A MACRO-ECONOMETRIC MODEL OF THAILAND

A MACRO-ECONOMETRIC MODEL OF THAILAND

by

SUCHART THADA THAMRONGVECH, M.Sc.

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*  TO MY MOTHER  *
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AUTHOR: Suchart Thada Thamrongvech, B.A. (Hons.) Thammasat University

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ABSTRACT

The main purpose of this thesis is to design and estimate a macro-econometric model for Thailand. It is intended that the model should be able to explain economic growth and development of the Thai economy; to provide estimates of structural parameters; to examine the relationships among major economic variables; to calculate multiplier effects of specific changes in government policies and other exogenous variables; to make conditional forecasts and policy simulations; and to assist in macro-economic policy planning.

A two-sector model is developed in order to highlight the dichotomy between agriculture and non-agriculture. It draws on aspects of both the Keynesian and neoclassical approaches to obtain demand and supply curves for both final and intermediate products, within a consistent general equilibrium framework.

The model also incorporates some important features of the Thai economy which are generally neglected in other models. Among these are: the dualistic character of production in the agricultural and non-agricultural sectors; the migration of labour from rural areas to the fast-growing urban sector; and the outflow of savings from

the rural to the urban sector. Another important feature is the explicit linkage of the government budget constraint, the foreign trade and foreign exchange markets, and the domestic money market. The linkage is important in providing a built-in stabilizing mechanism in the real economy.

The model is estimated by a simultaneous equations estimation procedure, and is tested for its stability as well as its forecasting ability by historical simulations over the period of study (1960-1978). According to the tests, the model performs reasonably well for most variables.

The model is then used to assess the effects which alternative hypothetical measures would have had on the Thai economy over the historical period. The experiments provide reasonable quantitative answers on the effects of fiscal, monetary and exchange rate policies. For example, devaluation improved the balance of payments, generated higher levels of output, consumption and investment with high inflationary pressure. The results of transferring government investment from the non-agricultural to the agricultural sector suggest that there has been underinvestment in agriculture. The policy also improved income distribution and increased real wages.

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All errors and omissions are, of course, my own responsibility.

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CHAPTER 1

INTRODUCTION

1.1 Objectives and Approach of the Study

The main purpose of this thesis is to design and estimate a macro-econometric model for Thailand. It is intended that the model should help us to understand the structure and important characteristics of the Thai economy, and be of assistance in the analysis of macro-policy initiatives including development planning.

The model developed is of a two-sector variety in order to highlight the agricultural and non-agricultural sectors of the economy. It draws on both the Keynesian short-run approach, in which aggregate output and employment are demand determined, and the neoclassical long-run approach, in which aggregate output is supply determined, and potential growth is limited by the quantities and characteristics of the factor inputs which are available. Aspects of these approaches are combined to obtain estimates of demand and supply curves for the products of both sectors, as well as for the factor inputs which they use. The money market is also modelled.

In all markets quantities and prices are determined consistently, within the overall general equilibrium framework.

Our model also incorporates some important features of the Thai economy which are generally neglected in other models.1 Among these are: (1) the dualistic character of production in the agricultural and non-agricultural sectors; (2) the migration of labour from rural areas to the fast-growing urban sector; and (3) the outflow of savings from the rural to the urban sector. Another important feature is the explicit link among the government budget constraint, the foreign trade and foreign exchange markets, and the domestic money market. The link is very important in representing the real economy, with its built-in stabilizing mechanism to adjust to any policy or exogenous shocks, by automatically reducing the multiplier effects of the shocks over time.

In somewhat more specific terms, the model can be used:

1. To explain economic growth and development and to be a source of information on estimates of the structural parameters of the Thai economy.

2. To study the relationships among major economic variables and the determination of their magnitudes and rates of change through time.

3. To study the roles of fiscal, monetary and exchange rate policies in determining the general level of economic activity.

4. To calculate multipliers as a basis for indicating the effects of specific changes in various government and other exogenous variables.

5. To be applied in conditional forecasting and policy simulation of major economic variables, given alternative government policies or changes in exogenous variables.

6. To be applied in economic policy planning on the macro-economic level.

In the present study, the model is tested for its forecasting ability and its stability properties. It is then applied in a series of simulation experiments in order to provide information on the effects of fiscal, monetary and exchange rate policies on major economic variables. The data used in estimating and testing the model are annual data for the period 1960-1978.

1.2 Organization of the Study

An overview of the growth and development of the Thai economy is provided in Chapter 2. Recent years have witnessed high rates of growth, and the chapter documents that growth as evidenced in the national income and product accounts. It also reviews the changes which have taken place in the population and the labour force, considers the broad changes in social and economic policy, and so on. The chapter is intended to provide the general setting for the formal model construction which follows.

Chapter 3 introduces a theoretical general equilibrium model which provides the basis for subsequent estimation. Incorporated in the model are some important characteristics of relevance for the Thai economy, such as the distinction between the agricultural and non-agricultural sectors, the rural to urban migration of labour as the economy becomes more industrialized, the flow of savings from the rural sector to the urban sector, the role of the government in economic development, and the effects of foreign trade and foreign exchange markets on the domestic economy.

Estimates of various components of the model are presented in Chapter 4 through 7, and estimates of the complete model are presented in Chapter 8. The estimation methods to be used and the statistical criteria to be applied throughout the study are discussed in Chapter 4. In addition, in this chapter estimates of the supply relationships in the model are presented and discussed. There are equations for the production functions in both the agricultural and non-agricultural sectors, and also for labour demand and supply. Chapter 5 first deals with the demand and income sides of the model. It then tests alternative hypotheses concerning consumption expenditure and, finally, turns to the revenue and expenditure relationships in the government sector. Hypotheses relating to the behaviour of private investment in both the agricultural and non-agricultural sectors are tested in Chapter 6. That chapter is also concerned with the level and composition of aggregate savings. Chapter 7 is concerned with the foreign sector, with the money market, and with prices.

Chapter 8 brings together all the necessary components of the complete model, based on the results reported in Chapter 4 through 7, and reestimates all the relationships, using a simultaneous equations estimation procedure, when appropriate. The model is tested for its forecasting ability and for its stability. The tests for its forecasting ability involve: simulating with the model over the data period to assess (1) its ability to replicate the actual levels of endogenous variables; and (2) its ability to replicate their direction of change. The stability tests involve: (1) simulating with the model over a period of 50 years in which the values of all exogenous variables remain fixed at their initial values (the standard run); and (2) shocking the standard run with a one-time change in either the exchange rate or the money supply. In both cases all endogenous variables should move towards steady-state levels.

A number of simulation experiments of policy interest are the topic of Chapter 9. The model is used to assess the impact which five alternative hypothetical policy measures would have had on the Thai economy over a portion of the historical period on which the model has been estimated (1960-1978).

Chapter 10 summarizes the study, discusses further applications and considers the possibilities for expanding and improving the model.

FOOTNOTES TO CHAPTER 1

1. Macro-econometric modelling for Thailand began with the work of Soonthornsima (1963). His model has 19 equations, and emphasises foreign trade, foreign loans, and aid. It was designed to provide a tool for use in development policy analysis in the 1960s.

   The Stephenson and Itharattana (1977) model is intended for agricultural planning. It has 55 equations, is linear in parameters and variables, except for the production functions and explains the components of real gross domestic expenditure (GDE) and gross domestic product (GDP) in some detail. The model assumes a positive marginal productivity of labour, but it has no labour market. It is closed by averaging the sum of the components of GDE and GDP to define GDP (= GDE).

   The model which Ramagura developed in his Ph.D. thesis (1972) has been extended and become The Chulalongkorn University's Model (Ramagura, 1976). It has 144 equations, and emphasises value added production functions and foreign trade. It assumes surplus labour with zero marginal productivity. The model determines GDP as the sum of value added. The model has money and foreign exchange markets and an aggregate price determination equation, but no explicit labour market.

   The model of the National Economic and Social Development Board (Government of Thailand, 1980a) has 232 equations and was designed for long-run forecasting in connection with the Fifth Five-Year Economic and Social Plan. It can be used to analyse the impact of tax policy, of exchange rate policy, among others. The model is highly disaggregated with respect to value added supply and exports, where it works at the commodity level in the case of certain important commodities. The supply of commodities is further disaggregated into four regions. Imports are used as a mechanism to adjust for the difference between total value added on the supply side (GDP) and total final demand (GDE). The model has no monetary sector, domestic prices depend on export and import prices and on indirect taxes, and surplus labour is assumed in all sectors.

   The Chaipravat, Meesook and Garnjarerndee model

(1979) contains 184 equations, and gives detailed emphasis to the financial sector. The domestic price level is defined as the sum of nominal government consumption and gross fixed investment divided by a variable equal to real GDP plus real imports less real personal consumption, private gross fixed investment, inventories and exports. The model is designed mostly for use in the simulation of monetary policy.

CHAPTER 2

SOME ASPECTS OF THE THAI ECONOMY

The general features of the economic growth, development and policies of Thailand since 1950 are presented in section 2.1. Section 2.2 discusses population and manpower. The balance on current account and balance of payments are considered in section 2.3. Sections 2.4 and 2.5 discuss Thai fiscal and monetary policies and her economic and social plans. Section 2.6 investigates factors important in accounting for the high rate of economic growth in Thailand.

2.1 Economic Growth and Development

Thailand is a market oriented developing country situated in Southeast Asia. She has an area of approximately 200,000 square miles, and an estimated population of about 46 million (middle of 1979). The population density, 230 persons per square mile, is among the lowest in Asia. Thailand has experienced relatively high rates of economic growth. (See Table 2.8.) Her average annual growth rate of real gross domestic product (GDP) was 7.3 percent between 1951-1979 (Table 2.3). The real GDP in

1979 was 7 times GDP in 1951, while population increased 2.3 times over the same period. Thus per capita GDP tripled from about 2,000 baht in 1951 to about 6,200 baht in 1979 (measured in 1972 price) (Table 2.1). (1 baht equals approximately $US 0.05.)

2.1.1 The Agricultural Sector

Agriculture was and is the largest sector, though its relative importance has declined. It accounted for about 50 percent of GDP (Table 2.2) and more than 80 percent of employment in the early 1950s. These shares declined to 26 percent of GDP and 60 percent of employment by 1979. Agricultural products also account for the largest share of exports (Table 2.6). They contributed about 80 percent of commodity exports in 1960 and about 50 percent in 1979.

Rice is the most important agricultural product and the leading export. Rice is also the staple food of Thai people and has been a traditional export since at least 1850 (Ingram, 1971, Chapter 3). Its share of value added in agriculture was about 47 percent in 1961 and about 30 percent in 1979 (Table 2.4).

In recent years, fruits, cassava, rubber, maize, sorghum, sugar-cane, spices, vegetables, tobacco and kenaf and jute have all played a more important role in the agricultural sector. Their share of value added increased from 30 percent in 1961 to 44 percent in 1979 (shown as "other crops" in Table 2.4). Thus there has been an ongoing process of agricultural diversification.

The main causes of agricultural diversification may be:

(1) The relative profitability of these crops compared to rice. This is in part due to the fact that the domestic price of rice has been for the most part depressed since the end of the Second World War by the rice export tax and premium. This policy was designed to generate tax revenue and to keep the cost of living in the urban sector low.

(2) The opening up of the upland areas by the expansion of the highway network in the late 1950s and in the early 1960s in conjunction with malaria eradication programmes begun in 1949. These opened up large areas more suitable for the cultivation of crops other than rice. (Because rice is more suitably grown in the lowland areas.)

(3) The fast-growing demand of domestic processing industries for sugar cane, tobacco and fruits, and the expansion of world demand for maize, rubber, cassava, jute and kenaf.

(4) The government policy on agricultural diversification in order to diversify production activities and exports and to reduce the degree of dependence on major agricultural products.

Relative land-abundance is a characteristic of Thai agriculture; planted area per capita has increased slightly over the period of 1956-1978. In fact, the planted area per agricultural worker has increased from 4 rai (1 rai = 0.4 acres or 0.16 hectares) per person in 1961 to 6.2 rai per person in 1978 (Table 2.5). The increase in planted area was accounted for largely through a reduction in forest land. Forest land has been reduced from 173 million rai in 1950 to 77 million in 1978, while farm holding land increased from 56 million rai to 116 million rai in the same period. Forest land in 1978 was only 24 percent of total land area.[1] Any further reduction in it may not be desirable since it may cause adverse environmental effects. Regular flooding in the Central Plain and Bangkok areas in recent years may have been largely caused by the reductions in forested land in the northern part of the country.

Expansion of the area under cultivation instead of increases in yields account for most of the growth in agricultural output. Average paddy yields have changed little from 1956 to 1978 (Table 2.5). This trend is also evident for most of other crops (in terms of average land productivity, Table 2.5). Though the use of fertilizer has been increasing, the Ricardian effect of diminishing returns on marginal land has had the opposite effect. In fact, the use of fertilizer was discouraged for at least two reasons; (1) there was lack of complementary irrigation investments (e.g., field ditches, dykes), though vast expenditures had already been made on the principal irrigation facilities (Siamwalla, 1975; Government of Thailand, 1980c, pp. 33-40). Thus the lack of appropriate water control has discouraged farmers from applying new techniques and new seed varieties, which use more fertilizers and give higher yields, (2) the government policy of protecting domestic fertilizer-producers caused the domestic price of fertilizer to be higher than the world market price while the price of rice was held below world market levels. The fertilizer policy was implemented during the period 1969-1973 and January-April 1978.

The use of machinery in agriculture has already started to replace animal power in all areas, though the ratio of (machine) capital to labour is still low, when compared to developed countries.

The share of livestock in agricultural value added (Table 2.4) has been more or less stable about 11 percent between 1961-1979, while the share of forestry has been declining, due to the lack of proper conservation and population pressure.

The fisheries industry, especially marine fishing has been the fastest growing component in the agricultural value added. The Thai fisheries industry is now ranked seventh in the world, second in Asia to Japan (Government of Thailand, 1980b, p. 23). Recently, many neighbouring countries have expanded their national exclusive economic zones from 3 miles to 200 miles. But the change has had little effect on Thai marine fishing. The slow down in its growth rate between 1977-1979 was largely due to the high price of fuel.

2.1.2 The Manufacturing Sector

The manufacturing sector has high real growth rates, between 10-12 percent, annually, during 1961-1979 (Table 2.3). This may be largely due to the government policy on promoting the industrial sector through private enterprise followed since the beginning of the 1960s. The policy shift occurred after the industrialization policy through public enterprise had failed in the 1950s due to inefficiency and corruption.

Between 1961-1971, policy was based on the promotion of import-substitution industrialization by providing tariff protection and other tax incentives. Industrial policy has shifted to give a priority to export expansion since 1972, by providing tax incentives and information on foreign markets.

The development of the manufacturing sector has changed the composition of imports from consumer goods to raw materials and capital goods (Table 2.7). The leading imports in recent years are fuel and lubricants, non-electrical machinery and parts, metals and chemicals. Most commodity imports are from Japan and U.S.A. (about 42-45 percent of the value of total commodity imports during the period 1960-1979).

Manufactured exports have increased under the export expansion policy. In the last 8-9 years the exports of manufactured goods, machinery and chemicals have increased rapidly from about 4 percent of total commodity exports in 1960 to about 35 percent in 1978. The average real growth rate of the manufactured exports was 24 percent during 1960-1978. The important manufactured exports are sugar, canned fruit, processed food, textile and textile products, precious stones, wood products and transistors.

The markets for Thai exports have diversified as well as the types of commodity exports, though the main exports are still (in order of value) rice, rubber, tin, maize and tapioca products (Table 2.6). The important markets for Thai exports are (in order of value) Japan, U.S.A., The Netherlands, Singapore, Hong Kong and Malaysia.

The manufacturing sector has changed rapidly, though it is still concentrated in and around the Bangkok area. In the 1950s, the industry groups of food, beverages and tobacco were prominent. In the last 10-15 years, the industrial groups of textiles, transport equipment, petroleum refining and petroleum products, chemicals and chemical products, non-metallic mineral products, rubber and rubber products, machinery and electrical machinery and supplies have increasingly played a more important role. The 1975 input-output table (Table 2.9) of Thailand displays the recent cross-sectional features of the disaggregate manufacturing sector and other sectors of the Thai economy.

Very recently, the Thai government has started the policy of promoting basic industries such as a steel complex, soda ash, fertilizers and newsprint (Akrasanee, 1980).

2.1.3 The Mining Sector

Tin metal and tin in-concentrate account for about half of the mining value added. Other important minerals are tungsten, fluorite, lignite, gypsum and marl. Tin metal is an important export (Table 2.6).

In 1982, natural gas from the gulf of Thailand became available. Its production is expected to be about 200 million cubic feet per day in 1982, 400 in 1983-84, 450 in 1985, and 500 in 1986-1990 (Government of Thailand, 1980b, pp. 24-26). These supplies will substitute for about 30-35 percent of the previously imported fuel and lubricants. The estimated gas reserves in the explored areas are around 14.1 trillion cubic feet (Sricharatchanya, 1982).

2.1.4 Infrastructure

The annual growth rates of infrastructure (construction, electricity and water supply, and communication and transportation) in real term have been very high since 1951 (Table 2.3).

The real growth rates of construction varied between 12 and 15 percent during 1951-1966. The rates declined to an annual rate of 4 percent during 1966-1976, and increased to 15 percent between 1976-1979. The high growth rate of construction in the 1950s and in the early 1960s were substantially created by the government investments in roads, dams, bridges, schools and hospitals to facilitate economic development. About 30-45 percent of the value added in construction is accounted for by the public sector.

The real annual growth rates of electricity and water supply were also high between 20-22 percent during 1951-1971, 14 percent during 1971-1976, and 12 percent between 1976-1979. Electricity and water supply are in large part provided by the public sector. The per capita consumption of electricity increased rapidly. In 1979 the per capita consumption was 251.5 kilo-watt/hour, while it was only 19.3 kilo-watt/hour in 1962. Total electrical consumption in 1979 was 13 times of that in 1962.

2.1.5 The Services and Trade Sectors

The wholesale and retail trade share in GDP was rather stable about 16-17 percent over the period 1951-1979 (Table 2.2), while the share of banking, insurance, real estate and ownership of dwellings doubled from 3.2 percent in 1951 to 6.9 percent in 1979. There are about 29 banks, 16 of them are incorporated in Thailand and owned by Thais, another 13 are branches of foreign banks. The 16 Thai bank have more than 90 percent of total deposits. This is because the foreign banks are not allowed to have more than one branch. This indicates a high degree of indigenous control of the Thai financial market. All but one of the banks are privately owned. To certain extent, the high growth of the banking sector has helped economic development in improving the efficiency in resource allocation.

The value added share of the public sector in GDP grew from 2.7 percent to about 4.0 percent, while the share of the services sector was stable at about 10 percent. The important activities of the services sector are education, hotels and restaurants, medical and health care and recreation and entertainment.

2.2 Population and Manpower

According to official estimates, population grew about 3.1 percent per year during 1950-1964. The rate gradually declined to 2.7 percent by 1971, and has drastically declined ever since to about 2 percent in 1979. Population was 20.3 million in 1951, and 46.2 million in 1979; there was approximately 5.5 million in 1850 (Ingram, 1971, p. 224). The absolute increase in the 29-year period 1951-79 is larger than that in the preceding one hundred years.

The pressure of high rates of population growth in Thailand has created concern both in and out of government for fear that rapid population growth may retard economic and social development and slow down the rise in the standard of living. There are virtually no religious or cultural barriers to prevent the use of family planning techniques in Thailand. The high birth rate especially in rural areas, may be mostly explained by: (1) the lack of knowledge on birth control, (2) the need for additional family labour, and (3) the fear of childhood mortality.

The recently drastic decline in the growth rate of population was largely due to the rapid decrease in birth rate since 1971, while the death rate has continued to slowly decline. The rapid reduction in the birth rate is mostly explained by the high acceptance rate of the family planning programme campaign conducted by the Thai government and the Family Planning Association of Thailand (which is a private organization supported mostly by international organizations), the improvement of health care and education, and the increase in economic development, urbanization and industrialization.

The current population growth rate of 2.0 percent per year is still high however. The present energetic campaign for family planning, health care and education will be needed for many years to come if the country wants to maintain the high rate of economic development and enchance the well-being of Thai people as a whole.

According to the target in the Fifth Economic and Social Plan (1982-1986), the growth rate of population is expected to be about 1.5 percent per year by the end of 1986. The growth rate of the labour force which is defined as the economically active population of 15-64 years of age, is expected to be about 2.7 percent per year for 1979-1984. Most of population and labour force will still be in the rural areas and agricultural sector respectively, but the ratios are declining.

Thailand has relatively high rates of female labour force participation. The rate was 81 percent in 1960 and 74 percent in 1970, while the male participation rates were 89.5 percent 87.7 percent in 1960 and 1970, respectively. The female participation rate declined significantly between 1960-1970 due to industrialization and other economic developments (World Bank, 1980, p. 69).

Rapid internal migration of labour has occurred only recently in Thailand. The migration has largely been between rural areas more than between rural and urban areas. Most of the migrants were farmers in search of new land (World Bank, 1980). However the urban population has been growing at nearly 5 percent per year since 1950, while the growth rates of the rural population were less than 2 percent per year. This was due to rural emigration into the urban sector. The natural growth rates of rural population were always higher than the rates in the urban sector.

2.3 Balance on Current Account and Balance of Payments

Though the balance on current account has been in deficit (except for 1961 and 1966) during the period 1961-1979, the balance of payments were mostly in surplus. This is due to a large net capital inflow over the same period, the annual average share of net capital inflow of GDP was about 3 percent.

From 1975-1979, the high prices of fuel and lubricants have caused a large deficit in the balance on current account and the balance of payments, which has created concern both in and out government. The share of import of fuel and lubricants in total commodity imports rose from about 9 percent in 1970 to 21 percent in 1979 (Table 2.7). However, the diversification of exports, which increased the rate of export growth and the availability of natural gas will mitigate the deficit in the balance on current account and improve the situation of the balance of payments in the coming years.

2.4 Fiscal and Monetary Policies

The main sources of government revenue are taxes. (See details in Chapter 5.) Indirect taxes accounts for 80-90 percent of total tax revenue during 1960-1979, while personal income tax contributes only 7-8 percent. The overall structure of the tax system is regressive. The major sources of indirect taxes are import duties and business and selective sales, which accounts for 80 percent of total indirect tax revenues.

Government expenditures may be disaggregated into 3 categories; consumption, investment and interest payments on government debt. Government consumption is the largest part of government expenditures. The main consumption expenditures are defense, general administration and education. The share of government consumption in GDP was 9.5 percent in 1960 and rose to 12 percent in 1979. Government fixed investment are mainly on infrastructure to facilitate economic development. The share of government investment in gross domestic product was about 5-8 percent during 1960-1978.

Since the end of the Second World War, the monetary policy in Thailand has aimed at the stabilization of the general price level and the exchange rate. The policy was to keep the growth rate of the money supply to be about 2-3 percent higher than the expected growth rate of real growth domestic product. The 2-3 percent differences was aimed at the monetization of the rural areas. The policy was largely successful. Over the period 1952-1971, the average annual growth rate of the GDP deflator was 1.5 percent and the rise in the price level in any single year has never been more than 4 percent (except for 10 percent in 1955 and 7 percent in 1966). The Thai baht has been a stable currency.

In 1971, when the Governor of the Bank of Thailand was changed, policy seems to have changed towards greater use of money creation to finance government deficits. Since then the ratio of the money supply (M1) to real gross domestic product has rapidly increased from about 11-13 percent during 1952-1971 to 15 percent in 1972, 17 percent in 1973-75, 18 percent in 1976, 19 percent in 1977, 20 percent in 1978 and 22 percent in 1979. The growth rate of the money supply has been much more than 2-3 percent higher than the growth rate of GDP since 1971.

Comparing between the two periods, the average annual growth rates of the money supply (M1), GDP and the GDP deflator were 8.7 percent, 7.1 percent and 1.5 percent, respectively during 1952-71. Between 1971-79, the average annual growth rates of the money supply, GDP and the GDP deflator were 14 percent, 7.7 percent and 10.2 percent, respectively.

The growth rates of output between the two periods are about the same. But the growth rate of the money supply in the second period was 1.6 times of that in the first period. The evidence seems to suggest that the excessive monetary expansion has created inflationary pressure in recent years.

However, the growth rate of the price was higher than the difference between the growth rates of output and the money supply. This may be due to two reasons: (1) In a period of inflation, velocity tends to increase, because people have less confidence in money, money becomes a less desirable form in which to hold assets. The opposite occurs in the deflationary period. (See Friedman, 1968b, pp. 23-25.) (2) Inflationary pressure from abroad due to the tremendous rise in price of oil, especially from 1973-79, may also account for the rapid inflation in Thailand.

The limited impact on real economic growth of the recent monetary policy may be explained in several ways. (1) The Thai economy has for the most part operated at full capacity. (2) The fixed exchange rate regime has reduced the effectiveness of monetary policy.

2.5 The Economic and Social Plans

Though the economic system is one of private enterprise, Thailand has had formal economic and social planning since 1961. The country is now in the period of the Fifth Plan (1982-1986). The plans may be considered as public development expenditure programmes and as outlines of government's policies on economic development. Taxes, subsidies, monetary measures and other incentives are normally used as the tools to implement the objectives of the plans in the private sector.

The First Plan (1961-1966) emphasized the provision of basic facilities such as irrigation, power, transportation and communication, and the establishment of the manufacturing sector through import substitution. A number of specific physical growth targets have been established. The target growth rate of output was 5.3 percent per year. Its actual rate was 8.1 percent per year.

The Second Plan (1967-1971) aimed at overall economic expansion, regionally balanced growth, manpower planning and the development of the industrial sector through import substitution. The growth rate of output was expected to be 8.5 percent per year. Its actual rate was 7.1 percent per year.

The Third Plan (1972-1976) emphasized the need to attain an output growth rate of 7 percent per year. (Its actual growth was 7.2 percent per year.) It regarded the balance of payments as a binding constraint on future growth and proposed a set of development strategies to relieve this constraint through further expansion and diversification of exports. Import growth was to be curbed through fiscal and monetary measures, calling for large increases in external capital inflows, both official and private. The plan also emphasized the agricultural diversification, the reduction of income disparity between rural and urban areas through the expenditures on agriculture, education and other services, which affect the rural sector directly.

The Fourth Plan (1977-1981) targeted output growth at 7 percent per year (the actual growth rate was 7.4 percent per year), agricultural growth at 5 percent, manufacturing at 9.6 percent, mining at 3.2 percent, exports at 13.7 percent and imports at 11.5 percent per year. The plan emphasized economic stability against the rising price of oil and the reduction in the population growth rate.

The Fifth Plan (1982-1986) emphasizes the restructuring of the economy, economic stability, the redistribution of income and growth to the rural sector, the development of energy sources and further expansion of exports to improve the balance of payments situation. The targets of the plan are: (1) an output growth rate of 6.6 percent per year, (2) the growth rates of agriculture, manufacturing, mining, exports and imports of 4.5 percent, 7.6 percent, 16.4 percent, 22.3 percent and 18.1 percent per year, respectively, and (3) the rate of population growth to be lowered to 1.5 percent per year by 1986.

Overall, the plans may be considered to have been successful in that most policies have been implemented and targets achieved. The basic task of rehabilitation and expansion of social overhead capital, which is the foundation of future growth, has been largely accomplished. The growth rate of output was always high (higher than the period before the plans, e.g., the growth rate of output during 1951-60 was 6.3 percent per year). The degree of fluctuations in output in the period before the plans has been reduced. The public administration in the field of development policies has been reorganized and improved. The economic structure has been rapidly changed from traditional agriculture towards industrial production and services. The majority of people has participated in and benefited from economic development and growth (World Bank, 1980), though the degree and nature of the sharing of the benefits of growth have not been equal.

2.6 Factors Accounting for the High Rate of Economic Growth

The average annual rate of growth of Thai gross domestic product was 6.25 percent between 1951-1960, 7.91 percent during 1960-70, and 7.46 percent between 1970-78. The high growth rates may be largely explained by the following factors:

(1) A high and rising level of fixed investment over

the period. The investment/GDP ratio was 16.6 percent in 1960; after 1963 the ratio was always higher than 20 percent. The average of the ratio between 1963-1978 was 23.5 percent.

(2) The market oriented system of the economy combined with an attractive climate for foreign investment and trade has increased competition and efficiency in the economy. Table 2.8 shows that the countries which adopted these policies (e.g., Malaysia, Japan, Singapore and South Korea) tend to have had high rates of economic growth. Countries that relied more on government control and discouraged foreign trade and investment (e.g., Burma, India and Sri Lanka) have grown slower. The degree of openness of the Thai economy is relatively high and increasing. The proportion of exports of goods and services in gross domestic product was about 16 percent in 1960, 19 percent in 1970 and 21 percent in 1978. The proportion of imports of goods and services in gross domestic product was 20 percent in 1960, 27 percent in 1970 and 25 percent in 1978.

(3) The contribution of the public sector to growth process by providing an environment for the private sector to operate efficiently, by facilitating development through the construction of infrastructure and by guiding the direction of economic development through the indicative economic plans.

(4) The high growth of exports and high level of foreign capital inflows combined with the long period of political and economic stability (which reduced the degree of risk and uncertainty for investments) have contributed significantly to economic growth.

FOOTNOTES TO CHAPTER 2

1. The data of forest land and farm holding land are obtained from Government of Thailand, Selected Economic Indicators Relating to Agriculture, 1979, Ministry of Agriculture and Cooperatives. A report by the Government of Thailand (1980c) shows that forest land in 1978 was about 37-40 percent of total area.

Table 2.1 Gross Domestic Product by Industrial Origin and Population of Thailand in Millions of 1972 Baht and Millions.

	Year						
	1951	1956	1961	1966	1971	1976	1979
Agri.	19,234	23,233	29,135	40,873	50,537	65,898	73,612
Min.	616	771	930	2,009	2,856	2,906	4,627
Manu.	5,038	7,449	9,197	15,911	25,202	42,529	58,036
Con.	1,074	2,012	3,514	6,908	7,689	10,022	15,367
Elec.	38	105	284	707	1,879	3,642	5,060
Comm.	1,462	2,475	4,861	6,906	9,373	14,650	20,831
Whol.	6,527	9,609	11,926	17,868	27,189	38,821	47,009
Bank.	1,315	1,647	3,654	5,647	9,665	13,872	19,698
Publ.	1,108	2,749	3,327	4,358	6,993	8,893	11,417
Serv.	4,224	5,451	7,028	10,501	15,705	21,276	29,090
GDP	40,636	55,501	73,856	111,688	157,088	222,509	284,747
POP	20.3	23.5	27.2	31.7	36.8	43.2	46.2
GDP/POP	2,002	2,362	2,715	3,523	4,269	5,151	6,163

Agri.= Agriculture; Min.= Mining and quarrying; Manu.= Manufacturing; Con.= Construction; Elec.= Electricity and water supply; Comm.= Communication and transportation; Whol.= Wholesale and retail trade; Bank.= Banking,insurance,real estate and ownership of dwellings; Publ.= Public administration and defense; Serv.= Services; GDP = Gross Domestic Product; POP = Population in million persons; GDP/POP = Per Capita GDP in baht (1 $US ≃ 20 baht).

Source: Office of the National Economic and Social Development Board, Bangkok, Thailand.

Table 2.2 Sectoral Share of GDP of Thailand at 1972 Prices.

	Year						
	1951	1956	1961	1966	1971	1976	1979
Agri.	47.3	41.9	39.4	36.6	32.2	29.6	25.9
Min.	1.5	1.4	1.3	1.8	1.8	1.3	1.6
Manu.	12.4	13.4	12.5	14.2	16.0	19.1	20.4
Con.	2.6	3.6	4.8	6.2	4.9	4.5	5.4
Elec.	0.1	0.2	0.4	0.6	1.2	1.6	1.8
Comm.	3.6	4.5	6.6	6.2	6.0	6.6	7.3
Whol.	16.1	17.3	16.1	16.0	17.3	17.4	16.5
Bank.	3.2	3.0	4.9	5.1	6.2	6.2	6.9
Publ.	2.7	4.9	4.5	3.9	4.5	4.0	4.0
Serv.	10.4	9.8	9.5	9.4	10.0	9.6	10.2
GDP	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Office of the National Economic and Social Development Board, Bangkok, Thailand.

Table 2.3 Average Annual Growth Rate of Value Added by Sectors in 1972 Prices.

	Year					
	1951-56	1956-61	1961-66	1966-71	1971-76	1976-79
Agri.	3.85	4.63	7.01	4.34	5.45	3.76
Min.	4.59	3.82	16.65	7.29	0.35	16.77
Manu.	8.14	4.31	11.59	9.64	11.03	10.92
Con.	13.38	11.80	14.47	2.17	5.44	15.31
Elec.	22.54	22.02	20.01	21.59	14.15	11.58
Comm.	11.10	14.45	7.28	6.30	9.34	12.45
Whol.	8.04	4.42	8.42	8.76	7.38	6.59
Bank.	4.61	17.28	9.10	11.35	7.49	12.40
Publ.	19.93	3.89	5.55	9.92	4.92	8.68
Serv.	5.23	5.21	8.36	8.38	6.26	10.99
GDP	6.43	5.88	8.62	7.06	7.21	8.57

Source: Office of the National Economic and Social Development Board, Bangkok, Thailand.

Table 2.4 Agricultural Value Added at 1972 Prices in Million Baht and the Output Share in Parenthesis.

	Year				
	1961	1966	1971	1976	1979
Paddy	13,738 (47.2)	18,862 (46.1)	18,857 (37.3)	19,508 (29.6)	21,915 (29.8)
Other Crops	8,784 (30.1)	13,110 (32.1)	18,095 (35.8)	29,505 (44.8)	32,123 (43.6)
Livestock	3,732 (12.8)	4,330 (10.6)	5,610 (11.1)	7,622 (11.6)	8,585 (11.7)
Fisheries	931 (3.2)	2,200 (5.4)	5,006 (9.9)	5,898 (8.9)	8,102 (11.0)
Forestry	1,950 (6.7)	2,371 (5.8)	2,969 (5.9)	3,365 (5.1)	2,887 (3.9)
Total Agri.	29,135 (100.0)	40,873 (100.0)	50,537 (100.0)	65,898 (100.0)	73,612 (100.0)

Source: Office of the National Economic and Social Development Board, Bangkok, Thailand.

Table 2.5 Planted Area (in Million Rai) and Yield of Paddy and of Other Crops.

	Year					
	1956	1961	1966	1971	1976	1978
Total Planted Area[a]	44.07	49.27	66.66	71.94	85.44	100.73
Paddy	37.65	38.62	45.45	47.04	53.60	62.49
Other Crops	6.42	10.65	21.21	24.90	31.84	38.24
Total Planted Area Per Capita (rai)	1.88	1.81	2.10	1.95	1.98	2.23
Total Planted Area Per Agricultural Worker (rai)		3.98	4.99	4.99	5.49	6.23
Yield of Paddy (kgs./rai)	230	231	257	292	281	280
Value Added Per Rai in 1972 Prices (or Average Land Productivity) of:						
Paddy		355.72	415.01	400.87	363.96	344.87
Other Crops		824.79	618.10	726.71	926.66	888.42

a Including area for multiple crop planting.

Note : 1 acre = 2.5 rai.

Source: 1. Monthly Bulletin, Bank of Thailand, various issues.
2. Selected Economic Indicators Relating to Agriculture, Ministry of Agriculture and Cooperatives, 1978, 1979.
3. Agricultural Statistics of Thailand, crop year 1978/79, Ministry of Agriculture and Cooperatives.
4. Office of the National Economic and Social Development Board, Bangkok, Thailand.

Table 2.6 Principal Export Products and Their Shares of the Value of Total Commodity Exports, Millions of Current Baht.

	Year					
	1960		1970		1979	
	Value	Share	Value	Share	Value	Share
Rice	2,570	29.84	2,516	17.03	15,592	14.41
Rubber	2,579	29.94	2,232	15.11	12,351	11.42
Tin	537	6.23	1,618	10.95	9,253	8.55
Maize	551	6.40	1,969	13.33	5,643	5.22
Tapioca Products	288	3.34	1,223	8.28	9,891	9.14
Jute & Kenaf	230	2.67	719	4.87	391	0.36
Shrimp	3	0.03	224	1.52	2,372	2.19
Tobacco leaves	21	0.24	197	1.33	1,243	1.15
Sugar	8	0.09	94	0.64	4,797	4.43
Mung beans	48	0.56	255	1.73	1,375	1.27
Fluorite	-	-	222	1.50	252	0.23
Sorghum	-	-	103	0.70	495	0.46
Cement	11	0.13	83	0.56	33	0.03
Teak	356	4.13	156	1.06	118	0.11
Others	1,412	16.40	3,161	21.39	44,373	41.02
Total	8,614	100.00	14,772	100.00	108,179	100.00

Source: Monthly Bulletin, Bank of Thailand, various issues.

Table 2.7 Imports of Commodities by Economic Classification and Their Share of the Value of Total Commodity Imports, Millions of Current Baht.

	Year					
	1960		1970		1979	
	Value	Share	Value	Share	Value	Share
Consumer Non-durables	2,558	27.10	3,486	13.20	9,327	6.08
Consumer Durables	807	8.55	1,892	7.16	6,665	4.34
Intermediate Products and Raw Materials	1,746	18.50	6,725	25.47	43,462	28.33
Capital Goods	2,367	25.08	9,371	35.49	39,835	25.96
Fuel & Lubricants	1,025	10.86	2,329	8.82	32,650	21.28
Other Goods	935	9.91	2,604	9.86	21,490	14.01
Total Imports of Goods	9,438	100.00	26,407	100.00	153,429	100.00

Source: Monthly Bulletin, Bank of Thailand, various issues.

Table 2.8 International Comparison on Economic Growth and Development.

Country	Average (1960-1978) Annual Growth Rate of Real GDP	Exports	Imports	The Ratio of Fixed Investment to GDP 1960	1979	Per Capita Current GDP ($US) 1960	1979
1 Burma	2.6a	-5.0a	-4.7a	8.7b	10.1c	61	133c
2 India	3.8	5.7	3.0	14.1	20.0	73	200
3 Sri Lanka	4.8a	0.1a	2.4a	15.3b	20.6	142	240
4 Philippines	5.6	5.9	5.5	14.1	24.0	164	646
5 Indonesia	7.6d	9.3d	16.9d	14.1e	21.9	73	331
6 Thailand	7.7	9.3	9.0	16.6	24.6	97	599
7 Malaysia	8.1g	8.0g	8.1g	20.0f	22.5h	278	1523
8 Japan	8.6	13.4	11.2	24.1	32.0	458	8627
9 Singapore	9.1	-	-	9.5	35.0	432	3829
10 South Korea	9.3	27.1	18.4	8.6	37.1	150	1279

Note: a = average between 1963-78; b = year 1963; c = year 1978;
d = average between 1970-78; e = year 1970; f = year 1971;
g = average between 1971-77; h = year 1977.

Source: (1) Yearbook of National Account Statistics 1979 and 1980, UN.
(2) World Statistics in Brief 1980, UN.

Table 2.9 The 1975 Input-Output Table of Thailand (16 Sectors)
at Current Producer's Prices.

Row Sector	Column Sector	01	02	03
01	Agriculture	5,592	26	50,355
02	Mining and Quarrying	-	-	66
03	Food, Beverage & Tobacco	6,120	-	7,774
04	Textile & Textile Products	225	4	472
05	Manufacture of Wood & Wood Products	264	4	37
06	Paper & Paper Products, Printing	4	4	253
07	Chemicals, Rubber & Petro. Products	4,228	351	1,443
08	Non-metalic Mineral Products	75	2	256
09	Metal & Metal Products, Machinery	1,087	236	827
10	Other Manufacturing Industries	11	-	24
11	Public Utility	61	7	765
12	Construction	237	51	392
13	Trade	2,122	58	6,205
14	Transportation & Communication	894	120	1,405
15	Services	1,214	131	1,026
16	Unclassified	229	77	215
190	Total Intermediate Input	22,411	1,070	71,215
201	Wages and Salaries	8,243	821	7,826
202	Operating Surplus	71,996	3,022	17,410
203	Depreciation	3,190	399	2,159
204	Net Indirect Tax	823	980	4,968
209	Total Value Added	84,252	5,222	32,452
210	Total Input	106,663	6,292	103,668

Source: Basic Input-Output Table of Thailand, 1975. National Economic and Social Development Board.

Row	04	05	06	07	08	09	10
01	2,459	2,522	42	1,781	34	6	127
02	2	-	10	11,278	613	2,292	64
03	-	-	51	191	2	-	376
04	13,655	47	48	556	55	143	515
05	33	786	31	37	22	229	92
06	119	13	1,893	246	88	86	99
07	2,391	416	594	5,499	856	3,270	310
08	-	13	-	147	258	257	51
09	286	162	153	402	314	16,293	615
10	26	20	4	34	8	74	758
11	544	141	175	654	144	642	53
12	152	43	91	200	64	138	25
13	1,870	570	476	1,347	356	2,965	534
14	268	190	134	385	306	731	76
15	605	128	126	948	197	493	102
16	38	53	91	184	95	200	88
190	22,447	5,103	3,919	23,891	3,414	27,817	3,833
201	3,631	843	630	3,716	537	2,962	796
202	5,227	2,027	1,285	5,123	1,111	6,025	2,682
203	1,274	295	252	1,306	348	1,359	158
204	1,191	342	238	1,212	275	1,603	198
209	11,322	3,508	2,405	11,357	2,271	11,949	3,834
210	33,769	8,611	6,324	35,248	5,685	39,766	7,717

Row	11	12	13	14	15	16	190
01	-	288	2	15	1,828	310	65,387
02	24	2,075	-	-	6	12	16,442
03	-	-	219	78	7,372	839	23,023
04	10	39	574	333	606	302	17,585
05	3	2,493	413	4	223	8	4,679
06	3	123	1,068	153	949	68	5,169
07	2,491	1,642	738	6,925	1,709	164	32,776
08	6	3,725	85	13	235	31	5,155
09	512	8,858	481	2,737	1,111	346	34,421
10	2	2	350	11	311	88	1,724
11	402	173	284	196	837	127	5,205
12	30	12	277	165	1,458	47	3,380
13	514	3,266	905	1,520	3,927	316	26,949
14	127	2,621	1,140	1,244	1,144	139	10,923
15	172	911	5,694	1,080	3,777	542	17,148
16	43	176	1,138	315	437	-	3,328
190	4,340	26,403	13,370	14,789	25,930	3,338	273,343
201	545	4,124	19,782	6,814	34,386	-	95,658
202	1,982	8,851	37,721	6,879	22,086	-	193,515
203	685	1,629	3,219	2,976	17,903	-	37,151
204	56	781	4,555	1,086	3,827	-	22,132
209	3,268	15,385	65,277	17,755	78,200	-	348,456
210	7,608	41,788	78,647	32,544	104,131	3,338	621,800

Row	301	302	303	304	305	409	509	600
01	34,527	81	164	2,501	6,546	-2,543	41,276	106,663
02	185	11	-	1,443	731	-12,520	-10,151	6,292
03	62,747	185	-	2,678	18,292	-3,257	80,645	103,668
04	14,858	613	7	859	2,690	-2,843	16,184	33,769
05	1,518	252	642	308	1,368	-156	3,932	8,611
06	1,974	608	-	36	191	-1,654	1,155	6,324
07	9,680	1,471	94	1,291	3,703	-13,766	2,473	35,248
08	610	82	55	206	518	-941	530	5,685
09	9,515	1,246	22,175	3,485	4,240	-35,316	5,345	39,766
10	4,947	210	451	954	1,558	-2,127	5,993	7,717
11	2,120	193	-	-	96	-5	2,404	7,608
12	1,295	430	36,683	-	-	-	38,408	41,788
13	37,950	890	5,172	1,376	6,310	-	51,698	78,647
14	15,722	1,339	679	372	4,189	-679	21,621	32,544
15	57,705	27,627	-	14	4,231	-2,593	86,984	104,131
16	348	128	-	-	441	-956	-39	3,338
190	255,700	35,366	66,121	15,521	55,104	-79,356	348,457	621,800
201	-	-	-	-	-	-	-	95,658
202	-	-	-	-	-	-	-	193,515
203	-	-	-	-	-	-	-	37,151
204	-	-	-	-	-	-	-	22,132
209	-	-	-	-	-	-	-	348,456
210	255,700	35,366	66,121	15,521	55,104	-79,356	348,457	970,256

Note: 301 = Personal Consumption Expenditures on Goods and Services.
302 = Government Consumption of Goods and Services.
303 = Total Gross Fixed Investment.
304 = Change in Inventories.
305 = Exports of Goods and Services.
409 = Imports of Goods and Services.
509 = Total Final Demand.
600 = Total Output.

CHAPTER 3

A MACRO-ECONOMETRIC MODEL: AN OVERVIEW

The macro-econometric model proposed in this study includes two sectors, agriculture and non-agriculture, in which demand and supply equilibrate in a consistent manner. The model may also be considered as a model of a dualistic market-oriented economy. The model displays some important features of the Thai economy as follows:

(1) The dualistic character of the production process in agriculture (rural) and non-agriculture (urban). The urban sector is more dynamic, more capital intensive, and has experienced higher rates of output growth. The difference in capital intensity may be termed "technological dualism".

(2) The rural-urban migration of labour. While the natural growth rates of urban population are lower than the rates in the rural sector, the actual growth rates of urban population have been consistently higher. (See Chapter 2.) This is the result, of course, of migration, which responds to differences in wage rates between the two sectors induced by the rapid urban economic growth.

(3) The behaviour of the demand components (personal

consumption, investment, government expenditure, exports and imports). The model also captures the flow of savings from the rural to the urban sector (the agricultural surplus in Fei and Ranis, 1966). The savings flow is considered in terms of the difference in fixed capital formation and in relative returns to capital between the two sectors. Less than half of the returns to capital in agriculture has been re-invested in that sector, even though the return per unit of capital in agriculture appears to be relatively higher. The amount of fixed investment in non-agriculture has generally exceeded the aggregate total return to capital in that sector. (See Chapter 4.)

(4) The role of the government in economic development through fiscal, monetary and exchange rate policies. The exchange rate regime in Thailand involved a single fixed rate during 1955-1972. The regime was changed in 1973 to one involving adjusted fixed rate, based on a weighted "basket" of currencies of Thailand's major trading partners and on other considerations. Exchange rate policy has hardly been applied since 1955, when the regime was changed from a multiple fixed rate to a single fixed rate system. This may be due to the goal of the monetary authorities in stabilizing the economy through stable monetary growth and a stable exchange rate. Public investment (especially in infrastructure), financed through

taxation and borrowing, and taxation policies (incentives or disincentives) are regularly used as strategies to promote development.

(5) The effects of foreign trade and foreign exchange markets on the domestic economy through the goods and money markets. The external sector has rather large effects on the Thai economy, since the degree of openness is relatively great. (See Chapter 2.)

Another important feature of the model is the explicit linkage of the government budget constraint, the foreign trade and exchange markets, and the domestic money market. The linkage is an important feature of the real economy, providing it with a built-in stabilizing mechanism for reducing the effects of exogenous shocks. (That is to say, the multiplier effects of the shocks are reduced over time.)

A simplified version of the model is presented in section 3.2. Section 3.1 discusses the model's general features. The definitions of variables appearing in the equations are provided in Appendix 1.

3.1 A General Discussion of the Simplified Model

The simplified version of the model (see section 3.2) is intended to provide an overview, without unnecessary complications; some variables have therefore been omitted. For instance, the determination of savings is not shown, and transfer payments, net factor income from abroad, and other less important variables are assumed to be zero. These variables will be introduced when the complete model is presented in subsequent chapters.

3.1.1 Output and Price Determination

A key feature of the model is the equilibrium determination of the supplies of output in agriculture (Qas) and non-agriculture (Qms) and the corresponding demands for output (Qad and Qmd). The relevant equations are (1a) or (1b), (3a) or (3b), (13) and (15), along with the market equilibrium equations (42a) and (42b). These six equations jointly determine the equilibrium prices and quantities of output in the two sectors.

Note that this system of six equations requires one of the prices (Pab or Pmb, the producers' prices of agricultural or non-agricultural output, respectively) to be a numeraire, or to be determined elsewhere, and only five equations are actually required for a solution. In practice, we drop the equation selected from (3) and let Pmb be determined outside the system.

Since the model as a whole contains a third good, namely money, and the price of money is always equal to one, that price provides a numeraire. We can thus determine the (purchasers') non-agricultural output price (Pm) as a function of the money/output ratio (nominal money supply to real gross domestic product, MS/GDP) and the price of imports of goods and services, adjusted for import duties (Pim). The relevant equation is (43a). The import price is included in the equation to represent the external cost effects of imported primary and intermediate inputs. Pmb is then calculated by adjusting for indirect taxes on non-agricultural output as in the identity (43b).

3.1.2 An Overview of the Model

The model as a whole may be thought of as consisting of three main parts: the supply side of the economy, the demand side of the economy and the market equilibrium conditions. The supply side is comprised of (1) the production functions and their inputs and (2) the labour market. The demand side consists of (1) equations to determine aggregate demand for goods and services and its components, (2) the government sector, (3) the foreign trade and foreign exchange markets, and (4) an aggregate money market. The market equilibrium conditions determine the equilibrium quantities and prices of outputs.

In terms of transactors, the model consists of (1) a private sector, which includes households and business firms (including, for present purposes, government business enterprises), (2) a government sector and (3) the rest of the world.

The general approach is to derive the supply and demand equations for the total output of agriculture and non-agriculture by explaining the behaviour of each of their components.

The two supply functions for total output (Qas and Qms) are obtained by substituting for the inputs in the production functions (equations (1b) and (3b)), in order to derive output-price relations. The resulting supply curves are upward sloping with respect to their own prices.

The labour inputs in the production functions are determined in the labour market.

Because of the lack of time series data for outputs and intermediate inputs, we use cross-sectional data from an input-output table for Thailand and apply a method developed by Klein (1952-53). The basic idea underlying the method is that an input-output coefficient can be interpreted as the constant value share of the input if a Cobb-Douglas production function with constant returns to scale is assumed. For instance, we can obtain the parameter values of the production function for agricultural output (Qas) by maximizing the profit function

$$Pr = Pab.Qas - Pab.Yas - Pab.Qaa - Pmb.Qma$$

where $Qas = A.Yas^{a_{01}}.Qaa^{a_{11}}.Qma^{a_{21}}$

$$a_{01} + a_{11} + a_{21} = 1$$

Yas = agricultural value added

Qaa = intermediate agricultural input used in producing agricultural output

Qma = intermediate non-agricultural input used in producing agricultural output

Pab = producers' price of agricultural output

Pmb = producers' price of non-agricultural output

From the first order conditions, we obtain

$$a_{01} = (Pab.Yas)/(Pab.Qas)$$

$$a_{11} = (Pab.Qaa)/(Pab.Qas)$$

$$a_{21} = (Pmb.Qma)/(Pab.Qas)$$

Equation (1b) is then derived from equation (1a) by substituting for the intermediate inputs in terms of the related input-output coefficients and prices. Similar procedures are applied to derive equation (3b) from (3a).

The two demands for total output (Qad and Qmd; equations (13) and (15)) are derived from the requirement of equilibrium in both the goods and services market and the money market. In the goods and services market, we can obtain an IS curve from the equilibrium between total investment and savings. An LM curve is obtained from the equilibrium between demand and supply in the money market. We can then use the LM and IS curves to obtain the demand curves for total output, which are downward sloping with respect to their own prices.

The demand and supply curves for each sector keep shifting and generating new values of outputs and prices over time, owing to the dynamic characteristics of the model. In particular, (1) the stock of physical capital changes through time as a result of investment and depreciation, (2) the population, labour force and other exogenous variables change through time, and (3) lagged adjustments on both the supply and demand sides make the short-run responses of the model different from its long-run equilibrium response.

3.1.3 The Structure of the Model

A brief discussion of the behaviour of the more important variables is presented below, in terms of the simplified version of the model. The estimated equations are presented and discussed further in Chapters 4, 5, 6 and 7. The particular estimated equations selected for inclusion in the final complete model are presented in Chapter 8.

Aggregate production functions and their inputs

Equations (1)-(4) determine the aggregate production functions of the total and value added outputs of agriculture and non-agriculture. The total outputs are required to satisfy the overall market equilibrium conditions; the value added outputs are used in the determination of other variables in the model.

Equation (2) determines the value added production of the agricultural sector (Yas), which is a function of its primary inputs (capital (Ka_{-1}), labour (Na) and land (L)) and the scale effect variables (rainfall (rf) and trend (t)). The inclusion of labour in the function is due to the evidence that the marginal productivity of labour in agriculture in Thailand is positive. (See Chapter 4.) The rainfall index represents the effects of weather conditions, which are important in crop production. The trend variable is included to represent the effects of changes in technology and in skill and education levels.

Equation (4) determines value added output in non-agriculture (Yms), based on inputs of capital (Km_{-1}) and labour (Nm), and allowing again for changes in technology, skills and education through the inclusion of a trend variable.

Equations (5) and (6) define the stocks of fixed capital (both private and government) in the agricultural and non-agricultural sectors, respectively. The capital stocks are assumed to have a constant depreciation rate of da in agriculture and dm in non-agriculture. (See Appendix 3.)

The production functions are estimated and discussed further in Chapter 4.

Equations of the labour market

The total population (POP) grows at the rates of g per annum (equation (7)). The actual population growth rate decreased over the period of study (1960-1978), owing to the government campaign to encourage family planning, the improvement of health care and education, and factors associated with economic development, industrialization and urbanization. (See Chapter 2.)

The model assumes that the labour market is always at a "full" or "natural" level of employment. The total labour force is growing at the rates of gl (equation (8)). Equation (9) determines the rural supply of labour (Na). The wage rates in the two sectors (equations (10) and (11)) are dependent on the marginal productivities of labour (derived from the value added production functions), although not necessarily equal to them. The coefficients b1 and b2 reflect imperfections in the labour market (as a results of monopoly, monopsony, skill differentials, and so on) which may cause wage rates to be different from marginal products. Equation (12) explains the allocation of labour between the two sectors (and implicitly rural-urban migration) as a function of relative wage rates, with allowance for lagged response. The lag term reflects differences between expected and actual wage rates, lack of information, and other sources of friction such as environment and family ties.

The equations of the labour market are estimated and discussed further in Chapter 4.

