

	180 Sector I/O Code	Direcior	Indirect	Total
1. Dairy Product	044	0.26	0.18	0.44
2. Flour and Other Grain Milling	052	0.28	00.7	0.35
3. Spinning	067	0.44	0.12	0.56
4. Weaving	068	0.25	0.08	0.33
5. Textile Bleaching	069	0.17	0.17	0.37
6. Pulp, Paper and Paper Products	081	0.29	0.14	0.43
7. Fertilizer and Pesticide	085	0.31	0.11	0.42
8. Paints, Varnishes and Lacquers	087	0.42	0.08	0.05
9. Iron and Steel Products	105	0.05	0.14	0.64
10. Secondary Steel Products	106	0.21	0.25	0.56
11. Electrical and Industrial Machinery	117	0.48	0.09	0.57
12. Radio and Television	118	0.29	0.12	0.14
13. Electricity	135	0.12	0.26	0.38

Table 30 : Products with High Net Foreign Exchange Earnings.

	180 Sector I/O Code	1975 %	1985 %
1. Other Cereals	003	97.73	96.05
2. Beans and Nuts	006	97.43	94.18
3. Coconut	010	97.00	97.16
4. Kenaf and Jute	012	97.81	96.27
5. Cattle and Buffaloes	018	98.45	95.89
6. Silk Worm	023	97.98	96.81
7. Charcoal and Firewood	029	99.04	97.90
8. Other Forestry Products	027	98.41	96.93
9. Salt	038	0.00	95.74
10. Coconut and Plam Oil	047	95.70	95.71
11. Products from Rice Milling	049	95.73	93.85
12. Products from Sugar Refineries	055	94.62	93.30

Table 31 : Products with Low net Foreign Exchange Earnings.

	180 Sector I/O Code	1975 %	1985 %
1. Products from Petroleum Refineries	093	29.3	32.4
2. Secondary Steel Products	106	59.6	42.9
3. Fertilizer and Pesticides	085	60.3	57.3
4. Electricity	135	67.0	61.5
5. Special Industrial Machinery	115	56.9	60.2
6. Plastic Products	098	67.2	61.7
7. Electrical Industrial Machinery	117	62.4	42.9
8. Basic Industrial Chemicals	084	69.8	65.8

Table 32: Indirect Taxes.

(Million Baht, Current Prices)

	180 Sector I/O Code	1975 Amount	1975 %	1985 Amount	1985 %	Compound Annual Growth Rate, +
1. Domestic Indirect Taxes	204	22,132	68.3	82,024	70.68	14.0
2. Import Taxes		10,285	31.	34,021	29.32	12.7
2.1 Import Duty	304	7,734	23.9	26,037	22.44	12.9
2.2 Import Sale Tax	402	2,551	7.8	7,984	6.88	12.1
3. Total Indirect Taxes (1+2)		32,417	100.0	116,045	100.00	13.6
4. Inport (c.i.f.)	401	79,356	-	319,712	-	14.9
5. Import Tax Rate (2/4)		12.96	-	10.64	-	-
6. Gross Output	210	621,800	-	2,534,385	-	15.1
7. Total Indirect Tax		5.21	-	4.58	-	-

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APPENDIX A

STRUCTURE OF THE THAILAND MACROECONOMETRIC MODEL

I. PRODUCTION, EMPLOYMENT, PRICES AND IMPORT

I-1 Production

I-1.1 Production in Agriculture

1. Total Planted Area

planted area = f (holding area of paddy land, average rainfall during planting season, expected net real producer price of farm product after adjustment for indirect taxes and domestic price level)

or

$$UPAAG = f\left(ERHAGX, ER1X, \frac{PTXAG-1}{PD-1}\right)$$

$$LN.\ UPAAG = -7.504272 + 1.663650\ LN\ ERHAGX + 0.092973\ LN.\ ERAX + 0.127309\ LN.\ \frac{PTXAG-1}{PD-1}$$
$$(-11.41721)\quad (29.18198)\quad (2.794820)$$

$\bar{R}^2$ = .977637 SE. = 0.032667

DW = 2.0338 N 23 (1961-1983)

PTXAG = net producer price for agricultural product excluding indirect taxes

PD = domestic price

2. Total Harvested Area

harvested area = f (planted area, average rainfall between the time of planting and harvesting)

UHAAG = f (UPAAG, ER2X)

LN. UHAAG = − 2.065247 + 0.951106 LN. UPAAG + 0.363225 LN. ERBX
(− 3.187699) (32.27061) (4.608538)

$\bar{R}^2$ = .980393 SE = 0.030883

DW = 2.3427 N = 24 (1960-1983)

3. Agricultural Production

real agricultural output = f (time, total harvested area, labor in agriculture, lagged fixed capital stock in agriculture, total planted area)

LN. GDPAGR = 0.021580 TIMEX + 0.762131 LN. UHAAG
(6.021829) (6.361592)
+ 0.234110 LN. (NEMAG . KFXTOAGR$_1$/UPAAG)
(1.710140)

$\bar{R}^2$ = .962764 SE = 0.058300
DW = 0.5636 N = 23 (1961-1983)

I-1.2 Production in Non-Agriculture

4. Non-Agricultural Production Function

real non-agricultural output = f (labour in non-agricultural sector, fixed capital stock in non-agricultural sector)

△ LN. (GDPNAR/NEMNA) = 0.941860 △ LN. (GDPNAR-1/NEMNA-1)

△ LN. (GDPNAR/NEMNA) = 0.941860 △ LN. (KFXTONAR-1/NEMNA)
(22.10250)
-0.014199 LN. (GDPNAR-1/NEMNA-1)
(-2.597967)
-0.061766 LN. (GDPNAR-1/KFXTONAR-1)

$\bar{R}$ = .962301 SE. = 0.018525
DW = 1.5201 N = 22 (1962-1983)

5. Gross Domestic Output

real total output = real agricultural output + real non-agricultural output

or

GDPR = GDPAGR - GDPNAR

6. Nominal Value of output in Ariculture

nominal agricultural output = real agricultural output · GDP deflator for agricultural product

GDPAG = GDPAGR · PGDAG

7. Nominal Value of Output in Non-Agriculture

nominal non-agricultural output = real non-agricultural output GDP deflator for non-agricultural product

or

GDPNA = GDPNAR · PGDNA

8. Nominal Value of Totat Output

nominal total output = nominal agricultural output + nominal non-agricultural output

or

GDP = GDPAG + GDPNA

1-2 Wage Rate Determination and Demand for Labour

9. Wage Rate Determination in Non-agricultural Sector gross

nominal non-agricultural wage rate = f (lagged real non-agricultural output, lagged employment in non-agriculture, lagged domestic price level)

LN. WGRNA = 0.927707 LN. ($GDPNAR_{-1}/NEMNA_{-1}$) + 0.943109 LN. (PD-1)
(116.1509) (13.42776)

$\bar{R}^2$ = .955280 SE = 0.112783
DW = 2.2059 N = 23 (1961-1983)

10. Demand for Labor in Non-agricultural Sector

employment in non-agricultural sector = f (time, (fixed capital stock in non-agricultural sector)$_{-1}$, real wage, lagged employment in non-agricultural sector)

or

$$NEMNA = f\left(TIMEX, KFXTONAR_{-1}, \frac{WGRNAX}{PTXNAX}\right)$$

LN. NEMNA = 0.040611 TIMEX + 0.584728 LN. $KFXTONAR_{-1}$
(7.895560) (7.880492)
- 0.982266 LN. (WGRNA/PTXNAX)
(-7.474840)
+ 0.377201 LN. NEMNA-1
(3.688645)

$\bar{R}^2$ = .977875 SE = .112783
DW = 0.7921 N = 23 (1961-1983)

where

PTXNA = net producers' price of non-agricultural product excluding indirect taxes

11. Available Supply of Labor in Agricultural Sector

labor in agricultural sector = labor force-employment in nonagricultural sector

or

NEMAG = NLFX-NEMNA

I-3 Price Relationships

12. Net Producer Price for Agricultural Products Excluding Indirect Taxes

net producer price for agricultural product = GDP deflator for agricultural product-business tax rate in agricultural sector-export tax

or

PTXAG = PGDAG-ZTBAGX-(TXAG*/GDPAGR)

where TXAG* = export tax revenue

Z = appearing as the first character of the variable indicates that the variable concerned is used as policy instrument.

13. Net Producer Price for Non-Agricultural Products Excluding Indirect Taxes

net producer price for non-agricultural product = GDP deflator for non-agricultural product business tax rate in agricultural sector export tax

or

PTXNA = PGDNA-ZTBNAX-TMNA/GDPNAR

14. Determination of Agricultural Price Deflator

GDP deflator for agricultural product = f (export price for agricultural product, domestic price level)

or

PGDAG = f (PXGAG, PD)

LN. PGDAG = - 0.086193 + 1.027612 LN. PXGAGX
(- 4.823296) (43.32212)
+ 0.699369 LN. (PD/PXGAGX)
(8.452475)

$\bar{R}^2$ = .989232 SE = 0.043785

DW = 1.3137 N = 24 (1960-1983)

15. Determination of Export Price for Agricultural Products in Local Currency

export price for agricultural product = export price for agricultural product in US $ · $\frac{\text{exchange rate in local currency per US \$}}{\text{exchange rate in local currency per US \$ in 1972}}$

or

$$PXGAG = PXGAG\$ \cdot \frac{ZXR\$}{20.913}$$

where exchange rate is 20.913 baht/US $ in 1972 and $ appearing as the last character of the variable indicates that the variable is measured in terms of $, a foreign currency, not a domestic currency unit.

16. Determination of Export Price for Non-Agricultural Products in Local Currency

export price for non-agricultural product = f (GDP deflator for non-agricultural product, price of imported raw material and fuel including import tax)

or

PXGNA = f (PGDNA, PMTRM)

PXGNA = − 0.435733 + 0.604807 PGDNA + 0.874681 PMTRM/PGDNA
(01.120121) (2.737416) (2.842181)

$\bar{R}^2$ = 0.686344 SE = 0.389566

DW = 1.0591 N = 24 (1960-1983)

17. Determination of Export Price for Nonfactor Services in Local Currency

export price for nonfactor services = f (domestic price level, export price for agricultural product)

PXS = f (PD, PXGAG)

PXS = − 1.059684 + 1.213850 PD + 0.880118 PXGAG/PD
(− 13.23397) (73.51199) (12.93258)

$\bar{R}^2$ = .996294 SE = 0.043385

DW = 1.8388 N = 24 (1960-1983)

18. Export Price of Non-Agricultural Product in U.S. dollars

export price of non-agricultural product in $

$$= \text{export price of non-agricultural product} / \frac{\text{current exchange rate}}{\text{exchange rate in 1972}}$$

or

$$PXGNA\$ = PXGNA / \frac{ZXR\$X}{20.913}$$

19. Export Price for Services in U.S. dollars

export price for services in $

$$= \text{export price for services} / \frac{\text{current exchange rate}}{\text{exchange rate in 1972}}$$

or

$$PXS\ \$ = PXS / \frac{ZXR\$X}{20.913}$$

20. Average Export Price Index for Goods and Services in Local Currency

average price of exports of goods and services

$$= \frac{\text{nominal value of exports of goods and services}}{\text{real value of exports of goods and services}}$$

or

PX = XGS/XGSR

21. Average Export Price Index for Goods and Services in US dollars

average price of exports of goods and services in $

$$= \text{average price of exports of goods and services} / \frac{\text{current exchange rate}}{\text{exchange rate in 1972}}$$

or

$$PX\$ = PX/\frac{ZXR\$X}{20.913}$$

22. Price of Imported Raw Materials and Fuels in Local Currency

import price of raw materials and fuels = import price of raw materials and fuels in \$. $\frac{\text{current exchange rate}}{\text{exchange rate in 1972}}$

or

PMRM = PMRM\$X, (ZXRSX/20.913)

23. Price of Imported Raw Materials and Fuels Including Import Taxes

import price of raw materials and fuels including import taxes = import price of raw materials and fuels (1 + import tariff rate for raw materials and fuels)

or

PMTRM = PMRM (1 + ZTRMRMX)

24. Price of Imported Capital Coods in Local Currency

import price of capital goods = import price of capital goods in \$. $\frac{\text{current exchange rate}}{\text{exchange rate in 1972}}$

or

PMK = PMK\$X . (ZXR\$X/20.913)

25. Price of Imported Capital Goods Including Import Taxes

import price of capital goods including import taxes = import price of capital goods (1 + import tariff rate for capital goods)

or

PMTK = PMK (1 + ZTRMKX)

26. Price of Imported Consumer Goods in Local Currency

import price of consumer goods = import price of consumer goods in \$. $\frac{\text{current exchange rate}}{\text{exchange rate in 1972}}$

or

PMC = PMC\$X . (ZXR\$X/20.913)

27. Price of Imported Consumer Goods Including Import Taxes

import price of consumer goods including import taxes = import price of consumer goods (1 + import tariff rate for consumer goods)

or

PMTC = PMC (1 + ZTRMCX)

28. Price of Imported Nonfactor Services in Local Currency (No Taxes)

import price of services = import price of services in $. $\frac{\text{current exchange rate}}{\text{exchange rate in 1972}}$

or

PMS = PMS$. (ZXR$X/20.913)

29. Average Import Price Index of Goods and Services in Local Currency

average price of imported goods and services = $\frac{\text{nominal import of goods and services}}{\text{real import of goods and services}}$

or

PM = MGS/MGSR

30. Average Import Price Index of Goods and Services in US. dollar

average price of imported goods and services in $ = average price of imported goods and services/$\frac{\text{current exchange rate}}{\text{exchange rate in 1972}}$

or

PM$ = $\frac{PM}{ZXR\$X/20.913}$

I-4 Import Demand

31. Import Demand for Raw Materials and Fuels

real import of raw material and fuels = f (real non-agricultural output price of imported raw materials and fuels including import tax, net producer price of non-agricultural product excluding indirect taxes)

or MRMR = f (GDPNAR, PMTRM, PTXNA)

MRMR = 837.6134 + 0.117296 GDPNAR-2078.261 PMTRM/PTXNA
(0.788116) (25.68005) (-3.226818)

$\bar{R}^2$ = .973356 SE = 1096.05

DW = 1.4018 N = 24 (1960-1983)

32. Import Demand for Capital Goods

real import of capital goods = f (real total fixed investment, price of imported capital goods including import taxes, domestic price level)

or MKR = f (IFXTOR, PMK, PD)

LN. MKR = -0.759577 + 0.972940 LN. IFXTOR

(- 2.724555) (36.14693)
- 1.056986 LN. (PMK (1 + 2TRMKX)/PD)
(-11.36331)

$\bar{R}^2$ = .984293 SE = 0.068474
DW = 1.0661 N = 24 (1960-1983)

33. Import Demand for Consumer Goods

real imports of consumer goods = f (real private consumption, price of imported consumer goods including import taxes, domestic price level)

or

MCR = f (CONHHR, PMC, PD)
LN. MCR = 0.430773 LN. CONHHR-0.495365 LN. (PMC (1+ZTRMCX)/PD)
(3.991320) (04.158366)
+ 0.464873 LN. MCR-1
(3.348408)

$\bar{R}^2$ = 0.929488 SE = 0.117631
DW = 1.2448 N = 23 (1961-1983)

34. Import Demand for Services

real imports of services = f (real private consumption, price of imported services, domestic price level)

or

MSR = f (CONHHR, PMS, PD)
MSR = 2543.503 + 0.33957 CONHHR - 3316.285 PMS/PD
(5.121570) (18.73776) (-6.155524)

$\bar{R}^2$ = .951188 SE = 273.807
DW = 1.4626 N = 24 (1960-1983)

35. Total Demand for Imports of Goods and Services

real imports of goods and services = real imports of raw materials and fuels + real imports of capital goods + real imports of consumer goods + real imports of services

or MGSR = MRMR + MKR + MCR + MSR

36. Nominal Value of Imported Goods and Services in Local Currency

nominal imports of goods and services
= import price of raw material and fuels · real imports of raw materials and fuels + import price of capital goods · real imports of capital goods + import price of consumer goods · real imports of consumer goods + import price of services · real imports of services

or MGS = PMRM · MRMR + PMK · MKR + PMC · MCR + PMS · MSR

37. Nominal Value of Imported Goods and Services in US Dollars

nominal imports of goods and services in $ = nominal import of goods and services /current exchange rate

or MGS$ = MGS/ZXR$X

II. DOMESTIC EXPENDITURE AND EXPORT

II-1 Real Consumption Expenditure

38. Real Private Consumption Expenditure

real private consumption = f (real disposable income)

or CONHHR = f (YDSHHR, CONHHR)

CONHHR = 3672.907 + 0.822360 YDSHHR
(2.038461) (64.89808)

$\bar{R}^2$ = .995273 SE = 2904.96
DW = 1.3892 N = 24 (1960-1983)

39. Real Government Consumption Expenditure

real government consumption = f (government net tax revenue)

or CONGVR = f (TAX)

CONGVR = 8765.783 + 0.301718 TAX
(9943036) (14.44469)

$\bar{R}^2$ = .912154 SE = 2608.74
DW = 0.3559 N = 24 (1960-1983)

II-2 Real Investment Expenditures

40. Fixed Capital Stock Accumulation, Private Sector

fixed capital stock in private sector agriculture
= f ((fixed capital stock in private sector agriculture)$_{-1}$,
real agricultural output, expected real net producer price for agricultural product excluding indirect tax)

or $KFXBPAGR = f\left((KFXBPAGR)_{-1}, GDPAGR, \frac{PTXAG_{-1}}{PD_{-1}}\right)$

KFXBPAGR = - 4186.155 + 0.995022 KFXBPAGR$_{-1}$
(-3.739424) (34.86299)
+ 0.078638 GDPAGR + 2053 PTXAG-1/PD-1
(4.728225) (1.586516)

$\bar{R}^2$ = .998656 SE = 362.478
DW = 1.5040 N = 23 (1960-1983)

41. Real Gross Fixed Investment in Agriculture, Private Sector

real gross fixed investment in agriculture, private

= increase in fixed capital stock in private sector, agriculture + depreciation

or $IFXBPAGR = (KFXBPAGR - KFXBPAGR_{-1}) + DAGX : KFXBPAGR_{-1}$

where DAG* = rate of depreciation of fixed capital stock in agriculture

42. Real Net Fixed Investment in Non-agriculture Private Sector

real gross fixed investment in non-agricultural sector, private business-depreciation

= f (degree of capacity utilization, rate of net profit after corporate income taxes to capital owners relative to average cost of borrowings from local and foreign sources)

or

$IFXBPNAR - 0.035\ KFXBPNAR_{-1} = f(YRDBPNA,\ YKNHHNA,\ YTRBPFOX,\ ZXRDX,\ GDPNAR,\ KFXBPNAR_{-1})$

$IFXBPNAR - 0.035KFXBPNAR_{-1}$

$= -18491.29 + 18.20539\ (100\ (YRDBPNA + YKNHHNA + YTRBPFOX \cdot ZXRDY)/GDPNAR)$

$(-8.088606)\quad (0.2193771)$

$- (0.7\ RLCBX + 0.0\ RLFCX - 0.1\ RFOX)$

$+ 91804.70\ GDPNAR/KFXBPNAR_{-1}$

(9.029105)

$\bar{R}^2 = .953061 \qquad SE = 2015.04$

$DW = 1.5748 \qquad N = 23\ (1961\text{-}1983)$

YRDBPNA = ratained earnings and depreciation allowance, non-agricultural private sector

YKNHHNA = capital income occured to non-agricultural households

YTRBPFO = net transfer from private business to foreign sector

43. Real Fixed Capital Stock of Private Business in Non-Agriculture

real fixed capital stock of private business in non-agriculture

= real fixed capital stock of private business in non-agriculture in previous period - depreciation + real gross fixed investment of private business in non-agriculture

$KFXBPNAR = (1-DNA^*)\ KFXBPNAR_{-1} + IFXBPNAR$

44. Private Business-Build-Up of Stock of Inventories

private business stock of inventory = f (lagged private business stock of inventory, logged real total output)

or

$$KIVBPR = f\ (KIVBPR_{-1},\ GDPR_{-1})$$

$$KIVBPR = -2315.754 + 0.914974\ KIVBPR - 1$$
$$(-\ 1.024650)\quad (8.090195)$$
$$+\ 0.086584\ GDPR - 1$$
$$(1.517946)$$

$\bar{R}^2$ = .991695 SE = 3450.56
DW = 1.1684 N = 23 (1961-1983)

45. Investment in Inventories

inventory investment = increase in stock of inventory

or

$$INVBPR = KIVBPR - KIVBPR_{-1}$$

46. Gross Fixed Investment in Business (Private Sector and State Enterprises)

real gross fixed investment in business
= real gross fixed investment in private sector, agriculture + real gross fixed investment in private sector, non-agriculture + real gross fixed investment in state enterprise, agriculture + real gross fixed investment in state enterprise, non-agriculture

or

$$IFXBUR = IFXBPAGR + \frac{IFXBSAGX}{PD} + \frac{IFXBSNAX}{PD} + \frac{IFXBSAGX}{PD}$$

47. Gross Fixed Investment, Government Sector

government real gross fixed investment = (government nominal gross fixed investment in agriculture + government nominal gross fixed investment in non-agriculture)/ domestic price level

or

$$IFXGVR = (IFXGVAGX + IFXGVNA)/PD$$

48. Total Gross Fixed Investment

total real gross fixed investment = business sector real gross fixed investment + government real gross fixed investment

or

$$IFXTOR = IFXBUR - IFXGVR$$

49. Real Fixed Capital Stock in Agriculture, Government Sector

government real fixed capital stock in agriculture = previous capital stock - depreciation + real gross investment

or

$$KFXGVAGR = (1-DAGX)\ KFXGVNAR_{-1} + IFXGVAGX/PD$$

50. Real Fixed Capital Stock in Non-Agriculture, Government Sector

government real fixed capital stock in non-agriculture

= previous capital stock - depreciation + real gross investment

or

$$KFXGVNAR = (1-DNAX)\ KFXGVNAR_{-1} - IFXGVNAX/PD$$

51. Real Fixed Capital Stock in Agriculture, State Enterprises

state enterprise real fixed capital stock in agriculture

= previous capital stock-depreciation + real gross investment

or

$$KFXBSAGR = (1-DAGX)\ KFXBSAGR_{-1} + ZFXBSAGX/PD$$

52. Real Fixed Capital Stock in Non-Agriculture, State Enterprises

state enterprise real fixed capital stock in non-agriculture

= previous capital stock - depreciation + real gross investment

or

$$KFXBSNAR = (1-DNAX)\ KFXBSNAR_{-1} + IFXBSNAX/PD$$

53. Total Real Fixed Capital Stock in Agriculture

total real fixed capital stock in agriculture

= private sector real fixed capital stock in agriculture + government real fixed capital stock in agriculture + state enterprise real fixed capital stock in agriculture

or

$$KFXTOAGR = KFXBPAGR + KFXGVAGR + KFXBSAGR$$

54. Total Real Fixed Capital Stock in Non-Agriculture

total real fixed capital stock in non-agriculture

= private sector real fixed capital stock in non-agriculture + government real fixed capital stock in non-agriculture + state enterprise real fixed capital stock in non-agriculture

or

$$KFXTONAR = KFXBPNAR + KFXGVNAR + KFXBSNAR$$

55. Total Real Fixed Capital Stock

total real fixed capital stock = total real fixed capital stock in agriculture + total real fixed capital stock in non-agriculture

or

$$KFXTOR = KFXTOAGR + KFXTONAR$$

56. Nominal Value of Private Consumption Enpenditure

nominal private consumption = real private consumption · domestic price level

or

CONHH = CONHHR · PD

57. Nominal Value of Government Consumption Expenditure

nominal government consumption = real government consumption · domestic price level

or

CONGV = CONGVR · PD

58. Nominal Value of Private Business Fixed Investment in Agriculture

nominal private business fixed investment in agriculture = real private business fixed investment in agriculture · domestic price level

or

IFXBPAG = IFXBPAGR · PD

59. Nominal Value of Private Sector Fixed Investment in Non-Agriculture

nominal private sector fixed investment in non-agriculture

= real private sector fixed investment in non-agriculture domestic price level

or

IFXBPNA = IFXBPNAR · PD

60. Nominal Value of Change in Inventories

nominal investment in inventory = real investment in inventory · domestic price level

or

INVBP = INVBPR · PD

61. Nominal Value of Gross Fixed Investment by Private Sector

nominal private sector gross fixed investment = nominal private sector gross fixed investment in agriculture + nominal private sector gross fixed investment in non-agriculture

or

IFXBP = IFXBPAG + IFXBPNA

62. Nominal Value of Gross Fixed Investment by State Enterprises

nominal state enterprise gross fixed investment

= nominal state enterprise gross fixed investment in agriculture + nominal state enterprise gross fixed investment in non-agriculture

or

IFXBS = IFXBSAGX + IFXBSNAX

63. Nominal Value of Gross Fixed Investment by Government

nominal government gross fixed investment = nominal government gross fixed investment in agriculture + nominal government gross fixed investment in non-agriculture

or

IFXGV = IFXBVAGX + IFXGVNAX

64. Nominal Value of Total Gross Fixed Investments

nominal total gross fixed investment = nominal private sector gross fixed investment + nominal state enterprise gross fixed investment + nominal government gross fixed investment

or

IFXTO = IFXBP + IFXBS + IFXGV

II-3. Exports

65. Export Volume of Agricultural Products

real exports of agricultural product = exogenous variable

or

XGAGR = XGAGRX

66. Export Volume of Non-Agricultural Products

real exports of non-agricultural product = exogenous variable

XGNAR = XGNARX

67. Export Volume of Non-factor Services

real exports of non-factor services = exogenous variable

XSR = XSRY

68. Export Volume of Goods and Services

real exports of goods and services = real export of agricultural products + real exports of non-agricultural products + real exports of non-factor services

XGSR = XGAGRX + XGNARX + XSRX

69. Nominal Export Value of Goods and Services in Local Currency

nominal exports of goods and services = export price of agricultural product. real exports of agricultural product + export price of non-agricultural product. real exports of non-agricultural product + export price of non-factor services. real exports of non-factor services

or

XGS = PXGAG · XGARG + PXGNA · XGNAR + PXS · XSR

70. Nominal Export Value of Goods and Services in US Dollars

nominal exports of goods and services in $ = nominal exports of goods and services/current exchange rate

or

XGS $ = XGS/ZXR $

III. DETERMINATION OF DOMESTIC PRICE

71. Real Aggregate Demand and Supply Equality of Final Goods and Services (Equilibrium Condition) to Determine Domestic Price Level

real output + real import of goods and services
= real private consumption + real government consumption + real business sector fixed investment + real government fixed invesment + real investment in inventory + real export of goods and services

or

GDPR + MGSR = CONHHR + CONGVR + IFXBUR + IFXGVR + INVBPR + XGSR

or

GDPR + MGSR - CONHHR - CONGVR - IFXBPAGR - IFXBPNAR - INVBPR + XGSR
= (IFXBSAGX + IFXBSNAX + IFXGVAGX + IFXGVNAX)/PD

or

PD = (CONGV + IFXGV + IFXBS)/(GDPR + MGSR - CONHHR - IFXBPAGR - IFXBPNAR - INVBPR - XGSR)

72. Nominal Value of Aggregate Demand and Supply Identity to Determine Non-Agricultural Price Deflator

nominal output + nominal imports of goods and services
= nominal private consumption + nominal government consumption + nominal private fixed investment + nominal state enterprise fixed investment + nominal government fixed investment + nominal investment in inventory + nominal exports of goods and services

or

GDP + MGS = GONHH + CONGV + IFXBP + IFXBS + IFXGV + INVBP + XGS

or

GDPNA = CONHH + CONGV + IFXBP + IFXBS + IFXGV + INVBP + XGS - MGS - GDPAG

or

$$PGDNA = \frac{1}{GDPNAR}(CONHH + CONGV + IFXBP + IFXBS + IFXGV + INVBP + XGS - MGS - GDPAG)$$

IV. INCOME DISTRIBUTION

73. Gross Labor Income in Non-Agriculture

gross labor income in non-agricultural sector

= employment in non-agricultural sector · gross wage rate in non-agricultural sector

or

YLBNA = NEMNA · WGRNA

74. Capital Income Accured to Non-agricultural Households

gross capital income in non-agricultural sector

= f ((fixed capital stock of private sector, non-agriculture)$_{-1}$)

or

YKNHHNA = f (KFXBPNAR$_{-1}$)

YKNHHNA = -34234.62 + 0.127702 KFXBPNAR-1
(-14.09449) (19.12263)

$\bar{R}^2$ = .945550 SE = 2493.16
DW = 0.5791 N = 23 (1961-1983)

75. Direct Taxes on Households in Non-agriculture

direct tax on household in non-agriculture

= f ((labor income in non-agriculture)$_{-1}$)

or

= f ((YLBNA)$_{-1}$)

TDRHH = -371.3861 + 0.028749 YLBNA-1
(-5.303486) (56.05890)

$\bar{R}^2$ = .993674 SE = 204.718
DW = 0.8422 N = 23 (1961-1983)

76. Import Taxes on Raw Materials and Fuels

import tax on raw materials and fuels

= import tariff rate for raw material and fuel. (import price of raw materials and fuel · imports of raw materials and fuels)

or

TMRM = ZTRMRMX · PMRM · MRMR

77. Import Taxes on Capital Goods

import tax on capital goods = import tariff rate for capital goods · (import price for capital goods · imports of capital goods)

or

TMK = ZTRMKX · PMK · MKR

78. Import Taxes on Consumer Goods

import tax on consumer goods = import tariff rate for consumer goods · (import price for consumer goods · imports of consumer goods)

or

TMC = ZTRMCX · PMC · MCR

79. Total Import Taxes (on Non-agricultural Sector)

total import taxes = import tax on raw material and fuel + import tax on capital goods + import tax on consumer goods

or

TMNA = TMRM + TMK + TMC

80. Other Indirect Taxes on Non-Agricultural Output

other indirect tax on non-agricultural output = business tax rate in non-agricultural sector · real non-agricultural output

or

TOINA = ZTBNAX · GDPNAR

81. Other Indirect Taxes (Excluding Export Taxes on Agricultural Output)

other indirect tax on agriculture output = business tax rate in agricultural sector · real agricultural output

or

TOIAG = ZTBAGX · GDPAGR

82. Disposable Household Income in Non-Agricultural Sector

disposable non-agricultural household income = non-agricultural labor income + non-agricultural capital income − non-agricultural direct tax − net transfer to foreign sector − net transfer to government

or

YDSHHNA = YLBNA + YKNHHNA − TDRHH − YTRHHFO − YTRHHGVX

83. Net Transfers from Households to Foreign Sector in Local Currency

net transfer to foreign sector = net transfer to foreign sector in $ · exchange rate

or

YTRHHFO = YTRHHFOX · ZXR$X

84. Disposable Household Income in Agricultural Sector

disposable agricultural household income = nominal agricultural output − export tax on agricultural product−other indirect tax on agricultural product

or

YDSHHAG = GDPAG − TXAGX − TOIAG

85. Nominal Disposable Income of All Households

nominal disposable income = disposable agricultural household income + disposable non-agricultural household income

or

YDSHH = YDSHHAG + YDSHHNA

86. Real Disposable Income of All Households

real disposable income = nominal disposable income /domestic price level

or

YDSHHR = YDSHH/PD

87. Gross Profits Accrued to Non-Agricultural Private Sector

private business non-agricultural gross profit = non-agricultural output
- import tax on non-agricultural product
- other indirect tax on non-agricultural product
- labor income in non-agriculture Sector
- capital income accrued to non-agricultural household
- property income accrued to government
+ interest on public debt
- direct tax on state enterprise
- retained earnings and depreciation, non-agriculture, state enterprise
- net transfer from private business to foreign sector
- net transfer from state enterprise to foreign sector

or

YGPBPNA = GDPNA - TMNA - TOINA - YLBNA - YKNHHNA - TPTGVNAX - YIPGVNAX - TDRBSNAX - YRDBSNAX - YTRBPFO - YTRBSFO

88. Net Transfer from Non-Agricultural Private Business to Foreign Sector in Local Currency

net transfer from non-agricultural private business to foreign sector
= net transfer from non-agricultural private business to foreign sector . exchange rate

or

YTRBPFO = YTRBPFO$X · ZXR$X

89. Net Transfers from State Enterprise to Foreign Sector in Local Currency

net transfer from state enterprise to foreign sector
= net transfer from state enterprise to foreign sector in $ · exchange rate

or

YTRBSFO = YTRBSFO$X · ZXR$X

90. Corporate Income Taxes on Non-Agriculture Private Business

corporate income tax on non-agricultural private business
= f ((gross profit accruing to non-agricultural private business)$_{-1}$)

or

TCYBPNA = f ((YGPBNA)$_{-1}$)

TCYBPNA = - 619.8234 + 0.188663 YGPBPNA-1
(-3.843685) (30.75213)

$\bar{R}^2$ = .979268 SE = 519.693

DW = 0.9498 N = 23 (1961-1983)

91. Retained Earnings and Depreciation Allowance of Non-Agricultural Private Sector

retained earnings and depreciation of non-agricultural private Sector
= gross profit occured to non-agricultural private Sector - corporate income tax on non-agricultural private Sector

or

YRDBPNA = YGPBPNA - TCYBPNA

92. Households' Nominal Net Savings

households' nominal net saving = household disposable income-private consumption

or

USVHH = YDSHH - CONHH

93. Private business net surplus or deficit
= retained earnings and depreciation, non-agricultural private sector
- nominal private gross fixed investment
- nominal investment in inventory

USVBP = YRDBPNA - IFXBP - INVBP

94. State Enterprises' Nominal Net Surplus (+) or Deficit (-)

state enterprises nominal net surplus = state enterprise retained earning and depreciation - state enterprise fixed investment in agriculture - state enterprise fixed investment in non-agriculture

or

USVBS = YRDBSNAX - IFXBSNAX

95. Business Sector's Nominal Net Surplus (+) or Deficit (-)

business sector's nominal net surplus = private business nominal net surplus + state enterprise nominal net surplus

or

USVBU = USVBP + USVBS

96. Government Net Tax Revenue (Less Transfer)

government net tax revenue = export taxes + other indirect tax on agricultural output + import tax + other indirect tax on non-agricultural output + direct tax on household + corporate income tax + direct tax on state enterprise + net transfer from household to government − net transfer from government to foreign sector + property income accrued to government − interest on public debt

or

TAX = TXAGX + TOIAG + TMNA + TOINA + TDRHH + TCYBPNA + TDRBSNAX + YTRHHGVX − YTRGVFO + TPTGVNAX − YIPGVNAX

97. Net Transfers from Government to Foreign Sector in Local Currency.

net transfer from government to foreign sector = net transfers from government to foreign sector in $ · exchange rate

or

YTRGVFO = YTRGVFOS · ZXR$

98. Government's Nominal Surplus (+) or Deficit (−)

government nominal surplus = government net tax revenue − government consumption − government fixed investment in agriculture − government fixed investment in non-agriculture

or

USVGV = TAX − CONGV − IFXGVAGX − IFXGVNAX

99. Foreign Sector's Surplus (equal to Current Account Deficit in Balance of Payments' but Opposite in Sign) in Local Currency

foreign sector's surplus = net transfer from household to foreign sector + net transfer from private business to foreign sector + net transfer from state enterprise to foreign sector + net transfer from government to foreign sector + imports of goods and services − exports of goods and services

or

USVFO = YTRHHFO + YTRBSFO − YTRBSFO + YTRGVFO + MGS − XGS

100. Current Account Deficit in Balance of Payments in US Dollars

current account deficit in $ = current account deficit in local currency/exchange rate

or

− USVFO = − USVFO/ZXR$X

APPENDIX B

NOTATION OF MACROECONOMETRIC VARIABLES

The first letter of the notation plays a very important role in identifying what the symbol refers to. In particular, it would indicate roughly which type of economic aggregate or indicator this variable is associated with. The first element of the symbol refers to economic aggregate or indicators according to the scheme below :

C = consumption expenditure
D = dummy variable
F = financial assets or liabilities (financial variables)
G = output or value added, usually GDP
I = investment expenditure
M = imports
K = capital stock
N = persons, population, employment etc.
P = price or price index
R = interest rate
T = tax revenue
A = exports
Y = income
E = exogenous variable, unclassified elsewhere
W = wage rate, wage income etc.
U = endogenous variable, unclassified elsewhere
Z = policy instrument, unclassifed elsewhere

The variable name which begins with one of the above characters can be follow by a maximum number of 7 characters, making the total number of characters for each variable not exceeding eight.

Wherever the break-down of economic aggregates into sectors is necessary, a two-characters symbol is required to follow the variable name as below :

AG = agriculture
MQ = mining and quarrying
MF = manufacturing
CO = construction
EW = electricity and water supply
TC = transportation and communication
WR = wholesale and retail trade
BI = banking, insurance, and real estate
PA = public administration and defense

SE = service
NA = non-agricultural sector
HH = household sector
BU = business sector
OF = other financial institution
GV = government
FO = foreign sector

In a case where "R" appears as the last character it indicates that the variable concerned is expressed in constant prices. Or, if the last character is "S", "ε", "r" etc., it indicates that the variable is measured in terms of a foreign currency, not the domestic currency unit. And, if the last characters is "X", it means that those variables are exogeneous.

Alphabetical Index of Variables in Macro Model

CONGV = nominal government consumption
CONGVR = real government consumption
CONHH = nominal private consumption
CONHHR = real private consumption

DW = Durbin Watson statistics

ER1X = average rainfall during planting season
ER2X = average rainfall between the time of planting
ERHAGX = holding area of paddy land

GDP = nominal total output
GDPAG = nominal agricultural output
GDPAGR = real agricultural output
GDPNA = nominal non-agricultural output
GDPNAR = real non-agricultural output
GDPR = nominal total output
GDPAGCR = real agricultural crop output
GDPAGNR = real agricultural non-crop output
IFXBP = nominal private business gross fixed investment
IFXBPAG = nominal private business fixed investment
IFXBPAGR = real gross fixed investment in agriculture, private business
IFXBPNA = nominal private business fixed investment in non-agriculture
IFXBPNAR = real gross fixed investment in private business, non-agriculture
IFXBS = nominal state enterprise gross fixed investment

IFXBSAGR = real gross investment
IFXBSNA = nominal gross fixed investment in state enterprise, non-agriculture
IFXBUR = real gross fixed investment in business sector
IFXGV = nominal government gross fixed investment
IFXGVAG = government nominal gross fixed investment in agriculture
IFXGVNA = government nominal gross fixed investment in non-agriculture
IFXGVR = government real gross fixed investment
IFXTO = nominal total gross fixed investment
IFXTOR = real total fixed investment, total real gross fixed investment
INVBP = nominal investment in inventory
INVBPR = inventory investment
KFXBPAGR = private business real fixed capital stock in agriculture
KFXBPNAR = real fixed capital stock of private business in non-agriculture
KFXBSAGR = state enterprise real fixed capital stock in agriculture
KFXBSNAR = state enterprise real fixed capital stock in non-agriculture
KFXGVAGR = government real fixed capital stock in agriculture
KFXGVNAR = government real fixed capital stock in non-agriculture
KFXTOAGR = total real fixed capital stock in agriculture
KFXTONAR = fixed capital stock in non-agricultural sector
KFXTOR = total real fixed capital stock
KIVBPR = private business stock of inventory

MCR = real import of consumer goods
MGS = nominal import goods and services
MGSR = real import of goods and services
MGSD = nominal import goods and services in U.S. dollar
MKR = real import of capital goods
MRMR = real import of raw material and fuels
MSR = real import for services

N = number
NEMAG = labour in agricultural sector
NEMNA = employment in non-agricultural sector
NLFX = labour force

PD = domestic price
PGDAG = GDP deflator for agricultural product
PGDNA = GDP deflator for non-agricultural product
PM = average price of imported goods and services
PMD = average price of imported goods and services in U.S. dollar
PMC = import price of consumer goods
PMCDX = import price of consumer goods in U.S. dollar

PMK = import price of capital goods
PMKDX = import price of capital goods in U.S. dollar
PMRM = import price of raw materials and fuels
PMRMDX = import prices of raw materials and fuels in U.S. dollar
PMTC = import price of consumer goods including import taxes
PMS = import price of services
PMSDX = import price of services in U.S. dollar
PMTK = import price of capital goods including import taxes
PMTRM = price of imported raw material and fuel including import taxes
PTXAG = net producer price for agricultural product excluding indirect taxes
PTXNA = net producer price for non-agricultural product excluding indirect taxes
PX = average price of exports of goods and services
PXD = average price of exports of goods and services in U.S. dollar
PXGAG = export price for agricultural product
PXGNA = export price for non-agricultural product
PXGNAD = export price for non-agricultural product in U.S. dollar
PXS = export price for services
PXSD = export price for services in U.S. dollar

RX = average cost of borrowing from local and foreign sources
R^2 = R square
RLCBS = interest rate on commercial bank loan
PXAGDX = export price for agricultural product in U.S. dollar

SE = standard error

TAX = government net tax revenue
TCYBPNA = corporate income tax on non-agricultural private business
TDRBSNA = direct tax on state enterprise
TDRHH = direct tax on household in non-agricultural sector
TIMEX = 1960 = 1
TMC = import tax on consumer goods
TMK = import tax on capital goods
TMNA = import tax revenue
TMRM = import tax on raw materials and fuels
TOIAG = other indirect tax on agriculture output
TOINA = other indirect tax on non-agriculture output
TPTGVNA = property income accrued to government
TXAGX = export tax revenue
UHAAG = total harvested area in agriculture

UPAAG = total planted area in agriculture
USVBP = private business's nominal net surplus or deficit
USVBS = state enterprises nominal net surplus
USVBU = business sector's nominal net surplus
USVFO = foreign sector's surplus
USVFOD = current account deficit in U.S. dollar
USVGV = government nominal surplus
USVHH = household nominal savings

WGRNA = gross wage rate in non-agricultural sector

XGAGX = nominal export of agricultural product
XGAGR = real export of agricultural product
XGNAX = nominal export of non-agricultural product
XGNAR = real export of non-agricultural product
XGS = nominal value of exports of goods and services
XGSD = nominal export of goods and services in U.S. dollar
XGSR = real value of exports of goods and services
XSX = nominal export of services
XSR = real export of non-factor services
YDSHH = nominal disposable income
YDSHHAG = disposable agricultural household income
YDSHHNA = disposable non-agricultural household income
YDSHHR = real disposable income
YGPBPNA = non-agricultural private business gross profit
YKNHHNA = capital income accruing to non-agricultural households
YIPGVNA = interest on public debt
YRDBPNA = retained earnings and depreciation allowance, non-agricultural private sector
YRDBSNA = retained earning and depreciation non-agriculture, state enterprise
YTRBPFO = net transfer from private business to foreign sector
YTRBPFO = net transfer from private business to foreign sector in U.S. dollar
YTRBSFO = net transfer from state enterprise to foreign sector
YTRBSFO = net transfer from state enterprise to foreign sector in U.S. dollar
YTRGVFO = net transfer from government to foreign sector
YTRHHFO = net transfer to foreign sector
YTRHHGV = net transfer to government
YLBNA = gross labour income in non-agricultural sector
YHFODX = net transfer to foreign sector in U.S. dollar
YGVFDX = net transfer from government to foreign sector in U.S. dollar

Z	= appearing as the first character of the variable indicates that the variable concerned is used as policy instrument
ZTBAGX	= business tax rate in agricultural sector
ZTBNAX	= business tax rate in non-agricultural sector
ZTRMCX	= import tariff rate for consumer goods
ZTRMKX	= import tariff rate for capital goods
ZMRMX	= import tariff rate of raw materials and fuels
ZXRDX	= exchange rate in local currency per U.S. $ = current exchange rate

APPENDIX C

INPUT-OUTPUT TABLE CODES

Forecasts presented in this report are in the form of input-output table codes. The codes used are those of 16 sectors, 58 sectors and 180 sectors. In general, the tables in the section on "Projected Changes of the Thai Economy in 1985" are in "180-sector codes", the tables in the section of "Findings from the Linkage of the Thailand Input-Output Table and the Macroeconometric Model" are in "58-sector codes", and the tables in Appendix A are in "16-sector codes." The input-output table codes used are shown in the following table.

INPUT-OUTPUT TABLE CODES 1.

16 Sectors		58 Sectors		180 Sectors	
001	Agriculture	001	Paddy	001	Paddy
		002	Maize	002	Maize
		003	Cassava	004	Cassava
		004	Beans and Nuts	006	Beans and Nuts
		005	Vegetables and Fruits	007	Vegetables
				008	Fruits
		006	Sugarcane	009	Sugarcane
		007	Rubber (Latex)	016	Rubber
		008	Other Crops	003	Other Cereals
				005	Other Root Crops
				010	Coconut
				011	Oil Palm
				012	Kenaf and Jute
				013	Crops for Textiles and Matting
				014	Tobacco
				015	Coffee and Tea
				017	Other Agricultural Products
				024	Agricultural Services
		009	Livestock	018	Cattle and Buffalo
				019	Swine
				020	Other Livestock
				021	Poultry
				022	Poultry Products
				023	Silk Worm
		010	Forestry	025	Logging
				026	Charcoal and Firewood
				027	Other Forestry Products
		011	Fishery	028	Ocean and Coastal Fishing
				029	Inland Fishing
002	Mining and Quarrying	012	Crude Oil and Coa	030	Coal and Lignite
				031	Petroleum and Natural Gas
		013	Metal Ore	032	Iron Ore
				033	Tin Ore
				034	Tungsten Ore
				035	Other Non-ferrous Metal Ore
		014	Non-metallic Ore	036	Fluorite
				037	Chemical Fertilizer Minerals
				038	Salt Evaporation
				039	Limestone
				040	Stone Quarrying
				041	Other Mining and Quarrying
003	Food Manufacturing	015	Slaughtering	042	Slaughtering
		016	Processing and Preserving of Foods	043	Canning, Preserving of Meat
				044	Dairy Products
				045	Canning of Fruits and Vegetables
				046	Canning, Preserving of Fish
				047	Coconut and Palm Oil
				048	Other Vegetable Animal Oils

INPUT–OUTPUT TABLE CODES 2.

16 Sectors		58 Sectors		180 Sectors	
		017	Rice and Other Grain Milling	049	Rice Milling
				050	Tapioca Milling
				051	Drying and Grinding of Maize
				052	Flour and Other Grain Milling
		018	Sugar Refineries	055	Sugar
		019	Other Foods	053	Bakery Products
				054	Noodles and Similar Products
				056	Confectionery
				057	Ice
				058	Monosodium Glutamate
				059	Coffee and Tea
				060	Other Food Products
		020	Animal Feed	061	Animal Feed
		021	Beverages	062	Distilling, Blending Spirits
				063	Breweries
				064	Soft Drinks
		022	Tobacco Processing and Products	065	Tobacco Processing
				066	Tobacco Products
		023	Spinning, Weaving and Bleaching	067	Spinning
				068	Weaving
				069	Textile Bleaching and Finishing
		024	Textile Products	070	Made-up Textile Goods
				071	Knitting
				072	Wearing Apparel, Except Footwear
				073	Carpets and Rugs
				074	Cordage, Rope and Twine Products
06	Paper Industries and Printing	025	Paper and Paper Products	081	Pulp, Paper and Paperboard
				082	Paper Products
		026	Printing and Publishing	083	Printing and Publishing
07	Rubber, Chemical and Petroleum Industries	027	Basic Chemical Products	084	Basic Industrial Chemicals
				086	Synthetic Resins and Plastics
		028	Fertilizer and Pesticides	085	Fertilizer and Pesticides
		029	Other Chemical Products	087	Paints, Varnishes and Lacquers
				088	Drugs and Medicines
				089	Soap and Cleaning Preparations
				090	Cosmetics
				091	Matches
				092	Other Chemical Products
		030	Petroleum Refinerice	093	Petroleum Refineries
				094	Other Petroleum Products
		031	Rubber Products	095	Rubber Sheets and Block Rubber
				096	Tyres and Tubes
				097	Other Rubber Products
		032	Plastic Wares	098	Plastic Wares
08	Non-metallic Products	033	Cement and Concrete Products	102	Cement
				103	Concrete and Cement Products

INPUT-OUTPUT TABLE CODES 3.

16 Sectors		58 Sectors		180 Sectors	
		034	Other Non-metallic Products	099	Ceramic and Earthern Wares
				100	Glass and Glass Products
				101	Structural Clay Products
				104	Other Non-metallic Products
009	Metal, Metal Products and Machinery	035	Iron and Steel	105	Iron and Steel
				106	Secondary Steel Products
		036	Non-ferrous Metal	107	Non-ferrous Metal
		037	Fabricated Metal Products	108	Cutlery and Hand Tools
				109	Furniture and Fixtures, Metal
				110	Structural Metal Products
				111	Other Fabricated Metal Products
		038	Industrial Machinery	112	Engines and Turbines
				113	Agricultural Machinery
				114	Wood and Metal Working Machinery
				115	Special Industrial Machinery
		039	Electrical Machinery and Apparatus	116	Office and Household Machinery
				117	Electrical Industrial Machinery
				118	Radio and Television
				119	Household Electrical Appliances
				120	Insulated Wire and Cable
				121	Electric Accumulators
				122	Other Electrical
		040	Motor Vehicles and Repairing	125	Motor Vehicles
				126	Motor Cycles and Bicycles
				127	Repairing of Motor Vehicles
		041	Other Transportation Equipment	123	Ship Building and Repairing
				124	Railroad Equipment
				128	Aircraft
010	Other Manufacturing	042	Leather Products	075	Tanneries, Leather Finishing
				076	Leather Products
				077	Footwear, Except Rubber
005	Saw Mills and Wood Products	043	Saw Mills and Wood Products	078	Saw Mills
				079	Wood and Cork Products
				080	Furniture and Fixtures, Wood
010	Other Manufacturing	044	Other Manufacturing	129	Scientific Equipment
				130	Photographic and Optical Goods
				131	Watches and Clocks
				132	Jewelry and Related Articles
				133	Sporting and Athletic Goods
				134	Other Manufactured Goods
011	Public Utilities	045	Electricity and Gas	135	Electricity
				136	Gas
		046	Water Works and Supply	137	Water Works and Supply
012	Construction	047	Building Construction	138	Residential Building
				139	Non-residential Building

INPUT-OUTPUT TABLE CODES 4.

16 Sectors		58 Sectors		180 Sectors	
		048	Public Works and Other Construction	140	Public Works of Agriculture
				141	Public Works of Non agriculture
				142	Construction of Electric Plant
				143	Construction of Telephone Communications
				144	Other Construction
013	Trade	049	Trade	145	Wholesale Trade
				146	Retail Trade
015	Services	050	Restaurants and Hotels	147	Restaurants and Drinking Place
				148	Hotels and Lodging
014	Transportation and Communication	051	Transportation	149	Railways
				150	Road Passenger Transport
				151	Road Freight Transport
				152	Services to Land Transport
				153	Ocean and Coastal Water Transport
				154	Inland Water Transport
				155	Water Transport Services
				156	Air Transport
				157	Other Services to Transport
				158	Storage and Warehousing
		052	Communication	159	Postal and Telecommunication
015	Services (Continued)	053	Banking, Insurance	160	Banking Service
				161	Life Insurance Service
				162	Non-life Insurance Service
		054	Real Estate	163	Real Estate
		055	Business Services	164	Business Services
		056	Public Services	165	Public Administration
				166	Sanitary and Similar Services
				167	Education
				168	Research and Scientific Services
				169	Hospital
		057	Other Services	170	Business and Labor Association
				171	Other Community Services
				172	Motion Picture Production
				173	Theatres and Movie Houses
				174	Radio, Television and Related
				175	Library and Museum
				176	Amusement and Recreation
				177	Repairs, n.e.c.
				178	Personal Services
016	Unclassified	058	Unclassified	180	Unclassified
190	Total Intermediate Transactions	190	Total Intermediate Transactions	190	Total Intermediate Transactions
201	Wages and Salaries	201	Wages and Salaries	201	Wages and Salaries

INPUT-OUTPUT TABLE CODES 5.

16 Seetors		58 Sectors		180 Sectors	
202	Operating Surplus	202	Operating Surplus	202	Operating Surplus
203	Depreciation	203	Depreciation	203	Depreciation
204	Indirect Taxes	204	Indirect Taxes	204	Indirect Taxes less Subsidies
209	Total Value Added	209	Total Value Added	209	Total Value Added
210	Control Total	210	Control Total	210	Control Total
301	Private Consumption Expenditure	301	Private Consumption Expenditure	301	Private Consumption Expenditure
302	Government Consumption Expenditure	302	Government Con-sumption Expenditure	302	Government Consumption Expenditure
303	Fixed Capital Formation	303	Fixed Capital Formation	303	Fixed Capital Formation
304	Increase in Stock	304	Increase in Stock	304	Increase in Stock
305	Exports	305	Exports	305	Exports (F.O.B.)
				306	Special Exports
309	Total Final Demand	309	Total Final Demand	309	Total Final Demand
310	Total Demand	310	Total Demand	310	Total Demand
409	Imports	409	Imports	401	Imports (C.I.F.)
				402	Import Tax
				403	Import Duty
				404	Special Imports
				409	Total Imports
509	Trade Margin and Trans-portation Cost	509	Trade Margin and Transportation Cost	501	Wholesale Trade Margin
				502	Retail Trade Margin
				503	Transportation Cost
				509	Total Margin and Transportation Cost
600	Control Total	600	Control Total	600	Control Total
700	Total Supply	700	Total Supply	700	Total Supply

APPENDIX D

Abbreviations

IDE	Institute of Development Economies
NESDB	National Economic and Social Development Board
CUSRI	Chulalongkorn University Social Research Institute
ELSA	Econometric Link System for ASEAN
ASEAN	Association of Southeast Asian Nations
I-O, I/O	Input-Output

Macroeconometric Model for Analysis Change in Oil Prices[1]

Charit Tingsabadh
Kitti Limskul

1. Introduction

Energy issues in Thailand are becoming more complex as the country develops its production bases and its indigenous energy resources in pursuit of social and economic development goals. Petroleum constitutes a major share of energy products which enter into a wide range of economic activities. Pricing of petroleum products is a major concern of the government in implementing its developmental objectives. In formulating an appropriate pricing policy, a thorough analysis of the impact of the regime of prices should be carried out to access its effectiveness.

The objectives of this paper are to evaluate and quantify, in terms of direction as well as magnitude of impact, the effects on the economy of changing the pricing of petroleum products, so as to provide one of the guidelines for the estabishment of energy prices in order to minimise the adversc effects during the achievement of the target economic growth.

The analysis of the economic impact of changing oil prices will cover the following aspects of the economy :

i) Growth and Productivity[2]
ii) Inflation
iii) Balance of payments
iv) Terms of Trade
v) Income Distribution
vi) Employment

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[1] The article is an outcome of the project funded by the National Energy Authority of Thailand. The project is directed by Warin Wanghancho and is managed by Charit Tingsabadh the advisors to the project are Piyasavasti Amranand and Wirat Wattanasiritham, the key research personnel are Wisoot Wiseschinda, Prayote Charoensuk, Akhom Termpitayapaisit, Wittaya Pintong and Somsak Bunphenkit.

[2] The precise definition of each aspects which are not conventionally used elsewhere will be discussed later in text.

To undertake the above analysis, we constructed a multisectoral macro-economic model and an input-output (I-O) table that is suitable for our analytical purpose. We made an aggregation of the I-O 180 sector to form a 33 sector while disaggregating those sectors of energy. In short, we incorporated the linkages of the energy sector with other sectors of the economy.

The paper is organised into 4 parts, with appendicies. After the introductory part 1, part 2 is the structure of the multi-sectoral macro-economic and I-O linked model incorporating the energy sub-model will be briefly discussed through blockwise equations and flow-chart.[3] In part 3, we experiment with energy prices change through a simulation analysis. The results will be discussed in terms of the 5 aspects listed above with conclusion and policy recommendation.

2. Structure of the Model

The overall modelling concept adopted in this paper is that of the economy-wide general equilibrium model. The model comprises an Input-Output Table with a fully specified final demand vector which takes into account prices and income distribution derived from the I-O table.

The energy product sub-sector is fully disaggregated while the rest of the economy is disaggregated at 2 levels to allow for different levels of analysis. The I-O table is firstly prepared for a 180-sector disaggregation. This is then aggregated into 33 sectors. The energy sub-sector is further disaggregated into 18 products. A brief summary of the I-O structure is shown in appendix 1 for reference.

The macro-economic I-O model consists of the following components :

2.1 Output Determination and Supply

In general, output valued at purchaser price (supply) is demand-determined in the basic I-O relationship, (SR : 39)[4]

$$\text{Eq : 39 : } XR_{it} = \sum_{j=1}^{33} A_{ijt} \cdot QR_{jt} + CGR_{it} + IGR + CPR_{it} + IPR_{it} + CFR_{it}$$

$$i = 11, 12, \ldots\ldots, 33.$$

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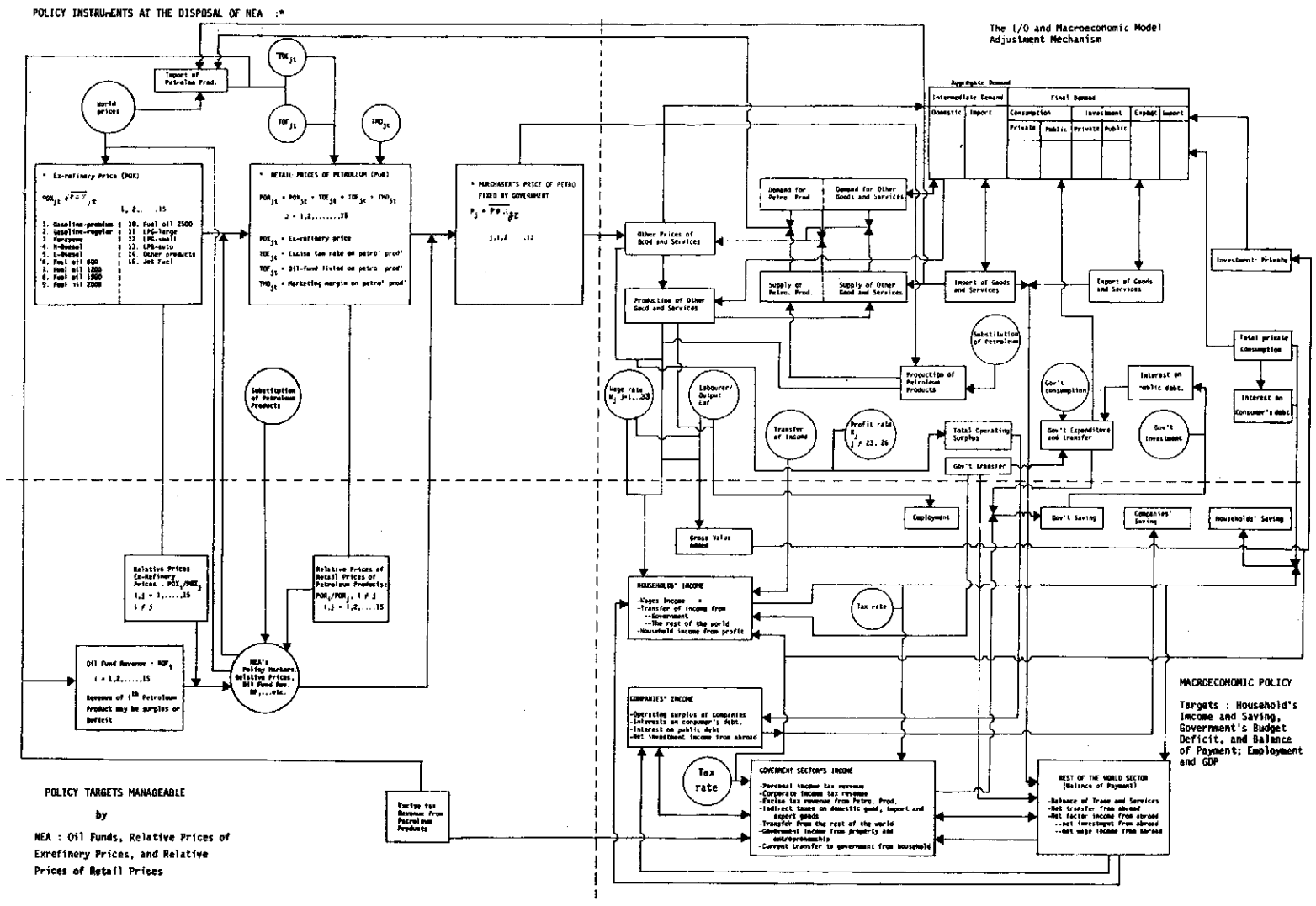
[3] For breivity, the evaluation of the model's validity will not be discussed here. Interest reader may find it in the final report submitted to the NEA (National Energy Administration).

[4] The first notation in parenthesis indicates variable name, the second implies equation number, both of which are consistent with those noted in lists of variables and equations, see appendix 2. Moreover subscript t indicates variables are valued at year t, subseript O indicates base year.

Diagram 1 : Diagramatic representation of the model : the economics impact of changing oil prices



Consequently, QR the output valued at producers' price is endogeneously determined (QR : 42)

$$\text{Eq. 42} \qquad QR_{it} = XR_{it} / (1 + TC_{io} + TM_{io})$$

$$i = 11, 12, \ldots\ldots, 33$$

where TC_{io}, TM_{io} are transport cost and trade margin per unit at base year.

However, in certain sectors, output is exogeneously determined, so that QR is predetermined, and hence XR. This is the case for exportable crops (sector 23) and other crops (sector 24),. For these sectors, adjustment accurs in foreign trade sector to equate supply with demand i.e., through export value (ER_{it} : 40)

$$\text{Eq. 40} \qquad ER_{it} = XR_{it} - \sum_{j=1}^{33} A_{ijt} \cdot QR_{it} - CGR_{it} - IGR_{ti} - CPR_{it} - IPR_{it} - CFR_{it}$$

$$i = 23, 24$$

For petroleum products, domestic supply is limited by refinery configuration capacity. Excess demand for these products will be met by imports. (XR : 41).

$$\text{Eq. 41} \qquad XR_{i+n,t} = \sum_{j=1}^{33} (A_{ijt} + A_{i+n,jt}) \cdot QR_{it} + CGR_{it} + CGR_{i+m,t} + IGR_{it} + IGR_{i+n,t} + CPR_{it} + CPR_{it} + CPR_{i+n,t} + IPR_{it} + IPR_{i+n,t} + ER_{it} + CFR_{it} + CFR_{i+n,t} - XR_{it}$$

$$i = 1, 2, \ldots, 8; \quad n = 33.$$

For natural gas and crude oil, outputs are exogeneously given in our model while demands only consist of intermediate demands. If the supply of natural gas is insufficient to meet demand, then more fuel oil will be assumed to substitute for the use. In this case their input-output coefficients (A_{ijt} for i = natural gas and fuel oil) will adjust to restore equilibrium.

$$\text{Eq. 38} \qquad XR_{it} = \overline{QR}_{it} (1 + TC_{io} + TM_{io})$$

$$i = 9, \quad i = 10$$

$$\text{Eq. 39} \qquad XR_{it} = \sum_{j=1}^{33} A_{ij} \cdot QR_{it}$$

$$i = 9, \quad 10$$

In short, A_{ij} (i = 9) will increase or decrease to fulfill the demand condition of natural gas (XR : 39) the supply of which is predetermined by (XR_{it} : 38). This in turn will lead to an adjustment in demand condition of fuel oil (XR_{it} ; i = 5) which, if not met by domestic capacity as cited above, import will be induced to achieve equilibrium ($XR_{i+n,t}$; i = 5, n = 33 : 44).

Similarly for crude oil, if domestic production of crude oil is insufficient to meet demand then more import of crude oil will be purchased ($XR_{i+n,t}$; i = 10, n = 33 : 44).

Total import of each commodity inclusive of import taxes is therefore a sum of those separated import demand components. (XR : 43).

$$\text{Eq. 43} \qquad XR_{i+n,t} = \sum_{j=1}^{33} A_{i+n,jt} \cdot QR_{it} + CGR_{itn,t} + IGR_{i+n,t}$$

$$= CPR_{i+n,t} + IPR_{i+n,t} + CFR_{j+n,t}$$

$$i = 11, 12, \ldots, 33, \quad n = 33.$$

Total import before tax (i.e., import at c.i.f. price) is given by (MR : 44)

$$\text{Eq. 44} \qquad MR_{it} = XR_{i+t\,n,} / (1 + TMR_{i+n,o})\,(1 + TC_{i+n,o} + TM_{i+n,o})$$

$$i = 11, 12, \ldots, 33; \quad n = 33.$$

2.2 Determination of Aggregate Demand Components.

In addition to the intermediate demand determination derived through the I-O table, the macro-economic model serves to provide the final demand vector for solving the I-O table. The final demand components are determined as follows :

2.2.1 Consumption

Consumption is divided into private consumption (CP) and public consumption (CG.) Total public consumption (CGT) is treated as exogeneous and is distributed to the various sectors by an allocation vector (CGR ; 14). Total private consumption (CPT) is determined as a function of disposable income and lagged consumption (CPT : 71). The total is then distributed to various sectors by means of the linear expenditure system (CPR^* : 32)

$$\text{Eq. 14} \qquad P_{it} \cdot CGR_{it} = \lambda_{it} \cdot CGT_t$$

$$i = 1, 2, \ldots, 33; \quad 34, \ldots\ldots, 66$$

Eq. 14 covers both domestic and imported goods. Substitution between imported goods and domestic goods are obtained using the Armington specification :

$$\text{Eq.} \qquad \frac{\lambda_{it}}{\lambda_{i+n,t}} = \frac{\lambda_{io}}{\lambda_{i+n,o}} \frac{(P_{i+n,t})\,\sigma i}{P_{i,t}}$$

$$i = 1, 2, \ldots, 33.$$

where λ_{io}, $\lambda_{i+n,t}$ are the base year's shares obtained from the input-output matrix.

The real government's expenditure in total, CGR_t is determined as :

Eq. 15 $$CGR_t = \sum_{i=1}^{33} CGR_{it}$$

Total private consumption and the expenditure of consumption on composite good i^{th}.

Eq. 71 $$CPT_t = -1338.1 + 0.60\,(HI_t - TDH_t - CTG_t - INCD_t - CTW_t) + 0.34\ CPT_{t-1}$$

(−1.5) (21.2) (9.1)

$R^2 = 1.00$ D.W. = 2.55 N = 23

Eq. 32 $$CPR_{it}^{*} = (\gamma_{it} + \beta_{it} \cdot CPT_t) / PA_{it}$$

Here PA_{it} is the price level which is a weighted average of domestic and imported goods. The γ_{it} and β_{it} are parameters of all commodities other than petroleum products. Estimated from the SES (Socio Economic Survey). For simplicity, $\gamma_{it} = \gamma_{io}$ and $\beta_{it} = \beta_{io}$ for all t.

For petroleum products, the Almost Ideal Demand System (AIDS) specification will be applied in the estimation of γ_{it} and β_{it} where substitution among products are crucial for our mode. Given that purchaser price and import price of petroleum product is exactly the same

Eq. 33 $$P_{it} = P_{i+n,\,t} = PA_{it}$$

$$i = 1, 2, \ldots, 8$$

The AIDS gives the following equations:

Eq. 34 $$\frac{\gamma_{it} + \beta_{it} \cdot CPT_t}{\sum_{j=1}^{8} \gamma_{jt} + \beta_{jt} \cdot CPT_t} = \frac{\gamma_{io} + \beta_{io} \cdot CPT_t}{\sum_{j=1}^{8} \gamma_{jo} + \beta_{jo} \cdot CPT_t} + \sum_{j=1}^{8} G_{ij} \log P_{jt}$$

where G_{ij}'s are coefficients to be estimated[5] according to the AIDS system and satisfy the add up condition, $\sum_i G_{ij} = o$ · The composite good consumption CPR_{it}^{*} i = 1,2,..,33 are further divided into domestic and imported goods.

Eq. 35 $$\frac{CPR_{it}}{CPRi+n,t} = \frac{CPR_{io}}{CPR_{i+n,o}} \cdot \left(\frac{P_{i+n,t}}{P_{it}}\right)^{\sigma_i}$$

Eq. 36 $$CPR_{it}^{*} = CPR_{it} + CPR_{i+n,t}$$

[5] See the estimation procedure in CUSRI, *Economic Impact of Oil Price Changes*: Inception Report Vol. I, p. 63.

$$\text{Eq. 37} \quad PA_{it} \cdot \overset{*}{CPR}_{it} = P_{it} \cdot CPR + P_{i+n,t} \cdot CPR_{i+n,t}$$

2.2.2 Investment

Investment is divided into public investment (IGT), and private investment (IPR). Public investment is exogeneously determined. This is then distributed into various sectors by an allocation vector (IGR: 16)

$$\text{Eq. 16} \quad P_{it} \cdot IGR_{it} = \mu_{it} \cdot IGT_t$$

$$\text{where} \quad \frac{\mu_{it}}{\mu_{i+n,t}} = \frac{\mu_{io}}{\mu_{i+n,o}} \cdot \left(\frac{P_{i+n,t}}{P_{int}}\right)^{\sigma_i}$$

and

$$\text{Eq. 19} \quad IGTR_t = \sum_{i}^{33} \cdot IGR_{it}$$

Total private investment (IPTR) is specified as a function of lagged output change and current profit (IPR: 20). The total is then distributed to various sectors by an allocation vector (IPR_{it}: 21)

$$\text{Eq. 20} \quad IPTR_t = \underset{(1.1)}{1367.7} + \underset{(2.1)}{0.295} (GDP_t - GDP_{t-1})$$
$$+ \underset{(3.6)}{0.575} (GDPR_{t-1} - GDPR_{t-2})$$
$$+ \underset{(8.8)}{1.15} (OSC - HIEP_t / PIPVT_t)$$
$$R^2 = 0.98 \quad D.W = 2.26 \quad N = 22.$$

$$\text{Eq. 21} \quad IPR_{it} = \nu_{it} \cdot IPTR_t \qquad i = 1, 2, .., 33.$$

$$\text{where} \quad \frac{\nu_{it}}{\nu_{i+n,t}} = \frac{\nu_{io}}{\nu_{i+n,o}} = \left(\frac{P_{i+n,t}}{P_{it}}\right)^{\sigma_t}$$

$$\text{and} \quad IP_{it} = P_{it} \cdot IPR_{it}$$

$$\text{Eq. 22} \quad IPT_t = \sum_{i=1}^{33} IP_{it}$$

2.2.3 Exports

As Thailand is a small country, the small country assumption implies that demand for Thai export by the rest of the world is demand determined in general.

$$\text{Eq. 24} \quad ER_{it} = E_{it} / PX_{it} = ER_{io} \cdot GDPW_{it}^{\rho_i} \cdot (PW_{it} / PX_{it})^{\eta_i}$$
$$i = 1, 2..33, \; i = 23, 24$$

Real export value at f.o.b. price of the i^{th} good (ER_{it}) is a function of world demand ($GDPW_{it}$), relative prices (PW_{it}/PX_{it}) and those cofficient ρ_i, γ_i which represent substitutability between world and Thai goods with respect to world income and relative prices. Total export value of goods (EXG_t) and services (EXS_t) at current prices are given by

$$\text{Eq. 26} \quad EXG_t = \sum_{i=1}^{28} PX_{it} \cdot ER_{it}$$

$$PX_{it} = P_{it} \cdot (1 + TXR_{it}) \; / \; (1 + TXR_{io})$$

$$\text{Eq. 27} \quad EXS_t = \sum_{i=29}^{33} PX_{it} \cdot ER_{it}$$

and the corresponding total exports at constant prices are:

$$\text{Eq. 28} \quad EXGR_t = \sum_{i=1}^{28} ER_{it}$$

$$\text{Eq. 29} \quad EXSR_t = \sum_{i=29}^{33} Er_{it}$$

In this model, total income from tourism in real terms $CFTR_t$ is given by the similar relationship as export demand functions.

$$\text{Eq. 30} \quad \log (CFTR_t) = 9.9 + 3.71 \log (GDPWF_t) - 0.65 \log \frac{PCFT}{PWF_t}$$

$$R^2 = 0.98 \quad D.W. = 1.11 \quad N = 21$$

Total spending of tourists is then disaggregated among different commodities using constant shares:

$$\text{Eq.} \quad CFR_{it} = k_i \cdot CFTR_t$$

2.2.4 Imports

Imports are treated as both intermediate inputs and final consumption. Substitution due to relative price is allowed for in intermediate goods import by allowing adjustment of the sectoral import coefficients using the Armington specification (Equation 11)

$$\text{Eq. 11} \quad \frac{A_{ijt}}{A_{i+n,it}} = \frac{A_{jjo}}{A_{i+n,jo}} \left(\frac{P_{it}}{P_{i+n,t}} \right)^{\sigma i}$$

where

$$\text{Eq. 12} \quad P_{i+n,t} = \frac{PM_{it} \cdot (1 + TMR_{it})\ (1 + TC_{i+n,t} \cdot P_{32t} + TM_{i+n,t} \cdot P_{33t})}{(1 + TMR_{io})\ (1 + TC_{i+n,o} + TM_{i+n,o})}$$

$$\text{Eq. 13} \quad P_{i+n,t} = P_{it}$$

The value of import which are neither petrolum products, natural gas nor crude oil is derived as a function of total production from the I-O table. After making allowances for taxes on import, the import before taxes (i.e., import at c.i.f. price) is in turn determined. This is based on the assumption that import demand for good i^{th} is equal to its supply. (MR : 44).

2.3 Prices Determination

Prices are explicitly treated in this model. Producers' prices (PQ) are determined in the basic I-O cost-plus relationship (PQ : 4) in general

$$\text{Eq. 4} \quad PQ_{it} = \sum_{i=1}^{n} P_{it} \cdot A_{ijt} + W_t \cdot L_{jt} + TR_{jt} \cdot PQ_{jt} + R_{jt} \cdot PQ_{jt}$$

However, as different price determination mechanisms operate in different sectors, producer prices are accordingly determined differently. Purchaser and producers' price and the corresponding adjustment mechanism are as follows :

2.3.1 Price of commodity at purchaser's price determined by world price (PW_{jt}) and export tax rate (TXR_{jt}),

$$\text{Eq. 3} \quad P_{jt} = PW_{jt} \cdot (1 + TXR_{jo}) \ / \ (1 + TXR_{jt})$$

$$j = 23,\ 26$$

This is the case of exportable crops (sector 23) and mineral products (sector 26) where producer's price is determined from the purchaser's price by deducting the transport cost and marketing margins

$$\text{Eq. 5} \quad PQ_{jt} = P_{jt} \cdot (1 + TC_{jo} + TM_{jo}) - TC_{jt} \cdot P_{32t} - TM_{jt} \cdot P_{33t}$$ [6]

Since PQ_{it} is also given in Eq. 4, the profit rate R_{jt} is a residual that balances Eq. 4., and Eq. 5.

$$\text{Eq. 7} \quad R_{jt} = \frac{1}{PQ_{jt}}\left(PQ_{jt} - \sum_{i=1}^{n} P_{it} \cdot A_{ijt} - W_t \cdot L_{jt} - TR_{jt} \cdot PQ_{jt}\right)$$

2.3.2 Purchase price is fixed by Government regulations.

In this case purchase price is fixed,

$$\text{Eq. 1} \quad P_{jt} = \overline{P_{jt}}$$

$$j = 1,\ 2,..,\ 13$$

[6] Sector 32 and 33 are transportation & communication and trade

The producer's price is in turn determined by the relation.

Eq. 5 $$PQ_{jt} = P_{jt} \cdot (1 + TC_{jo} + TM_{jo}) - TC_{jt} \cdot P_{s2t} - TM_{jt} \cdot P_{s3t}$$
$$j = 12, 13$$

for Electricity (sector 12) and Hydro-Electricity (sector 13)

For petroleum products (sector 1-8) including natural gas, Crude oil, and Condensate (sector 9-11), producer's price, PQ_{jt} is also fixed. In this case the ratio between transportation cost and marketing margin TC_{jt}/TM_{jt} remains constant.

Eq. 9 $$TC_{jt} \cdot P_{s2t} + TM_{jt} = P_{jt} \cdot (1 + TC_{jo} + TM_{jo}) - PQ_{jt}$$
$$j = 1, 2, \ldots, 11.$$

2.3.3 Purchase price determined by producer's price

In this case, producer's price is firstly determined by production cost,

Eq. 8 $$PQ_{jt} = \sum_{i=1}^{n} P_{it} \cdot A_{ijt} + W_t \cdot L_{jt} + TR_{jt} \cdot PQ_{jt} + R_{jt} \cdot PQ_{jt}$$
$$j = 14, 15, \ldots, 22, 24, 25, 27, 28, \ldots, 33.$$

Purchase price is finally determined as:

Eq. 2 $$P_{jt} = \frac{PQ_{jt} + TC_{jt} \cdot P_{s2t} + TM_{jt} \cdot P_{s3t}}{1 + TC_{jo} + TM_{jo}}$$

2.4 Income determination.

2.4.1 Household Incomes

The I-O table provides data on wage and profit incomes, as primary inputs into the production process. Total wage income is defined as the sum of wage income from the rest of the world (WROW, exogeneous) and the sum of wage in the value added arising from production (WAGE: 65)

Eq. 65 $$WAGE_t = WROW_t + \sum_{j=2}^{n} W_t \cdot L_{jt} \cdot OR_{jt} \cdot$$

Profit is computed from total operating surplus (TOS: 58)

Eq. 58 $$TOS_t = \sum_{j=1}^{33} R_{jt} \cdot PQ_{jt} \cdot QR_{jt}$$

From I-O table, TOS, the operating surplus of companies (OSC: 59) and depreciation (D: 61) are compacted.

Eq. 59 $$GSC_t = \underset{(1.8)}{634.7} + \underset{(690.1)}{0.984} TOS_t$$
$$R^2 = 0.99 \quad D.W. \ 0.76 \quad N = 24$$

Eq. 61 $D_t = \underset{(-5.3)}{2644.3} + \underset{(64.0)}{0.127}\ TOS_t$

$R^2 = 0.99$ D.W. = 0.68 N = 24

Household in come from profit is derived from OSC (HIEP: 62)

Eq. 62 $HIEP_t = \underset{(3.3)}{2057.0} + \underset{(341.6)}{0.855} \cdot OSC_t$

$R^2 = 0.99 \cdot$ D.W. = 1.00 N = 24

Total household income (HI) is obtained as the sum of wage and profit income including transfers from government (CFG) and the rest of the world

Eq. 66 $HI_t = WAGE_t + HIEP_t + CFG_t + CFW_t$

Deductions are also made for direct taxes. (TDH: 68) and other transfers to the government (CTG: 51), interest on consumer debt (INCD: 70) and transfer to the rest of the world (CTW: 69) to arrive at disposable income of households.

Eq. 68 $\log (TDH_t) = \underset{(-3.5)}{-2.20} + \underset{(3.2)}{0.358} \log (HI_{t-i}) + \underset{(7.8)}{0.74.6} + \log (TDH_{t-1})$

$R^2 = 0.998$ D.W. = 2.24 N = 23

Eq. 52 $CTG = \underset{(-2.0)}{-54.3} + \underset{(39.4)}{0.0033}\ HI_t$

$R^2 = 0.99$ D.W. = 1.39 N = 24

Eq. 70 $INCD_t = \underset{(-1.3)}{-196.5} + \underset{(6.7)}{0.996} + INCD_{t-1} + \underset{(1.6)}{0.0039}\ CPT_{-1}$

$R^2 = 0.996$ D.W. = 2.71 N = 23

Eq. 69 $CTW_t = \underset{(5.1)}{490} + \underset{(16.7)}{0.00051}\ HI_t$

$R^2 = 0.93$ D.W. = 2.24 N = 24

Eq. $SH_t = HI_t - TDH_t - CTG_t - INCD_t - CTW_t - CPT_t$

(ii) Company Income

Company incomes are derived from operating surplus (OSC), interest on consumer and public debt (INCD, INPD) and net investment income from abroad (NTI: 75) (TOC: 57)

Eq. 75 $NFI_t = \underset{(0.9)}{334.9} + 0.79\ NFI_t + 0.12\ CW_{t-1}$

$R^2 = 0.98$ D.W. = 3.25 N = 21

Eq. 57 $TOC_t = OSC_t + INCD_t + INPDG_t + NDI_t$

From this, deductions are made for direct company taxation (TDC: 63) and distribution to household (HIEP), to leave company savings (SC: 64)

Eq. 63 $TDC_t = \underset{(-1.6)}{-241.2} + \underset{(7.1)}{0.235}\ (OSC_t - HIEP_t - D_t)$

$$+ \underset{(31.5)}{0.971}\ TDC_{t-1}$$

$$R^2 = 0.989 \quad D.W.\ 2.7 \quad N = 23$$

Eq. 64 $SC_t = TOC_t - TDC_t - HIEP_t$

3.4.2 Government Income

Government income (TOG: 50) is derived from taxes (TT: 45), income from property and entrepreneurship (IPEG), and transfers from domestic and foreign sources (CTG: 51, CFWG: 52). IPEG is obtained from the I-O table as the difference between total and companies' operating surplus, (IPEG : 60) while the transfers are estimated as a share of the total income of the household and the government sector (CTG : 51, CFWG : 52)

Eq. 50 $TOG_t = TT_t + IPEG_t + CTG_t + CFWG_t$

Eq. 45 $TT_t = TT_t + TDC_t + TDH_t$

Eq. 51 $CTG_t = -54.3 - 0.0033\ HI_t$

$$(-2.0)\ (939.4)$$

$$R^2 = 0.99 \quad D.W. = 1.39 \quad N = 24$$

Eq. 52 $CFWG_t = 298.9 + 0.0024\ TOG_t$

$$(2.0)\ (9.6)$$

$$R^2 = 0.81 \quad D.W. = 0.48 \quad N = 24$$

Eq. 60 $IPEG_t = TOS_t - OSC_t$

Taxes revenue are the sum of all taxes collected (TT : 45). There are (1) indirect taxes (TI : 46) derived from domestic indirect taxes (TID : 47), taxes on imports (TIM : 48) and export taxes (TIX : 49) (2) direct taxes on companies derived from retained profit less depreciation (TDC : 63) and direct tax on household (TDH : 68)

Eq. 46 $TI_t = TID_t + TIM_t + TIX_t$

Eq. 47 $TID_t = \sum_{j=1}^{33} TR_{jt} \cdot PQ_{jt} \cdot QR_{jt}$

Eq. 48 $TIM_t = \sum_{j=1}^{33} TMR_{jt} \cdot P_{j+n,\,t} \cdot XR_{j+n,\,t}$

$$(1 + TMR_{jt})(1 + TC_{j+n,\,t} \cdot PQ_{32t} + TM_{j=n,\,t} \cdot PQ_{38t})$$

Eq. 49 $TIX_t = \sum_{j=1}^{33} ER_{jt} \cdot TXR_{jt} \cdot P_{jt}$

Eq. 53 $SG_t = TOG_t - INPDG_t - CFG_t - CTWG_t - CGT_t$

2.5 The Energy Submodel

Since the model is intended for use in analysing the impact of changes in oil prices, the energy subsector is designed to permit easy data entry and convenience

in the interpretation of model output. The model also captures essential features of the energy sector, namely the substitution between energy products in both final and intermediate demand.

Substituting different types of petroleum products (i = 1, 2,..., 8), the AIDS gives the following equation for substitution of different products :

$$\text{Eq. 10} \quad \frac{P_{it} \cdot A_{ikt}}{\sum_{j=1}^{8} P_{jt} \cdot A_{jkt}} = \frac{A_{iko}}{\sum_{j=1}^{8} A_{jko}} + \sum_{j} GS_{ijk} \cdot \log P_{it}$$

where GS_{ijk} are to be estimated and satisfy the requirement

$$\sum_{j=1} GS_{ijk} = o \text{ for all j. and k.}$$

2.5.1 Petroleum Finance

In our model, petroleum taxes serve to provide revenue for the government; at the same time the government aims to stabilize petroleum prices through the Oil Fund. The petroleum tax is an excise tax collected (ROE : 85) on the volume of production and import, while the Oil Fund levy (ROF : 86) is a surcharge on the excise tax collected.

$$\text{Eq. 85} \quad ROE_{it} = TOE_{it} \cdot QL_{it}$$

$$\text{Eq. 86} \quad ROF_{it} = TOF_{it} \cdot QL_{it}$$

From the I-O macro model solution, the value of total output to meet demand is obtanied as XR. To obtain the quantity demanded, the value of output is divided by the ex-refinery price (QL : 84)

$$\text{Eq. 84} \quad QL_{it} = XR_{it} / POX_{it}$$

2.6 The Equilibrium Condition : Macro-economic balance

As a general equilibrium model the balance between demand and supply is achieved through prices adjustment as its main feature. Taking exogeneous prices first, these in clude retail (POR) and ex-refinery prices (POX). Changes in these prices will lead to changes in the value of endogeneous variables in the model. The petroleum pricing submodel is the mechanism by which prices of the petroleum sector enter the model. The rest of other prices are effective through the demand equations corresponding to the I-O table.

However, in the format of input-output analysis, quantity adjustment also occurs in response to the final demand vector. The final demand is in turn determined partly through quantity adjustment.

Finally, the balance between supply and demand will be achieved. At equilibrium, the model solves for these variables which are crucial for our analysis listed at the begining of this paper. The model also sovlves for those macro-economic variable like value added and GDP through definitional relationships.

The detail of lists of equations, lists of variables and solution criterion are shown in appendix 2 and 3 respectively.

3. SIMULATION WITH ENERGY PRICE MODEL

3.1 Reference Forecast 1985-1995

3.1.1 Forecasting Assumptions :

The assumptions used in making the reference forecast are listed below:

i) World GDP (GDPW : 561-593) grows by 3% for all sectors
ii) Government expenditures (CGT (663) and IGT (665)) grow by 2% from 1985.
iii) Crop output (DR 23-24) grow by 2%.
iv) Electricity generation from hydroelectric energy remains constant at 4974.00 million baht annually.
v) No change in the import price of petroleum products.
vi) No change in the exchange rate after 17% devaluation in 1985.
vii) No change in exrefinery prices from 1984, as well as other tax rates and retail prices (Table 3.1).
viii) Domestic production of petroleum products is constrained by capacity expansion plans.
ix) No change in well-head prices for natural gas and condensate from 1985.

Table 3.1 Alternative Price Assumptions, BAHT/LITRE

Variable	Name		Ref.	Alter. 1	Alter. 2
1301	POR 1	PMG	11.70	12.87	10.00
1302	POR 2	RMG	10.80	11.88	9.50
1303	POR 3	KEROSENE	6.12	6.73	6.45
1304	POR 4	H-DIESEL	6.70	7.37	9.25
1305	POR 5	L-DIESEL	6.50	7.15	9.00
1306	POR 6	F.O. 600	4.32	4.75	4.54
1307	POR 7	F.O. 1200	4.17	4.59	4.38
1308	POR 8	F.O. 1500	4.09	4.50	4.29
1309	POR 9	F.O. 2000	4.04	4.40	4.24
1310	POR 10	F.O. 2500	3.99	4.19	4.19
1311	POR 11	LPG LARGE	9.46	9.46	9.46
1312	POR 12	LPG SMALL	9.99	9.99	9.99
1313	POR 13	LPG AUTO	9.26	9.29	9.29
1314	POR 14	OTHER PP	1.13	1.13	1.13
1315	POR 15	JET FUEL	5.21	5.73	5.73

3.1.2 Reference Run Results

Results are shown in Table 3.2, for 1985, 1990 and 1995. A discussion of the results follows :

i) Output

Using gross domestic product at factor cost as measure of output, the model shows output, (in 1982 prices) rising from 1021 billion baht in 1985, by 3.82% per annum for 1985-1990, and a slight decrease in the growth rate for 1990-1995.

ii) Balance of Payments

Since the main component of the balance of payments is the balance of trade, the discussion focuses on the results for exports and imports.

The model shows an improvement in the balance of trade from a deficit of 41.7% billion baht in 1985 to a surplus of 8 billion baht in 1990 and 20 billion baht in 1995. This results is occasioned by the assumption of steady growth for export of agricultural products which is in fact likely to fluctuate a lot from year to year.

iii) Price Level

Forecast results show a stability in the selected price indicators-private consumption price and the GDP deflator. The reason for this is the assumed stability of world prices fed into the model run.

iv) Terms of Trade

The terms of trade results reflect the assumption of price stability used. The import price index increases after 1985 following devaluation, but remains fairly stable thereafter. Similarly, the export price index increases after the devaluation, but remains stable up to 1995.

v) Income Distribution

Values of income variables show a steady growth, though at different rates for the different income-receiving sectors. The fastest growth is shown for total tax revenue, while incomes for the company and househole sectors grow more slowly.

vi) Energy Sector Supply

On the basis of assumptions listed at the begining, model results show a stable level of domestic supply of energy products after an increase during 1985-1990. However, as the economy continues to expand, imports of energy are required to satisty the rising demand.

Forecasts in this sector depend, however, on assumptions regarding domestic refinery capacity and level of natural gas production, as well as on substitutions within the sector.

vii) Employment

Finally model forecasts of employment by sector are shown. To highlight the trend in employment distribution, the share of agricultural employment falls steadily from 65% of total employment to around 61% over the 1985-1995 period.

Table 3.2 Macro-Economic Impacts of Alternative Petroleum Product Price Policies, 1985, 1990, 1995.

Variable		Alternative	1985	1990	1995
1. OUTPUT					
1104	GDPFR	1	1020905	1232797	1455959
		2	1013147	1224011	1447625
		3	1008973	1220121	1443864
1102	GDPR	1	1125014	1322295	1567874
		2	1116838	1313598	1557092
		3	1114033	1311084	1554768
2. BALANCE OF PAYMENTS					
673	EXG	1	212189	339247	432312
		2	213310	340122	433335
		3	213841	340678	433780
675	MG	1	252894	329465	410281
		2	249592	325631	405509
		3	249268	325350	405761
695	BT	1	-40705	9781	22030
		2	-36282	14490	27826
		3	-35426	15327	28018
3. PRICE LEVEL					
1106	PGDP	1	1.15	1.17	1.169
		2	1.157	1.177	1.176
		3	1.158	1.179	1.177
1109	PCPT	1	1.127	1.171	1.17
		2	1.134	1.178	1.177
		3	1.134	1.178	1.177
1114	PINT	1	1.111	1.192	1.19
		2	1.121	1.202	1.201
		3	1.129	1.21	1.208
4. TERMS OF TRADE					
1115	PXG	1	1.16	1.267	1.25
		2	1.162	1.27	1.253
		3	1.163	1.271	1.254
1118	PMG	1	1.035	1.187	1.186
		2	1.035	1.188	1.186
		3	1.035	1.188	1.186

5. INCOME DISTRIBUTION					
677	WAGE	1	707431	818488	960744
		2	703120	813801	954875
		3	700694	811356	952322
655	OSC	1	495652	653648	776927
		2	492827	650307	772284
		3	491154	648791	771121
647	TT	1	171399	238331	312670
		2	178216	247096	323043
		3	181419	250043	326009
6. EMPLOYMENT					
2583	AGRICULTURE	1	17583	19618	21783
		2	17555	19584	21742
		3	17525	19551	21707
2592	TOTAL	1	26981	30897	35434
		2	26875	30782	35290
		3	26809	30717	35221

3.2 Use of Model for Policy Formulation

3.2.1 Limitation of Model for Policy Analysis

The Energy Price Model is intended as an analytical tool to aid in the analysis of alternative policy choices. For illustrative purposes, two alternative petroleum product pricing policies were tested by the model to examime their impact on the economy.

While we consider that the model fulfils the abovementioned purpose, it is necessary to reiterate the limitations of the model's capacity. These relate to limitations inherent in the model and limitations imposed on the use of the model in the process of policy formulation.

The user of the model should be aware of the following limitations:

1) It is based on historical data, whether in the I-O component, or the macro-final demand component, so the use of the model for forecasting depends on the assumption that relationships embodied in the model will hold in the future. However, in a period of rapid structural change, this assumption may not be tenable.