Equations of aggregate demand for goods and services

Equations (13)-(26) explain the aggregate demand for goods and services. Equation (14) determines the final demand for agricultural goods (Yad), which consists of personal consumption of agriculture (Ca), change in agricultural inventory (IVa) and agricultural exports (Ea) less agricultural imports (IMa).

Final demand for non-agricultural products (Ymd) (equation (16)) is comprised of personal consumption of non-agricultural products (Cm), total government consumption (Cg), total gross fixed investment (I), non-agricultural inventory change (IVm) and exports of non-agricultural products (Em) less imports (IMm).

Equations (17) and (18) determine real total output (Q) and real gross domestic product (GDP), respectively. Both Q and GDP can be obtained by aggregation on either the demand or supply sides.

Equations (19) define personal income (PI) and disposable personal income (DPI) according to the national accounts identities. Some minor components have been ignored for simplicity but will be taken account of in the complete model.

Equations (20) determine depreciation in agriculture (Da) and in non-agriculture (Dm).

Equations (21) explain the behaviour of personal consumption of agricultural products (Ca) and non-agricultural products (Cm) as functions of real disposable income, relative prices (including indirect taxes) of agricultural products (Pa) and non-agricultural products (Pm), population (POP) and lagged consumption (justified on the basis of the permanent income or the habit persistence hypothesis). In Chapter 5, we search for the most appropriate form of consumption function among a number of alternatives.

Four alternative investment function hypotheses (desired capital stock, accelerator principle, simple demand and desired investment), all based on the concept of profit maximization, are considered in Chapter 6 in choosing a suitable behavioural equation for private gross fixed investment. The basic components explaining private gross fixed investment in agriculture (Ipa) (equation (23)) are its value added output (Yas), the real rate of interest (r), the price of investment goods (Pi) relative to the producers' price of agricultural output (Pab) and lagged investment (derived from the hypotheses noted above). Private gross fixed investment in non-agriculture (Ipm) (equation (24)) is determined in a similar way.

Equations (25) explain the behaviour of the change in inventory of agricultural goods (IVa) as a function of the inventory level at the end of the previous year (Kva_{-1}), total agricultural output (Qas), the real rate of interest (r) and the difference between the rates of change of the agricultural output price and the price of total output ($g_{Pa}-g_P$, which is a proxy for the opportunity cost of holding agricultural goods relative to holding non-agricultural goods). The stock of agricultural goods (Kva) is assumed to be the accumulation of inventory changes with zero depreciation. The behaviour of the change in inventory of non-agricultural goods (IVm) (equations (26)) is explained in a similar way.

The actual data for IVa and IVm include a statistical discrepancy, which cannot be identified separately. Largely for this reason we ignore the theoretical equations in the final econometric model and treat inventory change as exogenous.

Equations of the government sector

Equation (27) determines government revenue (Grev), which consists of personal income tax (Tp) and total indirect taxes less subsidies (IT). Other transfer payments are assumed to be zero in this simplified version of the model. Personal income tax is obtained as the product of the average tax rate (tp) and the personal income base (PI) (equation (28)). Indirect taxes (equations (29)) are disaggregated into import duties on agricultural products (ITima) and non-agricultural products (ITimm), export taxes on agricultural products (ITea) and non-agricultural products (ITem), and domestic indirect taxes on purchases of agricultural products (ITda) and non-agricultural products (ITdm). All tax rates (tp, tima, timm, tea, tem, tda and tdm) are viewed as policy variables.

Equations (30) determine the implicit indirect taxes on value added. Indirect taxes on agricultural value added (ITa) are obtained as the sum of the taxes on import, export and domestic demand for agricultural goods. Indirect taxes on non-agricultural value added (ITm) are obtained in the same way. The tax rates on agricultural value added (ta) and non-agricultural value added (tm) are calculated as tax revenues divided by the related value added at current producers' prices.

Government expenditure (Gex) (equation (31)) consists of government consumption expenditure (Pm.Cg) and government expenditure on gross fixed investment (Pi.Ig). Interest payments on government debt are assumed to be zero in this version. Government investment in agriculture (Iga) and in non-agriculture (Igm) (equation (33)), as well as the ratio of government consumption to GDP (cg, in equation (32)), are treated as policy variables.

Equation (34) represents the government budget constraint. Government expenditure (Gex) can be financed (through taxation) out of government revenue (Grev) or it can be financed by net domestic borrowing from the central bank or commercial banks (NDCg), net borrowing from abroad (BOWg), or the use of the treasury cash balance (ADg). (The latter can be positive or negative.) The government budget constraint links with the foreign exchange market through BOWg and with the money supply through net domestic borrowing (NDCg).

In Chapter 5, we discuss the variables in the government sector in more detail, in terms of their importance, magnitudes and roles in the economy.

Equations of the foreign trade and foreign exchange markets

Exports of goods and services (E) are disaggregated into exports from agriculture (Ea) and from non-agriculture (Em) (equations (35)). Each export demand (by foreigners) is assumed to be a function of world gross domestic product (GDPw$) and the price of the export (Pea or Pem) relative to its world price (Peaw$ or Pemw$). Both world gross domestic product and prices are in $US and are transformed into domestic currency by applying the rate of exchange (ex) of Thai baht for $US.

Equation (36a) explains imports of agricultural goods (IMa). All such imports are treated as consumer goods. We thus determine them as a function of real disposable income, import price (in domestic currency after import duties) (Pima) relative to the agricultural output price (after indirect taxes) (Pa), the relative prices of domestic outputs of agriculture (Pa) and non-agriculture (Pm), population (POP) and lagged imports (based on the concept of a lag in the adjustment to a desired level of imports).

Imports of non-agricultural products (IMm) equation (36b)) consist of consumer, intermediate, capital and other goods and services. The imports are assumed to be a function of gross domestic product (GDP), the relative prices of the imports (in domestic currency after import duties) (Pimm) and non-agricultural output (after indirect taxes) (Pm), the relative prices of the domestic outputs of agriculture (Pa) and non-agriculture (Pm) and lagged imports.

Equation (37) is an identity which determines the level of net foreign assets (NFA) at the end of the year as equal to the previous year's assets (NFA_{-1}), plus exports (Pe.E) (f.o.b.) after export duties, plus the net inflow of private capital (If), plus net foreign borrowing by the government (BOWg), plus the adjustment of the stock of assets due to the change in prices of gold, foreign currencies and other assets (AD), minus imports (Pimb.IM) (c.i.f.) before import duties. Other related transfer payments are assumed to be zero in this simplified model.

The net private capital inflow (If) (equation (38)) is a function of the difference between the nominal domestic rate of interest (R) and the nominal world rate (Rw), on the assumption that financial capital will flow to countries which offer higher nominal rates of return. (Because nominal returns are deflated by the same deflator, that is the price index faced by capital owners.) Other variables which determine the flows of capital may be ones relating to domestic government policy on foreign investment and the stability of the political and economic system of the country. (Changes in the exchange rate have not been a factor because of the fixed exchange rate system.) If is deflated by the GDP deflator, since it represents international capital flowing into Thailand which will be used to buy goods within that country.

Equations of the money market

The money market in our model is an aggregate one. The per capita demand for money (M) (equation 39) is a function of per capita GDP and the domestic nominal rate of interest (R). The nominal rate represents the difference between the cost of holding money (which is the general rate of inflation, g_p) and the return from holding other assets (e.g., bonds or savings accounts), which offers the net gain in terms of the real rate of interest.

Equation (40a) is an identity representing the determination of money supply (MS) as the sum of net foreign assets (NFA), net credit to the government (NDCg) and net credit to the private sector, less quasi-money and less savings deposits (NDCp). The supply of money links with the foreign sector through net foreign assets, and with the government budget constraint through net credit to the government. For instance, an increase in NFA will lead to the expansion of the money supply if there is no sterilization (by reducing domestic credit).

Equilibrium in the money market is determined by equation (40b). Equation (41) defines the real rate of interest (r) as the nominal rate (R) minus the actual rate of inflation, using the GDP deflator (g_p). This is only approximate, since the real rate of interest is actually defined as $r = 100.[(100+R)/(100+g_p) - 1]$.

Market equilibrium conditions

Equations (42a) and (42b) represent the market equilibrium conditions for the price and quantity of output in agriculture and non-agriculture, respectively.

Equations (43a) and (43b) explain the purchasers' and producers' prices (Pm and Pmb, respectively) of non-agricultural output, as discussed in section 3.1.1. Equations (44a) and (44b) define the purchasers' price of agricultural output (Pa) and the overall purchasers' price of gross domestic product (P).

Equations (45) determine the prices of imported agricultural, non-agricultural and total imports, both before and after import duties. The import prices in $US are assumed to be exogenous, since Thailand is a small importer.

Export prices are equal to domestic producers' prices adjusted for export duties (equations (46)).

The price of investment goods is obtained as a weighted average of the prices of non-agricultural output and non-agricultural imports (equation (47)).

In Chapter 7, the equations of the foreign trade, foreign exchange and money markets, and the market equilibrium conditions, will be estimated (where appropriate) and discussed further.

3.1.4 The Application of the Model

A number of policies, which affect both aggregate demand and aggregate supply, can be studied experimentally by the use of the model:

(1) Fiscal policy relates to government expenditure and revenue. Relevant policy variables are government consumption of goods and services as a share of GDP (cg) and government fixed investments in agriculture (Iga) and non-agriculture (Igm). Tax policies are associated with direct taxes (tp) and indirect taxes (tda, tdm, tea, tem, tima and timm).

(2) Monetary policy is implemented by controlling the quantity of net domestic credit (NDCg or NDCp). A policy of fixing (making exogenous) either the real (r) or nominal (R) rate of interest can be introduced into the model by letting either NDCg or NDCp become endogenous. (Otherwise they are treated as exogenous variables.)

(3) Exchange rate policy (implemented by controlling ex) affects the economy through the foreign trade and foreign exchange markets. This form of policy can be applied both with and without sterilization of domestic credit (NDCg or NDCp).

3.2 The Simplified Version of the Model

The equations of the simplified version of the model are set forth below. The symbol * indicates that a variable is exogenous and the symbol $ indicates measurement in $US. A subscript -1 denotes a one period lag. Flow variables are measured over the length of the year and stocks at the end of the year. Exact definitions of all variables are provided in Appendix 1. Policy variables are Bowg*, cg*, ex*, Iga*, Igm*, NDCg*, NDCp*, tda*, tdm*, tea*, tem*, tima*, timm* and tp*.

A. SUPPLY

A.1 Aggregate Production Functions and Fixed Capital Stocks

(1) The production function for total agricultural output:

(1a) $Qas = A.Yas^{a_{01}}.Qaa^{a_{11}}.Qma^{a_{21}}$

(1b) $Qas = Yas.[A.a_{11}^{a_{11}}.(a_{21}.Pab/Pmb)^{a_{21}}]^{1/a_{01}}$

(2) The agricultural value added production function:

$Yas = f(Ka_{-1}, Na, L^*, rf^*, t^*)$

(3) The production function for non-agricultural output:

(3a) $Qms = B.Yms^{a_{02}}.Qam^{a_{12}}.Qmm^{a_{22}}$

(3b) $Qms = Yms.[B.(a_{12}.Pmb/Pab)^{a_{12}}.a_{22}^{a_{22}}]^{1/a_{02}}$

(4) The non-agricultural value added production function:

$Yms = f(Km_{-1}, Nm, t^*)$

(5) Fixed capital stocks in agriculture:

$Kpa = (1-da).Kpa_{-1} + Ipa$

$Kga = (1-da).Kga_{-1} + Iga^*$

$Ka = Kpa + Kga$

(6) Fixed capital stocks in non-agriculture:

$Kpm = (1-dm).Kpm_{-1} + Ipm$

$Kgm = (1-dm).Kgm_{-1} + Igm^*$

$Km = Kpm + Kgm$

A.2 Labour Market

(7) Population:

$POP = POP_{-1}.(1+g^*/100)$

(8) Total labour supply:

$$N = N_{-1}.(1+gl^*/100)$$

(9) Rural labour supply:

$$Na = N - Nm$$

(10) Wage determination in agriculture (labour demand):

$$Wa/Pab = b1.(\partial Yas/\partial Na)$$

(11) Wage determination in non-agriculture (labour demand):

$$Wm/Pmb = b2.(\partial Yms/\partial Nm)$$

(12) The ratio of labour supplies:

$$Nm/Na = f[(Nm/Na)_{-1}, (Wm/Wa)]$$

B. DEMAND

B.1 Aggregate Demand for Goods and Services

(13) Total demand for agricultural output:

$$Qad = a_{11}.Qad + a_{12}.(Pmb/Pab).Qmd + Yad$$

(14) Final demand for agricultural output:

$$Yad = Ca + IVa + Ea - IMa$$

(15) Total demand for non-agricultural output:

$$Qmd = a_{21}.(Pab/Pmb).Qad + a_{22}.Qmd + Ymd$$

(16) Final demand for non-agricultural output:

$$Ymd = Cm + Cg + I + IVm + Em - IMm$$

(17) Total output:

$$Q = Qas + Qms \quad (= Qad + Qmd)$$

(18) Gross domestic product:

$$GDP = Yas + Yms \quad (= Yad + Ymd)$$

(19) Personal and disposable personal income:

$PI = P.GDP - IT - Pi.Da - Pi.Dm$

$DPI = PI - Tp$

(20) Depreciation:

$Da = da.Ka_{-1}$

$Dm = dm.Km_{-1}$

(21) Personal consumption of agricultural and non-agricultural products:

$Ca = f(Ca_{-1}, DPI/Pa, Pa/Pm, POP)$

$Cm = f(Cm_{-1}, DPI/Pm, Pa/Pm, POP)$

(22) Total gross fixed investment:

$I = Ipa + Ipm + Iga* + Igm*$

(23) Private gross fixed investment in agriculture:

$Ipa = f(Ipa_{-1}, Yas, Pi/Pab, r)$

(24) Private gross fixed investment in non-agriculture:

$Ipm = f(Ipm_{-1}, Yms, Pi/Pmb, r)$

(25) Change in inventory of agricultural goods:

$IVa = f[Kva_{-1}, Qas, r, (g_{Pa}-g_{P})]$

$Kva = Kva_{-1} + IVa$

$g_{Pa} = 100.(Pa - Pa_{-1})/Pa_{-1}$

$g_{P} = 100.(P - P_{-1})/P_{-1}$

(26) Change in inventory of non-agricultural goods:

$IVm = f[Kvm_{-1}, Qms, r, (g_{Pm}-g_{P})]$

$Kvm = Kvm_{-1} + IVm$

$g_{Pm} = 100.(Pm - Pm_{-1})/Pm_{-1}$

B.2 Government Sector

(27) Government revenue:

$$Grev = Tp + IT$$

(28) Personal income tax:

$$Tp = tp^{*}.PI$$

(29) Indirect taxes on imports and exports and domestic indirect taxes on final demand:

$$IT = ITima + ITimm + ITea + ITem + ITda + ITdm$$

$$ITima = tima^{*}.Pimab.IMa$$

$$ITimm = timm^{*}.Pimmb.IMm$$

$$ITea = tea^{*}.Pab.Ea$$

$$ITem = tem^{*}.Pmb.Em$$

$$ITda = tda^{*}.Pab.Yad$$

$$ITdm = tdm^{*}.Pmb.Ymd$$

(30) Implicit indirect taxes on value added:

$$ITa = ITima + ITea + ITda$$

$$ITm = ITimm + ITem + ITdm$$

$$ta = ITa/(Pab.Yas)$$

$$tm = ITm/(Pmb.Yms)$$

(31) Government expenditure:

$$Gex = Pm.Cg + Pi.Ig$$

(32) Government consumption of goods and services:

$$Cg = cg^{*}.GDP$$

(33) Government gross fixed investment in agriculture and in non-agriculture:

$$Ig = Iga^{*} + Igm^{*}$$

(34) Government budget constraint:

$$Gex = Grev + NDCg^* + BOWg^* + ADg$$

B.3 Foreign Trade and Foreign Exchange Markets

(35) Exports of agricultural and non-agricultural products:

$$Ea = f(GDPw\$^*.ex^*,\ Pea/Peaw\$^*.ex^*)$$

$$Em = f(GDPw\$^*.ex^*,\ Pem/Pemw\$^*.ex^*)$$

$$E = Ea + Em$$

(36) Imports of agricultural and non-agricultural products:

(36a) $IMa = f(IMa_{-1},\ DPI/Pa,\ Pima/Pa,\ Pa/Pm,\ POP)$

(36b) $IMm = f(IMm_{-1},\ GDP,\ Pimm/Pm,\ Pa/Pm)$

(36c) $IM = IMa + IMm$

(37) Net foreign assets:

$$NFA = NFA_{-1} + Pe.E - Pimb.IM + If + BOWg^* + AD^*$$

(38) Net private capital inflow:

$$If/P = f(Rw^*,\ R)$$

B.4 Money Market

(39) Demand for money:

$$M/P = f(GDP/POP,\ R,\ POP)$$

(40) Supply of money and money market equilibrium condition:

(40a) $MS = NFA + NDCg^* + NDCp^*$

(40b) $M = MS$

(41) Real rate of interest is defined as:

$$r = R - g_p$$

C. MARKET EQUILIBRIUM CONDITIONS

(42) Equilibrium in the commodity markets:

(42a) Qas = Qad

(42b) Qms = Qmd

(43) Non-agricultural output prices:

(43a) Pm = f(MS/GDP, Pim)

(43b) Pmb = Pm/(1+tm)

(44) Other aggregate prices:

(44a) Pa = Pab.(1+ta)

(44b) P = (Pa.Yas + Pm.Yms)/GDP

(45) Prices of imports of agricultural and non-agricultural products:

Pimab= Pimab$*.ex*

Pima = Pimab.(1+tima*)

Pimmb= Pimmb$*.ex*

Pimm = Pimmb.(1+timm*)

Pimb = (Pimab.IMa + Pimmb.IMm)/IM

Pim = (Pima.IMa + Pimm.IMm)/IM

(46) Prices of exports of agricultural and non-agricultural products:

Pea = Pab.(1+tea*)

Pem = Pmb.(1+tem*)

Pe = (Pea.Ea + Pem.Em)/E

(47) Price of investment goods:

Pi = d.Pm + (1-d).Pimm

CHAPTER 4

PRODUCTION FUNCTIONS AND THE LABOUR MARKET

The estimated production functions of agriculture and non-agriculture, and their implications are discussed in section 4.2. Section 4.3 explains and estimates the equations of the labour market. The estimation methods used in this and subsequent chapters, and the associated statistical criteria, are discussed in section 4.1.

4.1 The Estimation Methods Used and the Associated Statistical Criteria

The estimated complete model is presented in Chapter 8. The equations in it are selected from Chapters 4 through 7, in which equations representing alternative hypotheses are tested. The production functions and the labour market are the subjects of this chapter. Chapter 5 discusses the behaviour of personal consumption and the determination of the government sector. The behaviour of investment and savings are explained in Chapter 6. Chapter 7 expounds the foreign trade and foreign exchange markets, the money market and the determination of prices.

In order to select the appropriate relations of each equation, we have applied the ordinary least squares (OLS) method or the Cochrane-Orcutt (C-O) iterative procedure (where the problem of serial correlation occurred)[1] for the estimation of equations in Chapters 4-7. After selecting the equations to be included in the complete model, the whole model have been re-estimated by the method of two stage least squares using principal components of all predetermined variables in the model; this method is preferred to both OLS or C-O since they can yield biased and inconsistent estimates in a simultaneous equations model.

The statistical criteria for considering the estimates are: t-ratios (the estimated values of the coefficients divided by their estimated standard errors), the measure of goodness of fit adjusted for degree of freedom (R-bar^2), the standard error of the estimate (Se), and the Durbin-Watson statistic (D.W.) or Durbin-h statistic[2] (if it can be computed, instead of D.W., when the regressors contain lagged dependent variables).

When C-O is applied instead of OLS to correct for serial correlation, the estimated values of the autocorrelation coeffcients (rho) are reported together with their asymptotic t-values. In the case of a first-order process, a simple value for rho is shown; in the case of a second-order process, values are shown for rho1 and rho2 .

Annual data for the 1960-1978 period are used unless otherwise stated.

The computer programme used for the estimation is

SHAZAM, which was written by K. J. White, then of the Department of Economics, Rice University, and implemented on the Cyber 170 system, at McMaster University by K. Scott.

4.2 The Production Functions

The supply side consists of the production functions and the labour market. The production functions for gross output are discussed in sub-section 4.2.1. The value added production functions of agriculture (Yas) and non-agriculture (Yms) are estimated and discussed in sub-sections 4.2.2 and 4.2.3, respectively.

4.2.1 The Production Functions of Gross Outputs

From Chapter 3, we derived the gross output production functions of agriculture (Qas) and non-agriculture (Qms) as follow:

$$Qas = Yas.[A.a_{11}^{\,a_{11}}.(a_{21}.Pab/Pmb)^{a_{21}}]^{1/a_{01}} \qquad \ldots(4.1)$$

$$Qms = Yms.[B.(a_{12}.Pmb/Pab)^{a_{12}}.a_{22}^{\,a_{22}}]^{1/a_{02}} \qquad \ldots(4.2)$$

where Pab and Pmb are the producers' prices of the agricultural and non-agricultural outputs, respectively. All the a_{ij} coefficients are related to Cobb-Douglas productions for gross output (with constant returns to scale on the intermediate and primary inputs). As approximations to these coefficients we use the input coefficients in the input-output table (which are the constant value share of inputs to gross outputs). Thus we obtain:

a_{01} = (Pab.Yas)/(Pab.Qas) = .7883

a_{11} = (Pab.Qaa)/(Pab.Qas) = .0528

a_{21} = (Pmb.Qma)/(Pab.Qas) = .1589

a_{02} = (Pmb.Yms)/(Pmb.Qms) = .4919

a_{12} = (Pab.Qam)/(Pmb.Qms) = .1211

a_{22} = (Pmb.Qmm)/(Pmb.Qms) = .3870

All the numerical values of a_{ij} are obtained from the 1975 input-output table for Thailand. The value of the efficiency parameter A is then obtained by substituting the values of all the input coefficients, Qas and Yas from the input-output table, and the values of Pab and Pmb from the national accounts for the year 1975. A = 1.87359. The value of the efficiency parameter (B) is obtained in the same way. B = 2.65812.

We now have the gross output production functions:

$$Qas = 1.2569.Yas.(Pab/Pmb)^{.20157} \quad ...(4.1a)$$

$$Qms = 2.0561.Yms.(Pmb/Pab)^{.2462} \quad ...(4.2a)$$ [3]

4.2.2 The Agricultural Value Added Production Function

The share of the agricultural value added in gross domestic product (in real terms) was about 47 percent in 1951 and has continuously declined to about 26 percent in 1979. (See Table 2.2, Chapter 2.)

The value added production function of agriculture (Yas) (crops, livestock, fisheries and forestry) is postulated as a Cobb-Douglas function of its primary inputs, the last period capital stock (Ka_{-1}) (see Appendix 3), labour (Na) and the total planted area (including area for multiple crops planting) (L), and its scale effect variables, the rainfall index (rf) (showing the effect of weather, which is important in crop production) and Hicks-neutral technical progress (t). We add the damaged area (DL) as a proxy variable for the effects of crop disease, insect damage, adverse temperature, flooding and drought.

$$Yas = a.Ka_{-1}{}^{b}.(L^{*}-DL^{*})^{c}.Na^{d}.e^{f.rf^{*}+g.t^{*}} \qquad \ldots(4.3)$$

a = efficiency parameter

L-DL = harvested area, in millions of rai

Detailed definitions of all variables are presented in Appendix 1. The variables with * are assumed to be exogenous variables in the model.

The capital in agriculture includes machinery, buildings, and land improvements. The capital is assumed to have a constant depreciation rate of 0.0364. (See Capter 6.)

The planted area is used as a proxy variable for the aggregate land without any attempt to classify its quality. The damaged area of paddy production is used as a proxy for total damaged area, because (1) sufficient data on the latter are not available and (2) most of the damaged area, usually more than 95 percent, is in paddy production.

The use of fertilizer is not included, since it is classified as an intermediate input.

Though a large share of labour is still in the agricultural sector (about two-third in 1978, compare items 3 and 4, Table 4.1), a situation of surplus labour (which means that labour could be withdrawn from the agricultural sector without reducing its output or, in other words, the marginal productivity of labour in the agricultural sector is zero[4]) does not seem to have occurred. A number of studies on the micro- and macro-levels have confirmed that the marginal productivity of labour in the Thai agricultural sector is positive.[5] In fact, Jorgenson (1966) has summarized a number of studies on disguised unemployment and labour productivity in developing countries, and showed that there was virtually no historical evidence to support the hypothesis of zero marginal productivity of labour in the agricultural sector in any developing countries.[6] There is, however, seasonal unemployment.

It is therefore reasonable and, in fact, necessary to include labour as a primary input in determining the agricultural production function.

The unit of labour input is measured in terms of the number of persons per year instead of man-hours, because data on hours of works are not sufficiently avaiable. We assume full employment in the model, since the unemployment rates were quite low (always 1 percent or less) over the period of study (1960-1978).[7] No attempt is made to disaggregate the quality differences of labour.

Trend (t) is used to capture the effects of other variables, e.g., education and skills, which increase the (average) productivity of primary inputs. The values of such omitted variables normally increased over time.

Equation (4.3a) is the estimate of equation (4.3), showing a very high positive effect of labour input, while equation (4.3b), estimated without labour input, displays the decreasing returns to scale in capital and land.

By OLS:

$$\ln Yas = \underset{(-1.3134)}{-5.0488} + \underset{(2.1077)}{.1993} \ln Ka_{-1} + \underset{(4.5836)}{.4791} \ln(L^*-DL^*)$$

$$+ \underset{(3.0998)}{4.5978} \ln Na + \underset{(1.1885)}{.0675} rf^* - \underset{(-2.0534)}{.0503} t^* \qquad \ldots(4.3a)$$

$\bar{R}^2$ = .9967; Se = .0160; D.W. = 1.9453;

t-values are shown in parentheses

By C-O:

$$\ln Yas = \underset{(6.7444)}{6.5424} + \underset{(2.6633)}{.2075} \ln Ka_{-1} + \underset{(3.3469)}{.4022} \ln(L^*-DL^*)$$

$$+ \underset{(1.9488)}{.1128} rf^* + \underset{(2.8003)}{.0223} t^* \qquad \ldots(4.3b)$$

$\bar{R}^2$ = .9957; Se = .0181; D.W. = 1.9341; rho = $\underset{(-2.7283)}{-.5409}$

Because the meaning of non-constant returns to scale in an aggregate production function is ambiguous and severe multicollinearity means that we are unable to distinguish the degree of returns to scale of primary inputs from technical progress and the scale effects of other variables, we have re-estimated equation (4.3a) with the restriction of constant returns to scale on capital, labour and land (equation (4.3c)). The result is satisfactory. The output elasticities with respect to capital, land and labour are .2005, .3962 and .4033, respectively. The effects of Hicks-neutral technical progress as captured by the time trend is 1.69 percent per year.

By C-O:

$$\underset{}{\ln Yas} = \underset{(9.1524)}{5.6308} + \underset{(2.5604)}{.2005} \ln Ka_{-1} + \underset{(3.3587)}{.3962} \ln(L^*-DL^*)$$

$$+ \underset{(2.5558)}{.4033} \ln Na + \underset{(1.9775)}{.1131} rf^* + \underset{(3.0266)}{.0169} t^* \quad \ldots(4.3c)$$

$$\text{R-bar}^2 = .9959;\ Se = .0178;\ D.W. = 1.9439;\ rho = \underset{(-2.4348)}{-.4977}$$

The estimated 1978 marginal products of labour (in baht per person), capital (in baht per unit capital, also measured in baht) and land (in baht per rai) (in 1972 prices) were 1,873 , 0.25 and 314, respectively. The marginal product of labour doubled over the 1961 and 1978 period, while the marginal product of land increased by 25 percent over the same period. The marginal product of capital declined from 0.325 baht in 1961 to 0.249 baht in 1978. (See items 10, 15 and 18; Table 4.1.) These results indicate that the agricultural sector has gone through the process of agricultural mechanization, which leads to the increase in marginal products of land and labour and a decline in the marginal product of capital.

Equation (4.3c) will be used in the econometric model.

Note that there is virtually no statistical relationship between the damaged area (DL) and the rainfall index (rf), as indicated in equation (4.4):

By OLS:

$$DL = \underset{(0.8914)}{3.5376} - \underset{(-.0315)}{.1258}\, rf \qquad \ldots(4.4)$$

$$\text{R-bar}^2 = -.0624;\ Se = 1.3127;\ D.W. = 1.8901$$

4.2.3 The Non-Agricultural Value Added Production Function

The share of the non-agricultural value added in gross domestic product (in real terms) increased rapidly from about 53 percent in 1951 to about 74 percent in 1979. (See Table 2.2, Chapter 2.)

The non-agricultural value added (Yms) (which consists of: mining; manufacturing; construction; electricity and water supply; communication and transportation; wholesale and retail trade; banking, insurance, real estate and ownership of dwellings; public administration; and services) is assumed to be a function of its primary inputs, namely capital stock (Km_{-1}) and labour (Nm), and the scale effects of technical progress represented by trend (t).

The capital in non-agriculture includes machinery and buildings. It is assumed to have a constant depreciation rate of 0.0404. (See Chapter 6).

a. The CES production function

The constant elasticity of substitution (CES) function is:

$$Yms = A.e^{c.t}.[d.Km_{-1}^{-b} + (1-d).Nm^{-b}]^{-r/b} \qquad ...(4.5)$$

where A = efficiency parameter, $A > 0$

d = distribution parameter, $0 < d < 1$

r = returns to scale parameter, $r > 0$

b = substitution parameter, $b \geqslant -1$

By using Taylor's series, we can expand the natural logarithm of Yms, around $b = 0$ and drop the terms involving powers of b higher than one to obtain (see Kmenta, 1971, p. 463):

$$\ln Yms = \ln A + c.t + r.d.\ln Km_{-1} + r.(1-d).\ln Nm$$
$$- b.r.d.(1-d).[(\ln Km_{-1} - \ln Nm)^2]/2 \qquad ...(4.6)$$

The coefficients of $\ln Km_{-1}$ and $\ln Nm$ in equation (4.6) are expected to be non-negative, since r is theoretically positive and the values of d are between zero and one.

The estimated result of equation (4.6) is displayed in equation (4.6a):

By C-O:

$$\ln Yms = \underset{(-.2068)}{-2.2729} + \underset{(2.5046)}{.1250}\, t^* + \underset{(1.1994)}{2.6847} \ln Km_{-1}$$

$$- \underset{(-1.3922)}{3.7303} \ln Nm - \underset{(-1.1296)}{.2565} [(\ln Km_{-1} - \ln Nm)^2]/2 \quad \ldots(4.6a)$$

$$\text{R-bar}^2 = .9981;\ Se = .0193;\ D.W. = 1.3517;\ rho = \underset{(4.1068)}{.6955}$$

The result is not acceptable, since the coefficient of the labour input is negative, which may be due to the multicollinearity problem.

We have therefore imposed the restriction of constant returns to scale on capital and labour, because the production function is an aggregate one. This means that r is equal to one, yielding:

$$\ln Yms - \ln Nm = \ln A + c.t + d.(\ln Km_{-1} + \ln Nm)$$

$$- b.d.(1-d).[(\ln Km_{-1} - \ln Nm)^2]/2 \quad \ldots(4.7)$$

By C-O:

$$\ln Yms - \ln Nm = \underset{(-.0190)}{-.2333} + \underset{(2.3060)}{.0381}\, t^* + \underset{(.7005)}{1.7211}(\ln Km_{-1} - \ln Nm)$$

$$- \underset{(-.6113)}{.1513} [(\ln Km_{-1} - \ln Nm)^2)]/2 \quad \ldots(4.7a)$$

$$\text{R-bar}^2 = .9930;\ Se = .0207;\ D.W. = 1.1196;\ rho = \underset{(4.9820)}{.7613}$$

The estimated result of equation (4.7) is shown in equation (4.7a), with a value of d greater than one and all of the input terms not statistically significant.

b. The Cobb-Douglas production function

We now drop the last term of equation (4.7), which is equivalent to assuming that b = 0. This turns the CES function into a Cobb-Douglas one.

Equation (4.8) is estimated without the constant returns to scale restriction, and shows non-significance for both inputs.

By C-O:

$$\ln Yms = \underset{(4.1419)}{9.9213} + \underset{(.8265)}{.1456} \ln Km_{-1} - \underset{(-.8040)}{.8405} \ln Nm + \underset{(2.2123)}{.1009}\, t^{*} \qquad \ldots(4.8)$$

$$\text{R-bar}^2 = .9981;\ Se = .0193;\ D.W. = 1.2970;\ rho = \underset{(5.2026)}{.7750}$$

By C-O:

$$\ln Yms = \underset{(3.8074)}{6.9341} + \underset{(1.3612)}{.2518} \ln Km_{-1} + \underset{(4.0446)}{.7482} \ln Nm + \underset{(2.1579)}{.0284}\, t^{*} \qquad \ldots(4.9)$$

$$\text{R-bar}^2 = .9986;\ Se = .0168;\ D.W. = 2.1463;$$

$$rho1 = \underset{(6.3513)}{1.2094};\quad rho2 = \underset{(-3.0954)}{-.5894}$$

Equation (4.9) is estimated with the restriction of constant returns to scale on capital and labour. The result is satisfactory. The output elasticities with respect to capital and labour are 0.2518 and 0.7482, respectively. The effects of technical progress (skills, education, new technology) is 2.84 percent per year, which is higher than the technical progress in agriculture (1.69 percent per year).

The marginal product of labour is estimated at 22,150 baht per person, and that of capital at 0.114 baht in 1978 (measured in 1972 prices). The marginal product of labour increased 2.3 times between 1961 and 1978, while the marginal product of capital declined from 0.161 baht in 1961 to 0.114 baht in 1978. (See items 11 and 16, Table 4.1.)

The decline in the marginal productivity of capital in both sectors occurred because the growth rates of capital accumulation were higher than the growth rates of labour and land. Items 19 and 20 (Table 4.1) show that the capital-labour ratios in agriculture increased 2.6 times and in non-agriculture increased 3.2 times between 1961 and 1978.

The marginal product of capital in non-agriculture was about half of that in agriculture. (Compare items 15 and 16, Table 4.1.) This may indicate that there has been a bias in investment towards the non-agricultural sector. The same value of capital can generate more real output in agriculture.

Table 4.2 shows that there has been the flow of savings from agriculture into non-agriculture, since less than half of the output share of capital in agriculture was re-invested, while investment in non-agriculture has generally exceeded the amount of its capital share.

4.3 Labour Market

Data on wage rates in Thailand are rather difficult to obtain since there is no continuing official survey. We thus use the wage rates from Bertrand and Squire (1980), which were collected from various sources. Daily farm wage rates for the Central Plain of Thailand for 6 years (1965, 1967, 1970, 1972, 1975 and 1976) and the average manufacturing wage rates for unskilled labour for 7 years (1972-78) are used as proxies for the agricultural and non-agricultural wage rates. Both series have been indexed by their 1972 values.

4.3.1 Labour Demands

The wage rates were used to obtain estimates of the labour demand (marginal product of labour) functions derived from the Cobb-Douglas production function. Equations (4.10) and (4.11) are the estimated results of the agricultural and non-agricultural labour demands, respectively.

By C-O:

$$Wa/Pab = \underset{(53.919)}{.00032823}\ (Yas/Na) \qquad \ldots(4.10)$$

$\bar{R}^2$ = .8860; Se = .0769; D.W. = 1.9418; rho = −.5767; (−1.7292)

(6 observations)

By OLS:

$$Wm/Pmb = .000045399 \ (Yms/Nm) \qquad \ldots(4.11)$$
$$(30.564)$$

$$\text{R-bar}^2 = .7064; \ Se = .0996; \ D.W. = 1.4633; \ (7 \text{ observations})$$

Both intercepts were not significant and were suppressed. The estimates are then compared with the calculated marginal productities of labour from the production functions of agriculture (equation (4.3c)) and of non-agriculture (equation (4.9)). Both calculated marginal products of labour have been indexed by their 1972 values.

$$\partial Yas/\partial Na = .0002931 \ (Yas/Na) \qquad \ldots(4.12)$$

$$\partial Yms/\partial Nm = .00004488 \ (Yms/Nm) \qquad \ldots(4.13)$$

The coefficients are in fact very similar, which may confirm that the wage rates data from Bertrand and Squire are good proxies for the wage rates in our model.

We have thus generated series for the period 1960 through 1978 of nominal agricultural wages (Wa) and nominal non-agricultural wages (Wm) from equations (4.10) and (4.11), respectively. Both series were then used to estimate the labour allocation equation (below).

4.3.2 Labour Supplies

The total amount of labour is growing at the historical rates of gl (discussed in Chapter 3).

$$N = N_{-1}.(1+gl*/100) \qquad ...(4.14)$$

The ratio of urban to rural labour supplies (Nm/Na) is treated as a function of the relative nominal wage rates (Wm/Wa). (Both wage rates are deflated by the same price the GDP deflator, P, or the personal consumption deflator, Pc.) This ratio equation can be interpreted as a labour migration equation.

Several forms were attempted. Equation (4.15) shown below seems to perform better than the others.

By OLS:

$$\ln (Nm/Na) = \underset{(-49.583)}{-1.0670} + \underset{(5.0739)}{.6154} \ln(Wm/Wa)_{-1}$$

$$+ \underset{(9.7193)}{.2607} D_{74-78} \qquad ...(4.15)$$

$$D_{74-78} = 0 \text{ ; for 1960-73}$$
$$= 1 \text{ ; for 1974-78.}$$

$\bar{R}^2$ = .8476; Se = .0470; D.W. = 1.5026

R-bar^2 = .8476; Se = .0470; D.W. = 1.5026

The dummy variable (D_{74-78}) is used to capture a major change in the definition of labour employed since 1974. Persons who are seasonally unemployed (work less than 20 hours a week on average) are no longer counted as employed workers.[8] Because such workers are mostly in the agricultural sector, it is expected that employment in agriculture will be shifted downward from the previous trend.

The definition of labour force has also changed. From 1974 on a person who works less than 20 hours a week on average, and does not want to work more, is not counted in labour force. Hence both labour employed and labour force in the agricultural sector have declined from the previous trend while unemployment rates have changed very little.

We also incorporated a lagged dependent term in equation (4.16) to capture delayed effects such as the difference between the expected and actual wages, lack of information and other frictions. The estimates were not satisfactory, however.

With the ratio (Nm/Na) and N determined, we need to add the identity below, to determine simultaneously for Nm and Na:

$$Na = N - Nm \qquad \ldots(4.16)$$

Identity (4.16) may be viewed as an equation to determine rural labour supply.

FOOTNOTES TO CHAPTER 4

1. For estimates from a sample size of around 20, serial correlation may be considered to be serious if the value of the calculated rho from an OLS regression is greater than the absolute value of 0.3, see Rao and Griliches (1969); Maddala (1977, pp. 283).

2. For a discussion of the Durbin-h statistic, see for example; Durbin (1970, pp. 410-421); Pindyck and Rubinfeld (1976, pp. 194-195); Maddala (1977, pp. 284-289).

3. The series of Qas and Qms are obtained before hand by subtituting all the values of coefficients, and the time series of Yas, Yms and Pab and Pmb into equations (4.1a) and (4.2a), respectively.

4. See for example: Lewis (1954) and (1958); Fei and Ranis (1966).

5. See Long and Long (1962); Nakajud and Tongpan (1972); Trescott (1967); Siamwalla (1979); Bertrand (1980); Bertrand and Squire (1980).

6. In case of Thailand, there is a case study by Mellor and Stevens (1956), showing that the marginal productivity of labour in rice production was zero at Bangchun district near Bangkok. The study was one of many studies using what Jorgenson (1966) has called the "indirect method", measuring the difference between labour available from the agrarian population and labour requirements for production of the current level of agricultural output, to obtain "disguised unemployment". The measure may be fallacious because it does not take seasonal factors into account.

7. The unemployment rates for the whole country have never been reported above 1 percent. (See U.N. Yearbook of Labour Statistics 1980.)

8. See Government of Thailand (1980d).

Table 4.1 Average and Marginal Products of Inputs.

Year	1961	1966	1971	1976	1978
1. Yas	29,135	40,873	50,537	65,898	75,059
2. Yms	44,721	70,815	106,551	156,611	191,781
3. Na	12.372	13.352	14.409	15.551	16.163
4. Nm	3.423	4.120	4.961	6.035	6.478
5. L-DL	45.998	63.981	69.248	83.621	94.664
6. Ka_{-1}	17,966	28,530	40,090	52,503	60,484
7. Km_{-1}	70,021	126,465	241,098	359,104	423,914
Average and Marginal Products of Labour					
8. Yas/Na	2,355	3,061	3,507	4,238	4,644
9. Yms/Nm	13,065	17,188	21,478	25,950	29,605
10. $\partial Yas/\partial Na$	950	1,235	1,414	1,709	1,873
11. $\partial Yms/\partial Nm$	9,775	12,860	16,070	19,416	22,150
12. $(\partial Yms/\partial Nm)/(\partial Yas/\partial Na)$	10.289	10.413	11.365	11.361	11.826
Average and Marginal Products of Capital					
13. Yas/Ka_{-1}	1.622	1.433	1.261	1.255	1.241
14. Yms/Km_{-1}	.639	.560	.442	.436	.452
15. $\partial Yas/\partial Ka_{-1}$	.325	.287	.253	.252	.249
16. $\partial Yms/\partial Km_{-1}$	.161	.141	.111	.110	.114
Average and Marginal Products of Land					
17. Yas/(L-DL)	633	639	730	788	793
18. $\partial Yas/\partial(L\text{-}DL)$	251	253	289	312	314
Capital-Labour Ratios					
19. Ka_{-1}/Na	1,452	2,137	2,782	3,376	3,742
20. Km_{-1}/Nm	20,456	30,695	48,599	59,504	65,439
21. $(Km_{-1}/Nm)/(Ka_{-1}/Na)$	14.088	14.364	17.469	17.626	17.488

Note: Items 10, 15 and 18 are obtained from the derivatives of the Yas function (equation 4.3c), while items 11 and 16 are from the Yms function (equation (4.9)).

$\partial Yas/\partial Na$ is the marginal product of labour in agriculture, the other marginal products are shown in the same way.

Detailed definitions of the variables are presented in Appendix 1.

Table 4.2 Sectoral Gross Fixed Investments and Sectoral Output Shares of Capital Stock, in 1972 Million Baht.

Year	1961	1966	1971	1976	1978
(1) The return to capital in agricultural production	5,839	8,188	10,143	13,231	15,061
(2) Gross fixed investment in agriculture	2,371	3,617	3,932	4,751	7,338
(3) = (2)/(1)	.41	.44	.39	.36	.49
(4) The return to capital in non-agricultural production	11,273	17,832	26,762	39,501	48,326
(5) Gross fixed investment in non-agri.	9,633	23,491	34,747	40,367,	57,571
(6) = (5)/(4)	.85	1.32	1.30	1.02	1.19

Note: The return to capital, which is defined as the product of the capital and its marginal productivity, is calculated from the production functions concerned (equation (4.3c) for item (1) and equation (4.9) for item (4)).

CHAPTER 5

COMPONENTS OF INCOME, AGGREGATE CONSUMPTION, AND THE GOVERNMENT SECTOR

The variables on the demand and income sides of the model are discussed in more detail in section 5.1. Section 5.2 explains and estimates the consumption function under alternative hypotheses. The determination of the variables in the government sector are expounded in section 5.3.

5.1 Aggregate Demand and Income Components

As discussed in Chapter 3, the total demands for the output of the agricultural sector (Qad) and the non-agricultural sector (Qmd) are determined according to the identity in the input-output table as:

$$Qad = a_{11}.Qad + a_{12}.(Pmb/Pab).Qmd + Yad \qquad ...(5.1)$$

$$Qmd = a_{21}.(Pab/Pmb).Qad + a_{22}.Qmd + Ymd \qquad ...(5.2)$$

Substituting the numerical values of a_{ij} from the 1975 input-output table for Thailand, we have

$$Qad = .0528.Qad + .1211.(Pmb/Pab).Qmd + Yad \qquad ...(5.1a)$$

$$Qmd = .1589.(Pab/Pmb).Qad + .3870.Qmd + Ymd \qquad ...(5.2a)$$

We recall also the identities for final demand in both sectors.

$$Yad = Ca + IVa + Ea - IMa \qquad ...(5.3)$$

$$Ymd = Cm + Cg + I + IVm + Em - IMm \qquad ...(5.4)$$ [1]

Equations (5.1a), (5.2a), (5.3) and (5.4) will be used in the econometric model. (Definitions of variables are provided in Appendix 1; an asterisk, *, indicates that the variable is exogenous in the model.)

We now modify the definitions of the income components (introduced in Chapter 3) to make them consistent with actual data from Thailand's national income and expenditure accounts:

$$GDP = Yas + Yms \quad (= Yad + Ymd) \qquad ...(5.5)$$

$$NI = P.GDP-Pi.Da-Pi.Dm-IT+NFIfW^* \qquad ...(5.6)$$

$$PI = NI-Sc-Tc-PROg^*+INg+INp^*+TfGtH^*+TfWtH^* \qquad ...(5.7)$$

$$DPI = PI-Tp-TfHtG^* \qquad ...(5.8)$$

$$NDPI = DPI-INp^*-TfHtW^* \qquad ...(5.9)$$

Identity (5.5) defines real gross domestic product (GDP) as the sum of value added in the two sectors or, equivalently, the sum of final demand.

Identity (5.6) defines national income (NI) by subtracting from gross domestic product (P.GDP) the total capital consumption allowances (Pi.Da+Pi.Dm) and total indirect taxes less subsidies (IT) and adding net factor income payments from the rest of the world (NFIfW). All variables are in current prices.

Personal income (PI) is obtained in (5.7) by subtracting corporate saving (Sc), corporate income tax (Tc) and government property income (PROg) from NI, and by adding interest payments on government debt (INg) and on consumers debt (INp), transfers from government to households (TfGtH) and from the rest of the world to households (TfWtH). All variables are in current prices.

Identity (5.8) defines disposable personal income (DPI) as PI less personal income tax (Tp) and transfers from households to government (TfHtG). All variables are in current prices.

Identity (5.9) defines net disposable personal income (NDPI) by subtracting interest payments on consumers debt (INp) and transfers from households to the rest of the world (TfHtW) from DPI. All variables are in current prices.

5.2 Personal Consumption

Real personal consumption of goods and services (Cp) is disaggregated into consumption of agricultural goods (Ca) and non-agricultural goods (Cm):

$$Cp = Ca + Cm \qquad \ldots(5.10)$$

Consumption of non-agricultural goods is further disaggregated into consumption of durable goods (Cd), non-durable goods apart from agricultural goods (Cnd-Ca) and services (Cs):

$$Cm = (Cnd-Ca) + Cd + Cs \qquad ...(5.11)$$

The behaviour of Cnd, Cd, Cs and Ca will be considered under alternative hypotheses about consumption behaviour. The disaggregation of consumption will allow for differences in behaviour across components.

5.2.1 Consumption of Non-Durable Goods and of Services

The fractions of net disposable income (NDPI) spent on the consumption of non-durable goods and on services have ranged between 64-66 percent and 15-16 percent, respectively, over the period 1960-1978. These figures indicate that the average propensities to consume of these components have been rather constant over a fairly long period.

a. The Keynesian consumption function

We begin by estimating an equation consistent with the absolute income hypothesis (that is, the Keynesian consumption function) in which consumption is a function of real net disposable income. (The t-values are reported in parentheses.)

By OLS:

$$Cnd/POP = \underset{(2.3211)}{146.5300} + \underset{(30.5970)}{.6005}\ (NDPI/Pnd)/POP \quad ...(5.12)$$

$$\bar{R}^2 = .9821;\ Se = 53.825;\ D.W. = 1.8190$$

By C-O:

$$Cs/POP = \underset{(2.3635)}{85.3920} + \underset{(12.4860)}{.1333}\ (NDPI/Ps)/POP \quad ...(5.13)$$

$$\bar{R}^2 = .9658;\ Se = 21.176;\ D.W. = 1.3862;\ rho = \underset{(2.5425)}{.5140}$$

where Pnd = the Cnd deflator, 1972 = 1.00

Ps = the Cs deflator, 1972 = 1.00

The consumption functions for non-durable goods and for services are presented in (5.12) and (5.13), respectively. We may also mention that we have taken the effects of population size (POP) into account in both equations by expressing both the consumption and income variables in per capita terms.

The results are statistically satisfactory. The marginal propensities to consume out of net disposable income are .6005 and .1333 for Cnd and Cs, respectively. The intercept of each equation is positive, which indicates that both average propensities to consume tend to decline as income increases, which is consistent with the short-run consumption behaviour.[2]

b. The permanent income hypothesis consumption function

It is well recognized that the Keynesian consumption function does not satisfactorily account for long-run consumption behaviour, since empirical evidence shows that average propensities to consume are rather constant over the long periods of time. We therefore consider alternative specifications of consumption behaviour which can accommodate both the short-run variability and the long-run constancy in the average propensity to consume.

We consider first Friedman's permanent income hypothesis, PIH (Friedman, 1957),[3] which explains consumption behaviour in both the short-run and the long-run. The PIH long-run consumption function can be written as:

$$C_t = k.(NDPI/Pc)^p{}_t \qquad ...(5.14)$$

where C_t = real personal consumption expenditure at time t

$(NDPI/Pc)^p{}_t$ = permanent net disposable income, deflated by the consumption deflator (Pc), at time t

k = a long-run average propensity to consume.

Following Friedman (1957) and Evans (1969),[4] we approximate permanent income by a distributed lag function of current and past incomes, with geometrically declining weights:[5]

$$(NDPI/Pc)^p{}_t = (1-b).\sum_{i=0}^{\infty} b^i.(NDPI/Pc)_{t-i} \qquad ...(5.15)$$

To estimate the PIH consumption function, we substitute permanent income from equation (5.15) into equation (5.14) to obtain:

$$C_t = k.(1-b).\sum_{i=0}^{\infty} b^{i}.(NDPI/Pc)_{t-i} \qquad \text{...(5.14a)}$$

To apply a Koyck (1954) transformation, we lag equation (5.14a) by one period and multiply it by b :

$$b.C_{t-1} = k.(1-b).\sum_{i=0}^{\infty} b^{i+1}.(NDPI/Pc)_{t-i-1} \qquad \text{...(5.14b)}$$

Subtracting (5.14b) from (5.14a) and re-arranging terms:

$$C_t = k.(1-b).(NDPI/Pc)_t + b.C_{t-1} \qquad \text{...(5.16)}$$

We estimate equation (5.16), expressed in per capita terms, for both non-durable goods and services.[6]

By OLS:

$$Cnd/POP = \underset{(2.4088)}{.1278}(NDPI/Pnd)/POP + \underset{(9.7573)}{.8329}(Cnd/POP)_{-1} \qquad \text{...(5.17)}$$

$\text{R-bar}^2 = .9966$; Se = 23.605; Durbin-h = 1.2932

By OLS:

$$Cs/POP = \underset{(1.9996)}{.0378}(NDPI/Ps)/POP + \underset{(6.4167)}{.7954}(Cs/POP)_{-1} \qquad \text{...(5.18)}$$

$\text{R-bar}^2 = .9818$; Se = 15.451; Durbin-h = .0871

The intercepts of both equations were not statistically significant and were therefore suppressed.

The permanent income hypothesis explains consumption behaviour for both non-durables and services very well. The long-run (stationary state) marginal propensity to consume (MPC) for durable goods, which is also equal to the long-run average propensity to consume (APC), is 0.7648, while the short-run MPC is 0.1278. The long-run MPC for services is 0.1848, and the short-run MPC is 0.0378.

We have also tested the effects of relative prices in both equations:

By OLS:

$$Cnd/POP = \underset{(2.9466)}{.1732}(NDPI/Pnd)/POP + \underset{(7.1680)}{.7538}(Cnd/POP)_{-1}$$

$$- \underset{(-2.5664)}{2251.7}(Pnd/Pc) + \underset{(2.5393)}{2267.7}(Pnd/Pc)_{-1} \quad \ldots(5.19)$$

$R\text{-}bar^2 = .9974$; Se = 20.535; Durbin-h = 1.1335

By OLS:

$$Cs/POP = \underset{(2.8098)}{.0683}(NDPI/Ps)/POP + \underset{(3.0562)}{.5526}(Cs/POP)_{-1}$$

$$+ \underset{(1.8801)}{476.94}(Ps/Pc) - \underset{(-1.8453)}{451.37}(Ps/Pc)_{-1} \quad \ldots(5.20)$$

$R\text{-}bar^2 = .9836$; Se = 14.665; Durbin-h = -.6024

We note that neither intercept was statistically significant, both were suppressed. Also, the lagged values of the relative price terms result from applying the Koyck transformation.

The presence of the relative price terms in equation (5.19) is clearly a short-run effect, since both coefficients are nearly identical in absolute value. We have decided to keep the relative price terms in this equation because they help improve the estimate, and also because they make it possible for the model to capture these price effects. The short-run MPC is now 0.1732, while the long-run one is 0.7035.

On the other hand, both coefficients of the relative price terms in equation (5.20) display signs opposite to what we have expected (i.e., "wrong" signs). We have therefore dropped them from the equation, and returned to (5.18).

c. The permanent income hypothesis consumption function modified to allow for a non-linear response

A further consideration of equation (5.14) suggests that one could allow the elasticity of consumption with respect to permanent income to differ from unity. The interest in doing so is motivated, in part, by Friedman's (1963) reply to Liviatan (1963), in which he stated: "I conclude that if these results should be confirmed for other bodies of data, they would constitute relevant and significant evidence that the elasticity of permanent components is less than unity". An alternative form of (5.14) is:

$$C_t = k.[(NDPI/Pc)^P{}_t]^f \qquad \ldots(5.21)$$

where f = elasticity of consumption with respect to permanent income.

Here we define permanent income in a way which differs slightly from equation (5.15), namely as a multiplicatively distributed lag function of current and past incomes with geometrically declining weights:

$$(NDPI/Pc)^P{}_t = \prod_{i=0}^{\infty} [NDPI/Pc]^{(1-b).b^i}_{t-i} \qquad \ldots(5.22)$$

Substituting (5.22) into (5.21), and taking natural logarithms of both sides yields:

$$\ln C_t = \ln k + f.(1-b).\sum_{i=0}^{\infty} b^i.\ln(NDPI/Pc)_{t-i} \qquad \ldots(5.23)$$

We now apply a Koyck transformation to (5.23) to obtain:

$$\ln C_t = (1-b).\ln k + f.(1-b).\ln(NDPI/Pc) + b.\ln C_{t-1} \ldots(5.24)$$

Equation (5.24), with relative price terms added, has been estimated for both consumption functions.

By OLS:

$$\ln(Cnd/POP) = \underset{(-.0633)}{-.0064} + \underset{(2.8461)}{.2279} \ln[(NDPI/Pnd)/POP] + \underset{(8.5905)}{.7632} \ln(Cnd/POP) \underset{(-1.3406)}{-.6435} \ln(Pnd/Pc) \underset{(2.6614)}{+1.0682} \ln(Pnd/Pc)_{-1} \quad ...(5.25)$$

$\bar{R}^2 = .9978$; Se = .0092; Durbin-h = .4279

By OLS:

$$\ln(Cs/POP) = \underset{(-1.1808)}{-.2859} + \underset{(1.6694)}{.2133} \ln[(NDPI/Ps)/POP] + \underset{(5.2985)}{.7751} \ln(Cs/POP)_{-1} \quad ...(5.26)$$

$\bar{R}^2 = .9840$; Se = .0280; Durbin-h = .0189

The relative price terms in the consumption-of-services equation were dropped because they had wrong signs, as in the linear version.

The implied long-run average propensities to consume (k) are 0.97 for non-durable goods and 0.28 for services (both are clearly too high), while the values of the income elasticities (f) are 0.9624 and 0.9484, respectively.

We have chosen the linear versions (equations (5.18) and (5.19)) for the macro-econometric model, though the log-linear forms fit equally well. The reason is that the estimated long-run average propensities to consume from the linear equations are closer to the observed values than are the log-linear ones.

5.2.2 Consumption of Durable Goods

Unlike the consumption behaviour of non-durable goods and services, consumption expenditures on durable goods fluctuate more both over time and relative to disposable income. This may be explained by the significance of the physical stock, along with the relative price effects and the important opportunity cost of holding durable goods.

a. Consumption functions under the absolute income and the habit persistence hypotheses

The estimated Keynesian consumption function for durable goods, in per capita terms, is:

By C-O:

$$Cd/POP = -10.5700 + .0483\ (NDPI/Pd)/POP \qquad \ldots(5.27)$$
$$(-.2197)\quad(3.6523)$$

$$\bar{R}^2 = .7635;\ Se = 17.321;\ D.W. = 1.5561;\ rho = .6925$$
$$(4.0731)$$

The marginal propensity to consume out of net disposable income is 0.0483, while its average propensity to consume at the mean between 1961-1978 is 0.0458. These values are consistent with the relatively small portion of income spent on durable goods.

The absolute income hypothesis explains the consumption of durable goods rather well, but the highly significant value of rho, which was incorporated into the C-O estimate, indicates the possibility of omitted variables.

We now try the concept of habit persistence suggested Brown (1952), modified to include relative prices, and estimated in both linear and log-linear forms:

By OLS:

$$Cd/POP = \underset{(1.2438)}{.0228}\ (NDPI/Pd)/POP + \underset{(2.2716)}{.5601}\ (Cd/POP)_{-1}$$

$$\underset{(-2.3729)}{-218.14}\ (Pd/Pc) + \underset{(2.4521)}{211.56}\ (Pd/Pc)_{-1} \quad \ldots(5.28)$$

$\bar{R}^2$ (R-bar^2) =.7615; Se = 17.396; D.W.= 1.453;

(Durbin-h cannot be computed)

By OLS:

$$\ln(Cd/POP) = \underset{(-1.2035)}{-3.1487} + \underset{(.8531)}{.3222}\ \ln(Cd/POP)_{-1}$$

$$+ \underset{(1.5105)}{.8028}\ \ln[(NDPI/Pd)/POP]$$

$$\underset{(-2.9848)}{-1.7435}\ \ln(Pd/Pc) \underset{(2.5611)}{+1.3100}\ \ln(Pd/Pc)_{-1} \quad \ldots(5.29)$$

R-bar^2 = .8127; Se = .0995; D.W.= 1.484;

(Durbin-h cannot be computed)

The intercept of equation (5.28) was not significant and was suppressed, which makes the habit persistence hypothesis identical to the permanent income hypothesis. Equation (5.28) does not seem to explain consumption behaviour for durable goods better than the Keynesian consumption function, while the log-linear version (equation

5.29) indicates that the coefficient of lagged consumption is not statistically significant.

b. Consumption function under the stock adjustment hypothesis

We now turn to the stock adjustment model,[7] which states that the actual change in the stock of durable goods is a fraction (1-n) of the change required to achieve the desired level ($Kd^{\#}$):

$$Kd - Kd_{-1} = (1-n)(Kd^{\#} - Kd_{-1}) \qquad \ldots(5.30)$$

where n = the speed of adjustment coefficient; $0 \leqslant n \leqslant 1$. The partial adjustment may be caused by any delays due to lack of information, cost of holding durable goods and other frictions including habit persistence. The low values of n imply relatively quick adjustment, and vice versa. If the value of n is equal to zero, then actual stock is equal to its desired level, and the process of adjustment is instantaneously accomplished. On the opposite, if n = 1, the desired level will never be realized.

Estimates of the capital stock of consumer durable goods are obtained using the perpetual inventory method:

$$Kd = (1 - dd).Kd_{-1} + Cd \qquad \ldots(5.31)$$

where dd is the rate of depreciation of consumer durable goods, and is assumed equal to 0.0667. (See Appendix 4 for the estimation of Kd.)

The desired stock of consumer durable goods ($Kd^{\#}$) is usually assumed to be a function of income and relative prices:

$$Kd^{\#} = a + b.NDPI/Pd + c.Pd/Pc \qquad ...(5.32)$$

Substituting $Kd^{\#}$ from (5.32) into (5.30), we have:

$$Kd = (1-n)a + (1-n)b.NDPI/Pd + (1-n)c.Pd/Pc + n.Kd_{-1} \qquad ...(5.33)$$

On substitution of Kd from (5.33) into (5.31), with re-arrangement, we have:

$$Cd = (1-n)a + (1-n)b.NDPI/Pd + (1-n)c.Pd/Pc - (1-n-dd).Kd_{-1} \qquad ...(5.34)$$

We can either estimate equation (5.33) or (5.34) behaviourally and let the other be residually determined through identity (5.31).

Both equations were estimated in per capita terms:

By OLS:

$$Cd/POP = \underset{(8.7789)}{.0888}\ (NDPI/Pd)/POP - \underset{(-3.1639)}{86.2810}\ Pd/Pc$$

$$\underset{(-3.5581)}{-.0703}\ (Kd/POP)_{-1} \qquad \ldots(5.34a)$$

$$R\text{-}bar^2 = .7842;\ Se = 16.548;\ D.W. = 1.6180$$

By OLS:

$$Kd/POP = \underset{(9.1577)}{.0978}\ (NDPI/Pd)/POP - \underset{(-3.8527)}{110.97}\ Pd/Pc$$

$$+ \underset{(39.5960)}{.8268}\ (Kd/POP)_{-1} \qquad \ldots(5.33a)$$ [8]

$$R\text{-}bar^2 = .9972;\ Se = 17.478;\ Durbin\text{-}h = 1.2226$$

Both intercept terms were found not to be significant, and were suppressed. Note that the coefficients of the first and second terms in equations (5.33a) and (5.34a) are not identical (as shown in (5.33) and (5.34)) because we have incorporated the effects of population size (POP) into the estimated equations.

Equation (5.34a) seems to explain the behaviour of consumption of durable goods better than the absolute income and the habit persistence hypotheses (equations (5.27) and (5.28), respectively), in terms of both R-bar^2 and Se.

The estimated values of the adjustment coefficient (n) are 0.8268 from equation (5.33a) and 0.8630 from equation (5.34a), which indicate the slow adjustment process: according to equation (5.33a), about 16 periods are required to complete 95 percent of the adjustment,[9] while according to equation (5.34a) about 21 periods are needed.

The relative price elasticity (at the mean) of per capita expenditures of consumer durables, according to equation (5.34a), is -0.4840, indicating a rather inelastic character of demand.

c. A log-linear version of the stock adjustment hypothesis

The stock adjustment process may alternatively be defined in terms of the gap between desired and actual rates; in which case the adjustment hypothesis can be written as:

$$g_{Kd} - g_{Kd_{-1}} = (1-n)(g_{Kd^{\#}} - g_{Kd_{-1}}) \qquad ...(5.35)$$

where g_{Kd} = the actual rate of growth of stock

$g_{Kd^{\#}}$ = the desired rate of growth of stock

or $$Kd/Kd_{-1} = (Kd^{\#}/Kd_{-1})^{(1-n)} \qquad ...(5.36)$$ [10]

Furthermore if we define desired capital stock as a Cobb-Douglas function of income and relative prices, then:

$$Kd^{\#} = A.(NDPI/Pd)^{b}.(Pd/Pc)^{c} \qquad ...(5.37)$$

Substituting $Kd^{\#}$ from equation (5.37) into equation (5.36), we obtain:

$$Kd = Kd_{-1}^{\ n}.[A.(NDPI/Pd)^{b}.(Pd/Pc)^{c}]^{(1-n)} \qquad ...(5.38)$$

The estimate of equation (5.38), in per capita terms, in log-linear form, is shown below:

By OLS:

$$\ln(Kd/POP) = \underset{(-3.2230)}{-1.0418} + \underset{(5.2795)}{.3251} \ln(NDPI/Pd)/POP$$

$$\underset{(-1.6338)}{-.0745} \ln(Pd/Pc) + \underset{(27.1030)}{.7756} \ln(Kd/POP)_{-1} \quad ...(5.38a)$$

$\text{R-bar}^2 = .9983$; Se = .0147; Durbin-h = 1.0552

The result is statistically satisfactory. The estimated value of the adjustment coefficient (n) is 0.7756, which indicates a somewhat more rapid process of adjustment than under the linear version (equation 5.33a).

Between the Cd and Kd functions, we have decided to explain Cd behaviourally with equation (5.34a) in the econometric model, and let Kd be determined residually by identity (5.31).

5.2.3 Consumption of Agricultural Goods

Agricultural consumption (Ca) is part of the consumption of non-durable goods. Two hypotheses were tested. The Keynesian consumption function (equation (5.39)) and the habit persistence hypothesis (equation (5.40)).

By OLS:

$$Ca/POP = \underset{(5.3014)}{203.56} + \underset{(29.536)}{.1554} [(NDPI/Pa)/POP]$$

$$- \underset{(-.7973)}{30.289} (Pa/Pc) \quad ...(5.39)$$

$\text{R-bar}^2 = .9811$; Se = 13.027; D.W. = 1.6737

By OLS:

$$Ca/POP = \underset{(5.5936)}{232.85} - \underset{(-1.5124)}{.1679}\ (Ca/POP)_{-1}$$

$$+ \underset{(12.364)}{.1755}\ [(NDPI/Pa)/POP] - \underset{(-.3535)}{13.474}\ (Pa/Pc) \quad ...(5.40)$$

$\bar{R}^2$ = .9826; Se = 12.502; Durbin-h = -.5736

Equation (5.39) is satisfactory. The marginal propensity to consume out of net disposable income is 0.1554. The positive intercept indicates that as income rises, the average propensity to consume declines. Equation (5.40) shows a negative effect of lagged consumption, which makes the short-run marginal propensity greater than the long-run one.

We will incorporate equation (5.39)[11] into the econometric model.

Note that the real consumption of agricultural goods is obtained by deflating its current value by the purchaser's price of agricultural output (Pa).

5.3 Government Revenue, Government Expenditure and Government Budget Constraint

The determination of variables in the government sector is considered in this section.

5.3.1 Government Revenue

Government revenue in current prices (Grev) is defined as the sum of its income from personal income tax (Tp), corporate income tax (Tc), total indirect taxes less subsidies (IT), government property income (PROg), and net government transfer payments from domestic and foreign sources:

$$Grev = Tp+Tc+IT+PROg^*+TfHtG^*+TfWtG^*-TfGtH^*-TfGtW^* \quad ...(5.41)$$

a. Personal income tax

Personal income tax (Tp) accounted for some 7-8 percent of total tax revenue during the period 1960-1978. The average personal income tax rate (tp), is calculated as the ratio Tp/PI (where PI is personal income in current prices); it was about 1 percent between 1960 and 1967 and about 1.3 percent between 1968 and 1978, suggesting the minor role of the personal income tax as a source of government revenue. This is partly because the tax collection system is inefficient, as has long been recognized.

We use the following identity

$$Tp = tp^* . PI \quad ...(5.42)$$

to determine Tp, and treat tp as a policy variable in our model.[12]

b. Corporate income tax

Corporate income tax (Tc) is assumed equal to the corporate income tax rate (tc) multiplied by corporate profits before tax (PR):

$$Tc = tc^{*}.PR \qquad \ldots(5.43)$$

The variable tc is treated as a policy variable in the model. The tax rate was about 22 percent before 1974 and about 35 percent between 1975 and 1978.

c. Total indirect taxes less subsidies

While income taxes have only income effects (ignoring the labour-leisure trade off) (through the reduction of disposable personal income), indirect taxes have both income and price effects. The imposition of indirect taxes thus not only reduces national income (and in turn lowers disposable income) but also raises the price level, as is discussed Chapter 7, below.

Indirect taxes are the major source of government income. They accounted for 80 percent of total government revenue during 1960-74 and about 75 percent since 1975. The major sources of indirect tax revenue are import duties and business and selective sales taxes, which together accounted for 78 percent of the total in 1978. The relative importance of indirect taxes indicates that the overall tax system is regressive.

Indirect taxes (IT) are disaggregated into three categories: import duties (ITim), export duties (ITe), and domestic indirect taxes (business and selective sales taxes and other indirect taxes less subsidies) (ITd).

$$ITd = ITim + ITe + ITd \qquad \ldots(5.44)$$

c.1 Import duties

Import duties are disaggregated into import duties on consumer goods (ITimc), on capital goods (ITimi), on intermediate products and raw materials (ITimr), on fuels and lubricants (ITimf), and on other goods (ITimo):

$$ITim = ITimc + ITimi + ITimr + ITimf + ITimo \qquad \ldots(5.45)$$

To determine the tariff revenue on each import, we use the following identities:

$$ITimc = timc^{*}.(Pimcb.IMc) \qquad \ldots(5.46)$$

$$ITimi = timi^{*}.(Pimib.IMi) \qquad \ldots(5.47)$$

$$ITimr = timr^{*}.(Pimrb.IMr) \qquad \ldots(5.48)$$

$$ITimf = timf^{*}.(Pimfb.IMf) \qquad \ldots(5.49)$$

$$ITimo = timo^{*}.(Pimob.IMo) \qquad \ldots(5.50)$$

Each import duty is equal to its tariff rate multiplied by the value of imports at current prices before tariff. All tariff rates are treated as policy variables in the model.

The implicit tariff rate of all commodity imports (tim) may be derived as the ratio of total import duties (ITim) to the total value imports of goods at current prices before tariff. On this basis, tim ranged between 20 and 22 percent during 1960-72 and declined to about 13 percent during 1974-78.

c.2 Export duties

Export duties are collected primarily on rice exports. The duty on rice exports consists of two components: a rice export premium and a rice export duty. A heavy rice premium was applied after the end of World War II until 1969. It was used as a source of government revenue and as a tool to control the domestic supply and domestic price of rice. After 1969 the amount of premium collected on rice exports decreased drastically, except in 1974, when the high premium was re-imposed due to the world food shortage in that year.

The export duties are disaggregated into the duties on agricultural exports (ITea) and non-agricultural exports (ITem):

$$ITe = ITea + ITem \qquad ...(5.51)$$

Revenues from both export duties are determined by the following identities:

$$ITea = tea^{*}.(Pab.Ea) \qquad ...(5.52)$$

$$ITem = tem^{*}.(Pemb.Em) \qquad ...(5.53)$$

Each revenue is equal to its duty rate multiplied by the value exports at current price before the duty. Note that exports are disaggregated according to the definitions in the 1975 input-output table; that means that all rice exports are classified as non-agricultural. On this basis, we find that over the period of study (1960-78), the export duties on agriculture were zero, while that on non-agriculture ranged between 7 and 16 percent during 1960-69, and declined to about 2 to 4 percent after 1971, except in 1974 when the rate was about 10 percent.

Both tea and tem are treated as policy variables.

c.3 Domestic indirect taxes

We disaggregate the domestic indirect taxes into two categories based on the final demand functions: the indirect taxes on agricultural goods (ITda) and on non-agricultural goods (ITdm).

$$ITd = ITda + ITdm \qquad \ldots(5.54)$$

$$ITda = tda^{*}.(Pab.Yad) \qquad \ldots(5.55)$$

$$ITdm = tdm^{*}.(Pmb.Ymd) \qquad \ldots(5.56)$$

Since all domestic indirect taxes are collected on non-agricultural output, tda was zero over the period of study; the rates of tdm ranged between 7 and 9 percent.

Both tda and tdm are policy variables in the model.

c.4 Implicit indirect taxes on the value added

Since we have determined the indirect taxes through the final demand side, we now need to define them consistently with the value added side. This is done with equations (5.57)-(5.59).

$$IT = ITa + ITm \qquad \ldots(5.57)$$

$$ITa = ITima + ITea + ITda \qquad \ldots(5.58)$$

$$ITm = ITimm + ITem + ITdm \qquad \ldots(5.59)$$

Equation (5.57) is the definition of indirect taxes from the value added side. Indirect taxes on the agricultural output (ITa) are obtained as the sum of indirect taxes on agricultural imports (ITima), on agricultural exports (ITea), and on the domestic demand for agricultural goods (ITda) (equation (5.58)). Indirect taxes on non-agricultural output (ITm) are obtained in the same way (equation (5.59)).

Since separate data on ITima were not available but instead are incorporated in the import duties on consumer goods (ITimc), we worked with the historical ratio of ITa to ITimc (tia), and assumed it to be exogenous. This allows us to determine the relationship between ITa and the import duties on agricultural goods (equation (5.58a)). (Note that the values of ITea and ITda were zero over the period of study (1960-78).)

ITm is then determined from equation (5.57).

$$ITa = tia^{*}.ITimc + ITea + ITda \quad \ldots(5.58a)$$

$$ta = ITa/(Pab.Yas) \quad \ldots(5.60)$$

$$tm = ITm/(Pmb.Yms) \quad \ldots(5.61)$$

The implicit indirect tax rates on agricultural value added (ta) and on non-agricultural value added (tm) are determined by equations (5.60) and (5.61), respectively.

The rates of ta were very low (about 0.5 percent over the period 1960-1978), while the rates of tm were higher (between 14 and 18 percent).

d. Government income from property and entrepreneurship

Government income from property and entrepreneurship in current prices (PROg) consists of rents and profits from situations in which the government is directly involved in corporate ownership. This source of government income accounted for about 3 to 6 percent of total government revenue between 1960-78. Its average share in gross domestic product in current prices is about 0.6 percent over the same period. Note that the activity of government corporation is included in the private sector in this study.

PROg is treated as an exogenous variable in the model.

e. Government transfer payments

Domestic transfer payments to and from government, TfHtG and TfGtH, are exogenous in the model. The amount of both payments were very small, each being about 1 to 2 percent of total government revenue during 1960-78. It should be noted that since 1971 net transfer payments from households to government has been always positive.

The data on net transfer payments from the rest of the world to the government (that is, net foreign aid to government, TfWtG-TfGtW) are as reported in the balance of payments accounts. The aid was about 9 percent of total government revenue between 1960-63, 6 percent between 1964-71, and 1.5 percent between 1972-78. It was about 7, 4 and 1 percent of total gross fixed investment in current prices during the same periods. And it was about 1 percent of GDP in the 1960s and about 0.2 percent after 1973. While foreign aid was important for Thailand's economic development in the early 1960s, in recent years its role has declined rapidly.

We assume these variables to be exogenous in the model.

5.3.2 Government Expenditure

Total government expenditure in current prices (Gex) consists of government consumption (Pm.Cg), government investment (Pi.Ig) and interest payments on government debt (INg):

$$Gex = Pm.Cg + Pi.Ig + INg \quad ...(5.62)$$

a. Interest payments on government debt

Interest payments on government debt (INg) are the payments from government to the private sector associated with earlier borrowing. The payments were about 0.7 percent of GDP during 1960-70 and about 1.0 to 1.3 percent between 1971-78.

INg is assumed to be a function of government debt at the end of the previous year ($Gdebt_{-1}$), where government debt is the sum of the previous period's debt and the government deficit (Gdef):

$$Gdebt = Gdebt_{-1} + Gdef \quad ...(5.63)$$

By OLS:

$$INg = \underset{(-3.7671)}{-136.62} + \underset{(75.3080)}{.0600}\ Gdebt_{-1} \quad ...(5.64a)$$

$$R\text{-}bar^2 = .9970;\ Se = 93.378;\ D.W. = 1.5760$$

By OLS:

$$\ln INg = \underset{(-19.7830)}{-3.6969} + \underset{(58.7430)}{1.0754} \ln Gdebt_{-1} \quad ...(5.64b)$$

$$R\text{-}bar^2 = .9951;\ Se = .0650;\ D.W. = 2.4022$$

Equation (5.64a) shows that the nominal marginal rate of interest on government debt was about 6 percent. The positive intercept indicates that the average rate of the interest rises as the debt increases.

Note that the debt has increased every year (except in 1974) over the period of the study, from about 7,166 million baht or 13 percent of GDP in 1960 to about 100,000 million baht or 21 percent of GDP in 1978.[13]

Equation (5.64b) indicates that the interest payments were growing at a rate about 7.5 percent higher than the rate of growth of government debt.

We use equation (5.64a) to determine INg in the econometric model.

b. Government consumption expenditures on goods and services

The historical relation between real government consumption, Cg, and real GDP were estimated in both linear and log-linear forms as follows:

By C-O:

$$\underset{}{Cg} = \underset{(-2.9651)}{-1956.4} + \underset{(28.9360)}{.1171}\ GDP \qquad \ldots(5.65)$$

$$\bar{R}^2 = .9895;\ Se = 689.22;\ D.W. = 1.6885;\ rho = \underset{(1.5815)}{.3493}$$

By C-O:

$$\ln Cg = \underset{(-8.1870)}{-3.8354} + \underset{(28.6290)}{1.1310}\ \ln GDP \qquad \ldots(5.66)$$

$$\bar{R}^2 = .9914;\ Se = .0413;\ D.W. = 1.6754;\ rho = \underset{(2.0062)}{.4275}$$

Equation (5.65) shows that the government's marginal propensity to consume out of GDP is 0.1171, while equation (5.66) indicates that the growth rate of Cg was 13 percent higher than the growth rate of GDP over the period of the study.

The share of Cg in GDP has been increasing; it rose from about 9.5 percent in 1960 to about 11 percent in 1978. The main components of govenment consumption are defence, general administration and education. The defence share in Cg has grown considerably, from 25 percent in 1960 to 36 percent in 1978, while the education share declined from 25 percent in 1960 to 23 percent in 1978. Education and health expenditures from both government and private sectors are important in economic development, but we have not directly incorporated their effects in the present model.

We assume the following identity:

$$Cg = cg^{*}.GDP \qquad \ldots(5.67)$$

to determine Cg, where cg is the share of real government consumption expenditures in real gross domestic product. The variable cg is regarded as a policy variable in the econometric model.

c. Government investment

Real government gross fixed investment (Ig) was about 27-33 percent of total gross fixed investment (I) during 1960-78, with the exception of the years 1973, 1974, and 1975 when its share declined to 24, 16, and 22 percent, respectively. The share of Ig in GDP was about 5-8 percent between 1960-78. Ig is disaggregated into government gross fixed investments in agriculture (Iga) and in non-agriculture (Igm).

$$Ig = Iga^* + Igm^* \qquad \ldots(5.68)$$

The ratios of Iga to Igm fluctuated between 11-25 percent over the period 1960-1978. (The average ratio is 17 percent.) Both are treated as policy variables in the model.

d. Government deficit

The government deficit is derived by subtracting equation (5.41) from equation (5.62):

$$Gdef = Gex - Grev \qquad \ldots(5.69)$$

Since 1950, the Thai government has increased the level of government expenditures considerably, with the intension of promoting economic development. Its deficit has increased from 5 percent of government revenue in 1960 to 36-41 percent during 1970-78.

5.3.3 Government Budget Constraint

The government budget constraint is specified by equation (5.70). Government expenditures may be financed by government revenue (Grev), net domestic borrowing from either the commercial banks or the central bank (NDCg), net borrowing from abroad (BOWg), or treasury cash balance (ADg, which can be either positive or negative):

$$Gex = Grev + NDCg^{*} + BOWg^{*} + ADg \qquad \ldots(5.70)$$

NDCg and BOWg are policy variables in the model.

FOOTNOTES TO CHAPTER 5

1. The time series data on Qad and Qmd were obtained from the equilibrium conditions that Qad = Qas and Qmd = Qms. The time series data on Yad and Ymd were then derived from equations (5.1a) and (5.2a), respectively. The components of Yad and Ymd are obtained from the time series data of the national accounts. Each component is defined according to its definition in the 1975 input-output table for Thailand. The data of the changes in inventories (IVa and IVm) include the statistical discrepancy, which cannot be separated.
2. The absolute income hypothesis explains the behaviour of personal saving (Sp) as follow:

   By OLS:

   $$(Sp/Pc)/POP = \underset{(-2.7557)}{-242.10} + \underset{(8.2848)}{.2236}(NDPI/Pc)/POP$$

   $$\text{R-bar}^2 = .7991; \; Se = 75.789; \; D.W. = 1.6097$$

   where Pc is the personal consumption deflator (1972 = 1.00).

   The marginal propensity to save is equal to .2236. The intercept is negative indicating that the average propensity to save increases as income rises.

3. Evans (1969, pp. 67-69) claimed that the permanent income hypothesis has been found to agree more closely with observed consumption behaviour of non-durables and services than either the relative income or life-cycle hypotheses.

4. Friedman (1957, pp. 143-147) measured permanent income as a weighted average of current and past measured incomes with declining weights; he truncated the function after the first 17 terms. His estimate of k was .88, which was very close to the observed APC of .877 over the sample period. We have defined the permanent income without any truncation, as suggested by Evans (1969, pp. 23-25).

5. The formula is also known as Cagan's (1956) adaptive expectation hypothesis, which can be written in general

as:

$$X^e_t = b.X^e_{t-1} + (1-b).X_t$$

where X^e_t = the expected variable at time t
X_t = the actual variable at time t
b = the expectation coefficient; $0 \leqslant b \leqslant 1$

If we repeatedly substitute the actual variable for the expected one in the above formula, we obtained:

$$X^e_t = (1-b).\sum_{i=0}^{\infty} b^i . X_{t-i}$$

The above equation is identical to equation (5.15). It is worth noting that if the expectation is a type of rational expectation (perfect foresight in this case), then the coefficient b turns to be zero. We thus have:

$$X^e_t = X_t$$

That is, the expected variable is equal to the actual one, which implies that $(NDPI/Pc)^p_t = (NDPI/Pc)_t$. Thus under the rational expectation assumption, the PIH consumption function depends solely on present income.

6. Equation (5.16) was applied to estimate the function for total personal consumption:

By C-O:

$$Cp/POP = \underset{(2.8580)}{.1779}(NDPI/Pc)/POP + \underset{(10.7570)}{.8213}(Cp/POP)_{-1}$$

$\bar{R}^2$ (R-bar^2) = .9969; Se = 27.856; Durbin-h = .9289; rho = .4408 (1.8958)

The intercept was not significant and was suppressed. The permanent income hypothesis explains personal consumption very well.

7. See, for example, Wallis (1973a) and Evans and Klein (1967).

8. The lagged relative price term was tested in equations (5.33a) and (5.34a), but it was not significant.

9. To calculate the periods required to achieve the desired level of stock, we may use the method suggested by Wallis (1973a, pp. 37-38). After one period we have a fraction (1-n) fulfilled, and a fraction n of the change remains. In the second period, (1-n) of the

remainder is satisfied, thus after 2 periods a sum of $(1-n)+n(1-n) = (1-n^2)$ is accomplished and n^2 remains. So after t periods, $1-n^t$ is achieved.

If s is defined as a proportion already completed, then $s = 1-n^t$

or $1-s = n^t$

thus, $\ln(1-s) = t.\ln(n)$

or $t = \ln(1-s)/\ln(n)$

For example, if we want to know how many periods are required to complete 95 percent of the adjustment to the desired level of stock, where the adjustment coefficient (n) is .8268, then

$t = \ln(1-0.95)/\ln(0.8268) = 15.75$ periods.

10. Equation (5.35) can be transformed into equation (5.36) by taking the integral of both sides with respect to time, and then taking the anti-logarithms.

11. We have attempted to incorporate the effects of per capita real balances (measured at the middle of the year) $[(M+M_{-1})/2/P/POP)]$ and the effects of income distribution (as indicated by Yas/Yms times real net disposable income) into the four selected consumption functions: equations (5.18), (5.19), (5.34a) and (5.39). All results showed consumption not to be significantly affected by either or both variables.

12. The linear relation between Tp and PI was estimated by C-O:

$$Tp = -379.99 + .0151\ PI$$
$$(-1.8829)\quad (15.0980)$$

$\bar{R}^2$ (R-bar^2) = .9788; Se = 206.90; D.W. = 1.2114; rho = .6471 (3.6007)

13. Government debt was accumulated using base-year total (domestic and foreign) debt of 1960, which was reported in <u>Bank of Thailand Monthly Bulletin</u>, April 1976, vol.XVI, no.4. Our calculated series differs slightly from the series reported in the above source.

CHAPTER 6

INVESTMENT AND SAVINGS

Section 6.1 considers the behaviour of private fixed investment in the agricultural and non-agricultural sectors under four alternative hypotheses. The determination of savings is discussed in section 6.2.

6.1 Investment

Four alternative hypotheses for explaining the behaviour of private investment in agriculture and in non-agriculture were tested. These are: the stock adjustment hypothesis, the accelerator principle, the desired investment hypothesis and the simple demand concept. All hypotheses are based on the assumption of profit maximization.

a. The Stock Adjustment Hypothesis

The stock adjustment hypothesis used here is similar to the concept applied in estimating the consumption function for durable goods. It states that the change in actual stock is a fraction (1-n) of the change required to reach the desired level:

$$K - K_{-1} = (1-n)(K^{\#} - K_{-1}) \qquad \text{...(6.1)}$$

where K = capital stock measured at the end of this period

n = the coefficient of the speed of adjustment; $0 \leqslant n \leqslant 1$; low values of n indicate rapid adjustment, and vice versa.

Desired capital stock ($K^{\#}$) is assumed to be a function of output (Y), the purchasers' price of investment goods (Pi) relative to the producers' price of its output (Pb), and a real rate of interest at the beginning of the year (r).

$$K^{\#} = a + b.Y + c.Pi/Pb + d.r \qquad ...(6.2)$$

The real rate of interest (in percent) is defined as the nominal rate (R) (approximated by the loan rate of the Bank of Thailand measured at the middle of the year)[1] less the actual rate of inflation (g_P), based on the GDP deflator (P):

$$r = [(R - g_P) + (R_{-1} - g_{P_{-1}})]/2 \qquad ...(6.3a)$$

$$g_P = 100.(P - P_{-1})/P_{-1} \qquad ...(6.3b)$$

Substituting $K^{\#}$ from equation (6.2) into equation (6.1), we have:

$$K = (1-n).a + (1-n).b.Y + (1-n).c.Pi/Pb + (1-n).d.r + n.K_{-1} \qquad ...(6.4)$$

Equation (6.4) is a capital stock function under the stock adjustment hypothesis. Since the difference between two consecutive periods of actual capital is net investment, we can formulate a net investment (In) function according to the stock adjustment hypothesis as:

$$In = (1-n).a + (1-n).b.Y + (1-n).c.Pi/Pb + (1-n).d.r - (1-n).K_{-1} \quad ...(6.5)$$

b. The Accelerator Principle

If we first difference equation (6.4), then we obtain:

$$In = (1-n).b.(Y-Y_{-1}) + (1-n).c.[Pi/Pb-(Pi/Pb)_{-1}] + (1-n).d.(r-r_{-1}) + n.In_{-1} \quad ...(6.6)$$

Equation (6.6) is the net investment function under the accelerator principle.

c. The Desired Investment Hypothesis

If the partial adjustment is assumed to relate to gross fixed investment (I) instead of the capital stock, we obtain a relationship similar to (6.1):

$$I - I_{-1} = (1-m)(I^{\#} - I_{-1}) \quad ...(6.7)$$

where m is the coefficient indicating the speed of adjustment.

Desired investment ($I^{\#}$) is assumed to be a function of output (Y), relative prices (Pi/Pb), and the real rate of interest at the beginning of the year (r). The resulting investment function based on the desired investment hypothesis is:

$$I = (1-m).e + (1-m).f.Y + (1-m).g.Pi/Pb + (1-m).h.r + m.I_{-1} \quad ...(6.8)$$

In sub-section 6.1.1, we present the estimates of private investment in agriculture. Private investment in non-agriculture is discussed in sub-section 6.1.2.

6.1.1 Private Investment in Agriculture

The average share of private agricultural investment in total private gross fixed investment was about 12 percent over the period 1960-1978. Private agricultural investment fluctuated between 5 and 7 percent of agricultural value added over the same period. These figures indicate the small size of private capital accumulation in this sector.

a. The investment function based on the stock adjustment hypothesis

Equation (6.10) is the estimate of the net investment (Ipan) function based on the stock adjustment hypothesis. Net investment is equal to gross investment (Ipa) less depreciation ($da.Kpa_{-1}$), where da is the depreciation rate of capital stock in agriculture. The value of da is estimated in section 6.2 to be 0.0364.

$$Ipan = Ipa - da.Kpa_{-1} \qquad ...(6.9)$$

By OLS:

$$Ipan = \underset{(1.3874)}{1887.9} - \underset{(-1.1538)}{.0733}\ Kpa_{-1} + \underset{(1.7762)}{.0763}\ Yas$$

$$- \underset{(-1.3976)}{1977.4}\ (Pi/Pab) \qquad ...(6.10)$$

$$R\text{-}bar^2 = .4730;\ Se = 341.84;\ D.W. = 1.8859$$

The interest rate was not significant and was dropped. The estimate is satisfactory. The high value of n (= .9267) indicates a slow adjustment to meet the desired level; the implication is that it would take about 39 periods to complete 95 percent of the adjustment.[2]

b. The investment function based on the accelerator principle

Equation (6.11) displays the estimate of the net investment function based on the accelerator principle.

By OLS:

$$Ipan = \underset{(12.722)}{1.0709}\ Ipan_{-1} - \underset{(-.4234)}{.0163}\ (Yas - Yas_{-1})$$

$$- \underset{(-.7533)}{1095.8}\ [Pi/Pab - (Pi/Pab)_{-1}]$$

$$- \underset{(-1.5062)}{23.473}\ (r - r_{-1}) \qquad ...(6.11)$$

$$R\text{-}bar^2 = .3313;\ Se = 384.33;\ Durbin\text{-}h = -.2559$$

The intercept was not significant and was suppressed. The result is not satisfactory. The coefficient of the lagged dependent variable is greater than one, which indicates instability, and other variables are not statistically significant.

c. The investment function based on the desired investment hypothesis

Equations (6.12a) and (6.12b) are the estimates of the gross investment (Ipa) function based on the desired investment hypothesis in linear and log-linear forms, respectively.

By OLS:

$$Ipa = \underset{(1.7918)}{2148.20} + \underset{(1.6010)}{.4373}\, Ipa_{-1} + \underset{(2.5699)}{.0334}\, Yas - \underset{(-1.6953)}{2247.7}\,(Pi/Pab) \qquad \ldots(6.12a)$$

$\bar{R}^2$ = .8081; Se = 318.03; D.W. = 2.0501;

(Durbin-h cannot be computed)

By OLS:

$$\ln Ipa = \underset{(-1.2935)}{-1.3526} + \underset{(1.8034)}{.4424}\,\ln Ipa_{-1} + \underset{(2.4994)}{.5338}\,\ln Yas - \underset{(-1.8681)}{.7638}\,\ln(Pi/Pab) \qquad \ldots(6.12b)$$

$\bar{R}^2$ = .8339; Se = .1044; D.W. = 1.9905;

(Durbin-h caanot be computed)

The real interest rate was not significant in either equation, and was dropped. Both equations are satisfactory. Equation (6.12a) shows a short-run marginal propensity to invest of 0.0334, while its long-run value is 0.0594. Equation (6.12b) displays short-run output and relative price elasticities of 0.5338 and -0.7638, respectively, while their long-run values are 0.9573 and -1.3698.

d. The investment function based on the simple demand concept

Equations (6.13a) and (6.13b) are the estimates of the investment function based on the ordinary demand concept in both linear and log-linear forms.

By OLS:

$$Ipa = \underset{(1.7001)}{2141.8} + \underset{(7.9552)}{.0517}\ Yas - \underset{(-1.4389)}{1989.9}\ (Pi/Pab) \quad \ldots(6.13a)$$

$$\bar{R}^2 = .7881;\ Se = 334.19;\ D.W. = 1.6089$$

By OLS:

$$\ln Ipa = \underset{(-1.4252)}{-1.5861} + \underset{(8.5228)}{.8779}\ \ln Yas - \underset{(-1.5634)}{.6812}\ \ln(Pi/Pab) \ldots(6.13b)$$

$$\bar{R}^2 = .8090;\ Se = .1120;\ D.W. = 1.5110$$

The interest rate was dropped from both equations since it was not significant and had the wrong sign.

Equation (6.13a) is satisfactory, though the relative price term is not significant at the 5 percent level. The marginal propensity to invest is 0.0517, and the positive intercept indicates that the average propensity falls as output rises.

Equation (6.13b) suggests that agricultural investment is inelastic with respect to both output and relative prices. The output elasticity is 0.8779, indicating that Ipa has been increasing at lower rate than the growth in output.

Among the four hypotheses, we have selected equation (6.10), which explains net private investment in agriculture according to the desired capital stock concept, for inclusion in the econometric model. Gross investment in agriculture (Ipa) is then determined by identity (6.9).

6.1.2 Private Investment in Non-Agriculture

The share of private non-agricultural gross fixed investment in non-agricultural value added fluctuated between 16 and 26 percent during the period 1960-78, indicating that this sector is more capital intensive than the agricultural one.

a. The investment function based on the stock adjustment hypothesis

Equation (6.14b) is the estimate of net private investment (Ipmn) function based on the stock adjustment hypothesis. Net investment is equal to gross investment (Ipm) less depreciation ($dm.Kpm_{-1}$), where dm is the depreciation rate of capital stock in non-agriculture, estimated in section 6.2 to equal 0.0404.

$$Ipmn = Ipm - dm.Kpm_{-1} \qquad ...(6.14a)$$

By OLS:

$$\underset{}{Ipmn} = \underset{(4.0922)}{40034.0} - \underset{(-.0383)}{.0024}\ Kpm_{-1} + \underset{(1.7231)}{.1914}\ Yms$$

$$- \underset{(-4.6865)}{45283.0}\ (Pi/Pmb) - \underset{(-2.8280)}{229.91}\ r \qquad ...(6.14b)$$

$\bar{R}^2$ = .9373; Se = 1701.9; D.W. = 1.9063

The coefficient of capital stock is shown not to be significantly different from zero, implying that the desired level of capital will never be realized.

b. The investment function based on the accelerator principle

We now turn to the estimate of the Ipmn function based on the accelerator concept.

By OLS:

$$Ipmn = \underset{(7.8782)}{.8870}\ Ipmn_{-1} + \underset{(1.8094)}{.3450}\ (Yms - Yms_{-1})$$

$$- \underset{(-3.0375)}{41501.0}\ [Pi/Pmb - (Pi/Pmb)]$$

$$- \underset{(-2.1218)}{189.15}\ (r - r_{-1}) \qquad ...(6.15)$$

$\bar{R}^2$ = .8776; Se = 2234.3; Durbin-h = -1.2913

The intercept was suppressed. The result is satisfactory. The coefficient of $Ipmn_{-1}$ is 0.8870, indicating a slow adjustment process in attaining the desired stock level.

c. The investment function based on the desired investment hypothesis

Equations (6.16a) and (6.16b) are estimates of the gross fixed investment (Ipm) function based on the desired investment hypothesis, in linear and log-linear forms.

By OLS:

$$\underset{}{Ipm} = \underset{(4.9093)}{34848.0} + \underset{(.2118)}{.0329}\ Ipm_{-1} + \underset{(6.6192)}{.2518}\ Yms$$

$$- \underset{(-4.8532)}{40746.0}\ (Pi/Pmb) - \underset{(-2.7266)}{224.33}\ r \qquad \ldots(6.16a)$$

$\bar{R}^2 = .9699$; Se = 1723.5; Durbin-h = -.3193

By OLS:

$$\ln Ipm = - \underset{(-4.1142)}{4.6763} + \underset{(.5032)}{.0844}\ \ln Ipm_{-1} + \underset{(5.1573)}{1.1931}\ \ln Yms$$

$$- \underset{(-4.7890)}{1.8392}\ \ln(Pi/Pmb) - \underset{(-2.5182)}{.0093}\ r \qquad \ldots(6.16b)$$

$\bar{R}^2 = .9776$; Se = .0774; Durbin-h = .1719

The non-significant values of the coefficients of the lagged investment terms in both equations suggest that the desired investment concept may not be suitable to explain the behaviour of private non-agricultural investment.

d. The investment function based on the simple demand concept

Equations (6.17a) and (6.17b) are the estimates of the private non-agricultural gross fixed investment (Ipm) function based on the simple demand concept.

By OLS:

$$Ipm = \underset{(5.6832)}{35469.0} + \underset{(20.4980)}{.2593}\ Yms - \underset{(-5.6795)}{41514.0}\ (Pi/Pmb) - \underset{(-2.8495)}{225.65}\ r \qquad \ldots(6.17a)$$

$$\bar{R}^2 = .9719;\ Se = 1663.7;\ D.W. = 1.8025$$

By OLS:

$$\ln Ipm = -\underset{(-8.4470)}{5.1533} + \underset{(25.0300)}{1.3064}\ \ln Yms - \underset{(-6.7736)}{1.9613}\ \ln(Pi/Pmb) - \underset{(-2.5875)}{.0093}\ r \qquad \ldots(6.17b)$$

$$\bar{R}^2 = .9788;\ Se = .0754;\ D.W. = 1.6041$$

Both equations are satisfactory. Equation (6.17a) estimates the marginal propensity to invest out of non-agricultural output (Yms) of 0.2593. Equation (6.17b) indicates that both the output and relative price elasticities exceed one, and that a one percent increase in the real rate of interest will reduce the growth rate of investment by about one percent.

Among the four concepts above, we have chosen equation (6.17a), which explains private non-agricultural gross fixed investment according to the simple demand concept, for inclusion in the econometric model.

6.2 Savings

Total saving (S) in current prices consists of domestic saving (Sd) and foreign saving (Sf):

$$S = Sd + Sf \qquad \ldots(6.18)$$

Domestic saving is composed of personal saving (Sp), corporate saving (Sc), government saving (Sg), and savings in terms of consumption allowances on fixed capital in agriculture (Pi.Da) and in non-agriculture (Pi.Dm):

$$Sd = Sp + Sc + Sg + Pi.Da + Pi.Dm \qquad \ldots(6.19)$$

The term "foreign saving" is used to mean the negative of the balance on current account (which is discussed in Chapter 7):

$$Sf = - BOC \qquad \ldots(6.20)$$

6.2.1 Personal and Government Savings

Personal saving (Sp) is a major source of domestic saving. Its share of domestic saving was about 45-62 percent during the period 1960-1978, while the corporate saving share was 5-10 percent, and the government saving share was 10-20 percent.

Sp and Sg are determined by the following identities:

$$Sp = NDPI - Pc.Cp \quad \ldots(6.21)$$

$$Sg = Tp + Tc + IT + PROg^* + TfHtG^* + TfWtG^* - TfGtH^* - TfGtW^* - INg - Pm.Cg \quad \ldots(6.22)$$

Identity (6.21) defines personal saving by subtracting total personal consumption (Pc.Cp) from net disposable income (NDPI). The share of personal saving in NDPI was about 12-14 percent during 1960-1971, while during 1972-1978 it increased to 16-17 percent, which is a relatively high rate.

Identity (6.22) defines government saving as total government revenue from all taxes, other income and net transfer payments, less interest payments on government debt (INg) and government consumption (Pm.Cg). Note that the net transfer payments from the rest of the world to government (TfWtG - TfGtW) is the net foreign aid to the government.

6.2.2 Depreciation of Fixed Capital

Real depreciation of fixed capital is disaggregated into depreciation in the agricultural sector (Da) and in the non-agricultural sector (Dm).

Since capital stock in our model is assumed to be subject to a constant rate of depreciation, we have estimated the equations for Da and Dm as follows:

By C-O:

$$Da = \underset{(9.1062)}{.0364}\ Ka_{-1} \qquad \ldots(6.23)$$

$\bar{R}^2 = .8777$; Se = 162.25; D.W. = 1.4272; rho = .8142 (5.9499)

By C-O:

$$Dm = \underset{(16.9940)}{.0404}\ Km_{-1} \qquad \ldots(6.24)$$

$\bar{R}^2 = .9834$; Se = 580.60; D.W. = 1.1622; rho = .8382 (6.5207)

Both intercepts were not significant and were suppressed. The estimated depreciation rate of agricultural capital stock (da) is 0.0364 and of non-agricultural capital stock (dm) is 0.0404.

6.2.3 Corporate Saving and Profit

Gross corporate profit (PR) can be disaggregated into corporate saving or undistributed corporate profit (Sc), corporate dividend (DV), and corporate income tax (Tc).

$$PR = Sc + DV + Tc \qquad \ldots(6.25)$$

a. Gross corporate profit

Gross corporate profit is postulated to be a function of last period GDP, in current prices.

By OLS:

$$PR = -\ 1711.2 \quad + .0488\ (P.GDP)_{-1} \qquad \ldots(6.26a)$$
$$\quad (-3.9341)(20.9050)$$

$$\bar{R}^2 = .9625;\ Se = 997.39;\ D.W. = 1.5179$$

By C-O:

$$\ln PR = -\ 8.9223 + 1.4631\ \ln(P.GDP)_{-1} \qquad \ldots(6.26b)$$
$$\quad (-6.8151)(13.2000)$$

$$\bar{R}^2 = .9747;\ Se = .1440;\ D.W. = 1.6051;\ rho = \underset{(3.2225)}{.6049}$$

Equation (6.26b) shows that PR was growing about 46 percent faster than nominal GDP, while equation (6.26a) indicates a marginal share PR in $P.GDP_{-1}$ of about 4.9 percent. The negative intercept indicates that the average share of PR in $P.GDP_{-1}$ rises as $P.GDP_{-1}$ increases. Both equations reflect the growing importance of the corporate sector in the Thai economy.

We use equation (6.26b) in the econometric model.

b. Corporate saving

Equations (6.27) and (6.28) relate corporate saving (Sc) to gross and net profits, respectively. Both are in current prices.

By OLS:

$$Sc = 639.90 \quad + \quad .4985\ PR \qquad \ldots(6.27)$$
$$\quad (2.0605) \quad (17.1050)$$

$$\bar{R}^2 = .9733;\ Se = 422.07;\ D.W. = 1.4927$$

By OLS:

$$Sc = 49.3460 + .8015\ (PR - Tc) \qquad \ldots(6.28)$$
$$(.4259) \quad (50.5370)$$

$$\text{R-bar}^2 = .9969;\ Se = 144.36;\ D.W. = 1.5147$$

The results indicate that Sc is better explained by net profit (PR-Tc). Corporate saving may be determined after the corporations have paid income tax; thus an increase in the tax rate may reduce corporate saving and, in turn, investment.

We have chosen equation (6.27), to include in the econometric model.

Note that corporate dividend (DV) can be determined residually by identity (6.25), since corporate income tax (Tc) is determined in the government sector, as discussed in Chapter 5.[3]

FOOTNOTES TO CHAPTER 6

1. The Bank of Thailand loan rate is selected as the nominal domestic rate of interest in the model, because it seems more suitable than the others in representing the monetary policy conducted by the central bank. Though all interest rates operated through financial institutions in Thailand are subject to control, the bank of Thailand loan rate fluctuated over a wider range. This may indicate the pressure from the money market on the montary authorities.

   We would not expect to predict the interest rate in the model accurately, since in the short-run the monetary authorities can resist the market pressure and make interest rate differ from competitive ones.

2. See footnote 9, Chapter 5 for the calculation of the period needed to attain the desired level of capital stock.

3. The estimates of corporate dividend on gross and net profits are displayed below:

   By OLS:

   $$DV = 65.8370 + .1267\ PR$$
   $$(1.1597)\quad(23.7910)$$

   $\bar{R}^2$ = .9860; Se = 77.1580; D.W. = 1.7307

   By OLS:

   $$DV = -49.3460 + .1985\ (PR - Tc)$$
   $$(-.4259)\quad(12.1570)$$

   $\bar{R}^2$ = .9511; Se = 144.360; D.W. = 1.5147

   Opposite to the behaviour of corporate saving, corporate dividend seems to be better explained by gross profit (PR).

CHAPTER 7

FOREIGN SECTOR, MONEY MARKET AND PRICES

The equations of the foreign sector, which are concerned with the imports and exports of goods and services and with the balance of payments, are estimated and discussed in sections 7.1 and 7.2. Section 7.3 estimates the equations in the money market. The determination of prices is considered in section 7.4.

7.1 Imports of Goods and Services

The supply curves of all imported goods are assumed to be infinitely elastic, which is likely to be suitable for a small importer like Thailand. The prices of imports are thus given, and the quantities imported are determined solely by import demand functions.

Real imports of goods and services (IM) are disaggregated into two categories: imports of agricultural goods (IMa) and imports of non-agricultural goods (IMm):

$$IM = IMa + IMm \quad \ldots(7.1)$$

$$IMm = (IMc-IMa) + IMr + IMi + IMf + IMo + IMs \quad \ldots(7.2)$$

(As before, detailed definitions of variables are presented in Appendix 1; variables with * are exogenous in the model.)

Imports of non-agricultural goods are disaggregated into: imported non-agricultural consumer goods (IMc-IMa), imported intermediate goods and raw materials (IMr), imported capital goods (IMi), imported fuels and lubricants (IMf), imported other goods (IMo), and imports of services (IMs) (equation (7.2)). In this study the behaviour of all these components will be considered.

7.1.1 The Import Demand Function for Consumer Goods

Imported consumer goods (IMc) accounted for about 10-11 percent in personal consumption expenditures on durable and non-durable goods (Cd&nd) during 1960-70. The share declined to 5-6 percent during 1972-79. The share of IMc in net disposable income (NDPI/Pimc) has also exhibited a similar trend; it was about 6-7 percent between 1960-1970 and 3-4 percent during 1972-79.

a. The linear demand function

We assume that the desired level of imports of consumer goods ($IMc^{\#}$) is a function of real net disposable income and the price of imported consumer goods after tariff (Pimc) (measured in domestic currency) relative to the price of personal consumption of durable and non-durable goods (Pd&nd);

$$IMc^{\#} = a + b.NDPI/Pimc + c.Pimc/Pd\&nd \qquad ...(7.3)$$

Note that the exchange rate enters the import function via the import price, since the price is defined in terms of domestic currency. The discussion of the exchange rate and import prices is presented in section 7.4.

The actual level of imports is assumed to be based on the partial adjustment hypothesis,[1] which states that the change in actual imports is a fraction (1-n) of the difference between desired imports ($IMc^{\#}$) and the previous period's actual imports:

$$IMc - IMc_{-1} = (1-n)(IMc^{\#} - IMc_{-1}) \qquad ...(7.4)$$

Again, n is the speed of adjustment coefficient; $0 \leqslant n \leqslant 1$; high values of n indicate slow adjustment, and vice versa. The partial adjustment may be caused by any delays due to lack of information, habit persistence, or other frictions.

Substituting $IMc^{\#}$ from equation (7.3) into equation (7.4) and re-arranging, we have

$$IMc = (1-n)a + (1-n)b.NDPI/Pimc$$
$$+ (1-n)c.Pimc/Pd\&nd + n.IMc_{-1} \qquad ...(7.5)$$

The estimates of the IMc function are:

By OLS:

$$IMc = \underset{(4.9884)}{8284.3} + \underset{(3.5324)}{.4281}\ IMc_{-1} + \underset{(4.3159)}{.0118}\ (NDPI/Pimc)$$

$$- \underset{(-4.4817)}{7024.3}\ (Pimc/Pd\&nd) \qquad \text{...(7.5a)}$$

$\text{R-bar}^2 = .8531$; Se = 383.0; Durbin-h = -.3631

By OLS:

$$IMc = \underset{(8.0145)}{12450.0} + \underset{(6.0574)}{.0176}\ (NDPI/Pimc)$$

$$- \underset{(-5.2874)}{9671.0}\ (Pimc/Pd\&nd) \qquad \text{...(7.5b)}$$

$\text{R-bar}^2 = .7406$; Se = 508.86; D.W. = 1.5560

Equation (7.5a) is satisfactory. The short-run marginal propensity to import consumer goods is 0.0118, while its stationary state long-run value is 0.0206.

Equation (7.5b) is estimated on the assumption that the adjustment process is realized in one period (n = 0). The import function is thus a function of net disposable income and the relative prices. Though the individual t-value are satisfactory, the relatively low R-bar^2 and high Se (as compared to equation (7.5a)) suggest the possibility of omitted variables. We conclude that the lagged value plays an important role in its import demand function.

b. The log-linear demand function

If we define desired imports as a Cobb-Douglas function of real net disposable income and relative prices, and postulate the partial adjustment process in terms of growth rates, the import function can be written as

$$\ln IMc = (1-m).\ln A + (1-m)b.\ln(NDPI/Pimc) + (1-m)c.\ln(Pimc/Pd\&nd) + m.\ln IMc_{-1} \qquad ...(7.6)$$

where m is the speed of adjustment coefficient ($0 \leqslant m \leqslant 1$).

The estimates of equation (7.6) are displayed below. Equation (7.6a) is statistically satisfactory, and shows a short-run relative price elasticity of about minus one, while the short-run income elasticity is 0.2741. The long-run stationary state income and price elasticities are 0.4164 and -1.6481, respectively. Equation (7.6b) is based on the assumption that the adjustment process is realized in one period.