2) The model requires data in the form of exogenieusly determined variables to solve for the remaining endogenous variables. These data are subject to uncertainty.

3) The most significant limitation, from the standpoint of using the model for policy analysis, is the lack of an explicity defined policy preference function. As such it is a simulation model, and not an optimisation model. But even if an optimisation model can be defined, as is the case with linear and other types of programming models, it remains the case that the objective function, as well as some of the constraints, may not be fully specified by the policy makers.

3.2.2 Additional Considerations for Policy Analysis

Before proceeding to discuss the simulation results and the recommendations of this study, we shall make the following observations,

1) Policy objectives do not necessarily have to be consistent with each other. For instance, efficiency of resource utilisation may imply a reduction in public revenue, leaving more to be decided by resource allocation decisions within the private sector. Also, efficiency in resource utalisation may lead to an undesirable pattern of income distribution, by concentrating control over resources in the hands of the already well-to-do who can put the resources to productive uses, rather than distributing the resources to the poor, who are likely to use it for consumption purposes. In this case, a choice has to be made among the various policy objectives and decisions have to be made on the extent to which each objective is to be fulfilled.

2) The translation of policy objectives into targets and plans is subject to a wide margin of discretion in the interpretation of the policy. To illustrate, efficiency of resource utilisation can be interpreted to mean achievement of full employment for labour, on the ground that unemployed labour represents an ineficient use of human resources. Alternatively, it can be interpreted to mean the efficient use of capital resources, such that the highest returns are obtained from capital eventhough this may in turn lead to a high, and unacceptable, level of unemployment.

3) The solution to these problems, in the context of a policy analyst imploying an analytical tool such as the Energy Price Model, is to attempt, in so far as it is possible to do so, to translate specific policy objectives into a set of variables and their values. The advantage of doing so is that objectives become explicitly and clearly defined, and allow for a clear appreciation of the trade-offs that are entailed in pursuing one policy objective over another. This procedure is adopted here.

These limitations should lead to the conclusion that a model has a limited though useful role in the process of policy analysis and policy formulation.

3.3 Policy Issues for Model Simulation

3.3.1 The Policy Problem

With reference to the energy policy issues outlined in part 2, we may restate the policy problem as follows:-

i) pricing of natural gas for alternative uses.

ii) pricing of oil products to achieve efficiency of resource utilisation, public revenue and income distribution.

It is desired that recommendations be made for the pricing of individual petroleum products "to minimise impact on the economy and the cost of living". Thus, concern with the cost of living is clearly perceived to be directly linked to pricing of petroleum products, in addition to other impacts on the economy.

The simulations that follow have been carried out to illustrate the use of the model for policy analysis. The issues under consideration are related to the pricing of refined petroleum products only. The issue of natural gas pricing is not considered in this paper.

3.3.2 Simulation of Alternative Petroleum Pricing Policies

Alternative Petroleum Price Assumptions

Two alternative petroleum pricing strategies are investigated using the model. These are shown in Table 4.1 as Alternatives 2 and 3. Each is described briefly below.

Alternative 2: High Petroleum Product Prices.

Increases are stipulated for all petroleum products except LPG. The increases are designed to reflect the upward pressure of devaluation on the domestic petroleum prices in the absence of downward movement in petroleum import prices. The increases are also designed to examine the impact on the government's fiscal position, particularly the sensitivity of total tax revenue to changes in the petroleum taxes. In this alternative, the order of relative prices of various petroleum products except LPG has been maintained.

Alternative 3: Change in Relative Prices of Petroleum Products.

For Alternative 3, changes in relative prices of petroleum products except LPG are stipulated. Prices for premium and regular gasoline are reduced to 10.00 baht per litre, while diesel prices are raised to 9.25 baht per litre for high speed diesel and 9.00 baht per litre for low speed diesel. Kerosene price is also increased from the reference run level, but is lower than in Alternative 2. Fuel oil prices are raised to encourage the use of natural gas instead.

3.4 Results of Simulation

3.4.1 *Alternative 2: High Petroleum Products Prices*

High prices of petroleum products have an adverse impact on output. Real GDP falls from 1,123,014 million baht in the referece run to 1,116,838 million, baht. Inflation also increase as a result; the GDP deflator increases from 1.15 in the reference run to 1.157. The inflationary impact is felt in both the consuming sector and the producing sector, as the consumption expenditure deflator incresases from 1.127 to 1.134, and the intermediate product deflator rises from 1.11 to 1.21.

The consequence of the fall in output can be seen in the balance of trade. Export earnings increases from 212,189 million baht to 213,310 million baht, as more of domestic production becomes available for export following a fall in domestic demand. Import of goods declines for the same reason, so that the balance of trade improves slightly through a reduction from the deficit of 40,705 million baht to 36,282 million baht.

Despite the overall inflationary impact, the effect of the petroleum price policy on the terms of trade is marginal. Export price index rises by 0.002 point, while import prices remain the same.

For income distribution, the fall in GDP reduces the amount of wages and operating surplus of companies by approximately 4,000 and 3,000 million baht respectively, so that the impact in proportional terms is greater for companies than for the wage earners. The government is the only beneficiary from the increase in the petroleum prices as tax revenue increases despite the fall in the level of output. Employment also falls as a result of the fall in output. Agricultural employment declines from 17,583 to 17,555, a fall of about 30,000 jobs. The decline in employment is felt more strongly in the non-agricultural sectors, as total employment falls by nearly 10,000 jobs, or about 60,000 jobs in non-agriculture.

In sum, therefore, the increase in petroleum product prices has a deflationary impact on the economy through depressing domestic incomes and demand, while benefiting the public sector and the balance of trade.

The long term impact, up to 1990 and 1995, is broadly similar. The level of output falls below the reference run level, while overall price levels increase. Private sector incomes are depressed while tax revenue increases.

3.4.2 Alternative 3: Change in Relative Prices of Petroleum Products.

The main feature of alternative 3 is the increase in the price of diesel to narrow the differential between gasoline and diesel prices.

The macro-economic impact of this alternative is even more deflationary than an across-the-board price increase. For 1985 real GDP declines to 1,114,033 million baht. The overall price impact is marginally different from that of alternative 2, though the intermediate output sector is more strongly affected, as increases in transport costs increase overall production costs.

The deflationary impact on income is similar in direction to the impact of alternative 2, but is bigger in magnitudes. Thus wage income falls to 700,694 million baht, and operating surplus falls to 491,154 million baht compared with 703,120 and 492,827 million baht under alternative 2. Total tax revenue also increases to 181,419 million baht, a rise from 178,216 million baht under alternative 2.

Employment also decreases further, by about 30,000 in agriculture, and 35,000 in non-agriculture.

Finally, the pattern of impacts is maintained for 1990 and 1995.

3.5 Petroleum Product Consumption Under Various Alternatives

3.5.1 Reference Run

Under the assumptions adopted for the reference run, the model's forecast of the demand for petroleum products is given in Table 4.3, in terms of domestic demand and demand for imports. Since Domestic production capacity is fixed by the capacity of the refineries, (QL1–15 in the data input) the changes in total demand will be met by changes in the quantity of imports.

The model results show that for all the selected forecast years, there will be net imports for gasoline, diesel, kerosene and jet fuel. However, for fuel oil and LPG, there will be a surplus of domestic, supply over demand for 1985. However by 1990, the surplus will have turned into a deficit, so that further imports will be required. The surplus in 1985 is due to the use of natural gas for electric power generation in place of fuel oil and the production LPG from domestic natural gas. However, while demand grows over the period, domestic supply will remain fixed at the level of planned capacity expansion.

3.5.2 Alternative 2: High Petroleum Product Prices.

Under the assumptions of Alternative 2, which lead to a lower level of economic activity, indicated by a lower level of output, it may be expected that demand for petroleum products will also decline. This can be seen from Table 4.3. For instance, import of premium gasoline is 627 million litres, against 799 million litres in the reference run. In the case of fuel oil and LPG, the amount of exports is increased.

Over the forecasting period, the pattern of reduced import demand, relative to the reference run, is repeated. Given the same relation of product prices, the relative volumes of petroleum product consumption remain unchanged. Diesel continues to be most heavily demanded in terms of volume.

3.5.3 Alternative 3: Change in Relative Product Prices.

3.5.3.1 In Alternative 3, the price of gasoline is reduced while the price of diesel is raised. This may be expected to lead to a relative slowdown in the growth of diesel demand, while demand for gasoline is encouraged.

The model results conform to expectation. Demand for premium gasoline increases relative to that of the reference run. However, the increase does not extend to demand for regular gasoline probably owing to the smaller price differential between the two grades of gasoline. Demand for diesel declines relative to the level forecast in the reference run. For other petroleum products, where substitution with diesel is not at issue, demand falls as a result of the decline in the level of economic activity induced by the higher price of diesel.

Table 3.3 : Petroleum Product Consumption Under Alternative Price Assumptions, 1985, 1990 & 1995, Million Litres.

PRODUCT	AFTER.	1985		1990		1995	
		DOM.	IMP.	DOM.	IMP.	DOM.	IMP.
PMG	1	866	799	1047	953	1047	1525
	2	866	627	1047	740	1047	1275
	3	866	1143	1047	1375	1047	2020
RMG	1	1298	397	1570	417	1570	1037
	2	1298	350	1570	359	1570	966
	3	1298	256	1570	245	1570	842
KEROSENE	1	351	456	489	582	489	806
	2	351	403	489	509	489	716
	3	351	421	489	535	489	748
DIESEL	1	3488	2465	4875	1923	4875	3195
	2	3488	2368	4875	1810	4875	3056
	3	3488	2270	4875	1675	4875	2918
FUEL OIL	1	2573	-1123	3162	301	3162	2511
	2	2573	-1178	3162	238	3162	2427
	3	2573	-1209	3162	203	3162	2395
LPG	1	1137	336	865	401	865	752
	2	1137	-378	865	385	865	732
	3	1137	-386	865	374	865	721
JET FUEL	1	1024	402	1425	178	1425	410
	2	1024	379	1425	150	1425	376
	3	1024	354	1425	113	1425	340

3.6 Policy Implications of Simulation Results

3.6.1 Increasing Petroleum Product Prices.

The effect of raising petroleum product prices is to

1) reduce level of output and employment
2) improve the balance of trade
3) increase inflation
4) increase government tax revenue

These are measured against the alternative of keeping petroleum product prices at the level of 1984, and under the assumptions outlined at the beginning of this part.

Under the prevailing circumstances, with government concern centering on achieving a sustainable level of the rate of exchange after the recent devaluation and to maintain the fiscal deficit at a manageable level, it is probably preferable to sacrifice some growth of GDP for these objectives. Real GDP will have been

reduced by approximately 150 baht per person in 1985 (assuming 55 million population), and foregone employment of 106,000 jobs, or 4.0 per cent of the total employment forecast in the reference run. Adding a concern to improve the balance of payments, the reduction in the balance of trade deficit will amount to 4,423 billion baht in 1985, or 10% improvement on the deficit forecast in the reference run. These can be considered valuable gains to set against the loss in output.

3.6.2 Changing Petroleum Product Price Differentials.

The effect of changing the petroleum product price differentials, as expressed in alternative 3, is, relative to alternative 2, to

i) reduce the level of output and employment
ii) improve the balance of trade
iii) increase inflation
iv) increase government tax revenue

The main question is whether to raise the price of diesel, since it is considered impractical to consider lowering the price of gasoline due to the adverse impact on the government's tax revenue. We shall consider this issue in terms of whether the increase in relative diesel price can be justified, in the light of results obtained from alternative 2

The increase in relative diesel price would reduce-output from alternative 2 level by 41,721 billion baht, equivalent to a further reduction in per capita income of 75 baht for 1985. In return, the gain in the balance of trade will be 856 million baht. No change is predicted for the consumer price, index, though the intermediate goods price index will increase by 0.7%. The tax revenue will increase by 3,203 million baht, or 1.8% over the alternative 2 result.

3.6.3 Policy Recommendations

From the above discussion it should be seen that an across-the-board increase in petroleum product prices and an increase plus a change in relative prices produce both favourable impacts on the balance of trade and the tax revenue position, with marginal impact on output, inflation and incomes. However, Alternative 3 gives a more favourable outcome in terms of the balance of trade and the total tax revenue position. Thus it is recommended that alternative 3 be adopted, namely :

i) retail price for premium gasoline be set at 10 baht/litre.
ii) retail price for regular gasoline be set at 9.50 baht/litre.
iii) retail prices for diesel be increased to 9.25 baht/litre for high speed diesel and 9.00 baht/litre for low speed diesel
iv) prices of LPG be kept at the level of 1984.
v) price of kerosene by raised to 6.45 baht/litre.
vi) price of fuel oil be raised by 0.20 baht/litre for each type of fuel oil.

3.7 Simulation Results and Recent Trends in World Petroleum Product Prices.

3.7.1 Recent Trends in Petroleum Product Prices

Since the beginning of 1985, the world market for petroleum products has witnessed a downward trend in prices, both of crude oil and refined products, as OPEC suppliers continue to exceed production quotas and refineries reduce prices to maintain. Some degree of capacity utilisation. These trends have a direct impact on Thailand in three respects.

3.7.2 Directions of Impact

The first level of impact concerns the fall in the price of crude oil. If import of crude oil is obtained at lower prices, an immediate gain is achieved in the balance of trade, which will in turn allow a greater volume of other imports. This should benefit the economy directly by allowing a higher level of economic activity at the same level of import and indirectly by lowering the cost of production of industries, if the reduction in crude prices is passed to consumers in the form of lower retail prices.

The second level of impact relates to the domestic petroleum industry. Ex-refinery prices are calculated on the basis of foreign prices, in practice Singporean refinery prices. The higher the foreign price, the higher will be the exrefinery prices which in turn means the greater the profit for the refinery, as long as the price so determined is above the refinery's cost of production. However, if following a fall in foreign prices, the calculated ex-refinery prices fall to below the refinery's costs of production, the refinery will not be able to operate profitably. From a broad economic perspective, it may be argued that domestic refineries should then cease to operate and the country switch to importing its demand for petroleum products. To accept this logic would however be short-sighted as the cost of shutting down the refineries would out-weigh the saving in the change to foreign sources, not to mention the cost of greater dependence on imports. Thus it should be an objective of policy to maintain the refineries in operation, even if they may have to be subsidised for doing so. The retail prices should be set so that the consumer may enjoy the benefit of lower prices, while at the same time having the benefit of a secure source of petroleum from the domestic supply capacity.

The final aspect of the petroleum pricing issue concerns the status of the public sector's tax revenue. As shown in the simulation results, the government benefits from maintaining a high retail price for petroleum products, at the expense of the private sector and the overall country. Lowering the ex-refinery prices and keeping the retail prices constant would have the same fiscal effect, since the difference will accrue to the government in the form of taxes and oil fund levy. The advantages of keeping a large margin between retail price and ex-refinery prices are, in

addition, that overall level of demand is constrained, so that import demand is kept low, until refineries cease production and turn to imports to satisfy the demand for refined products.

3.7.3 Issues for Further Study

Taking the above consideration into account, we propose a number of policy alternatives for further investigation.

i) Examination of changes in ex-refinery prices and retail prices to achieve the objectives of macro-economic growth and stability, and public sector revenue position.

ii) Examination of the rate of utilisation of domestic petroleum resources both oil and gas to take advantage of the current low prices for petroleum products in the world market.

APPENDIX 1

Sectoral Classification of the Model

Sector No.	Sector	Commodities and Correspondence with Code in Basic Input-Output Table
1	Gasoline-Premium	Gasoline-Premium 093A
2	Gasoline-Regular	Gasoline-Regular 093B
3	Diesel	H-Diesel 093F, L-Diesel 093G
4	LPG	LPG 093D
5	Fuel Oil	Fuel Oil 093H
6	Kerosene	Kerosene 093E
7	Jet Fuel	Jet Fuel 093C
8	Other Petroleum Products	Other Products 093I, 094
9	Natural Gas	Natural Gas (condensated) 136
10	Crude Oil	Crude Petroleum 031A
11	Condensate	Natural Gas 031B
12	Electricity	Electricity-Fuel Oil 135B, Natural gas 135C Nuclear 135D, Lignite 135E, Solar 135F, Others 135G
13	Electricity-Hydro	Electricity-Hydro 135A
14	Charcoal	Charcoal 026A
15	Fuel Wood	Fuel Wood 026B
16	Coal	Coal 030A
17	Lignite	Lignite 030B
18	Bagasse	Bagasses 055B
19	Saw Mill Waste	Saw Mill Waste 078B
20	Nuclear	Nuclear Power 180B
21	Solar	Solar Energy 180C
22	Other Energy	Energy Unclassified 180D
23	Exportable Crops	Paddy 001, Rice Milling 049, Maize 002, Other, Cereals 003 Cassava 004, Sugar Cane 009, Kenaf & Jute 012, Tapioca Milling 050, Grinding of Maize 051, Flour and Other Grain Milling 052, Sugar 055A, Rubber 016, Rubber Sheet & Block Rubber 095
24	Other Crops	Other Root Crops 005, Beans & Nuts 006; Vegetables 007, Fruits 008, Coconut 010, Oil Palm 011, Other Crops for Textiles & Matting 013, Tobacco 014, Coffee & Tea 015, Other Agriculture Products 017, Tobacco Processing 065, Tobacco Products 066

Sector No.	Sector	Commodities and Correspondence with Code in Basic Input-Output Table
25	Other Agriculture	Cattle & Buffalo 018, Swine 019, Other Livestock 020, Poultry 021 Poultry Products 022, Silkworms 023, Agricultural Services 024, Logging 025, Other Forest Products 027, Ocean & Coastal Fishing 028, Inland Fishing 029
26	Mining & Quarrying	Iron Ore 032, Tin Ore 033, Tungsten Ore 034, Other Non-Ferrous Metal Ore 035, Flouritc 036, Chemical Fertilizer 037, Salt 038, Lime 039, Stone Quarrying 040, Other Mining & Quarrying 041, Non Ferrous Metal 107
27	Food Processing	Slaughtering 042, Canning & Preservation of Meat 043 Dairy Products 044, Canning & Preservation of Vegetables 045, Canning & Preservation of Fish & Other Sea Foods 046, Coconut & Palm Oil 047, Animal Oil, Animal Fat, Vegetable Oil & By-Products 048, Bakery Products 053, Noodles & Similar Products 054, Confectionary 056, Ice 057, Monosodium Glutamate 058, Coffee & Tea 059, Other Food Products 060, Animal Feed 061, Distilling & Spitrits Blending 062, Breweries 063, Soft Drinks & Carbonated Water 064
28	Other Manufacturing Industry	Fertilizers & Pesticides 085, Spinning 067, Weaving 068, Textile Bleaching & Finishing 069, Made up Textile Goods 070, Knitting 071, Wearing Apparel 072, Carpets & Rugs 073, Jute Mill Products 074, Tanneries & Leather Finishing 075, Leather Products 076, Footwear, Except of Rubber 077, Sawmills 078A, Wood Furniture & Fixtures 080, Pulp, Paper & Paper-Board 081, Paper and Paper-Board Products 082, Printing & Publishing 083, Basic Industrial Chemical 084, Synthetic Resins, Plastics & Artificial Fiber Material, Excluding Glass 086, Paints, Varnishes & Laquers 087, Drugs & Medicines 088, Soap and Cleaning Preparations

Sector No.	Sector	Commodities and Correspondence with Code in Basic Input-Output Table
		089, Cosmetics 090, Matches 091, Other Chemical Products 092, Tires & Tubes 097, Plastic Ware 098, Ceramics & Earthware 099, Glass & Glass Products 100, Structural Clay Products 101, Cement Products 103, Other Non-Metallic Products 104, Scientific Equipment 129, Photographic & Optical Goods 130, Watches & Clocks 131, Jewelry & Related Articles 132, Recreational & Athletic Equipment 133, Other Manufactures Goods 134 Iron & Steel 105, Secondary Steel Products 106, Cutlery & Hand Tools 108, Metal Furnitures & Fixtures 109, Structural Metal Products 110, Other Fabricated Metal Products 111, Engines & Turbines 112, Agricultural Machinery 113, Wood & Metal Working Machines 114, Special Industrial Machinery 115, Office & Household Machinery & Appliance 116, Electrical Industrial Machinery & Appliances 117, Radio Television & Communication Equipment and Apparatus 118, Household Electrical Appliances 119, Insulated Wire & Cable 120, Electric Accumulators & Batteries 121, Other Electrical Aparatus & Supplies 122, Ship Building & Repairing 123, Railroad Equipment 124, Motor Vehicles 125, Motorcycles & Bicycles 126, Repair of Vehicles 127, Aircraft 128
29	Construction	Residential Building & Construction 138, Non-Residential Building & Construction 139, Public Works for Agriculture & Forestry 140, Non-Agricultural Public Works 141, Construction & Communication Facilities 143, Other Construction 144
30	Market Services	Restaurants & Drinking Places 147, Hotels & Places of Lodging 148, Banking Services 160, Life Insurance Services 161, Other Insurance

Sector No.	Sector	Commodities and Correspondence with Code in Basic Input-Output Table
		Services 162, Real Estate 163, Business Services 164, Motion Picture Production 172, Movie Theaters 173, Radio, Television and Related Services 174, Amusement and Recreation 176, Repairs Not Elsewhere Classified 177, Personal Services 178, Other Services Not Elsewhere Classified 179
31	Non Market Services	Public Administration 165, Sanitary & Similar Services 166 Education 167, Research 168, Hospitals 169, Business & Labor Associations 170, Other Community Services 171, Water & Supply 137
32	Transport & Communication	Railway 149, Road Passenger Transport 150, Road Freight Transport Services 152, Ocean Transport 153, Coastal & Inland Water Transport 154 Water Transport Services 155, Air Transport 156, Other Services 157, Storage & Warehousing 158, Post & Telecommunications 159
33	Trade	Wholesale Trade 145, Retail Trade 146

The general equilibrium model has 8 types of petroleum products which are further disaggregated in the petroleum pricing sub-model as follows :

1. Gasoline-premium
2. Gasoline-regalar
3. Kerosene
4. H-Diesel
5. L-Diesel
6. Fuel oil 600
7. Fuel oil 1200
8. Fuel oil 1500
9. Fuel oil 2000
10. Fuel oil 2500
11. LPG-large
12. LPG-small
13. LPG-auto
14. Other products
15. Jet fuel

APPENDIX 2.1

Equations Used in the Model

EQUATION 1 P_j .. = exogeneously fixed, $j = 1,---13$

EQUATION 2 $$P_{jt} = \frac{PQ_{jt} + TC_{jt} + P_{32} + TM_{jt} + P_{33t}}{1 + TC_{jo} + TM_{jo}}$$ $j = 14\text{-}22, 24, 25, 27\text{-}33$

EQUATION 3 $$P_{jt} = PW_{jt}.(1 + T \times R_{jo})/(1 + T \times R_{jt})$$ $j = 23, 26$

EQUATION $$PQ_{jt} = \sum_{i=1}^{n} P_{it} \cdot A_{it} + W_t.L_{jt} + TR_{jt} + PQ_{jt} + R_{jt}.PQ_{jt}$$ $j = 1,---33$

EQUATION 5 $$PQ_{jt} = P_{jt}.(1 + TC_{jo} + TM_{jo}) - TC_{jt}.P_{32t} - TM_{jt}.P_{33t}$$ $j = 23, 26$

EQUATION 6 $$PQ_{jt} = P_{jt}.(1 + TC_{jo} + TM_{jo}) - TC_{jt}.P_{32t} - TM_{jt}.P_{33t}$$ $j = 12, 13$

EQUATION 7 $$R_{jt} = \frac{1}{PQ_{jt}} PQ_{jt} - \sum_{i=1}^{n} P_{it}.A_{ijt} - W_t.L_{jt} - TR_{jt}.PQ_{jt}$$ $j = 23, 26$

EQUATION 8 $$PQ_{jt} = \sum_{i=1}^{n} P_{it}.A_{it} + W_t.L_{jt} + TR_{jt}.PQ_{jt} + R_{jt}.PQ_{jt}$$ $j = 14\text{-}22, 24, 25, 27\text{-}33$

EQUATION 9 $$TC_{jt}.P_{32}t + TM_{jt}.P_{33t} = P_{jt}.(1 + TC_{jo} + TM_{jo}) - PQ_{jt}$$

such that TC_{jt}/TM_{jt} remain unchanged $j = 1, 2,-----, 11$

EQUATION 10 $$\frac{P_{it}.A_{ikt}}{\sum_{j=1}^{8} P_{jt}.A_{ikt}} = \frac{A_{iko}}{\sum_{j=1}^{8} A_{jko}} + \sum_{j} GS_{ijk}.\log P_{jt}$$ $i = 1, 2, ----, 8$

APPENDIX 2.1 (Continued)

EQUATION 11 $$\frac{A_{ijt}}{A_{i+n,jt}} = \frac{A_{ijo}}{A_{i+n,jo}} \cdot \left(\frac{P_{it}}{P_{i+n,t}}\right)^{\sigma_i}$$ $i = 1,2....,33,\ n = 33$

EQUATION 12 $$P_{i+n,t} = \frac{PM_{it} \cdot (1 + TMR_{it})(1 + TC_{i+n,t} \cdot P_{32t} + TM_{i+n,t} \cdot P_{33t})}{(1 + TMR_{io})\ (1 + TC_{i+n,o} + TM_{i+n,o})}$$ $i = 1,2---,\ 33,\ n = 33$

EQUATION 13 $$P_{i+n,t} = P_{i,t}$$ $i = 1,\ 2---,\ 8$

EQUATION 14 $$P_{it} \cdot CGR_{it} = X_{it} \cdot CGT_t$$ $i = 1,\ ---33,\ 34,...66$

EQUATION 15 $$CGR_t = \sum_{i=1}^{m} CGR_{it}$$

EQUATION 16 $$P_{it} \cdot IGR_{it} = \mu_{it}\ IGT_t$$

EQUATION 17 $$PCGT_t = CGT_t / CGTR_t$$

EQUATION 18 $$PIPB_t = IGR_t / IGTR_t$$

EQUATION 19 $$IGTR_t = \sum_{i} IGR_{it}$$

EQUATION 20 $$IPR_t = \underset{(1.1)}{1367.7} + \underset{(2.1)}{0.295}\ (GDPR_t - GDPR_{t-1}) + \underset{(3.6)}{0.575}\ (GDPR_{t-1} - GDPR_{t-2})$$

$$= \underset{(8.8)}{+1.15}\ ((OSC_t - HIEP_t)/PIPVT_t)$$

$R^2 = 0.98$ D.W. = 2.26 N = 22

EQUATION 21 $IPR_{it} = \nu_{it} . IPR_t$ $i = 1, 2, ---23$

EQUATION 22 $IPT_t = \sum_i IP_{it}$

EQUATION 23 $PIPV_t = IPT_t / IPTR_t$

EQUATION 24 $ER_{it} = E_{it}/PX_{it} = ER_{io} . GDPW_{it}^{\rho_i} . (PW_{it}/PX_{it})^{\eta_i}$ $i = 1, 2, ...33$

EQUATION 25 $PX_{it} = P_{it} . (1 + T \times R_{it})/(1 + T \times R_{io})$

EQUATION 26 $EXG_t = \sum_{i=1}^{28} PX_{it} . ER_{it}$

EQUATION 27 $EXS_t = \sum_{i=29}^{33} PX_{it} . ER_{it}$

EQUATION 28 $EXGR_t = \sum_{i=1}^{28} ER_{it}$

EQUATION 29 $EXSR_t = \sum_{i=29}^{33} ER_{it}$

EQUATION 30 $\log(CFTR_t) = 9.9 + 3.71 \log(GDPWF_t) - 0.65 \log \frac{PCFT_t}{PWF_t}$

$R^2 = 0.98$ D.W. = 1.11 W = 21

EQUATION 31 $CFR_{it} = k_i . CFTR_t$

APPENDIX 2.1 (Continued)

EQUATION 32 $$CPR^{*}_{it} = (\gamma_{it} + \beta_{it} \cdot CPT_t)/PA_{it}$$

EQUATION 33 $$P_{it} = P_{i+n,t} = PA_{it} \qquad i = 1, 2, \text{----}8$$

EQUATION 34 $$\frac{\gamma_{it} + \beta_{it} \cdot CPT_t}{\sum_{j=1}^{8} \gamma_{it} + \beta_{it} \cdot CPT_t} = \frac{\gamma_{io} + \beta_{io} \cdot CPT_t}{\sum_{j=1}^{8} \gamma_{jo} + \beta_{jo} \cdot CPT_t} + \sum_{j=1}^{8} G_{ij} \log P_{jt}$$

EQUATION 35 $$\frac{CPR_{it}}{CPR_{i+n,t}} = \frac{CPR_{io}}{CPR_{i+n,o}} \left(\frac{P_{i+n,t}}{P_{it}} \right)^{\sigma_i}$$

EQUATION 36 $$CPR^{*} = CPR_{it} + CPR_{i+n,t}$$

EQUATION 37 $$PA_{it} \cdot CPR^{*}_{it} = P_{it} \cdot CPR_{it} + P_{i+n,t} \cdot CPR_{i+n,t}$$

EQUATION 38 $$XR_{it} = QR_{it} \cdot (1 + TC_{io} + TM_{io})$$

EQUATION 39 $$XR_{it} = \sum_{i=j}^{33} A_{ijt} \cdot QR_{jt} + CGR_{it} + IGR_{it} + CPR_{it} + IPR_{it} + ER_{it} + CFR_{it}$$

EQUATION 40 $$ER_{it} = XR_{it} - \sum_{j=1}^{33} A_{ijt} \cdot QR_{jt} - CGR_{it} - IGR_{it} - CPR_{it} - IPR_{it} - CFR_{it} \qquad i = 23, 24$$

EQUATION 41 $XR_{i+n,t} = \sum_{i=1}^{33} (A_{ijt} + A_{i+n,jt}).QR_{jt} + CGR_{it} + CGR_{i+n,t} + IGR_{it} + IGR_{i+n,t}$

$+ CPR_{it} + CPR_{i+n,t} + IPR_{it} + IPR_{it} + IPR_{i+n,t} + ER_{it} + CFR_{it}$

$+ CFR_{i+n,t} - XR_{it}$ $\quad i = 1,2...,33,\ n = 33$

EQUATION 42 $QR_{it} = XR_{it} / (1 + TC_{io} + TM_{io})$ $\quad i = 1,2...,33.$

EQUATION 43 $XR_{it} = \sum_{i=1}^{33} A_{ijt}.QR_{jt} + CGR_{it} + IGR_{it} + CPR_{it} + IPR_{it} + CFR_{it}$

$i = 1,2,....33.$ $\quad i \neq$ petroleum products

EQUATION 44 $MR_{it} = XR_{i+n,t}/(1 + T \times R_{i+n,o})(1 + TC_{i+n,o} + TM_{i+n,o})$ $\quad i = 1,2,...33,\ n = 33$

EQUATION 45 $TT_t = TI_t + TDC_t + TDH_t$

EQUATION 46 $TI_t = TID_t + TIM_t + TIX_t$

EQUATION 47 $TID_t = \sum_{j=1}^{33} TR_{jt}.PQ_{jt}.QR_{jt}$

EQUATION 48 $TIM_t = \sum_{j=1}^{33} \frac{TMR_{jt}.P_{j+n,t}.XR_{j+n,t}}{(1 + TMR_{jt})(1 + TC_{j+n,t}.PQ_{33t} + TM_{j+n,t}.PQ_{34t})}$

EQUATION 49 $TIX_t = \sum_{j=1}^{33} ER_{jt}.TXR_{jt}.P_{jt}$

APPENDIX 2.1 (Continued)

EQUATION 50 $TOG_t = TT_t + IPEG_t + CTG_t + CFWG_t$

EQUATION 51 $CTG_t = -54.3 + .0033HI_t$

(-2.0) (39.4)

$R^2 = 0.99$ D.W. = 1.39 N = 24

EQUATION 52 $CFWG_t = 298.9 + 0.0024\ TOG_t$

(2.0) (9.6)

$R^2 = 0.81$ D.W. = 0.48 N = 24

EQUATION 53 $SG_t = TOG_t - INPDG_t - CFG_t - CTWG_t - CGT_t$

EQUATION 54 $CFG_t = 210.3 + .0016\ TOG_t$

(9.3) (4.1)

$R^2 = 0.44$ D.W. = 1.17 N = 24

EQUATION 55 $CTWG_t = 22.2 - .000097\ TOG_t$

(6.8) (-1.8)

$R^2 = 0.12$ D.W. = 0.92 N = 24

EQUATION 56 $INPDG_t = 9.4 + 0.958\ INPDG_{t-1} + 0.07(IGT_{t-1} - SG_{t-1})$

(0.1) (15.6)

$R_2 = 0.998$ D.W. = 29 N = 23

EQUATION 57 $TOC_t = OSC_t + INCD_t + INPDG_t + NFI_t$

EQUATION 58 $TOS_t = \sum_{j=1}^{33} R_{jt} \cdot PQ_{jt} \cdot QR_{jt}$

EQUATION 59 $OSC_t = 634.7 + 0.984\ TOS_t$

(1.8) (690.1)

$R^2 = 1.00$ D.W. = 0.76 N = 24

EQUATION 60 $IPEG_t = TOS_t - OSC_t$

EQUATION 61 $D_t = -2644.3 + 0.127\ TOS_t$

(-5.3) (64.0)

$R^2 = 0.99$ D.W. = 0.68 N = 24

EQUATION 62 $HIEP_t = 2057.0 + 0.855\ OSC_t$

(3.3) (341.6)

$R^2 = 1.000$ D.W. = 1.00 N = 24

EQUATION 63 $TDC_t = -241.2 + 0.235\ (OSC - HIEP_t - D_t) + 0.971\ TDC_{t-1}$

(-1.6) (7.1) (31.5)

$R^2 = 0.989$ D.W. = 2.7 N = 23

EQUATION 64 $SC_t = TOC_t - TDC_t - HIEP_t$

EQUATION 65 $WAGE_t = WROW_t + \sum_{j=1}^{n} W_t \cdot L_{jt} \cdot QR_{jt}$

APPENDIX 2.1 (Continued)

EQUATION 66 $HI_t = WAGE_t + HIEP_t + CFG_t + CFW_t$

EQUATION 67 $\log(CFW_t) = \underset{(40.6)}{6.79} + \underset{(6.3)}{0.128} + HI_t$

$R^2 = 0.64$ D.W. = 0.87 N = 24

EQUATION 68 $\log(TDH_t) = \underset{(-3.5)}{-2.20} + \underset{(3.2)}{0.358}\log(HI_{t-1}) + \underset{(7.8)}{0.746}\log(TDH_{t-1})$

$R^2 = 0.998$ D.W. = 2.24 N = 23

EQUATION 69 $CTW_t = \underset{(5.1)}{49.0} + \underset{(16.7)}{.00051}\ HI_t$

$R^2 = 0.93$ D.W. = 2.24 N = 24

EQUATION 70 $INCD_t = \underset{(-1.3)}{-196.5} + \underset{(6.7)}{0.996}\ INCD_{t-1} + .0039\ CPT_{-1}$

$R^2 = 0.996$ D.W. = 2.71 N = 23

EQUATION 71 $CPT_t = \underset{(-1.5)}{-1338.1} + \underset{(21.2)}{0.60}\ (HI_t - TDH_t - CTG_t - INCD_t - CTW_t) + \underset{(9.1)}{0.34}\ CPT_{t-1}$

$R^2 = 1.00$ D.W. = 2.55 N = 23

EQUATION 72 $SH_t = HI_t - TDH_t - CTG_t - INCD_t - CTW_t - CPT_t$

EQUATION 73 $BT_t = EXG_t - MG_t$

EQUATION 74 $TRAN_t = CFW - CTW_t + CFWG_t - CTWG_t$

EQUATION 75 $NFI_t = \underset{(0.9)}{334.9} + 0.79\ NFI_{t-1} + \underset{(-6.3)}{0.12}\ CA_{t-1}$

$R^2 = 0.98 \qquad D.W = 3.25 \qquad N = 21$

EQUATION 76 $CA_t = BT_t + EXS_t - MS_t + TRAN_t + NFW_t$

EQUATION 77 $NFW_t = NFI_t + WROW_t$

EQUATION 78 $VA_{jt} = (W_t \cdot L_{jt} + R_{jt} \cdot PQ_{jt}) \cdot QR_{jt}$ $\quad j = 1, 2, \ldots 33.$

EQUATION 79 $VAR_{jt} = (L_{jt} + R_{jt})\ QR_{jt}$ $\quad j = 1, 2, \ldots 33.$

EQUATION 80 $GDPF_t = \sum_{j=1}^{33} VA_{jt}$

EQUATION 81 $GDPFR_t = \sum_{j=1}^{33} VAR_{jt}$

EQUATION 82 $GDP_t = GDPF_t + TI_t$

EQUATION 83 $GNP_t = GDP_t + NFW_t$

EQUATION 84 $QL_{it} = XR_{it}/POX_{it}$ $\quad i = 1, 2, 3, 15, 16, 17.$

APPENDIX 2.1 (Continued)

EQUATION 85 $ROE_{it} = TOE_{it} \cdot QL_{it}$ $i = 1,------36$

EQUATION 86 $ROF_{it} = TOF_{it} \cdot QL_{it}$ $i = 1,------36$

EQUATION 87 $ROT_{it} = ROE_{it} + ROF_{it}$ $i = 1,------36$

EQUATION 88 $CPIR_{it} = CPR_{it} + CPR_{i+nt}$ $i = 1,------33,\ n = 33.$

EQUATION 89 $CPBR_{it} = CGR_{it} + CGR_{i+nt}$ $i = 1,------33,\ n = 33.$

EQUATION 90 $IPVP_{it} = IPR_{it} + IPR_{i+nt}$ $i = 1,------33,\ n = 33.$

EQUATION 91 $IPBR_{it} = IGR_{it} + IGR_{i+nt}$ $i = 1,------33,\ n = 33.$

EQUATION 92 $CFOR_{it} = CFR_{it} + CFR_{i+nt}$ $i = 1,------33,\ n = 33.$

EQUATION 93 $CPI_{it} = CPR_{it} \cdot P_{it} + CPR_{i+nt} \cdot P_{i+nt}$ $i = 1,------33,\ n = 33.$

EQUATION 94 $CPB_{it} = CGR_{it} \cdot P_{it} + CPR_{i+nt} \cdot P_{i+nt}$ $i = 1,------33,\ n = 33.$

EQUATION 95 $IPV_{it} = IPR_{it} \cdot P_{it} + IPR_{i+nt} \cdot P_{i+nt}$ $i = 1,------33,\ n = 33.$

EQUATION 96 $IPB_{it} = IGR_{it} \cdot P_{it} + IGR_{i+nt} \cdot P_{i+nt}$ $i = 1,------33,\ n = 33.$

EQUATION 97 $CFO_{it} = CFR_{it}.P_{it} + CFR_{i+nt}.P_{i+nt}$ i = 1,------33

EQUATION 98 $PCP_{it} = CPI_{it}/CPIR_{it}$ i = 1,------33

EQUATION 99 $PCG_{it} = CPB_{it}/CPBR_{it}$ i = 1,------33

EQUATION 100 $PIPV_{it} = IPV_{it}/IPVR_{it}$ i = 1,------33

EQUATION 101 $PIPB_{it} = IPB_{it}/IPBR_{it}$ i = 1,------33

EQUATION 102 $PCF_{it} = CFO_{it}/CFOR_{it}$ i = 1,------33

EQUATION 103 $VA_{it} = (W_t.L_{it} + R_{it}.PQ_{it}).QR_{it}$ i = 1,------33

EQUATION 104 $VAR_{it} = (L_{it} + R_{it}).OR_{it}$ i = 1,------33

EQUATION 105 $PVA_{it} = VA_{it}/VAR_{it}$ i = 1,------33

EQUATION 106 $X_{it} = P_{it}.XR_{it}$ i = 1,------33

EQUATION 107 $Q_{it} = PQ_{it}.QR_{it}$ i = 1,------33

EQUATION 108 $EX_{it} = P_{it}(1 + T \times R_{it}).ER_{it}$ i = 1,------33

APPENDIX 2.1 (Continued)

EQUATION 109 $EXR_{it} = (1 + T \times R_{io}).ER_{it}$ $i = 1,------33$

EQUATION 110 $MR_{it} = XR_{i+nt}/(1 + TMR_{i+no})(1 + TC_{i+no} + TM_{i+no})$

EQUATION 111 $INR_{jt} = \sum_{i=1}^{33} A_{ijt} + A_{i+n,jt}.QR_{jt}$ $i = 1,------33$

EQUATION 112 $IN_{jt} = \sum_{i=1}^{33} P_{jt}.A_{ijt} + P_{j+nt}.A_{i+n,jt}.QR_{jt}$ $i = 1,------33$

EQUATION 113 $PIN_{jt} = IN_{jt}/INR_{jt}$

APPENDIX 2.2

Alphabetical List of Variables

Variable	Number	Description of Variable
Aij		(i, j) th element of Input-Output Table
BT	695	trade balance
CA	696	current account balance
CFG	681	current transfer from government to household
CFOi	2101-2133	consumption of foreigners of good i
CFORi	2101-2133	consumption of foreigners of good i (real)
CFT	1108	total consumption of foreigners
CFTR	1107	total consumption of foreigners (real)
CFW	680	current transfer from abroad to households
CFWG	649	current transfer from abroad to government
CGi		public consumption of good i
CGRi	821-886	public consumption of good i (real)
CGT	663	total public consumption
CGTR	664	total public consumption (real)
CPBi	1781-1813	public consumption of good i
CPBRi	1741-1773	public consumption of good i (real)
CPIi	1661-1693	private consumption of good i
CPIRi	1621-1653	private consumption of good i (real)
CPi		private consumption of good i
CPRi	361-426	private consumption of good i (real)
CPT	671	total private consumption
CPTR	672	total private consumption (real)
CPR*i		private consumption of composite good i (domestic + import) (real)
CTG	653	current transfer to government
CTW	685	current transfer from households to the rest of the world
CTWG	648	current transfer from government to the rest of the world
D	657	depreciation
Ei		export of good i
EMPi	2581-2592	employment in sector i, thousand persons
ERi	901-9333	export of good i (real)
EXCH	1130	exchange rate index, 1982=1
EXG	673	total export of goods
EXGR	674	total export of goods (real)
EXi	2461-2493	export of good i

APPENDIX 2.2 (Continued)

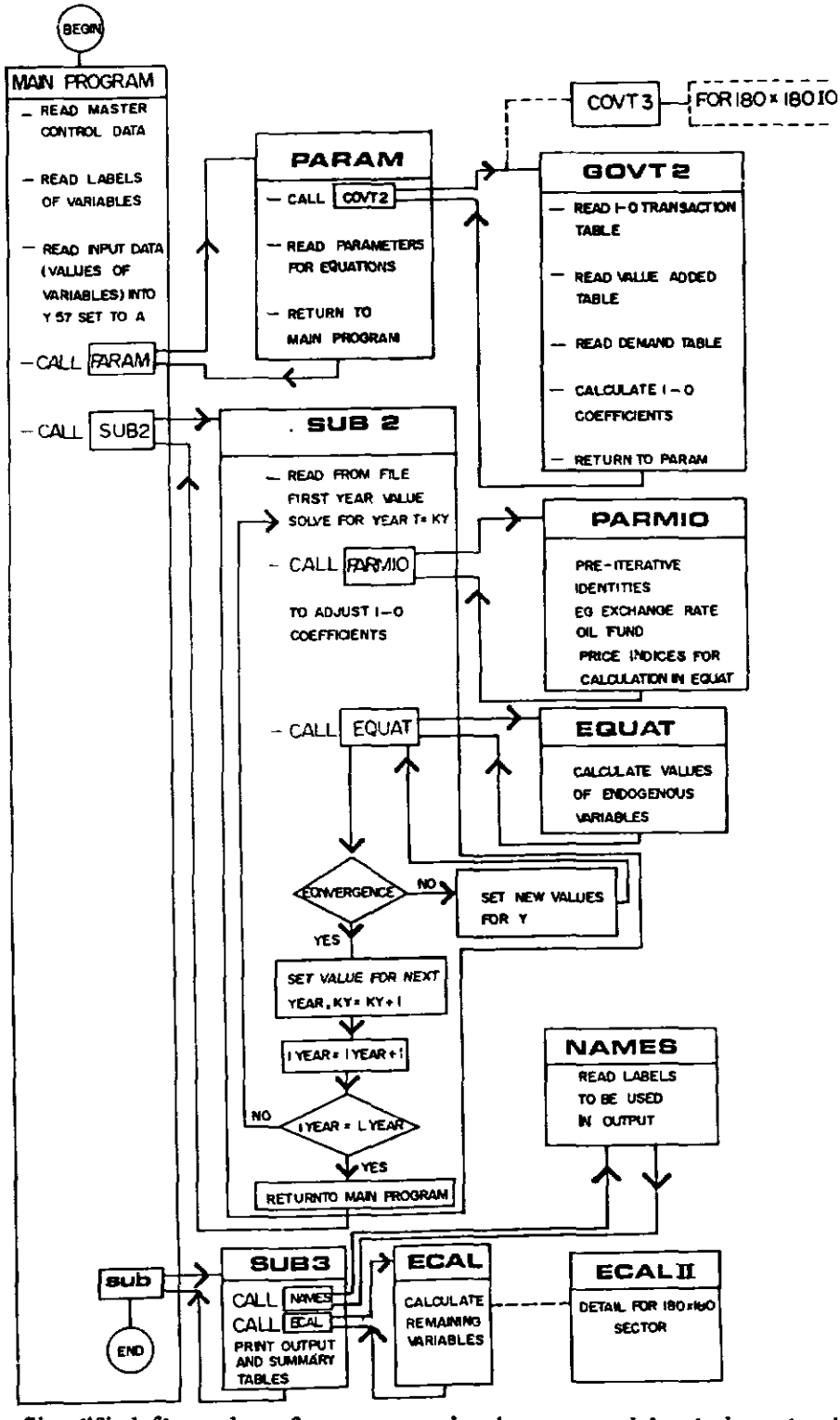
Variable	Number	Description of Variable
EXRi	2421-2453	export of good i (real)
EXS	689	total export of services
EXSR	690	total export of services (real)
EXT	1123	total exports
EXTR	1124	total exports (real)
GDP	1101	GDP at market prices
GDPR	1102	GDP at market prices (real)
GDPRk	1121-1122	GDP at market prices (real) lagged k years
GDPF	1103	GDP at factor cost
GDPFR	1104	GDP at factor cost (real)
GDPWi	561-593	world GDP index for commodity i
GDPWF	1127	world GDP index for turism
GNP	1105	GNP at current market prices
HI	682	household income
HIEP	679	household income from property and entrepreneurship
IGi		public investment demand for good i
IGRi	281-346	public investment demand for good i (real)
IGT	665	total public investment
IGTR	666	total public investment (real)
INCD	683	interest on consumers' debt
INi	2341-2373	intermediate demand for good i
INRi	2301-2333	intermediate demand for good i (real)
INTDT		total intermediate demand
INTDTR	662	total intermediate demand (real)
IPi		private investment demand for good i
IPBi	2021-2053	public investment demand for good i
IPBRi	1981-2013	public investment demand for good i (real)
IPEG	651	government income from property and entrepreneurship
PPRi	441-506	private investment demand for good i (real)
IPT	667	total private investment
IPTR	668	total private investment (real)
IPVi	1900-1933	private investment in good i
IPVRi	1861-1893	private investment in good i (real)
IR	1129	
IT	669	total investment
ITR	670	total investment (real)
Li		labour share of sector i
Mi	2541-2573	import c.i.f. of good i
MRi	2501-2533	import c.i.f. of good i (real)

Variable	Number	Description of Variable
MG	675	total import of goods
MGR	676	total import of goods (real)
MS	691	total import of services
MSR	692	total import of services (real)
MT	1125	total imports
MTR	1126	total imports (real)
NFI	693	net investment income from abroad
NFW	694	net factor income from the rest of the world
OSC	655	operating surplus of companies
Pi	1–33	purchaser's price for good i
PAi		price of composite good i (domestic + import)
PCFi	2181–2213	price deflator for tourist expenditure on good i
PCFT	1113	price deflator for tourist expenditure
PCGT	1110	price deflator for government consumption
PCPi	1701–1733	price deflator for private consumption of good i
PCRP		purchaser's price of crude oil
PCRW		well-head price of crude oil
PCSP		purchaser's price of condensate
PCSW		well-head price of condensate
PGDP	1106	GDP deflator
PINi	2381–2413	price deflator for intermediate demand of good i
PINT	1114	price deflator for total intermediate demand
PIPBi	2061–2093	price deflator for public investment for good i
PIPBT	1112	price deflator for public investment
PIPVi	1941–1973	price deflator for private investment for good i
PIPVT	1111	price deflator for private investment
PMi	981–1013	import price (c.i.f.) of good i
PMG	1118	price index for imported goods
PMS	1119	price index for imported services
PMT	1120	price index for total imports
PNGP		purchaser's price of natural gas
PNGW		well-head price of natural gas
PORi	1301–1318	retail price of petroleum product i
POXi	1141–1176	ex-refinery price of product i
PQi	741–773	producer's price of good i
PVAi	1581–1631	price deflator for sector i
PWi	601–633	world price for good i
PWF	1128	world price of tourism

Variable	Number	Description of Variable
PXi	781–813	export price of good *i*
PXG	1115	price index for export of goods
PXS	1116	price index of export of services
PXT	1117	price index of total exports
QCR		domestic production of crude oil
QCS		domestic production of condensate
QLi	1321–1338	domestic production of petroleum product i, i = 1,....18
QLi + 18	1339–1356	import of petroleum product i, i = 1,....18
QRi	701–740	production of good i at producer's prices
QTR	700	total production at producer's prices (real)
Ri	81–113	profit rate of sector i (real)
ROEi	1401–1436	excise tax revenue from petroleum product i
ROFi	1361–1396	oil fund revenue from petroleum product i
ROTi	1441–1474	total tax revenue from petroleum product i
S	660	total gross savings
SC	659	corporations' savings
SH	686	households's savings
Ti	121–153	indirect tax rate on domestic good i (current price)
TCi		transport cost on good i (real)
TDC	658	corporate income tax
TDH	684	personal income tax
TI	646	total indirect tax
TID	641	total indirect tax on domestic goods
TIDO	642	total indirect tax on domestic oil products
TIM	643	total import taxes
TIMO	644	total import taxes on petroleum products
TIX	645	export tax
TMi		trade margin on good i (real)
TMOi	1221–1256	marketing margin on petroleum product i
TMRi	941–973	rate of import duty on good i
TOC	656	total income of companies
TOEi	1181–1220	excise tax rate on petroleum product i
TOFi	1261–1296	oil-fund levy on petroleum product i
TOG	650	total government income
TOS		total operating surplus of companies
TRi	611–193	indirect tax rate on domestic good i (real)
TRAN	697	net transfer from abroad

Variable	Number	Description of Variable
TREND	688	time trend, 1982 = 1
TT	647	total taxes
TXRi	521–553	export tax rate on good i
VAi	1541–1573	value added of sector i
VARi	1501–153	value added of sector i (real)
W	687	wage rate index, 1982 = 1
WAGE	678	total wage income
WROW		net wage income from abroad
Xi	2221–2253	total supply of good i
XRi	201–266	total supply of good i (real)
XT		total supply
XTR	698	total supply (real)
XTMi		total supply of imported good i
XTMRi	699	total supply of imported good i (real)

APPENDIX 3



Simplified flow chart for energy price impact model solution algorithm.

Short-Terms Economic Forcasting : A Case of Thailand

Kitti Limskul

1. Introduction

This paper plans to identify indicators of business cycles in the Thai economy. Before 1970's the economy had not yet fully industrialized as agriculture was still the main and leading industry. However, since the end of 1970's the manufacturing sector played more important role in terms of real GDP. As the Thai economy grows more and more towards industrialization the role of short-term adjustment of expectations among business enterprises become indispensable. It is our task to show that there is business cycles in the Thai economy. And if it is possible to depict those indicators of leading, coincident, and lagging which are specific to the Thai economy, it may be helpful, for the short-term economic prediction.

The second section explains the general economic situation in Thailand during 1984-1985. In addition we also gather some indicators to determine pattern of economic growth. In this section, we also report the tentative reference date after constructing the Historical Diffusion Index. (HDI). The third part of the paper we try to construct the Diffusion Index through sets of tentative coincident indicators. In this section we utilize a "Time Series Model" for the sake of forcasting sets of coincident indicators. The fourth section, we report the business condition conducted through survey of representative firms. The consistency between the "Business Survey Index" and the "Diffusion Index" will be mentioned. Furthermore, we also present alternative of predicting economic condition in 1986 by our model. The last section will be discussion of the result and conclusion.

Table 1 GDP's Growth Rate at Constant Price (%)

	1980-1983	1984	1985 (est.)
GDP	5.5	6.2	4.0
Growth Rate of GDP Implicit Deflator			
Primary Industry			
- Agriculture	5.3	-10.3	-8.0
Non-Primary Industry			
- Manufacturing	6.7	4.7	1.9
- Construction	10.3	0.9	2.3
Overall industry	7.8	1.0	1.4

Source : NESDB

2. The General Economic Condition and the Tentative Reference Date.

2.1. The General Economic Condition 1984-1985.

The Thai economic which had been growing in terms of real GDP during 1980-1983 shows a rather lower level of growth in 1984, and 1985. From table 1 the GDP's growth rate in 1985 is 4.0 percent (estimated) compared with 6.2 and 5.5 percent in 1984 and during 1980-1983 respectively. This low level of economic expansion is however within a normal norm among non-oil exporting countries, the GDP's growth rate of which is around 3.6-4.7.* The main cause of the contraction of the economic activities may be due to prices; the returns to producers, are too low. Especially, the general price level of the agricultural sector shows an uneven declining of 8.0 percent in 1985. This is caused by low level of export prices of main cash crops especially rice. It is a well known fact that the purchasing power of the agricultural sector is the main engine which stirs the non-agricultural sector and the total economic activities. This low prices situation may be the main reason for economic contraction.

Moreover, on the expenditure side, the investment of both private and public sector in Table 2 indicates that the private sector's investment growth rate increases by 0.3 percent while the public sector's investment decreases by 8.0 percent. This implies the public policy towards growth through fiscal activities is not active at all.

Table 2: Private and Public Investment

Unit : Million Baht

	1980	1981	1982	1983	1984	1985
1. Gov. Expenditure						
Consumption	82,026	75,731	110,876	120,665	129,906	140,501
Investment	62,256	68,600	66,483	72,924	81,826	85,102
2. Investment (at current price)						
- Public	62,256	68,600	66,483	72,924	81,826	85,102
- Private	114,843	120,467	113,415	133,068	147,264	142,927
3. Investment (at constant price)						
(growth rate)	(3.2)	(1.6)	(-10.8)	(10.7)	(7.4)	(-5.2)
- Public	47,729	47,706	42,395	43,837	50,719	46,645
(growth rate)	(-3.4)	(-.05)	(-11.1)	(12.8)	(6.0)	(-8.0)
- Private	23,703	24,850	22,337	23,812	26,218	26,305
(growth rate)	(19.7)	(4.8)	(-10.1)	(6.6)	(10.1)	(0.3)
4. Foreign Invest. in Thailand (at constant price)	3,816	6,363	4,339	8,008	8,507	
(growth rate)		(66.7)	(-31.8)	(84.6)	(6.2)	

Note : Figures in parenthesis are growth rates (%)
Source : NESDB

* World Bank, Short Terms Economic Outlook, July 1985.

2.1.1 Type of Growth Pattern in Thailand.

One way to identify the tentative reference dates in our study is to understand about pattern of growth process in Thailand. Study by L. Vanida clearly indicates the growth pattern as follows :

The Thai economy dipped toward recession and/or deflationery growth after 1980. This cyclical down swing may be dued to the second oil crisis and the world economic condition as well as the government policy to remedy the external balance by tight monetary control and inactive fiscal activities.

This finding are crucial and may be applicable to our study to some extent in specifying the tentative reference dates apart from G.D.P. growth rate.

Table 3 : Economic Growth Pattern of Thailand (1972–1985)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Measured with Gr. of GNP	S	IG	IG	S	IG	DG	R	R	DG	S
Measured with Gr. of GDP	S	S	IG	S	IG	DG	R	R	DG	S
Banking and Financial sector	R	IG	IG	IG	S	DG	R	R	R	S
Transportation	S	DG	S	S	DG	S	DG	S	DG	S
Construction	R	IG	S	S	IG	R	R	DG	DG	S
Agriculture	S	S	DG	S	IG	DG	R	IG	DG	S
Manufacturing	R	S	IG	IG	S	DG	R	S	S	DG
Trade	S	IG	DG	R	S	DG	R	R	S	DG

Note : IG = Inflationary Growth
DG = Deflationary Growth
S = Stagflation
R = Recession

Source : Vanida Lavantaksin, Analysis of Economic situation in Thailand Through The National Income Account. An unplished paper, for internal used. (in Thai) National Accounts Division, NESDB, Thailand, 1986.

2.2 The Tentative Reference Dates.

In order to construct the Current Diffusion Index (CDI,) we apply the historical data to observe the tentative reference dates in terms of a Historical Diffusion Index (HDI). The graphs of the HDI are plotted by means of specifying peak (P) and through (T) of the final trend cycle, and final seasonally adjusted series obtaining from the X–11 procedure.

2.2.1 The Tentative Reference Dates Obtaining from the Final Trend Cycle.

Time series data of productions of important manufacturing output shown in Table 4 are plotted. The HDI of "group 1, 2, 3" and "group 1+2+3" are shown in Figures 2, 3, 4 and 5 repectively. The tentative reference dates are shown in Table 4. We see that the tentative reference dates are not so much compatible with the GDP's growth rate (see Table 5 and Figure 2, 3, 4, 5). This may be explained that in Thailand the non-agricultural sector's productions are not able to reflect the real business conditions. We are obliged to look for another series which have an immediate effect on the economy. This may be the productions of cash crops of the agricultural sector, which we will explore in the next section.

2.2.2 The Tentative Reference Dates Obtaining from the Final Seasonally Adjusted Series.

As we have mentioned earlier that the production levels of agricultural cash crops are subjected to plantation cycles. This implies there may not be production activities during particular time span. We therefore use their farm prices as their dual variables, since we believe that there exist a non-negative price for any production plan.

Table 4 Time Series Data (Final Trend Cycle) Used in Constructing HDI.

Group 1 : - Production of detergent
- Production of Petroleum
- Production of commercial vehicle
- Electricity consume by large users
- Production of beer
- Sale of Department store

Group 2 : - Production of gunny bag
- Production of tungsten
- Production of tinplate
- Production of gypsum
- Production of fluorite
- Production of motorcycle

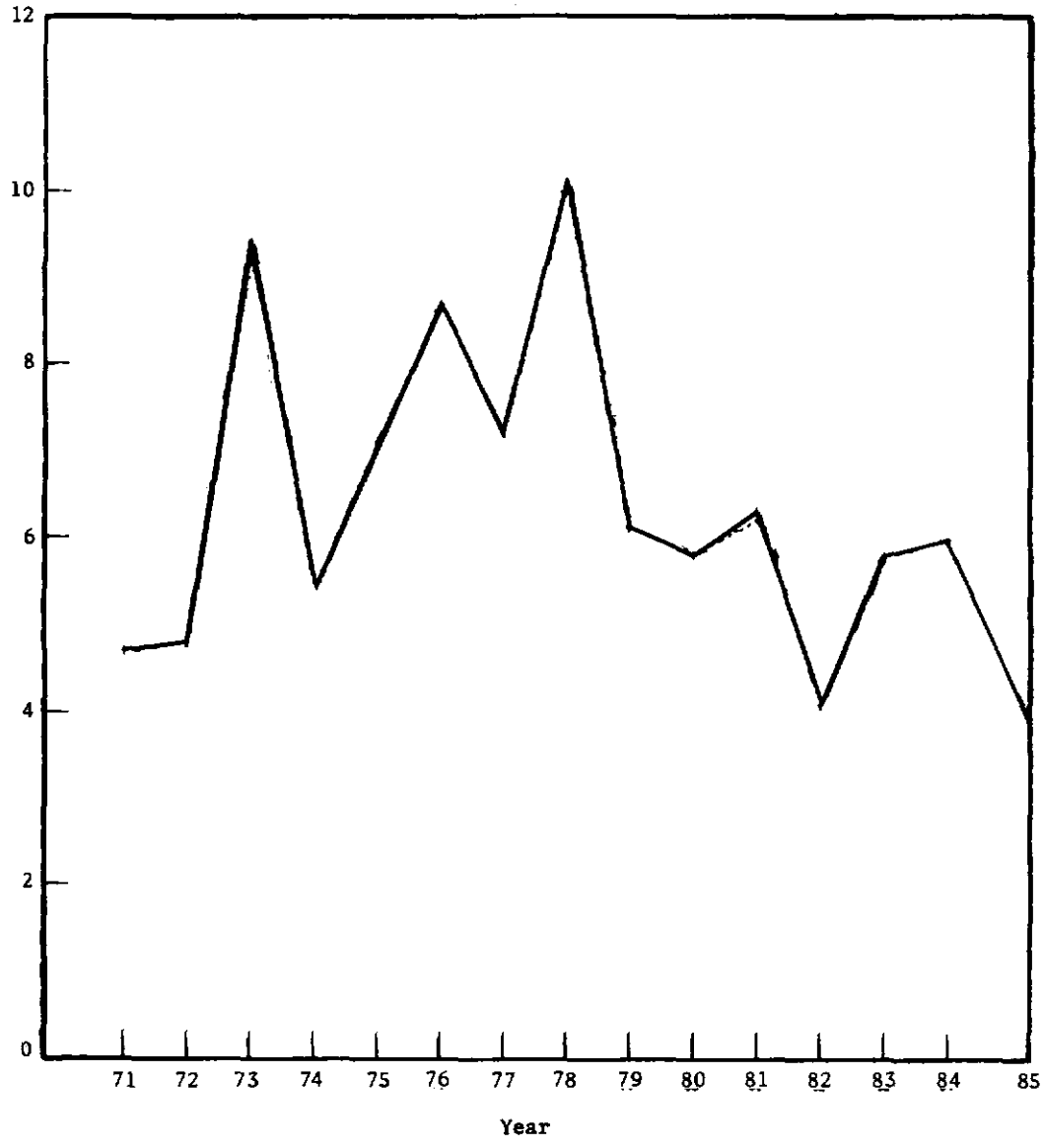
Group 3 : - Production of lignite
- Production of cement
- Production of iron
- Production of galvanize
- Production of cigarette
- Trade index of import volume

Group 4 : - "group 1 + 2 + 3"

Note : Data are grouped according to their pattern of change.
Source of Data : Data tape compiled by IDE from various sources and updated by NESDB and CUSRI.

IDE = Institute of Developing Economies
NESDB = National Economic and Social Development Board
CUSRI = Chulalongkorn University Social Research Institute

GDP Growth rate (%) 1971 - 1984 (1972 Prices)



Source : NESDB

Figure 1

Historical diffusion index (group 1)

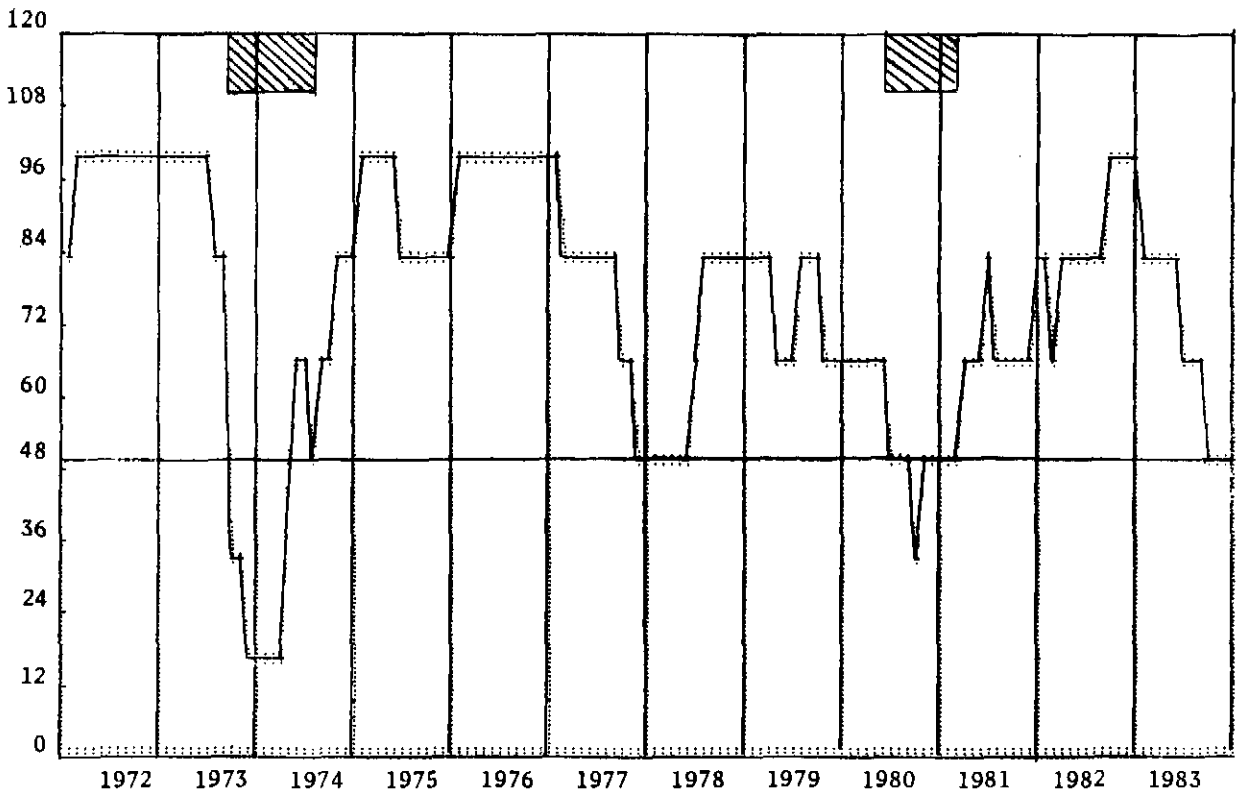


Figure 2

Historical diffusion index (group 2)

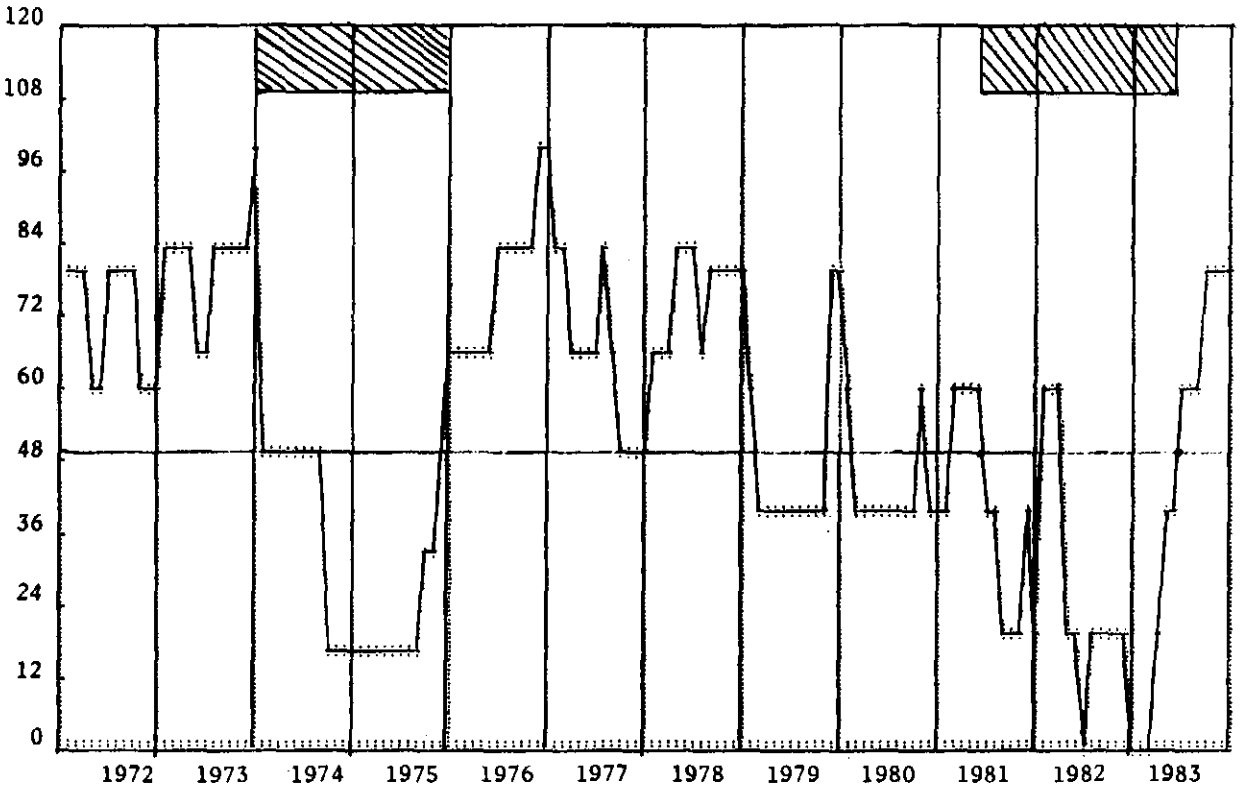


Figure 3

Historical diffusion index (group 3)

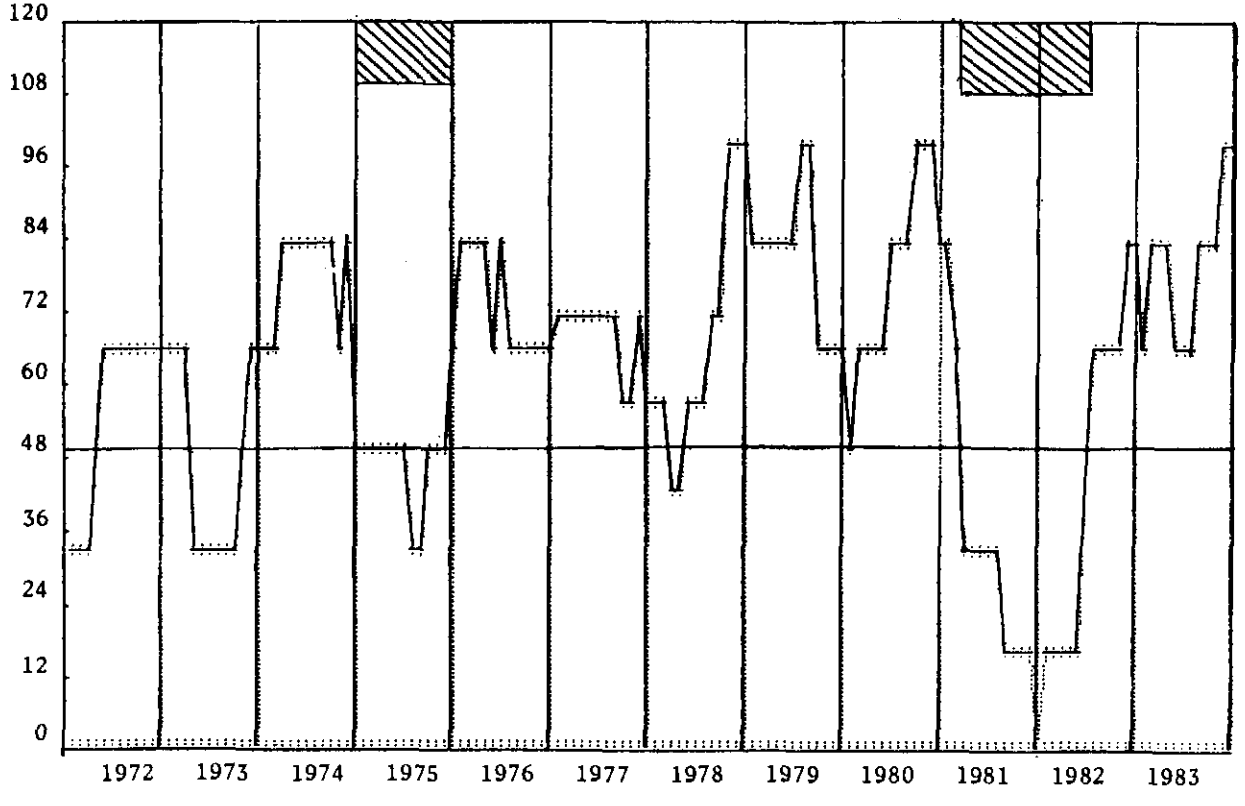


Figure 4

Historical diffusion index : "group 1 + 2 + 3"

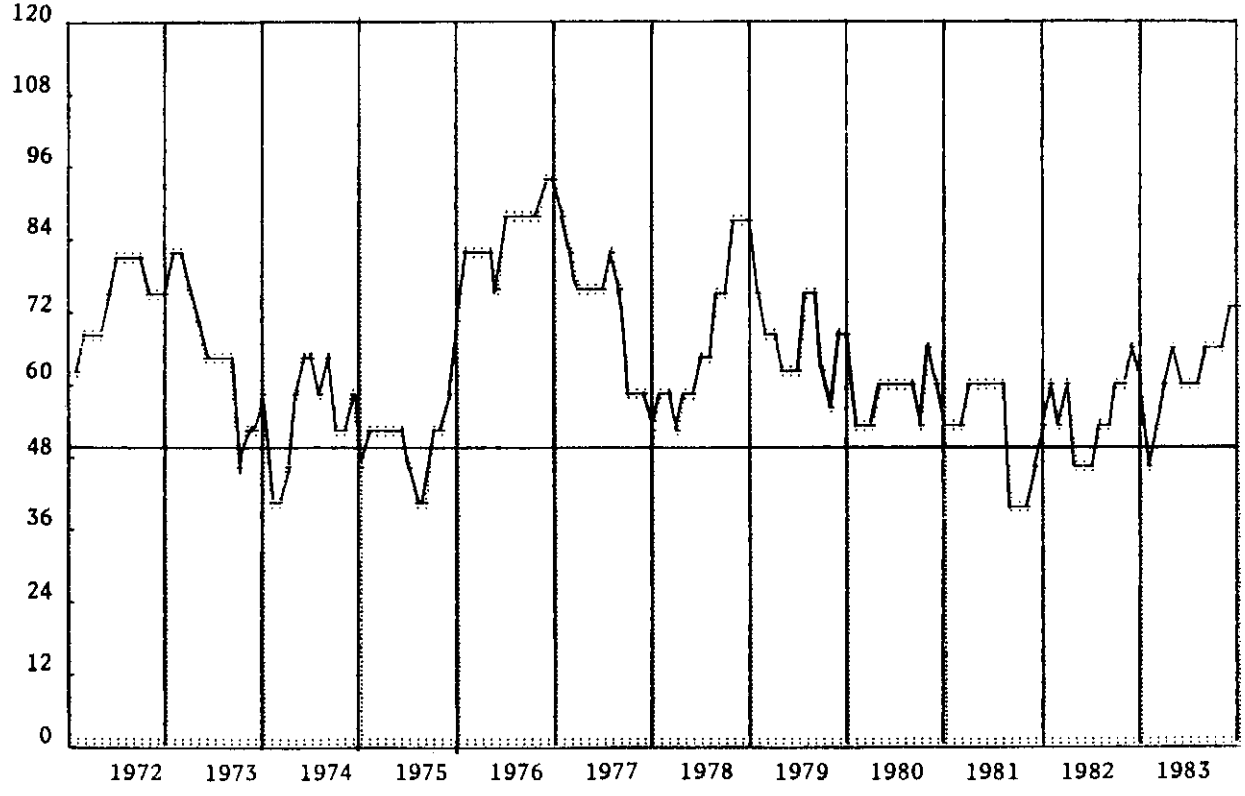


Figure 5

Table 5 Tentative Reference Dates Shown by Dates of Contracting period of some Series.

Group	Tentative Reference Dates (Shown by Dates of Contracting Period)	
	Peak	Trough
Group 1	1973 (10)	1974 (4)
	1980 (5)	1981 (2)
Group 2	1974 (7)	1975 (11)
	1981 (5)	1983 (6)
Group 3	1981 (2)	1982 (6)
Group 4: "group 1+2+3"	1974 (1)	1975 (9)
	1981 (5)	1983 (2)
GDP's growth rate (annual)	1973	1974
	1976	1977
	1978	1982
	1984	–

Note : Figures in ( ) indicate month of the year;
Source : From Figures 2, 3, 4 and 5

We also combine prices of main agricultural cash crops namely paddy, maize, cassava, sugar cane, and rubber with other components of time series data, for instance export price, detergent production and other non-agricultural main productions. The details are shown in Table 6.

The seasonally adjusted series obtaining from the X-11 procedure also provide us with 'turning point' of peaks (P) and troughs (T). Accordingly, we construct the table of change. Finally, we obtain the tentative reference dates as shown by dates of contracting periods in Figure 6, 7 and 8. The summary of the dates is shown in Table 6.

Here also the reference dates do not fit so well with the GDP's growth rate. It should be noted that the dates for group 5 are quite consistent with those from group 7. Moreover, the later half of the HDI of both group 5 and 7 indicates that the economy contracts during 1981 (5)–1983 (2), and 1981 (2)–1982 (7) respectively. This is consistent with the GDP's growth rate which indicates that the economy shrinks during 1978–1982.

Bearing these limitations in mind, we select the group 5 and/or group 7 for our information of tentative reference dates.

Table 6 Time Series Data (Final Seasonally Adjusted) Used in Constructing HDI.

Group 5 : - Farm price of paddy
- Farm price of cassava
- Farm price of maize
- Farm price of suger cane
- Farm price of rubber
- Export price index
- Production of car
- Production of petroleum
- Production of detergent

Group 6 : - Production of gunny bag
- Production of motor cycle
- Production of cement
- Production of beer
- Production of lignite
- Production of galvanize
- Production of gypsum
- Production of iron
- Production of tungsten

Group 7 : - "Group 5 + 6"

Source - Figure 6, 7 and 8

Table 7 Tentative Reference Dates Shown by Dates of Contracting Period.

Group	Tentative Reference Dates (Shown by Dates of Contracting Period)	
	Peaks	Troughs
Group 5	1975 (4)	1975 (12)
	1981 (1)	1982 (4)
	1984 (1)	1984 (11)
Group 6	1974 (10)	1975 (7)
	1978 (4)	1980 (4)
	1982 (6)	1983 (5)
	1985 (2)	-
Group 7 : "group 5 + 6"	1974 (11)	1975 (12)
	1981 (2)	1982 (7)
	1985 (1)	-
GDP's growth rate	1973	1974
(annual)	1976	1977
	1978	1982
	1984	-

Note : Figures in ( ) represent month of the year.
Source : From Figure 6,7 and 8

Historical diffusion index (group 5)

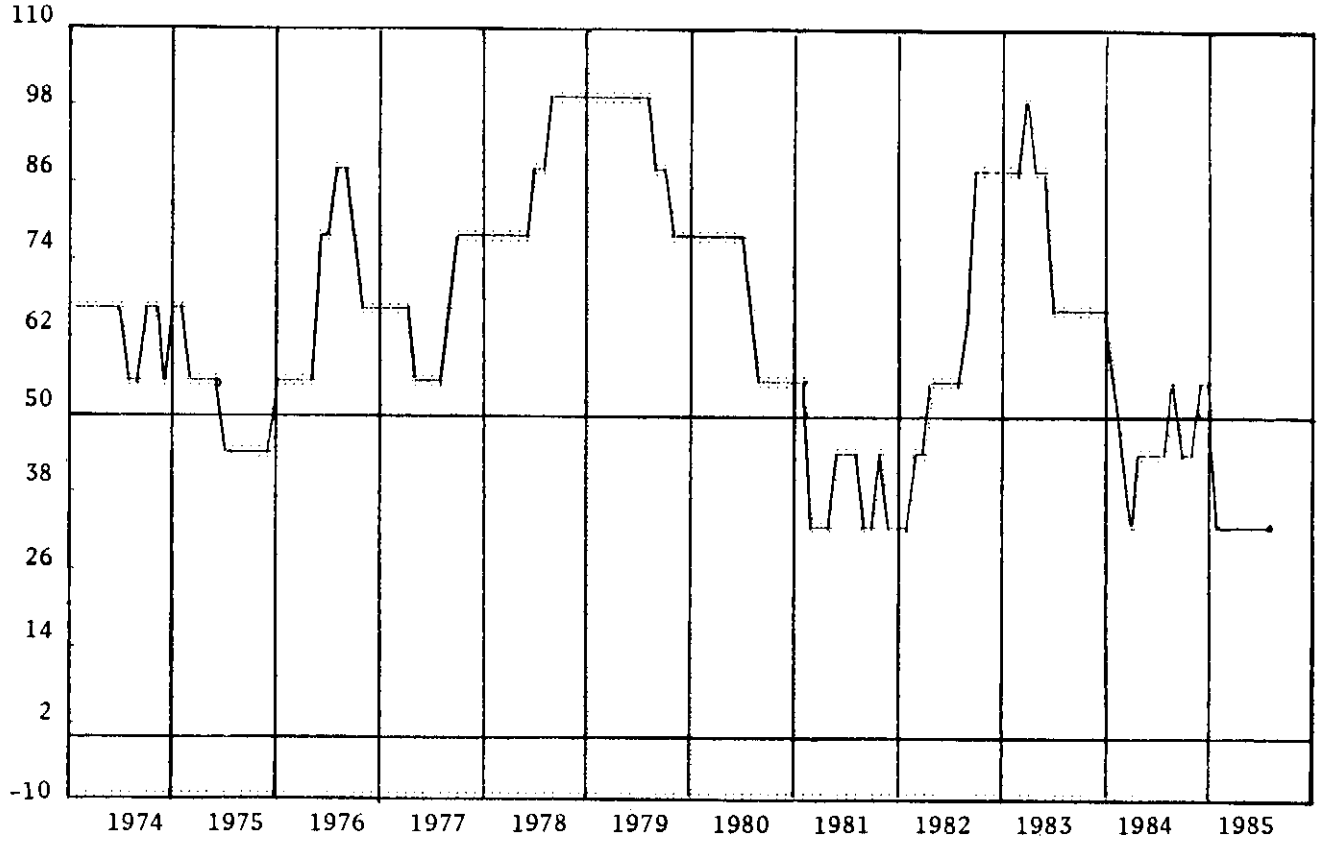


Figure 6

Historical diffusion index (group 6)

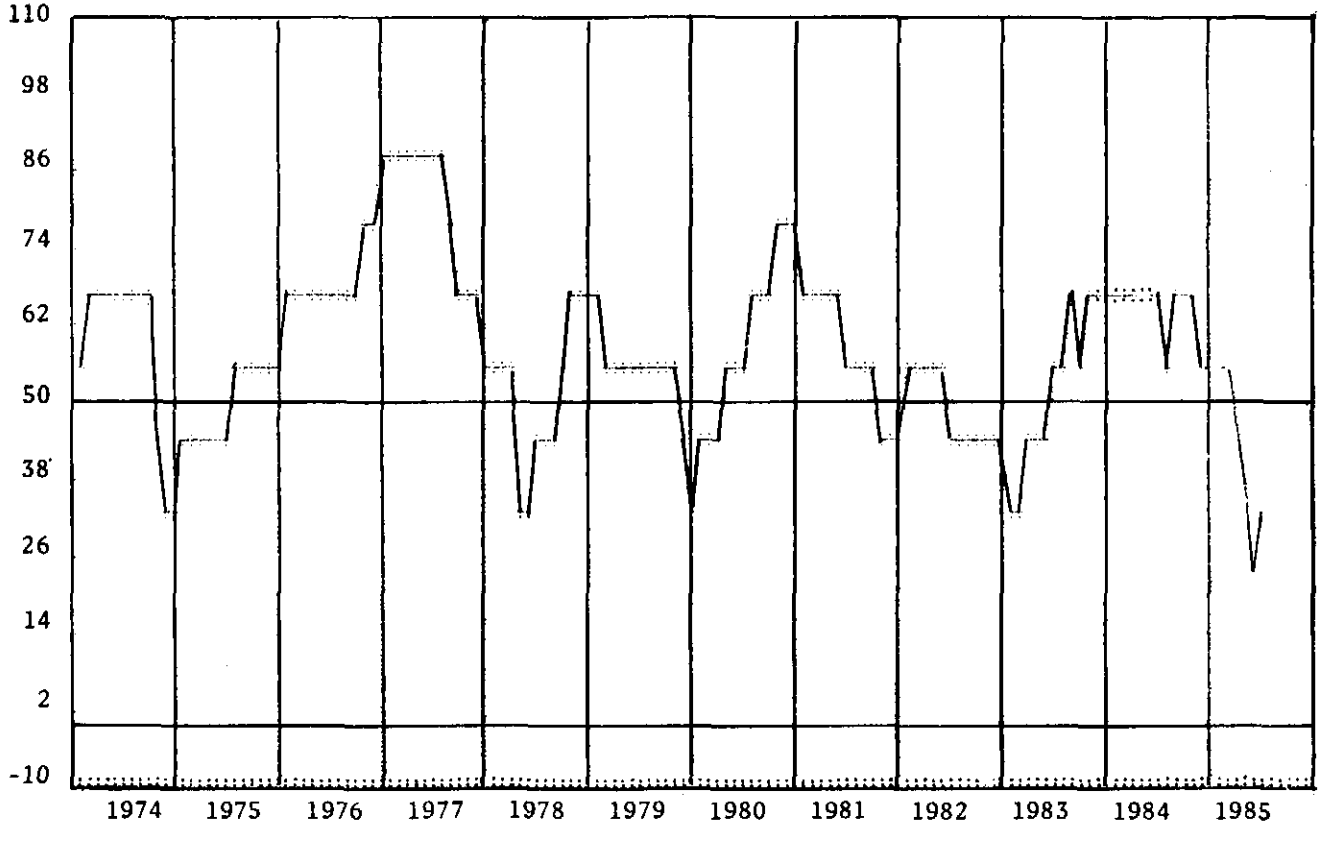


Figure 7

Historical diffusion index (group 7)

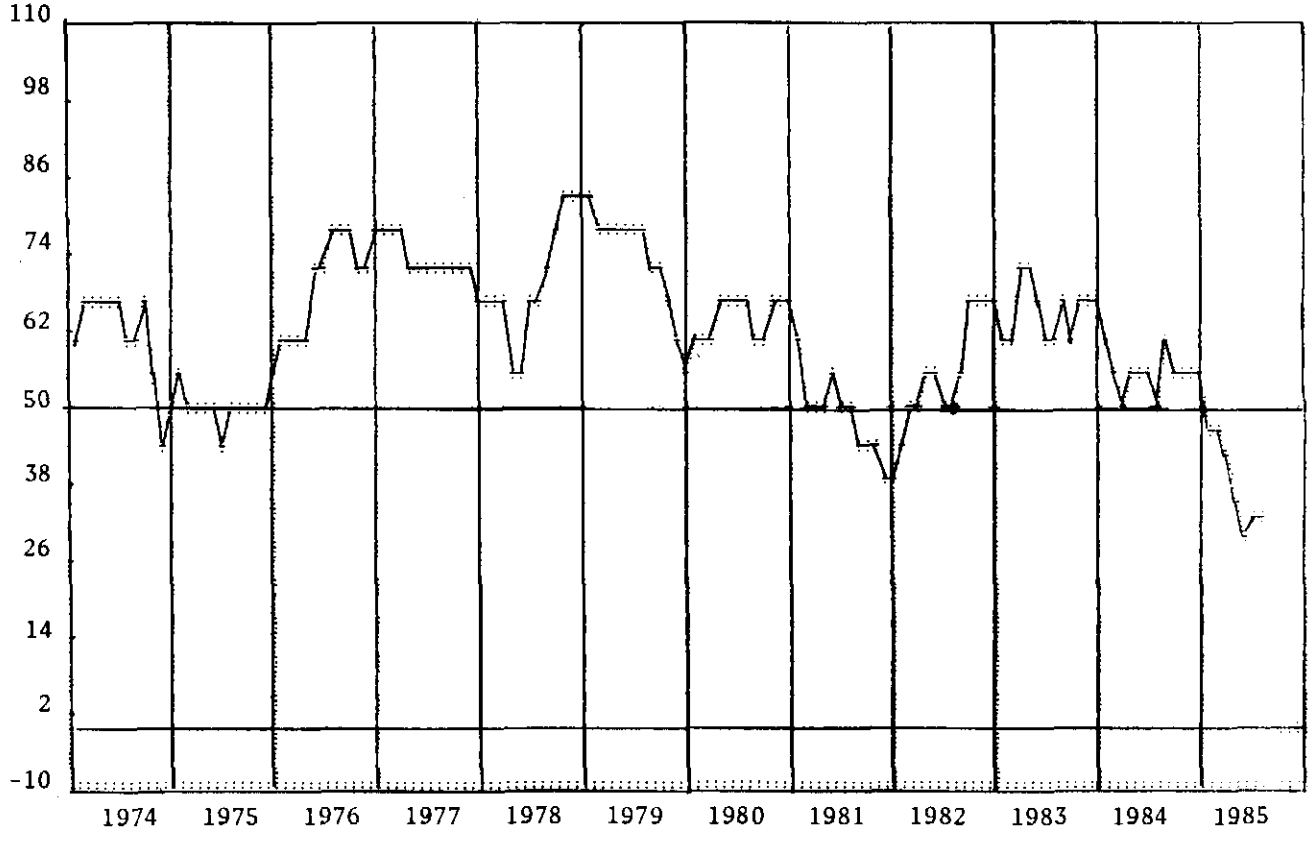


Figure 8

Table 8 Selected Coincidence Indicators.

Series	Month for Cyclical Dominant (MCD)
Group A :	
– Farm price of sugar cane	4
– Farm price of paddy	3
– Farm price of cassava	3
– Farm price of maize	4
– Farm price of rubber	3
– Export price index	3
– Production of car	5
– Production of petroleum	6
– Production of detergent	6
Group B :	
– Production of gunny bag	3
– Production of motorcycle	4
– Production of cement	5
– Production of gypsum	6
– Production of beer	4
– Production of iron	6
– Production of lignite	5
– Production of tungsten	5
– Production of galvanize	5
Group C : "Group A + B"	

2.3 Selection the Component of Indexes.

In this section we try to select variables which determines the coincident, leading, and lagging indicators after the tentative reference dates have been estabished. In order to do this we utilize output from the X–11 procedure. The selection of components of coincident index is shown in Table 8. In plotting the coincident index we also apply the so-called "Month for Cyclical Dominant" or the MCD of each coincident indicator. The graphs of each selected group A, B and C are shown in Figure 9,10 and 11 respectively.

The index of leading, and lagging indicators are for the time being not exactly known. In this paper, we will utilize the coincident index to make short–term forecasting say, to the first quarter of 1986. This may be helpful for the selection of indicators for leading and lagging index.

3. Short-Term Forecasting with Time Series Model.

In this paper, the selected component of coincident indicators in Table 8 are quantified from 1970 up to 1984 and/or 1985 (12). Some series should be updated up to 1985 (12) in order to be ready for prediction. Unfortunately, some series are not available up to 1985(12). This will be reconciled by specifying the origin of forecasting to be the latest period which the data is available.

Bearing this constraint in mind, the ARIMA process of a familiar Time Series Model are tried with these series. The estimation results of the model with its statistics are shown in Table 9. Forecasted and actual series are shown in Figure. 12-32.