By OLS:

$$\ln IMc = \underset{(3.2930)}{2.3970} + \underset{(2.9211)}{.3418} \ln IMc_{-1} + \underset{(4.8604)}{.2741} \ln(NDPI/Pimc) - \underset{(-5.2558)}{1.0848} \ln(Pimc/Pd\&nd) \qquad ...(7.6a)$$

$\bar{R}^2$ = .8820; Se = .0546; Durbin-h = -.5474

By OLS:

$$\ln IMc = \underset{(6.7309)}{3.9869} + \underset{(7.8124)}{.3885} \ln(NDPI/Pimc)$$

$$- \underset{(-6.4807)}{1.3990} \ln(Pimc/Pd\&nd) \qquad \ldots(7.6b)$$

$\bar{R}^2$ = .8228; Se = .0670; D.W. = 1.9121

Equation (7.6a) is chosen for the econometric model.[2]

7.1.2 The Import Demand Function for Agricultural Goods

Imported agricultural goods are categorized in accordance with the definitions in the 1975 input-output table for Thailand. All imports of agricultural goods are therefore treated as consumer goods.

The concept of desired import demand is applied here. The desired level of imported agricultural goods is postulated to be a function of real net disposable income and the price of the agricultural imports (approximated by Pimc, since no price index is available for agricultural imports) relative to the price of domestic agricultural output (Pa).

By OLS:

$$IMa = \underset{(1.7180)}{576.00} + \underset{(3.6373)}{.7355} IMa_{-1} + \underset{(1.9524)}{.0015} (NDPI/Pimc)$$

$$- \underset{(-1.4441)}{494.91} (Pimc/Pa) \qquad \ldots(7.7a)$$

$\bar{R}^2$ = .7389; Se = 101.20; Durbin-h = 1.2833

By OLS:

$$\ln IMa = .1113 + .7552 \ln IMa_{-1} + .1350 \ln(NDPI/Pimc) - .4195 \ln(Pimc/Pa) \qquad \ldots(7.7b)$$
$$(.1088)\quad(3.7511)\qquad\qquad(1.5275)\qquad\qquad(-1.5041)$$

$\text{R-bar}^2 = .7229$; Se = .0900; Durbin-h = 1.7950

Both results are satisfactory, though some t-values are not high. The lagged import terms show strong partial adjustment in both equations. Equation (7.7a) indicates that a very small percent of disposable income was spent on agricultural imports. Equation (7.7b) shows that the short-run income and relative price elasticities are 0.1350 and -0.4195, respectively, which are rather low. The long-run income and relative price elasticities are 0.5515 and -1.7136, respectively. We note that the import equations were also estimated without the lagged term, but the results were not satisfactory.

Equation (7.7b) is chosen for inclusion in the econometric model.

7.1.3 The Import Demand Function for Intermediate Goods and Raw Materials

Imported intermediate goods and raw materials (IMr) increased considerably from about 2 percent of GDP in 1960 to about 6 percent in 1973. Similarly, IMr increased from about

10 percent of total commodity imports in 1960 to about 30 percent in 1973. These reflect the policy of import substitution implemented during the period 1961-71, designed to reduce imports of consumer goods and increase imports of intermediate goods. After 1973 the share of IMr in GDP was rather stable, between 4 and 5 percent.

We have employed the desired import concept for the estimates of the import demand function for intermediate goods and raw materials. The desired level of imports is assumed to be a function of GDP and the prices of imported intermediate goods after tariff (Pimr) relative to the purchasers' price of non-agricultural output (Pm).

The estimated results of the IMr function in both linear and log-linear, with and without the lagged import term, are displayed below.

By OLS:

$$\underset{}{IMr} = \underset{(1.3007)}{3323.5} + \underset{(2.3929)}{.4578}\, IMr_{-1} + \underset{(2.3080)}{.0311}\, GDP$$

$$- \underset{(-2.4565)}{3092.1}\, (Pimr/Pm) \qquad \ldots(7.8a)$$

$$\text{R-bar}^2 = .9529;\ Se = 900.72;\ \text{Durbin-h} = 1.3646$$

By C-O:

$$IMr = \underset{(.8399)}{2447.5} + \underset{(8.0915)}{.0576}\, GDP - \underset{(-2.3664)}{3486.4}\, (Pimr/Pm) \qquad \ldots(7.8b)$$

$$\text{R-bar}^2 = .9505;\ Se = 843.13;\ D.W. = 1.4944;\ rho = \underset{(2.0875)}{.4416}$$

By OLS:

$$\ln IMr = \underset{(-2.7059)}{-4.4809} + \underset{(3.9099)}{.4202} \ln IMr_{-1}$$

$$+ \underset{(3.9142)}{.8222} \ln GDP - \underset{(-6.1979)}{.9248} \ln(Pimr/Pm) \qquad \ldots(7.9a)$$

R-bar^2 = .9933; Se = .0651; Durbin-h = -.7730

By OLS:

$$\ln IMr = \underset{(-9.4482)}{-10.207} + \underset{(18.453)}{1.6066} \ln GDP$$

$$- \underset{(-5.9146)}{1.1434} \ln(Pimr/Pm) \qquad \ldots(7.9b)$$

R-bar^2 = .9869; Se = .0909; D.W. = 1.6347

All four equations perform satisfactorily statistically. The lagged import component seems to play an important role in explaining the behaviour of such imports.

We choose equation (7.9a) for use in the econometric model. The short-run elasticities of imports with respect to GDP is 0.8222 and with respect to the relative price is -0.9248, while the stationary state long-run elasticities are 1.4181 and -1.5950, respectively.

7.1.4 The Import Demand Function for Capital Goods

Imports of capital goods (IMi) were some 30 to 40 percent of total gross fixed investment (I) between 1961 and 1975. The share decreased to 23 to 26 percent between 1976 and 1978. The high proportion of IMi/I shows a high degree of foreign dependency for capital goods, although such dependency has been somewhat mitigated in recent years.

The concept of desired imports is also applied for the estimates of the IMi function, where the desired imports ($IMi^{\#}$) are assumed to be a function of GDP and the price of imported capital goods after tariff (Pimi) relative to the price of investment goods (Pi). The estimates of the IMi function in both linear and log-linear forms, and with and without the lagged import term, are shown below.

By OLS:

$$\underset{}{IMi} = \underset{(7.2992)}{17448.0} + \underset{(2.4682)}{.2641}\, IMi_{-1} + \underset{(6.3913)}{.0653}\, GDP$$

$$- \underset{(-6.8274)}{21027.0}\, (Pimi/Pi) \qquad \ldots(7.10a)$$

$\text{R-bar}^2 = .9296$; Se = 1105.1; Durbin-h = -.4400

By OLS:

$$IMi = \underset{(9.7597)}{21123.0} + \underset{(12.768)}{.0860}\, GDP$$

$$- \underset{(-8.8407)}{25494.0}\, (Pimi/Pi) \qquad \ldots(7.10b)$$

$\text{R-bar}^2 = .9058$; Se = 1279.0; D.W. = 1.9424

By OLS:

$$\ln IMi = \underset{(-4.3241)}{-4.4745} + \underset{(1.9535)}{.2069}\, \ln IMi_{-1}$$

$$+ \underset{(6.3578)}{.9815}\, \ln GDP \underset{(-7.1103)}{-1.5830}\, \ln(Pimi/Pi) \qquad \ldots(7.11a)$$

$\text{R-bar}^2 = .9619$; Se = .0872; Durbin-h = -.0698

By OLS:

$$\ln IMi = \underset{(-7.3523)}{-5.8958} + \underset{(18.836)}{1.2583} \ln GDP$$

$$- \underset{(-10.801)}{1.8851} \ln(Pimi/Pi) \qquad \ldots(7.11b)$$

$$\bar{R}^2 = .9547; \; Se = .0951; \; D.W. = 1.9811$$

All four equations perform satisfactorily statistically. We selected equation (7.11b) for inclusion in the econometric model.

7.1.5 The Import Demand Functions for Fuels and Lubricants and for Other Goods

The share of fuels and lubricants in total commodity imports at current prices has grown considerably since 1973, because of the large increases in the price of oil. The share was about 8 to 11 percent between 1960 and 1972, but it increased to 20 to 23 percent between 1974 and 1978.

The imports of other goods amounted to about 10-12 percent of total commodity imports during 1960-1978. In fact, a portion of these imports are capital goods such as trucks, buses and passenger cars.

The concept of desired imports is employed to estimate functions for both categories, where desired imports is a function of GDP and the price of the imports relative to the purchasers' price of non-agricultural goods (Pm).

The estimates of the IMf funtion in both linear and log-linear forms, with and without the lagged terms, are displayed below.

By OLS:

$$IMf = \underset{(-.6722)}{-114.95} + \underset{(.6812)}{.1371}\ IMf_{-1} + \underset{(4.8084)}{.0182}\ GDP$$

$$- \underset{(-2.5833)}{238.56}\ (Pimf/Pm) \qquad \text{...(7.12a)}$$

$\bar{R}^2$ = .9561; Se = 228.10; Durbin-h = -.1411

By OLS:

$$IMf = \underset{(-.9670)}{-153.32} + \underset{(17.013)}{.0205}\ GDP - \underset{(-2.7039)}{244.20}\ (Pimf/Pm) \qquad \text{...(7.12b)}$$

$\bar{R}^2$ = .9577; Se = 223.99; D.W. = 1.6368

By OLS:

$$\ln IMf = \underset{(-4.7650)}{-7.7298} - \underset{(-.5216)}{.1071}\ \ln IMf_{-1}$$

$$+ \underset{(5.2417)}{1.3794}\ \ln GDP - \underset{(-2.7187)}{.1577}\ \ln(Pimf/Pm) \qquad \text{...(7.13a)}$$

$\bar{R}^2$ = .9649; Se = .0881; Durbin-h = -.1158

By OLS:

$$\ln IMf = \underset{(-10.159)}{-6.9672} + \underset{(21.227)}{1.2458}\ \ln GDP$$

$$- \underset{(-2.7399)}{.1502}\ \ln(Pimf/Pm) \qquad \text{...(7.13b)}$$

$\bar{R}^2$ = .9666; Se = .0859; D.W. = 2.3376

The results show that the lagged value of the dependent variable in imports of fuels and lubricants equations are not statistically significant. This suggests that the adjustment process is rapid.

We have chosen equation (7.13b), which explains the behaviour of fuel and lubricant imports with a simple demand concept, for inclusion in the econometric model. The elasticity of IMf with respect to GDP is 1.2458. The growth rate of IMf is about 25 percent higher than the growth rate of GDP, indicating the growing need for fuels and lubricants as the country becomes more industrialized. The relative price elasticity is equal to -0.1502, indicating the very inelastic character of the import demand.

The estimates of the IMo function in both linear and log-linear forms, with and without the lagged terms, are shown below.

By OLS:

$$\underset{}{IMo} = \underset{(6.5939)}{4970.3} + \underset{(1.1143)}{.1414}\ IMo_{-1} + \underset{(6.3775)}{.0243}\ GDP - \underset{(-6.2946)}{6682.0}\ (Pimo/Pm) \qquad \ldots(7.14a)$$

$\bar{R}^2 = .9069$; Se = 435.63; Durbin-h = .4311

By OLS:

$$IMo = \underset{(10.123)}{5551.7} + \underset{(12.588)}{.0278}\ GDP - \underset{(-8.9039)}{7423.4}\ (Pimo/Pm) \qquad \ldots(7.14b)$$

$\bar{R}^2 = .9054$; Se = 439.12; D.W. = 1.5741

By OLS:

$$\ln IMo = \underset{(-5.8658)}{-4.9389} - \underset{(-.0191)}{.0020} \ln IMo_{-1}$$

$$+ \underset{(8.6124)}{1.0811} \ln GDP - \underset{(-8.8993)}{1.3308} \ln(Pimo/Pm) \quad \ldots(7.15a)$$

$\text{R-bar}^2 = .9610$; Se = .0776; Durbin-h = .8370

By OLS:

$$\ln IMo = \underset{(-7.8317)}{-4.9287} + \underset{(20.758)}{1.0790} \ln GDP$$

$$- \underset{(-13.293)}{1.3288} \ln(Pimo/Pm) \quad \ldots(7.15b)$$

$\text{R-bar}^2 = .9636$; Se = .0749; D.W. = 1.6248

The results indicate that such imports are not affected by their lagged value. We thus select equation (7.15b) for the econometric model. Its elasticities with respect to GDP and the relative price are 1.0790 and -1.3288, respectively.

7.1.6 The Import Demand Functions for Services

The estimates of IMs as a function of GDP and the import price relative to the purchasers' price of non-agricultural output (Pm) are displayed below.

By OLS:

$$IMs = \underset{(5.3044)}{3600.8} + \underset{(1.7388)}{.2273} IMs_{-1} + \underset{(6.2028)}{.0258} GDP$$

$$- \underset{(-5.5107)}{4443.8} (Pims/Pm) \quad \ldots(7.16a)$$

$\text{R-bar}^2 = .9546$; Se = 325.51; Durbin-h = 1.7556

By C-O:

$$IMs = 4162.2 + .0306\ GDP - 4947.8\ (Pims/Pm) \quad \ldots(7.16b)$$
$$(5.6245)(12.695) \quad (-6.5780)$$

$$\text{R-bar}^2 = .9589;\ Se = 309.67;\ D.W. = 1.5258;\ rho = .4895\ (2.3813)$$

By OLS:

$$\ln IMs = -8.8063 + .1264 \ln IMs_{-1}$$
$$(-5.6821)\ (.9746)$$

$$+ 1.3431 \ln GDP - 1.5054 \ln(Pims/Pm) \quad \ldots(7.17a)$$
$$(6.3018) \quad (-6.2306)$$

$$\text{R-bar}^2 = .9766;\ Se = .0817;\ \text{Durbin-h} = 1.0993$$

By OLS:

$$\ln IMs = -10.162 + 1.5430 \ln GDP$$
$$(-14.900)\ (26.672)$$

$$- 1.6955 \ln(Pims/Pm) \quad \ldots(7.17b)$$
$$(-11.913)$$

$$\text{R-bar}^2 = .9766;\ Se = .0815;\ D.W. = 1.5197$$

Equation (7.17b) is chosen for the econometric model; the elasticities with respect to GDP and the relative price are 1.543 and -1.6955, respectively, which seem rather high.

7.2 Exports of Goods and Services and the Balance of Payments

Real exports of goods and services (E) are disaggregated into two categories: exports of agricultural goods (Ea) and non-agricultural goods (Em).

$$E = Ea + Em \quad \ldots(7.18)$$

7.2.1 The Export Demand Function for Agricultural Goods

Agricultural exports are defined according to the 1975 input-output table for Thailand. Demand for such exports is assumed to be a function of world gross domestic product (excepting the socialist countries) (GDPw$) and the price of Thai exports (Pea) relative to the world price (approximated by the world export price of food (Peaw$)). Both GDPw$ and Peaw$ are indices in 1972 $US; they have been converted into Thai baht using the exchange rate (ex), expressed as an index with base 1.00 in 1972, when the rate was 20.8 baht per $US.

Estimates were obtained in both linear and log-linear forms:

By C-O:

$$\underset{(.8092)}{Ea = 2644.9} + \underset{(1.8493)}{2694.4} \, [GDPw\$^{*}.(ex^{*}/20.8)] \quad \underset{(-.6272)}{- 1435.1} \, [Pea/(Peaw\$^{*}.ex^{*}/20.8)] \qquad ...(7.19a)$$

$\bar{R}^2$ = .5399; Se = 662.97; D.W. = 1.8116; rho = .3518 (1.5946)

By C-O:

$$\ln Ea = \underset{(95.552)}{8.2771} + \underset{(2.5963)}{.8692} \ln[GDPw\$^{*}.(ex^{*}/20.8)] \quad \underset{(-.3820)}{- .2189} \ln[Pea/(Peaw\$^{*}.ex^{*}/20.8)] \qquad ...(7.19b)$$

$\bar{R}^2$ = .6442; Se = .1726; D.W. = 1.7979; rho =.3890 (1.7916)

Equation (7.19b) will be used to explain agricultural exports in the econometric model.

7.2.2 The Export Demand Function for Non-Agricultural Goods

Similar to agricultural exports, we postulate that exports of non-agricultural goods are a function of GDPw$ and the price of Thai exports (Pem) relative to the world price (approximated by the world export price of primary products, except crude pretroleum, (Pemw$)). Both GDPw$ and Pemw$ are converted into Thai baht by the exchange rate (ex).

By C-O:

$$\underset{(1.8034)}{Em = 22867.0} + \underset{(5.3751)}{32390.0}\ [GDPw\$^*.(ex^*/20.8)]$$

$$- \underset{(-3.3783)}{25317.0}\ [Pem/(Pemw\$^*.ex^*/20.8)] \qquad \ldots(7.20a)$$

$$R\text{-}bar^2 = .9434;\ Se = 2273.8;\ D.W. = 1.8019;\ rho = \underset{(2.9951)}{.5767}$$

By C-O:

$$\ln Em = \underset{(162.81)}{10.262} + \underset{(6.9780)}{1.4642}\ \ln[GDPw\$^*.(ex^*/20.8)]$$

$$\underset{(-3.2127)}{-1.0451}\ \ln[Pem/(Pemw\$^*.ex^*/20.8)] \qquad \ldots(7.20b)$$

$$R\text{-}bar^2 = .9610;\ Se = .0904;\ D.W. = 1.7918;\ rho = \underset{(3.0521)}{.5840}$$

Equation (7.20b) will be used to explain non-agricultural exports in the econometric model. The estimated income and price elasticities of such exports are 1.4642 and -1.0451, respectively.

7.2.3 Balance of Payments

The definitions of the balance on current account (BOC), the balance of payments (BOP), and net foreign assets (NFA) are displayed below.

$$BOC = Pe.E - Pimb.IM + NFIfW^* + TfWtH^* + TfWtG^* - TfHtW^* - TfGtW^* \quad ...(7.21)$$

$$BOP = BOC + If + BOWg^* \quad ...(7.22)$$

$$NFA = NFA_{-1} + BOP + AD^* \quad ...(7.23)$$

Identity (7.21) is the definition of the balance on current account (BOC) in current prices; it is equal to the value of exports (Pe.E) (f.o.b.) after export duties less the value of imports (Pimb.IM) (c.i.f.) before import duties plus net factor income from the rest of the world (NFIfW) and net foreign transfer payments of both private and public sectors.

Identity (7.22) is the definition of the balance of payments (BOP); it is the sum of the current account balance, direct investment and net private borrowings in both short and long term from foreign sources (i.e., net private foreign capital inflow) (If) and net foreign borrowing of the Thai government (BOWg). All are in million of current baht.

BOWg was about 0.6 percent of GDP at current prices, on average, between 1960 and 1978, while If was about 2 percent of GDP over the same period, on average.

Identity (7.23) defines net foreign assets (NFA) at the end of the year, as the sum of the previous year's assets, current net change in the balance of payments (BOP), and other adjustment in the stock of foreign assets due to the changes in prices of gold, foreign currencies, and other assets (AD). All are in current prices.

7.2.4 Net Private Foreign Capital Inflow

Real net foreign capital inflow (If/P) is assumed to be a function of real gross domestic product (GDP) and the difference between the nominal rates of domestic interest (R) and the world interest (Rw). The nominal rates are used because (financial) capital will flow to the place which offers the highest nominal rate of interest rate. (The expected change in exchange rate is not included because there was a fixed exchange rate during the data period.)

The Bank of Thailand loan rate (R), at the middle of the year (in percent), is used as a proxy for the domestic rate. The average 3-month Euro-dollar rate (London) (in percent) is a proxy for the world rate.

Several functional forms were tested to explain the behaviour of net private foreign capital inflow (If), and two are reported below.

By OLS:

$$\ln(If/P) = \underset{(-2.7593)}{-\ 6.8019} + \underset{(.9040)}{5.1521}\ \ln\left[(100+R)/(100+Rw^{*})\right]$$

$$+ \underset{(5.9552)}{1.2323}\ \ln GDP \qquad \ldots(7.24a)$$

$$\text{R-bar}^2 = .6641;\ Se = .3312;\ D.W. = 2.4653$$

By OLS:

$$\ln(If/P) = \underset{(-2.6381)}{-\ 6.5886} \ \underset{(-.0792)}{-\ .3991} \ln [(100+R)/(100+Rw^*)]_{-1}$$

$$+ \underset{(5.7854)}{1.2306} \ln GDP_{-1} \qquad ...(7.24b)$$

$\bar{R}^2$ = .6523; Se = .3370; D.W. = 2.2801

The equations show no significance for the ratio of the interest rate. This may indicate that net foreign capital flows into Thailand over the period of the study were largely explained by other factors, such as the political situation, the investment atmosphere, and the foreign exchange controls.[3] We therefore treat If as an exogenous variable in our econometric model.

7.3 The Money Market

The money market in our model is an aggregated one. The supply of money (MS) (defined as currency in public hands plus demand deposits (M1)) is dependent on the amount of net foreign assets (NFA), net domestic credit to government (NDCg) and net domestic credit to the private sector less quasi-money and less savings deposits (NDCp). All are measured in nominal terms at the end of the year.

$$MS = NFA + NDCg^* + NDCp^* \qquad ...(7.25)$$

$$M = MS \qquad ...(7.26)$$

Identity (7.25) links the money market, the government budget constraint (equation (5.70), Chapter 5) and the foreign exchange constraint (equation 7.23). For example, a surplus in the balance of payments will increase NFA and raise the domestic money supply if there is no sterilization. An increase in government expenditure financed through domestic borrowing (NDCg) from the Bank of Thailand will increase the domestic money supply if there is no reduction in domestic credit to the private sector (NDCp). Both NDCg and NDCp are monetary policy variables in the model.

Identity (7.26) defines the equilibrium in the money market between the supply of money (MS) and the demand for money (M).

Real money demand is assumed to be a Cobb-Douglas function of real permanent income (GDP^p) and the expected (domestic) nominal rate of interest ($R^{\#}$). The expected nominal rate of interest represents the difference between the real return to holding other assets (e.g., bonds or saving accounts, which offers the net return in terms of expected real rate of interest), and the cost of holding money (which is the expected rate of inflation). The Bank of Thailand loan rate is used as a proxy for the nominal rate of interest (in percent).

$$(M+M_{-1})/2/P = A.(GDP^p)^c.[(100+R)^{\#}]^d \qquad \ldots(7.27)$$

Both money demand and the rate of interest are measured at the middle of the year. The interest rate term is increased by 100 to avoid statistical problems in the unlikely event that the interest rate should become zero.

Permanent income and the expected rate of interest are defined as multiplicatively distributed lag functions of their own current and past values, with geometrically declining weights.

$$GDP^{p} = \prod_{i=0}^{\infty} GDP_{t-i}{}^{(1-b).b^{i}} \qquad \ldots(7.27a)$$

$$R^{\#} = \prod_{i=0}^{\infty} R_{t-i}{}^{(1-b).b^{i}} \qquad \ldots(7.27b)$$

We further assume that the weights of the above two equations are the same. This is equivalent to assuming that the demand for real money is explained by the partial adjustment hypothesis, where desired real money demand is a function of GDP and the actual (nominal) rate of interest.

Estimates were made in both in aggregate and per capita forms:

By OLS:

$$\ln[(M+M_{-1})/2/P] = \underset{(2.4042)}{7.4166} + \underset{(10.20)}{.8815} \ln[(M+M_{-1})/2/P]_{-1}$$

$$+ \underset{(1.3713)}{.1185} \ln GDP - \underset{(-2.3746)}{1.6243} \ln(100+R) \qquad \ldots(7.28a)$$

$\text{R-bar}^2 = .9892$; $Se = .0297$; Durbin-h $= 1.7884$; $F(1,14) = .427$

By OLS:

$$\ln [(M+M_{-1})/2/P/POP] = \underset{(2.5614)}{8.2909} + \underset{(1.9355)}{.1694} \ln(GDP/POP)$$

$$+ \underset{(9.4930)}{.8306} \ln [(M+M_{-1})/2/P/POP]_{-1}$$

$$- \underset{(-2.5684)}{1.8387} \ln (100+R) \qquad ...(7.28b)$$

$\bar{R}^2 = .9423$; Se = .0317; Durbin-h = 1.7678; $F(1,14) = .251$

Both equations were estimated with the restriction that they be homogenous degree one in income and lagged money demand, to satisfy the steady-state property that doubling real income will double the real money demand. These restrictions are confirmed by the F-tests.

Equation (7.28b) will be incorporated in the econometric model.

7.4 The Determination of Aggregate and Sectoral Prices

All prices in the model are prices after taxes, except when subscript b is attached.

7.4.1 Aggregate Output Prices

As discussed in Chapter 3, we determine the purchasers' non-agricultural output price (Pm) as a function of the money/output ratio (nominal money supply to real gross domestic product, MS/GDP) and the price of imports of goods and services, adjusted for import duties (Pim). The import price is included in the equation to represent the external cost effects of imported primary and intermediate inputs.

Estimates were made in both linear and log-linear forms:

By OLS:

$$Pm = \underset{(2.7844)}{.4529}\, Pm_{-1} + \underset{(2.7894)}{2.5269}\, [(MS+MS_{-1})/2/GDP] + \underset{(4.6300)}{.2415}\, Pim \qquad ...(7.29a)$$

$$\text{R-bar}^2 = .9805;\ Se = .0437;\ \text{Durbin-h} = 1.3365$$

By OLS:

$$\ln Pm = \underset{(2.0091)}{.4548} + \underset{(4.0853)}{.5883}\, \ln Pm_{-1} + \underset{(4.0048)}{.2042}\, \ln Pim + \underset{(1.8262)}{.2075}\, \ln[(MS+MS_{-1})/2/GDP] \qquad ...(7.29b)$$

$$\text{R-bar}^2 = .9775;\ Se = .0390;\ \text{Durbin-h} = 1.1334$$

(The money supply is measured at the middle of the year.) The intercept was suppressed in equation (7.29a) and homogeneity of degree one was imposed in equation (7.29b). Both restrictions were done to satisfy the long-run (stationary state) property that for a given GDP, doubling all prices and the money supply will double Pm.

Equation (7.29a) will be used in the econometric model, since it seems to fit somewhat better than equation (7.29b).

Other aggregate prices are determined by the following identities:

$$Pmb = Pm/[(1+tm)/1.15198] \quad \ldots(7.30)^4$$

$$Pa = Pab.(1+ta)/1.00695 \quad \ldots(7.31)$$

$$P = (Pa.Yas + Pm.Yms)/GDP \quad \ldots(7.32)$$

Note that the producers' price of agricultural output (Pab) is determined from the equilibrium between the demand for and the supply of agricultural output, as discussed in Chapter 3.

Identity (7.30) is to determine the producers' price of non-agricultural output (Pmb), which is equal to Pm divided by one plus its indirect tax rate (index).

Identity (7.31) is to define the purchasers' price of agricultural output (Pa) by adding indirect taxes to Pab. We index the tax rates to 1.00 in 1972 since the prices are indices. (All taxes are discussed in Chapter 5.)

Identity (7.32) is to obtain the purchasers' price of gross domestic product (P), which is equal to nominal GDP divided by real GDP.

7.4.2 Import Prices

Since Thailand is a small importer, we assume all import prices (before tariff, in $US) to be exogenously determined. Each import price, before tariff, in Thai baht is thus equal to its price in $US times the Thai exchange rate (ex), expressed as an index.

$$Pimcb = Pimcb\$^*.ex^*/20.8 \qquad ...(7.33)$$

$$Pimib = Pimib\$^*.ex^*/20.8 \qquad ...(7.34)$$

$$Pimrb = Pimrb\$^*.ex^*/20.8 \qquad ...(7.35)$$

$$Pimfb = Pimfb\$^*.ex^*/20.8 \qquad ...(7.36)$$

$$Pimob = Pimob\$^*.ex^*/20.8 \qquad ...(7.37)$$

$$Pims = Pims\$^*.ex^*/20.8 \qquad ...(7.38)$$

Pimc, Pimi, Pimr, Pimf, Pimo and Pims stand for the imported prices of consumer goods, capital goods, raw materials, fuels and lubricants, and other goods and services, respectively. Subscript b means the price is before import tariffs and $ denotes that the unit is in $US. Import prices, after tariffs, are determined by the prices before tariff time one plus the tariff rates, expressed as indices.

$$Pimc = Pimcb(1 + timc^*)/1.2706 \qquad ...(7.39)$$

$$Pimi = Pimib(1 + timi^*)/1.1902 \qquad ...(7.40)$$

$$Pimr = Pimrb(1 + timr^*)/1.0890 \qquad ...(7.41)$$

$$Pimf = Pimfb(1 + timf^*)/1.0796 \qquad ...(7.42)$$

$$Pimo = Pimob(1 + timo^*)/1.3650 \qquad ...(7.43)$$

The imported prices of goods and services both before and after import duties are then determined by identities (7.44a) and (7.44b), respectively.

$$Pimb = (Pimcb.IMc + Pimib.IMi + Pimrb.IMr + Pimfb.IMf + Pimob.IMo + Pims.IMs)/IM \quad ...(7.44a)$$

$$Pim = (Pimc.IMc + Pimi.IMi + Pimr.IMr + Pimf.IMf + Pimo.IMo + Pims.IMs)/IM \quad ...(7.44b)$$

7.4.3 Export Prices

Export prices after export duties are defined by the following identities.

$$Pea = Pab.(1+tea^*)/1.0000 \quad ....(7.45)$$

$$Pem = Pemb.(1+tem^*)/1.0136 \quad ....(7.46)$$

$$Pe = (Pea.Ea + Pem.Em)/E \quad ....(7.47)$$

Identity (7.45) defines the agricultural export price after export duties (Pea), which is equal to the producers' price of agricultural output (Pab) times one plus the export duty rate, expressed as an index. Since over the period of the study there were no export duties on agricultural goods, the export prices after duties were thus equal to the producers' price of agricultural output. Note that we do not have actual data for the export price of agricultural goods and have used the price of the agricultural output as a proxy.

Identities (7.46) and (7.47) define the export prices of non-agricultural goods and of total exports of goods and services.

The export price of non-agricultural goods before export duties (Pemb) is postulated to be a function of its lag, the producers' price of non-agricultural output (Pmb) and the price of world non-agricultural exports (approximated by the world export price of primary products, except crude petroleum (Pemw\$)).

By OLS:

$$\ln Pemb = \underset{(5.3305)}{.0933} + \underset{(1.0464)}{.1383} \ln Pemb_{-1} + \underset{(1.3845)}{.1890} \ln Pmb$$

$$+ \underset{(6.6178)}{.6727} \ln(Pemw\$^{*}.ex^{*}/20.8) \qquad \ldots(7.48)$$

$$\text{R-bar}^2 = .9707;\ Se = .0617;\ \text{Durbin-h} = 1.4699$$

The world export price is converted into Thai currency by our exchange rate index. The estimate of equation (7.48) was restricted to be homogeneous of degree one in $Pemb_{-1}$, Pmb and the world price. The estimate indicates that the export price is largely determined by the world price.

Equation (7.48) will be incorporated into the econometric model.

7.4.4 Other Sectoral Prices

All other sectoral prices are estimated as (geometrically) weighted averages of the (relevant) domestic price, the (relevant) import price, and its own lagged value. The estimates were restricted to be homogenous of degree one.

Several forms were attempted. The equations reported here are considered to be statistically superior to the others.

a. Price of investment goods

The purchasers' price of domestic investment goods (Pi) is a function of Pm and the import price (in domestic currency) of capital goods (Pimi) (averaged between this year and last year). The Pi_{-1} term was not significant and was dropped.

By C-O:

$$\ln Pi = \underset{(-.4711)}{-.0142} + \underset{(8.0087)}{.6785} \ln Pm + \underset{(3.7957)}{.3215} \ln [(Pimi+Pimi_{-1})/2] \qquad \ldots(7.49)$$

$$\bar{R}^2 = .9866;\ Se = .0393;\ D.W. = 1.9005;\ rho = \underset{(3.7920)}{.6664}$$

b. Price of consumer durable goods

The domestic purchasers' price of consumer durable goods (Pd) is a weighted average of Pm and the price of imported consumer goods (Pimc) (averaged between this year and last year). The Pd_{-1} term was not significant.

By C-O:

$$\ln Pd = \underset{(-.3672)}{-.0254} + \underset{(2.4390)}{.5790} \ln Pm + \underset{(1.7733)}{.4210} \ln [(Pimc+Pimc_{-1})/2] \qquad \ldots(7.50)$$

$$\bar{R}^2 = .9778;\ Se = .0516;\ D.W. = 1.2089;\ rho = \underset{(6.4724)}{.8363}$$

c. Price of consumer non-durable goods

The domestic purchasers' price of consumer non-durable goods (Pnd) is a weighted average of its lagged value, the GDP deflator (P) and the price of imported consumer goods.

By OLS:

$$\ln Pnd = \underset{(4.0527)}{.0331} + \underset{(5.3273)}{.3020} \ln Pnd_{-1} + \underset{(7.2509)}{.6908} \ln Pm$$

$$+ \underset{(.1222)}{.0072} \ln Pimc \qquad \text{...(7.51)}$$

$\text{R-bar}^2 = .9963$; Se = .0165; Durbin-h = .1989

d. Price of consumption of services

The domestic purchasers' price of consumption of services (Ps) is a weighted average of its lagged value and Pm.

By OLS:

$$\ln Ps = \underset{(2.3398)}{.0094} + \underset{(7.6770)}{.3663} \ln Ps_{-1} + \underset{(13.283)}{.6337} \ln Pm \qquad \text{...(7.52)}$$

$\text{R-bar}^2 = .9964$; Se = .0142; Durbin-h = -.6514

e. Prices of total consumer goods (Pc) and consumer durable and non-durable goods (Pd&nd)

Both prices are determined as identities, namely the ratio of their nominal values to their real values.

$$Pc = (Pd.Cd + Pnd.Cnd + Ps.Cs)/Cp \qquad \text{...(7.53)}$$

$$Pd\&nd = (Pd.Cd + Pnd.Cnd)/(Cd + Cnd) \qquad \text{...(7.54)}$$

FOOTNOTES TO CHAPTER 7

1. See section 5.2.2 and footnote 9, Chapter 5, for the discussion concerning with the partial adjustment concept and the speed of adjustment (n).

2. The IMc function in per capita terms was tried, but the results in both linear and log-linear forms were not satisfactory.

3. For the discussion concerned with the exchange arrangement and exchange control administrated by the Thai government, see IMF (1982).

4. The prices before indirect taxes are derived as follows:
   Let Pm = the purchasers' price of non-agricultural output
   Pmb = the producers' price of non-agricultural output
   tm = indirect tax rate on non-agricultural output
   Define Pm and tm as:

   $Pm = Pmb.(1+tm)/(1+tm_{1972})$

   $tm = ITm/(Pmb.Yms)$; where 1972 is the index base year

   Substitute tm into the Pm equation:

   $Pm = (Pmb+ITm/Yms)/[1+(ITm/Yms)_{1972}]$; since $Pmb_{1972} = 1.0$

   Pmb can thus be calculated as:

   $Pmb = Pm.[1+(ITm/Yms)_{1972}] - ITm/Yms$

   Other prices before indirect taxes are derived in the same way.

CHAPTER 8

ESTIMATION AND TESTS OF THE FINAL MODEL

Section 8.1 presents the complete model, incorporating the selected structural equations discussed in Chapters 4, 5, 6 and 7. The equations have been re-estimated by the method of two stage least squares, where appropriate, using a subset of the principal components obtained from the full set of predetermined variables in the model, as described below. The application of two stage principal component least squares is intended to provide consistent parameter estimates, the OLS estimator being inconsistent because of the simultaneous nature of the model.

In section 8.2, the model is tested for its forecasting ability and stability properties. The test of forecasting ability is carried out by (1) simulating with the model over the data period to assess its ability to replicate the actual levels of endogenous variables, as indicated by various summary measures, and (2) comparing the directions of change between the simulated and actual endogenous variables.

The stability tests are performed by (1) simulating over 50 years with all exogenous variables fixed at their initial levels to determine whether the model will tend toward a steady time path under such conditions, and (2) simulating the effects of a one-time shock to the exchange rate or the money supply to ascertain whether the model will return to a steady time path after its initial response to the shock.

8.1 The Estimated Model

The complete model consists of 32 behavioural equations and 94 identities. There are 18 policy variables and 28 other exogenous variables. The selected structural equations are reported with t-values (in parentheses), coefficients of determination adjusted for degree of freedom (R-bar^2), standard errors of estimate (Se), Durbin-Watson statistics (D.W.) or Durbin-h statistics (if they can be computed) instead of D.W. when the explanatory variables include lagged dependent variables. The values of the Durbin-h statistics are indicated by the symbol (!).[1]

The method used is reported for each equation in the listing of the model. OLS refers to ordinary least squares. C-O denotes the OLS method with a correction for first-order or second-order autocorrelation of error terms based on the Cochrane-Orcutt iterative procedure. 2SLS means two stage least squares, using principal components. F2SLS indicates the Fair (1970) two stage iterative procedure, which was applied whenever serial correlation problems occurred in the simultaneous equations system. When the Cochrane-Orcutt or

Fair procedures are applied, the estimated values of the autocorrelation coefficients are reported, together with their asymtotic t-values. In the case of a first-order process, a simple value for rho is shown; in the case of a second-order process, values are shown for rho1 and rho2 .

The principal components were obtained from all predetermined variables in the model.[2] The components were ordered according to their importance in explaining the total variation of the predetermined variables.

To obtain a suitable subset of the principal components, the first four, five, six and seven components were considered. These subsets accounted for 99.89, 99.95, 99.98 and 99.99 percent of total variation, respectively. The four subsets were then used to generate the estimated values of endogenous variables for insertion on the right hand sides of the equations to be estimated. The estimated values of the variables were found to be virtually the same for the subsets of five, six and seven components. We therefore chose the first five components for use in the first stage of the two stage least squares procedure. In the second stage of the two stage procedure, each equation was fitted using the actual predetermined variables, which it contains, as well as the computed endogenous variables based on the first stage principal component regression.

The Fair two stage procedure was applied to the equations in the simultaneous system which had an autocorrelation problem. The five selected principal components were also used as instrumental variables in the first stage regressions under the Fair procedure.

The equations which are recursively determined, or which contain only predetermined variables on the right side, were estimated by either OLS or OLS with the Cochrane-Orcutt procedure (C-O).

The detailed definitions of variables are presented in Appendix 1. As before, the symbol * indicates that a variable is exogenous, the symbol $ indicates measurement in $US, and a subscript -1 denotes a one-period lag. As stated previously, flow variables are measured over the length of the year and stocks are at the end of the year; policy variables are Bowg*, cg*, ex*, Iga*, Igm*, NDCg*, NDCp*, tda*, tdm*, tc*, tea*, tem*, timc*, timf*, timi*, timo*, timr* and tp*.

The equations are listed below. Following each equation are the values of R-bar^2 (R-bar^2 is not available (n.a.), when the Fair procedure is applied), Se, D.W. (or Durbin-h), and the symbol representing the method of estimation, in that order. (In equation (2), for example, R-bar^2 = .996, Se = .0178, D.W. = 1.94, and the Cochrane-Orcutt method was used.)

A. SUPPLY

A.1. Aggregate Production Functions and Fixed Capital Stocks

The production function for total agricultural output:

(1) $Qas = 1.2569\ Yas.(Pab/Pmb)^{.20157}$

The agricultural value added production function:

(2) $\ln Yas = \underset{(9.1524)}{5.6308} + \underset{(2.5604)}{.2005} \ln Ka_{-1}$

$+ \underset{(2.5558)}{.4033} \ln Na + \underset{(3.3587)}{.3962} \ln (L^*-DL^*)$

$+ \underset{(1.9775)}{.1131}\ rf^* + \underset{(3.0266)}{.0169}\ t^*$ .996 .0178 1.94 C-O
rho=-.4977
(-2.4348)

The production function for total non-agricultural output:

(3) $Qms = 2.0561\ Yms.(Pmb/Pab)^{.2462}$

The non-agricultural value added production function:

(4) $\ln Yms = \underset{(3.8074)}{6.9341} + \underset{(1.3612)}{.2518} \ln Km_{-1}$

$+ \underset{(4.0446)}{.7482} \ln Nm + \underset{(2.1579)}{.0284}\ t^*$ .999 .0168 2.15 C-O
rho1=1.2094; rho2=-.5894
(6.3513) (-3.9054)

Fixed capital stocks in agriculture:

(5) $Ka = Kga + Kpa$

(6) $Kga = (1-da).Kga_{-1} + Iga^*$

(7) $Kpa = (1-da).Kpa_{-1} + Ipa$

$da = 0.0364$; from equation (47)

Fixed capital stocks in non-agriculture:

(8) $Km = Kgm + Kpm$

(9) $Kgm = (1-dm).Kgm_{-1} + Igm*$

(10) $Kpm = (1-dm).Kpm_{-1} + Ipm$

$dm = 0.0404$; from equation (48)

Total fixed capital stock:

(11) $K = Ka + Km$

A.2 Labour Market

Population and total labour supply:

(12) $POP = POP_{-1}.(1+g*/100)$

(13) $N = N_{-1}.(1+gl*/100)$

Wage determination in agriculture

(agricultural labour demand):

(14) Wa/Pab = .00032823 (Yas/Na) (53.919)	.886	.0769	1.94 rho=-.5767 (-1.7292)	C-O

Wage determination in non-agriculture

(non-agricultural labour demand):

(15) Wm/Pmb = .000045399 (Yms/Nm) (30.564)	.706	.0996	1.46	OLS

Rural labour supply:

(16) $Na = N - Nm$

Ratio of labour supplies (rural-urban labour migration):

$$(17)\ \ln (Nm/Na) = \underset{(-49.583)}{-1.0670} + \underset{(5.0739)}{.6154} \ln (Wm/Wa)_{-1}$$

$$+ \underset{(9.7193)}{.2607} D_{74-78} \qquad .848 \quad .0470 \quad 1.50 \quad \text{OLS}$$

$$D_{74-78} = 0 \;;\; \text{for } 1960\text{-}73$$
$$= 1 \;;\; \text{for } 1974\text{-}78$$

B. DEMAND

B.1 Aggregate Demand for Goods and Services

Total demand for agricultural output:

$$(18)\ Qad = .0528\ Qad + .1211\ (Pmb/Pab).Qmd + Yad$$

Final demand for agricultural output:

$$(19)\ Yad = Ca + IVa^{*} + Ea - IMa$$

Total demand for non-agricultural output:

$$(20)\ Qmd = .1589\ (Pab/Pmb).Qad + .3870\ Qmd + Ymd$$

Final demand for non-agricultural output:[3]

$$(21)\ Ymd = Cm + Cg + \bar{I} + IVm + Em - IMm$$

Total output:

$$(22)\ Q = Qas + Qms\ (= Qad + Qmd)$$

Gross domestic product:

$$(23)\ GDP = Yas + Yms$$

Total final demand:

$$(24)\ GDP = Yad + Ymd$$

National, personal, disposable
and net disposable income:

(25) NI = P.GDP-Pi.Da-Pi.Dm-IT+NFIfW*

(26) PI = NI-Sc-Tc-PROg*+INg+INp*+TfGtH*+TfWtH*

(27) DPI = PI-Tp-TfHtG*

(28) NDPI = DPI-INp*-TfHtW*

Personal consumption of agricultural
and non-agricultural products:

(29) Cp = Ca + Cm

(30) Cm = (Cnd - Ca) + Cd + Cs

Consumption of agricultural products:

(31) Ca/POP = 239.58 + .1576 (NDPI/Pa)/POP
(5.2207)(29.605)

-75.254 Pa/Pc   .979 12.46 1.62 2SLS
(-1.5033)

Consumption of non-durable goods:

(32) $Cnd/POP = .6607\ (Cnd/POP)_{-1}$
(2.6277)

+ .2250 (NDPI/Pnd)/POP
(1.5837)

- 2883.2 Pnd/Pc
(-2.6680)

+ $2919.7\ (Pnd/Pc)_{-1}$
(2.6155)   .997 18.70 1.57 2SLS

Consumption and stock of durable goods:

(33) $Cd/POP = .0913\ (NDPI/Pd)/POP$
(9.1875)

$- 92.113\ Pd/Pc$
(-3.4613)

$- .0738\ (Kd/POP)_{-1}$ .783 15.14 1.66 2SLS
(-3.9701)

(34) $Kd = (1-dd).Kd_{-1} + Cd$

$dd = 0.0667$; (see Appendix 4)

Consumption of services:

(35) $Cs/POP = .7675\ (Cs/POP)_{-1}$
(5.4290)

$+ .0420\ (NDPI/Ps)/POP$ .982 14.59 .30! 2SLS
(1.9503)

Gross and net fixed investment:

(36) $I = Ip + Ig$

(37) $Ip = Ipa + Ipm$

(38) $Ipa = Ipan + da.Kpa_{-1}$

(39) $Ipmn = Ipm - dm.Kpm_{-1}$

Private net fixed investment in agriculture:

(40) $Ipan = 1310.8 + .1761\ Yas - .2175\ Kpa_{-1}$
$(.9213)(3.1191)\quad(-2.6648)$

$- 2482.1\ (Pi/Pab)$ n.a. 393.1 2.27 F2SLS
(-1.7225) rho=-.3229
(-1.3343)

Private gross fixed investment in non-agriculture:

(41) Ipm = 37777.0 + .2558 Yms
(6.0148) (20.513)

- 43096.0 (Pi/Pmb) - 343.49 r .967 1585.9 1.84 2SLS
(-5.8776) (-3.8312)

Total, domestic and foreign savings:

(42) S = Sd + Sf

(43) Sd = Sp + Sc + Sg + Pi.(Da+Dm)

(44) Sf = - BOC

Personal and government savings:

(45) Sp = NDPI - Pc.Cp

(46) Sg = Tp + Tc + IT + PROg* + TfHtG* + TfWtG*

- TfGtH* - TfGtW* - INg - Pm.Cg

Depreciation in fixed capital stock

in agriculture and non-agriculture:

(46) Da = $da.Ka_{-1}$; da = 0.0364
(9.1062) .878 162.3 1.43 C-O
rho= .8142
(5.9499)

(47) Dm = $dm.Km_{-1}$; dm = 0.0404
(16.9940) .983 580.6 1.16 C-O
rho= .8382
(6.5207)

Corporate profit and saving:

(49) ln PR =-8.9223 + 1.4631 $\ln(P.GDP)_{-1}$
(-6.8151)(13.200) .975 .1440 1.61 C-O
rho= .6049
(3.2225)

(50) $Sc = 49.3460 + .8015\ (PR-Tc)$ .997 144.4 1.51 OLS
$\qquad\qquad (1.4259)\ (50.537)$

B.2 The Government Sector

Government revenue:

(51) $Grev = Tp + Tc + IT + PROg^* + TfHtG^* + TfWtG^* - TfGtH^* - TfGtW^*$

Personal income tax:

(52) $Tp = tp^*.PI$

Corporate income tax:

(53) $Tc = tc^*.PR$

Indirect taxes less subsidies:

(54) $IT = ITim + ITe + ITd$

Import duties:

(55) $ITim = ITimc + ITimi + ITimr + ITimf + ITimo$

(56) $ITimc = timc^*.(Pimcb.IMc)$

(57) $ITimi = timi^*.(Pimib.IMi)$

(58) $ITimr = timr^*.(Pimrb.IMr)$

(59) $ITimf = timf^*.(Pimfb.IMf)$

(60) $ITimo = timo^*.(Pimob.IMo)$

Export duties:

(61) $ITe = ITea + ITem$

(62) $ITea = tea^*.(Pab.Ea)$

(63) $ITem = tem^*.(Pemb.Em)$

Domestic indirect taxes on final demand:

(64) $ITd = ITda + ITdm$

(65) $ITda = tda^{*}.(Pab.Yad)$

(66) $ITdm = tdm^{*}.(Pmb.Ymd)$

Implicit indirect taxes on value added:

(67) $ITm = IT - ITa$

(68) $ITa = tia^{*}.ITimc + ITea + ITda$

(69) $ta = ITa/(Pab.Yas)$

(70) $tm = ITm/(Pmb.Yms)$

Government expenditure:

(71) $Gex = Pm.Cg + Pi.Ig + INg$

Interest payments on government debt:

(72) $INg = -136.62 + .0600\ Gdebt_{-1}$
(-3.7671) (75.308) .997 93.38 1.58 OLS

Government consumption of goods and services:

(73) $Cg = cg^{*}.GDP$

Government gross fixed investment:

(74) $Ig = Iga^{*} + Igm^{*}$

Government debt and deficit:

(75) $Gdebt = Gdebt_{-1} + Gdef$

(76) $Gdef = Gex - Grev$

Government budget constraint:

(77) Gex = Grev + NDCg* + BOWg* + ADg

B.3 Foreign Trade and Foreign Exchange Markets

Balance on current account:

(78) BOC = Pe.E - Pimb.IM + NFIfW* + TfWtH*

+ TfWtG* - TfHtW* - TfGtW*

Balance of payments:

(79) BOP = BOC + If* + BOWg*

Net foreign assets:

(80) NFA = NFA_{-1} + BOP + AD*

Imports of agricultural and non-agricultural goods:

(81) IM = IMa + IMm

(82) IMm = (IMc-IMa) + IMi + IMr + IMf + IMo + IMs

Imports of agricultural goods:

(83) ln IMa = -.3191 + .6776 ln IMa_{-1}
(-.4176) (4.5811)

+ .2034 ln(NDPI/Pimc)
(3.0090)

- 2.3832 ln(Pimc/Pa) .808 .0660 -.86! 2SLS
(-3.6926)

Imports of consumer goods:

(84) $\ln IMc = 2.3391 + .2865 \ln IMc_{-1}$
$(2.7519)(1.7789)$

$+ .3170 \ln(NDPI/Pimc)$
(3.7417)

$- 1.3671 \ln(Pimc/Pd\&nd)$ .793 .0639 .007! 2SLS
(-3.8760)

Imports of capital goods:

(85) $\ln IMi = -6.5715 + 1.3124 \ln GDP$
$(-7.8446)\ (18.871)$

$-2.1756 \ln(Pimi/Pi)$ .946 .0945 2.22 2SLS
(-10.628)

Imports of intermediate products and raw materials:

(86) $\ln IMr = -3.9566 + .4458 \ln IMr_{-1}$
$(-2.5948)(4.3256)$

$+ .7606 \ln GDP$
(3.8743)

$- .9450 \ln(Pimr/Pm)$ .993 .0576 -.65! 2SLS
(-6.2179)

Imports of fuels and lubricants:

(87) $\ln IMf = -6.7200 + 1.2234 \ln GDP$
$(-10.2910)(21.8270)$

$- .1112 \ln(Pimf/Pm)$ .966 .0798 2.37 2SLS
(-1.9844)

Imports of other goods:

(88) $\ln IMo = -4.9394 + 1.0795 \ln GDP$
$(-8.2247)(21.875)$

$-1.3445 \ln(Pimo/Pm)$ .964 .0685 1.65 2SLS
(-12.832)

Imports of services:

(89) $\ln IMs = -10.3710 + 1.5610 \ln GDP$
(-15.889)(28.164)

$- 1.7683 \ln(Pims/Pm)$ .976 .0751 1.55 2SLS
(-12.118)

Exports of agricultural and non-agricultural goods:

(90) $E = Ea + Em$

(91) $Ea = 1197.8 + 3302.2\ GDPw\$^*.(ex^*/20.8)$
(.2546) (1.9750)

$-469.65\ Pea/(Peaw\$^*.ex^*/20.8)$ .487 699.9 1.29 2SLS
(-.1376)

(92) $\ln Em = 10.250 + 1.5086 \ln[GDPw\$^*.(ex^*/20.8)]$
(166.45) (7.2095)

$-.9309 \ln[Pem/(Pemw\$^*.ex^*/20.8)]$ n.a. .0909 1.70 F2SLS
(-2.7011) rho= .5542
(2.7530)

B.4 The Money Market

Demand for money:

(93) $\ln[(M+M_{-1})/2/P/POP] = 9.9985 + .1842 \ln(GDP/POP)$
(2.4684)(1.9174)

$+ .8158 \ln[(M+M_{-1})/2/P/POP]_{-1}$
(8.4910)

$- 2.2096 \ln(100+R)$ .941 .0292 1.63! 2SLS
(-2.4648)

Money supply and money market equilibrium condition:

(94) $MS = NFA + NDCg^* + NDCp^*$

(95) M = MS

Real rate of interest and rate of inflation:

(96) $r = [(R - g_P) + (R_{-1} - g_{P_{-1}})]/2$

(97) $g_P = 100.(P-P_{-1})/P_{-1}$

C. MARKET EQUILIBRIUM CONDITIONS

Equilibrium in the commodity market:

(98) Qas = Qad

(99) Qms = Qmd

Aggregate prices:

(100) $Pm = .4237\ Pm_{-1} + 2.6890\ (MS+MS_{-1})/2/GDP$
(2.7555) (3.1545)

$+ .2484\ Pim$ .980 .0400 1.35! 2SLS
(5.0561)

(101) Pa = Pab.(1+ta)/1.00695

(102) Pmb = Pm/[(1+tm)/1.15198]

(103) P = (Pa.Yas + Pm.Yms)/GDP

Import prices:

(104) Pimcb = Pimcb$*.ex*/20.8

(105) Pimib = Pimib$*.ex*/20.8

(106) Pimrb = Pimrb$*.ex*/20.8

(107) Pimfb = Pimfb$*.ex*/20.8

(108) Pimob = Pimob$*.ex*/20.8

(109) Pims = Pims$*.ex*/20.8

(110) Pimb = (Pimcb.IMc + Pimib.IMi + Pimrb.IMr
+ Pimfb.IMf + Pimob.IMo + Pims.IMs)/IM

(111) Pimc = Pimcb(1 + timc*)/1.2706

(112) Pimi = Pimib(1 + timi*)/1.1902

(113) Pimr = Pimrb(1 + timr*)/1.0890

(114) Pimf = Pimfb(1 + timf*)/1.0796

(115) Pimo = Pimob(1 + timo*)/1.3650

(116) Pim = (Pimc.IMc + Pimi.IMi + Pimr.IMr
+ Pimf.IMf + Pimo.IMo + Pims.IMs)/IM

Export prices:

(117) Pea = Pab.(1+tea*)/1.0000

(118) Pem = Pemb.(1+tem*)/1.0136

(119) Pe = (Pea.Ea + Pem.Em)/E

(120) ln Pemb = .0936 + .1354 ln $Pemb_{-1}$
(5.8503) (1.1204)

+ .6714 ln(Pemw$*.ex*/20.8)
(7.2308)

+ .1932 ln Pmb .971 .0564 1.42! 2SLS
(1.5440)

Other prices:

(121) ln(Pi/Pm) = .3767 ln[{(Pimi+$Pimi_{-1}$)/2}/Pm]
(5.1947)

- .0067 n.a. .0488 1.76 F2SLS
(-.3082) rho= .2946
(1.2022)

(122) $\ln (Pd/Pm) = .2775 \ln[\{(Pimc+Pimc_{-1})/2\}/Pm]$
(1.5069)

$- .0400$ n.a. .0427 1.03 F2SLS
(-.5353) rho= .8966
(8.5900)

(123) $\ln Pnd = .0354 + .3003 \ln Pnd_{-1}$
(3.9166)(5.2140)

$+ .6719 \ln P$
(6.2195)

$+ .0278 \ln Pimc$ .996 .0151 .243! 2SLS
(.4138)

(124) $\ln Ps = .0090 + .3577 \ln Ps_{-1}$
(2.3582)(7.7915)

$+ .6423 \ln Pm$ .996 .0134 -.58! 2SLS
(13.990)

(125) Pc = (Pd.Cd + Pnd.Cnd + Ps.Cs)/Cp

(126) Pd&nd = (Pd.Cd + Pnd.Cnd)/(Cd + Cnd)

Note that equation (3) will be dropped to satisfy the general equilibrium condition discussed in Chapter 3.

8.2 The Tests

The solution of the model for simulation purposes was effected by using the Gauss-Seidel procedure in the Time Series Processor (TSP) computer programme written by B. H. Hall and R.E. Hall. This programme has been implemented to the Cyber 170 system at McMaster University by K. Scott.

Equation (1a) (below) is used instead of equation (1) to determine the producers' price of agricultural output (Pab). (The use of equation (1) was found to result in practical difficulties in obtaining a computer solution with the model.)[4]

Equation (1a) assumes that the ratio of the producers' agricultural to non-agricultural prices (Pab/Pmb) is a negative function of the corresponding value added ratio (Yas/Yms), and positive function of the corresponding final demand ratio (Yad/Ymd). The equation was estimated in the log-linear form:

$$\text{(1a)}\quad \ln(Pab/Pmb) = \underset{(-4.0650)}{-.0533} + \underset{(21.367)}{.5258} \ln(Yad/Ymd) \underset{(-24.1650)}{- 1.0002} \ln(Yas/Yms) \qquad .980 \quad .0118 \quad 1.42 \quad \text{2SLS}$$

All of the simulation experiments are dynamic; that is to say, the current endogenous values generated by the model are used in the next period as lagged values.

In solving the system, equations estimated by the Cochrane-Orcutt or Fair procedure are modified to incorporate the autocorrelated error components. Thus an equation of form (a) below is transformed into form (b):

$$\text{(a)}\quad \hat{Y} = \hat{a} + \hat{b}.X + \hat{u}\ ;\ \text{where}\ \hat{u} = \hat{\rho}.\hat{u}_{-1} + \hat{e},\ \text{and}$$

$$\hat{e} = \text{non-autocorrelated random term}$$

$$\text{(b)}\quad \hat{Y} = \hat{a} + \hat{b}.X + \hat{\rho}.(\hat{Y}_{-1} - \hat{a} - \hat{b}.X_{-1})$$

Similarly, for a log-linear equation the transformed form is:

$$\widehat{\ln Y} = \hat{a} + \hat{b}.\ln X + \hat{\rho}.(\widehat{\ln Y}_{-1} - \hat{a} - \hat{b}.\ln X_{-1})$$

8.2.1 The Tests of the Forecasting Ability

Two tests were attempted. First, the model was used to simulate the historical period 1963-1978 and the simulated and actual values of the endogenous variables were compared. (The starting year is 1963 rather than 1960 since there are lags of up to three years in the model.) Secondly, the directions of change of the simulated and actual endogenous variables were compared.

a. Historical Simulation

Chart 8.1 presents results for 12 selected variables from the historical simulation and compares them with the actual values. The variables are gross domestic product (GDP), the GDP deflator (P), agricultural value added (Yas), non-agricultural value added (Yms), total personal consumption (Cp), total gross fixed investment (I), total exports of goods and services (E), total imports of goods and services (IM), balance of payments (BOP), government deficit (Gdef), total fixed capital stock (K) and the ratio of labour employed in non-agriculture to total labour employed (Nm/N). Results for other variables are reported in Appendix 6.

Note that the symbols for variables in Chart 8.1 are in capital letters (YAS rather than Yas, for example). Sl at the end of a variable symbol indicates a simulated value.

The following statistical criteria are applied in analysing the forecasting ability of the model:

(1) Correlation Coefficient

(2) Root-Mean-Square Error: $RMSE = \sqrt{1/T \sum_{t=1}^{T} (P_t - A_t)^2}$

(3) Mean Absolute Error: $MAE = 1/T \sum_{t=1}^{T} |P_t - A_t|$

(4) Mean Error: $ME = 1/T \sum_{t=1}^{T} (A_t - P_t)$

(5) Coefficient of Regression of Actual on Predicted Values

(6) Theil's Inequality Coefficient:

$$U = RMSE \Big/ \left[\sqrt{1/T \sum_{t=1}^{T} P_t^2} + \sqrt{1/T \sum_{t=1}^{T} A_t^2} \right]$$

where P_t denotes a predicted value for year t and A_t denotes an actual value.

The values of U are between 0 and 1. If U = 0, $P_t = A_t$ for all t and the forecast is perfect. U = 1 indicates the worst possible prediction. Values of U less than 0.3 or 0.4 are considered not to be unduly large. (See Theil, 1961, pp. 30-39.)

Theil (1961 and 1966, pp. 26-35) has shown that the square of the numerator of the inequality coefficient, which is the Mean-Square-Error (MSE), can be decomposed as follows:

$$U^M = (\bar{P} - \bar{A})^2/MSE$$

$$U^S = (S_P - S_A)^2/MSE$$

$$U^C = [2.(1-r).S_P.S_A]/MSE$$

$$U^M + U^S + U^C = 1$$

where $\bar{P}$, $\bar{A}$, S_P and S_A are the means and standard deviations of the P and A series, respectively, and r is the coefficient of correlation between P and A. U^M, U^S and U^C are the proportions of inequality (error) due to bias, differences of variation and differences of co-variation, respectively. U^M is an indication of systematic error, since it measures the difference between the means of the predicted and actual series. U^S indicates the ability of the model to reproduce the degree of variation of the actual series. If U^S is large, it means that the predicted series fluctuates considerably, while the actual series does not, or vice versa. U^C measures the remaining error, which may be regarded as unsystematic. For any value of $U > 0$, we would wish U^M to be close to 0. The ideal result would be $U^M = U^S = 0$ and $U^C = 1$. Values of U^M above 0.1 or 0.2 may be considered large, indicating the presence of a systematic bias in the model. (See Pindyck and Rubinfeld, 1976, pp. 364-365.)

Theil has also suggested an alternative decomposition of MSE into the fractions of error due to bias (U^M), to difference of the regression coefficient from unity (U^R) and to residual variance (U^D).

$$U^R = (S_P - r.S_A)/MSE$$

$$U^D = [(1 - r^2).S_A{}^2]/MSE$$

$$U^M + U^R + U^D = 1.$$

Again, the ideal result would be $U^M = U^R = 0$ and $U^D = 1$.

Most variables performed reasonably well in the simulation tests, as indicated by Chart 8.1 and Appendix 6. The forecasts are less accurate for some variables during the period 1973-75, which may be due to the unexpected increase in the price of oil (especially in 1973-74), the domestic political instability and overthrow of the military government (1973-75), and the worsening of the Vietnam War and ultimate victory of North Vietnam (1974-75).

It should also be noted that many equations in the model were estimated with a restriction to satisfy certain steady-state properties. This may make the model less accurate in short-run (1 year) forecasts, though more suitable for medium-run (3 years or more) forecasts.

The type of simulation is also a consideration. Dynamic simulation (as used here) is suitable for testing the robustness of the model and is appropriate for medium-term forecasts. However, static simulation (as it is called) using actual lagged endogenous variables, may be more suitable for assessing the year-to-year forecasting ability.

Based on Theil's inequality coefficient (U), most variables perform well, having values of U much less than 0.1. Only BOP has a U value, which may be considered large (0.41). However, the fact that BOP has small values of U^M and U^S (their sum is less 0.1) indicates that the errors are mostly unsystematic. Other variables with values of U greater than 0.1 are; BOC (.20), Cd (.12), g_p (.29), g_Y (.22), IMa (.14), PR (.13), r (.38), R (.21), Sc (.13), Sp (.11) and Tc (.13). All of the foregoing variables have values of U^M much less than 0.1, and values of U^C close to one, indicating again that errors are largely unsystematic.

With regard to bias, the following variables have values of U^M greater than 0.1: Cnd (.30), Cp (.17), Gdef (.11), IMi (.19), K (.41), Ka (.70), Km (.34) and Pi (.17). The values of U^M for Cnd, Km, K and Ka especially are rather high. However, the overall inequality measure (U) is less than 0.1 in every case.

The other statistical measures generally indicate similar patterns and lead to the same conclusions.

b. Predicting the direction of change

Table 8.1 displays some results relating to the ability of the model to forecast correctly the directions of change of the endogenous variables. Results for the same 12 variables as before are presented, based on the same historical simulation. The table shows the numbers of correct predictions as ratios to the total of 15 year-to-year predictions of change over the period 1963-1978.

Table 8.1 Proportions of correct predictions of directions of change for selected variables

GDP	P	Yas	Yms	Cp	I
15/15	10/15	13/15	15/15	15/15	13/15
E	IM	BOP	Gdef	K	Nm/N
13/15	12/15	9/15	13/15	15/15	9/15

In most cases the direction of change was predicted reasonably well, although for BOP and Nm/N the success rate was about 60 percent, which is not high. These latter results may indicate problems associated with the equations in the foreign trade and foreign exchange markets and in the labour market.

Note that the labour market is treated in a highly aggregated manner; the rural-urban allocation of labour is explained only by relative wage rates (in equation (17)). Other variables (including non-economic ones) may influence labour supply and migration but have not been taken account of in the model.

The relatively inaccurate prediction of direction of change of the balance of payments is, in fact, quite common in econometric forecasting and simulation, it may be noted.

8.2.2 Tests for Stability

The first test for stability involves simulation for 50 years with all exogenous variables fixed at their 1961 levels. We refer to this as the "standard run". The results for 6 selected variables (GDP, P, Yas, Yms, I and BOP) are shown in Chart 8.2.

First, we can conclude that the model is stable. Secondly, the growth rate for every variable is decreasing, indicating that the model is moving towards a steady state. (BOP may be considered to be already at its steady-state level.) Note that the changes in the variables are generally quite small. For instance, the value of GDP in the first period (year 4) is 77,885, which is equivalent to its actual 1962 value, while the value of GDP in the 50th period is 96,130, which is equivalent to the actual value of GDP in 1965.

The second stability test involves a shock to the standard run in the form of a one-time devaluation (reduction of the exchange rate) by 10 percent in year 6 only. (The rate is returned to its former level from year 7 onwards.) The results are compared with the standard run in Chart 8.2, and they indicate clearly that the model is stable. The multiplier effects of the shock are temporary. The model moves back towards the time path traced out in the standard run after a reasonable length of time.

The third stability test involves a shock to the standard run in the form of a one-time increase in the money supply of 10 percent in year 5 only, through an increase in net domestic credit to the private sector (NDCp). Comparison of the results with those of the standard run is made in Chart 8.3, and they confirm again the conclusion that the model is stable.

The final stability test involves an increase in the level of NDCp equal to 10 percent of the money supply in 1961, and the maintenance of the increase (from year 4 to year 50) as a sustained shock to the standard run. The results (Chart 8.4) display the longer (positive) multiplier effects on all variables that one would expect. However, each variable approaches its value in the (unshocked) standard run. Thus monetary policy seems to have only short-run effects.

It is of interest to note that a one-time 10 percent devaluation seems to have larger multiplier effects than a sustained 10 percent increase in the money supply.

FOOTNOTES TO CHAPTER 8

1. Significance tests based on the t-distribution, the distribution of D.W., and so on, are strictly valid only for the standard regression model with normally distributed errors. However, we shall follow common practice and use the test statistics for our equations estimated by principal component 2SLS or other methods on the assumption that they are valid as approximate indicators of significance.

2. For detailed discussion concerned with the use of principal components in 2SLS estimation, see, for example, Kloek and Mennes (1960, pp. 45-61) and Klein (1969, pp. 171-192).

3. We treat the change in agricultural inventory (IVa) as an exogenous variable, while the change in non-agricultural inventory (IVm) is residually determined in the model. Since we define GDP from both the value added and final demand sides (equations (23) and (24), respectively).

4. While Newton's procedure in TSP can solve a smaller version of the model (including equations (1) and (18)), the Gauss-Seidel and the Fletcher-Powell procedures cannot. Unfortunately, Newton's procedure cannot be applied, using the McMaster version of TSP, for a model of more than 50 equations due to insufficient memory. We solve the problem by using equation (1a) instead of equation (1) and use the Gauss-Seidel procedure in TSP to obtain a solution.

Chart 8.1 Selected Variables from the Historical Simulation

```
COMPARISON OF ACTUAL AND PREDICTED SERIES
******************************************

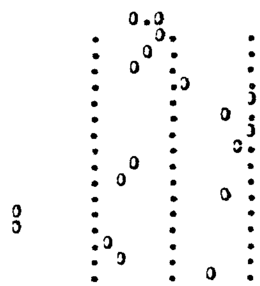
     ACTUAL: GDP          PREDICTED: GDPS1

SAMPLE =          4        19

CORRELATION COEFFICIENT =      .9957                          (SQUARED =     .9914      )
ROOT-MEAN-SQUARED ERROR =      5315.
MEAN ABSOLUTE ERROR =      4479.
MEAN ERROR =     -1001.
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED =      .9643
THEIL"S INEQUALITY COEFFICIENT =      .1574E-01
FRACTION OF ERROR DUE TO BIAS =      .3550E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION =      .1021
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION =      .8624
ALTERNATIVE DECOMPOSITION   (LAST 2 COMPONENTS):
     FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY =      .1310
     FRACTION OF ERROR DUE TO RESIDUAL VARIANCE =      .8335
```

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

PLOT OF RESIDUALS(O)



	ACTUAL	FITTED	RESIDUAL
1963	.8654E+05	.8780E+05	-.126E+04
1964	.9226E+05	.9368E+05	-.142E+04
1965	.9954E+05	.1027E+06	-.311E+04
1966	.1117E+06	.1105E+06	.117E+04
1967	.1204E+06	.1147E+06	.567E+04
1968	.1306E+06	.1265E+06	.410E+04
1969	.1409E+06	.1353E+06	.559E+04
1970	.1501E+06	.1455E+06	.457E+04
1971	.1571E+06	.1603E+06	-.325E+04
1972	.1646E+06	.1680E+06	-.342E+04
1973	.1801E+06	.1768E+06	.335E+04
1974	.1900E+06	.2012E+06	-.112E+05
1975	.2035E+06	.2146E+06	-.111E+05
1976	.2225E+06	.2276E+06	-.511E+04
1977	.2383E+06	.2428E+06	-.394E+04
1978	.2668E+06	.2636E+06	.325E+04

```
COMPARISON OF ACTUAL AND PREDICTED SERIES
******************************************

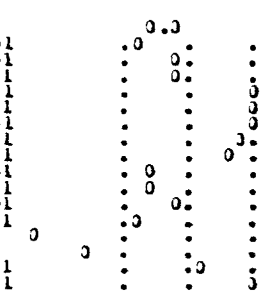
     ACTUAL: P            PREDICTED: PS1

SAMPLE =          4        19

CORRELATION COEFFICIENT =      .9839                          (SQUARED =     .9681      )
ROOT-MEAN-SQUARED ERROR =      .5430E-01
MEAN ABSOLUTE ERROR =      .5332E-01
MEAN ERROR =     -.7443E-02
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED =      .9212
THEIL"S INEQUALITY COEFFICIENT =      .2740E-01
FRACTION OF ERROR DUE TO BIAS =      .1340E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION =      .1172
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION =      .8694
ALTERNATIVE DECOMPOSITION   (LAST 2 COMPONENTS):
     FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY =      .1792
     FRACTION OF ERROR DUE TO RESIDUAL VARIANCE =      .8074
```

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

PLOT OF RESIDUALS(O)



	ACTUAL	FITTED	RESIDUAL
1963	.7866	.8363	-.497E-01
1964	.8093	.8287	-.194E-01
1965	.8469	.8615	-.146E-01
1966	.9077	.8467	.610E-01
1967	.8995	.8320	.675E-01
1968	.8941	.8341	.600E-01
1969	.9122	.8531	.591E-01
1970	.9065	.8699	.366E-01
1971	.9205	.9534	-.329E-01
1972	1.000	1.041	-.408E-01
1973	1.202	1.214	-.123E-01
1974	1.429	1.479	-.507E-01
1975	1.468	1.626	-.158
1976	1.517	1.625	-.108
1977	1.646	1.626	.194E-01
1978	1.789	1.726	.634E-01

Chart 8.1 Continued

COMPARISON OF ACTUAL AND PREDICTED SERIES
****

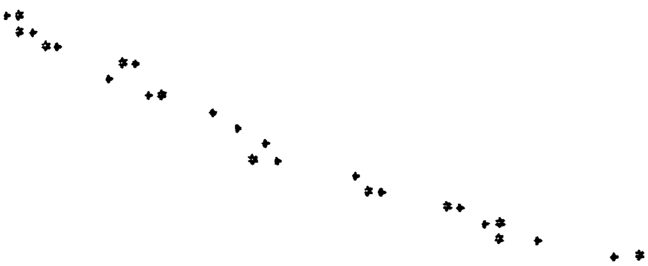
ACTUAL: YAS   PREDICTED: YASS1

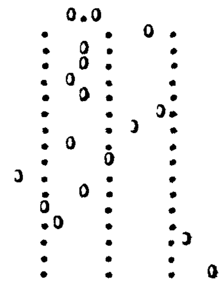
SAMPLE = 4 19

CORRELATION COEFFICIENT = .9956   (SQUARED = .9913)
ROOT-MEAN-SQUARED ERROR = 1144.
MEAN ABSOLUTE ERROR = 937.9
MEAN ERROR = -255.9
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9967
THEIL'S INEQUALITY COEFFICIENT = .1101E-01
FRACTION OF ERROR DUE TO BIAS = .5402E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .1152E-03
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9459
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .1201E-02
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .9448

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	.3411E+05	.3337E+05	742.
1964	.3461E+05	.3500E+05	-383.
1965	.3593E+05	.3637E+05	-434.
1966	.4087E+05	.4151E+05	-639.
1967	.3983E+05	.4036E+05	-530.
1968	.4371E+05	.4282E+05	889.
1969	.4702E+05	.4661E+05	413.
1970	.4833E+05	.4910E+05	-767.
1971	.5054E+05	.5044E+05	99.1
1972	.4992E+05	.5147E+05	-.155E+04
1973	.5624E+05	.5674E+05	-502.
1974	.5696E+05	.5819E+05	-.123E+04
1975	.6208E+05	.6293E+05	-853.
1976	.6590E+05	.6458E+05	.132E+04
1977	.6554E+05	.6828E+05	-.274E+04
1978	.7506E+05	.7315E+05	.191E+04





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

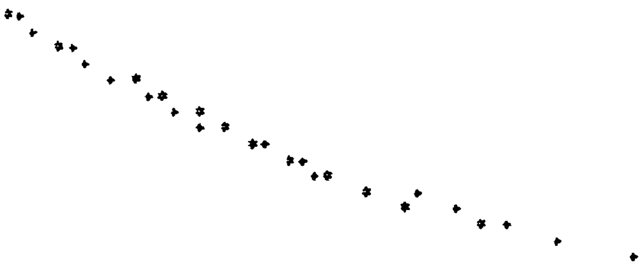
ACTUAL: YMS   PREDICTED: YMSS1

SAMPLE = 4 19

CORRELATION COEFFICIENT = .9937   (SQUARED = .9874)
ROOT-MEAN-SQUARED ERROR = 4999.
MEAN ABSOLUTE ERROR = 4116.
MEAN ERROR = -735.5
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9533
THEIL'S INEQUALITY COEFFICIENT = .2133E-01
FRACTION OF ERROR DUE TO BIAS = .2165E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .1171
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .8612
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .1548
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .8236

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	.5243E+05	.5444E+05	-.200E+04
1964	.5765E+05	.5868E+05	-.103E+04
1965	.6361E+05	.6629E+05	-.267E+04
1966	.7082E+05	.6901E+05	.181E+04
1967	.8056E+05	.7435E+05	.620E+04
1968	.8689E+05	.8368E+05	.321E+04
1969	.9392E+05	.8865E+05	.528E+04
1970	.1018E+06	.9642E+05	.534E+04
1971	.1066E+06	.1099E+06	-.335E+04
1972	.1147E+06	.1166E+06	-.186E+04
1973	.1239E+06	.1200E+06	.386E+04
1974	.1330E+06	.1430E+06	-.100E+05
1975	.1414E+06	.1517E+06	-.103E+05
1976	.1566E+06	.1630E+06	-.643E+04
1977	.1733E+06	.1745E+06	-.120E+04
1978	.1918E+06	.1904E+06	.134E+04



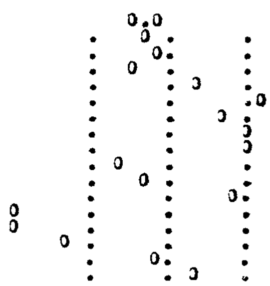


Chart 8.1 Continued

COMPARISON OF ACTUAL AND PREDICTED SERIES
****

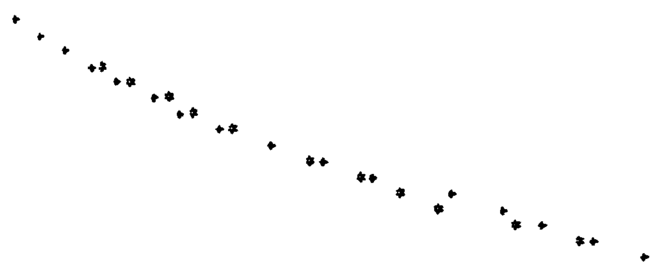
ACTUAL: CP PREDICTED: CPS1

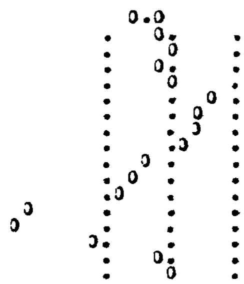
SAMPLE = 4 19

CORRELATION COEFFICIENT = .9951 (SQUARED = .9901)
ROOT-MEAN-SQUARED ERROR = 4310.
MEAN ABSOLUTE ERROR = 2823.
MEAN ERROR = -1821.
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9377
THEIL"S INEQUALITY COEFFICIENT = .1725E-01
FRACTION OF ERROR DUE TO BIAS = .1785
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .2159
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .6055
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .2522
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .5692

PLOT OF ACTUAL(*) AND FITTED(+) VALUES PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	.6044E+05	.6094E+05	-502.
1964	.6441E+05	.6463E+05	-219.
1965	.6892E+05	.6941E+05	-482.
1966	.7499E+05	.7458E+05	409.
1967	.8094E+05	.7824E+05	.270E+04
1968	.8631E+05	.8414E+05	.216E+04
1969	.9137E+05	.8997E+05	.141E+04
1970	.9798E+05	.9663E+05	.134E+04
1971	.1037E+06	.1057E+06	-.197E+04
1972	.1103E+06	.1132E+06	-.293E+04
1973	.1196E+06	.1228E+06	-.325E+04
1974	.1262E+06	.1361E+06	-.993E+04
1975	.1344E+06	.1456E+06	-.111E+05
1976	.1462E+06	.1522E+06	-.591E+04
1977	.1585E+06	.1591E+06	-683.
1978	.1687E+06	.1688E+06	-113.





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

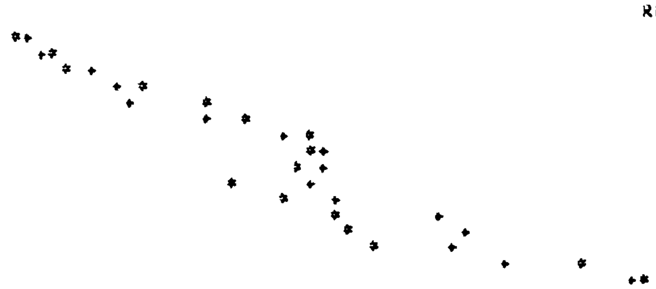
ACTUAL: I PREDICTED: IS1

SAMPLE = 4 19

CORRELATION COEFFICIENT = .9439 (SQUARED = .8909)
ROOT-MEAN-SQUARED ERROR = 4344.
MEAN ABSOLUTE ERROR = 3503.
MEAN ERROR = -962.1
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9055
THEIL"S INEQUALITY COEFFICIENT = .5421E-01
FRACTION OF ERROR DUE TO BIAS = .4906E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .1438E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9366
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .7767E-01
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .8733

PLOT OF ACTUAL(*) AND FITTED(+) VALUES PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	.1798E+05	.1869E+05	-705.
1964	.2065E+05	.2030E+05	351.
1965	.2201E+05	.2331E+05	-.130E+04
1966	.2711E+05	.2577E+05	.134E+04
1967	.3251E+05	.2672E+05	.579E+04
1968	.3540E+05	.3188E+05	.353E+04
1969	.3981E+05	.3771E+05	.210E+04
1970	.3995E+05	.4078E+05	-832.
1971	.3868E+05	.4092E+05	-.224E+04
1972	.3461E+05	.3971E+05	-.510E+04
1973	.3790E+05	.4146E+05	-.355E+04
1974	.4214E+05	.4936E+05	-.722E+04
1975	.4241E+05	.5147E+05	-.905E+04
1976	.4512E+05	.5082E+05	-.570E+04
1977	.5983E+05	.5395E+05	.588E+04
1978	.6491E+05	.6357E+05	.134E+04



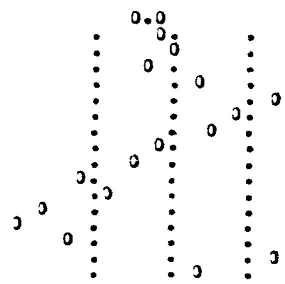


Chart 8.1 Continued

COMPARISON OF ACTUAL AND PREDICTED SERIES
****

ACTUAL: E PREDICTED: ESL

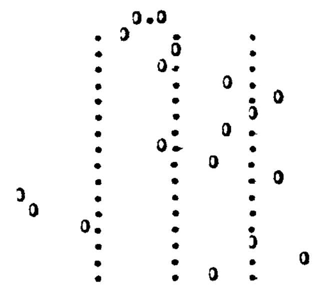
SAMPLE = 4 19

CORRELATION COEFFICIENT = .9436 (SQUARED = .8903)
ROOT-MEAN-SQUARED ERROR = 3050.
MEAN ABSOLUTE ERROR = 2561.
MEAN ERROR = 478.0
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9896
THEIL'S INEQUALITY COEFFICIENT = .5365E-01
FRACTION OF ERROR DUE TO BIAS = .2457E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .1923E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9562
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .8727E-03
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .9746

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	.1224E+05	.1398E+05	-.174E+04
1964	.1513E+05	.1517E+05	-47.9
1965	.1533E+05	.1676E+05	-434.
1966	.2054E+05	.1846E+05	.207E+04
1967	.2340E+05	.1979E+05	.351E+04
1968	.2411E+05	.2121E+05	.290E+04
1969	.2465E+05	.2300E+05	.155E+04
1970	.2484E+05	.2531E+05	-474.
1971	.2808E+05	.2686E+05	.122E+04
1972	.3364E+05	.2970E+05	.394E+04
1973	.2884E+05	.3448E+05	-.554E+04
1974	.2777E+05	.3290E+05	-.513E+04
1975	.2943E+05	.3264E+05	-.320E+04
1976	.3848E+05	.3578E+05	.270E+04
1977	.4352E+05	.3885E+05	.467E+04
1978	.4481E+05	.4325E+05	.155E+04



COMPARISON OF ACTUAL AND PREDICTED SERIES
****

ACTUAL: IM PREDICTED: IMSL

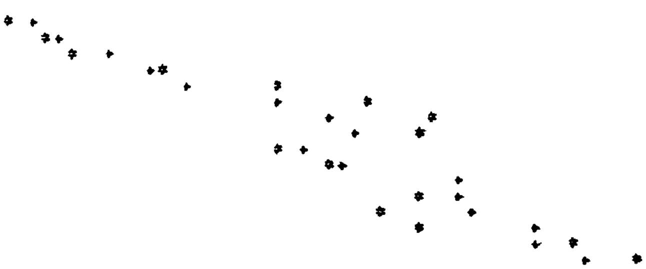
SAMPLE = 4 19

CORRELATION COEFFICIENT = .9369 (SQUARED = .8778)
ROOT-MEAN-SQUARED ERROR = 3495.
MEAN ABSOLUTE ERROR = 2861.
MEAN ERROR = 384.4
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9634
THEIL'S INEQUALITY COEFFICIENT = .4713E-01
FRACTION OF ERROR DUE TO BIAS = .1210E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .6029E-02
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9819
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .1016E-01
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .9777

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	.1785E+05	.1907E+05	-.121E+04
1964	.1981E+05	.2093E+05	-.112E+04
1965	.2174E+05	.2337E+05	-.153E+04
1966	.2642E+05	.2564E+05	773.
1967	.3295E+05	.2779E+05	.516E+04
1968	.3842E+05	.3291E+05	.551E+04
1969	.4183E+05	.3632E+05	.551E+04
1970	.4082E+05	.3751E+05	.331E+04
1971	.3311E+05	.3418E+05	-.107E+04
1972	.3562E+05	.3684E+05	-.122E+04
1973	.4302E+05	.4292E+05	96.2
1974	.4103E+05	.4287E+05	-.134E+04
1975	.3861E+05	.4392E+05	-.531E+04
1976	.4102E+05	.4742E+05	-.640E+04
1977	.4977E+05	.4725E+05	.252E+04
1978	.5334E+05	.5025E+05	.308E+04



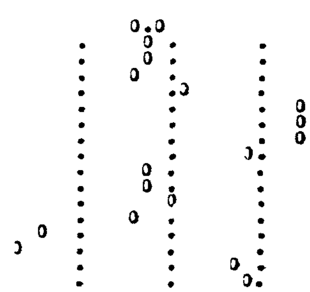


Chart 8.1 Continued

COMPARISON OF ACTUAL AND PREDICTED SERIES
****

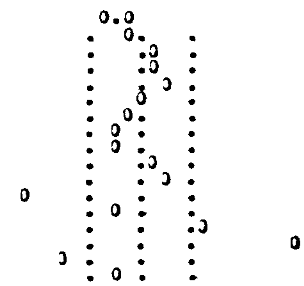
ACTUAL: BOP   PREDICTED: BOPS1

SAMPLE =   4   19

```
CORRELATION COEFFICIENT =     .6834                    (SQUARED =     .4671     )
ROOT-MEAN-SQUARED ERROR =     4248.
MEAN ABSOLUTE ERROR =    2914.
MEAN ERROR =    -66.66
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED =     .5571
THEIL"S INEQUALITY COEFFICIENT =     .4080
FRACTION OF ERROR DUE TO BIAS =     .2462E-03
FRACTION OF ERROR DUE TO DIFFERENT VARIATION =     .6211E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION =     .9376
ALTERNATIVE DECOMPOSITION  (LAST 2 COMPONENTS):
     FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY =     .3565
     FRACTION OF ERROR DUE TO RESIDUAL VARIANCE =     .6433
```

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	949.0	1631.	-682.
1964	1430.	890.7	539.
1965	1985.	1442.	543.
1966	3304.	1546.	.176E+04
1967	1313.	1146.	167.
1968	449.0	1470.	-.102E+04
1969	-914.0	677.2	-.159E+04
1970	-2652.	-640.0	-.201E+04
1971	-335.0	-1687.	.135E+04
1972	3991.	1781.	.221E+04
1973	864.0	9448.	-.858E+04
1974	8012.	.1010E+05	-.209E+04
1975	-2858.	-7426.	.457E+04
1976	-33.00	-.1172E+05	.116E+05
1977	-7538.	-2033.	-.551E+04
1978	-.1330E+05	-.1094E+05	-.236E+04



COMPARISON OF ACTUAL AND PREDICTED SERIES
****

ACTUAL: GDEF   PREDICTED: GDEFS1

SAMPLE =   4   19

```
CORRELATION COEFFICIENT =     .9862                    (SQUARED =     .9727     )
ROOT-MEAN-SQUARED ERROR =     1277.
MEAN ABSOLUTE ERROR =     766.3
MEAN ERROR =     428.6
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED =     1.042
THEIL"S INEQUALITY COEFFICIENT =     .5404E-01
FRACTION OF ERROR DUE TO BIAS =     .1127
FRACTION OF ERROR DUE TO DIFFERENT VARIATION =     .8723E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION =     .8001
ALTERNATIVE DECOMPOSITION  (LAST 2 COMPONENTS):
     FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY =     .4799E-01
     FRACTION OF ERROR DUE TO RESIDUAL VARIANCE =     .8393
```

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	1470.	1282.	188.
1964	1834.	2003.	-169.
1965	2386.	2145.	240.
1966	3079.	3149.	-69.3
1967	2578.	3394.	-816.
1968	3661.	3960.	-299.
1969	5000.	5235.	-235.
1970	7021.	6975.	45.2
1971	7462.	8391.	-929.
1972	9345.	9532.	-187.
1973	6652.	6084.	568.
1974	-1484.	-2445.	961.
1975	7917.	5583.	.233E+04
1976	.1848E+05	.1447E+05	.401E+04
1977	.1759E+05	.1639E+05	.120E+04
1978	.2577E+05	.2576E+05	13.6

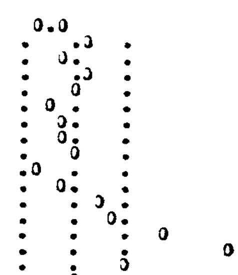


Chart 8.1 Continued

COMPARISON OF ACTUAL AND PREDICTED SERIES
****

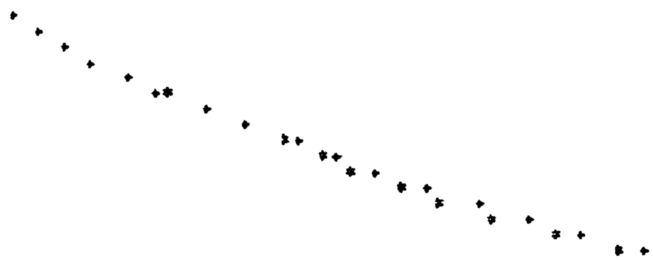
ACTUAL: K   PREDICTED: KS1

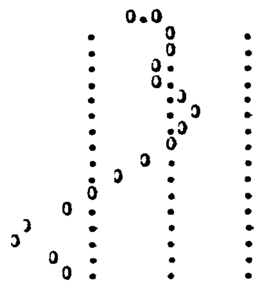
SAMPLE = 4 19

CORRELATION COEFFICIENT = .9991 (SQUARED = .9982)
ROOT-MEAN-SQUARED ERROR = .1382E+05
MEAN ABSOLUTE ERROR = 9977.
MEAN ERROR = -8859.
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9299
THEIL"S INEQUALITY COEFFICIENT = .2097E-01
FRACTION OF ERROR DUE TO BIAS = .4110
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .4393
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .1497
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .4498
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .1393

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	.1230E+06	.1237E+06	-741.
1964	.1387E+06	.1395E+06	-817.
1965	.1550E+06	.1576E+06	-.255E+04
1966	.1754E+06	.1774E+06	-.203E+04
1967	.1996E+06	.1974E+06	.227E+04
1968	.2253E+06	.2216E+06	.370E+04
1969	.2537E+06	.2507E+06	.297E+04
1970	.2812E+06	.2817E+06	-477.
1971	.3063E+06	.3115E+06	-.524E+04
1972	.3283E+06	.3389E+06	-.106E+05
1973	.3532E+06	.3670E+06	-.137E+05
1974	.3827E+06	.4018E+06	-.191E+05
1975	.4116E+06	.4373E+06	-.257E+05
1976	.4419E+06	.4707E+06	-.233E+05
1977	.4844E+06	.5059E+06	-.215E+05
1978	.5301E+06	.5494E+06	-.192E+05





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

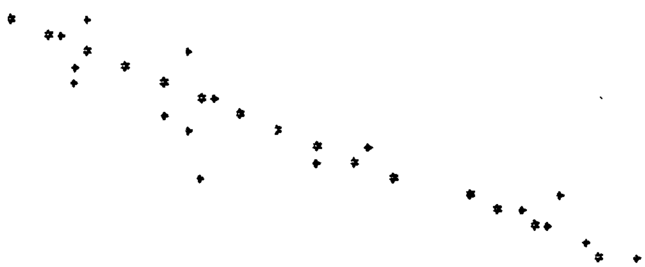
ACTUAL: Nm/N   PREDICTED: (Nm/N)S1

SAMPLE = 4 19

CORRELATION COEFFICIENT = .9296 (SQUARED = .8642)
ROOT-MEAN-SQUARED ERROR = .7929E-02
MEAN ABSOLUTE ERROR = .6145E-02
MEAN ERROR = .7402E-03
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .8736
THEIL"S INEQUALITY COEFFICIENT = .1531E-01
FRACTION OF ERROR DUE TO BIAS = .8938E-02
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .2651E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9646
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .1165
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .8745

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	.2242	.2321	-.785E-02
1964	.2280	.2294	-.140E-02
1965	.2319	.2425	-.106E-01
1966	.2358	.2305	.529E-02
1967	.2398	.2306	.921E-02
1968	.2438	.2454	-.150E-02
1969	.2478	.2401	.772E-02
1970	.2519	.2427	.923E-02
1971	.2561	.2615	-.538E-02
1972	.2603	.2570	.323E-02
1973	.2645	.2445	.199E-01
1974	.2725	.2816	-.910E-02
1975	.2761	.2782	-.209E-02
1976	.2795	.2806	-.101E-02
1977	.2847	.2843	.397E-03
1978	.2861	.2903	-.420E-02



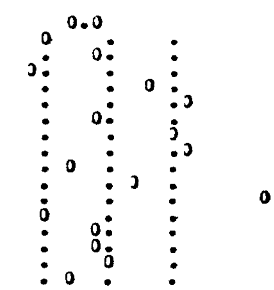
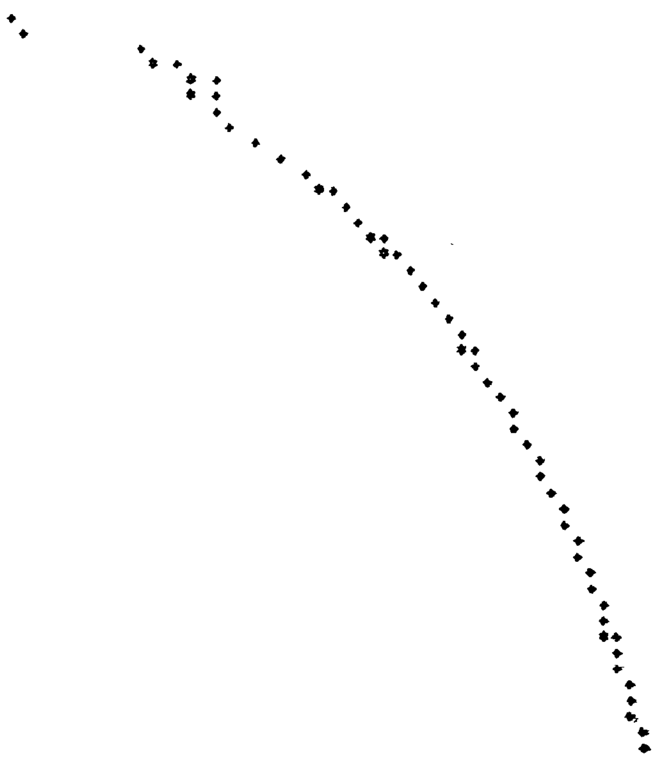
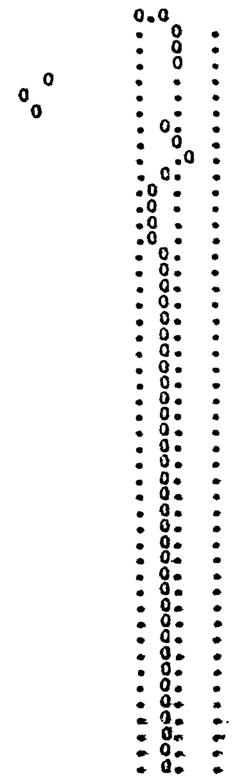


Chart 8.2 Comparison of Standard Run with Simulation Involving a 10 Percent Devaluation in Year 6

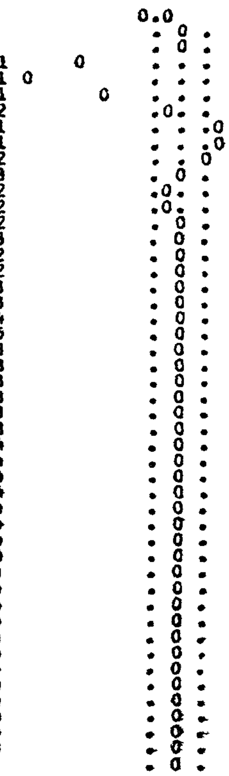
GDP — PLOT OF STANDARD (*) AND EXPERIMENTAL (+) VALUES — PLOT OF RESIDUALS(O)





	STANDARD	EXPERIMENTAL	RESIDUAL
4	.7788E+05	.7788E+05	0.
5	.7814E+05	.7814E+03	0.
6	.8175E+05	.8175E+05	0.
7	.8217E+05	.8275E+05	-584.
8	.8313E+05	.8382E+05	-686.
9	.8329E+05	.8394E+05	-656.
10	.8386E+05	.8392E+05	-57.1
11	.8439E+05	.8438E+05	16.1
12	.8509E+05	.8503E+05	61.7
13	.8575E+05	.8581E+05	-53.1
14	.8641E+05	.8651E+05	-102.
15	.8700E+05	.8713E+05	-136.
16	.8754E+05	.8765E+05	-116.
17	.8802E+05	.8811E+05	-92.7
18	.8847E+05	.8854E+05	-76.2
19	.8888E+05	.8895E+05	-70.7
20	.8929E+C5	.8935E+05	-66.3
21	.8968E+05	.8975E+05	-69.5
22	.9006E+05	.9013E+05	-69.2
23	.9C42E+05	.9049E+05	-67.5
24	.9C77E+05	.9C84E+05	-64.1
25	.9111E+05	.9117E+05	-60.8
26	.9143E+05	.9149E+05	-57.9
27	.9173E+05	.9179E+05	-55.7
28	.9202E+05	.9207E+05	-53.9
29	.9230E+05	.9235E+05	-52.3
30	.9256E+05	.9261E+05	-50.6
31	.9282E+05	.9287E+05	-49.0
32	.9306E+05	.9311E+05	-47.4
33	.9330E+05	.9335E+05	-45.8
34	.9353E+05	.9357E+05	-44.4
35	.9374E+05	.9379E+05	-43.1
36	.9395E+05	.9399E+05	-41.9
37	.9415E+05	.9419E+05	-40.7
38	.9434E+05	.9438E+05	-39.6
39	.9453E+05	.9457E+05	-38.5
40	.9471E+05	.9474E+05	-37.5
41	.9488E+05	.9491E+05	-36.6
42	.9504E+05	.9507E+05	-35.8
43	.9520E+05	.9523E+05	-34.9
44	.9535E+05	.9538E+05	-34.2
45	.9549E+05	.9552E+05	-33.5
46	.9563E+05	.9566E+05	-32.9
47	.9576E+05	.9579E+05	-32.3
48	.9589E+05	.9592E+05	-31.8
49	.9601E+05	.9604E+05	-31.3
50	.9613E+05	.9616E+05	-30.8

P — PLOT OF STANDARD (*) AND EXPERIMENTAL (+) VALUES — PLOT OF RESIDUALS(O)

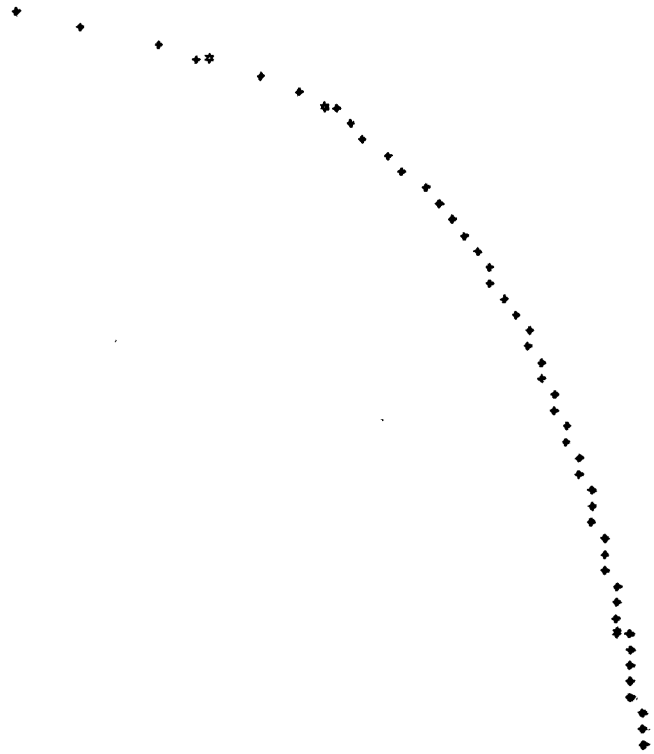


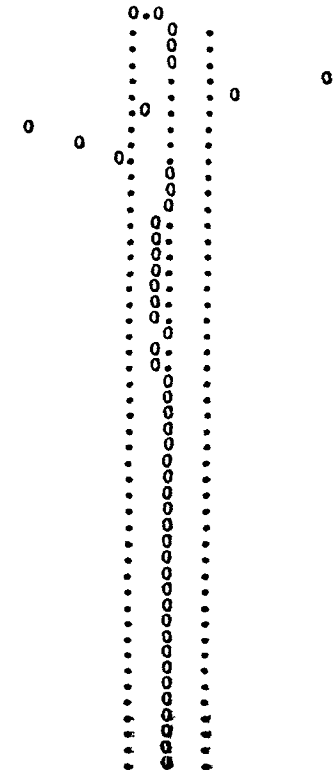
	STANDARD	EXPERIMENTAL	RESIDUAL
4	.8739	.8739	0.
5	.8861	.8861	0.
6	.8637	.9142	-.505E-01
7	.8193	.8917	-.725E-01
8	.7914	.8303	-.390E-01
9	.7803	.7854	-.511E-02
10	.7832	.7666	.165E-01
11	.7884	.7709	.175E-01
12	.7909	.7816	.932E-02
13	.7887	.7882	.484E-03
14	.7839	.7875	-.362E-02
15	.7787	.7822	-.355E-02
16	.7746	.7760	-.145E-02
17	.7718	.7714	.419E-03
18	.7699	.7687	.123E-02
19	.7684	.7673	.110E-02
20	.7668	.7662	.614E-03
21	.7650	.7649	.173E-03
22	.7632	.7632	-.104E-04
23	.7614	.7613	.726E-05
24	.7596	.7595	.105E-03
25	.7580	.7578	.182E-03
26	.7564	.7562	.204E-03
27	.7550	.7548	.182E-03
28	.7536	.7535	.146E-03
29	.7523	.7522	.115E-03
30	.7511	.7510	.961E-04
31	.7498	.7497	.871E-04
32	.7486	.7486	.816E-04
33	.7475	.7474	.750E-04
34	.7464	.7463	.658E-04
35	.7453	.7452	.547E-04
36	.7442	.7442	.429E-04
37	.7432	.7432	.314E-04
38	.7423	.7422	.205E-04
39	.7413	.7413	.100E-04
40	.7404	.7404	-.470E-06
41	.7395	.7395	-.111E-04
42	.7386	.7386	-.220E-04
43	.7377	.7377	-.332E-04
44	.7368	.7369	-.446E-C4
45	.7360	.7361	-.562E-04
46	.7352	.7352	-.680E-04
47	.7344	.7344	-.801E-04
48	.7336	.7336	-.925E-04
49	.7328	.7329	-.105E-03
50	.7320	.7321	-.118E-03

Chart 8.2 Continued

Yas — PLOT OF STANDARD (*) AND EXPERIMENTAL (+) VALUES — PLOT OF RESIDUALS(O)

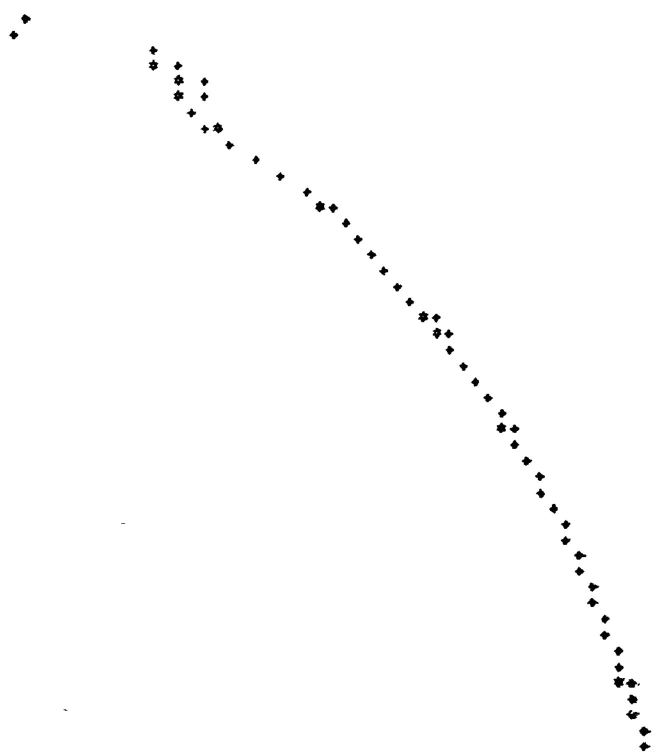
	STANDARD	EXPERIMENTAL	RESIDUAL
4	.2956E+05	.2956E+05	0.
5	.2998E+05	.2998E+05	0.
6	.3044E+05	.3044E+05	0.
7	.3083E+05	.3075E+05	80.3
8	.3114E+05	.3111E+05	31.5
9	.3136E+05	.3138E+05	-11.5
10	.3153E+05	.3160E+05	-73.1
11	.3167E+05	.3172E+05	-47.8
12	.3180E+05	.3183E+05	-26.3
13	.3193E+05	.3193E+05	-1.55
14	.3205E+05	.3205E+05	2.90
15	.3216E+05	.3216E+05	1.61
16	.3226E+05	.3226E+05	-4.49
17	.3235E+05	.3236E+05	-7.63
18	.3243E+05	.3244E+05	-7.86
19	.3251E+05	.3251E+05	-6.30
20	.3258E+05	.3258E+05	-5.07
21	.3264E+05	.3265E+05	-3.74
22	.3271E+05	.3271E+05	-3.36
23	.3277E+05	.3277E+05	-3.33
24	.3282E+05	.3282E+05	-3.42
25	.3287E+05	.3288E+05	-3.42
26	.3292E+05	.3293E+05	-3.29
27	.3297E+05	.3297E+05	-3.10
28	.3301E+05	.3302E+05	-2.92
29	.3306E+05	.3306E+05	-2.79
30	.3310E+05	.3310E+05	-2.70
31	.3313E+05	.3314E+05	-2.64
32	.3317E+05	.3317E+05	-2.59
33	.3321E+05	.3321E+05	-2.55
34	.3324E+05	.3324E+05	-2.51
35	.3327E+05	.3327E+05	-2.47
36	.3330E+05	.3330E+05	-2.45
37	.3333E+05	.3333E+05	-2.43
38	.3336E+05	.3336E+05	-2.42
39	.3338E+05	.3338E+05	-2.42
40	.3341E+05	.3341E+05	-2.43
41	.3343E+05	.3343E+05	-2.44
42	.3345E+05	.3345E+05	-2.46
43	.3347E+05	.3348E+05	-2.49
44	.3349E+05	.3350E+05	-2.52
45	.3351E+05	.3352E+05	-2.56
46	.3353E+05	.3353E+05	-2.61
47	.3355E+05	.3355E+05	-2.66
48	.3356E+05	.3357E+05	-2.72
49	.3358E+05	.3358E+05	-2.78
50	.3359E+05	.3360E+05	-2.86





Yms — PLOT OF STANDARD (*) AND EXPERIMENTAL (+) VALUES — PLOT OF RESIDUALS(O)

	STANDARD	EXPERIMENTAL	RESIDUAL
4	.4832E+05	.4832E+05	0.
5	.4816E+05	.4816E+05	0.
6	.5131E+05	.5131E+05	0.
7	.5134E+05	.5201E+05	-664.
8	.5199E+05	.5271E+05	-718.
9	.5192E+05	.5257E+05	-644.
10	.5233E+05	.5232E+05	16.0
11	.5272E+05	.5266E+05	63.8
12	.5329E+05	.5321E+05	88.0
13	.5383E+05	.5388E+05	-51.6
14	.5436E+05	.5447E+05	-105.
15	.5484E+05	.5498E+05	-137.
16	.5528E+05	.5539E+05	-111.
17	.5567E+05	.5576E+05	-85.1
18	.5604E+05	.5611E+05	-68.4
19	.5638E+05	.5644E+05	-64.4
20	.5671E+05	.5677E+05	-61.2
21	.5703E+05	.5710E+05	-65.7
22	.5735E+05	.5742E+05	-65.8
23	.5766E+05	.5772E+05	-64.1
24	.5795E+05	.5801E+05	-60.7
25	.5824E+05	.5829E+05	-57.3
26	.5851E+05	.5856E+05	-54.6
27	.5876E+05	.5881E+05	-52.6
28	.5901E+05	.5906E+05	-51.0
29	.5924E+05	.5929E+05	-49.5
30	.5947E+05	.5951E+05	-47.9
31	.5968E+05	.5973E+05	-46.4
32	.5989E+05	.5994E+05	-44.8
33	.6009E+05	.6014E+05	-43.3
34	.6029E+05	.6033E+05	-41.9
35	.6047E+05	.6051E+05	-40.6
36	.6065E+05	.6069E+05	-39.4
37	.6082E+05	.6086E+05	-38.3
38	.6099E+05	.6103E+05	-37.2
39	.6115E+05	.6118E+05	-36.1
40	.6130E+05	.6133E+05	-35.1
41	.6145E+05	.6148E+05	-34.2
42	.6159E+05	.6162E+05	-33.3
43	.6172E+05	.6176E+05	-32.5
44	.6185E+05	.6188E+05	-31.7
45	.6198E+05	.6201E+05	-30.9
46	.6210E+05	.6213E+05	-30.3
47	.6221E+05	.6224E+05	-29.6
48	.6233E+05	.6235E+05	-29.0
49	.6243E+05	.6246E+05	-28.5
50	.6253E+05	.6256E+05	-28.0