Table 9 The Estamation on of the Model

List of Variable	Model
Group A :	
- Farm price of paddy	ARIMA (1, 2, 0) (1, 1, 1)
- Farm price of maize	ARIMA (0, 2, 2) (1, 1, 1)
- Farm price of srugar cane	ARIMA (0, 1, 2) (0, 1, 1)
- Farm price of cassava	ARIMA (0, 2, 1) (0, 1, 1)
- Farm price of rubber	ARIMA (0, 2, 2) (0, 1, 1)
- Export price Index	ARIMA (0, 2, 1) (1, 1, 1)
- Production of car	ARIMA (0, 1, 2) (1, 1, 1)
- Production of petroleum	ARIMA (0, 1, 2) (1, 1, 1)
- Production of detergent	ARIMA (0, 1, 2) (1, 1, 1)
Group B :	
- Production of gunny bag	ARIMA (1, 1, 1) (1, 1, 1)
- Production of motor cycle	ARIMA (0, 1, 1) (0, 1, 1)
- Production of cement	ARIMA (0, 1, 1) (1, 1, 1)
- Production of beer	ARIMA (2, 1, 2) (1, 1, 1)
- Production of lignite	ARIMA (1, 1, 1) (1, 1, 1)
- Production of galvanize	ARIMA (0, 2, 1) (0, 1, 1)
- Production of gypsum	ARIMA (0, 1, 2) (1, 1, 1)
- Production of iron	ARIMA (0, 1, 2) (1, 1, 1)
- Production of tungsten	ARIMA (2, 1, 1) (2, 1, 1)
Group C : "Group A + B"	