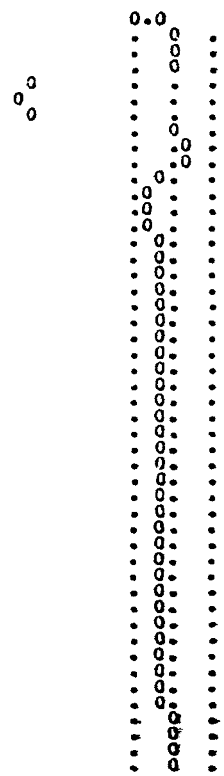
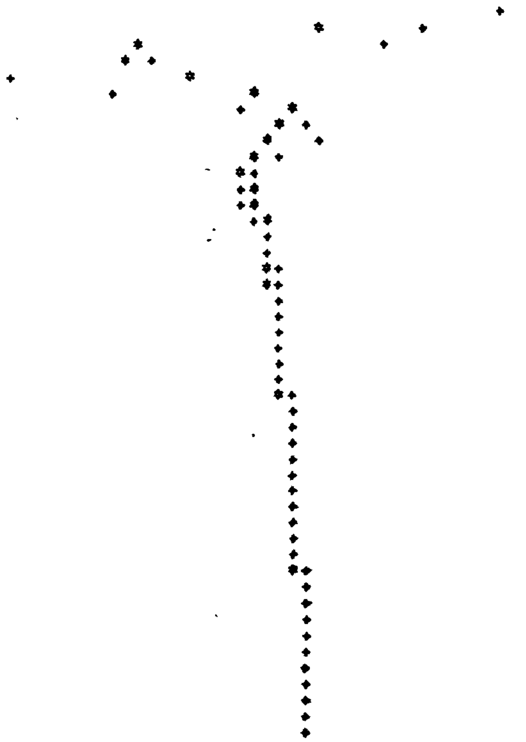


Chart 8.2 Continued

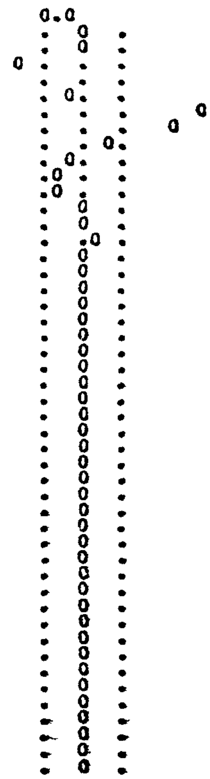
I

PLOT OF STANDARD (*) AND EXPERIMENTAL (+) VALUES

	STANDARD	EXPERIMENTAL	RESIDUAL
4	.1588E+05	.1588E+05	0.
5	.1389E+05	.1389E+05	0.
6	.1142E+05	.1288E+05	-.146E+04
7	8926.	.1227E+05	-.334E+04
8	8770.	9132.	-362.
9	9641.	7219.	.242E+04
10	.1065E+05	8612.	.204E+04
11	.1107E+05	.1044E+05	629.
12	.1101E+05	.1136E+05	-356.
13	.1073E+05	.1138E+05	-648.
14	.1052E+05	.1097E+05	-450.
15	.1045E+05	.1058E+05	-132.
16	.1051E+05	.1042E+05	87.6
17	.1062E+05	.1048E+05	139.
18	.1072E+05	.1063E+05	84.0
19	.1077E+05	.1077E+05	8.42
20	.1080E+05	.1084E+05	-35.6
21	.1081E+05	.1086E+05	-45.0
22	.1083E+05	.1086E+05	-31.1
23	.1085E+05	.1086E+05	-13.9
24	.1088E+05	.1088E+05	-3.81
25	.1091E+05	.1091E+05	-2.32
26	.1094E+05	.1094E+05	-5.56
27	.1097E+05	.1098E+05	-9.34
28	.1099E+05	.1100E+05	-11.4
29	.1101E+05	.1103E+05	-11.6
30	.1104E+05	.1105E+05	-10.9
31	.1106E+05	.1107E+05	-10.0
32	.1107E+05	.1108E+05	-9.62
33	.1109E+05	.1110E+05	-9.63
34	.1111E+05	.1112E+05	-9.88
35	.1113E+05	.1114E+05	-10.2
36	.1114E+05	.1115E+05	-10.4
37	.1116E+05	.1117E+05	-10.5
38	.1117E+05	.1118E+05	-10.6
39	.1118E+05	.1119E+05	-10.8
40	.1119E+05	.1120E+05	-10.9
41	.1120E+05	.1121E+05	-11.2
42	.1121E+05	.1122E+05	-11.4
43	.1121E+05	.1123E+05	-11.7
44	.1122E+05	.1123E+05	-12.0
45	.1122E+05	.1124E+05	-12.4
46	.1123E+05	.1124E+05	-12.7
47	.1123E+05	.1124E+05	-13.1
48	.1123E+05	.1124E+05	-13.6
49	.1123E+05	.1124E+05	-14.0
50	.1123E+05	.1124E+05	-14.5



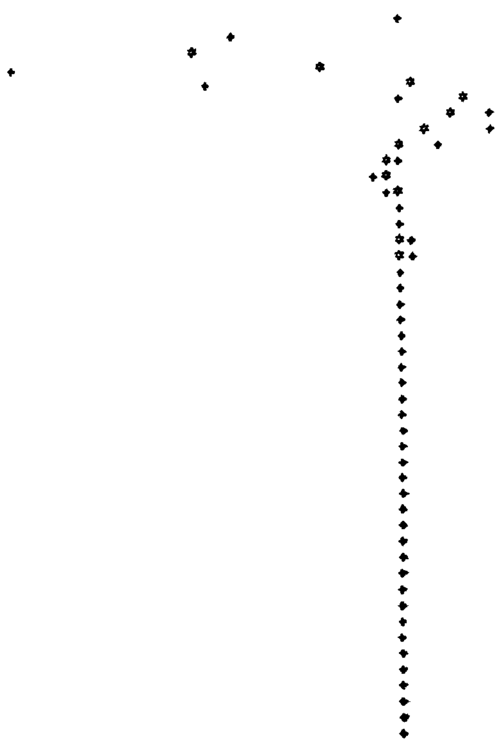
PLOT OF RESIDUALS(0)



BGP

PLOT OF STANDARD (*) AND EXPERIMENTAL (+) VALUES

	STANDARD	EXPERIMNETAL	RESIDUAL
4	88.97	88.97	0.
5	-797.7	-797.7	0.
6	-1024.	1326.	-.235E+04
7	-370.1	-1940.	.157E+04
8	134.6	-964.7	.110E+04
9	385.4	32.97	352.
10	325.2	524.4	-199.
11	169.2	505.9	-337.
12	31.05	265.5	-234.
13	-18.43	38.87	-57.3
14	-1.789	-57.19	55.4
15	42.28	-39.01	81.3
16	77.50	27.83	49.7
17	92.48	83.36	9.13
18	90.13	104.8	-14.7
19	81.10	99.40	-18.3
20	72.55	83.56	-11.0
21	68.65	70.34	-1.69
22	68.77	65.37	3.40
23	71.00	66.97	4.03
24	73.44	71.26	2.18
25	75.16	75.02	.146
26	76.02	76.96	-.940
27	76.28	77.30	-1.03
28	76.29	76.90	-.603
29	76.30	76.46	-.157
30	76.40	76.33	.739E-01
31	76.61	76.53	.872E-01
32	76.90	76.91	-.754E-02
33	77.22	77.33	-.105
34	77.55	77.70	-.154
35	77.84	78.00	-.157
36	78.10	78.24	-.138
37	78.31	78.43	-.118
38	78.50	78.60	-.109
39	78.65	78.77	-.111
40	78.80	78.92	-.117
41	78.94	79.07	-.124
42	79.08	79.21	-.129
43	79.20	79.34	-.132
44	79.32	79.45	-.134
45	79.41	79.55	-.136
46	79.49	79.63	-.139
47	79.56	79.70	-.143
48	79.61	79.75	-.148
49	79.64	79.79	-.152
50	79.66	79.81	-.157



PLOT OF RESIDUALS(0)

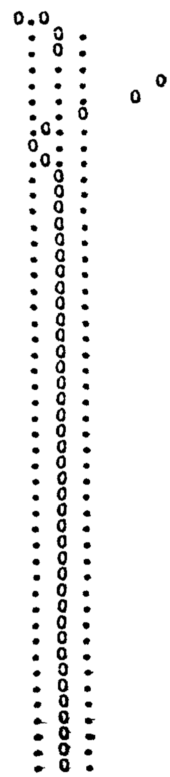
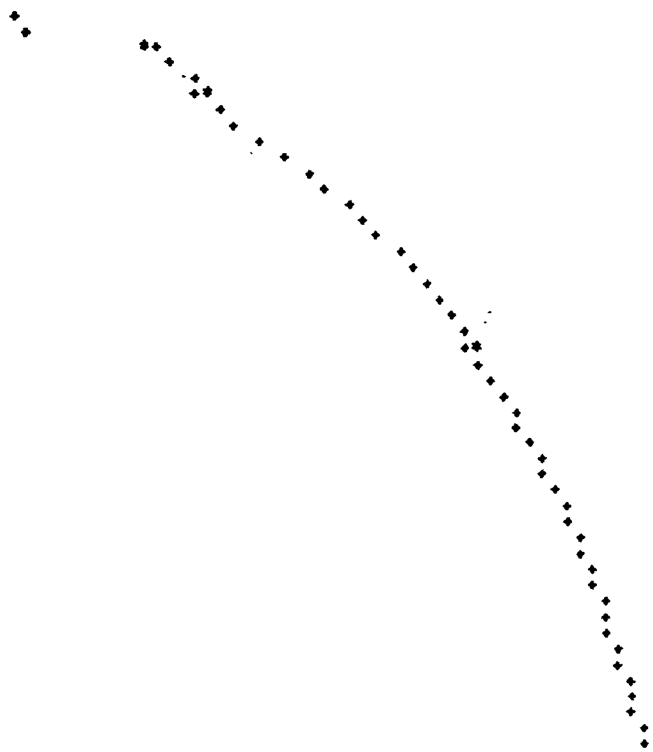
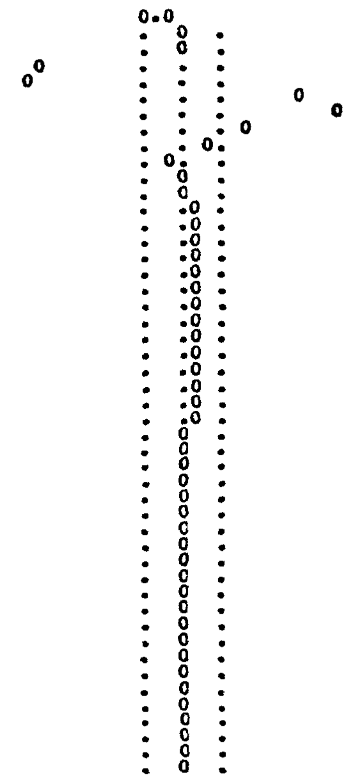


Chart 8.3 Comparison of Standard Run with Simulation Involving a 10 Percent Increase in the Money Supply in Year 5

GDP PLOT OF STANDARD (*) AND EXPERIMENTAL (+) VALUES PLOT OF RESIDUALS(O)

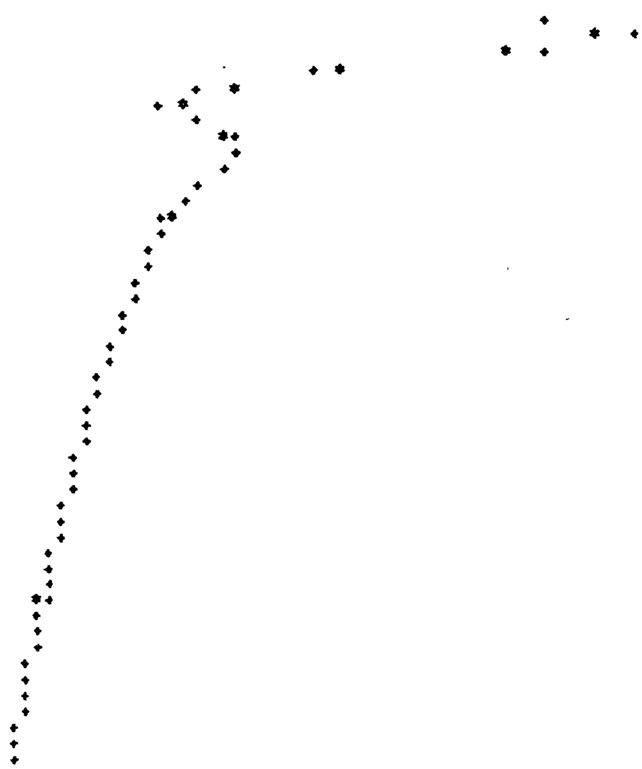
	STANDARD	EXPERIMENTAL	RESIDUAL
4	.7788E+05	.7788E+05	0.
5	.7814E+05	.7814E+05	0.
6	.8175E+05	.8191E+05	-160.
7	.8217E+05	.8234E+05	-172.
8	.8313E+05	.8301E+05	124.
9	.8329E+05	.8312E+05	165.
10	.8386E+05	.8379E+05	70.6
11	.8439E+05	.8437E+05	23.2
12	.8509E+05	.8510E+05	-9.32
13	.8575E+05	.8576E+05	-4.86
14	.8641E+05	.8641E+05	2.85
15	.8700E+05	.8698E+05	15.7
16	.8754E+05	.8752E+05	18.4
17	.8802E+05	.8800E+05	17.0
18	.8847E+05	.8845E+05	12.9
19	.8888E+05	.8887E+05	10.2
20	.8929E+05	.8928E+05	8.79
21	.8968E+05	.8967E+05	8.80
22	.9006E+05	.9005E+05	9.11
23	.9042E+05	.9041E+05	9.21
24	.9077E+05	.9077E+05	8.96
25	.9111E+05	.9110E+05	8.48
26	.9143E+05	.9142E+05	7.98
27	.9173E+05	.9172E+05	7.56
28	.9202E+05	.9201E+05	7.24
29	.9230E+05	.9229E+05	6.99
30	.9256E+05	.9256E+05	6.75
31	.9282E+05	.9281E+05	6.51
32	.9306E+05	.9306E+05	6.27
33	.9330E+05	.9329E+05	6.03
34	.9353E+05	.9352E+05	5.79
35	.9374E+05	.9374E+05	5.57
36	.9395E+05	.9395E+05	5.37
37	.9415E+05	.9415E+05	5.17
38	.9434E+05	.9434E+05	4.99
39	.9453E+05	.9452E+05	4.81
40	.9471E+05	.9470E+05	4.63
41	.9488E+05	.9487E+05	4.47
42	.9504E+05	.9503E+05	4.31
43	.9520E+05	.9519E+05	4.15
44	.9535E+05	.9534E+05	4.00
45	.9549E+05	.9549E+05	3.86
46	.9563E+05	.9563E+05	3.73
47	.9576E+05	.9576E+05	3.59
48	.9589E+05	.9589E+05	3.47
49	.9601E+05	.9601E+05	3.34
50	.9613E+05	.9613E+05	3.23





P PLOT OF STANDARD (*) AND EXPERIMENTAL (+) VALUES PLOT OF RESIDUALS(O)

	STANDARD	EXPERIMNETAL	RESIDUAL
4	.8739	.8739	0.
5	.8861	.8968	-.107E-01
6	.8637	.8725	-.875E-02
7	.8193	.8124	.691E-02
8	.7914	.7808	.106E-01
9	.7803	.7733	.697E-02
10	.7832	.7824	.777E-03
11	.7884	.7910	-.254E-02
12	.7909	.7938	-.288E-02
13	.7887	.7902	-.153E-02
14	.7839	.7840	-.149E-03
15	.7787	.7781	.564E-03
16	.7746	.7740	.567E-03
17	.7718	.7715	.250E-03
18	.7699	.7700	-.552E-04
19	.7684	.7686	-.192E-03
20	.7668	.7670	-.179E-03
21	.7650	.7651	-.101E-03
22	.7632	.7632	-.315E-04
23	.7614	.7614	-.104E-05
24	.7596	.7596	-.360E-05
25	.7580	.7580	-.194E-04
26	.7564	.7565	-.326E-04
27	.7550	.7550	-.371E-04
28	.7536	.7537	-.347E-04
29	.7523	.7524	-.297E-04
30	.7511	.7511	-.254E-04
31	.7498	.7498	-.232E-04
32	.7486	.7487	-.225E-04
33	.7475	.7475	-.225E-04
34	.7464	.7464	-.223E-04
35	.7453	.7453	-.218E-04
36	.7442	.7443	-.209E-04
37	.7432	.7433	-.201E-04
38	.7423	.7423	-.192E-04
39	.7413	.7413	-.186E-04
40	.7404	.7404	-.180E-04
41	.7395	.7395	-.175E-04
42	.7386	.7386	-.169E-04
43	.7377	.7377	-.165E-04
44	.7368	.7369	-.160E-04
45	.7360	.7360	-.156E-04
46	.7352	.7352	-.151E-04
47	.7344	.7344	-.147E-04
48	.7336	.7336	-.144E-04
49	.7328	.7328	-.141E-04
50	.7320	.7320	-.138E-04



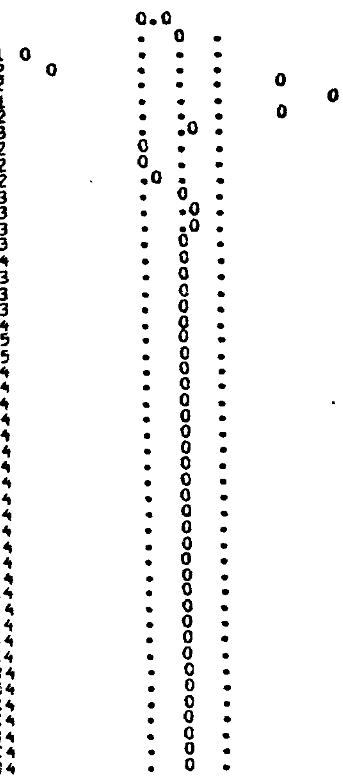
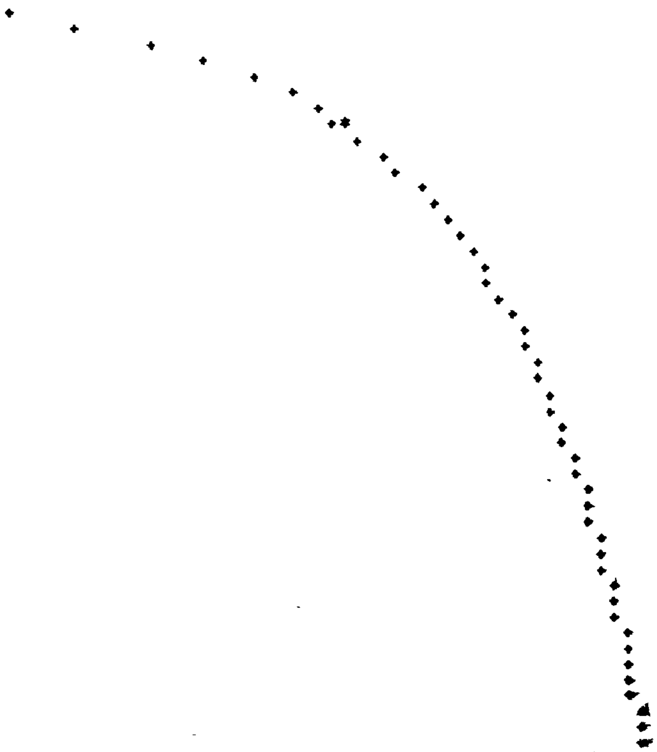


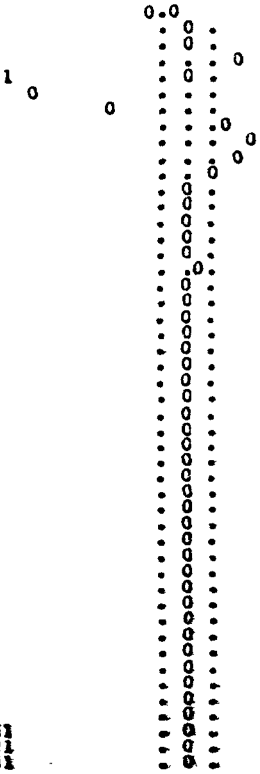
Chart 8.3 Continued

Yas

PLOT OF STANDARD (*) AND EXPERIMENTAL (+) VALUES



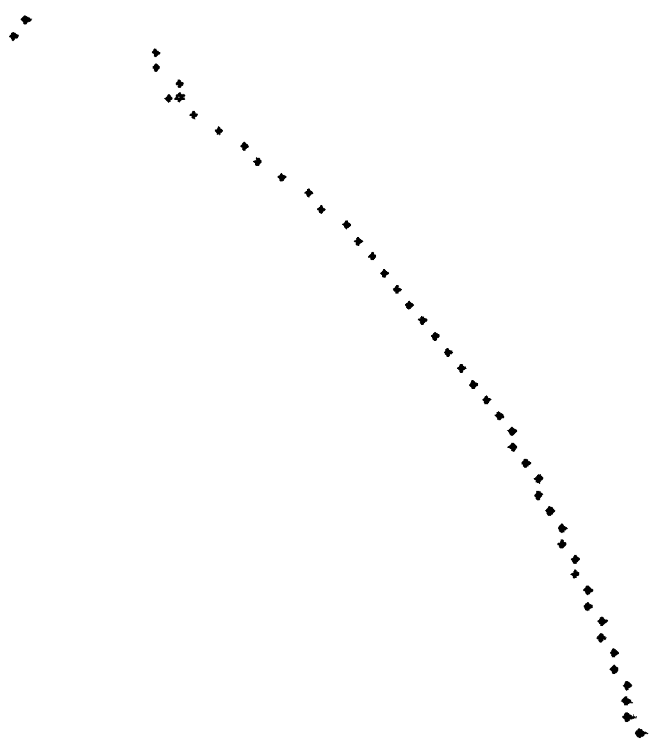
PLOT OF RESIDUALS(0)



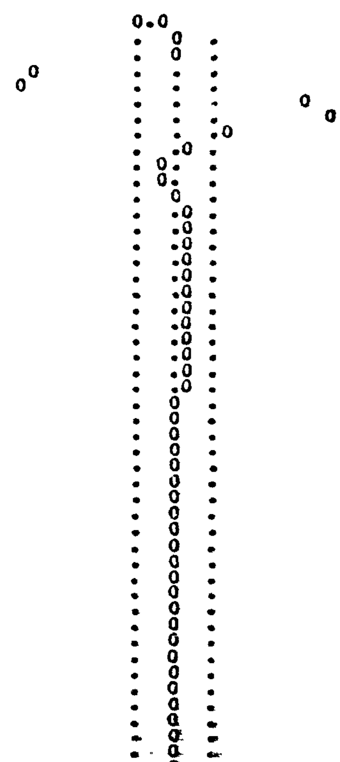
	STANDARD	EXPERIMNETAL	RESIDUAL
4	.2956E+05	.2956E+05	0.
5	.2998E+05	.2998E+05	0.
6	.3044E+05	.3043E+05	7.74
7	.3083E+05	.3083E+05	-.160E-01
8	.3114E+05	.3116E+05	-24.5
9	.3136E+05	.3138E+05	-12.8
10	.3153E+05	.3152E+05	6.22
11	.3167E+05	.3166E+05	9.91
12	.3180E+05	.3179E+05	8.45
13	.3193E+05	.3192E+05	3.51
14	.3205E+05	.3205E+05	.699
15	.3216E+05	.3216E+05	-.772
16	.3226E+05	.3226E+05	-.305
17	.3235E+05	.3235E+05	.444
18	.3243E+05	.3243E+05	1.02
19	.3251E+05	.3250E+05	1.08
20	.3258E+05	.3258E+05	.891
21	.3264E+05	.3264E+05	.618
22	.3271E+05	.3271E+05	.435
23	.3277E+05	.3276E+05	.362
24	.3282E+05	.3282E+05	.361
25	.3287E+05	.3287E+05	.374
26	.3292E+05	.3292E+05	.375
27	.3297E+05	.3297E+05	.354
28	.3301E+05	.3301E+05	.324
29	.3306E+05	.3306E+05	.293
30	.3310E+05	.3310E+05	.269
31	.3313E+05	.3313E+05	.251
32	.3317E+05	.3317E+05	.238
33	.3321E+05	.3321E+05	.227
34	.3324E+05	.3324E+05	.215
35	.3327E+05	.3327E+05	.204
36	.3330E+05	.3330E+05	.192
37	.3333E+05	.3333E+05	.181
38	.3336E+05	.3336E+05	.171
39	.3338E+05	.3338E+05	.163
40	.3341E+05	.3341E+05	.154
41	.3343E+05	.3343E+05	.146
42	.3345E+05	.3345E+05	.138
43	.3347E+05	.3347E+05	.131
44	.3349E+05	.3349E+05	.124
45	.3351E+05	.3351E+05	.118
46	.3353E+05	.3353E+05	.112
47	.3355E+05	.3355E+05	.105
48	.3356E+05	.3356E+05	.990E-01
49	.3358E+05	.3358E+05	.930E-01
50	.3359E+05	.3359E+05	.880E-01

Yms

PLOT OF STANDARD (*) AND EXPERIMENTAL (+) VALUES



PLOT OF RESIDUALS(0)



	STANDARD	EXPERIMENTAL	RESIDUAL
4	.4832E+05	.4832E+05	0.
5	.4816E+05	.4816E+05	0.
6	.5131E+05	.5148E+05	-168.
7	.5134E+05	.5151E+05	-172.
8	.5199E+05	.5184E+05	149.
9	.5192E+05	.5174E+05	178.
10	.5233E+05	.5227E+05	64.4
11	.5272E+05	.5271E+05	13.3
12	.5329E+05	.5331E+05	-17.8
13	.5383E+05	.5383E+05	-8.36
14	.5436E+05	.5436E+05	2.15
15	.5484E+05	.5482E+05	16.5
16	.5528E+05	.5526E+05	18.7
17	.5567E+05	.5566E+05	16.6
18	.5604E+05	.5603E+05	11.9
19	.5638E+05	.5637E+05	9.07
20	.5671E+05	.5670E+05	7.90
21	.5703E+05	.5702E+05	8.18
22	.5735E+05	.5734E+05	8.67
23	.5766E+05	.5765E+05	8.85
24	.5795E+05	.5794E+05	8.59
25	.5824E+05	.5823E+05	8.11
26	.5851E+05	.5850E+05	7.61
27	.5876E+05	.5875E+05	7.21
28	.5901E+05	.5900E+05	6.92
29	.5924E+05	.5923E+05	6.69
30	.5947E+05	.5946E+05	6.48
31	.5968E+05	.5968E+05	6.26
32	.5989E+05	.5989E+05	6.03
33	.6009E+05	.6009E+05	5.80
34	.6029E+05	.6028E+05	5.58
35	.6047E+05	.6047E+05	5.37
36	.6065E+05	.6065E+05	5.18
37	.6082E+05	.6082E+05	4.99
38	.6099E+05	.6098E+05	4.81
39	.6115E+05	.6114E+05	4.64
40	.6130E+05	.6130E+05	4.48
41	.6145E+05	.6144E+05	4.32
42	.6159E+05	.6158E+05	4.17
43	.6172E+05	.6172E+05	4.02
44	.6185E+05	.6185E+05	3.88
45	.6198E+05	.6197E+05	3.74
46	.6210E+05	.6210E+05	3.61
47	.6221E+05	.6221E+05	3.49
48	.6233E+05	.6232E+05	3.37
49	.6243E+05	.6243E+05	3.25
50	.6253E+05	.6253E+05	3.14

Chart 8.3 Continued

I

PLOT OF STANDARD (*) AND EXPERIMENTAL (+) VALUES

PLOT OF RESIDUALS(O)

	STANDARD	EXPERIMENTAL	RESIDUAL
4	.1588E+05	.1588E+05	0.
5	.1389E+05	.1452E+05	-630.
6	.1142E+05	.1190E+05	-476.
7	8526.	7885.	.104E+04
8	8770.	7794.	976.
9	9641.	9757.	-116.
10	.1065E+05	.1107E+05	-422.
11	.1107E+05	.1139E+05	-328.
12	.1101E+05	.1112E+05	-112.
13	.1073E+05	.1068E+05	49.2
14	.1052E+05	.1042E+05	100.
15	.1045E+05	.1037E+05	73.9
16	.1051E+05	.1049E+05	22.1
17	.1062E+05	.1063E+05	-13.6
18	.1072E+05	.1074E+05	-22.8
19	.1077E+05	.1079E+05	-14.6
20	.1080E+05	.1080E+05	-2.61
21	.1081E+05	.1081E+05	5.00
22	.1083E+05	.1082E+05	6.56
23	.1085E+05	.1084E+05	4.45
24	.1088E+05	.1088E+05	1.68
25	.1091E+05	.1091E+05	.140E-01
26	.1094E+05	.1094E+05	-.291
27	.1097E+05	.1097E+05	.179
28	.1099E+05	.1099E+05	.757
29	.1101E+05	.1101E+05	1.07
30	.1104E+05	.1103E+05	1.09
31	.1106E+05	.1105E+05	.943
32	.1107E+05	.1107E+05	.780
33	.1109E+05	.1109E+05	.676
34	.1111E+05	.1111E+05	.639
35	.1113E+05	.1113E+05	.637
36	.1114E+05	.1114E+05	.639
37	.1116E+05	.1115E+05	.629
38	.1117E+05	.1117E+05	.604
39	.1118E+05	.1118E+05	.573
40	.1119E+05	.1119E+05	.542
41	.1120E+05	.1120E+05	.514
42	.1121E+05	.1121E+05	.490
43	.1121E+05	.1121E+05	.468
44	.1122E+05	.1122E+05	.446
45	.1122E+05	.1122E+05	.424
46	.1123E+05	.1123E+05	.401
47	.1123E+05	.1123E+05	.379
48	.1123E+05	.1123E+05	.357
49	.1123E+05	.1123E+05	.335
50	.1123E+05	.1123E+05	.313

SOP

PLOT OF STANDARD (*) AND EXPERIMENTAL (+) VALUES

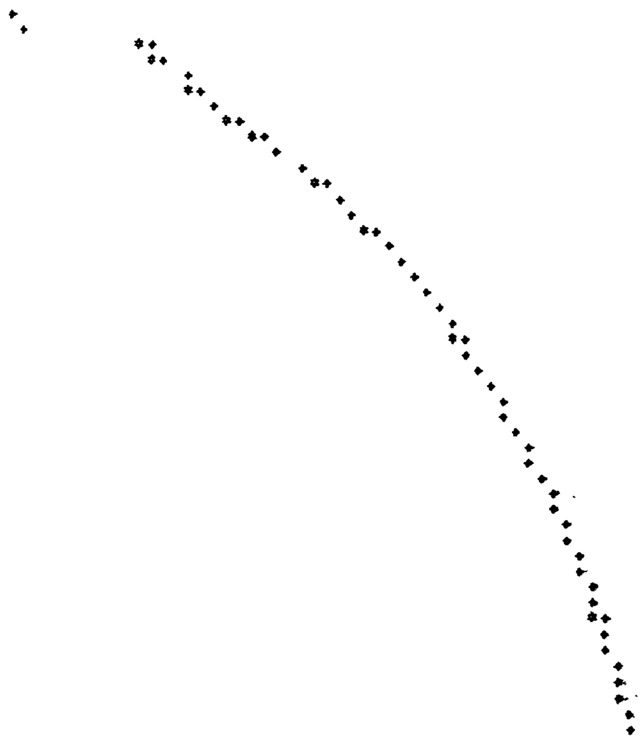
PLOT OF RESIDUALS(O)

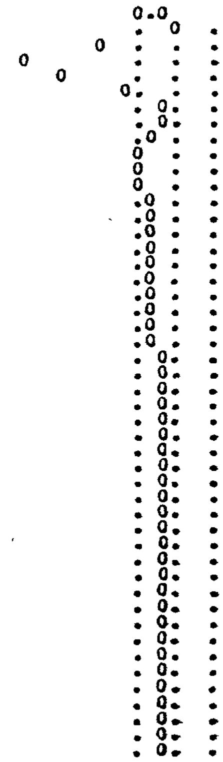
	STANDARD	EXPERIMENTAL	RESIDUAL
4	88.97	88.97	0.
5	-797.7	-1016.	218.
6	-1024.	-1268.	244.
7	-370.1	-273.5	-96.6
8	134.6	371.7	-237.
9	385.4	562.5	-177.
10	325.2	382.5	-57.3
11	169.2	141.7	27.6
12	31.05	-23.62	54.7
13	-18.43	-56.56	38.1
14	-1.789	-12.24	10.5
15	42.28	50.82	-8.54
16	77.50	90.37	-12.9
17	92.48	100.7	-8.26
18	90.13	91.88	-1.75
19	81.10	78.89	2.21
20	72.55	69.59	2.96
21	68.65	66.87	1.78
22	68.77	68.45	.321
23	71.00	71.52	-.526
24	73.44	74.09	-.647
25	75.16	75.53	-.367
26	76.02	76.06	-.424E-01
27	76.28	76.14	.136
28	76.29	76.14	.155
29	76.30	76.21	.905E-01
30	76.40	76.38	.191E-01
31	76.61	76.63	-.193E-01
32	76.90	76.92	-.232E-01
33	77.22	77.23	-.913E-02
34	77.55	77.54	.595E-02
35	77.84	77.83	.138E-01
36	78.10	78.09	.141E-01
37	78.31	78.30	.106E-01
38	78.50	78.49	.700E-02
39	78.65	78.65	.496E-02
40	78.80	78.80	.453E-02
41	78.94	78.94	.493E-02
42	79.08	79.07	.537E-02
43	79.20	79.20	.548E-02
44	79.32	79.31	.525E-02
45	79.41	79.41	.484E-02
46	79.49	79.49	.444E-02
47	79.56	79.55	.411E-02
48	79.61	79.60	.386E-02
49	79.64	79.63	.365E-02
50	79.66	79.65	.344E-02

Chart 8.4 Comparison of Standard Run with Simulation Involving an Increase in the Money Supply of 10 Percent of the 1961 Level in Each Year from Year 4 to Year 50

GDP PLOT OF STANDARD (*) AND EXPERIMENTAL (+) VALUES PLOT OF RESIDUALS(0)

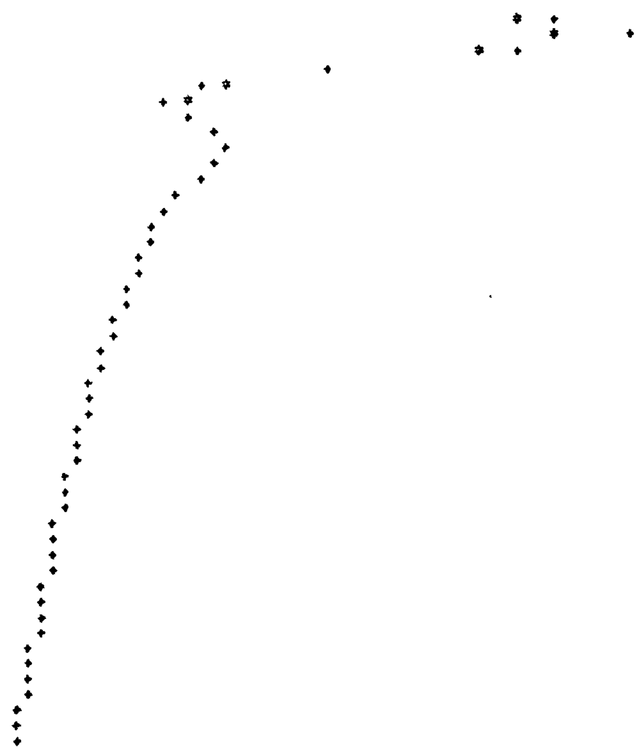
	STANDARD	EXPERIMENTAL	RESIDUAL
4	.7788E+05	.7788E+05	0.
5	.7814E+05	.7830E+05	-159.
6	.8175E+05	.8209E+05	-335.
7	.8217E+05	.8242E+05	-250.
8	.8313E+05	.8323E+05	-100.
9	.8329E+05	.8332E+05	-37.7
10	.8386E+05	.8389E+05	-29.8
11	.8439E+05	.8445E+05	-60.2
12	.8509E+05	.8517E+05	-75.3
13	.8575E+05	.8584E+05	-83.5
14	.8641E+05	.8649E+05	-78.3
15	.8700E+05	.8707E+05	-68.9
16	.8754E+05	.8759E+05	-54.8
17	.8802E+05	.8808E+05	-57.0
18	.8847E+05	.8852E+05	-52.1
19	.8888E+05	.8894E+05	-56.0
20	.8929E+05	.8934E+05	-49.9
21	.8968E+05	.8973E+05	-49.7
22	.9006E+05	.9010E+05	-46.7
23	.9042E+05	.9047E+05	-44.8
24	.9077E+05	.9082E+05	-42.7
25	.9111E+05	.9115E+05	-41.1
26	.9143E+05	.9147E+05	-39.5
27	.9173E+05	.9177E+05	-38.1
28	.9202E+05	.9206E+05	-36.7
29	.9230E+05	.9233E+05	-35.3
30	.9256E+05	.9260E+05	-34.0
31	.9282E+05	.9285E+05	-32.7
32	.9306E+05	.9310E+05	-31.5
33	.9330E+05	.9333E+05	-30.4
34	.9353E+05	.9356E+05	-29.4
35	.9374E+05	.9377E+05	-28.3
36	.9395E+05	.9398E+05	-27.4
37	.9415E+05	.9418E+05	-26.4
38	.9434E+05	.9437E+05	-25.6
39	.9453E+05	.9455E+05	-24.7
40	.9471E+05	.9473E+05	-23.9
41	.9488E+05	.9490E+05	-23.1
42	.9504E+05	.9506E+05	-22.4
43	.9520E+05	.9522E+05	-21.7
44	.9535E+05	.9537E+05	-21.0
45	.9549E+05	.9551E+05	-20.4
46	.9563E+05	.9565E+05	-19.8
47	.9576E+05	.9578E+05	-19.2
48	.9589E+05	.9591E+05	-18.7
49	.9601E+05	.9603E+05	-18.1
50	.9613E+05	.9615E+05	-17.6





P PLOT OF STANDARD (*) AND EXPERIMENTAL (+) VALUES PLOT OF RESIDUALS(0)

	STANDARD	EXPERIMENTAL	RESIDUAL
4	.8739	.8849	-.110E-01
5	.8861	.9060	-.199E-01
6	.8637	.8757	-.120E-01
7	.8193	.8202	-.930E-03
8	.7914	.7858	.559E-02
9	.7803	.7744	.590E-02
10	.7832	.7800	.316E-02
11	.7884	.7881	.321E-03
12	.7909	.7919	-.100E-02
13	.7887	.7896	-.968E-03
14	.7839	.7842	-.292E-03
15	.7787	.7784	.313E-03
16	.7746	.7740	.570E-03
17	.7718	.7713	.484E-03
18	.7699	.7696	.323E-03
19	.7684	.7682	.168E-03
20	.7668	.7667	.127E-03
21	.7650	.7649	.121E-03
22	.7632	.7630	.149E-03
23	.7614	.7612	.166E-03
24	.7596	.7594	.168E-03
25	.7580	.7578	.157E-03
26	.7564	.7563	.142E-03
27	.7550	.7549	.129E-03
28	.7536	.7535	.121E-03
29	.7523	.7522	.115E-03
30	.7511	.7509	.111E-03
31	.7498	.7497	.106E-03
32	.7486	.7485	.101E-03
33	.7475	.7474	.956E-04
34	.7464	.7463	.901E-04
35	.7453	.7452	.849E-04
36	.7442	.7442	.800E-04
37	.7432	.7432	.754E-04
38	.7423	.7422	.709E-04
39	.7413	.7412	.666E-04
40	.7404	.7403	.623E-04
41	.7395	.7394	.581E-04
42	.7386	.7385	.539E-04
43	.7377	.7376	.499E-04
44	.7368	.7368	.459E-04
45	.7360	.7360	.419E-04
46	.7352	.7351	.380E-04
47	.7344	.7343	.342E-04
48	.7336	.7335	.303E-04
49	.7328	.7327	.265E-04
50	.7320	.7319	.226E-04



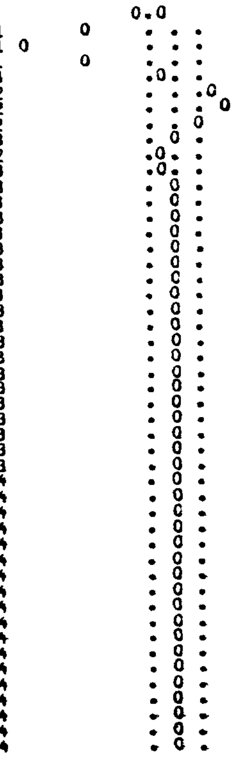


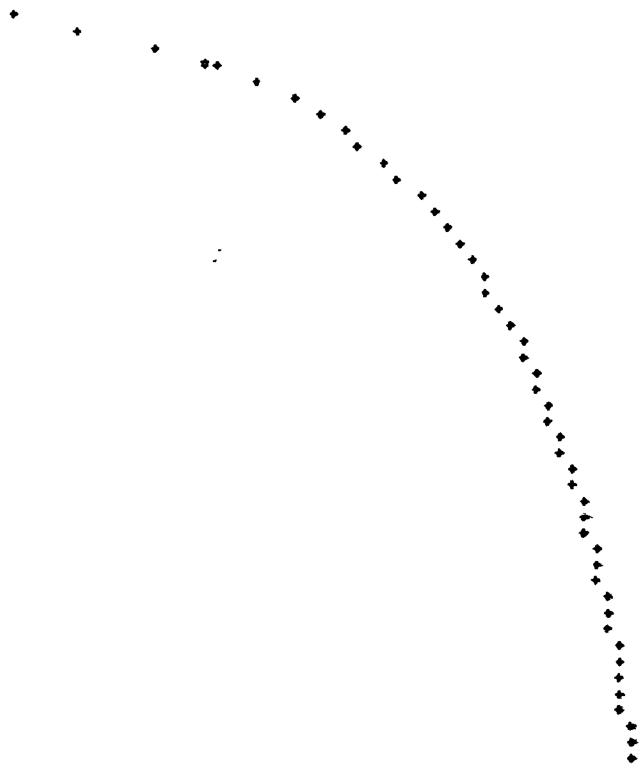
Chart 8.4 Continued

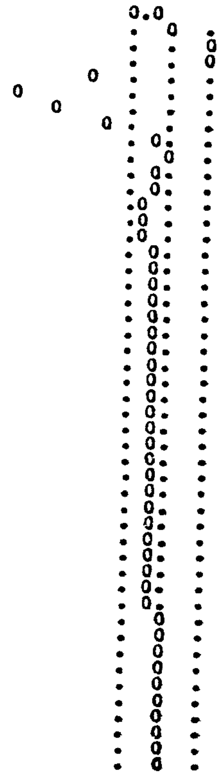
Yas

PLOT OF STANDARD (*) AND EXPERIMENTAL (+) VALUES

PLOT OF RESIDUALS(0)

	STANDARD	EXPERIMENTAL	RESIDUAL
4	.2956E+05	.2956E+05	0.
5	.2998E+05	.2997E+05	6.78
6	.3044E+05	.3043E+05	5.89
7	.3083E+05	.3084E+05	-12.9
8	.3114E+05	.3116E+05	-24.7
9	.3136E+05	.3138E+05	-19.5
10	.3153E+05	.3154E+05	-10.5
11	.3167E+05	.3167E+05	-2.64
12	.3180E+05	.3180E+05	-.899
13	.3193E+05	.3193E+05	-1.33
14	.3205E+05	.3205E+05	-2.89
15	.3216E+05	.3216E+05	-3.88
16	.3226E+05	.3226E+05	-4.59
17	.3235E+05	.3235E+05	-3.29
18	.3243E+05	.3243E+05	-3.04
19	.3251E+05	.3251E+05	-2.10
20	.3258E+05	.3258E+05	-2.45
21	.3264E+05	.3265E+05	-2.16
22	.3271E+05	.3271E+05	-2.19
23	.3277E+05	.3277E+05	-2.08
24	.3282E+05	.3282E+05	-1.99
25	.3287E+05	.3288E+05	-1.87
26	.3292E+05	.3292E+05	-1.75
27	.3297E+05	.3297E+05	-1.66
28	.3301E+05	.3302E+05	-1.58
29	.3306E+05	.3306E+05	-1.51
30	.3310E+05	.3310E+05	-1.45
31	.3313E+05	.3314E+05	-1.39
32	.3317E+05	.3317E+05	-1.34
33	.3321E+05	.3321E+05	-1.29
34	.3324E+05	.3324E+05	-1.24
35	.3327E+05	.3327E+05	-1.20
36	.3330E+05	.3330E+05	-1.16
37	.3333E+05	.3333E+05	-1.12
38	.3336E+05	.3336E+05	-1.09
39	.3338E+05	.3338E+05	-1.06
40	.3341E+05	.3341E+05	-1.03
41	.3343E+05	.3343E+05	-1.01
42	.3345E+05	.3345E+05	-.991
43	.3347E+05	.3347E+05	-.972
44	.3349E+05	.3349E+05	-.956
45	.3351E+05	.3351E+05	-.942
46	.3353E+05	.3353E+05	-.930
47	.3355E+05	.3355E+05	-.921
48	.3356E+05	.3357E+05	-.914
49	.3358E+05	.3358E+05	-.908
50	.3359E+05	.3360E+05	-.904



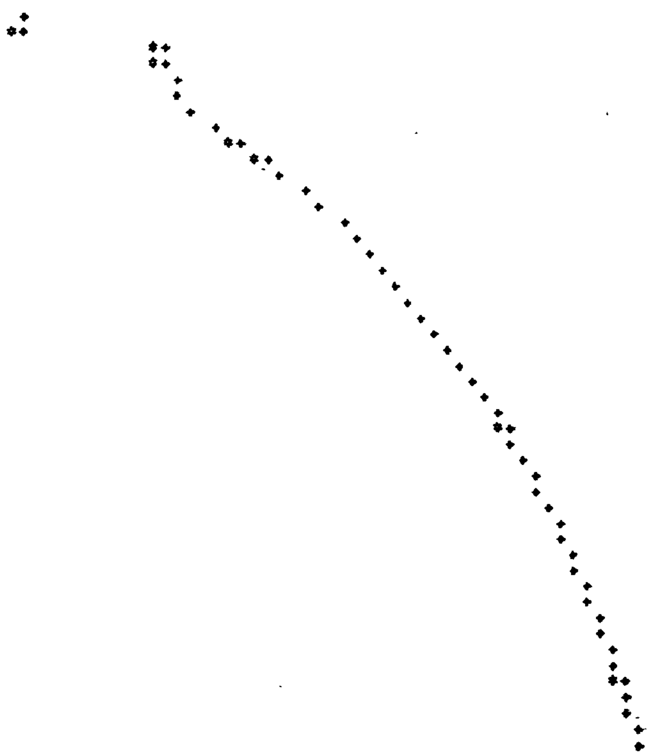


Yms

PLOT OF STANDARD (*) AND EXPERIMENTAL (+) VALUES

PLOT OF RESIDUALS(0)

	STANDARD	EXPERIMENTAL	RESIDUAL
4	.4832E+05	.4832E+05	0.
5	.4816E+05	.4832E+05	-165.
6	.5131E+05	.5165E+05	-341.
7	.5134E+05	.5158E+05	-237.
8	.5199E+05	.5207E+05	-75.7
9	.5192E+05	.5194E+05	-18.2
10	.5233E+05	.5235E+05	-19.3
11	.5272E+05	.5278E+05	-57.6
12	.5329E+05	.5337E+05	-74.4
13	.5383E+05	.5391E+05	-82.2
14	.5436E+05	.5444E+05	-75.4
15	.5484E+05	.5490E+05	-65.0
16	.5528E+05	.5533E+05	-50.2
17	.5567E+05	.5573E+05	-53.7
18	.5604E+05	.5609E+05	-49.1
19	.5638E+05	.5643E+05	-53.9
20	.5671E+05	.5676E+05	-47.4
21	.5703E+05	.5708E+05	-47.5
22	.5735E+05	.5739E+05	-44.6
23	.5766E+05	.5770E+05	-42.7
24	.5795E+05	.5799E+05	-40.7
25	.5824E+05	.5828E+05	-39.2
26	.5851E+05	.5854E+05	-37.8
27	.5876E+05	.5880E+05	-36.4
28	.5901E+05	.5904E+05	-35.1
29	.5924E+05	.5927E+05	-33.8
30	.5947E+05	.5950E+05	-32.5
31	.5968E+05	.5971E+05	-31.3
32	.5989E+05	.5992E+05	-30.2
33	.6009E+05	.6012E+05	-29.1
34	.6029E+05	.6032E+05	-28.1
35	.6047E+05	.6050E+05	-27.1
36	.6065E+05	.6068E+05	-26.2
37	.6082E+05	.6085E+05	-25.3
38	.6099E+05	.6101E+05	-24.5
39	.6115E+05	.6117E+05	-23.7
40	.6130E+05	.6132E+05	-22.9
41	.6145E+05	.6147E+05	-22.1
42	.6159E+05	.6161E+05	-21.4
43	.6172E+05	.6174E+05	-20.7
44	.6185E+05	.6187E+05	-20.1
45	.6198E+05	.6200E+05	-19.5
46	.6210E+05	.6212E+05	-18.9
47	.6221E+05	.6223E+05	-18.3
48	.6233E+05	.6234E+05	-17.8
49	.6243E+05	.6245E+05	-17.2
50	.6253E+05	.6255E+05	-16.7



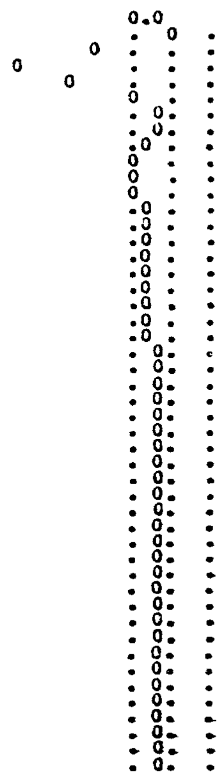


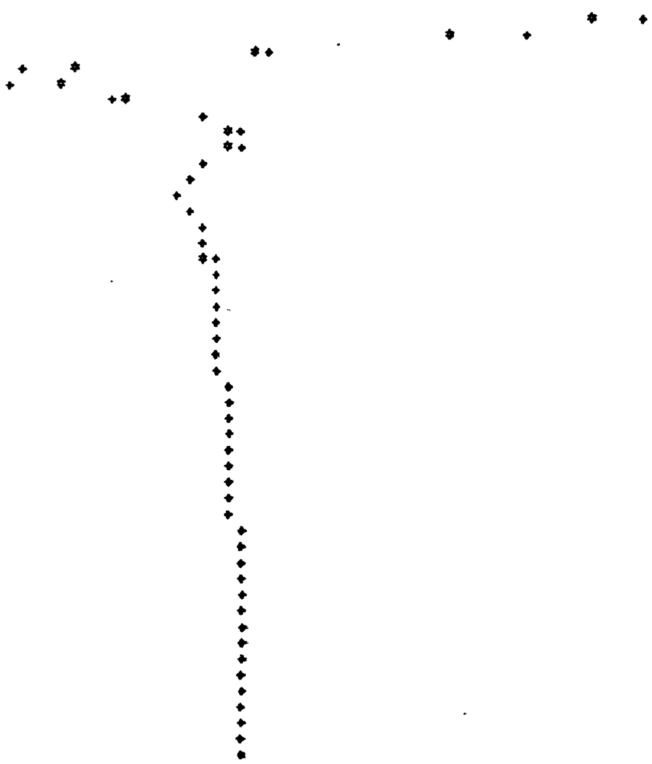
Chart 8.4 Continued

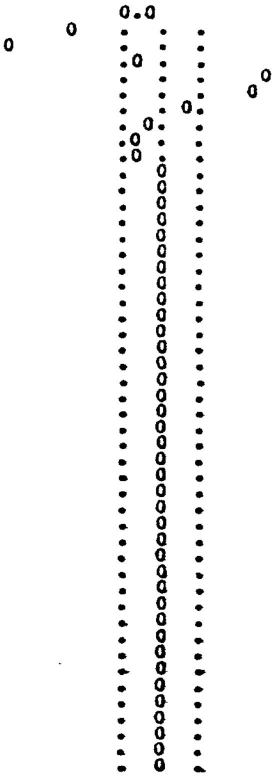
I

PLOT OF STANDARD (*) AND EXPERIMENTAL (+) VALUES

PLOT OF RESIDUALS(0)

	STANDARD	EXPERIMENTAL	RESIDUAL
4	.1588E+05	.1652E+05	-643.
5	.1389E+05	.1499E+05	-.111E+04
6	.1142E+05	.1161E+05	-185.
7	8926.	823C.	696.
8	8770.	8139.	631.
9	9641.	9436.	204.
10	.1C65E+05	.1C78E+05	-126.
11	.1107E+05	.1128E+05	-217.
12	.1101E+05	.1116E+05	-148.
13	.1073E+05	.1078E+05	-45.2
14	.1C52E+05	.1049E+05	23.2
15	.1045E+05	.1041E+05	40.0
16	.1C51E+05	.1C49E+05	24.5
17	.1C62E+05	.1062E+05	-3.15
18	.1C72E+05	.1C73E+05	-15.7
19	.1077E+05	.1079E+05	-19.0
20	.1C80E+05	.1C81E+05	-11.9
21	.1081E+05	.1082E+05	-7.30
22	.1C83E+05	.1083E+05	-4.14
23	.1085E+05	.1085E+05	-3.65
24	.1C88E+05	.1C88E+05	-4.50
25	.1091E+05	.1091E+05	-5.51
26	.1C94E+05	.1094E+05	-5.96
27	.1097E+05	.1097E+05	-5.87
28	.1C99E+05	.11C0E+05	-5.49
29	.1101E+05	.1102E+05	-5.11
30	.1104E+05	.11C4E+05	-4.86
31	.1106E+05	.1106E+05	-4.74
32	.1107E+05	.11C8E+05	-4.69
33	.1109E+05	.1110E+05	-4.65
34	.1111E+05	.1111E+05	-4.59
35	.1113E+05	.1113E+05	-4.51
36	.1114E+05	.1115E+05	-4.42
37	.1116E+05	.1116E+05	-4.34
38	.1117E+05	.1117E+05	-4.28
39	.1118E+05	.1118E+05	-4.23
40	.1119E+05	.1119E+05	-4.18
41	.1120E+05	.1120E+05	-4.15
42	.1121E+05	.1121E+05	-4.12
43	.1121E+05	.1122E+05	-4.10
44	.1122E+05	.1122E+05	-4.08
45	.1122E+05	.1123E+05	-4.07
46	.1123E+05	.1123E+05	-4.07
47	.1123E+05	.1123E+05	-4.08
48	.1123E+05	.1124E+05	-4.09
49	.1123E+05	.1123E+05	-4.12
50	.1123E+05	.1123E+05	-4.15



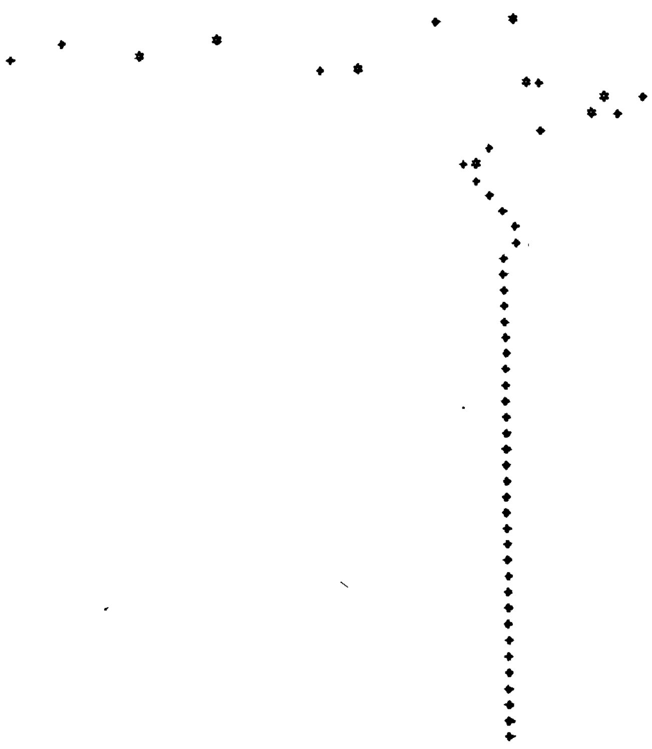


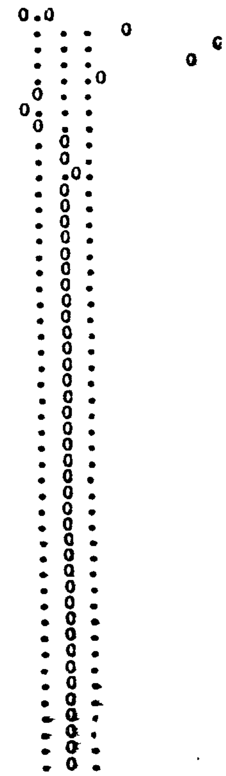
80P

PLOT OF STANDARD (*) AND EXPERIMENTAL (+) VALUES

PLOT OF RESIDUALS(0)

	STANDARD	EXPERIMENTAL	RESIDUAL
4	88.97	-121.6	211.
5	-797.7	-1261.	464.
6	-1C24.	-1399.	375.
7	-37C.1	-487.3	117.
8	134.6	197.9	-63.3
9	385.4	494.6	-109.
10	325.2	398.9	-73.8
11	169.2	186.8	-17.6
12	31.05	12.95	18.1
13	-18.43	-44.46	26.0
14	-1.789	-17.68	15.9
15	42.28	39.64	2.64
16	77.50	83.C2	-5.52
17	92.48	98.29	-5.80
18	9C.13	93.58	-3.45
19	81.10	81.23	-.134
20	72.55	71.62	.929
21	68.65	67.43	1.22
22	68.77	68.19	.585
23	71.00	71.0C	-.318E-02
24	73.44	73.77	-.328
25	75.16	75.50	-.337
26	76.02	76.22	-.203
27	76.28	76.35	-.669E-01
28	76.29	76.29	.531E-C3
29	76.30	76.30	.299E-02
30	76.40	76.43	-.257E-C1
31	76.61	76.67	-.535E-C1
32	76.90	76.97	-.663E-01
33	77.22	77.29	-.650E-01
34	77.55	77.61	-.573E-01
35	77.84	77.89	-.501E-01
36	78.10	78.15	-.463E-01
37	78.31	78.36	-.456E-01
38	78.50	78.54	-.463E-01
39	78.65	78.70	-.470E-01
40	78.80	78.85	-.471E-01
41	78.94	78.99	-.466E-01
42	79.08	79.12	-.459E-01
43	79.20	79.25	-.452E-01
44	79.32	79.36	-.448E-01
45	79.41	79.46	-.447E-01
46	79.49	79.54	-.446E-01
47	79.56	79.60	-.446E-C1
48	79.61	79.65	-.447E-01
49	79.64	79.68	-.448E-01
50	79.66	79.70	-.450E-01





CHAPTER 9

SOME POLICY SIMULATION RESULTS

This chapter presents and discusses the results of the following simulations: (1) a hypothetical devaluation of the domestic domestic currency by 10 percent in 1963, with the exchange rate held at the reduced level through to 1978; (2) a 20 percent reduction of all tariff rates in 1963, the new rates being maintained until 1978; (3) an annual transfer of real government fixed investment from the non-agricultural sector equal to 5 percent of total government fixed investment in every year from 1963 to 1978; (4) a proportionate increase in government fixed investment in agriculture and non-agriculture financed by an increase in all tax rates of 10 percent of their actual levels in each year from 1963 to 1978; (5) the implementation of a policy of more rapid increase in the growth rate of the money supply (through an increase in domestic credit to the private sector) by setting the rate equal to the actual growth rate of gross domestic product in every year plus 5 percent; this policy is compared with one in which the money supply growth rate is set at the GDP growth rate plus 2 percent, which accords roughly with the actual policy of the Bank of Thailand from the end of World

War II until 1971.