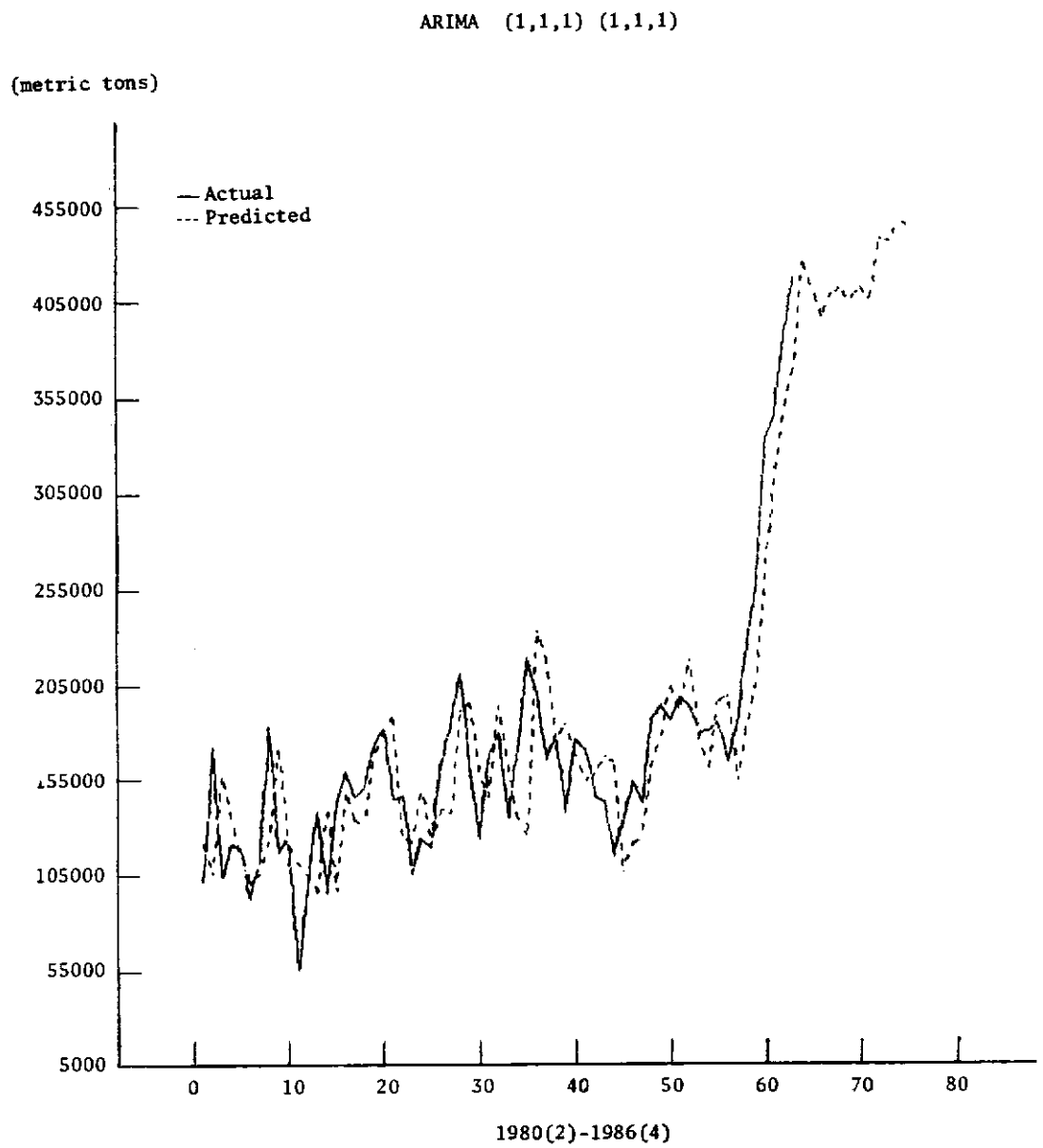


Figure 9 Forecasting : Lignite Production

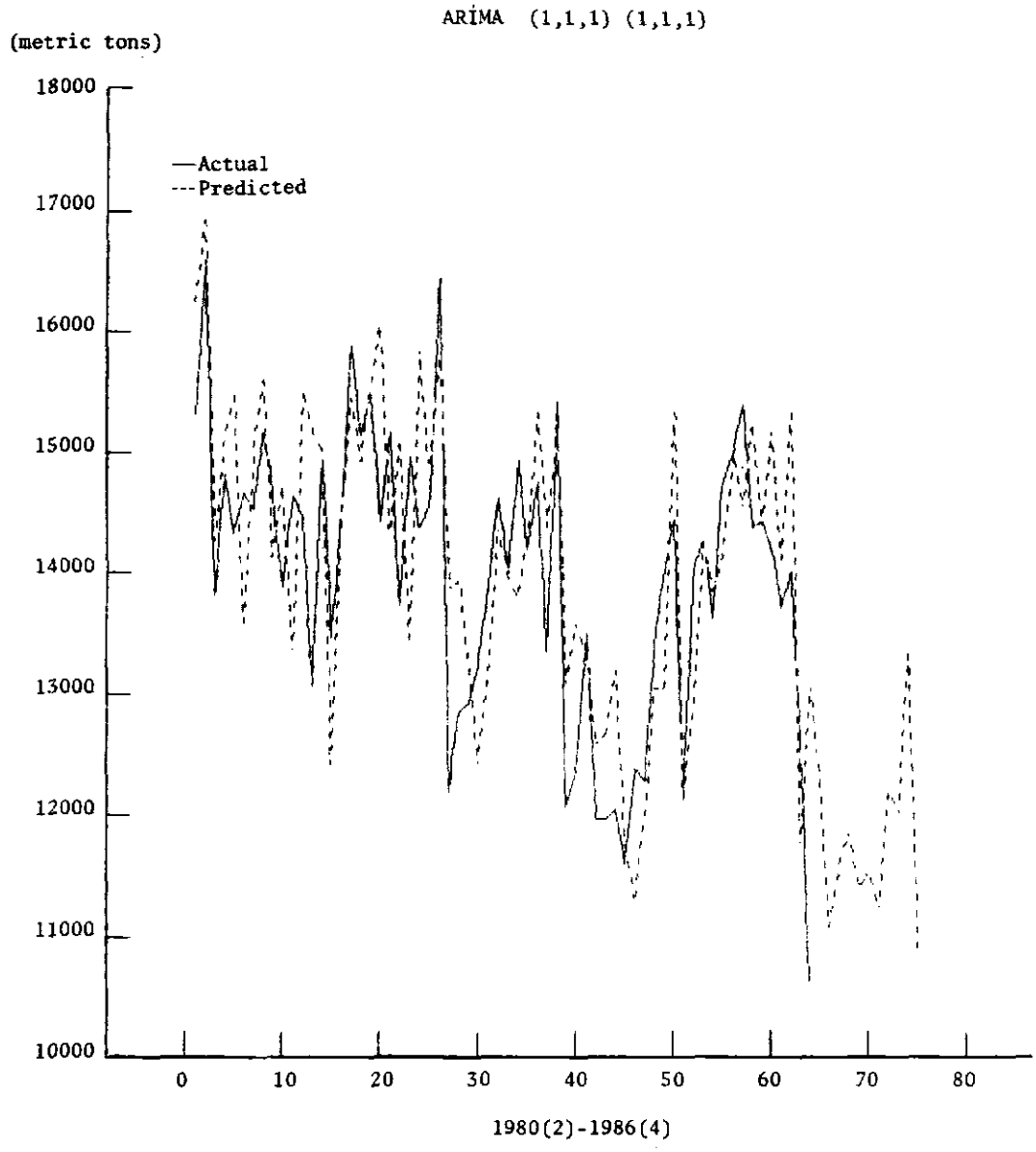


Figure 10 Forecasting : Gunnybag Production

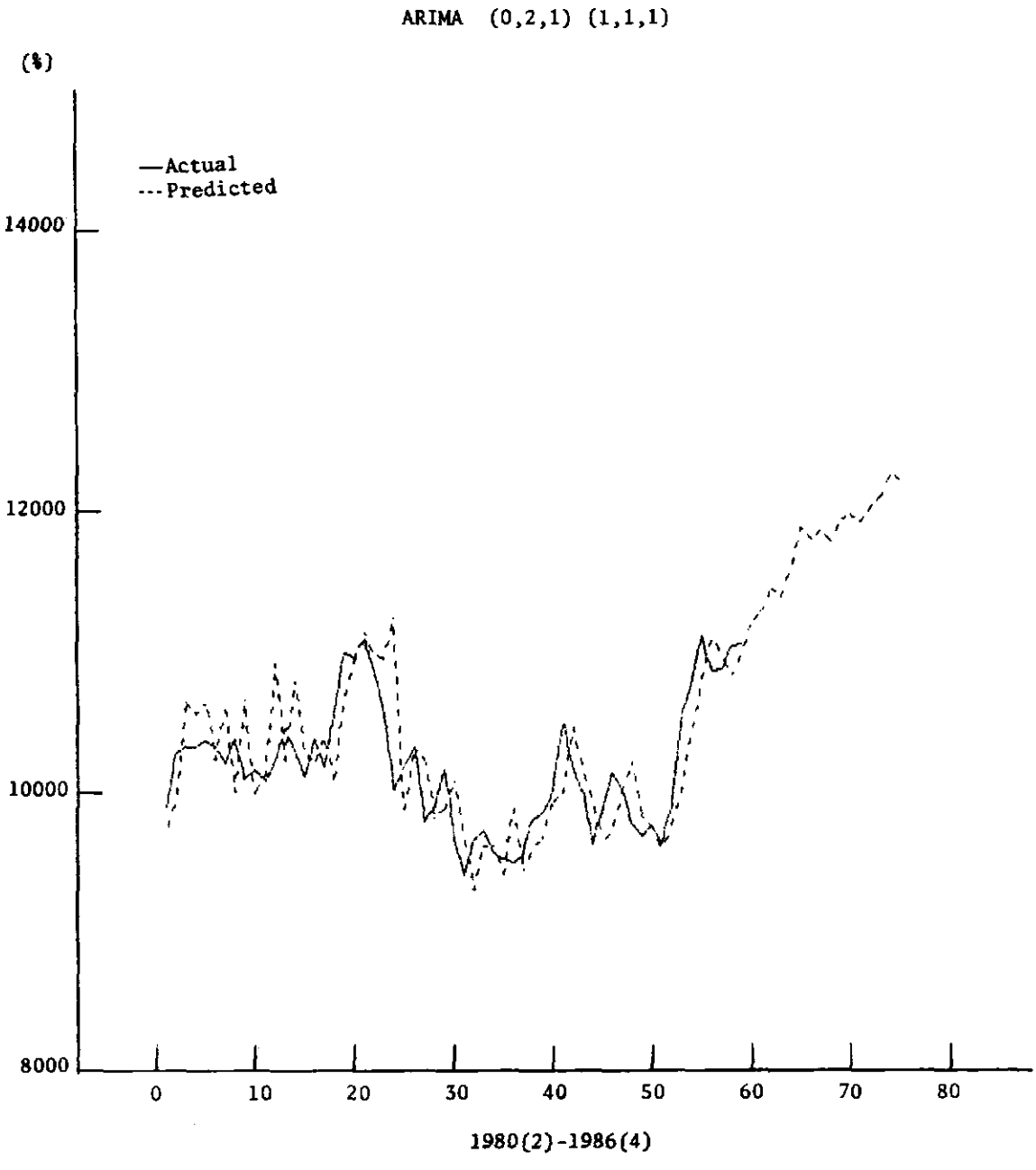


Figure 11 Forecasting : Export price index

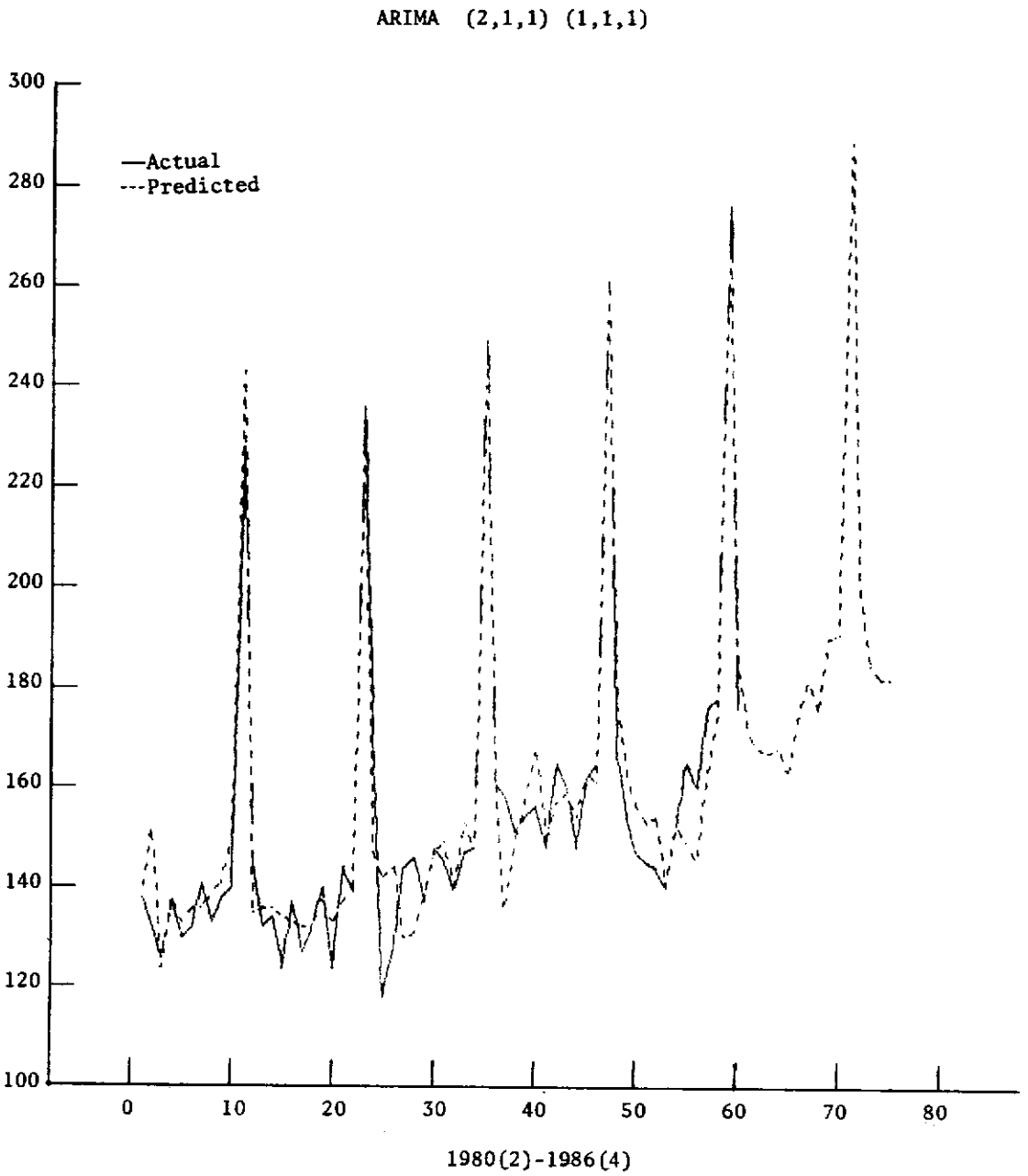


Figure 12 Forecasting : Departmentstore sales

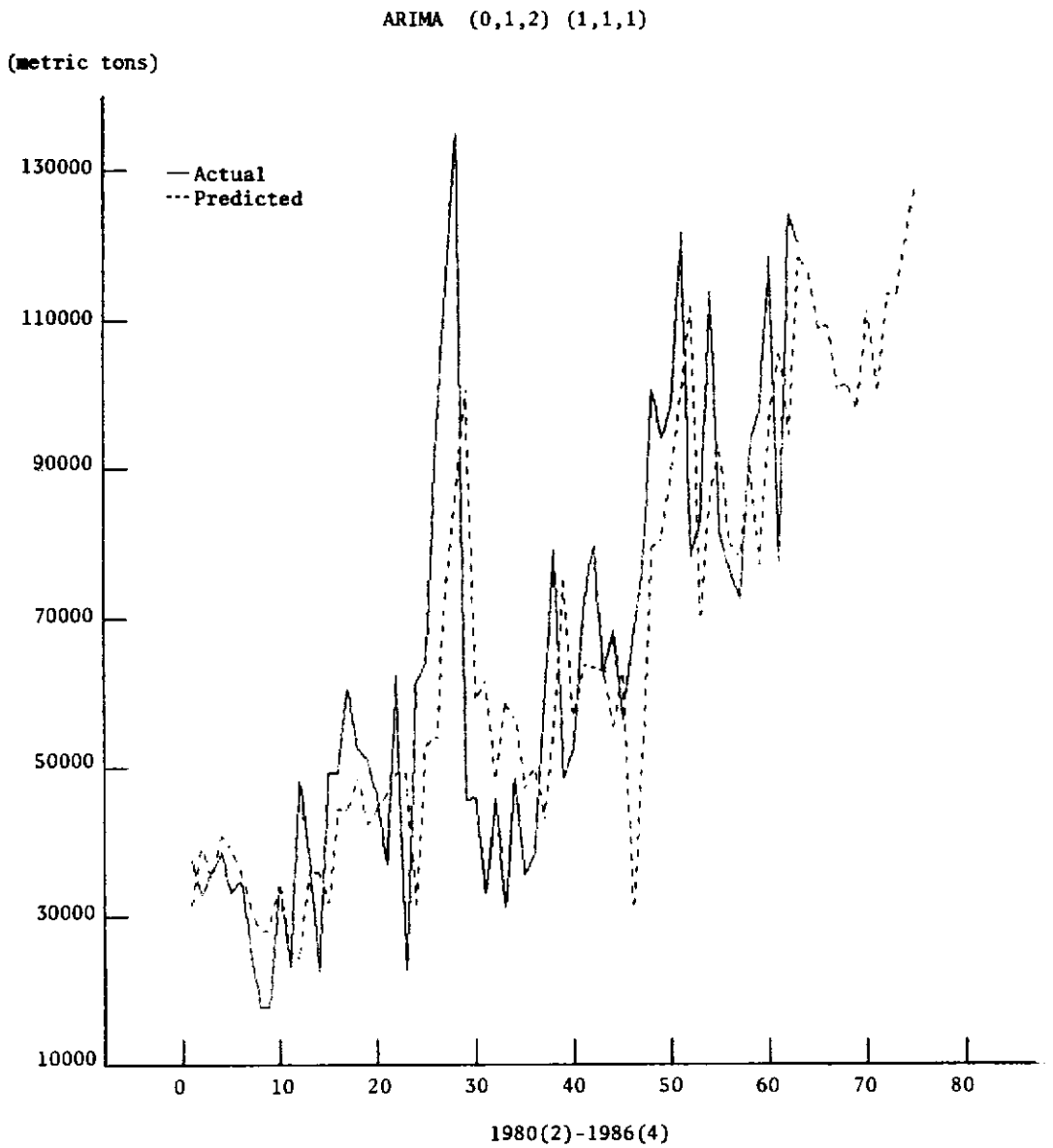


Figure 13 Forecasting : Gypsum Production

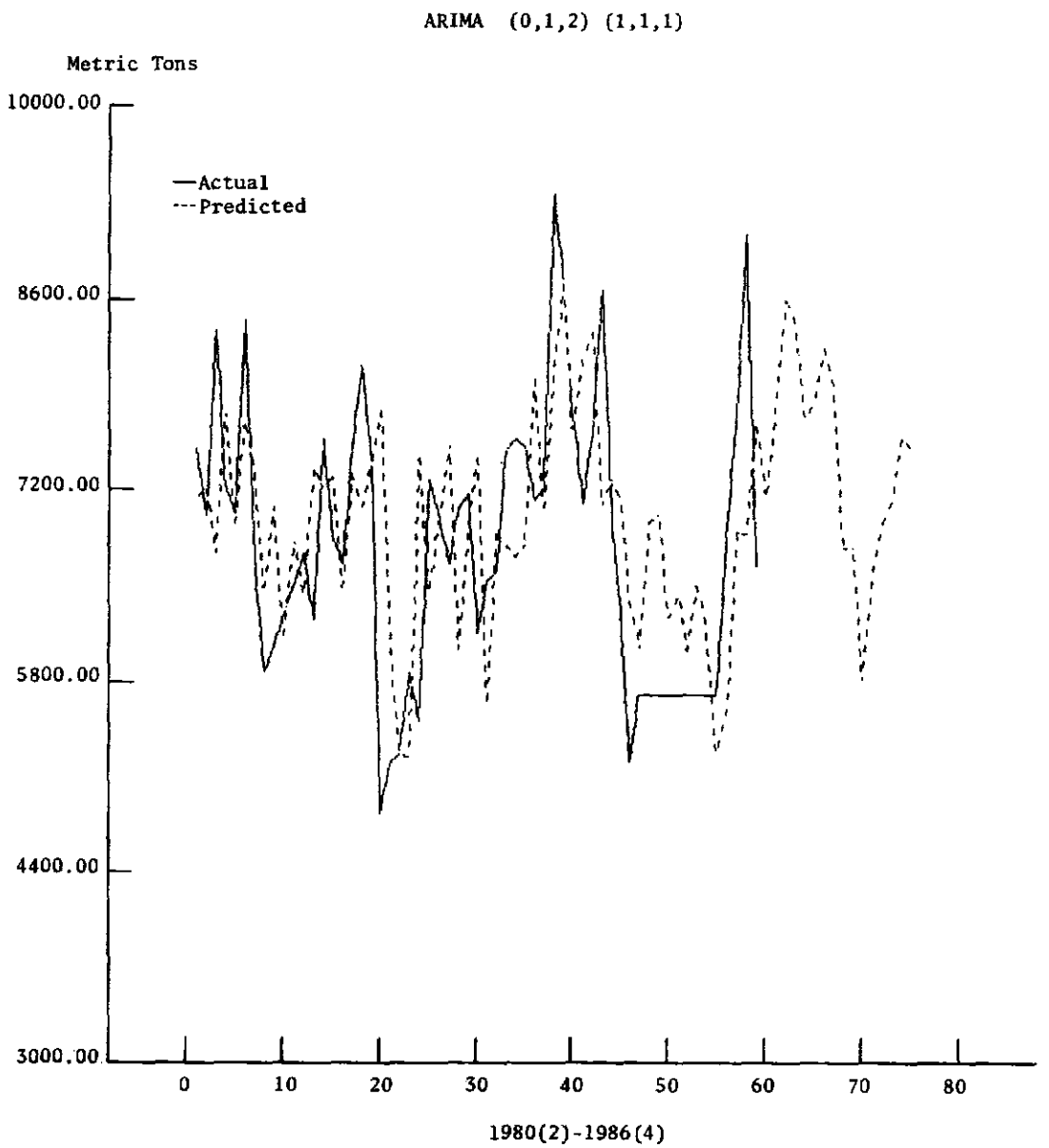


Figure 14 Forecasting : Detergent Production

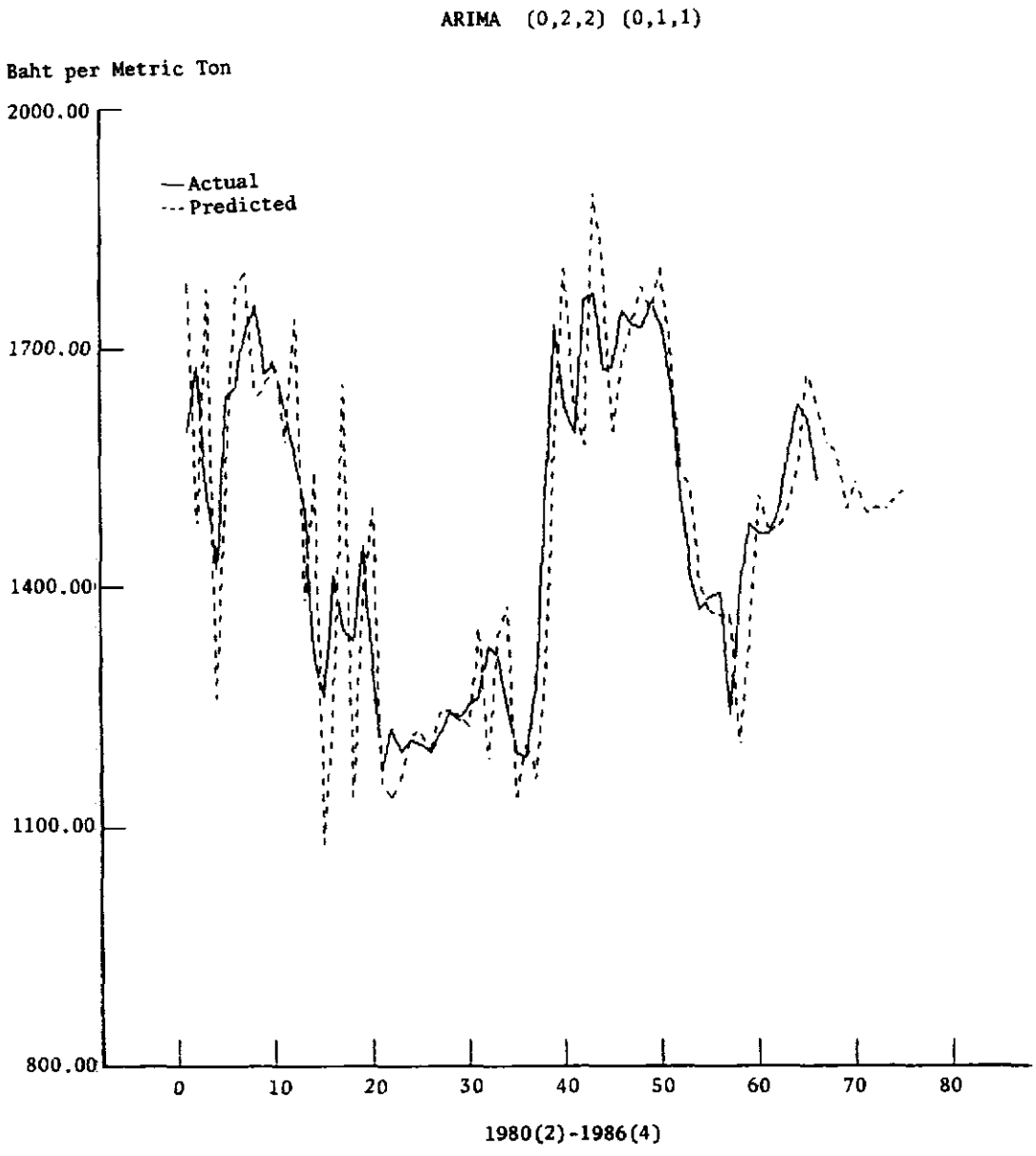


Figure 15 Forecasting : Farm price of Rubber

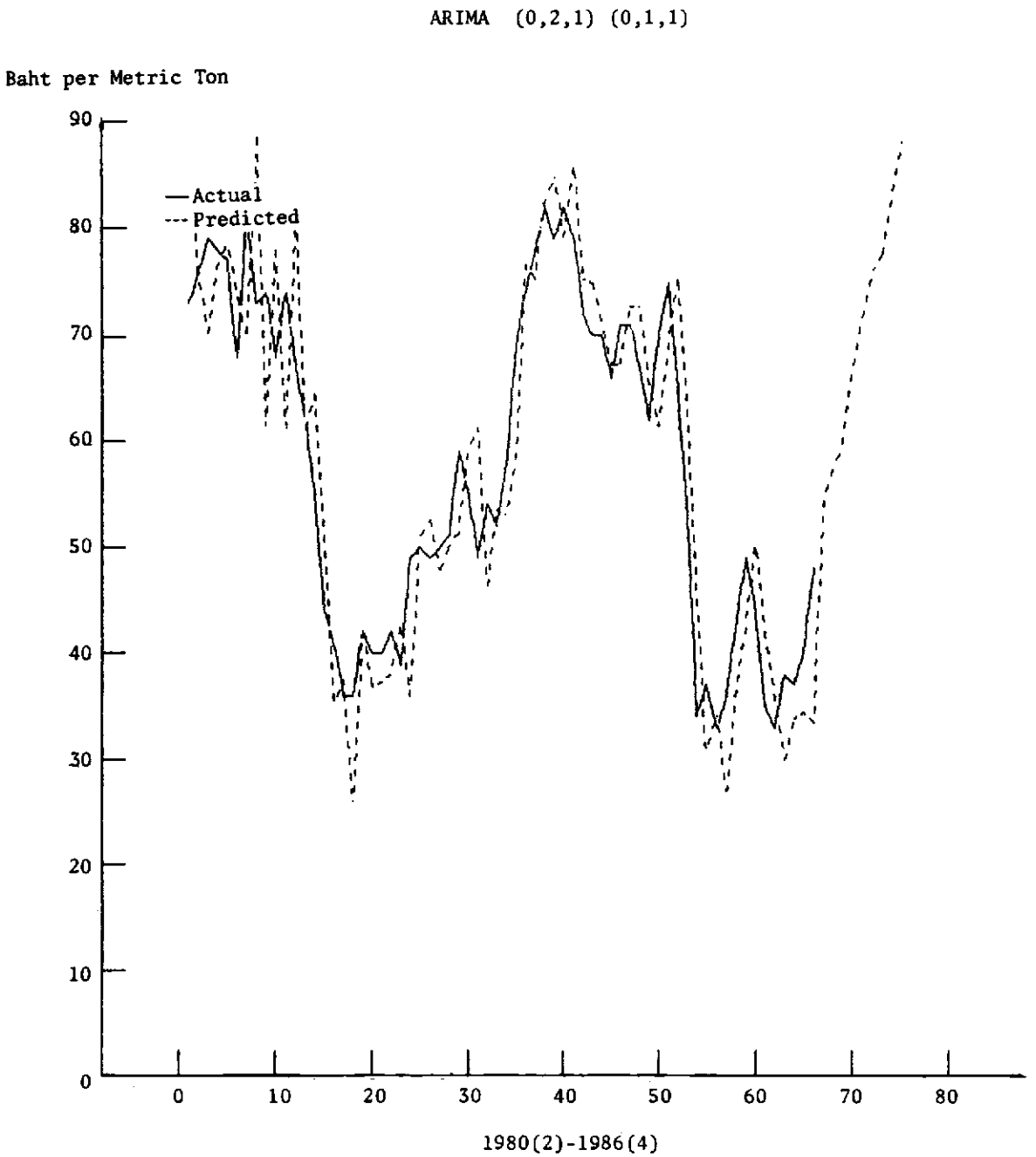


Figure 16 Forecasting : Farm price of Cassava

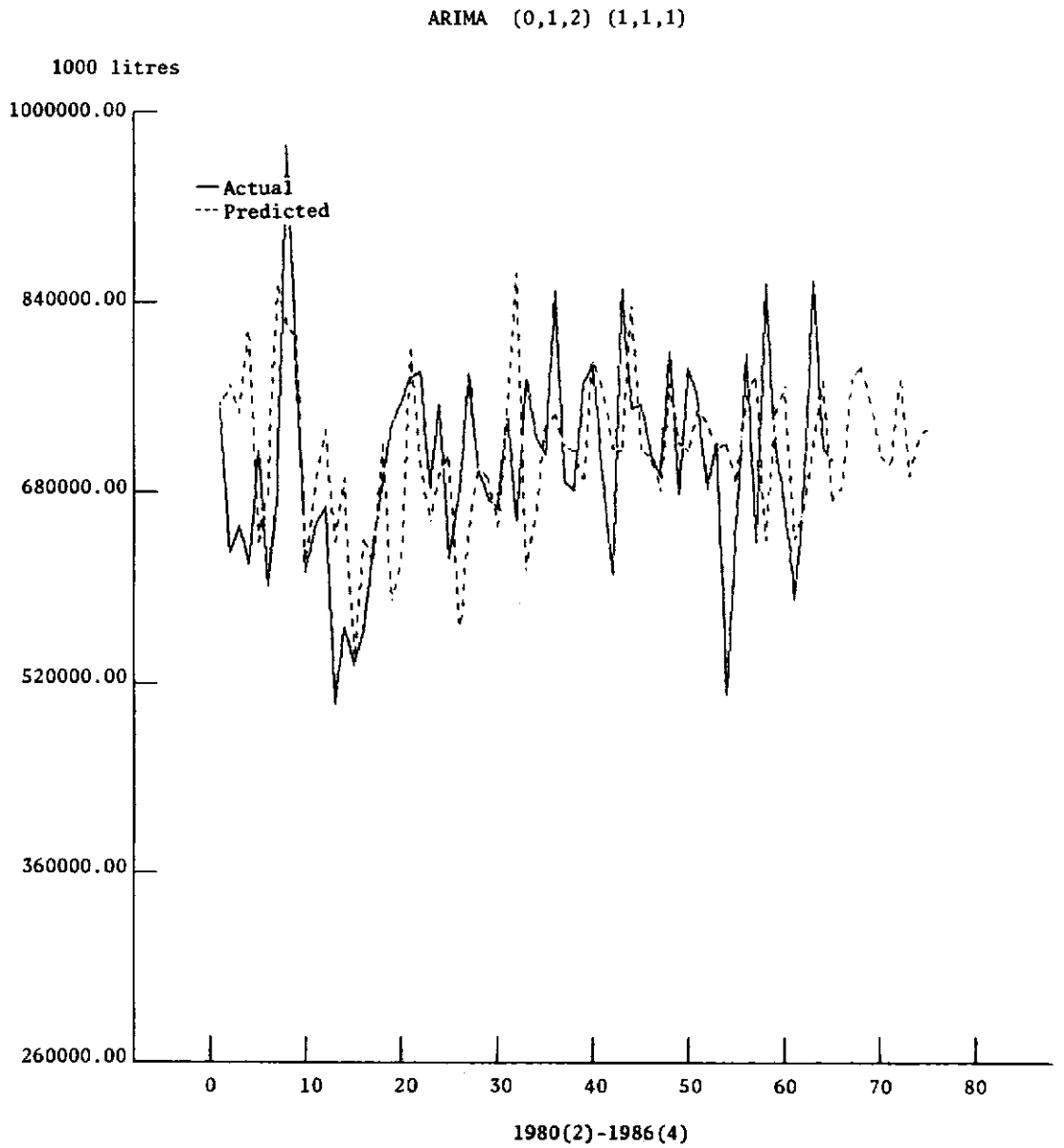


Figure 17 Forecasting : Petroleum Production

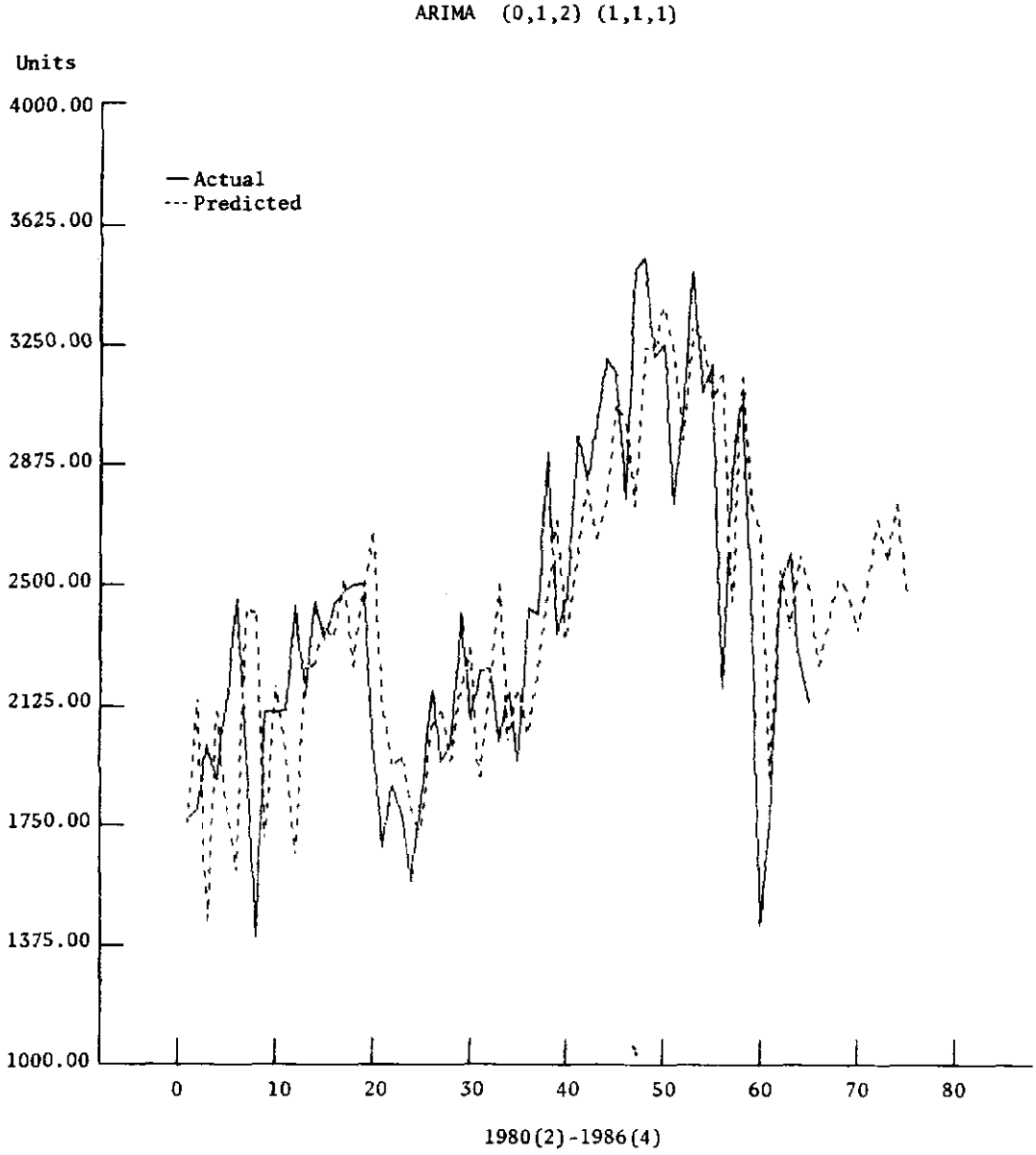


Figure 18 Forecasting : Car Production

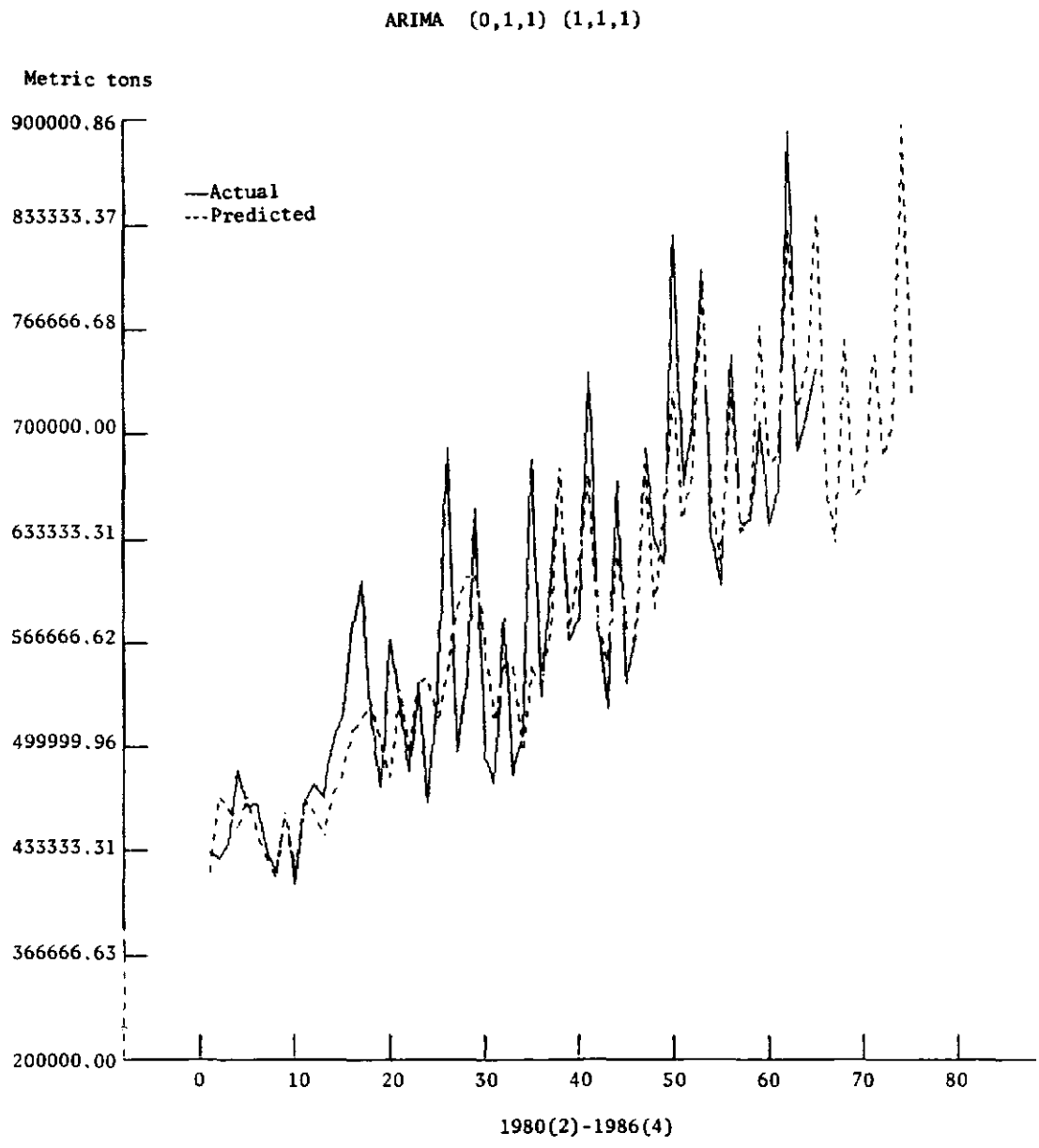


Figure 19 Forecasting : Cement Production

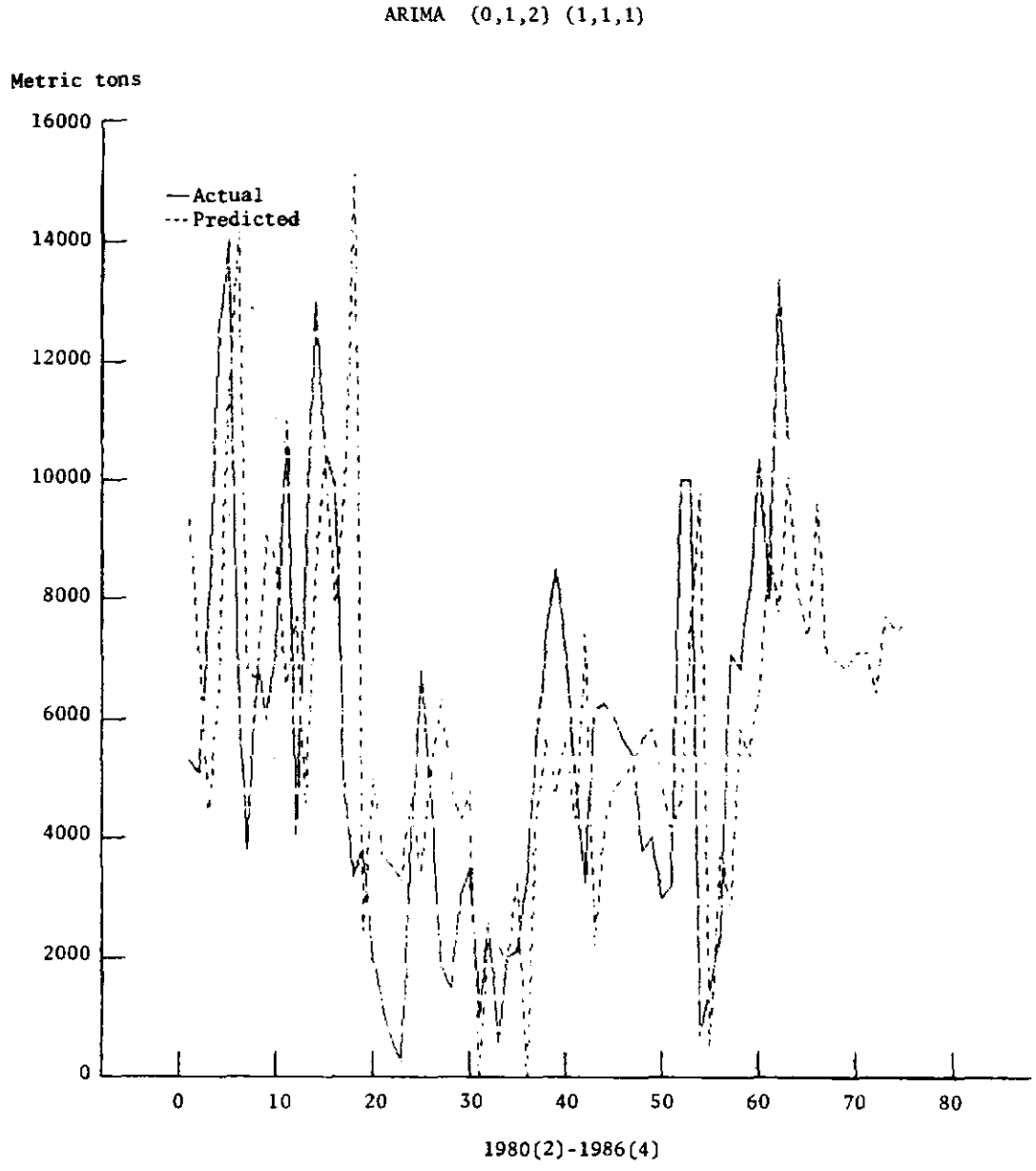


Figure 20 Forecasting : Iron Production

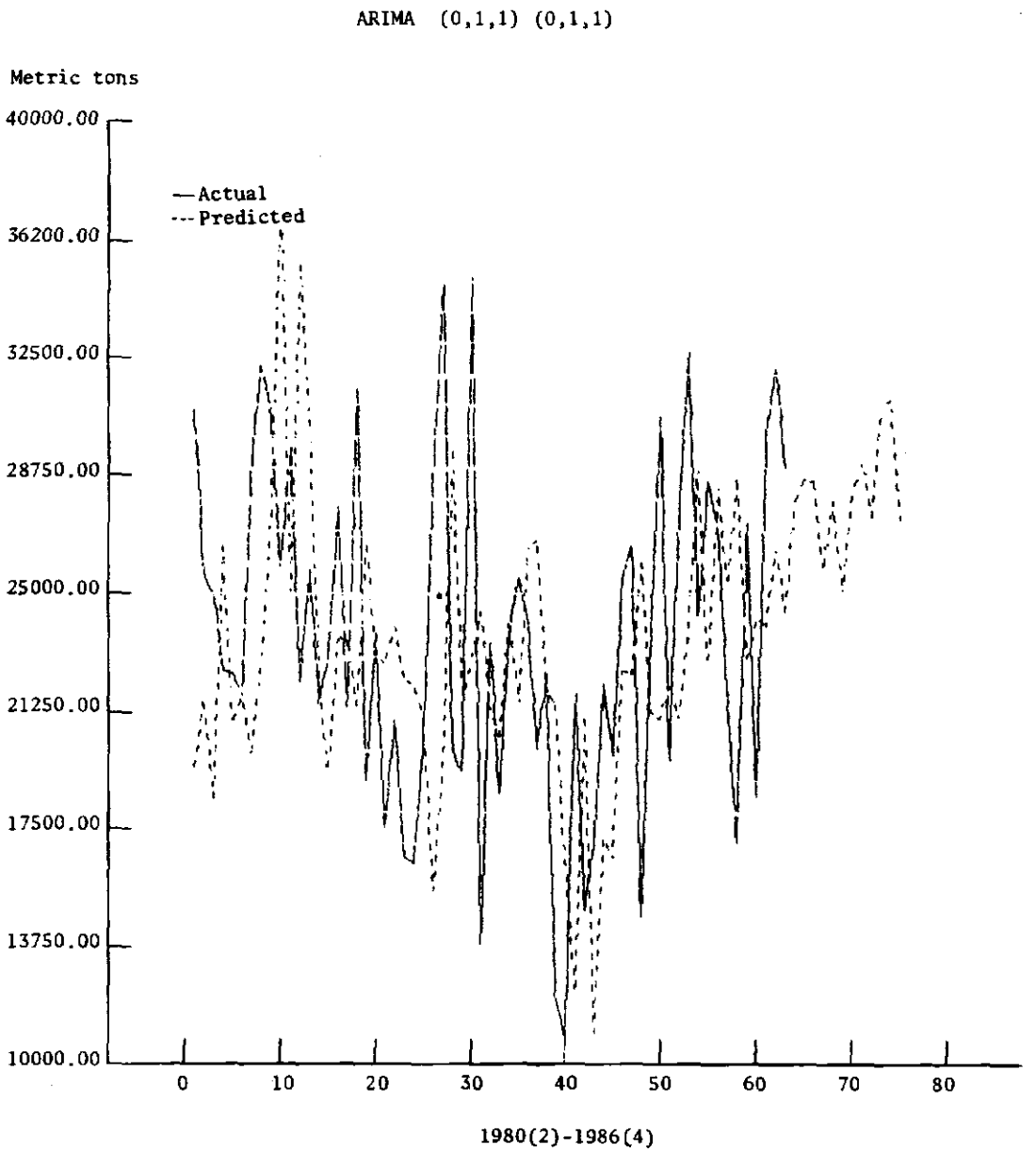


Figure 21 Forecasting : Fluorite Production

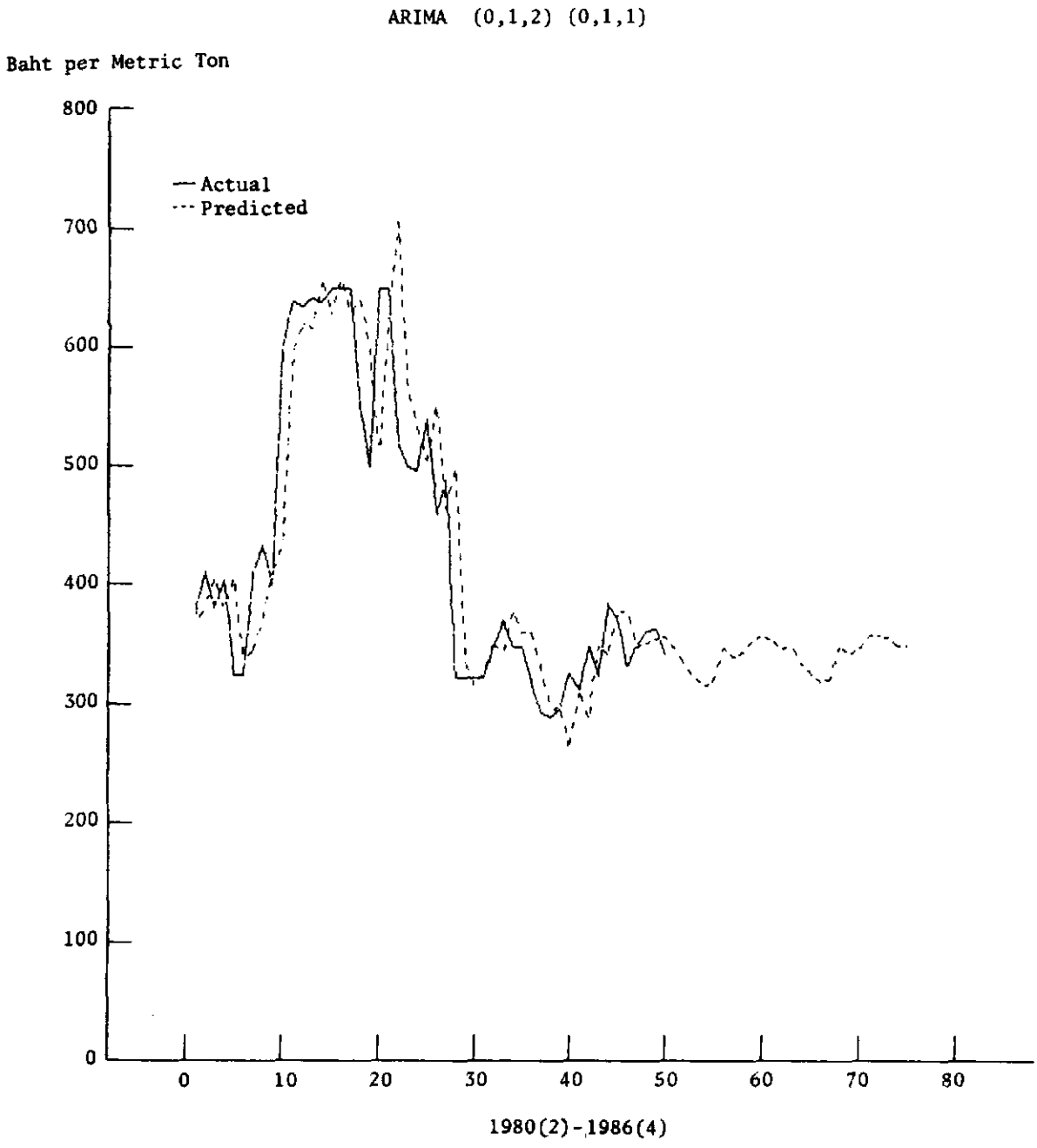


Figure 22 Forecasting : Farm Price of Sugar

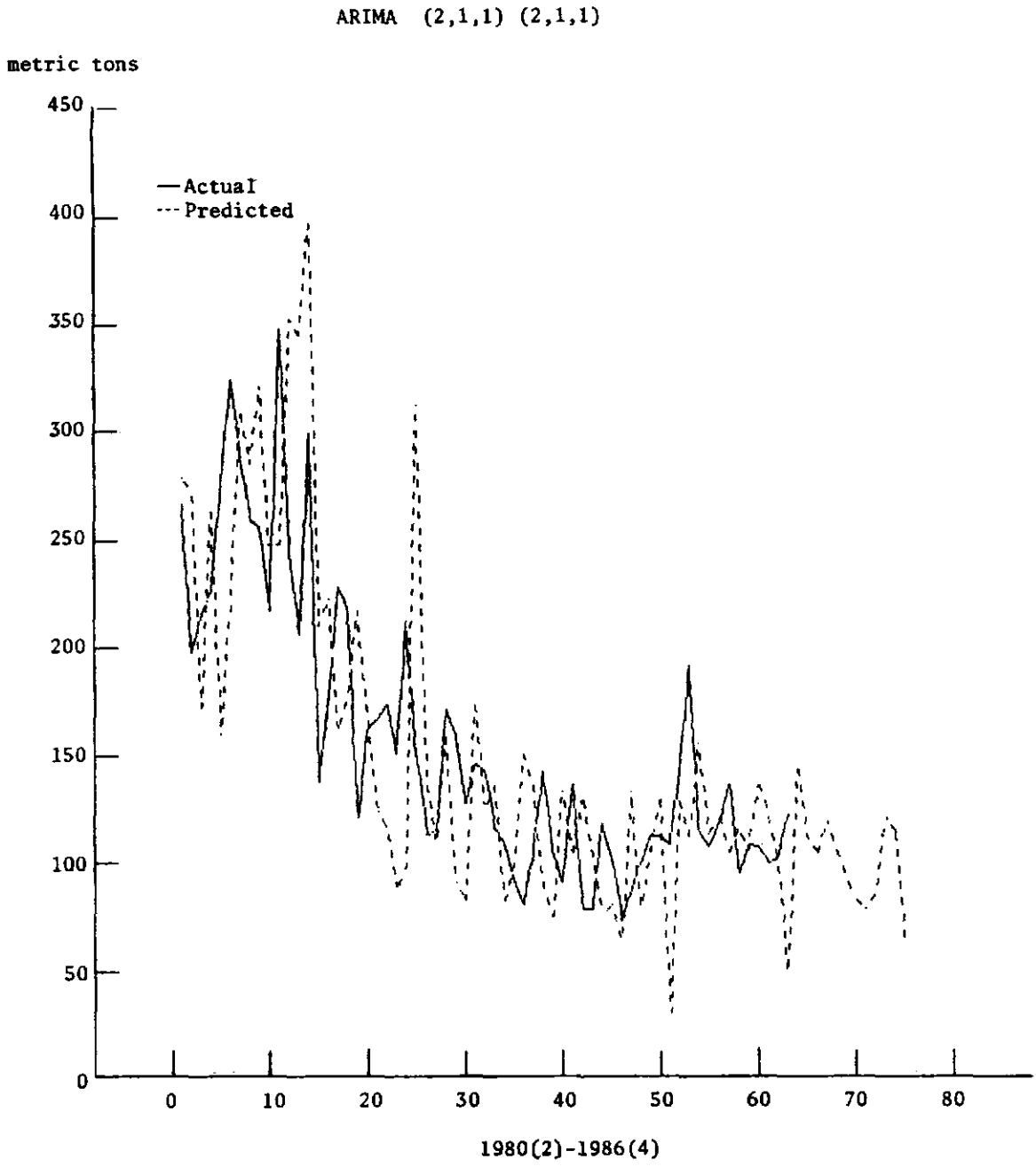


Figure 23 Forecasting : Tungsten Production

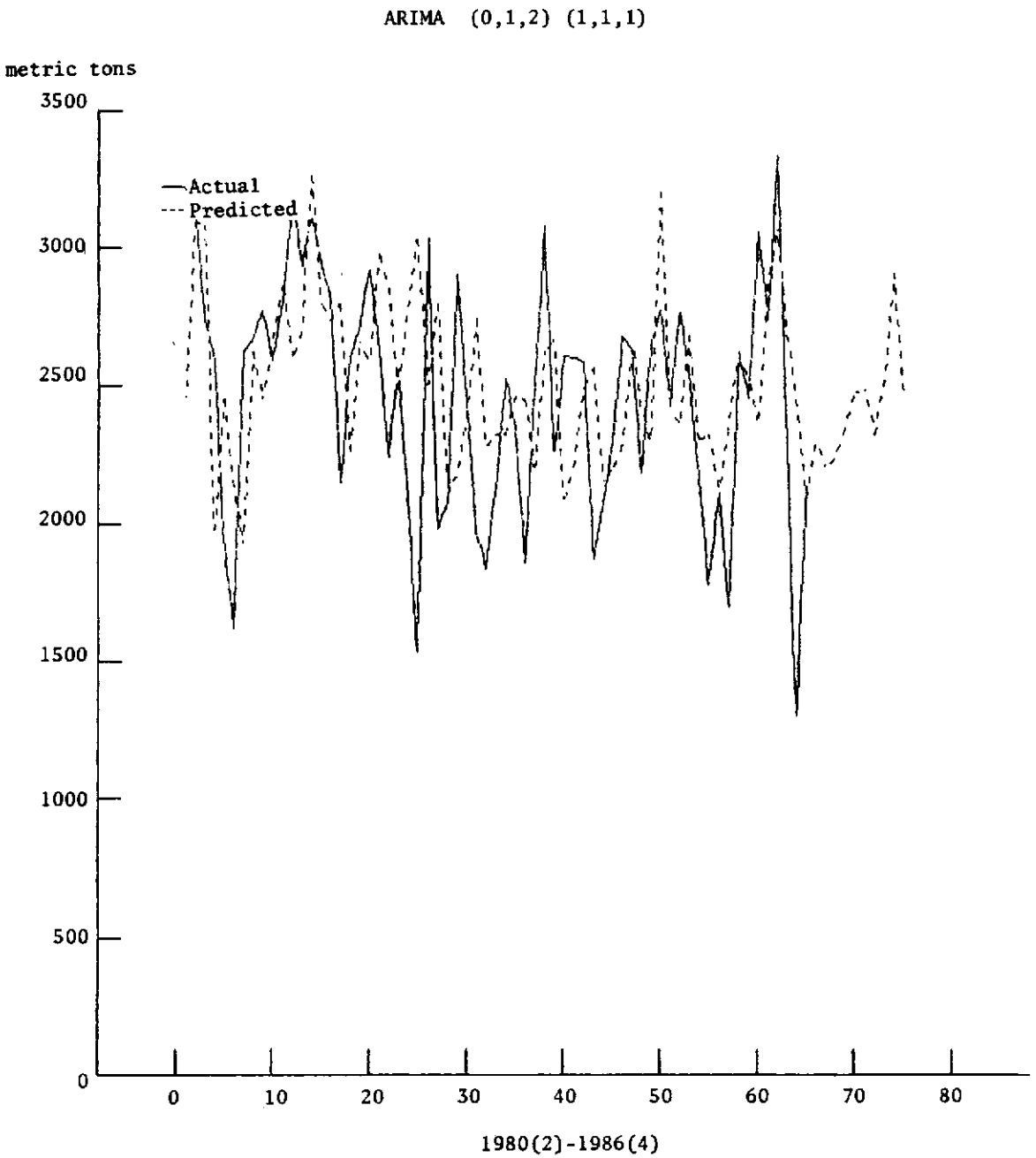


Figure 24 Forecasting : Cigarettes Production

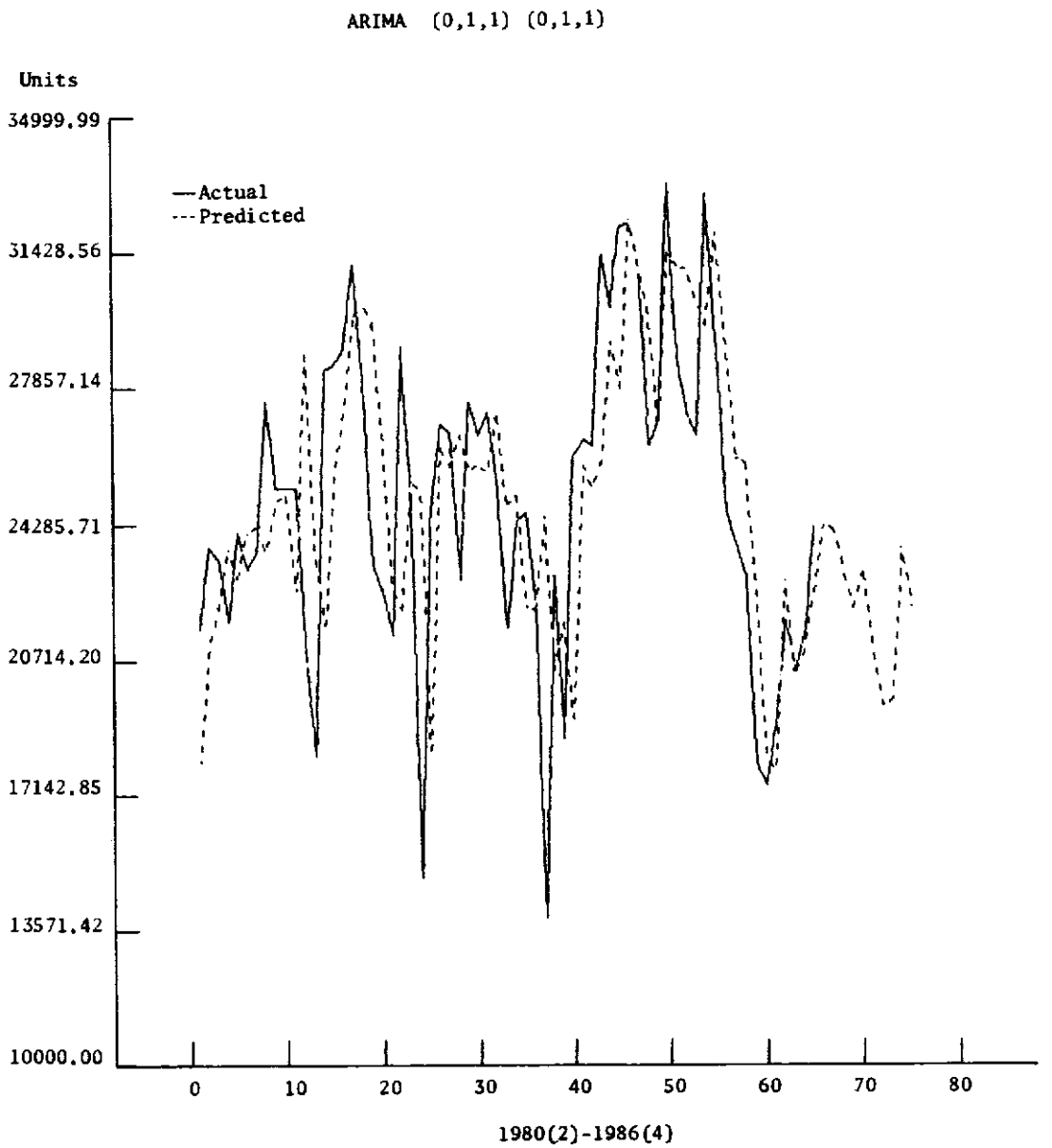


Figure 25 Forecasting : Motorcycle Production

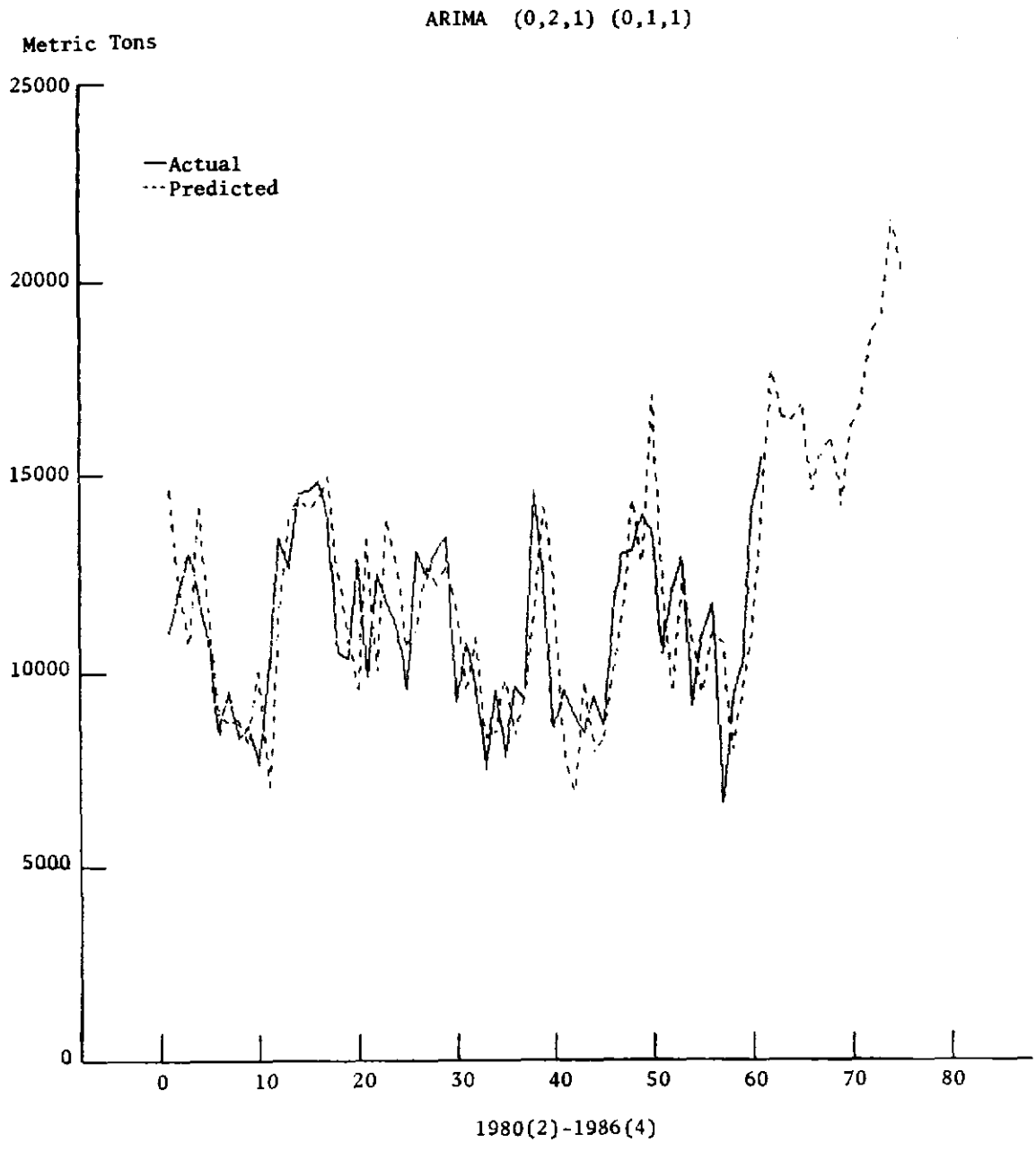


Figure 26 Forecasting : Galvanize Production

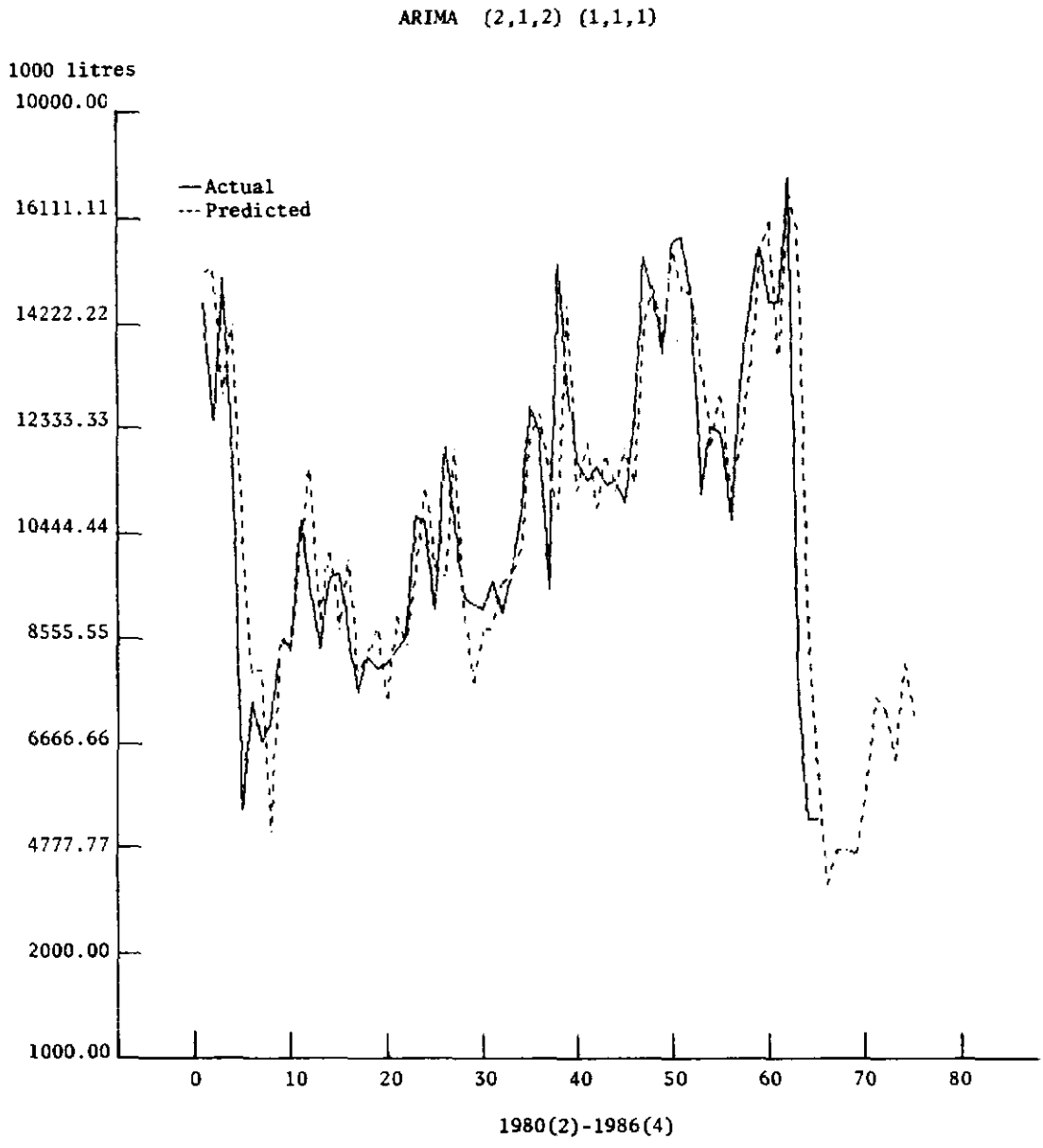


Figure 27 Forecasting : Beer Production

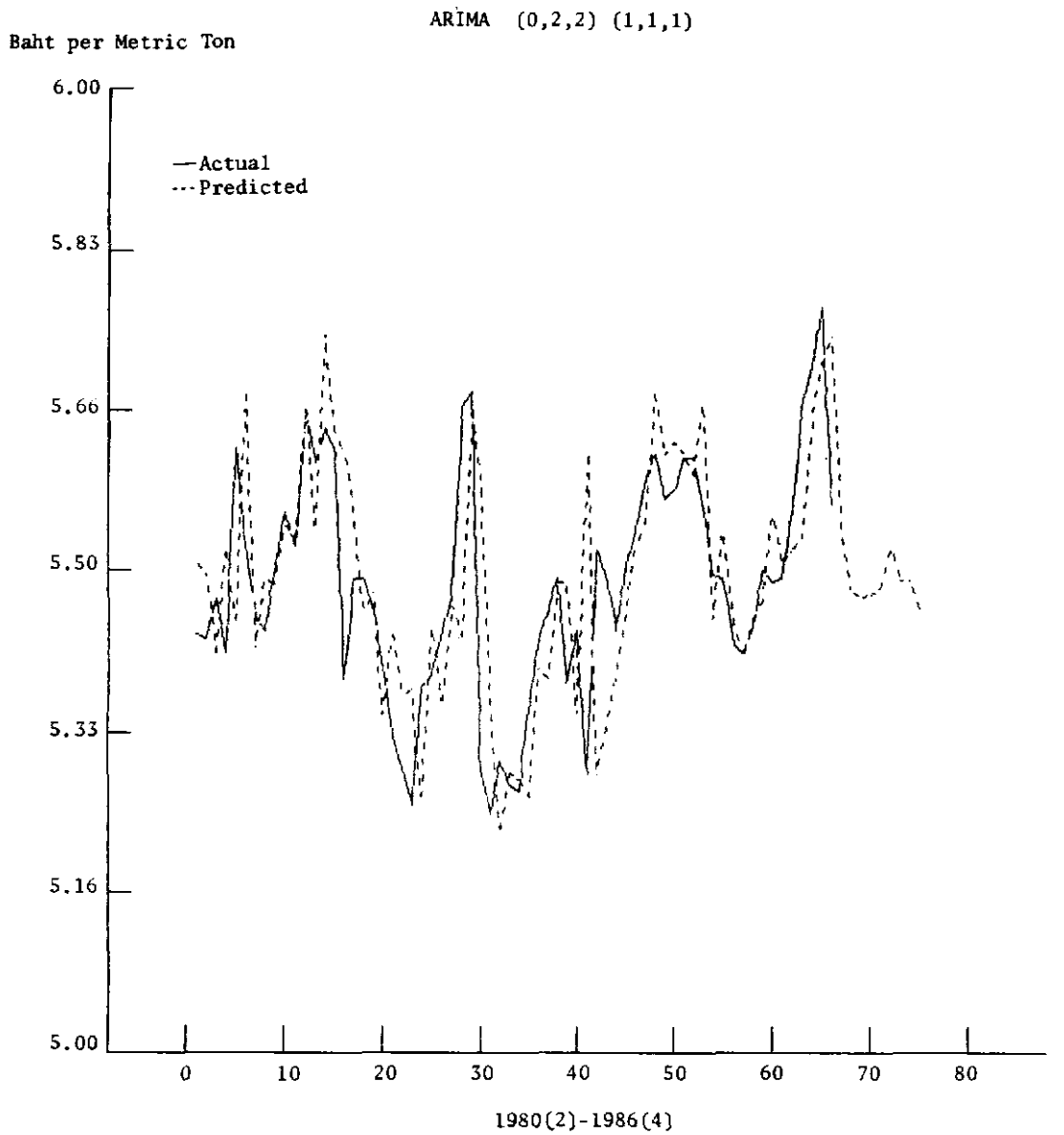


Figure 28 Forecasting : Farm Price of Maize

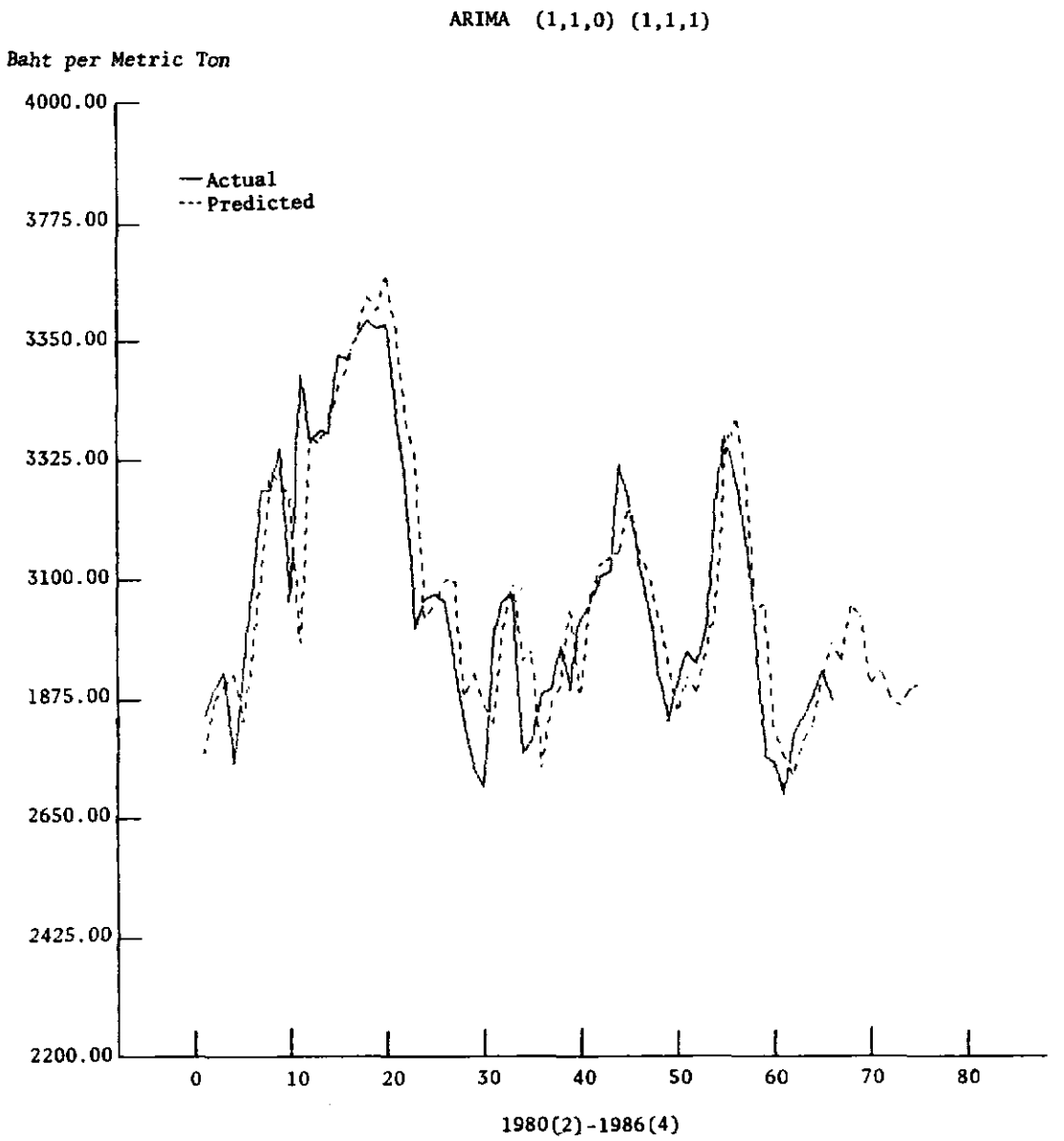


Figure 29 Forecasting : Farm Price of Paddy

DI of Group A 1974 (1)–1986 (4)

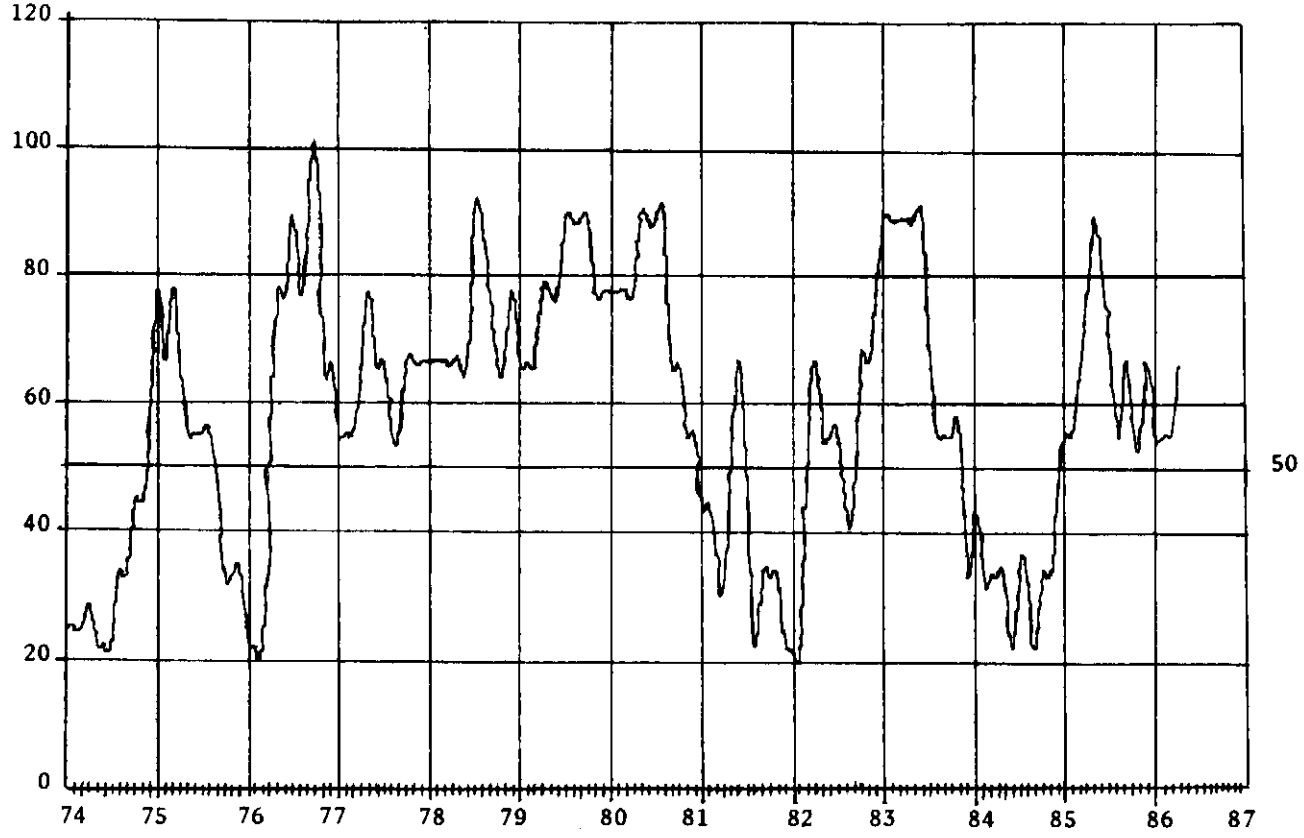


Figure 30

DI of Group B 1974 (1)-1986 (4)

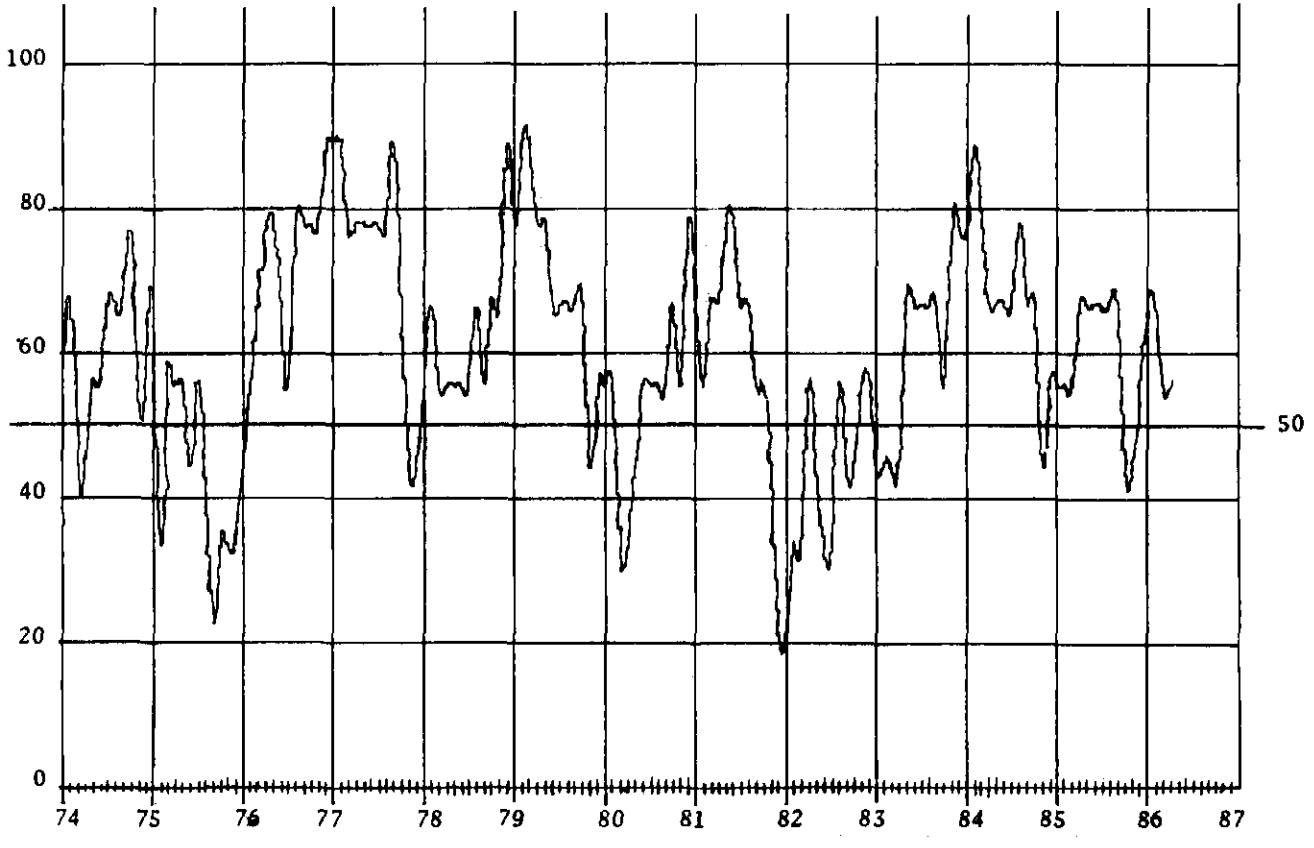


Figure 31

DI of Group"A+B"1974 (1)-1986 (4)

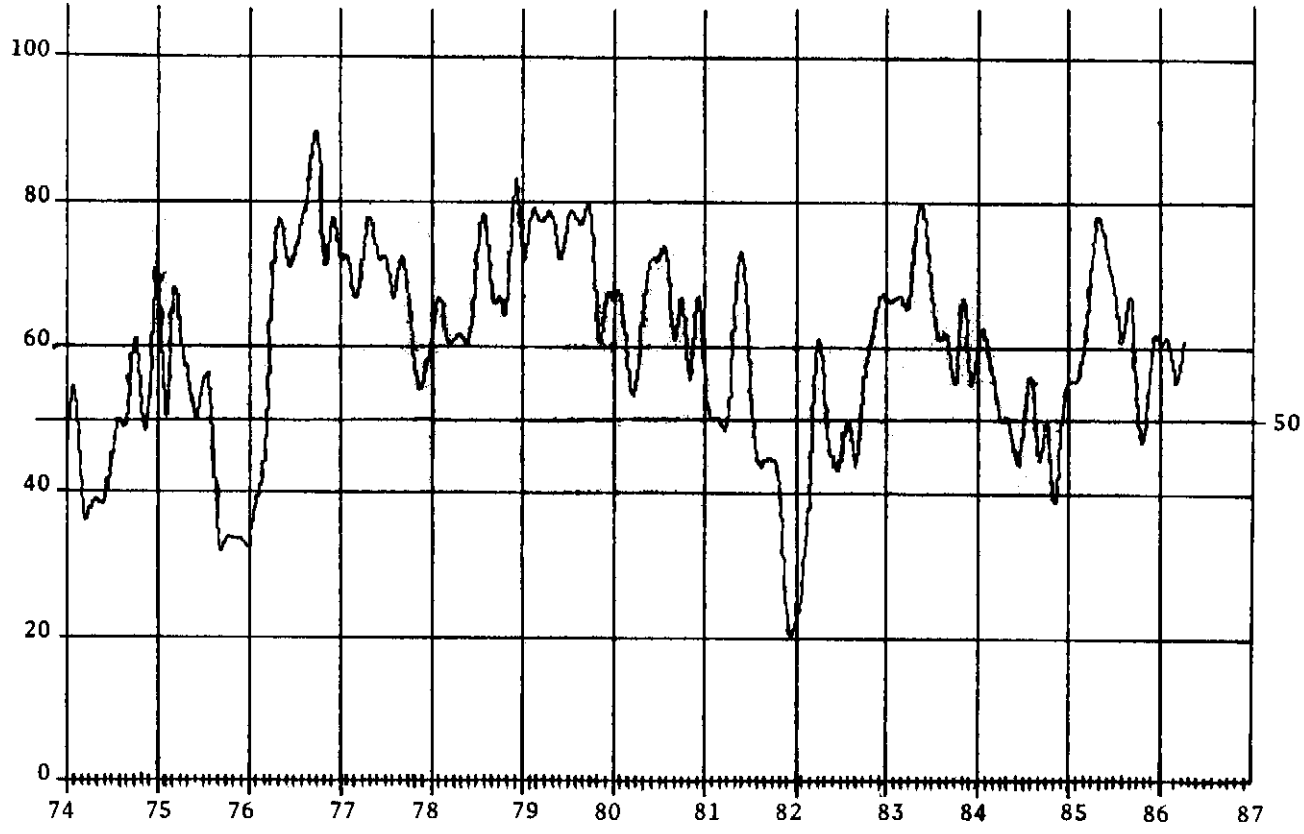


Figure 32

Table 10 Predicted Values by Time Series Model 1985 (12)–1986 (4).