In all of the above experiments, we have assumed that the government would buy or sell bonds to the public to cover any deficit or surplus. A government deficit (or surplus) would lead to an increase (or decrease) in NDCg (net domestic credit to government). The change in NDCg would be matched by an opposite change in NDCp (net domestic credit to the private sector). Thus the level of the money supply would not be changed as a result of the change in government deficit (or surplus).

The results of simulation (1) to (4) are presented in terms of the actual and percentage difference of selected variables from the control values provided by the historical test simulation discussed in the previous chapter. The results of simulation (5) are presented as differences between the "plus 5" and "plus 2" policy results.

9.1 A Devaluation of Domestic Currency by 10 Percent with New Exchange Rate Maintained from 1963 to 1978

The primary effects of the devaluation are the rise in import prices (in domestic currency) and the decline in export prices (in foreign currency). Total real exports (E) are higher than their control values by about 4.6 percent in 1963 and 13.4 percent in 1978. (See Table 9.1a and 9.1b.) Total real imports (IM) are lower in the first two years (1963-64) but higher in later years, owing to increases in domestic prices and real gross domestic product (GDP).

GDP rises above the control solution by about 0.8-1.2 percent during 1966-78. Its growth rate (g_Y) is about three to five-tenths of a percentage point higher in the early three years, 1965-67, although the change in the rate fluctuates in later years. GDP is 2,536 million baht higher (at 1972 prices) in 1978. Note that the changes in both exports and imports are greater than the changes in GDP. The rate of growth of total real personal consumption (Cp) is higher by 1-1.9 percent during 1964-69, although again the rate declines in later years. This latter result is due to the increase in domestic prices, which reduces the rate of increase of real personal disposable income.

Real private fixed investment in non-agriculture (Ipm) increases over the whole period, which is mostly due to the decline in the nominal (R) and real (r) rates of interest and the rise in real non-agricultural value added (Yms).

The balance on current account (BOC) and the balance of payments (BOP) are generally improved. This leads to increases in net foreign assets (NFA), which in turn cause the money supply (MS) to be greater.

The increases in both import prices and the money supply raise all domestic price levels (including export prices in domestic currency). The GDP deflator (P) is higher by about 15-18 percent during most of the period. The percentage differences are generally higher than the percentage change in the exchange rate. The inflation rate (g_P) is about 5 percent higher during 1963-65, although the inflationary pressure subsides in later years.

The government deficit (Gdef) (in current prices) is generally higher, owing to the greater increases in government consumption expenditures than in tax revenues.

The ratio of urban employment to total employment (Nm/N) rises by about two to five-tenths of a percentage point during 1967-78, which is due to the higher increase in Yms relative to Yas, and hence to the higher increase in the real non-agricultural wage rate (Wm/P) relative to the real agricultural wage rate (Wa/P). The real non-agricultural wage rate (Wm/P) is about 0.8-1.1 percent higher than in the control solution over the period 1966-78.

The per capita output in agriculture (Yas/Na) increases slightly by about 2.0 baht in 1966 and 7.0 baht in 1978, at 1972 prices, while non-agricultural per capita output (Yms/Nm) increases relatively much more. Hence the devaluation policy benefits people in the urban areas more than in the rural areas.

This simulation experiment demonstrates that a devaluation policy would improve the balance of payments situation and increase the volume of international trade, which would be the primary objectives of the policy. The policy would also generate higher levels of GDP, output per capita, consumption, and investment, although with an increase in inflationary pressure during the first 4 or 5 years.

9.2 A 20 Percent Reduction of All Tariff Rates in 1963 with New Rates Maintained through to 1978

The effects of a 20 percent reduction of the tariff rates on imported consumer goods (timc), imported capital goods (timi), imported fuel and lubricants (timf), imported intermediate goods (timr) and other imported goods (timo) are displayed in Tables 9.2a and 9.2b.

The tariff reduction has a deflationary effect on domestic prices. P is about 2-3 percent lower than in the control solution over the whole period. The inflation rate (g_p) is about 1.3-1.4 percent lower in the first two years (1963-64); in later years the differences are smaller.

Yms declines slightly in 1965-67, owing to the decline of Ipm during 1964-65. The reduction of Ipm is caused by the rise in the nominal and real rates of interest in the first 2-3 years.

The decline in the nominal rate of interest is a result of the reduction in the money supply. The latter is caused by the deficit in the balance of payments, which reduces the level of net foreign assets (NFA).

In the latter years, both Ipa and Ipm increase, owing to the decline in the price of investment goods (Pi) relative to producers' output prices (Pab and Pmb).

GDP is higher by 0.1-0.2 percent after small declines in the early years. Personal consumption is higher by about 1 percent from 1970 on. The greater effect on personal consumption than on GDP is what one would expect since the reduction in taxes implies a transfer of resources from the government to the private sector.

Total imports are higher by about 1-3 percent during the first two years but the differences become smaller in later years. Total exports are higher by about 0.4-0.6 percent during most of the period, owing to the reduced export prices. The balance of payments situation is worsened, as expected. It should also be noted that imports of consumer goods are higher, while imports of intermediate goods and raw materials are lower.

Nm/N is higher than in the control solution by about 0.03-0.1 percent during the simulation period, reflecting the fact that Yms rises more (in percentage terms) than does Yas in later years. However, real wage rates in both sectors improve as a consequence of the lower domestic prices and the higher levels of domestic output.

Both government revenue and government expenditure are lower than they would otherwise be, but revenue decreases more, which is mostly a reflection of the losses of tariff revenue. The result is a greater government deficit.

Yas/Na is higher by 1-2 baht (in 1972 prices) over most of the simulation period; Yms/Nm is higher by 48 baht in 1978, after an initial decline.

The model shows that a tariff reduction policy would increase the share of the private sector in GDP. The policy is also deflationary. The level of GDP can be raised over the medium term but the percentage increase is not large.

9.3 An Annual Transfer of Government Fixed Investment from the Non-Agricultural Sector to the Agricultural Sector Equal to 5 Percent of Total Government Fixed Investment in Every Year from 1963 to 1978

This policy increases Yas more than it reduces Yms, and consequently there is an increase in the overall GDP. There is also a reduction of domestic prices. (See Tables 9.3a and 9.3b.) GDP is raised by about 0.1-0.2 percent over most of the period, while P is reduced by 0.4-0.7 percent in most years.

Note that government fixed investment in Thailand has been mostly in infrastructure (roads, bridges, dams, electricity, and so on).

There is very little change in personal consumption in this experiment. Total fixed investment is lower as a result of the large decreases in Ipm induced by the reduced levels of Yms.

Exports are increased slightly, owing to the decline in export prices, and imports are reduced, owing to the decline in domestic prices. However, the balance of payments is slightly worse because the effects of the decline in the export prices are larger than the effects of the increase in real exports and the decline in real imports.

There is a small reduction of the nominal rate of interest over most of the simulation period as a consequence of the slightly reduced money supply associated with the lower level of net foreign assets.

The real wage rate in agriculture (Wa/P) is higher by 0.1 percent in 1964 and by 0.7 percent in 1978, while the real non-agricultural wage rate (Wm/P) is increased slightly. The ratio Nm/N is reduced, as expected, reflecting the lower level of Yms.

Yas/Na increases over time relative to the control solution, until by 1978 there is a difference of 91 baht. On the other hand, Yms/Nm falls (relative to the control solution), and by a somewhat greater amount. Since people in the rural areas are normally poorer than those in the urban areas, the policy therefore tends to reduce the degree of inequality in the income distribution.

The government deficit is greater and the gap increases over time because most taxes are collected from the non-agricultural sector.

The results of this experiment indicate that there has been relative underinvestment in the agricultural sector, since the hypothetical transfer increases agricultural value added more than it reduces non-agricultural value added. The policy also tends to improve the distribution of income. Real wage rates are increased in both sectors, although relatively more in the agricultural sector.

9.4 A Proportionate Increase in Government Fixed Investment in Agriculture and Non-Agriculture Financed by an Increase in All Tax Rates of 10 Percent of Their Actual Levels in Each Year from 1963 to 1978

The following tax rates are increased by 10 percent the rates on personal income (tp), on corporate income (tc), on domestic demand for non-agricultural goods (tdm), on exports of non-agricultural goods (tem), on imports of consumer goods (timc), on imports of capital goods (timi), on imports of fuel and lubricants (timf), on imports of intermediate goods (timr) and imports of other goods (timo). The additional tax revenue is used solely to finance additional government fixed investment in agriculture and non-agriculture, the allocation between the two sectors being in proportion to their actual historical levels. The government deficit remains at the actual levels over the whole period.

This policy reduces personal consumption considerably. (See Tables 9.4a and 9.4b.) In the aggregate, consumption is lowered by about 1-1.4 percent in most years, compared with the control solution. Output increases in both sectors The percentage rise in the overall GDP is from about 0.12 percent in 1964 to about 0.94 percent in 1978.

Private fixed investment in non-agriculture is reduced over the whole period. The decline in Ipm are mostly a consequence of the higher prices of investment goods relative to their output prices. However, total fixed investment (public plus private) is higher, except for 1967.

The rate of growth of GDP (g_Y) is generally higher by 0.1-0.2 percent, while the price level (P) is raised over the whole period as a result of the higher indirect tax rates.

The per capita output increases but real wages decline in both sectors, owing to the relative increase in domestic prices.

Both exports and imports are reduced because of the higher export and import duties.

The effect of this policy is to transfer resources from the private to the government sector. The policy generates greater output and investment but reduces personal consumption.

9.5 A Money Supply Growth Rate Equal to GDP Growth Rate Plus 5 Percent Compared with GDP Growth Rate Plus 2 Percent over the Period 1963 to 1978

The money supply is increased in each year by the actual growth rate of GDP (g_Y) plus 5 percent, in the one case, and plus 2 percent, in the other. The increase in the money supply is effected through an expansion of net domestic credit to the private sector (NDCp).

From the end of World War II until 1971, monetary policy in Thailand involved a "rule of thumb" such that the rate of expansion of the money supply was to be increased by the expected rate of growth of GDP plus 2-3 percent. The 2-3 percent rule was aimed at monetizing the rural areas. The policy was changed in 1972. (See Chapter 2.)

Tables 9.5a and 9.5b show the actual and percentage differences of the "plus 5" from the "plus 2" results for selected variables.

These differences indicate that real GDP would have been higher under a "plus 5" policy. There is a higher rate of inflation in the early part of the simulation period, but the pressure is not great. Personal consumption and investment generally increase while exports generally decline, owing to the increase in export prices. Imports increase owing to the rise in the domestic price level. The balance of payments is generally worsened, and this in turn reduces net foreign assets and hence the money supply. The actual growth rates of money supply are therefore somewhat less than the intended ones.

Output per capita and real wages are higher in both sectors under the "plus 5" policy. The ratio of Nm/N is generally higher too, since Yms tends to increase by more than Yas.

Table 9.1a Actual Difference in Selected Variables Following a Devaluation of Domestic Currency by 10 Percent with New Exchange Rate Maintained from 1963 to 1978

	GDP	P	Yas	Yms	Cp
1963	0.	.418475E-01	0.	0.	278.343
1964	-42.0960	.884043E-01	14.2850	-56.3810	672.468
1965	439.490	.133465	8.49600	430.995	1147.24
1966	878.060	.152517	15.7120	862.345	1408.04
1967	1270.36	.153573	15.8280	1254.53	1437.01
1968	1523.94	.143904	20.5820	1503.37	1281.92
1969	1497.12	.136964	28.9360	1468.18	1073.83
1970	1417.36	.135573	34.3940	1382.96	937.555
1971	1427.13	.148462	38.9280	1388.20	933.050
1972	1459.51	.171652	39.6940	1419.82	1076.71
1973	1532.48	.213453	42.7640	1489.72	1175.54
1974	1995.88	.258569	23.5020	1972.38	1186.50
1975	2046.05	.280491	26.5100	2019.54	1176.20
1976	2220.26	.273607	16.9020	2203.37	1086.05
1977	2504.17	.269545	-3.30100	2507.46	1062.69
1978	2536.04	.281654	4.79300	2531.25	1095.72
	1	2	3	4	5

	I	E	IM	K	Nm/N
1963	674.469	639.048	-1433.66	674.470	0.
1964	2503.87	1161.84	-242.061	3151.10	-.816117E-03
1965	3206.11	1593.87	1353.97	6230.08	-.124585E-03
1966	2683.66	1963.84	2704.91	8662.50	.200990E-03
1967	1804.26	2267.99	3483.85	10117.5	.737004E-03
1968	924.485	2591.55	3795.73	10634.2	.968015E-03
1969	479.080	2941.00	3591.72	10684.7	.852021E-03
1970	700.674	3316.62	3392.54	10954.9	.680203E-03
1971	1108.97	3557.89	3099.16	11622.4	.540263E-03
1972	1660.11	3922.51	3635.34	12814.3	.557417E-03
1973	1954.98	4519.07	4936.47	14252.9	.568018E-03
1974	1775.39	4302.73	4947.95	15453.8	.106723E-02
1975	1637.38	4280.51	5031.28	16468.2	.935173E-03
1976	1711.45	4732.43	5338.82	17515.8	.111193E-02
1977	1794.81	5174.39	5121.39	18604.4	.149763E-02
1978	1624.30	5803.33	5149.63	19478.5	.116023E-02
	1	2	3	4	5

	BOP	Gdef	g_Y	g_P	R
1963	1280.91	140.572	0.	5.23748	-.593004
1964	1310.37	208.844	-.479427E-01	5.34496	-2.44421
1965	750.020	187.788	.518625	4.53163	-1.45569
1966	98.9704	259.300	.392752	2.14587	-.355959
1967	-253.742	273.655	.322221	.370821	.196435
1968	-132.880	327.209	.106175	-1.02130	.786379
1969	350.602	425.191	-.103366	-1.04496	.263442
1970	670.682	653.726	-.141446	-.412445	-.246753
1971	682.654	850.800	-.915865E-01	-.119938E-01	-.714097
1972	1022.42	1007.54	-.223511E-01	.869651	-1.08970
1973	3330.86	238.107	-.175696E-02	1.08737	-.550983
1974	1935.11	-1676.40	.141340	-.103070	-.755365
1975	-964.623	-399.941	-.409916E-01	-.212826	-.775773
1976	-480.255	733.950	.232305E-01	-.357549	-1.22644
1977	1476.86	644.678	.591483E-01	-.219913	-.843163
1978	2420.58	1981.02	-.744710E-01	-.229808	-.170895
	1	2	3	4	5

	Yas/Na	Yms/Nm
1963	0.	0.
1964	-1.76033	39.7220
1965	.193879	112.069
1966	1.97584	198.978
1967	3.97526	246.504
1968	5.50426	261.619
1969	5.75626	257.622
1970	5.46776	241.019
1971	5.30444	228.782
1972	5.33284	229.039
1973	5.60250	244.574
1974	7.39259	244.041
1975	7.08421	255.609
1976	7.52705	256.106
1977	8.92393	253.778
1978	7.75405	268.222
	1	2

Table 9.1b Percentage Difference in Selected Variables Following a Devaluation of Domestic Currency by 10 Percent with New Exchange Rate Maintained from 1963 to 1978

	GDP	P	Yas	Yms	Cp
1963	0.	5.00373	0.	0.	.456740
1964	-.449369E-01	10.5677	.408170E-01	-.960817E-01	1.04049
1965	.428135	15.4918	.233630E-01	.650196	1.65294
1966	.794497	18.0135	.378495E-01	1.24967	1.88793
1967	1.10739	18.4589	.392130E-01	1.68727	1.83665
1968	1.20475	17.2522	.480701E-01	1.79660	1.52351
1969	1.10691	16.0542	.620874E-01	1.65620	1.19358
1970	.973987	15.5848	.700507E-01	1.43427	.970203
1971	.890057	15.5721	.771800E-01	1.26311	.883148
1972	.868540	16.4928	.771209E-01	1.21798	.950845
1973	.866846	17.5785	.753697E-01	1.24093	.957164
1974	.992131	17.4790	.403904E-01	1.37944	.871547
1975	.953327	17.2516	.421232E-01	1.33138	.808078
1976	.975441	16.8322	.251732E-01	1.35144	.713802
1977	1.03143	16.5754	-.433458E-02	1.43689	.667780
1978	.962132	16.3229	.655261E-02	1.32917	.648995
	1	2	3	4	5

	I	E	IM	K	Nm/N
1963	3.60879	4.57098	-7.51839	.545254	0.
1964	12.3363	7.65633	-1.15679	2.25863	-.355714
1965	13.7571	9.50755	5.79367	3.95208	-.513729E-01
1966	10.4159	10.6367	10.5477	4.88169	.871819E-01
1967	6.75227	11.4606	12.5373	5.12599	.319620
1968	2.90000	12.2166	11.5353	4.79824	.394457
1969	1.27029	12.7849	9.88964	4.26181	.354831
1970	1.71815	13.1021	9.04466	3.88931	.280320
1971	2.71022	13.2458	9.06740	3.73114	.206623
1972	4.18080	13.2064	10.0039	3.78108	.216859
1973	4.71486	13.1059	11.0016	3.88408	.232280
1974	3.59678	13.0796	11.5425	3.84645	.378955
1975	3.18135	13.1153	11.4555	3.76605	.336145
1976	3.36776	13.2253	11.2577	3.72112	.396307
1977	3.32653	13.3199	10.8381	3.67721	.526853
1978	2.55530	13.4291	10.2471	3.54568	.399639
	1	2	3	4	5

	Wa/P	Wm/P
1963	.450072	-.288683
1964	.172010	.614757E-01
1965	.268543	.453451
1966	.209570	.886099
1967	.219121	1.07257
1968	.281962	1.04760
1969	.311559	.916108
1970	.337059	.794018
1971	.309789	.785171
1972	.290575	.792403
1973	.280466E-01	.887726
1974	.322305E-01	.791160
1975	.191342E-01	.916799
1976	-.235278	.977210
1977	-.699744E-01	.847780
1978	.108938	.788088
	1	2

Table 9.2a Actual Difference in Selected Variables Following a 20 Percent Reduction of All Tariff Rates in 1963 with New Rates Maintained through 1978

	GDP	P	Yas	Yms	Cp
1963	0.	-.105037E-01	0.	0.	114.968
1964	49.3460	-.217508E-01	3.24300	46.1020	135.233
1965	-18.1000	-.283595E-01	8.07900	-26.1960	165.081
1966	-49.9100	-.284629E-01	8.38300	-58.2940	279.827
1967	-40.1500	-.264850E-01	8.63100	-48.7850	440.667
1968	21.4100	-.244208E-01	8.54400	12.8660	649.637
1969	83.4600	-.237190E-01	10.2310	73.2280	834.697
1970	132.950	-.241127E-01	12.0960	120.854	992.459
1971	161.030	-.274395E-01	14.6000	146.430	1105.50
1972	191.560	-.297467E-01	14.7110	176.850	1201.77
1973	211.690	-.318890E-01	16.1150	195.580	1363.18
1974	329.530	-.349535E-01	10.4730	319.060	1522.37
1975	360.040	-.370280E-01	12.2790	347.760	1582.94
1976	405.940	-.402757E-01	10.3010	395.650	1617.13
1977	467.140	-.417513E-01	6.18600	460.950	1721.33
1978	453.320	-.416524E-01	11.4990	441.830	1898.49
	1	2	3	4	5

	I	E	IM	K	Nm/N
1963	137.897	16.3550	507.956	137.900	0.
1964	-328.422	58.0790	190.270	-196.010	.149985E-03
1965	-291.823	92.3890	-57.7490	-479.790	.362617E-04
1966	84.1620	104.756	-94.9560	-376.130	.490785E-04
1967	336.189	104.396	-105.897	-24.6200	.172489E-04
1968	449.620	100.854	26.7250	426.160	.836236E-04
1969	442.341	101.622	111.925	851.480	.101039E-03
1970	345.341	110.230	173.119	1162.68	.101212E-03
1971	281.778	125.417	156.827	1397.78	.649458E-04
1972	301.222	140.647	-64.0310	1642.87	.941052E-04
1973	469.669	146.364	2.49300	2046.52	.926085E-04
1974	554.446	125.646	99.7330	2518.65	.253705E-03
1975	439.940	120.753	89.5960	2857.22	.201111E-03
1976	329.981	139.902	119.868	3072.17	.225215E-03
1977	383.280	158.548	64.3470	3331.72	.310366E-03
1978	558.152	167.342	-8.53000	3755.68	.186180E-03
	1	2	3	4	5

	BOP	Gdef	g_Y	g_P	R
1963	-368.061	368.651	0.	-1.31461	.274803
1964	-167.505	333.157	.561996E-01	-1.37351	.530633
1965	12.5374	355.010	-.770035E-01	-.713476	-.948030E-02
1966	57.7801	402.953	-.295423E-01	-.698615E-01	-.198977
1967	71.1609	464.322	.105517E-01	.181304	-.177333
1968	-20.7806	536.922	.572762E-01	.264749	-.138094
1969	-78.8587	588.878	.478735E-01	.155425	.116874E-01
1970	-93.5551	648.900	.318861E-01	.875600E-02	.239995E-01
1971	-124.416	720.226	.998266E-02	-.119772	.717725E-01
1972	-34.4854	798.378	.142033E-01	.224460E-01	.148369
1973	-74.5184	1121.00	.603901E-02	.278645	-.139683
1974	-71.9910	1580.22	.500811E-01	.329463	-.731949E-01
1975	-136.113	1687.14	.420670E-02	.961508E-01	.137895
1976	-161.150	1791.49	.112110E-01	-.204963	.286386
1977	-94.8720	1915.05	.149752E-01	-.920280E-01	.131115
1978	9.20700	2068.69	-.221339E-01	.167219	-.135643
	1	2	3	4	5

	Yas/Na	Yms/Nm
1963	0.	0.
1964	.777869	2.00981
1965	.758846	-8.69556
1966	.820664	-18.1153
1967	.694876	-13.2154
1968	.967520	-3.50174
1969	1.16363	8.04804
1970	1.29864	17.5083
1971	1.33078	23.5159
1972	1.44498	26.3799
1973	1.51215	30.3798
1974	2.08333	32.5502
1975	1.95277	40.4220
1976	1.96583	43.6835
1977	2.28467	43.3947
1978	1.91068	48.6054
	1	2

Table 9.2b Percentage Difference in Selected Variables Following a 20 Percent Reduction of All Tariff Rates in 1963 with New Rates Maintained through 1978

	GDP	P	Yas	Yms	Cp
1963	0.	-1.25594	0.	0.	.188654
1964	.526762E-01	-2.62467	.926633E-02	.785647E-01	.209249
1965	-.176324E-01	-3.29295	.222713E-01	-.395191E-01	.237849
1966	-.451602E-01	-3.36170	.201943E-01	-.844767E-01	.375207
1967	-.349993E-01	-3.18339	.213829E-01	-.656131E-01	.563219
1968	.169256E-01	-2.92773	.109549E-01	.153756E-01	.772068
1969	.617068E-01	-2.78022	.210525E-01	.826060E-01	.927775
1970	.913611E-01	-2.77187	.246361E-01	.125338	1.02702
1971	.100429	-2.87813	.239465E-01	.133235	1.04633
1972	.113995	-2.85816	.285818E-01	.151709	1.06129
1973	.119742	-2.62616	.234020E-01	.162917	1.10995
1974	.163806	-2.36282	.179989E-01	.223144	1.11825
1975	.167755	-2.27740	.105108E-01	.229261	1.08752
1976	.178344	-2.47775	.150514E-01	.242673	1.06285
1977	.192409	-2.56746	.905989E-02	.264145	1.08166
1978	.171982	-2.41392	.157205E-01	.232006	1.12447
	1	2	3	4	5

	I	E	IM	K	Nm/N
1963	.737828	.116984	2.65383	.111481	0.
1964	-1.61810	.382730	.909286	-.140495	.653726E-01
1965	-1.25219	.551108	-.247109	-.304357	.149526E-01
1966	.326652	.567384	-.370277	-.211965	.212884E-01
1967	1.25815	.527532	-.381091	-.124736E-01	.748042E-02
1968	1.41040	.475428	.812180E-01	.192287	.340758E-01
1969	1.17287	.441764	.308181	.339629	.420784E-01
1970	.846824	.435457	.461543	.412787	.417105E-01
1971	.688638	.466918	.458838	.448729	.248384E-01
1972	.758594	.473536	-.173813	.484759	.366109E-01
1973	1.13271	.424476	.580850E-02	.557702	.378705E-01
1974	1.12326	.381944	.232656	.626891	.900828E-01
1975	.854784	.369981	.204225	.653405	.722883E-01
1976	.649328	.390971	.252759	.652662	.802700E-01
1977	.710379	.408136	.136174	.658525	.109181
1978	.878068	.386901	-.160736E-01	.683648	.641265E-01
	1	2	3	4	5

	Wa/P	Wm/P
1963	.502024	.640287
1964	.519773	.552045
1965	.413691	.458842
1966	.441089	.457020
1967	.465826	.539522
1968	.515262	.605219
1969	.554036	.644076
1970	.596458	.651449
1971	.543216	.623610
1972	.523736	.605622
1973	.438556	.643258
1974	.413527	.576942
1975	.406861	.588918
1976	.411922	.660833
1977	.480514	.628123
1978	.511384	.623629
	1	2

Table 9.3a Actual Difference in Selected Variables Following an Annual Transfer of Government Fixed Investment from the Non-agricultural to the Agricultural Sector Equal to 5 Percent of Total Governement Fixed Investment in Every Year from 1963 to 1978

	GDP	P	Yas	Yms	Cp
1963	0.	0.	0.	0.	0.
1964	38.5020	-.907080E-03	78.9030	-40.4010	4.53500
1965	56.1800	-.177849E-02	162.306	-106.122	4.15800
1966	108.000	-.279496E-02	272.528	-164.527	6.70200
1967	116.290	-.315094E-02	343.455	-232.169	3.40900
1968	129.920	-.369015E-02	461.787	-331.867	-6.14100
1969	200.210	-.467455E-02	595.274	-395.064	-9.52600
1970	250.500	-.519904E-02	721.441	-470.941	-8.46400
1971	209.330	-.548542E-02	828.316	-618.980	-20.3000
1972	228.790	-.637460E-02	915.777	-686.980	-30.8500
1973	367.780	-.890980E-02	1050.97	-693.190	-18.3000
1974	294.000	-.943230E-02	1108.31	-814.310	-31.6900
1975	286.570	-.104537E-01	1209.08	-922.510	-46.7200
1976	308.550	-.938550E-02	1256.03	-947.470	-27.3800
1977	268.850	-.957240E-02	1387.89	-1119.05	-47.7700
1978	303.300	-.103860E-01	1549.14	-1245.84	-61.9800

	I	E	IM	K	Nm/N
1963	0.	0.	0.	0.	0.
1964	-21.7100	1.83700	-2.33400	-20.6300	0.
1965	-46.9660	4.20500	-13.6130	-64.4500	-.815771E-04
1966	-57.0760	6.55000	-23.5880	-115.180	-.122854E-03
1967	-62.5950	7.99600	-34.5340	-167.670	-.164123E-03
1968	-71.9160	9.98400	-38.4490	-225.590	-.290897E-03
1969	-88.4740	12.5600	-38.4660	-295.800	-.318883E-03
1970	-102.622	13.7830	-51.8670	-375.090	-.355843E-03
1971	-116.937	14.2180	-65.9940	-463.290	-.504507E-03
1972	-133.903	16.7410	-55.0930	-562.900	-.596163E-03
1973	-156.032	21.1720	-63.0890	-678.660	-.473009E-03
1974	-174.174	19.9560	-76.3650	-806.430	-.496648E-03
1975	-174.952	20.5070	-85.2650	-928.810	-.684015E-03
1976	-189.055	19.6940	-95.3690	-1058.85	-.599545E-03
1977	-229.335	19.0140	-93.9610	-1221.71	-.791871E-03
1978	-256.254	20.4470	-85.5200	-1402.13	-.784426E-03

	BOP	Gdef	g_Y	g_P	R
1963	0.	0.	0.	0.	0.
1964	-3.08813	3.32690	.438495E-01	-.108460	-.423831E-01
1965	-1.06310	9.71100	.149275E-01	-.100930	-.434388E-01
1966	-.376400	16.4235	.462623E-01	-.121792	-.653172E-01
1967	3.29910	23.1949	.378468E-02	-.479368E-01	-.473985E-01
1968	1.47370	33.1487	.147194E-02	-.640775E-01	-.617413E-01
1969	-3.85732	42.5530	.484069E-01	-.108411	-.722815E-01
1970	.228520	55.1615	.259052E-01	-.509864E-01	-.515431E-01
1971	4.71200	73.2335	-.457436E-01	.245754E-01	-.364933E-01
1972	-10.3796	85.9168	.585924E-02	-.407655E-01	-.539460E-01
1973	-35.6796	114.684	.755223E-01	-.142342	-.582051E-01
1974	-19.9660	156.297	-.702798E-01	.117984	.257692E-01
1975	-1.74100	198.111	-.134454E-01	-.590830E-02	-.264350E-01
1976	-2.81300	219.203	.215431E-02	.659720E-01	.141580E-01
1977	-2.12560	251.390	-.264398E-01	-.113243E-01	-.326680E-01
1978	-22.2560	285.515	.469725E-02	-.141574E-01	-.380959E-01

	Yas/Na	Yms/Nm
1963	0.	0.
1964	6.10334	-10.4960
1965	12.2125	-20.1966
1966	19.7753	-31.7333
1967	24.7630	-43.6217
1968	32.4049	-52.1485
1969	40.7535	-62.2359
1970	48.5820	-71.6881
1971	55.1658	-75.5281
1972	59.4578	-82.1312
1973	67.1583	-93.5072
1974	71.6564	-96.4359
1975	75.1945	-93.5931
1976	77.3501	-99.1278
1977	83.6400	-101.962
1978	91.2811	-111.554

Table 9.3b Percentage Difference in Selected Variables Following an Annual Transfer of Government Fixed Investment from The Non-agricultural to the Agricultural Sector Equal to 5 Percent of Total Government Fixed Investment in Every Year from 1963 to 1978

	GDP	P	Yas	Yms	Cp
1963	0.	0.	0.	0.	0.
1964	.411004E-01	-.109457	.225452	-.688494E-01	.701685E-02
1965	.547285E-01	-.206436	.445322	-.160095	.599085E-02
1966	.977218E-01	-.330108	.655507	-.238424	.898640E-02
1967	.101372	-.378730	.853279	-.312254	.435705E-02
1968	.102708	-.442401	1.07852	-.396599	-.729834E-02
1969	.148027	-.547926	1.27727	-.445658	-.105883E-01
1970	.172140	-.597656	1.45937	-.488413	-.875874E-02
1971	.130553	-.575366	1.64225	-.563203	-.192143E-01
1972	.136151	-.612491	1.77925	-.589318	-.272437E-01
1973	.208034	-.733749	1.85991	-.577422	-.149005E-01
1974	.146144	-.637615	1.93473	-.569512	-.232780E-01
1975	.133523	-.642953	1.92117	-.608165	-.320975E-01
1976	.135557	-.577393	1.94500	-.581133	-.179954E-01
1977	.110736	-.588646	2.03268	-.641266	-.300180E-01
1978	.115067	-.601908	2.11786	-.654194	-.367107E-01
	1	2	3	4	5

	I	E	IM	K	Nm/N
1963	0.	0.	0.	0.	0.
1964	-.106963	.121055E-01	-.111540E-01	-.147871E-01	0.
1965	-.201527	.250832E-01	-.582503E-01	-.408842E-01	-.336385E-01
1966	-.221525	.354764E-01	-.923703E-01	-.649089E-01	-.532893E-01
1967	-.234255	.404052E-01	-.124277	-.849490E-01	-.711758E-01
1968	-.225592	.470648E-01	-.116848	-.101788	-.118538
1969	-.234590	.545999E-01	-.135914	-.117985	-.132804
1970	-.251643	.544490E-01	-.138280	-.133169	-.146645
1971	-.285783	.523325E-01	-.193082	-.148730	-.215895
1972	-.337220	.563642E-01	-.149550	-.166094	-.231935
1973	-.376306	.614018E-01	-.145993	-.184943	-.193428
1974	-.352861	.606632E-01	-.178143	-.200720	-.176344
1975	-.339924	.631389E-01	-.194136	-.212405	-.245865
1976	-.372018	.550370E-01	-.201099	-.224945	-.213687
1977	-.425054	.489460E-01	-.193844	-.241475	-.278565
1978	-.403131	.472742E-01	-.170373	-.255230	-.270182
	1	2	3	4	5

	Wa/P	Wm/P
1963	0.	0.
1964	.806410E-01	.847716E-02
1965	.131712	.190616E-01
1966	.201036	.506312E-01
1967	.287364	.317085E-01
1968	.329872	.461113E-01
1969	.397934	.822565E-01
1970	.559582	.825520E-01
1971	.591253	.821307E-01
1972	.520663	.103262
1973	.532594	.132332
1974	.584935	.286905E-01
1975	.567951	.835073E-01
1976	.666048	.313629E-01
1977	.677770	.560777E-01
1978	.736700	.494072E-01
	1	2

Table 9.4a Actual Difference in Selected Variables Following a Proportionate Increase in Government Fixed Investment in Agriculture and Non-agriculture Financed by an Increase in All Tax Rates of 10 Percent of Their Actual Levels in Each Year from 1963 to 1978

	GDP	P	Yas	Yms	Cp
1963	0.	.238259E-02	0.	0.	-289.692
1964	108.980	.755266E-02	50.6430	58.3380	-430.650
1965	203.580	.102260E-01	78.2260	125.354	-578.219
1966	375.260	.977292E-02	152.797	222.463	-680.388
1967	448.630	.889833E-02	166.509	282.118	-787.877
1968	373.110	.751303E-02	167.973	205.136	-983.345
1969	426.880	.668192E-02	193.057	233.823	-1136.45
1970	511.150	.694268E-02	215.726	295.422	-1263.53
1971	672.420	.785354E-02	256.616	415.800	-1364.78
1972	660.700	.756150E-02	260.963	399.740	-1492.83
1973	784.290	.607310E-02	321.304	462.990	-1627.78
1974	1018.38	.527590E-02	379.832	638.550	-1841.83
1975	1312.62	.416030E-02	473.480	834.140	-1848.01
1976	1696.86	.459800E-02	565.090	1130.78	-1762.87
1977	2133.40	.271110E-02	706.658	1426.74	-1774.37
1978	2483.51	-.987000E-04	806.485	1677.03	-1833.78
	1	2	3	4	5

	I	E	IM	K	Nm/N
1963	679.101	-100.422	-271.516	679.100	0.
1964	486.220	-141.094	-115.913	1138.57	-.899445E-04
1965	1197.79	-151.876	-6.30500	2291.51	-.191005E-05
1966	656.918	-123.606	22.1160	2858.01	-.629464E-04
1967	-336.664	-107.311	28.1520	2408.57	.478887E-05
1968	519.899	-126.706	-49.3150	2833.83	-.755919E-04
1969	791.195	-120.437	-84.1610	3513.56	-.594199E-04
1970	1360.86	-71.7690	-119.345	4735.94	-.265338E-04
1971	310.632	-34.0410	-112.697	4859.56	-.164739E-04
1972	1125.34	-25.2460	-18.3640	5793.12	-.258291E-04
1973	1963.36	-53.5390	-64.4740	7527.86	.112629E-04
1974	2769.27	-211.238	-85.1480	9999.62	-.695732E-04
1975	3658.97	-38.2140	-85.9800	13262.7	-.811419E-04
1976	4637.55	-22.7880	-133.799	17374.5	-.445705E-04
1977	2843.12	-15.8900	-123.839	19528.2	-.174970E-03
1978	2183.90	-1.81000	-122.285	20937.5	-.681815E-04
	1	2	3	4	5

	BOP	g_Y	g_P	R
1963	186.484	0.	.298197	-.308125
1964	88.5566	.124116	.619020	-.308663
1965	.763600	.897352E-01	.283920	-.665114E-01
1966	-35.6564	.151747	-.317704E-01	.429611E-01
1967	-44.0842	.533063E-01	-.822984E-01	.945363E-01
1968	11.7132	-.105572	-.167472	.384079E-01
1969	35.3853	.220214E-01	-.119100	-.408429E-01
1970	37.1673	.382223E-01	.150513E-01	-.449430E-02
1971	39.1435	.747873E-01	.279004E-01	-.201470E-01
1972	10.6239	-.273346E-01	-.105264	-.895890E-01
1973	20.0953	.528751E-01	-.252235	.107444E-01
1974	-49.2320	.709116E-01	-.173942	.668689E-01
1975	-58.7909	.111849	-.113362	.428690E-01
1976	-63.9320	.141139	.269157E-01	.942880E-01
1977	-126.063	.141054	-.115871	.132218
1978	-138.377	.683229E-01	-.182664	.147882
	1	2	3	4

	Yas/Na	Yms/Nm
1963	0.	0.
1964	3.60095	21.1408
1965	6.02520	30.3187
1966	11.1121	59.9229
1967	12.1537	68.2303
1968	11.9153	51.7074
1969	13.4127	57.3318
1970	14.8936	66.4690
1971	17.8596	83.4594
1972	17.6354	80.9349
1973	21.1118	92.6093
1974	25.1193	115.423
1975	30.8643	149.268
1976	36.1926	191.014
1977	44.0114	246.605
1978	49.7513	261.988
	1	2

Table 9.4b Percentage Difference in Selected Variables Following a Proportionate Increase in Government Fixed Investment in Agriculture and Non-Agriculture Financed by an Increase in All Tax Rates of 10 Percent of Their Actual Levels in Each Year from 1963 to 1978

	GDP	P	Yas	Yms	Cp
1963	0.	.284888	0.	0.	-.475363
1964	.116335	.911378	.144704	.994167E-01	-.666330
1965	.198320	1.18697	.215112	.189108	-.833099
1966	.339547	1.15426	.358081	.322382	-.912300
1967	.391077	1.06954	.412517	.379433	-1.00699
1968	.294961	.900714	.392308	.245149	-1.16867
1969	.315617	.783220	.414239	.263768	-1.26318
1970	.351254	.798096	.439372	.306382	-1.30753
1971	.419367	.823758	.508776	.378332	-1.29179
1972	.393176	.725532	.507021	.342913	-1.31829
1973	.443633	.500138	.556284	.385667	-1.32539
1974	.506226	.356646	.652778	.446589	-1.35292
1975	.611596	.255879	.750283	.549907	-1.26963
1976	.745492	.282867	.876605	.693566	-1.15864
1977	.878719	.166717	1.03496	.817587	-1.11499
1978	.942203	-.572004E-02	1.10256	.880613	-1.08615
	1	2	3	4	5

	I	E	IM	K	Nm/N
1963	3.63358	-.718298	-1.42389	.548997	0.
1964	2.39555	-.929785	-.558718	.816098	-.392033E-01
1965	5.13958	-.905953	-.259792E-01	1.45363	-.787611E-03
1966	2.54965	-.669480	.862404E-01	1.61061	-.273038E-01
1967	-1.25993	-.542262	.101310	1.22029	.207681E-02
1968	1.63086	-.597295	-.149870	1.27865	-.308029E-01
1969	2.09787	-.523555	-.231734	1.40145	-.247459E-01
1970	3.33702	-.283519	-.318179	1.68140	-.109348E-01
1971	.759155	-.126732	-.329724	1.56006	-.630042E-02
1972	2.83404	-.849992E-01	-.493493E-01	1.70937	-.100486E-01
1973	4.73508	-.155416	-.150220	2.05144	.460577E-02
1974	5.61029	-.642131	-.198632	2.48890	-.247032E-01
1975	7.10923	-.117086	-.195764	3.03300	-.291661E-01
1976	9.12565	-.636836E-01	-.282134	3.69109	-.158856E-01
1977	5.26950	-.409042E-01	-.252074	3.85980	-.615511E-01
1978	3.43564	-.418479E-02	-.243332	3.81126	-.234840E-01
	1	2	3	4	5

	Wa/P	Wm/P
1963	-.860500	-.942239
1964	-.812077	-.813777
1965	-.734571	-.791826
1966	-.571288	-.567076
1967	-.499531	-.565470
1968	-.615791	-.668775
1969	-.614791	-.638082
1970	-.580806	-.594589
1971	-.465140	-.486971
1972	-.491401	-.481497
1973	-.405045	-.460650
1974	-.426380	-.491789
1975	-.213714	-.249543
1976	.683629E-02	-.132626
1977	.313149E-01	-.224279E-01
1978	.853070E-01	.277239E-01
	1	2

Table 9.5a Actual Difference in Selected Variables Following a Money Growth Rate Equal to GDP Growth Rate Plus 5 Percent Compared with GDP Growth Rate Plus 2 Percent Over the Period 1963-78

	GDP	P	Yas	Yms	Cp
1963	0.	.638050E-02	0.	0.	67.5650
1964	65.3180	.630129E-02	.471000	64.8460	84.5620
1965	117.830	.239563E-02	1.40600	116.424	51.4130
1966	92.9700	-.982330E-03	1.35500	91.6120	6.62000
1967	45.0400	-.173338E-02	1.55300	43.4960	-12.1240
1968	23.6500	-.123778E-02	1.21400	22.4440	-8.98100
1969	19.3800	.462540E-03	.975000	18.4030	19.1470
1970	31.3600	.189529E-02	.683000	30.6850	46.8980
1971	48.2300	.237679E-02	.760000	47.4700	57.2900
1972	57.6800	.179860E-02	.805000	56.8700	45.4500
1973	54.9900	.539500E-03	.954000	54.0300	19.1300
1974	52.9300	.181130E-02	.559000	52.3600	35.9900
1975	52.6900	.337750E-02	.617000	52.0700	55.9200
1976	66.1800	.219610E-02	.340000	65.8400	38.9100
1977	72.6800	-.106480E-02	-.227000	72.9100	-12.0900
1978	51.4800	-.216040E-02	.143000	51.3400	-31.8600
	1	2	3	4	5

	I	E	IM	K	Nm/N
1963	363.183	-19.0680	184.427	363.190	0.
1964	332.002	-22.0560	245.546	680.550	.642904E-04
1965	-122.992	-10.8120	156.462	530.120	.935805E-04
1966	-233.668	2.74800	19.2500	275.100	.995021E-04
1967	-112.293	7.77200	-52.5390	151.740	.397073E-04
1968	5.85200	6.60300	-62.6130	151.490	.147888E-04
1969	95.1500	-1.32300	18.5520	240.540	.255610E-05
1970	131.198	-9.43100	106.543	362.050	.123182E-04
1971	87.5200	-12.4720	127.152	434.970	.207073E-04
1972	18.6430	-10.3000	114.648	436.070	.297219E-04
1973	-42.5700	-3.90100	65.4630	375.930	.267043E-04
1974	33.8630	-7.26600	89.3270	394.640	.278273E-04
1975	112.424	-12.4220	138.380	491.150	.239578E-04
1976	38.8950	-9.90500	121.953	510.250	.320485E-04
1977	-99.4660	3.04400	4.54600	390.210	.421225E-04
1978	-89.7790	9.68400	-58.1580	284.690	.197562E-04
	1	2	3	4	5

	BOP	Gdef	g_Y	g_P	R
1963	-125.281	15.9229	0.	.798560	-.611675
1964	-176.582	6.04110	.743900E-01	.258400E-02	.265204
1965	-119.204	-12.1445	.491411E-01	-.479717	.376448
1966	-22.4403	-15.3337	-.327287E-01	-.383438	.122813
1967	30.8047	-8.48070	-.453840E-01	-.916888E-01	-.841249E-01
1968	39.5426	-4.10490	-.225848E-01	.602137E-01	-.841883E-01
1969	-8.70679	3.50010	-.464635E-02	.209926	-.123580
1970	-72.1609	7.49230	.776340E-02	.167005	-.371514E-01
1971	-110.189	4.09660	.938720E-02	.345969E-01	.117197E-01
1972	-107.424	-2.07160	.444663E-02	-.837062E-01	.654440E-01
1973	-69.9145	-11.4705	-.338222E-02	-.151425	.562415E-01
1974	-133.640	-10.7755	-.546498E-02	.943220E-01	-.122997
1975	-224.764	-9.08880	-.137408E-02	.929240E-01	-.835830E-01
1976	-206.361	-15.3650	.479484E-02	-.724506E-01	.953720E-01
1977	-17.6331	-35.6350	.910243E-03	-.197157	.245948
1978	106.728	-28.1100	-.112689E-01	-.632859E-01	-.412653E-01
	1	2	3	4	5

	Yas/Na	Yms/Nm
1963	0.	0.
1964	.262345	12.5467
1965	.455218	21.8217
1966	.500418	15.3045
1967	.265125	7.44895
1968	.149470	3.89163
1969	.802697E-01	3.91224
1970	.103194	5.60064
1971	.151982	7.65099
1972	.194942	8.53003
1973	.194125	8.28032
1974	.188912	6.54126
1975	.177260	6.62185
1976	.207260	7.78967
1977	.241913	7.54921
1978	.135584	5.83527
	1	2

Table 9.5b Percentage Difference in Selected Variables Following a Money Growth Rate Equal to GDP Growth Rate Plus 5 Percent Compared with GDP Growth Rate Plus 2 Percent Over the Period 1963-78

	GDP	P	Yas	Yms	Cp
1963	0.	.743214	0.	0.	.110438
1964	.695531E-01	.745858	.134573E-02	.110074	.130370
1965	.114383	.275797	.385584E-02	.174696	.739080E-01
1966	.839165E-01	-.114921	.326378E-02	.132249	.885690E-02
1967	.391785E-01	-.209568	.384693E-02	.583124E-01	-.154973E-01
1968	.186718E-01	-.149529	.283507E-02	.267699E-01	-.106800E-01
1969	.143219E-01	.543483E-01	.209186E-02	.207456E-01	.212811E-01
1970	.215378E-01	.217684	.130099E-02	.317971E-01	.485000E-01
1971	.300580E-01	.249355	.150674E-02	.431481E-01	.541953E-01
1972	.343024E-01	.172596	.156397E-02	.487401E-01	.401066E-01
1973	.310862E-01	.439197E-01	.168133E-02	.449672E-01	.155417E-01
1974	.262841E-01	.121985	.960683E-03	.365672E-01	.264102E-01
1975	.245269E-01	.206396	.980370E-03	.342814E-01	.383689E-01
1976	.290494E-01	.133944	.526493E-03	.403331E-01	.255348E-01
1977	.299028E-01	-.655600E-01	-.332466E-03	.417162E-01	-.760013E-02
1978	.195163E-01	-.124998	.195499E-03	.269312E-01	-.188651E-01
	1	2	3	4	5

	I	E	IM	K	Nm/N
1963	1.81674	-.137050	.935925	.290553	0.
1964	1.57089	-.145979	1.13746	.480613	.279949E-01
1965	-.538726	-.646153E-01	.656714	.333057	.385445E-01
1966	-.904818	.149115E-01	.737033E-01	.153709	.431051E-01
1967	-.426919	.392396E-01	-.139432	.764726E-01	.172051E-01
1968	.186689E-01	.310811E-01	-.191839	.682083E-01	.602326E-02
1969	.250879	-.574781E-02	.515434E-01	.956900E-01	.106441E-02
1970	.319665	-.372591E-01	.283860	.128129	.507606E-02
1971	.213761	-.464302E-01	.371996	.139241	.791842E-02
1972	.468928E-01	-.346854E-01	.310605	.128329	.115615E-01
1973	-.101204	-.113360E-01	.150299	.102038	.109186E-01
1974	.684296E-01	-.221069E-01	.206795	.978528E-01	.987683E-02
1975	.218404	-.381065E-01	.311812	.111941	.860871E-02
1976	.758550E-01	-.277286E-01	.253717	.107969	.114183E-01
1977	-.185654	.783379E-02	.961383E-02	.769104E-01	.148095E-01
1978	-.141519	.223949E-01	-.115344	.517059E-01	.680262E-02
	1	2	3	4	5

	Wa/P	Wm/P
1963	-.274292E-01	.314711E-01
1964	.771209E-02	.904299E-01
1965	.321645E-01	.123279
1966	.335173E-01	.699948E-01
1967	.191897E-01	.321710E-01
1968	.143631E-01	.169681E-01
1969	.895592E-02	.198620E-01
1970	.710546E-02	.245346E-01
1971	.490202E-02	.301521E-01
1972	.860596E-02	.323869E-01
1973	.851464E-02	.308602E-01
1974	.827640E-02	.275608E-01
1975	.670484E-03	.264495E-01
1976	-.304038E-02	.305626E-01
1977	.884817E-02	.244302E-01
1978	.115917E-01	.170372E-01
	1	2

CHAPTER 10

SUMMARY AND CONCLUSIONS

The macro-econometric model designed and estimated for Thailand in this study is a two-sector model in order to highlight the dichotomy between agriculture and non-agriculture in the economy. It draws on aspects of both the Keynesian and neoclassical approaches to obtain demand and supply curves for both final and intermediate products, within a consistent general equilibrium framework.