	Farm Price of Paddy Baht/Ton	Farm Price of Maize Baht/Ton
1985 (12)	2,929.28	5,481.37
1986 (1)	2,877.19	5,526.57
1986 (2)	2,863.22	5,490.56
1986 (3)	2,893.50	5,489.46
1986 (4)	2,904.01	5,458.28

	Export Price Index	Production of Car Unit (12)
1985 (12)	119.05	2,530
1986 (1)	120.15	2,700
1986 (2)	120.87	2,570
1986 (3)	122.61	2,749
1986 (4)	121.87	2,469

	Farm Price of Sugar Cane Baht/Ton	Farm Price of Cassava Baht/Ton	Farm Price of Rubber Baht/Ton
1985 (12)	358.55	721.80	1,495.30
1986 (1)	359.77	762.15	1,502.64
1986 (2)	357.31	777.54	1,500.28
1986 (3)	350.37	836.00	1,514.91
1986 (4)	353.91	882.41	1,522.11

	Production of Petroleum 1,000 Litres	Production of Detergent Metric Tons
1985 (12)	702,009	6,616
1986 (1)	778,093	6,963
1986 (2)	693,574	7,146
1986 (3)	727,052	7,604
1986 (4)	733,381	7,492

	Production of Gunny bag	Production of Motorcycle
1985 (12)	11,255	20,835
1986 (1)	12,223	19,504
1986 (2)	12,025	19,676
1986 (3)	13,384	23,611
1986 (4)	10,895	22,092

Table 10 (Continued)

	Production of Lignite Metric Tons	Production of Galvanize Metric Tons
1985 (12)	405,744	16,884
1986 (1)	439,161	18,650
1986 (2)	437,970	19,126
1986 (3)	447,782	21,483
1986 (4)	445,419	20,270

	Production of Cement Metric Tons	Production of Beer 1,000 Litres	Production of Gypsum Metric Tons
1985 (12)	754,623	7,492	100,446
1986 (1)	684,602	7,492	113,506
1986 (2)	705,904	6,310	113,325
1986 (3)	896,655	8,177	121,731
1986 (4)	725,740	7,199	128,579

	Production of Iron Metric Tons	Production of Tungsten Metric Tons
1985 (12)	7,101	79
1986 (1)	6,454	87
1986 (2)	7,708	121
1986 (3)	7,508	114
1986 (4)	7,533	63

	Production of Cigarette Metric Tons	Production of Fluorite Metric Tons
1985 (12)	2,485	29,187
1986 (1)	2,328	27,402
1986 (2)	2,525	30,977
1986 (3)	2,909	31,161
1986 (4)	2,482	27,380

	Department Sales	Stock Price Index	Money Supply: M1
1985 (12)	288.94	143.27	87,457
1986 (1)	198.38	139.93	91,108
1986 (2)	185.01	136.48	90,466
1986 (3)	181.59	134.40	93,690
1986 (4)	181.62	130.67	90,450

In addition, the forecasting values of each series are shown in Table 10. It is noted that most of the predicted values show sign of recovery after the end of 1985 (12). If this is so then the diffusion index constructed by these predicted value will be above the 50 percent line. We therefore plot the DI for these series of Groups A, B and C. The results are shown in Figure 30, 31 and 32. As we have expected, the DI for Group A which comprises mostly the indicators from agricultural sector namely, their respective prices show signs of recovery after dipping under the 50 percent line during 1983 (11)-1984 (12). From the beginning of 1985 (1) to 1985 (12) it shows sign of recovery. Though still fluctuating above the 50 percent line, it shows no signs of becoming peak in the first quarter of 1986. The DI for the Group B. which comprises mostly of these important manufacturing products shows signs of recovery after 1983 (4). It fluctuates above the 50 percent line since then. After the end of 1985 (12) to the first quarter, the DI constructed from the predicted values shows signs of recovery but still is not able to reach its peak. The DI constructed from the composition of Group A and B shows signs of recovery after dipping to the trough in 1982 (10). It seems that the economy contracted again though with short period during 1984 (2)-1984 (12). After that it seems to recover but still not able to be fully expanded in 1985 (1)-1985 (12). After the end of 1985 to the first quarter of 1986 (4) the index inclines during the first two months 1986 (2) then declines again during 1986 (3)-1986 (4).

The meaning of these graphs and figures is not at all easy to interpret. However, as far as the state of art permits us, we would like to conclude that the Thai economy during the first quarter of 1986 is not totally dim. On the other hand, it seems that the recovery process works its way through out the quarter. Yet, we dare not say that our prediction can say more about when will the economy expands towards its peak within 1986. But we are still hopeful, for the DI really confirms us that we are not near a stalemate. Moreover, we have been passing through the turning point after the end of 1984 and are surging up for the past 17 months, though with ups and downs.

4. The Business Survey.

In order to check whether our tentative reference date, the coincident diffusion index are relevant to economic situation we apply a business survey. The survey of businessmen's expectation about future prospect and a backward looking to check whether their past expectation i.e., the last three months are consistent with their ex-post realization.

In addition, the objective of the survey is to collect information on general business and economic situations in order to establish the Business Survey Index (BSI). The BSI will, then, be used to analyse and forecast the business and economic situations as compared with those of the Diffusion Index (DI).

The sampling design bases its sector dispersion on the manufacture classification of the national accounts. Only those with potential significance for business and economic conditions are selected to conduct the survey. They are all non-agricultural sectors.

As for the agricultural sectors crops, livestocks, fisheries and forestry), though it possesses a high percentage share of GDP at about 23.24 percent (see Table 11), it is excluded from the design on the ground that it is not present in the form of any corporations-the target group of this survey.

Considering of percentage share of sector's GDP to the total, the sample size of each sector can be identified. The percentage share of GDP of each sector is shown in Table 11.

Table 11: G.D.P. at 1972 Prices and Percentage Share

Sector of Origin	1982	1983	1984	%	%	%
1. Agriculture	78,502	81,449	84,297	24.23	23.75	23.19
1.1 Crops	59,904	61,919	63,611	18.49	18.06	17.50
Paddy	22,056	23,874	23,813	6.81	6.96	6.55
Rubber	2,629	2,815	2,883	.81	.82	.79
Coconut	409	419	429	.13	.12	.12
Sugarcane	6,684	4,648	4,976	2.06	1.36	1.37
Maize & Sorghum	2,768	3,509	3,966	.85	1.02	1.09
Groundnut	337	340	354	.10	.10	.10
Mung Bean	684	746	790	.21	.22	.22
Castor Bean	76	76	77	.02	.02	.02
Soyabean	268	336	368	.08	.10	.10
Cassava	6,065	6,638	7,070	1.88	1.94	1.94
Tobacco	2,040	1,659	1,612	.63	.48	.44
Cotton	692	731	754	.21	.21	.21
Kenaf & Jute	515	622	567	.16	.18	.16
Kapok	159	186	166	.05	.05	.05
Seasame	141	84	105	.04	.02	.03
Garlic & Onion	2,754	2,624	2,767	.85	.77	.76
Vegetables	1,990	2,101	2,159	.61	.61	.59
Fruits	9,180	10,034	10,230	2.83	2.93	2.81
Other Crops	427	477	525	.13	.14	.14
1.2 Livestocks	9,897	10,332	10,742	3.05	3.01	2.95
1.3 Fisheries	6,019	6,568	6,998	1.86	1.92	1.92
1.4 Forestry	2,282	2,630	2,946	.83	.77	.81

Table 11 *(Continued)*

Sector of Origin	1982	1983	1984	%	%	%
2. Mining & Quarrying	4,431	4,414	5,166	1.37	1.29	1.42
3. Manufacturing	67,317	72,252	76,944	20.77	21.07	21.16
3.1 Food	10,865	10,405	10,989	3.35	3.03	3.02
3.2 Beverages	5,582	6,316	7,114	1.72	1.84	1.96
3.3 Tobacco & Snuffs	4,054	4,325	4,563	1.25	1.26	1.26
3.4 Textiles	9,744	10,415	10,815	3.01	3.04	2.97
3.5 Wearing Apparel	7,204	7,745	8,116	2.22	2.26	2.23
3.6 Leather	401	415	449	.12	.12	.12
3.7 Wood & Cork	805	873	921	.25	.25	.25
3.8 Furniture	415	474	518	.13	.14	.14
3.9 Paper & Paper product	975	1,037	1,069	.30	.30	.29
3.10 Printing	1,888	1,784	1,873	.58	.52	.52
3.11 Chemical	5,732	6,199	6,652	1.77	1.81	1.83
3.12 Petroleum refining	3,223	3,319	3,196	.99	.97	.88
3.13 Rubber Products	1,433	1,585	1,635	.44	.46	.45
3.14 Non-metal Products	3,779	4,116	4,489	1.17	1.20	1.23
3.15 Basic Metal	538	539	590	.16	.16	.16
3.16 Metal Products	609	666	730	.16	.16	.16
3.17 Machinery	1,297	1,425	1,572	.40	.42	.43
3.18 Electrical Machine	1,227	1,414	1,544	.38	.41	.42
3.19 Transport Equip.	5,541	6,861	7,379	1.71	2.00	2.03
3.20 Misselaneous	2,010	2,339	2,730	.62	.68	.75
4. Construction	15,097	15,927	16,650	4.66	4.64	4.58
5. Electricity & Water	6,755	7,348	8,141	2.08	2.14	2.24
6. Transportation	21,715	23,290	24,945	6.70	6.79	6.86
6.1 Private	46,109	55,965	61,523	14.23	16.32	16.92
6.2 Public	17,024	17,743	20,990	5.25	5.17	5.77
7. Trade	52,789	55,076	57,974	16.29	16.06	15.95
7.1 Imports	9,595	10,534	11,792	2.96	3.07	3.24
7.2 Domestic	43,194	44,542	46,182	13.33	12.99	12.70
8. Banking	21,396	24,233	26,856	6.60	7.07	7.39
9. Ownership of Dwelling	4,936	5,178	5,385	1.52	1.51	1.43
10. Public Admin.	13,833	14,498	15,301	4.27	4.23	4.21
11. Services	37,261	38,276	41,904	9.96	10.02	10.03
11.1 Hotels	32,288	34,361	36,463	1.13	1.15	1.25
11.2 Entertain	3,663	3,954	4,547	.00	.00	.00
11.3 Others	1,820	661	894	.41	.23	.25
Total	324,032	342,946	363,563	100.00	100.00	100.00

Source: NESDB.

Table 12 Sample Size Selected by Share in GDP.

Sector	Share in GDP. (%)	Sample size
Manufacturing	22	64
Construction	5	16
Transportation	6	18
Wholesale & Retail Trade	16	50
Banking & Insurance	7	22
Services	10	30
Others	35	-
Total	100	200

The frames (population) used in fixing the sizes and locating the places of samples are taken from "Million Baht Business 1985", taking into account the highest possibility of acquiring cooperation and the highest volumes of sales respectively. All are located in Bangkok and the four nearby provinces, namely, Nontaburi, Samutprakan, Patumthani and Samutsakorn.

The total samples for this pilot susvey are set up at 200. The sample size of each sector is arrived at by applying its percentage share of GDP to the number of total samples. This is, consequently, adjusted taking into account the time constraint and also the highest possibility of return. The sample size allocation is shown in Table 12.

The following is detail of allocation of the sample size of each sector.

(1) Manufacturing. The sample size resulted from the mentioned method is 64. This can, in turn, be distributed into various activities according to the ISIC by mean of their GDP shares. The results of sample size distribution for manufacturing are presented in Table 13.

(2) Transportation. According to the GDP share, the sample size fallen in this sector is 18, as follows:

	Share of GDP (%)	Sample size
1. Land transport	68.3	12
2. Water transport	9.2	2
3. Air transport	8.3	2
4. Communication	7.9	1
5. Transport support service	6.3	1

Table 13 : Selected Sample from Manufacturing Sector.

code ISIC	Type of Commodities	Total % Share/GDP.	No. of Sample
311-312	Food	3.02	9
313	Beverages	1.96	6
314	Tobacco and snuff	1.26	4
321	Textiles	2.97	9
322	Wearing apparel	2.23	7
323-324	Leather	0.12	9
331	Wood and cork	0.25	1
332	Furniture and fixture	0.14	0
341	Paper, paper Pro.	0.29	1
342	Printing	0.52	2
351-352	Chemicals	1.88	6
353-354	Petroleum Refin	0.88	3
355-356	Rubber products	0.45	1
361-369	Non-Metallic Pro.	1.23	4
371-372	Basic metal Ind.	0.16	0
381	Metal products	0.16	0
382	Machinery	0.43	1
383	Electrical Mach.	0.42	2
384	Transport Equip.	2.03	6
389-390	Miscellaneous	0.75	2
	Total	21.16	64

Some adjustment has been made, however, the finalized sample size of the transportation is that of item (2), that is only 2 samples. All the rest, which amounts 16, is transfered to manufacturing and trade sectors according to their shares respectively (manufacturing 8 and trade 6).

(3) Banking. According to the GDP share, the sample size of this sector can be fixed up at 22. It is distributed into sub-sectors as follows.

	Share of GDP (%)	Sample size
1. Banking and other financial institution	90	20
2. Insurance and real estate	10	1

For the first item, it comprises 10 domestic commercial banks, 5 foreign commercial banks, and other financial institutions as for the rest.

For the second item, it would be 1 real estate.

(4) Services. (not included in this pilot survey).

(5) Construction. The fixed up sample size is 16.

In conclusion, the finalized sample size as compared with the preliminary ones are as follows :

Sectors	Previous sample size	Finalized sample size
Manufacturing	64	116
Construction	16	16
Transportation	18	2
Trade	50	66
Banking & Financial Institutions	22	21
Services	30	-
	200	221

4.1 Survey Method and Period of Survey Conducted.

The survey is done on two basis. Firstly, the entrepreneurs will be interviewed directly. Secondly, the other means namely mailing or phoning will also be applied to reach informations.

The survey was conducted during 1st-31st October 1985.

4.2 The Survey's Result.

4.2.1 Evaluation Procedure.

In each sector, the representative businessmen are interviewed with 32 questions. The question for each sector are almost similar except for banking and finance sector dued to its special characteristics. The list of questionaires are shown in Table 14-27. For each sector, answer to each question by businessmen are summed and devided through by total numbers of response. This is done on two basis, a simple average method, and a weighted average method (by sale volume).

Therefore, if most of the expectations (ahead/backward) towards the economic conditions reflecting in the question is downs (ups) we get a negative (positive) numerical value after evaluating the answer with +1 and -1 for ups and downs respectively. In addition, for the entrepreneur who feels that there is no change in the situation we assign a zero value to it. After the row-sum of 32 answers, we give a general picture to each of the answer for the sector. The average negative (positive) numerical values will be assigned a negative (positive) sign. In order to evaluate the general expectation of each sector we count numbers of plus signs out of total sample for the sector. It should be noted that a zero numerical value will be assigned a 0.5 value in counting (the plus sign) to distinguish it from a down turn of situation in the sector. The results are therefore a 'business survey

index' for each industry. The index is compatible with expectation 3 months before and 3 months ahead. The index for each industry is shown in Table 29.

Moreover, in order to grasp a more concrete business condition we evaluate sets of questions from important sector namely the manufacturing and trade (see Table 14–28). The Business Survey Index derived from this selected questions (though arbitrary) is shown in Teble 30.

4.2.2 Interpretation of the Results.

The overall business condition expected by representative firms are sluggish in nearly four out of five sectors except the financial and banking sector, These are shown by the BSI in Table 29, which dip below a 50 percent level in both foreward and backward expectation. The 3 months ahead BSI (both the weighted and simple average) are however greater than those of 3 months ago. This may imply that in general the businessmen are to a small extent optimistic towards the economic condition in a near future ahead compared with the last 3 months. However, the numbers of optimists are less than 50 percent of the representative businessmen in manufacturing, wholesale and retail trade and transportation sector in the weighted average case. In addition, numbers of optimists also less than 50 percent of total representative businessmen in manufacturing, wholesale and retail trade, construction and transportation in the simple average case. It should be noted that the prospects for finance and banking sector are not at all sluggish in all cases. This may imply that in general, businessmen in the non-finance and banking sectors do not see any brisk future in their business up to the end of 1985. On the other hand, those who are in the finance and banking sector see brighter future in relative, perhaps with past experience of transaction volumes through banking system during harvesting period toward the end of the year.

The business down turns are also confirmed in Table 13 where some questions are arbitrary chosen. It seems that the future prospects are even worse in manufacturing and trade sectors.

Table 14 : Responses for situations 3 months ago Transportation sector

Business survey
Nov. 1984

	Question	Sumai/ N	+ −	Sumai*Si/ Sums	+ −
1	General economic situation	-0.500	−	-0.667	−
2	Business situation	-0.500	−	-0.667	−
3	Value of transport to abroad	-0.500	−	-0.667	−
4	Value of transport from abroad	-0.500	−	-0.333	−
5	Price/unit (to abroad)	-0.500	−	-0.333	−
6	Price/unit (from abroad)	0.000	0	0.000	0
7	Domestic competition*	0.500	+	0.667	+
8	Overseas competition*	-1.000	−	-1.000	−
9	Number of employee	0.000	0	0.000	0
10	Wages and salaries*	0.000	0	0.000	0
11	Normal working hours	0.000	0	0.000	0
12	Overtime working hours	0.000	0	0.000	0
13	Change in production equipment	0.000	0	0.000	0
14	Change in land and building	0.000	0	0.000	0
15	Change in ships	0.000	0	0.000	0
16	Change in other equipment	0.000	0	0.000	0
17	Petroleum products used	0.000	0	0.000	0
18	Electricity used	0.000	0	0.000	0
19	Interest rate	0.000	0	0.000	0
20	Loan sources	0.000	0	0.000	0
21	Bad debt rate*	-0.500	−	-0.667	−
22	Foreign interest rate*	1.000	+	1.000	+
23	Movement of baht value*	-0.500	−	-0.667	−
24	Production of Thai farmers (total)	0.000	0	0.000	0
25	Production of Thai farmers (north)	0.000	0	0.000	0
26	Production of Thai farmers (central)	0.000	0	0.000	0
27	Production of Thai farmers (northeast)	0.000	0	0.000	0
28	Production of Thai farmers (south)	0.000	0	0.000	0
29	Government economic policy	0.000	0	0.000	0
30	Financial and trade policy	0.000	+	0.333	+
31	Construction budget	-1.000	−	-0.333	−
32	Politic atmosphere	-1.000	−	-0.333	−
Sum			3		3
Business survey index			9%		9%

Table 15 : Responses for situation 3 months ahead transportation sector

Business survey
Nov. 1985

	Questions	Sumai/ N		Sumai*Si/ Sums	
1	General economic situation	-1.000	-	-1.000	-
2	Business situation	-1.000	-	-1.000	-
3	Value of transport to abroad	-1.000	-	-1.000	-
4	Value of transport from abroad	0.000	0	0.000	0
5	Price/unit (to abroad)	-1.000	-	-1.000	-
6	Price/unit (from abroad)	-0.500	-	-0.667	-
7	Domestic competition*	0.500	+	0.667	+
8	Overseas competition*	-1.000	-	-1.000	-
9	Number of employee	0.000	0	0.000	0
10	Wages and salaries	0.000	0	0.000	0
11	Normal working hours	0.000	0	0.000	0
12	Overtime working hours	0.000	0	0.000	0
13	Change in production equipment	0.000	0	0.000	0
14	Change in land and building	0.000	0	0.000	0
15	Change in ships	0.000	0	0.000	0
16	Change in other equipment	0.000	0	0.000	0
17	Petroleum products used	0.000	0	0.000	0
18	Electricity used	0.000	0	0.000	0
19	Interest rate*	1.000	+	0.333	+
20	Loan sources	0.000	0	0.000	0
21	Bad debt rate*	-0.500	-	-0.667	-
22	Foreign interest rate*	0.500	+	0.333	+
23	Movement of baht value*	0.500	+	0.333	-
24	Production of Thai farmers (total)	0.000	0	0.000	0
25	Production of Thai farmers (north)	0.000	0	0.000	0
26	Production of Thai farmers (central)	0.000	0	0.000	0
27	Production of Thai farmers (northeast)	0.000	0	0.000	0
28	Production of Thai farmers (south)	0.000	0	0.000	0
29	Government economic policy	0.000	0	0.000	0
30	Financial and trade policy	1.000	+	0.333	+
31	Construction budget	-1.000	-	-0.333	-
32	Politic atmosphere	-1.000	-	-0.333	-
Sum			5		5
Business survey index			16%		16%

Table 16 : Responses for situations 3 months ago Construction section

	Questions	Business survey Nov. 1985 Sumai/ N	+ −	Sumai*Si/ Sums	+ −
1	General economic situation	-0.636	−	-0.772	−
2	Business situation	-0.364	−	-0.245	−
3	Construct. value for government	-0.364	−	0.295	−
4	Construct. value for private	-0.250	−	-0.101	−
5	Price/unit of construction	-0.300	−	0.453	+
6	Number of employee	-0.364	−	-0.170	−
7	Wages and salaries*	0.091	+	0.107	+
8	Normal working hours	-0.091	−	-0.018	−
9	Overtime working hours	-0.182	−	-0.708	−
10	Change in trucks	-0.273	−	-0.177	−
11	Change in other equipment	0.000	0	-0.077	−
12	Change in production equipment	-0.182	−	-0.111	−
13	Change in land and building	-0.273	−	-0.172	−
14	Price/unit of domest material*	-0.100	−	-0.041	−
15	Price/unit of import material*	0.000	0	0.558	−
16	Petroleum products used	-0.182	−	-0.087	−
17	Electricity used	0.091	+	-0.023	−
18	Interest rate*	0.000	0	0.470	−
19	Loan sources	0.091	+	0.585	+
20	Bad debt rate*	0.182	+	0.103	
21	Foreign interest rate*	0.429	+	0.648	+
22	Movement of baht value*	-0.111	−	0.586	+
23	Production of Thai farmers (total)	0.000	0	-0.023	−
24	Production of Thai farmers (north)	0.600	+	0.139	+
25	Production of Thai farmers (central)	0.200	+	0.071	+
26	Production of Thai farmers (northeast)	0.400	+	0.082	+
27	Production of Thai farmers (south)	0.500	+	0.105	+
28	Government economic policy	-0.250	−	-0.052	−
29	Financial and trade policy	-0.500	−	-0.736	−
30	Construction budget	-0.636	−	-0.877	−
31	Politic atmosphere	-0.750	−	-0.788	−
Sum			9		13
Business survey index			29%		42%

Table 17 : Responses for situations 3 months ahead construction sector

	Questions	Sumai/ N	+ −	Business survey Nov. 1985 Sumai*Si/ Sums	+ −
1	General economic situation	−0.545	−	0.326	+
2	Business situation	−0.182	−	0.471	+
3	Construct. value for government	−0.091	−	0.092	−
4	Construct. value for private	−0.125	−	0.537	+
5	Price/unit of construction	−0.600	−	0.350	+
6	Number of employee	−0.091	−	−0.076	−
7	Wages and salaries*	0.000	0	0.092	+
8	Normal working hours	0.000	0	−0.054	−
9	Overtime working hours	−0.273	−	0.445	+
10	Change in trucks	−0.182	−	−0.159	−
11	Change in other equipment	0.091	+	0.507	+
12	Change in production equipment	−0.182	−	0.420	+
13	Change in land and building	−0.273	−	−0.172	−
14	Price/unit of domest material*	0.000	0	−0.023	−
15	Price/unit of import material*	−0.200	−	−0.034	−
16	Petroleum products used	0.091	+	0.074	+
17	Electricity used	0.455	+	0.149	+
18	Interest rate*	0.000	0	−0.481	−
19	Loan sources	−0.091	−	−0.067	−
20	Bad debt rate*	0.182	+	0.103	+
21	Foreign interest rate*	0.000	0	−0.558	−
22	Movement of baht value*	−0.222	−	0.505	+
23	Production of Thai farmers (total)	0.000	0	−0.023	−
24	Production of Thai farmers (north)	0.600	+	0.139	+
25	Production of Thai farmers (central)	0.200	+	0.071	+
26	Production of Thai farmers (northeast)	0.500	+	0.105	+
27	Production of Thai farmers (south)	0.500	+	0.105	+
28	Government economic policy	−0.375	−	−0.063	−
29	Financial and trade policy	0.000	0	−0.006	−
30	Construction budget	−0.273	−	−0.097	−
31	Politic atmosphere	−0.500	−	−0.108	−
Sum			8		16
Business survey index			26%		52%

Table 18 : Responses for situations 3 months ago banking sector

	Questions	Sumai/ N	+ −	Business survey Nov. 1985 Sumai*Si/ Sums	+ −
1	General economic situation	-0.467	−	06.000	−
2	Business situation	-0.214	−	07.000	−
3	Saving deposit	0.500	+	04.000	+
4	Demand deposit	0.286	+	76.000	+
5	Time deposit	0.714	+	72.000	+
6	Loan to business	0.267	+	14.000	+
7	Overdrafts	0.000	0	94.000	−
8	Housing loan	0.364	+	85.000	+
9	Other loans	0.667	+	14.000	+
10	Interest rate to business	-0.857	−	24.000	−
11	Interest rate to O.D.	-0.917	−	31.000	−
12	Interest rate to housing loan	-1.000	−	67.000	−
13	Interest rate to others	-1.000	−	06.000	−
14	Bad debt rate (business)*	-0.214	−	46.000	−
15	Bad debt rate (O.D.)*	-0.100	−	30.000	+
16	Bad debt rate (housing loan)*	-0.100	−	58.000	−
17	Bad debt rate (others)*	-0.000	0	0.000	0
18	Int. Rate of domes. loan sources*	0.533	+	30.000	+
19	Int. Rate of foreign loan sources*	0.571	+	53.000	+
20	Domestic loan sources	0.533	+	56.000	−
21	Foreign loan sources	0.500	+	58.000	+
22	Money supply (domes. loan source)	0.533	+	69.000	+
23	Money supply (forei. loan source)	0.429	+	01.000	−
24	Number of employee	0.400	+	34.000	+
25	Wages and salaries*	-0.400	−	09.000	−
26	Normal working hours	0.067	+	96.000	+
27	Overtime working hours	0.071	+	86.000	+
28	Change in production equipment	0.500	+	00.000	+
29	Change in trucks	0.333	+	83.000	+
30	Change in other equipment	0.538	+	30.000	+
31	Change in land and building	0.333	+	61.000	+
32	Foreign interest rate*	0.667	+	93.000	+
33	Movement of baht value*	-0.467	−	18.000	−
34	Production of Thai farmers (total)	0.000	0	32.000	+

Table 18 (Continued)

	Questions	Sumai/ N	+ −	Business survey Nov. 1985 Sumai*Si/ Sums	+ −
35	Production of Thai farmers (north)	0.250	+	04.000	+
36	Production of Thai farmers (central)	0.167	+	11.000	+
37	Production of Thai farmers (northeast)	−0.083	−	42.000	+
38	Production of Thai farmers farmers (south)	−0.033	−	33.000	+
39	Government economic policy	0.083	+	67.000	−
40	Financial and trade policy	−0.231	−	98.000	−
41	Construction budget	−0.500	−	44.000	−
42	Politic atmosphere	−0.867	−	48.000	−
Sum			23		25
Business survey index			55 %		60 %

Table 19 : Responses for situations 3 months ago banking sector.

	Questions	Sumai/ N	+ −	Business survey Nov. 1985 Sumai*Si/ Sums	+ −
1	General economic situation	−0.467	−	06.000	−
2	Business situation	−0.214	−	07.000	−
3	Saving deposit	0.500	+	04.000	+
4	Demand deposit	0.286	+	76.000	+
5	Time deposit	0.714	+	72.000	+
6	Loan to business	0.267	+	14.000	+
7	Overdrafts	0.000	0	94.000	−
8	Housing loan	0.364	+	85.000	+
9	Others loans	0.667	+	14.000	+
10	Interest rate to business	−0.857	−	24.000	−
11	Interest rate to O.D.	−0.917	−	31.000	−
12	Interest rate to housing loan	−1.000	−	67.000	−
13	Interest rate to others	−1.000	−	06.000	−
14	Bad debt rate (business)*	−0.214	−	46.000	−
15	Bad debt rate (O.D.)*	−0.100	−	30.000	+
16	Bad debt rate (housing loan)*	−0.100	−	58.000	−
17	Bad debt rate (others)*	0.000	0	0.000	0
18	INT. Rate of domes. loan sources*	0.533	+	30.000	+
19	INT. Rate of foreign loan sources*	0.517	+	53.000	+
20	Domestic loan sources	0.533	+	56.600	+
21	Foreign loan sources	0.500	+	58.000	+

Table 19 (Continued)

	Questions	Sumai/ N	+ −	Business survey Nov. 1985 Sumai*Si/ Sums	+ −
22	Money supply (domes. loan source)	0.533	+	69.000	+
23	Money supply (forei. loan source)	0.429	+	01.000	−
24	Number of employee	0.400	+	34.000	+
25	Wages and salaries*	−0.400	−	09.000	−
26	Normal working hours	0.067	+	96.000	+
27	Overtime working hours	0.071	+	86.000	+
28	Change in production equipment	0.500	+	00.000	+
29	Change in trucks	0.333	+	83.000	+
30	Change in other equipment	0.533	+	30.000	+
31	Change in land and building	0.333	+	61.000	+
32	Foreign interest rate*	0.667	+	93.000	+
33	Movement of baht value*	−0.467	−	18.000	−
34	Production of Thai farmers (total)	0.000	0	32.000	+
35	Production of Thai farmers (north)	0.250	+	04.000	+
36	Production of Thai farmers (central)	0.167	+	11.000	+
37	Production of Thai farmers (northeast)	−0.083	−	42.000	+
38	Production of Thai farmers (south)	−0.083	−	33.000	+
39	Government economic policy	0.033	+	67.000	−
40	Financial and trade policy	−0.231	−	98.000	−
41	Construction budget	−0.500	−	44.000	−
42	Politic atmosphere	−0.867	−	48.000	−
Sum			23		25
Business survey index			55%		60%

Table 20 : Responses for situations 3 months ahead banking sector

	Questions	Sumai/ N	+ −	Business survey Nov. 1985 Sumai*Si Sums	− −
1	General economic situation	−0.267	−	88.000	−
2	Business situation	0.214	+	35.000	+
3	Saving deposit	0.636	+	90.000	+
4	Demand deposit	0.692	+	35.000	+
5	Time deposit	0.538	+	59.000	−
6	Loan to business	0.538	+	65.000	+
7	Overdrafts	0.273	+	93.000	+
8	Housing loan	0.400	+	98.000	+

Table 20 (Continued)

	Questions	Business survey Nov. 1985 Sumai/ N	+ −	Sumai*Si/ Sums	+ −
9	Other loans	1.000	+	14.000	+
10	Interest rate to business	0.385	+	60.000	+
11	Interest rate to O.D.	0.273	+	79.000	+
12	Interest rate to housing loan	0.111	+	35.000	−
13	Interest rate to others	0.250	+	00.000	+
14	Bad debt rate (business)*	0.308	+	80.000	+
15	Bad debt rate (O.D.)*	0.000	0	37.000	+
16	Bad debt rate (housing loan)*	0.333	+	92.000	+
17	Bad debt rate (others)*	0.333	+	14.000	+
18	Int. Rate of domes. loan sources*	−0.267	−	44.000	−
19	Int. Rate of foreign loan source*	0.143	+	70.000	+
20	Domestic loan sources	0.667	+	31.000	+
21	Foreign loan sources	0.429	+	97.000	+
22	Money supply (domes. loan source)	0.600	+	10.000	+
23	Money supply (forei. loan source)	0.286	+	97.000	+
24	Number of employee	0.500	+	98.000	+
25	Wages and salaries*	−0.214	−	58.000	−
26	Normal working hours	0.067	+	96.000	+
27	Overtime working hours	0.357	+	09.000	+
28	Change in production equipment	0.625	+	96.000	+
29	Change in trucks	0.333	+	83.000	+
30	Change in other equipment	0.692	+	94.000	+
31	Change in land and building	0.500	+	25.000	+
32	Foreign interest rate*	0.067	+	48.000	+
33	Movement of baht valuc*	0.067	+	00.000	+
34	Production of Thai farmers (total)	0.556	+	57.000	+
35	Production of Thai farmers (north)	0.167	+	35.000	−
36	Production of Thai farmers (central)	0.333	+	67.000	+
37	Production of Thai farmers (northeast)	0.250	+	67.000	+
38	Production of Thai farmers (south)	−0.083	−	75.000	−
39	Government economic policy	0.231	+	40.000	+
40	Financial and trade policy	0.000	0	87.000	+
41	Construction budget	−0.643	−	29.000	−
42	Politic atmosphere	0.267	+	90.000	+
Sum			35		34
Business survey index			33%		31%

Table 21 : Responses for situations 3 months ago trade sector

	Questions	Sumai/ N	+ −	Business survey Nov. Sumai*Si/ Sums	1985 + −
1	General economic situation	−0.783	−	−0.860	−
2	Business situation	−0.333	−	−0.389	−
3	Domestic orders	−0.243	−	−0.410	−
4	Overseas orders	−0.348	−	−0.145	−
5	Domestic sales	−0.306	−	−0.418	−
6	Export	−0.261	−	−0.102	−
7	Domestic price	−0.200	−	−0.050	−
8	Export Price	−0.217	−	−0.197	−
9	Domestic competition*	−0.364	−	−0.159	−
10	Overseas competition*	−0.485	−	−0.308	−
11	Number of employee	0.064	+	0.071	+
12	Wages and salaries	−0.133	−	−0.179	−
13	Normal working hours	−0.064	−	−0.012	−
14	Overtime working hours	−0.282	−	−0.343	−
15	Change in truch	−0.086	−	0.003	+
16	Change in other equipment	0.024	+	0.131	+
17	Change in land and building	0.023	+	0.043	+
18	Stocks of goods*	0.087	+	0.037	+
19	Cost of domest purchased goods*	−0.220	−	−0.203	−
20	Cost of IMP. Purchased goods*	−0.531	−	−0.284	−
21	Petroleum products used	−0.051	−	−0.110	−
22	Electricity used	−0.100	−	−0.132	−
23	Interest rate	0.350	+	0.162	+
24	Loan sources	−0.119	−	−0.091	−
25	Bad debt rate*	−0.222	−	−0.257	−
26	Foreign interest rate*	0.309	+	0.393	+
27	Movement of baht value	0.311	+	0.428	+
28	Production of Thai farmers (total)	0.105	+	−0.046	−
29	Production of Thai farmers (north)	0.310	+	0.084	+
30	Production of Thai farmers (central)	0.367	+	0.132	+
31	Production of Thai farmers (northeast)	0.233	+	0.034	+
32	Production of Thai farmers (south)	0.276	+	0.064	+
33	Government economic policy	−0.511	−	−0.633	−
34	Financial and trade policy	−0.467	−	−0.618	−
35	Construction budget	−0.692	−	−0.752	−
36	Politic atmosphere	−0.659	−	−0.688	−
Sum			12		12
Business survey index			33%		33%

Table 22 : Responses for situations 3 months ahead trade sector

	Questions	Sumai/ N	÷ −	Business survey Nov. 1985 Sumai*Si/ Sums	* −
1	General economic situation	−0.444	−	−0.318	−
2	Business situation	−0.182	−	−0.112	−
3	Domestic orders	0.162	+	0.030	+
4	Overseas orders	−0.083	−	0.056	+
5	Domestic sales	0.083	+	−0.128	−
6	Export	−0.087	−	0.051	+
7	Domestic price	−0.059	−	−0.003	−
8	Export price	−0.125	−	−0.054	−
9	Domestic competition*	−0.545	−	−0.326	−
10	Overseas competition*	−0.485	−	−0.143	−
11	Number of employee	0.000	0	−0.011	−
12	Wages and salaries	−0.283	−	−0.409	−
13	Normal working hours	0.043	+	0.076	+
14	Overtime working hours	−0.051	−	−0.155	−
15	Change in truck	−0.086	−	−0.004	−
16	Change in other equipment	0.100	+	0.146	+
17	Change in land and building	0.070	+	0.040	+
18	Stocks of goods*	−0.044	−	0.081	+
19	Cost of domest purchased goods*	−0.282	−	−0.156	−
20	Cost of Imp. purchased goods*	−0.406	−	−0.181	−
21	Petroleum products used	−0.026	−	−0.105	−
22	Electricity used	−0.050	−	−0.157	−
23	Interest rate*	−0.025	−	0.014	+
24	Loan sources	−0.048	−	−0.027	−
25	Bad debt rate*	−0.250	−	−0.418	−
26	Foreign interest rate*	0.184	+	0.114	+
27	Movement of baht value*	0.279	+	0.280	+
28	Production of Thai farmers (total)	0.211	+	0.134	+
29	Production of Thai farmers (north)	0.448	+	0.314	+
30	Production of Thai farmers (central)	0.367	+	0.268	+
31	Production of Thai farmers (northeast)	0.233	+	0.209	+
32	Prouuction of Thai farmers (south)	0.241	+	0.175	+
33	Government economic policy	−0.364	−	−0.463	−
34	Financial and trade policy	−0.311	−	−0.441	−
35	Construction budget	−0.684	−	−0.675	−
36	Politic atmosphere	−0.250	−	−0.275	−
Sum			12		15
Business survey index			33%		42%

Table 23 : Responses for situations 3 months ago manufacturing sector

Business survey
Nov. 1985

	Questions	Sumai/ N	+ −	Sumai*Si/ Sums	+ −
1	General economic situation	-0.629	−	-0.565	−
2	Business situation	-0.406	−	-0.516	−
3	Production volume	-0.246	−	-0.282	−
4	Percentage of production/capacity	-0.281	−	-0.286	−
5	Domestic orders	-0.209	−	-0.260	−
6	Overseas orders	-0.082	−	-0.145	−
7	Domestic sales	-0.242	−	-0.326	−
8	Export	-0.085	−	-0.140	−
9	Domestic price	-0.179	−	-0.018	−
10	Export price	-0.234	−	-0.142	−
11	Domestic competition*	-0.304	−	-0.389	−
12	Overseas competition*	-0.224	−	-0.024	−
13	Number of employee	-0.127	−	-0.149	−
14	Wages and salaries*	0.000	0	-0.178	−
15	Normal working hours	-0.099	−	0.010	+
16	Overtime working hours	-0.311	−	-0.350	−
17	Change in production equipment	0.221	+	0.386	+
18	Change in trucks	0.032	+	0.151	+
19	Change in other equipment	0.119	+	0.241	+
20	Change in land and building	0.091	+	0.199	+
21	Stocks of raw materials*	0.162	+	0.506	+
22	Stocks of work in process*	0.129	+	-0.104	−
23	Stocks of finished goods*	0.086	+	-0.111	−
24	Change in domestic R/M purchased	-0.203	−	-0.244	−
25	Change in imported R/M purchased	-0.293	−	-0.161	−
26	Domestic raw material price*	-0.066	−	-0.017	−
27	Imported raw material price*	-0.164	−	0.142	+
28	Petroleum products used	-0.300	−	-0.479	−
29	Electricity used	-0.200	−	-0.318	−
30	Interest rate*	0.000	0	-0.295	−
31	Loan sources	0.014	+	0.002	+
32	Bad debt rate*	-0.096	−	0.046	−
33	Foreign interest rate*	0.439	+	0.133	+
34	Movement of baht value*	-0.033	−	-0.221	−

Table 23 (Continued)

	Questions	Business survey Nov. 1985 Sumai/ N	+ −	Sumai*Si/ Sums	+ −
35	Production of Thai farmers (total)	-0.643	−	-0.047	−
36	Production of Thai farmers (north)	-0.300	−	-0.042	−
37	Production of Thai farmers (central)	-0.128	−	-0.015	−
38	Production of Thai farmers (northeast)	-0.333	−	-0.035	−
39	Production of Thai farmers (south)	-0.256	−	-0.080	−
40	Government economic policy	-0.890	−	-0.164	−
41	Finanacial and trade policy	-0.559	−	-0.247	−
42	Construction budget	-0.577	−	-0.392	−
43	Politic atmosphere	-0.269	−	-0.052	−
Sum			9		10
Business survey index			21%		23%

Table 24 : Responses for situations 3 months ahead manufacturing sector

	Questions	Business survey Nov. 1985 Sumai/ N	+ −	Sumai*Si/ Sums	+ −
1	General economic situation	-0.536	−	-0.421	−
2	Business situation	-0.229	−	-0.228	−
3	Production volume	-0.119	−	-0.006	−
4	Percentage of production/capacity	-0.190	−	-0.008	−
5	Domestic orders	-0.075	−	0.167	+
6	Overseas orders	-0.082	−	0.001	+
7	Domestic sales	-0.030	−	0.220	+
8	Export	-0.106	−	-0.003	+
9	Domestic price	-0.134	−	-0.027	−
10	Export price	-0.208	−	-0.020	−
11	Domestic competition*	-0.203	−	-0.241	−
12	Overseas competition*	-0.327	−	-0.109	−
13	Number of employee	-0.200	−	-0.382	−
14	Wages and salaries*	-0.257	−	-0.296	−
15	Normal working hours	0.000	0	0.006	+
16	Overtime working hours	-0.194	−	-0.172	−
17	Change in production equipment	0.194	+	-0.051	−
18	Change in trucks	0.033	+	0.049	+
19	Change in other equipment	0.179	+	0.150	+
20	Change in land and building	0.108	+	0.124	+

Table 24 (Continued)

	Questions	Sumai/ N	+ −	Business survey Nov. 1985 Sumai*Si/ Sums	+ −
21	Stocks of raw materials*	0.194	+	0.032	+
22	Stocks of work in process*	0.081	+	0.054	+
23	Stocks of finished goods*	0.127	+	0.269	+
24	Change in domestic R/M purchased	0.031	+	0.159	+
25	Change in imported R/M purchased	−0.298	−	−0.532	−
26	Domestic raw material price*	−0.180	−	−0.070	−
27	Imported raw material price*	−0.196	−	−0.083	−
28	Petroleum products used	0.068	+	0.080	+
29	Electricity used	−0.015	−	0.020	+
30	Interest rate*	−0.037	−	−0.032	−
31	Loan sources	−0.015	−	0.068	+
32	Bad debt rate*	−0.118	−	−0.068	−
33	Foreign interest rate*	0.086	+	−0.150	−
34	Movement of baht value*	0.032	+	0.244	+
35	Production of Thai farmers (total)	−0.043	−	−0.085	−
36	Production of Thai farmers (north)	−0.081	−	−0.010	−
37	Production of Thai farmers (central)	−0.027	−	−0.020	−
38	Production of Thai farmers (northeast)	−0.108	−	−0.012	−
39	Production of Thai farmers (south)	−0.243	−	−0.100	−
40	Government economic policy	−0.356	−	−0.094	−
41	Financial and trade policy	−0.424	−	0.006	+
42	Construction budget	−0.431	−	−0.359	−
43	Politic atmosphere	−0.414	−	−0.148	−
Sum			11		16
Business survey index			26%		37%

Table 25 : Responses for situations 3 months ago manufacturing sector

	Questions	Sumai/ N	+ −	Business survey Nov. 1985 Sumai*Si/ Sums	+ −
1	General economic situation	−0.635	−	−0.579	−
2	Business situation	−0.384	−	−0.498	−
3	Production volume	−0.247	−	−0.278	−

Table 25 (Continued)

	Question	Business survey Nov. 1985 Sumai/ N	+ −	Sumai*Si/ Sums	+ −
4	Percentage of production/capacity	−0.265	−	−0.283	−
5	Domestic orders	−0.211	−	−0.266	−
6	Overseas orders	−0.060	−	−0.137	−
7	Domestic sales	−0.271	−	−0.341	−
8	Export	−0.042	−	−0.130	−
9	Domestic price	−0.183	−	−0.028	−
10	Export price	−0.250	−	−0.140	−
11	Domestic competition*	−0.201	−	−0.390	−
12	Overseas competition*	−0.220	−	−0.027	−
13	Number of employee	−0.133	−	−0.150	−
14	Wages and salaries*	−0.067	−	−0.193	−
16	Overtime working hours	−0.277	−	−0.343	−
21	Stocks of raw materials*	0.153	−	−0.494	+
22	Stocks of work in process*	0.136	+	−0.099	−
23	Stocks of finished goods*	0.081	+	−0.116	−
24	Change in domestic R/M purchased	0.191	−	−0.234	−
25	Change in imported R/M purchased	−0.742	−	−0.150	−
26	Domestic raw material price*	−0.077	−	−0.019	−
27	Imported raw material price*	−0.153	−	0.145	−
29	Electricity used	−0.159	−	−0.310	−
30	Interest rate*	−0.027	−	−0.304	−
33	Foreign interest rate*	0.433	+	0.180	+
34	Movement of baht value*	0.047	−	−0.214	−
36	Production of Thai farmers (north)	−0.286	−	−0.040	−
37	Production of Thai farmers (central)	−0.122	−	0.016	−
38	Production of Thai farmers (northeast)	−0.341	−	0.035	−
39	Production of Thai farmers (south)	−0.293	−	−0.080	−
40	Government economic policy	−0.397	−	−0.170	−
41	Financial and trade policy	−0.540	−	−0.238	−
42	Construction budget	−0.582	−	−0.384	−
43	Politic atmosphere	−0.363	−	−0.060	−
Sum			4.0		4.0
Business survey index			12%		12%

Table 26 : Responses for situation 3 months ago manufacturing sector

Business survey
Nov. 1985

	Question	Sumai/ N	+ −	Sumai*Si/ Sums	+ −
1	General economic situation	−0.479	−	−0.402	−
2	Business situation	−0.176	−	−0.210	−
3	Production volume	−0.099	−	−0.002	−
4	Percentage of production/capacity	−0.149	−	0.002	+
5	Domestic orders	−0.070	−	0.168	+
6	Overseas orders	−0.060	−	0.002	+
7	Domestic sales	−0.000	0	0.221	+
8	Export	−0.083	−	0.005	+
9	Domestic price	−0.127	−	0.025	−
10	Export price	−0.245	−	−0.134	−
11	Domestic competition*	−0.178	−	−0.232	−
12	Overseas competition*	−0.321	−	−0.114	−
13	Number of employee	−0.189	−	−0.376	−
14	Wages and salaries*	−0.284	−	−0.270	−
16	Overtime working hours	−0.152	−	−0.168	−
21	Stocks of raw materials*	0.169	+	0.089	+
22	Stocks of work in process*	0.076	+	0.061	+
23	Stocks of finished goods*	0.133	+	0.274	+
24	Change in domestic R/M purchased	0.029	+	0.154	+
25	Change in imported R/M purchased	−0.279	−	−0.519	−
26	Domestic raw material price*	−0.185	−	−0.070	−
27	Imported raw material price*	−0.183	−	−0.071	−
29	Electricity used	−0.000	0	0.011	−
30	Interest rate*	−0.068	−	−0.026	−
33	Foreign interest rate*	0.115	+	−0.133	−
34	Movement of baht value*	0.015	+	0.222	+
36	Production of Thai farmers (north)	−0.103	−	−0.012	−
37	Production of Thai farmers (central)	−0.051	−	−0.022	−
38	Production of Thai farmers (northeast)	−0.128	−	−0.014	−
39	Production of Thai farmers (south)	−0.282	−	−0.102	−
40	Government economic policy	−0.349	−	−0.093	−
41	Financial and trade policy	−0.397	−	0.011	+
42	Construction budget	−0.482	−	−0.352	−
43	Politic atmosphere	−0.387	−	−0.139	−
Sum			7.0		13.0
Business survey index			21%		38%

Table 27 : Responses for situation 3 months ago trade sector

	Questions	Sumai/ N	+ −	Business survey Dec. 1985 Sumai*Si/ Sums	+ −
1	General economic situation	−0.787	−	−0.871	−
2	Business situation	−0.348	−	−0.400	−
3	Domestic orders	−0.263	−	−0.420	−
5	Domestic sales	−0.324	−	−0.429	−
9	Domestic competition*	−0.356	−	−0.159	−
10	Overseas competition*	−0.412	−	−0.298	−
12	Wages and salaries*	−0.130	−	−0.179	−
14	Overtime working hours	−0.300	−	−0.353	−
18	Stocks of goods*	0.128	+	0.055	+
19	Cost of domest. purchased goods*	−0.238	−	−0.214	−
20	Cost of Imp. purchased goods*	−0.545	−	−0.294	−
Sum			1.0		1.0
Business survey index			9%		9%

Table 28 : Responses for situations 3 months ahead trade sector

	Questions	Sumai/ N	+ −	Business survey Dec. 1985 Sumai*Si/ Sums	+ −
1	General economic situation	−0.457	−	−0.328	−
2	Business situation	−0.200	−	−0.122	−
3	Domestic orders	0.132	+	0.019	+
5	Domestic sales	0.054	+	−0.138	−
9	Domestic competition*	−0.533	−	−0.326	−
10	Overseas competition*	−0.412	−	−0.133	−
12	Wages and salaries*	−0.277	−	−0.409	−
14	Overtime working hours	−0.075	−	−0.166	−
18	Stocks of goods*	0.000	0	0.099	+
19	Cost of domest. purchases goods*	−0.300	−	−0.166	−
20	Cost of Imp. purchased goods*	−0.424	−	−0.192	−
Sum			2.5		2.0
Business survey index			23%		18%

Table 29 The Business Survey Index : 1985 (10)-1985 (12)

(%)

Sector	BSI (Simple Average)		BSI (Weighted Average)	
	3 months ago	3 months ahead	3 months ago	3 months ahead
Manufacturing	21	26	23	37
Wholesale and retail trade	33	33	33	42
Finance and Banking	55	83	60	81
Construction	30	27	43	53
Transportation	9	16	9	16

Source : Summary Table 1-10

Table 30 The Business Survey Index : 1985 (10)-1985 (12)

Sector	BSI (Simple Average)		BSI (Weighted Average)	
	3 months ago	3 months ahead	3 months ago	3 months ahead
Manufacturing	12	21	12	38
Wholesale and Retail Trade	9	23	9	18

Source : Table 15-28

4.3 Consistency Between DI and BSI

One of our main objectives is to extract from our findings the leading and lagging indicators. The procedure is not easy at all, to do this we repeatedly update the tentative reference dates from time to time. At first, we would rather check the compatability between DI, and BSI.

Table 31 is a summary of business condition at the third and fourth quarter of 1985 as seen by businessmen compared with quantitative estimation of DI.

In general, the DI dips through out the last quarter but being ups and downs during the third quarter. The BSI on the other hand is up during the last quarter compared with third quarter. This is however less than 50 percent i.e., less than 50% of representative businessmen see any brisk future from October-December of 1985. The exceptions are only for Banking sector.

In short, the quantitative estimation of DI is not rejected by BSI of their validity.

4.4 Tuning the Tentative Reference Dates.

With updated data and predicted data we reconstruct the HDI up to the end of 1985. The new HDI corresponds with the former HDI of group 5, 6 and 7 in Figure 6, 7 and 8 are shown in Figure 33, 34 and 35. The difference is that the former HDIs of group 5, 6 and 7 indicate peak during the first quarter of 1985 while the new HDI of group 5 indicate trough during the last quarter of 1984 and business went down during 1985 as HDI dips through out the first and second quarter with minor sign of recovery.

Table 31 A Compatability Between DI and BSI During Third and Fourth Quarters of 1985 : 1985 (7)-1985 (10); 1985 (10)-1985 (12)

	Third Quarter	Fourth Quarter
Group A		
BSI	Down	up compared with last quarter but less than 50%
DI	U-D-U	U-D-U
Group B		
BSI	Down	up compared with last quarter but less than 50%
DI	U-U-U	D-D-D
Group "A + B"		
BSI	Down	up compared with last quarter but less than 50%
DI	D-U-U	D-D-D

Note : U = Up ; D = Down

Source : Figure 33, 34, 35 and Table 29, 30

New HDI Consistent With Former HDI of Group 5.

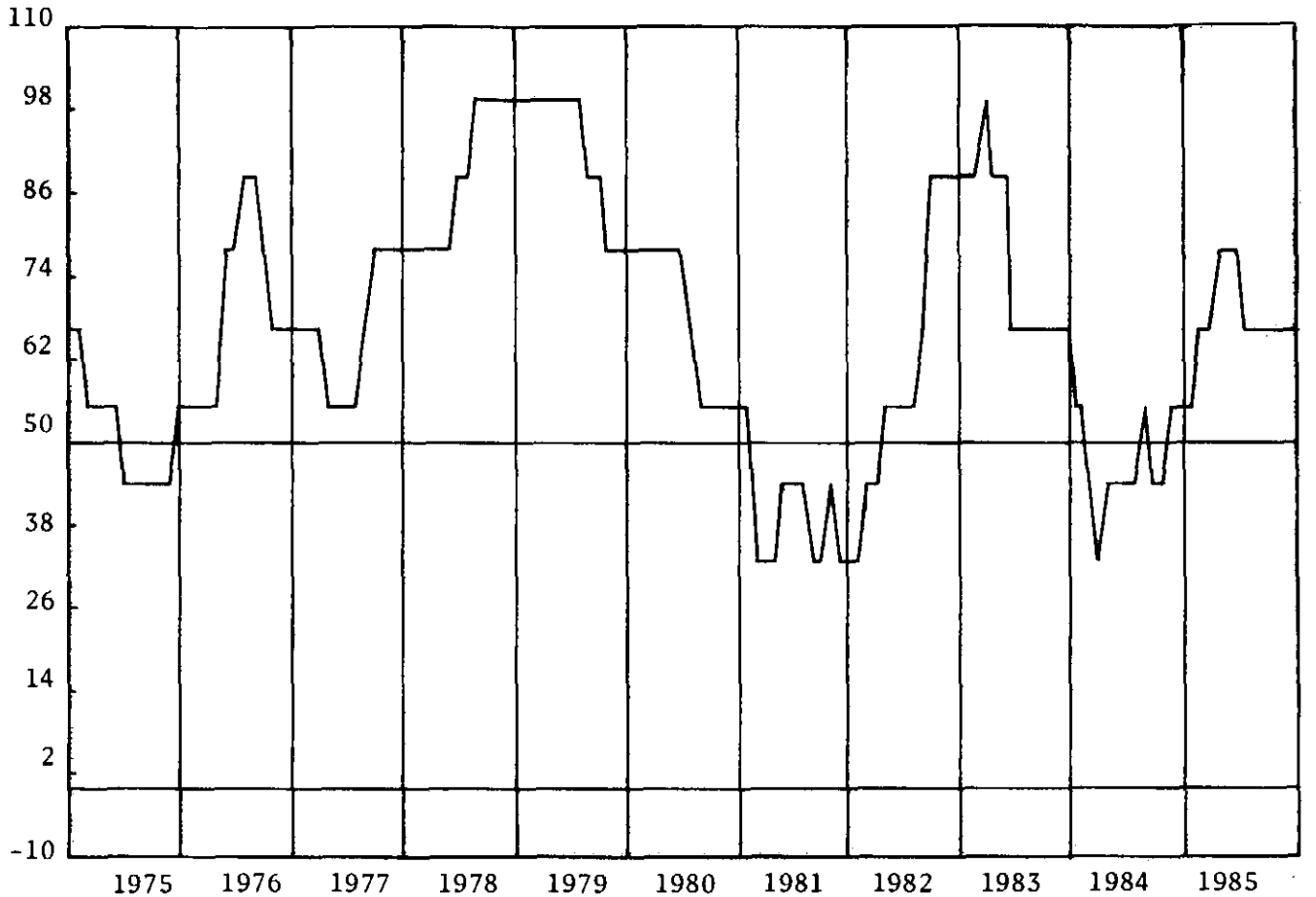


Figure 33

New HDI Consistent With Former HDI of Group 6.

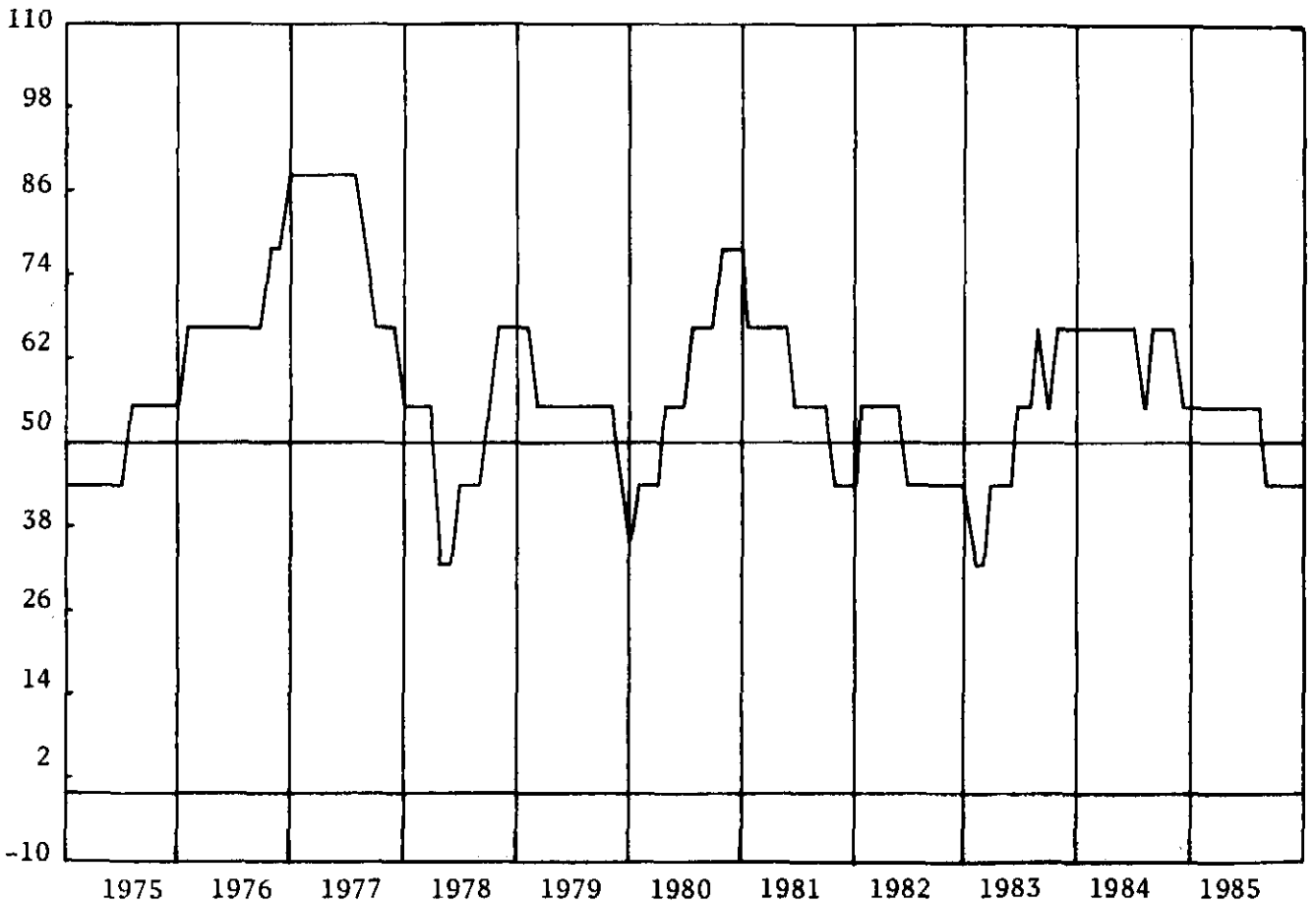


Figure 34

New HDI Consistent With Former HDI of Group 7.

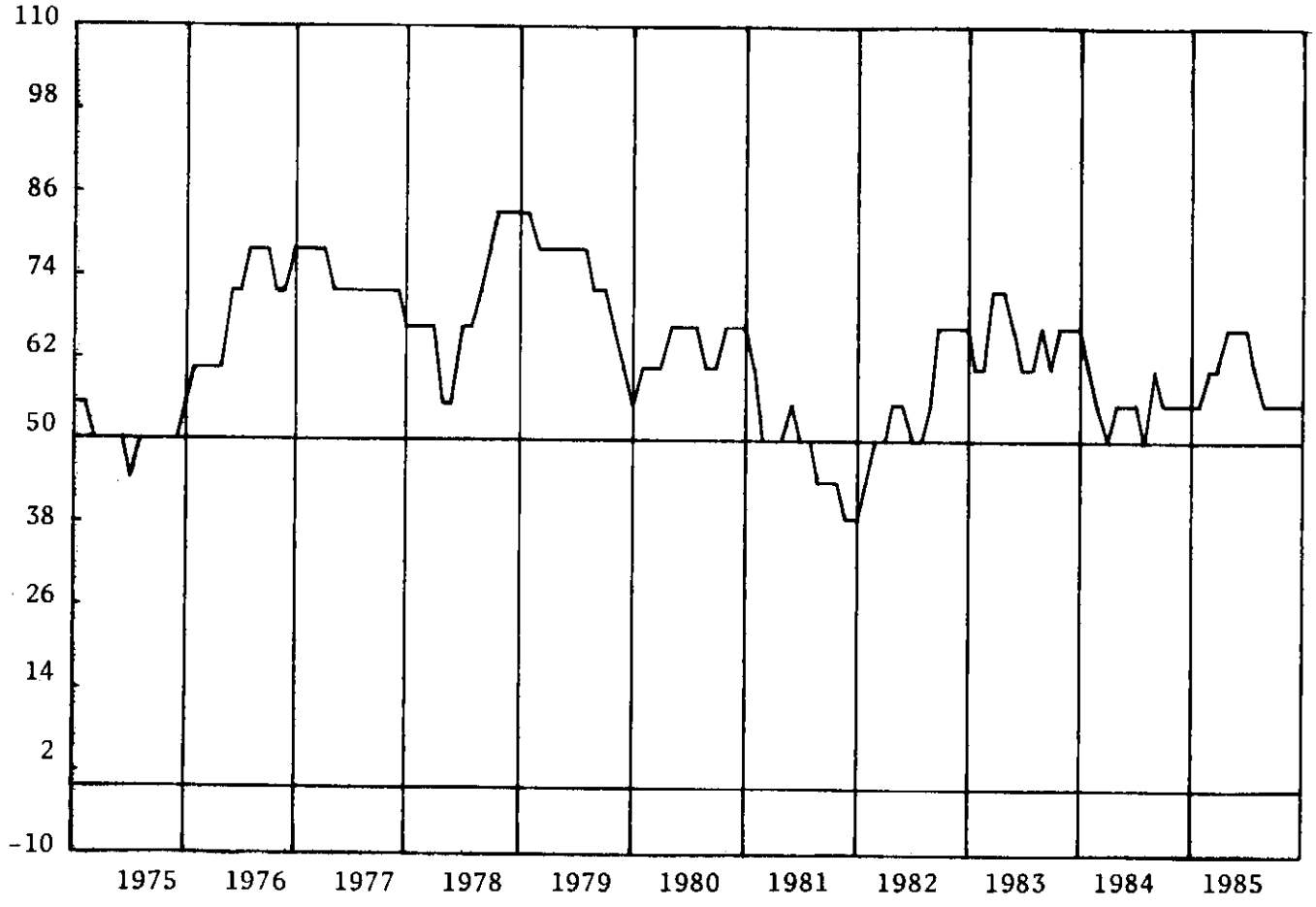


Figure 35

DI of 18 Variables 1974 [1]--1986 [12]

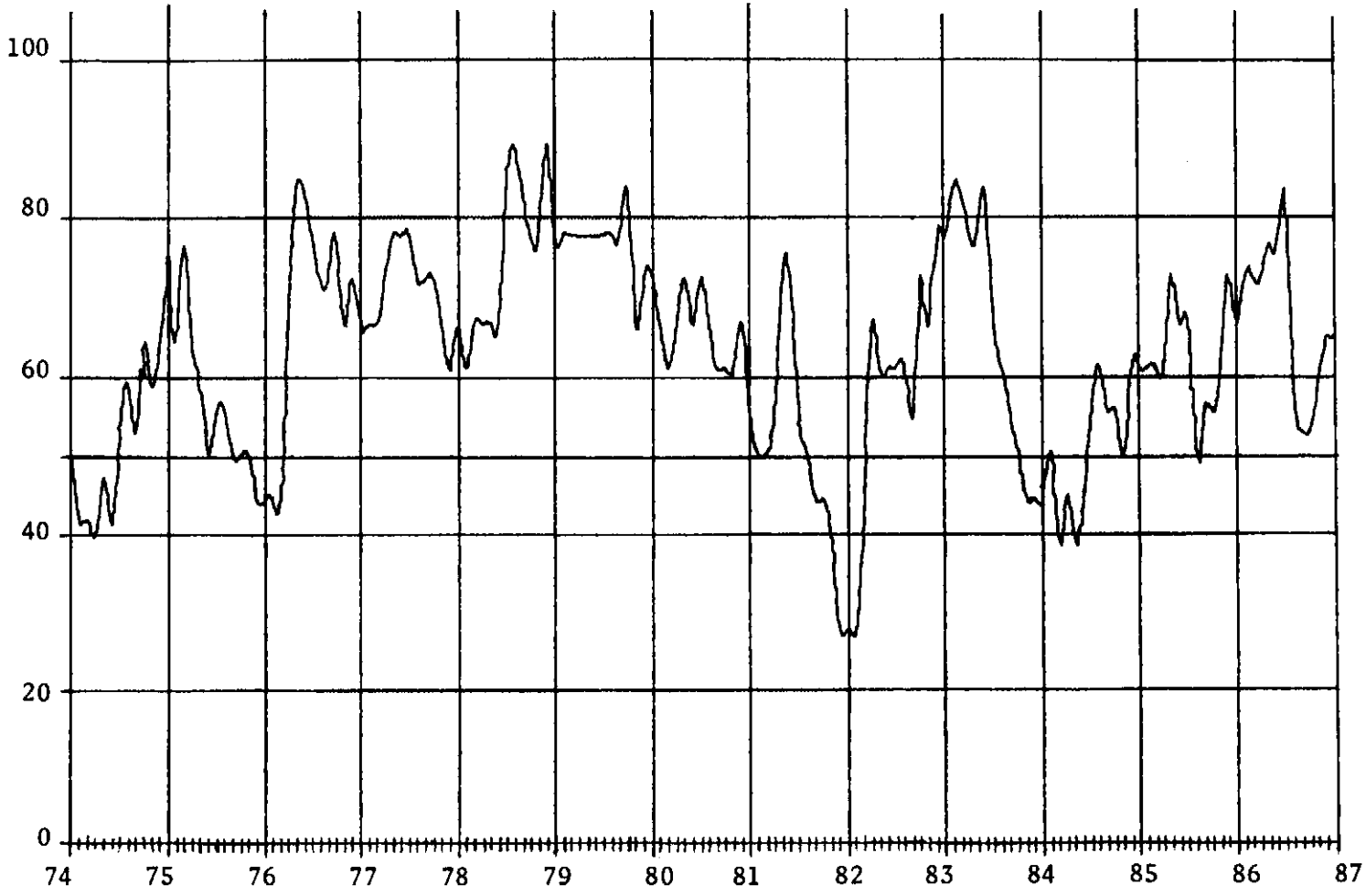


Figure 36

DI of 18 Variables With MCD = 3 1974 [1]–1986 [12]

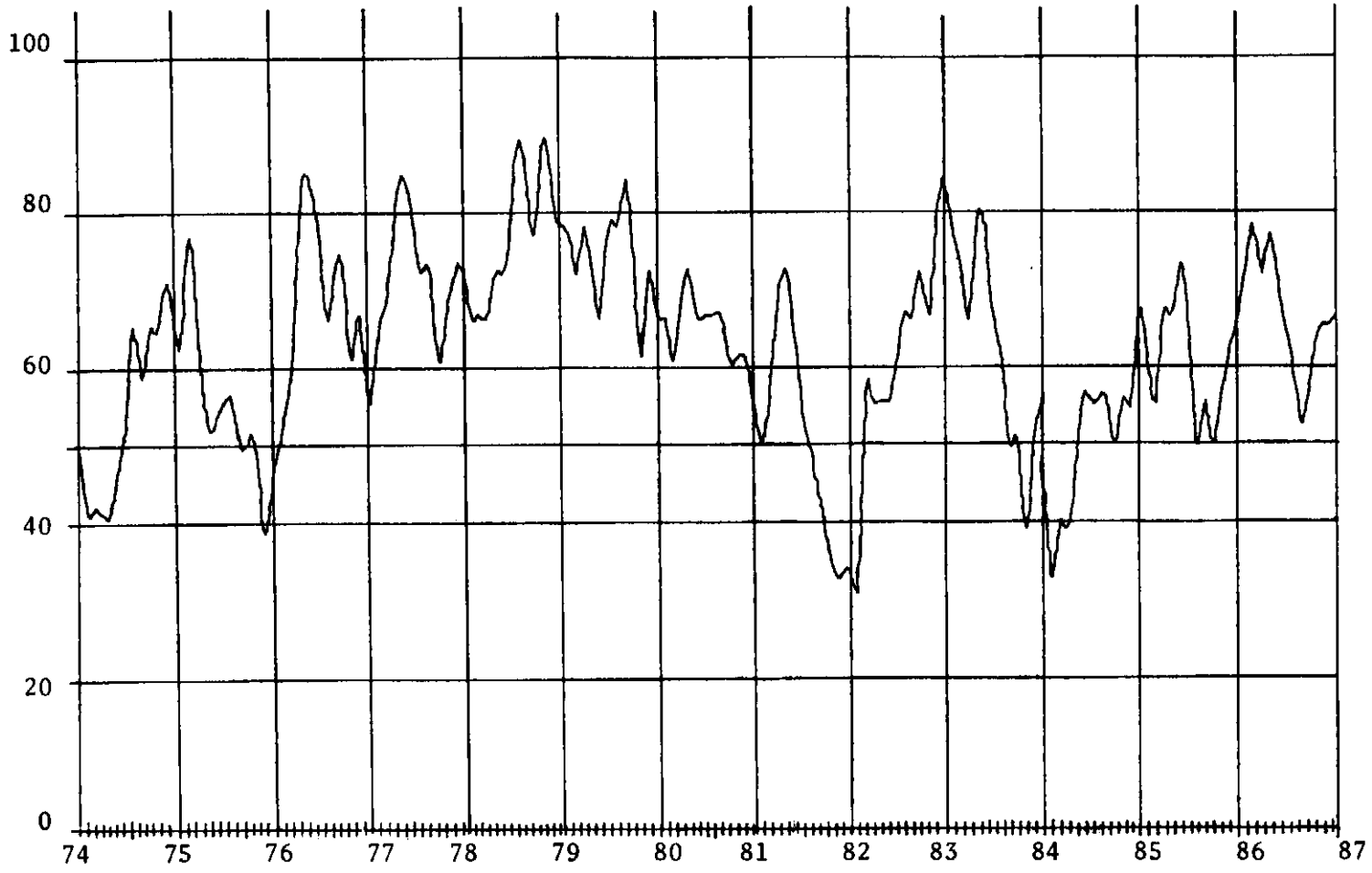


Figure 37

DI of 18 Variables With MCD = 6 1974 [1]–1986 [12]

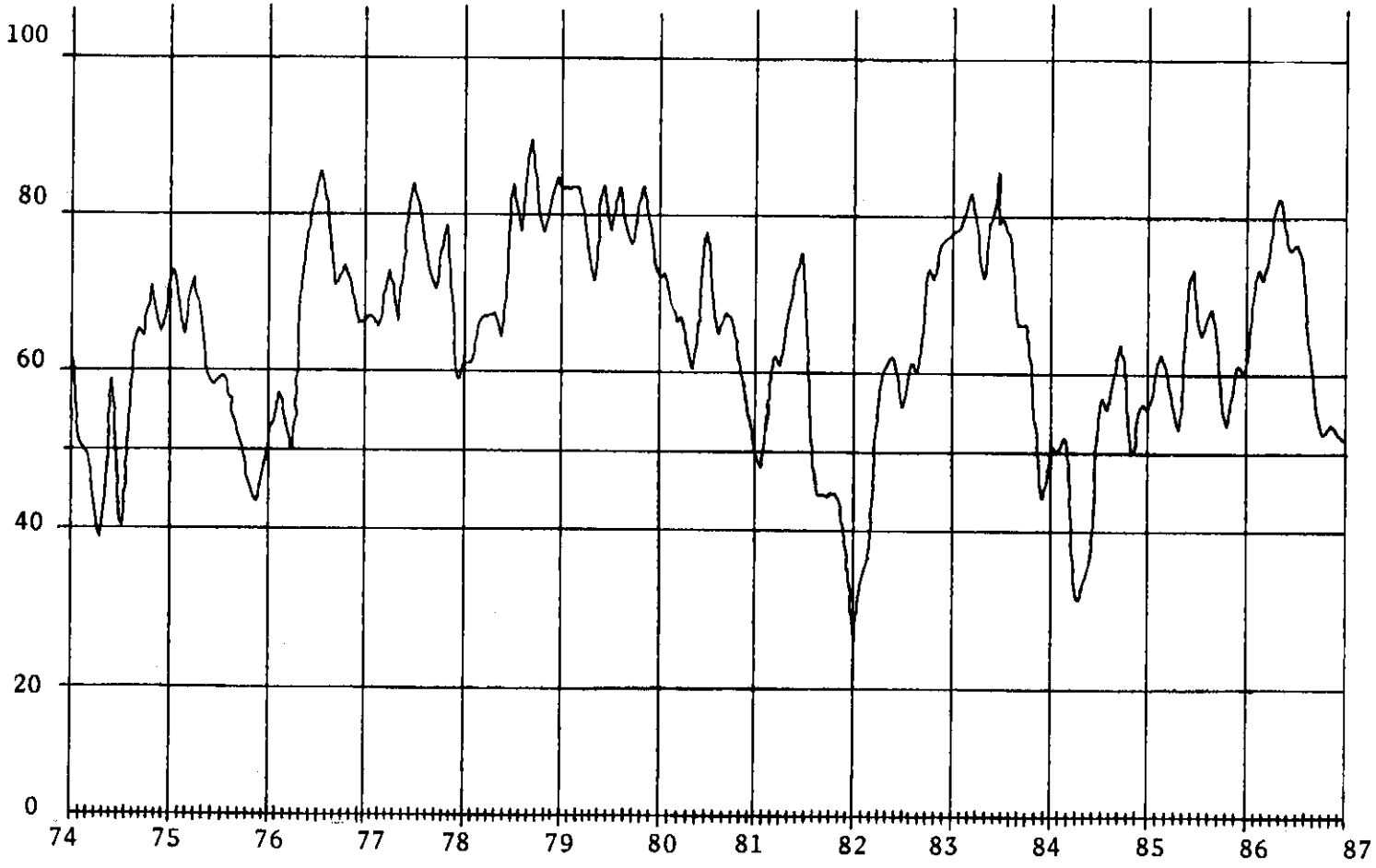


Figure 38

DI of 18 Variables With MCD = 9 1974 [1]–1986 [12]

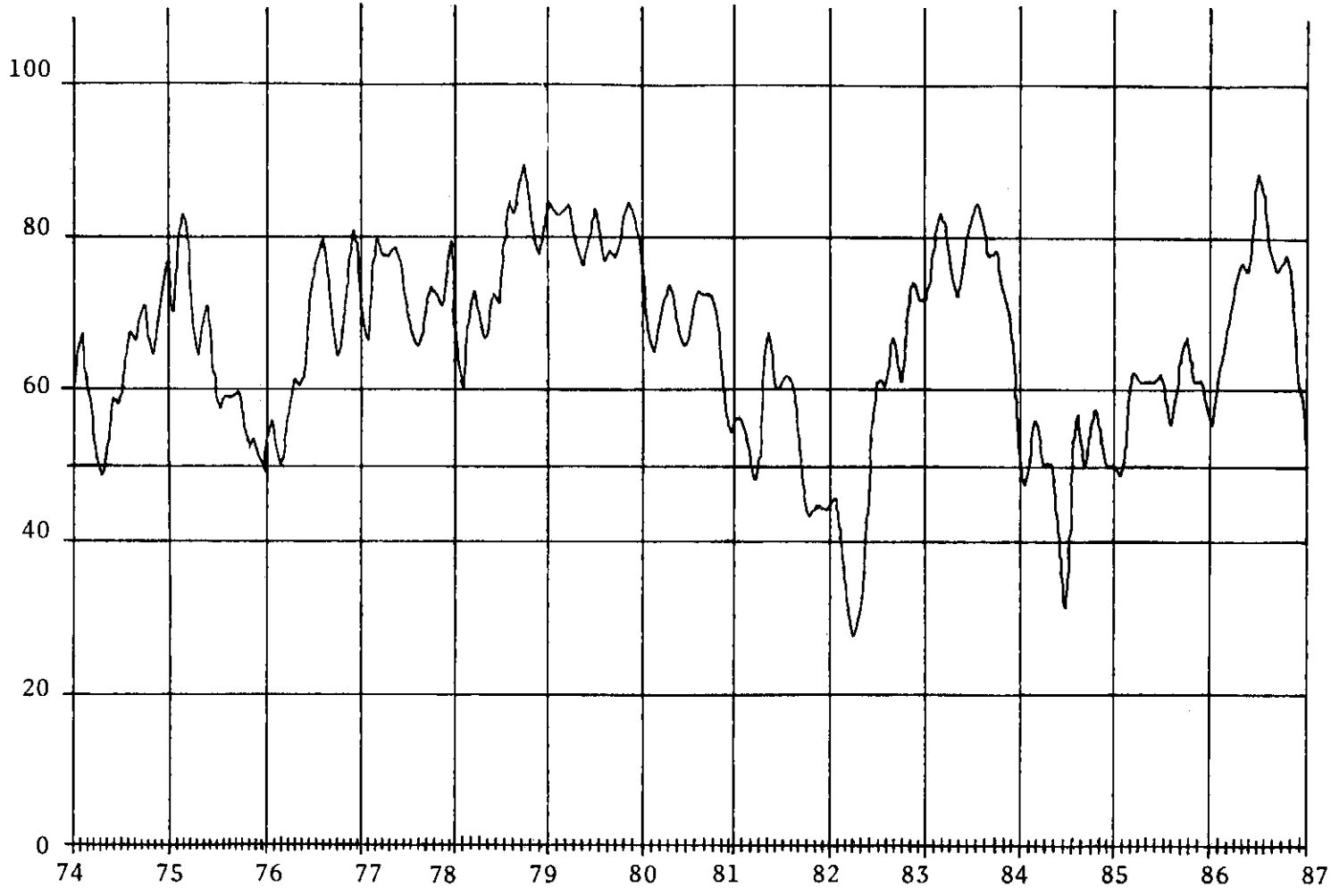


Figure 39

DI of 18 Variables With MCD = 12 1974 [1]-1986 [12]

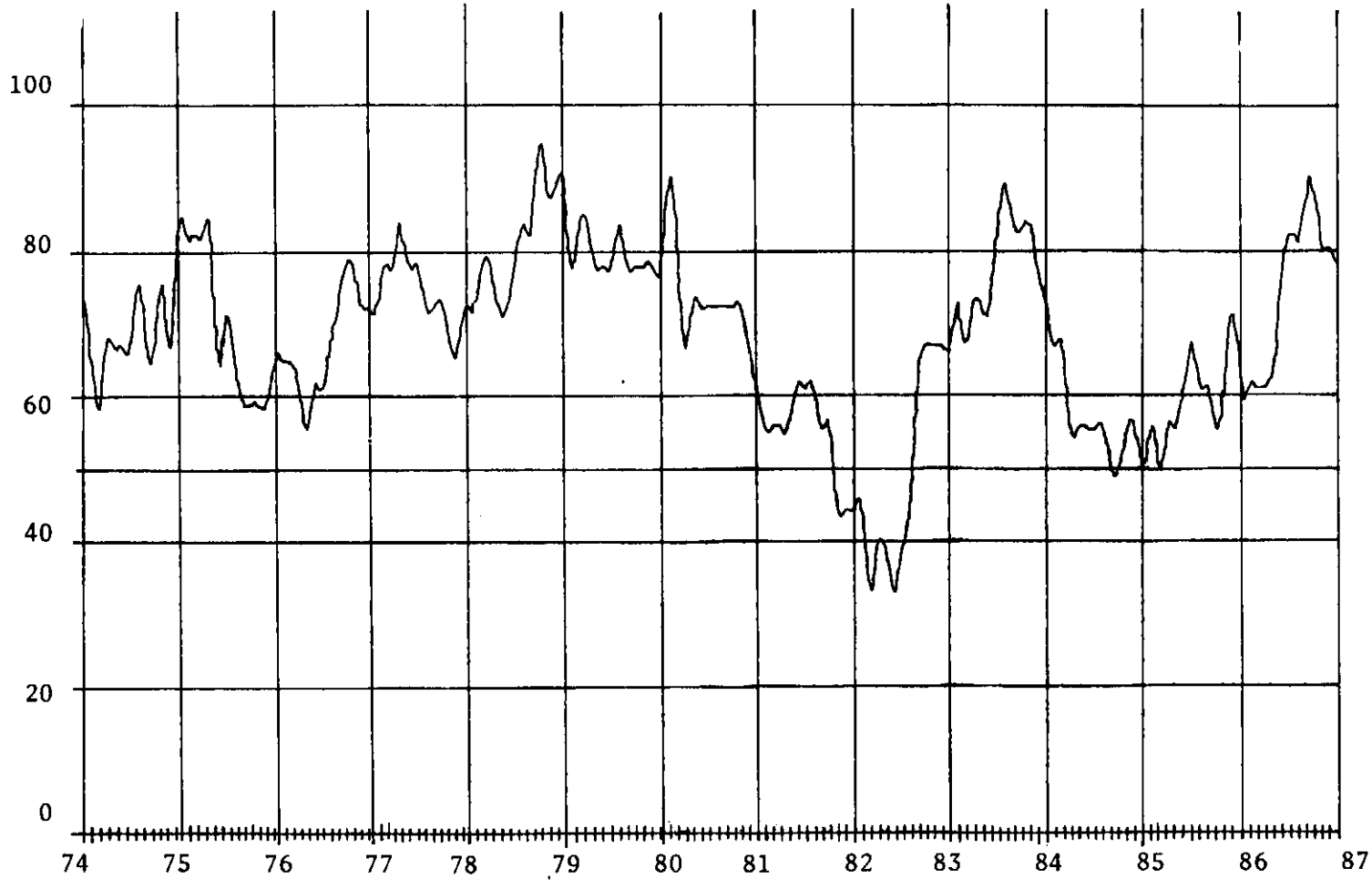


Figure 40

The new DI of group 6 on the other hand is quite consistent with the former one as it surged to its peak during the third guarter while the former surged during the second quarter of 1985.

In total, the group 7 which is a composition of group 5 and 6 shows its ups and downs above the 50 percent line compared with the former HDI which surged to its peak during the firt quarter.

It is a matter of art to select one set of HDI out of the two alternatives. As far as the state of construction of the diffusion indices is concerned we choose the new ones which are more consistent with the BSI.

4.5 Economic Prediction Up to the End of 1986.

One of our enquiries in this study is that will the economy recover and reach its peak within 1986. It is very controversial among government circle, businessmen and scholars whether the present economic situation in the world will throw the Thai economy into difficulties. Scholars tend to believe that in 1986 the Thai economy is going down. The businessmen on the other hand see brighter future than scholars but cautiously tighten their investment expenditure. Nevertheless, government circle although percieving quite clear of the economic down turns (as measured by the low G.D.P. growth rate of 4.0 percent) is not able to stir the economy up through fiscal activities i.e., government investment dued to difficulty in budget deficit and debt service. These arguments have been tested by various method both quantitative and qualitative interviewing method. The quantitative method used so far are econometric model both Kenesian type of model and a new fashionable model called a "General Equilibrium Model". In this paper, we present another alternative, namely the "Time Series Model" using the ARIMA process. We show our result in terms of diffusion index.

Results of the estimation are shown in Figure 33, 34 and 35. It is noted here that DI in these figures are estimated from list of variables similar to DI in Figure 30, 31, 32 of group A, B and C. The difference is that some variables are neglected namely production of gypsum, iron, tungsten and galvanize and replaced by production of cigarette, department store sales, stock price index and electricity consumed by large users (see Table 32). Although we make an arbitrarily change of variables to be composite index, results are not at all inconsistent with the former. On the contrary, the DI seem to be more likely to reflect the "cyclical up-swing" of the economy after the middle of 1984 to the end of 1986.

We also try to construct DI on different hypothesis namely, DI with MCD obtaining from the X-11 procedure (Figure 36-40) DI with MCD equals to 3, 6, 9 and 12 respectively. The results are quite consistent with each others, say the DIs surge upward over the 50 percent line after the middle of 1984.

This implies that the economy after dipping to its trough during the middle of 1984 expands towards its turning point. Nevertheless, there is no sign of turning into recovery until the second-fourth quarter of 1986. According to our quantitative predictions the recovery will surge to its peak around the middle of 1986 but still it is not able to reach its peak within 1986.

The result has two points to be noted :

(1) We do agree with some business circle especially Banking and Financial Institution that situation in 1986 are not totally dim. Moreover, the economy is surging towards its turning point and after the middle of 1986 it is likely to recover to its peak.

Table 32 Additional Variables Used in Constructing New DI.

Variables	MCD	Model
Production of cigarette	6	ARIMA (0, 1, 2) (1, 1, 1)
Department Sales	3	ARIMA (2, 1, 1) (1, 1, 1)
Index of Stock Price	2	ARIMA (0, 2, 1) (0, 1, 1)
Electricity Consumed by Large Users	4	ARIMA (0, 1, 2) (1, 1, 1)

(2) We do to little extent agree with scholars circle that growth rate of the Thai economy has shifted downward from its past trend. But this rather be dued to short-run government policy in managing the economy in 1984 (11)-1985 (12). These were devaluation at the end of 1984, financial credit squeeze by 18 percent, increase in several tax schedule for important commodities, zero-growth policy of government sector etc., not to mention business down turns in the world economy dued to protectionism and oil price decrease (affecting purchasing power of oil exporting countries).

In sum, we are still hopeful for the recovery of the Thai economy since the middle of 1984 especially after the middle of 1986.

Nevertheless, our quantitative prediction must be reconciled by quarterly survey of business condition as well as updating our set of data base for turning our predictions towards more reliability by the publics.

Moreover, our quantitative predicton utilizes simply past performances of each variables as such in the framework of "Time Series Analysis". There are no sets of simultaneous equations as in ordinary econometric model. Therefore, our prediction should be balanced by other studies as well as business survey.

5. Discussion of the Results and Conclusion.

The result of estimation in terms of DI as well as the result of the business survey, the BSI is to some extent consistent to one another. The preditcion

of economic condition in 1986 has to be reconciled by business survey in every quarter of 1986 such that quantitative prediction will be updated. Results are concluded as follows :

(1) The Thai economy which had recovered for a short period during 1974-1976 after the first oil crisis dipped down again after 1976.

(2) The cyclical down swing after 1976 consumed medium period of recovery. The economy recovered again and surged to its peak in the beginning of 1981. The recovery took about 5 years.

(3) The economy contracted again during the first quarter of 1981-the first quarter of 1982.

(4) The recovery made its way through, after the first quarter of 1982-the last quarter of 1983. It took nearly 18 months before reaching its peak.

(5) The economy contracted again for short period during the last quarter of 1983-the second quarter of 1984.

After the middle of 1984 the up-swing seems to emerge, this implies a moving toward recovery rather than contraction, though with ups and downs. Ours result is not easy to reconcile with low G.D.P. growth rate in 1985, as well as various beliefs of future economic condition up to the end of 1986.

(6) After the end of second quarter of 1986 the Thai economy will surge up to recovery. It is not able to reach its peak within 1986, though.

The weak point of this study is that we utilize cioncident diffusion index to predict future economic situation. This should be reconciled by quarter-to-quarter survey of businessmen's view. Moreover, sets of leading and lagging that are consistent with finalized date of reference should be comprehensively studied.

บทคัดย่อ

1985 Forecasts from the Econometric Link System for Thailand

ในบทความนี้ ได้มีการเสนอวิธีการที่จะเอาแบบจำลองมหภาคเข้าร่วมกับตารางปัจจัยผลผลิต และได้ประยุกต์แบบจำลองและตารางดังกล่าว เพื่อทำนายเศรษฐกิจของปี 2528 การทำนายนั้นเป็นการทำนายเกี่ยวกับมูลค่าของตัวแปรผันทางเศรษฐกิจมหภาคอันเป็นส่วนประกอบของรายได้ประชาชาติของไทย นอกจากนี้ยังได้แบ่งการทำนายเป็นสาขาเศรษฐกิจเป็นจำนวน 180 สาขาตามตารางปัจจัยผลผลิตด้วย

Macroeconometric Model for Analysing Change in Oil Prices

บทความนี้แสดงถึงสมการของแบบจำลองทางเศรษฐมิติ เพื่อวิเคราะห์ผลกระทบของการเปลี่ยนแปลงราคาน้ำมันที่มีต่อการผลิต การจำเริญ ภาวะเงินเฟ้อ ดุลการชำระเงิน ดุลการค้า การจ้างงาน และการกระจายรายได้ ผลที่แสดงในบทความนี้เป็นผลเบื้องต้น นอกจากการแสดงผลที่ได้รับจากแบบจำลองแล้ว ยังได้แสดงถึงวิธีการกำหนดแนวคิดหลักและการกำหนดแบบจำลองในทางปฏิบัติที่เกี่ยวกับแต่ละส่วนเพื่อการผลิต การจำเริญ ภาวะเงินเฟ้อ เหล่านี้เป็นต้น

Short-Terms Economic Forecasting: A Case of Thailand

เนื่องจากโครงสร้างของระบบเศรษฐกิจไทยกำลังเปลี่ยนแปลงไปสู่การเป็นประเทศอุตสาหกรรมมากขึ้น ดังนั้นบทบาทของการคาดคะเนเศรษฐกิจในระยะสั้นจึงเป็นสิ่งที่จำเป็นจะขาดเสียมิได้โดยเฉพาะอย่างยิ่งสำหรับนักธุรกิจ และเนื่องจากว่า ระบบเศรษฐกิจไทยขึ้นอยู่กับวัฏจักรธุรกิจไม่น้อย การศึกษาครั้งนี้จึงพยายามที่จะคาดการณ์ถึงวัฏจักรธุรกิจข้างต้น ในการนี้ได้จัดสร้างดัชนีการกระจายซึ่งภาวะเศรษฐกิจ (Diffusion Index) มาเป็นเครื่องมือสำคัญสำหรับการคาดคะเนภาวะเศรษฐกิจ ดัชนีการกระจาย ฯ (Diffusion Index) นี้ประกอบด้วย leading, coincident และ lagging DI ทั้งนี้ leading DI จะบอกให้เราทราบถึงเหตุการณ์ที่จะเกิดขึ้น

ในอนาคตอันใกล้ ส่วน coincident DI กับ lagging DI นั้นจะชี้ว่า มีอะไรเกิดขึ้นควบคู่ไปกับสภาพการณ์ทั่วไปทางเศรษฐกิจในขณะนั้น และหลังจากนั้นตามลำดับ

นอกจากนี้ การศึกษาในครั้งนี้เลือก Coincident DI เพื่อใช้ทำนายเหตุการณ์ในอนาคตด้วยวิธีการ ARIMA ของ 'Time Series Model' อย่างไรก็ตาม เป็นที่น่าสังเกตว่าผลของการคาดคะเนดังกล่าวนี้ดูจะไม่สอดคล้องกับความรับรู้ทั่วไปของบุคคลต่าง ๆ ในสังคม ไม่ว่าจะเป็นนักธุรกิจ นักวิชาการ หรือข้าราชการของรัฐบาล กล่าวคือ จากการศึกษาเราพบว่า เศรษฐกิจไทยกำลังฟื้นตัวและขยายตัวเข้าสู่จุดสูงสุดของวัฏจักรธุรกิจระหว่างไตรมาสที่ 2 ของปี 2529 หลังจากที่มีการเปลี่ยนแปลงแบบขึ้น ๆ ลง ๆ ในช่วงปี 1984 (1) – 1985 (12)

การศึกษายังได้เสนอผลของการสำรวจสภาวะธุรกิจในไตรมาสสุดท้ายของปี 2528 ด้วยว่าโดยทั่วไปนักธุรกิจมองสภาวะธุรกิจค่อนข้างไม่สดใสนัก

พิมพ์ที่โรงพิมพ์จุฬาลงกรณ์มหาวิทยาลัย โทร. 2150880 ต่อ 226

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