The model is intended to be able to explain the economic structure, growth and development of the Thai economy; to be of assistance in the analysis of macro-policy initiatives including development planning; to examine the relationships among the major economic variables; to provide information on the estimates of structural parameters; to calculate multipliers as a basis for indicating the effects of specific changes in various government policies and other exogenous variables; and to make conditional forecasts and policy simulations.

The model also captures some important features of the Thai economy which are generally neglected in other models. Among these features are: the dualistic character in the production process between the agricultural and non-agricultural sectors; the migration of labour from rural areas to the fast-growing urban sector; and the outflow of savings from the rural to the urban sector. Another important characteristic of the model is the explicit link among the government budget constraint, the foreign trade and foreign exchange markets, and the domestic money market. The linkage is important in providing a built-in stabilizing mechanism in the real economy.

The estimated model has been tested for its forecasting ability by (1) historical simulation over the data period (1960-1978); and (2) comparing the direction of change between some selected simulated variables and their actual series. According to the tests, the model performs reasonably well for most variables.

The stability of the model has also been tested by (1) simulating with the model over 50 periods during which all exogenous variables are frozen at their initial levels (the standard run) to make sure that the model will not explode and will have a tendency to return to a steady state level; and (2) shocking the standard run by a one-time change in the exchange rate or the money supply to see that over some reasonable period the endogenous variables in the model will move towards their values in the standard run. The results indicated that the model is stable and tends towards a steady state level. The model also survived the shock, and moved towards the values in standard run over a reasonable period.

The model was then used for five different policy simulations over a portion of the study period: (1) a sustained 10 percent devaluation of the domestic currency; (2) a sustained decrease in all tariff rates by 20 percent; (3) an annual transfer of government fixed investment from the non-agricultural sector to the agricultural sector equal to 5 percent of total government fixed investment; (4) a proportionate increase in government fixed investment in both sectors financed by a 10 percent increase in all tax rates every year; and (5) a comparison of two alternative monetary policies, one having monetary growth rates equal to the actual growth rates of gross domestic product plus 5 percent and the other with plus 2 percent.

The experiments provided reasonable quantitative answers to the effects of such policies on major economic variables. For example, the devaluation policy improved the balance of payments situation, increased the degree of international trade, and generated higher levels of GDP, consumption and investment with rather high inflationary pressure for the first 4 or 5 years.

The tariff reduction policy increased the share of the private sector in GDP. Prices generally fall, GDP declined in the early years and later increased, the balance of payments worsened, government deficit increased, and real wages in both sectors increased.

The results of the policy of transferring government fixed investment from the non-agricultural to the agricultural sector suggest that there has been underinvestment in the agricultural sector: the transfer generates an increase in value added in agriculture which more than offsets the reduction in non-agriculture. The policy also improves income distribution (in terms of output per worker) and increases real wages, especially in the agricultural sector.

The policy of an increase in government investment financed by taxation transfers resources from the private sector to the government sector. The policy reduces personal consumption considerably. GDP and total gross fixed investment increase, though private investment in both sectors declines because of the increase in the price of investment goods relative to output prices.

Finally, from a comparison of the two monetary growth policies, it seems that the plus 5 percent policy is preferred to the plus 2 one in terms of raising the levels of GDP, consumption, investment, real wages and output per capita, although the balance of payments situation is worsened.

The model can, of course, be used for other policy simulations as well as conditional future forecasting. The model can also be applied with any specified welfare function to solve for the optimum level of the objectives given policy instruments. (See for example, Theil, 1964).

The model constructed here is rather aggregate. There are many possibilities of extending the model:

(1) The model is a two sector model; it could be extended to a multi-sector model by disaggregating the non-agricultural sector into manufacturing, mining, construction, etc., or disaggregating the agricultural sector by selected commodities.

(2) The demographic sector in the model is very aggregate; it could be expanded to make it suitable for long-run forecasting, over periods of many decades.

(3) The monetary sector could also be extended to differentiate various monetary policy instruments.

(4) The income distribution variables in the model are rather crude, and further efforts are needed to explain them; they are very important in assessing alternative economic development policies.

(5) Private and government expenditures on health and education have not been directly incorporated in the model; this may turn out to be an important factor in the present stage of economic growth and development of Thailand.

(6) The model should recognize the widespread inefficiency in the government sector; for example, private

investment is likely to create more capital stock than government investment, for the same amount of investment.

(7) The effects of pollution and the limitation of natural resources could be incorporated to recognize the costs associated with economic growth and the limits to growth.

(8) Some adjustments should be made to the model, if it is to be applied for future forecasting, to take account of the discovery of natural gas in recent years.

APPENDIX 1

LIST OF VARIABLES AND PARAMETERS FOR THE MACRO-ECONOMETRIC MODEL

An asterisk (*) denotes an exogenous variable. Flow variables are measured over the length of a year and stocks are measured at the end of the year. "m.c. baht" indicates millions of current-value baht, and "m.72 baht" indicates millions of baht expressed in 1972 purchasing power. Variables which appear in the theoretical model of Chapter 3, but not in the econometric model, are defined in a separate list, below. The sources of data and data listing are presented in Appendix 2.

<u>Variables</u>

AD*	= adjustment of the stock of foreign assets due to the change in prices of gold, foreign currencies, and other assets, and net errors and omissions	m.c. baht
ADg	= treasury cash balance and net errors and omissions	m.c. baht
BCC	= balance on current account	m.c. baht
BOP	= balance of payments	m.c. baht
BOWg*	= net foreign borrowing of the Thai government, net allocation of SDRs and net errors and omissions	m.c. baht

cg*	= share of real government consumption expenditures in real gross domestic product (Cg/GDP)	
Ca	= personal consumption of agricultural goods	m.72 baht
Cd	= personal consumption of durable goods	m.72 baht
Cg	= government consumption expenditures on goods and services	m.72 baht
Cm	= personal consumption of non-agricultural goods	m.72 baht
Cnd	= personal consumption of non-durable goods	m.72 baht
Cp	= total personal consumption expenditures on goods and services	m.72 baht
Cs	= personal consumption of services	m.72 baht
D_{74-78}	= dummy variable (1960-73 = 0, 1974-78 = 1)	
Da	= capital consumption allowances on fixed investment in the agricultural sector (deflated by the investment deflator, Pi)	m.72 baht
Dm	= capital consumption allowances on fixed investment in the non-agricultural sector (deflated by the investment deflator, Pi)	m.72 baht
DL*	= damaged area of paddy production	million rai
DPI	= disposable personal income	m.c. baht
ex*	= exchange rate of Thai baht per $US	
E	= total exports of goods and services	m.72 baht
Ea	= exports of agricultural goods	m.72 baht
Em	= exports of non-agricultural goods	m.72 baht
g*	= rate of population growth	percent

gl*	= rate of labour force growth	percent
g_p	= growth rate of the gross domestic product deflator (proxy for inflation rate)	percent
g_Y	= rate of growth of gross domestic product	percent
Gdebt	= government debt	m.c. baht
Gdef	= government deficit	m.c. baht
Gex	= government expenditure	m.c. baht
Grev	= government revenue	m.c. baht
GDP	= gross domestic product	m.72 baht
GDPw$*	= index of world gross domestic product (except socialist countries) in 1972 $US	1972 = 1.00
I	= total gross fixed investment	m.72 baht
If*	= foreign direct investment and net private borrowing in both short and long terms from foreign sources	m.c. baht
Ig	= total government gross fixed investment	m.72 baht
Iga*	= government gross fixed investment in the agricultural sector	m.72 baht
Igm*	= government gross fixed investment in the non-agricultural sector	m.72 baht
Ip	= total private gross fixed investment	m.72 baht
Ipa	= private gross fixed investment in the agricultural sector	m.72 baht
Ipan	= private net fixed investment in the agricultural sector	m.72 baht

Ipm	= private gross fixed investment in the non-agricultural sector	m.72 baht
Ipmn	= private net fixed investment in the non-agricultural sector	m.72 baht
IM	= total imports of goods and services	m.72 baht
IMa	= imports of agricultural goods	m.72 baht
IMc	= imports of consumer goods	m.72 baht
IMf	= imports of fuels and lubricants	m.72 baht
IMi	= imports of capital goods	m.72 baht
IMm	= imports of non-agricultural goods	m.72 baht
IMo	= imports of other goods	m.72 baht
IMr	= imports of intermediate products and raw materials	m.72 baht
IMs	= imports of services	m.72 baht
INg	= interest payments on government debt	m.c. baht
INp*	= interest payments on consumers debt	m.c. baht
IT	= total indirect taxes less subsidies	m.c. baht
ITa	= indirect taxes on agricultural value added output	m.c. baht
ITd	= domestic indirect taxes less subsidies (business, selective sales and other indirect taxes) on demand for goods and services	m.c. baht
ITda	= domestic indirect taxes on demand for agricultural goods	m.c. baht
ITdm	= domestic indirect taxes on demand for non-agricultural goods	m.c. baht

ITe	= export duties	m.c. baht
ITea	= export duties on agricultural goods	m.c. baht
ITem	= export duties on non-agricultural goods	m.c. baht
ITim	= import duties	m.c. baht
ITimc	= import duties on consumer goods	m.c. baht
ITimf	= import duties on fuels and lubricants	m.c. baht
ITimi	= import duties on capital goods	m.c. baht
ITimo	= import duties on other goods	m.c. baht
ITimr	= import duties on intermediate products and raw materials	m.c. baht
ITm	= indirect taxes on non-agricultural value added output	m.c. baht
IVa*	= change in agricultural inventory	m.72 baht
IVm	= change in non-agricultural inventory	m.72 baht
K	= total stock of fixed investment	m.72 baht
Ka	= total stock of fixed investment in the agricultural sector (see Appendix 3)	m.72 baht
Kd	= stock of consumer durable goods (see Appendix 4)	m.72 baht
Kga	= stock of government fixed investment in the agricultural sector (see Appendix 4)	m.72 baht
Kgm	= stock of government fixed investment in the non-agricultural sector (see Appendix 4)	m.72 baht
Km	= total stock of fixed investment in the non-agricultural sector (see Appendix 3)	m.72 baht

Kpa	= stock of private fixed investment in the agricultural sector (see Appendix 4)	m.72 baht
Kpm	= stock of private fixed investment in the non-agricultural sector (see Appendix 4)	m.72 baht
L*	= total planted area (including area for multiple crops planting)	million rai
M	= demand for money	m.c. baht
MS	= money supply (currency in public hands plus demand deposits) at the end of the year	m.c. baht
N	= total persons employed	million
Na	= persons employed in the agricultural sector	million
Nm	= persons employed in the non-agricultural sector	million
NDCg*	= net domestic credit to government at the end of the year	m.c. baht
NDCp*	= net domestic credit to the private sector less quasi-money and less savings deposits at the end of the year	m.c. baht
NDPI	= net disposable personal income	m.c. baht
NFA	= net foreign assets of Thailand at the end of the year	m.c. baht
NFIfW*	= net factor income payments from the rest of the world	m.c. baht
NI	= national income	m.c. baht
P	= implicit price index after indirect taxes for gross domestic product (the GDP deflator)	1972 = 1.00

Pa = implicit price index after indirect taxes for agricultural output 1972 = 1.00

Pab = implicit price index before indirect taxes for agricultural output 1972 = 1.00

Pc = implicit price index after indirect taxes for total personal consumption expenditures on goods and services (the Cp deflator) 1972 = 1.00

Pd = implicit price index after indirect taxes for personal consumption of durable goods (the Cd deflator) 1972 = 1.00

Pd&nd = implicit price index after indirect taxes for personal consumption of durable and non-durable goods 1972 = 1.00

Pe = implicit price index after export duties for exports of goods and services 1972 = 1.00

Pea = implicit price index after export duties for exports of agricultural goods 1972 = 1.00

Peaw$* = index of world export prices for agricultural goods (approximated by the world export price of food, in $US) 1972 = 1.00

Pem = implicit price index after export duties for exports of non-agricultural goods 1972 = 1.00

Pemb = implicit price index before export duties for exports of non-agricultural goods 1972 = 1.00

Pemw$*	= index of world export prices for non-agricultural goods (approximated by world export prices of primary products except crude pretroleum, in $US)	1972 = 1.00
Pi	= implicit price index after indirect taxes for total gross fixed investment (the I deflator)	1972 = 1.00
Pim	= unit value index after import duties for total imports of goods and services	1972 = 1.00
Pimb	= unit value index before import duties for total imports of goods and services	1972 = 1.00
Pimc	= unit value index after import duties for imports of consumer goods	1972 = 1.00
Pimcb	= unit value index before import duties for imports of consumer goods	1972 = 1.00
Pimcb$*	= unit value index before import duties for imports of consumer goods, in $US	1972 = 1.00
Pimf	= unit value index after import duties for imports of fuels and lubricants	1972 = 1.00
Pimfb	= unit value index before import duties for imports of fuels and lubricants	1972 = 1.00
Pimfb$*	= unit value index before import duties for imports of fuels and lubricants, in $US	1972 = 1.00
Pimi	= unit value index after import duties for imports of capital goods	1972 = 1.00

Pimib	= unit value index before import duties for imports of capital goods	1972 = 1.00
Pimib$*	= unit value index before import duties for imports of capital goods, in $US	1972 = 1.00
Pimo	= unit value index after import duties for imports of other goods	1972 = 1.00
Pimob	= unit value index before import duties for imports of other goods	1972 = 1.00
Pimob$*	= unit value index before import duties for imports of other goods, in $US	1972 = 1.00
Pimr	= unit value index after import duties for imports of intermediate products and raw materials	1972 = 1.00
Pimrb	= unit value index before import duties for imports of intermediate products and raw materials	1972 = 1.00
Pimrb$*	= unit value index before import duties for imports of intermediate products and raw materials, in $US	1972 = 1.00
Pims	= unit value index for imports of services	1972 = 1.00
Pims$*	= unit value index for imports of services, in $US	1972 = 1.00
Pm	= implicit price index after indirect taxes for non-agricultural output	1972 = 1.00
Pmb	= implicit price index before indirect taxes for non-agricultural output	1972 = 1.00

Pnd	= implicit price index after indirect taxes for consumption of non-durable goods (the Cnd deflator)	1972 = 1.00
Ps	= implicit price index after indirect taxes for consumption of services (the Cs deflator)	1972 = 1.00
PI	= personal income	m.c. baht
POP	= population	million
PR	= gross corporate profit	m.c. baht
PROg*	= government income from property and entrepreneurship	m.c. baht
Q	= total output	m.72 baht
Qad	= demand for agricultural output	m.72 baht
Qas	= supply of agricultural output	m.72 baht
Qmd	= demand for non-agricultural output	m.72 baht
Qms	= supply of non-agricultural output	m.72 baht
r	= real rate of interest, defined as the nominal rate (R) less the actual rate of inflation of GDP, at the beginning of the year	percent
rf*	= rainfall index (see Appendix 5)	mean = 1.00
R	= nominal Bank of Thailand loan rate at the middle of the year (a proxy for domestic rate of interest)	percent
Rw*	= nominal average 3-month Euro-dollar rate of interest (London) (a proxy for the world rate)	percent
S	= total saving	m.c. baht
Sc	= corporate saving	m.c. baht

Sd	=	total domestic saving	m.c. baht
Sf	=	foreign saving	m.c. baht
Sg	=	government saving	m.c. baht
Sp	=	personal saving	m.c. baht
t*	=	time trend	1960 = 1.00
ta	=	implicit indirect tax rate on agricultural value added	
tc*	=	corporate income tax rate	
tda*	=	domestic indirect tax rate on demand for agricultural goods	
tdm*	=	domestic indirect tax rate on demand for non-agricultural goods	
tea*	=	duty rate on exports of agricultural goods	
tem*	=	duty rate on exports of non-agricultural goods	
tia*	=	ratio of indirect taxes on agricultural value added to import duties on consumer goods (ITa/ITimc)	
timc*	=	tariff rate on imports of consumer goods	
timf*	=	tariff rate on imports of fuels and lubricants	
timi*	=	tariff rate on imports of capital goods	
timo*	=	tariff rate on imports of other goods	
timr*	=	tariff rate on imports of intermediate products and raw materials	
tm	=	implicit indirect tax rate on non-agricultural value added	
tp*	=	personal income tax rate	

Tc	= corporate income tax	m.c. baht
Tp	= personal income tax	m.c. baht
TfGtH*	= transfer payments from government to households	m.c. baht
TfGtW*	= transfer payments from government to the rest of the world	m.c. baht
TfHtG*	= transfer payments from households to government	m.c. baht
TfHtW*	= transfer payments from households to the rest of the world	m.c. baht
TfWtG*	= transfer payments from the rest of the world to government	m.c. baht
TfWtH*	= transfer payments from the rest of the world to households	m.c. baht
Wa	= index of nominal wage rate for unskilled labour in the agricultural sector	1972 = 1.00
Wm	= index of nominal wage rate for unskilled labour in the non-agricultural sector	1972 = 1.00
Yad	= final demand for agricultural output	m.72 baht
Yas	= agricultural value added output	m.72 baht
Ymd	= final demand for non-agricultural output	m.72 baht
Yms	= non-agricultural value added output	m.72 baht

Additional Variables for the Theoretical Model in Chapter 3

g_{Pa} = growth rate of the price of agricultural output

g_{Pm} = growth rate of the price of non-agricultural output

ITima = import duties on agricultural goods

ITimm = import duties on non-agricultural goods

Kva = stock of agricultural inventory

Kvm = stock of non-agricultural inventory

Pima = unit value index after import duties for imports of agricultural goods

Pimab = unit value index before import duties for imports of agricultural goods

Pimab$*= unit value index before import duties for imports of agricultural goods, in $US

Pimm = unit value index after import duties for imports of non-agricultural goods

Pimmb = unit value index before import duties for imports of non-agricultural goods

Pimmb$*= unit value index before import duties for imports of non-agricultural goods, in $US

Qaa = intermediate agricultural input used in producing agricultural output

Qam = intermediate agricultural input used in producing non-agricultural output

Qma = intermediate non-agricultural input used in producing agricultural output

Qmm = intermediate non-agricultural input used in producing non-agricultural output

tima* = rate of import duties on imported agricultural goods

timm* = rate of import duties on imported non-agricultural goods

Parameters

da = estimated rate of depreciation of agricultural capital stock (= 0.0364; see Chapter 6)

dm = estimated rate of depreciation of non-agricultural capital stock (= 0.0404; see Chapter 6)

dd = rate of depreciation of stock of consumer durable goods (= 0.0667; see Appendix 4)

A = efficiency parameter of the production function for total agricultural output (= 1.87359)

B = efficiency parameter of the production function for total non-agricultural output (= 2.65812)

Parameters Obtained from the 1975 Input-Output Table of Thailand

a_{01} = value share of agricultural value added to total agricultural output; (Pab.Yas)/(Pab.Qas) = .7883

a_{02} = value share of non-agricultural value added to total non-agricultural output; (Pmb.Yms)/(Pmb.Qms) = .4919

a_{11} = value share of intermediate agricultural input used in producing agricultural output to total agricultural output; (Pab.Qaa)/(Pab.Qas) = .0528

a_{12} = value share of intermediate agricultural input used in producing non-agricultural output to total non-agricultural output; (Pab.Qam)/(Pmb.Qms) = .1211

a_{21} = value share of intermediate non-agricultural input used in producing agricultural output to total agricultural output; (Pmb.Qma)/(Pab.Qas) = .1589

a_{22} = value share of intermediate non-agricultural input used in producing non-agricultural output to total non-agricultural output; (Pmb.Qmm)/(Pmb.Qms) = .3870

APPENDIX 2

SOURCES OF DATA AND DATA LISTING

1. Data for the following variables were obtained from the Office of the National Economic and Social Development Board, Bangkok, Thailand:

Cd, Cnd, Cp, Cs, Da, Dm, E, Grev, GDP, I, Ig, Ip, IMc, IMf, IMi, IMo, IMr, IMs, INg, INp, IT, ITa, ITm, NFIfW, NI, P, Pa, Pc, Pd, Pd&nd, Pe, Pi, Pimcb, Pimfb, Pimib, Pimob, Pimrb, Pims, Pm, Pnd, Ps, PR, PROg, Sc, Sg, Sp, Tp, TfGtH, TfGtW, TfHtG, TfHtW, TfWtG, TfWtH, Yas and Yms.

2. Data for the following variables were obtained from Bank of Thailand Monthly Bulletin (various issues):

BOP, BOWg, DL, If, ITd, ITdm, ITe, ITem, ITim, ITimc, ITimf, ITimi, ITimr, M, MS, NDCg, NDCp, NFA, R and Tc.

3. Data for the following variables were derived from identities in the model:

The numbers in parentheses refer to the equation numbers in Chapter 8.

AD (80), ADg (77), BOC (78), cg (73), Cm (30), DPI (27), Em (90), g (12), gl (13), g_p (97), Gdebt (75), Gdef (76), Gex (71), Ipan (38), Ipmn (39), IM (81), IMm (82), ITda (64), ITea (61), ITimo (55), IVa (19), IVm (21), K (11), N (16), NDPI (28), Pab (101), Pea (117), Pem (119), Pemb (118), Pim (116), Pimb (110), Pimc (111), Pimcb$ (104), Pimf (114), Pimfb$ (107), Pimi (112), Pimib$ (105), Pimo (115), Pimob$ (108), Pimr (113), Pimrb$ (106), Pims$ (109), Pmb (102), PI (26), Q (22), Qad (98), Qas (1), Qmd (99), Qms (3), r (96), S (42), Sd (43), Sf (44), ta (69), tc (53), tda (65), tdm (66), tea (62), tem (63), tia (68), timc (56), timf (59), timi (57), timo (60), timr (58), tm (70), tp (52), Wa (14), Wm (15), Yad (18) and Ymd (20).

4. Data created with use of definitions in the 1975 Input-Output Table for Thailand:

Ca, Ea and IMa.

Nominal Ca and Ea were deflated by Pa; nominal IMa was deflated by Pimc.

5. Other Data:

Cg is obtained as nominal Cg divided by Pm, where nominal Cg is from the Office of the National Economic and Social Development Board. It thus differs somewhat from the published Cg series.

ex is from U.N. <u>1979 Yearbook of International Trade</u>

Statistics.

g_Y is equal to 100.(GDP-GDP$_{-1}$)/GDP$_{-1}$.

GDPw$ is obtained from U.N. 1980 Yearbook of National Account Statistics. Volume II.

Iga, Igm, Ipa and Ipm are obtained from National income of Thailand, 1964-65 Edition. Office of the National Economic and Social Development Board, Ramagura (1976) and U.N. 1980 Yearbook of National Account Statistics. Volume I. The series of Iga and Igm have been adjusted proportionately for their errors and discrepancies from Ig. Similar adjustments have been made for Ipa and Ipm.

Ka and Km are from Appendix 3.

Kd, Kga, Kgm, Kpa and Kpm are from Appendix 4.

L is obtained from Agricultural Statistics of Thailand: Crop Year 1978/1979. Ministry of Agriculture and Cooperatives.

The series of Na and Nm are created from the series of workers employment index in agriculture and workers employment index in manufacturing, respectively. Both indexes are from Table I-1, in Selected Economic Indicators Relating to Agriculture. Issues 1978 and 1979, Ministry of Agriculture and Cooperatives. Both indexes have been converted into levels by the benchmarks (1970) of workers in agricultural sector and workers in non-agricultural sector, reported in Table I-8, in the same bulletins.

Peaw$ and Pemw$ are obtained from U.N. Methods Used _in Compiling the United Nations Price Indexes for Basic Commodities in International Trade._ Series M, no. 29, rev. 2, 1979; and from U.N. _1980 Yearbook of International Trade Statistics._

POP is obtained from Ramagura (1976) for the periods 1960-1966, and from Department of Local Administration, Ministry of Interior for the periods 1967-1978.

rf is from Appendix 5.

Rw is obtained from IMF _International Financial Statistics Yearbook 1982._

	AD	ADg	BOC	BOP	BOWg
1960	-59.5000	-3006.05	38.7462	950.500	463.054
1961	-88.4000	-1867.96	846.839	1660.00	56.5609
1962	-47.8000	-1377.20	-341.595	1295.00	130.995
1963	632.300	-1205.95	-1115.05	949.000	450.450
1964	8.00000	-95.3542	-419.654	1430.00	435.654
1965	-6.70000	-3.18613	-516.786	1985.00	1150.69
1966	-1.50000	303.260	495.660	3304.00	1339.44
1967	-223.800	108.867	-1153.53	1313.00	375.033
1968	-1.40000	-1883.99	-2733.39	449.000	1034.59
1969	0.	-2279.04	-3810.04	-914.000	-19.3641
1970	-8.10000	-4692.38	-4990.28	-2652.00	-78.4152
1971	-.300000	-12343.5	-3315.72	-335.000	1457.42
1972	378.200	-17562.1	-1062.70	3591.00	1308.80
1973	830.400	-21320.6	-1381.67	864.000	-37.1345
1974	131.600	-30312.3	-5668.31	8012.00	4705.41
1975	1469.90	-25113.6	-14507.2	-2858.00	3749.91
1976	-841.600	-25133.8	-10606.2	-83.0000	3623.54
1977	920.000	-36009.8	-24611.0	-7538.00	3944.82
1978	2318.70	-38064.5	-25447.0	-13298.0	3362.94
	1	2	3	4	5

	cg	Ca	Cd	Cg	Cm
1960	.981600E-01	14127.0	2564.00	6884.80	36456.0
1961	.950000E-01	14669.0	2763.00	7016.40	38589.0
1962	.951000E-01	15992.0	3125.00	7595.80	40620.0
1963	.964000E-01	17277.0	3614.00	8342.90	43162.0
1964	.941000E-01	18281.0	4204.00	8680.90	46130.0
1965	.970000E-01	18459.0	4933.00	9653.60	50465.0
1966	.915000E-01	19771.0	5598.00	10217.0	55217.0
1967	.941000E-01	21102.0	6405.00	11331.0	59834.0
1968	.105700	22790.0	6856.00	13806.0	63517.0
1969	.106170	24128.0	7035.00	14964.0	67246.0
1970	.108540	26774.0	5828.00	16291.0	71204.0
1971	.110520	27871.0	4847.00	17361.0	75810.0
1972	.108640	26730.0	4551.00	17885.0	83524.0
1973	.101940	27269.0	5179.00	18363.0	92291.0
1974	.975300E-01	29052.0	6850.00	18526.0	97155.0
1975	.105090	30882.0	6670.00	21387.0	103560.
1976	.112040	33501.0	7412.00	24929.0	112740.
1977	.107190	34735.0	9361.00	25602.0	123720.
1978	.111280	42284.0	9389.00	29694.0	126440.
	1	2	3	4	5

	Cnd	Cp	Cs	Da	Dm
1960	38720.0	50583.0	9299.00	451.020	1795.50
1961	40737.0	53258.0	9758.00	527.460	2026.50
1962	42996.0	56612.0	10491.0	651.490	2537.70
1963	45550.0	60439.0	11075.0	768.250	3074.60
1964	48205.0	64411.0	12002.0	950.480	3957.10
1965	51160.0	68924.0	12831.0	1070.40	4637.70
1966	55368.0	74988.0	13622.0	1218.80	5516.00
1967	60015.0	80936.0	14516.0	1418.20	6814.60
1968	63543.0	86307.0	15908.0	1584.80	8134.10
1969	67227.0	91374.0	17112.0	1760.70	9698.30
1970	72774.0	97978.0	19376.0	1811.40	10631.0
1971	78557.0	103681.	20277.0	1902.40	11711.0
1972	84242.0	110254.	21461.0	1538.00	11060.0
1973	90984.0	119560.	23397.0	1540.60	11405.0
1974	95638.0	126207.	23719.0	1446.10	11239.0
1975	101814.	134445.	25963.0	1347.70	12130.0
1976	109641.	146241.	29188.0	1510.00	13294.0
1977	118520.	158455.	30574.0	2030.50	15324.0
1978	126300.	168720.	33031.0	2145.70	17013.0
	1	2	3	4	5

	DL	DPI	ex	E	Ea
1960	1.73860	45681.0	21.1015	9986.10	1450.30
1961	3.27000	49685.0	20.9600	11708.0	2044.00
1962	2.92210	53305.0	20.9908	11722.0	2036.40
1963	1.54100	56252.0	20.7469	12244.0	2235.80
1964	3.55660	60576.0	20.8000	15127.0	3218.30
1965	3.45730	68588.0	20.8000	16330.0	3157.80
1966	2.67680	82884.0	20.8000	20536.0	4126.50
1967	5.05780	86684.0	20.8000	23395.0	3142.50
1968	5.54410	92039.0	20.8000	24111.0	3300.00
1969	2.44740	100965.	20.8000	24653.0	3617.10
1970	4.19450	107060.	20.8000	24840.0	4139.60
1971	2.69600	113146.	20.8000	28082.0	4784.70
1972	3.55600	130270.	20.8000	33641.0	3866.00
1973	3.87600	175820.	20.5884	28839.0	3841.20
1974	4.05600	215083.	20.3749	27769.0	5401.40
1975	3.20900	238490.	20.3786	29433.0	4862.70
1976	1.81900	270004.	20.3998	38483.0	4976.80
1977	1.49300	308049.	20.3000	43521.0	3540.60
1978	6.06300	371570.	20.3322	44806.0	3992.40
	1	2	3	4	5

	Em	g	gl	g_P	g_Y
1960	8535.80	3.00546	—	-4.11110	13.3633
1961	9664.00	3.10724	2.01511	3.72870	5.29948
1962	9685.60	3.08710	2.01963	.752000E-01	8.09995
1963	10008.0	3.10160	2.02929	-1.55190	8.39951
1964	11909.0	3.11203	2.04367	2.88570	6.60011
1965	13172.0	3.08518	2.04447	4.64600	7.89970
1966	16409.0	3.25309	2.05607	7.17910	12.1996
1967	20252.0	2.29994	2.06016	-.903380	7.79045
1968	20811.0	3.32615	2.07481	-.600330	8.46001
1969	21036.0	2.89121	2.08757	2.02440	7.91972
1970	20700.0	2.98378	2.09331	-.624860	6.49279
1971	23297.0	3.57243	2.09783	1.54440	4.66114
1972	29775.0	4.18251	2.11608	8.63660	4.79656
1973	24998.0	4.14494	2.11830	20.2000	9.42743
1974	22368.0	3.45432	2.65360	18.8520	5.44225
1975	24570.0	2.56472	2.04003	2.77890	7.14083
1976	33506.0	1.93442	2.02288	3.34400	9.33351
1977	39980.0	2.45314	1.44538	8.44870	7.33993
1978	40814.0	2.14592	3.39300	8.70810	11.7229
	1	2	3	4	5

	Gdebt	Gdef	Gex	Grev	GDP
1960	7165.90	364.300	7863.40	7499.10	70139.0
1961	7749.99	553.800	8474.70	7920.90	73656.0
1962	8790.39	1070.60	9914.20	8843.60	79838.0
1963	10260.4	1469.80	11436.0	9966.00	86544.0
1964	12094.3	1833.70	12562.0	10728.0	92256.0
1965	14480.2	2385.90	14355.0	11969.0	99544.0
1966	17559.9	3079.40	16814.0	13734.0	111688.
1967	20137.6	2578.10	18324.0	15746.0	120389.
1968	23798.5	3660.90	21810.0	18149.0	130598.
1969	28796.0	4599.90	24531.0	19531.0	140941.
1970	35819.9	7021.40	26966.0	19945.0	150092.
1971	43282.6	7462.10	28061.0	20599.0	157088.
1972	52627.6	9345.00	31785.0	22440.0	164626.
1973	59279.3	6651.70	34859.0	28207.0	180146.
1974	57795.6	-1483.70	39051.0	40534.0	189950.
1975	65713.3	7917.30	49208.0	41291.0	203514.
1976	84192.3	18480.0	62890.0	44410.0	222509.
1977	101782.	17589.0	73983.0	56394.0	238841.
1978	127553.	25771.0	94441.0	68670.0	266840.
	1	2	3	4	5

	GDPw$	I	If	Ig	Iga
1960	.554300	11621.0	448.700	3124.90	632.400
1961	.576100	12004.0	756.600	3395.40	616.300
1962	.608700	14571.0	1505.60	4433.80	774.500
1963	.641300	17982.0	1613.60	5441.60	927.700
1964	.673900	20648.0	1413.80	6300.40	1160.10
1965	.717400	22006.0	1351.10	7371.30	1306.70
1966	.750000	27109.0	1468.90	8752.90	1179.50
1967	.782600	32508.0	2091.50	9337.00	937.200
1968	.826100	35404.0	2147.80	10316.0	1010.50
1969	.869600	39811.0	2915.40	11840.0	1167.20
1970	.913000	39949.0	2416.70	12091.0	1574.80
1971	.945700	38679.0	1523.30	11165.0	1241.50
1972	1.00000	34607.0	3744.90	11440.0	1764.00
1973	1.06520	37903.0	2282.80	8982.00	1141.60
1974	1.08700	42139.0	6974.90	6867.00	814.000
1975	1.08700	42411.0	7899.30	9488.00	1117.90
1976	1.14130	45118.0	6899.70	13542.0	1736.60
1977	1.19570	59832.0	13128.2	16665.0	2601.70
1978	1.29910	64909.0	8766.10	19411.0	2965.70
	1	2	3	4	5

	Igm	Ip	Ipa	Ipan	Ipm
1960	2492.50	8495.90	1688.70	1291.98	6807.20
1961	2779.10	8608.30	1754.70	1311.30	6853.60
1962	3659.30	10137.2	1856.10	1365.40	8281.10
1963	4513.90	12540.3	1997.30	1457.40	10543.0
1964	5140.30	14347.2	1961.20	1368.60	12386.0
1965	6064.60	14634.8	2177.80	1536.10	12457.0
1966	7573.40	18355.6	2437.60	1740.60	15918.0
1967	8399.80	23170.8	2851.60	2091.90	20319.2
1968	9305.50	25087.7	2879.20	2044.10	22208.5
1969	10672.8	27971.3	2653.10	1744.40	25318.2
1970	10516.2	27858.1	2663.30	1692.00	25194.8
1971	9923.50	27514.0	2690.70	1658.70	24823.3
1972	9676.00	23167.1	2194.10	1102.70	20973.0
1973	7840.40	28921.0	2745.60	1615.10	26175.4
1974	6053.00	35272.0	3350.40	2162.20	31921.6
1975	8370.10	32923.0	3127.80	1862.10	29795.2
1976	11805.4	31576.0	3014.00	1681.70	28562.0
1977	14063.3	43167.0	4169.80	2777.60	38997.2
1978	16445.3	45498.0	4371.90	2879.90	41126.1
	1	2	3	4	5

	Ipmn	IM	IMa	IMc	IMf
1960	4976.60	12672.0	873.000	4557.05	886.924
1961	4821.60	13602.0	845.670	4547.24	941.206
1962	6053.80	16039.0	894.710	5205.74	1197.52
1963	8070.70	17861.0	943.400	5074.09	1224.19
1964	9587.10	19806.0	930.360	5095.39	1528.94
1965	9270.20	21741.0	980.800	5572.15	1408.59
1966	12356.0	26418.0	1045.20	6490.13	2007.97
1967	16257.0	32947.0	1153.00	7464.50	1695.34
1968	17488.0	38419.0	1152.70	7216.73	2114.19
1969	19891.0	41826.0	1333.30	7728.89	2118.37
1970	18963.0	40816.0	1137.70	7361.82	2574.63
1971	17824.0	33107.0	1016.40	6019.57	2668.92
1972	13252.0	35615.0	942.020	5725.00	3116.00
1973	17917.0	43016.0	991.310	5937.89	3840.04
1974	22938.0	41027.0	910.880	5553.92	3185.22
1975	19883.0	38608.0	1035.90	5343.19	3279.82
1976	17844.0	41019.0	1198.40	6554.72	3547.94
1977	27556.0	49772.0	1465.60	7260.94	4127.68
1978	28569.0	53338.0	1552.90	7756.83	4515.37
	1	2	3	4	5

	IMi	IMm	IMo	IMr	IMs
1960	3458.28	11799.0	1552.66	1169.17	1008.00
1961	3716.07	12756.0	1605.00	1297.29	1095.50
1962	4924.07	15144.0	2030.75	1412.98	1268.10
1963	6190.73	16918.0	2435.36	1597.24	1339.10
1964	6637.66	18876.0	2766.65	2026.20	1750.80
1965	7411.24	20760.0	2882.31	2362.68	2104.10
1966	9026.70	25373.0	3485.10	2945.96	2462.30
1967	12460.3	31794.0	4744.64	3512.65	3069.90
1968	15344.6	37266.0	5909.53	3939.18	3894.40
1969	17202.4	40493.0	5735.53	4663.16	4377.80
1970	15344.0	39678.0	5266.52	5795.41	4473.30
1971	9638.36	32091.0	3292.61	6756.14	4731.60
1972	9783.00	34673.0	3121.00	9131.00	4738.70
1973	12560.4	42025.0	4634.54	11486.3	4556.60
1974	15932.9	40116.0	4295.36	8893.88	3166.00
1975	14510.9	37572.0	3828.23	8556.79	3088.60
1976	12077.2	39821.0	4484.07	10036.4	4319.20
1977	13697.4	48306.0	6145.36	13001.3	5538.70
1978	15204.1	51785.0	6034.65	13711.5	6115.20
	1	2	3	4	5

	INg	INp	IT	ITa	ITd
1960	330.000	140.000	5609.00	107.000	2515.00
1961	388.000	141.000	6473.00	122.000	2836.00
1962	353.000	173.000	7002.00	114.000	3383.00
1963	464.000	207.000	7649.00	140.000	3705.00
1964	491.000	265.000	8826.00	148.000	4377.00
1965	578.000	312.000	9725.00	164.000	5325.00
1966	788.000	377.000	11133.0	199.000	6276.00
1967	804.000	451.000	12556.0	98.0000	6952.00
1968	1068.00	566.000	14158.0	105.000	7616.00
1969	1320.00	600.000	15408.0	228.000	8466.00
1970	1442.00	587.000	15765.0	289.000	9513.00
1971	1790.00	624.000	16210.0	344.000	10509.0
1972	2460.00	690.000	17780.0	347.000	11764.0
1973	3135.00	1001.00	22726.0	263.000	14780.0
1974	3419.00	1312.00	32244.0	317.000	18878.0
1975	3452.00	1972.00	31119.0	435.000	21157.0
1976	3813.00	2659.00	33438.0	465.000	22578.0
1977	4836.00	3244.00	43717.0	511.000	29575.0
1978	6013.00	4157.00	51733.0	527.000	35106.0
	1	2	3	4	5

	ITda	ITdm	ITe	ITea	ITem
1960	0.	2515.00	1233.00	0.	1233.00
1961	0.	2836.00	1277.00	0.	1277.00
1962	0.	3383.00	1098.00	0.	1098.00
1963	0.	3705.00	1164.00	0.	1164.00
1964	0.	4377.00	1609.00	0.	1609.00
1965	0.	5325.00	1570.00	0.	1570.00
1966	0.	6276.00	1361.00	0.	1361.00
1967	0.	6952.00	1319.00	0.	1319.00
1968	0.	7616.00	1568.00	0.	1568.00
1969	0.	8466.00	1505.00	0.	1505.00
1970	0.	9513.00	848.000	0.	848.000
1971	0.	10509.0	414.000	0.	414.000
1972	0.	11764.0	406.000	0.	406.000
1973	0.	14780.0	1041.00	0.	1041.00
1974	0.	18878.0	5001.00	0.	5001.00
1975	0.	21157.0	1435.00	0.	1435.00
1976	0.	22578.0	1361.00	0.	1361.00
1977	0.	29575.0	1684.00	0.	1684.00
1978	0.	35106.0	1944.00	0.	1944.00
	1	2	3	4	5

	ITim	ITimc	ITimf	ITimi	ITimo
1960	2061.00	636.000	515.000	413.000	318.000
1961	2360.00	723.000	557.000	484.000	396.000
1962	2521.00	792.000	699.000	512.000	274.000
1963	2780.00	920.000	642.000	635.000	372.000
1964	2840.00	945.000	584.000	725.000	311.000
1965	2830.00	1020.00	298.000	780.000	426.000
1966	3496.00	1235.00	313.000	1034.00	541.000
1967	4285.00	1468.00	422.000	1334.00	609.000
1968	4975.00	1669.00	574.000	1583.00	654.000
1969	5437.00	1870.00	499.000	1694.00	783.000
1970	5404.00	1767.00	515.000	1624.00	894.000
1971	5287.00	1536.00	297.000	1682.00	1097.00
1972	5610.00	1549.00	248.000	1861.00	1139.00
1973	6905.00	1848.00	347.000	2666.00	809.000
1974	8365.00	2092.00	485.000	3386.00	1122.00
1975	8527.00	1926.00	420.000	3534.00	1550.00
1976	9499.00	2091.00	473.000	3672.00	1434.00
1977	12458.0	2646.00	576.000	5268.00	1508.00
1978	14683.0	3172.00	1019.00	6283.00	1348.00
	1	2	3	4	5

	ITimr	ITm	IVa	IVm	K
1960	179.000	5702.00	8573.70	-4837.60	87986.6
1961	200.000	6351.00	8023.70	-4552.10	97436.4
1962	244.000	6888.00	6529.30	-1153.10	108818.
1963	211.000	7509.00	5912.60	-515.500	122957.
1964	275.000	8678.00	2058.10	1137.00	138697.
1965	306.000	9561.00	5430.00	-1058.60	154995.
1966	373.000	10933.0	8670.70	-3414.70	175369.
1967	452.000	12457.0	3271.50	1894.50	199644.
1968	495.000	14053.0	2815.70	6573.30	225329.
1969	591.000	15180.0	3279.20	8685.80	253681.
1970	604.000	15476.0	-5965.90	17816.0	281188.
1971	675.000	15866.0	-7488.30	9880.30	306254.
1972	813.000	17433.0	1217.00	2637.00	328263.
1973	1233.00	22463.0	13278.0	5218.90	353220.
1974	1280.00	31927.0	5445.50	10891.0	382673.
1975	1097.00	30684.0	6623.20	7822.80	411607.
1976	1829.00	32973.0	5798.60	2958.40	441922.
1977	2460.00	43206.0	966.000	237.000	484398.
1978	2861.00	51206.0	-5749.50	17799.0	530148.
	1	2	3	4	5

	Ka	Kd	Kga	Kgm	Km
1960	17965.6	11538.0	5785.28	19723.5	70021.0
1961	19809.1	13531.4	6317.52	22508.1	77627.2
1962	21788.1	15753.9	6931.13	25856.6	87029.5
1963	23944.9	18517.1	7630.48	29768.3	99011.9
1964	26115.7	21486.0	8432.50	33750.1	112581.
1965	28529.9	24985.9	9310.60	38364.2	126465.
1966	30928.3	29317.3	9968.40	43984.2	144441.
1967	33298.8	33766.9	10247.0	49631.6	166346.
1968	35603.7	38370.6	10507.8	55523.5	189725.
1969	37663.3	42846.3	10823.0	61925.2	216018.
1970	40090.1	45816.4	11557.8	68042.2	241098.
1971	42119.9	47607.5	11928.9	73254.2	264134.
1972	44540.0	48983.1	13246.3	79591.2	283723.
1973	46886.6	50894.9	13977.8	84284.2	306333.
1974	49604.9	54350.2	14533.9	88081.2	333068.
1975	52502.8	57395.0	15569.7	94234.2	359104.
1976	55743.4	60978.8	17128.6	103464.	386178.
1977	60484.3	66272.5	19091.9	113644.	423914.
1978	65676.3	71241.1	21404.0	125633.	464472.
	1	2	3	4	5

	Kpa	Kpm	L	M	MS
1960	12180.3	50297.5	47.5000	8662.30	8662.30
1961	13491.6	55119.1	49.2680	9509.80	9509.80
1962	14857.0	61172.9	53.4090	9525.10	9525.10
1963	16314.4	69243.6	55.8060	10201.5	10201.5
1964	17683.2	78830.7	57.0270	10937.8	10937.8
1965	19219.3	88100.9	58.7180	12916.8	12916.8
1966	20959.9	100457.	66.6580	14656.5	14656.5
1967	23051.8	116714.	62.3900	15706.3	15706.3
1968	25095.9	134202.	66.5560	17285.4	17285.4
1969	26840.3	154093.	69.1650	17988.8	17988.8
1970	28532.3	173056.	70.5230	19447.5	19447.5
1971	30191.0	190880.	71.9400	21445.7	21445.7
1972	31293.7	204132.	71.4030	24830.9	24830.9
1973	32908.8	222049.	81.4030	29936.5	29936.5
1974	35071.0	244987.	80.5700	33207.9	33207.9
1975	36933.1	264870.	87.0130	34982.5	34982.5
1976	38614.8	282714.	85.4400	40627.4	40627.4
1977	41392.4	310270.	92.8940	44296.3	44296.3
1978	44272.3	338839.	100.727	52905.4	52905.4
	1	2	3	4	5

	N	Na	Nm	NDCg	NDCp
1960	15.4830	12.1850	3.29810	2907.30	-1079.40
1961	15.7950	12.3720	3.42280	2365.20	-1261.40
1962	16.1140	12.5620	3.55210	2316.80	-2444.90
1963	16.4410	12.7550	3.68640	2225.50	-3258.50
1964	16.7770	12.9510	3.82560	1493.50	-3228.20
1965	17.1200	13.1450	3.97020	1238.50	-2972.50
1966	17.4720	13.3520	4.12040	1437.30	-4734.10
1967	17.8330	13.5560	4.27640	2094.10	-5430.30
1968	18.2030	13.7650	4.43800	4510.40	-6715.10
1969	18.5830	13.9770	4.60570	7298.40	-7885.60
1970	18.9720	14.1920	4.77970	11791.8	-8260.20
1971	19.3700	14.4090	4.96050	18348.1	-12483.0
1972	19.7800	14.6320	5.14810	25598.3	-20717.0
1973	20.1990	14.8570	5.34240	28009.7	-19717.0
1974	20.7350	15.0840	5.65100	24123.9	-20704.0
1975	21.1580	15.3160	5.84210	29280.7	-22698.0
1976	21.5860	15.5510	6.03470	35990.3	-26838.0
1977	21.8980	15.6640	6.23360	49654.0	-26215.0
1978	22.6410	16.1630	6.47830	60452.6	-17425.0
	1	2	3	4	5

	NDPI	NFA	NFIfW	NI	P
1960	45490.0	6834.40	-99.0000	46503.0	.769700
1961	49497.0	8406.00	-93.0000	50550.0	.798400
1962	53090.0	9653.20	-98.0000	54331.0	.799000
1963	55994.0	11234.5	-40.0000	57528.0	.786600
1964	60247.0	12672.5	-79.0000	62180.0	.809300
1965	68205.0	14650.8	-11.0000	70353.0	.846900
1966	82435.0	17953.3	-8.00000	85054.0	.907700
1967	86142.0	19042.5	168.000	89589.0	.899500
1968	91372.0	19490.1	272.000	95339.0	.894100
1969	100245.	18576.0	226.000	104526.	.912200
1970	106320.	15915.9	379.000	110481.	.906500
1971	112376.	15580.6	30.0000	117084.	.920500
1972	129450.	19949.8	-327.000	133921.	1.00000
1973	174690.	21644.2	-424.000	178270.	1.20200
1974	213613.	29787.8	-798.000	220532.	1.42860
1975	236330.	28399.7	-219.000	246465.	1.46830
1976	267114.	27475.1	-1261.00	278895.	1.51740
1977	304569.	20857.1	-2014.00	318690.	1.64560
1978	367170.	9877.80	-3712.00	387530.	1.78890
	1	2	3	4	5

	Pa	Pab	Pc	Pd	Pd&nd
1960	.760400	.761900	.777500	.746900	.764200
1961	.793200	.794500	.797800	.741900	.788000
1962	.756100	.757720	.825800	.724500	.821000
1963	.720100	.721000	.825400	.700300	.820300
1964	.722600	.723350	.832400	.689100	.825700
1965	.817800	.818920	.849800	.700200	.844300
1966	.905400	.906820	.889000	.717100	.886900
1967	.865600	.873180	.929500	.753900	.930600
1968	.837800	.841220	.937200	.764900	.935900
1969	.857600	.858710	.946700	.750700	.948500
1970	.796400	.795960	.943400	.758600	.943900
1971	.807100	.805900	.955600	.850600	.950200
1972	1.00000	1.00000	1.00000	1.00000	1.00000
1973	1.33220	1.33680	1.15450	1.25120	1.16740
1974	1.48760	1.49240	1.41070	1.40860	1.42820
1975	1.51520	1.51870	1.47650	1.47200	1.49770
1976	1.58820	1.59220	1.53880	1.51710	1.55940
1977	1.69260	1.69660	1.64500	1.63830	1.66130
1978	1.74750	1.75260	1.80550	1.74630	1.83070
	1	2	3	4	5

	Pe	Pea	Peaw$	Pem	Pemb
1960	.992600	.761900	.701800	1.03180	.901420
1961	.998700	.794500	.684200	1.04190	.923960
1962	.977500	.757720	.701800	1.02370	.924300
1963	.959800	.721000	.754400	1.01310	.910660
1964	.969600	.723350	.789500	1.03610	.915170
1965	.975900	.818920	.771900	1.01350	.908160
1966	.979700	.906820	.789500	.998030	.928700
1967	.948500	.873180	.771900	.960190	.908150
1968	.937800	.841220	.754400	.953110	.890770
1969	.978000	.858710	.789500	.998510	.940580
1970	.993800	.795960	.824600	1.03340	1.00650
1971	.962900	.805900	.859700	.995140	.990940
1972	1.00000	1.00000	1.00000	1.00000	1.00000
1973	1.51000	1.33680	1.52630	1.53660	1.51590
1974	2.18280	1.49240	1.94740	2.34950	2.15800
1975	1.93710	1.51870	1.75440	2.01990	1.98900
1976	1.85030	1.59220	1.84210	1.88860	1.87380
1977	1.88870	1.69660	2.10530	1.90570	1.88960
1978	2.22290	1.75260	2.12280	2.26890	2.25220
	1	2	3	4	5

	Pemw$	Pi	Pim	Pimb	Pimc
1960	.800000	.701300	.840800	.832186	.685010
1961	.763600	.724800	.849100	.830682	.688230
1962	.763600	.740000	.798900	.786386	.673980
1963	.800000	.743900	.791800	.781918	.713390
1964	.818200	.729000	.798600	.796669	.753490
1965	.818200	.738400	.783600	.792891	.732080
1966	.818200	.769800	.775300	.779675	.721400
1967	.800000	.766800	.746500	.749983	.717290
1968	.800000	.776100	.711800	.707038	.762550
1969	.818200	.773000	.709600	.702856	.792040
1970	.854600	.819200	.766500	.761154	.763850
1971	.890900	.833200	.854500	.945114	.822520
1972	1.00000	1.00000	1.00000	.999992	1.00000
1973	1.52730	1.16730	1.09470	1.10360	1.08140
1974	1.94550	1.40270	1.66020	1.70355	1.42940
1975	1.81820	1.55920	1.83370	1.89209	1.52910
1976	1.92730	1.62400	1.93530	1.98416	1.38190
1977	2.14550	1.64850	2.07700	2.12777	1.49150
1978	2.20000	1.79440	2.24730	2.29964	1.63500
	1	2	3	4	5

	Pimcb	Pimcb$	Pimf	Pimfb	Pimfb$
1960	.732000	.721500	1.60830	1.15570	1.13920
1961	.728300	.722700	1.54320	1.07420	1.06600
1962	.704200	.697800	1.48740	1.02210	1.01280
1963	.725100	.727000	1.40960	.997400	1.00000
1964	.771900	.771900	1.23710	.953600	.953600
1965	.747100	.747100	1.08570	.960500	.960500
1966	.726300	.726300	1.00840	.932800	.932800
1967	.714700	.714700	1.09820	.936700	.936700
1968	.737600	.737600	1.12550	.943600	.943600
1969	.764400	.764400	1.01790	.863400	.863400
1970	.730500	.730500	1.02320	.904600	.904600
1971	.789900	.789900	1.04740	1.01950	1.01950
1972	1.00000	1.00000	1.00000	1.00000	1.00000
1973	1.06280	1.07370	1.20800	1.21380	1.22630
1974	1.43950	1.46950	3.79680	3.94670	4.02900
1975	1.58240	1.61510	4.13540	4.33650	4.42620
1976	1.43680	1.46500	4.48220	4.70560	4.79790
1977	1.53070	1.56840	4.81690	5.06070	5.18530
1978	1.66850	1.70690	4.89660	5.06070	5.17710
	1	2	3	4	5

	Pimi	Pimib	Pimib$	Pimo	Pimob
1960	.675350	.684400	.674600	.678050	.720700
1961	.685530	.685700	.680500	.699750	.708400
1962	.641540	.659600	.653600	.603190	.688400
1963	.636660	.655200	.656900	.608260	.677500
1964	.628720	.639100	.639100	.568010	.662900
1965	.629750	.644300	.644300	.599360	.670300
1966	.626890	.631600	.631600	.591980	.652800
1967	.598590	.605400	.605400	.554930	.629100
1968	.543230	.543400	.543400	.497650	.568600
1969	.530720	.533200	.533200	.507650	.556400
1970	.602020	.610700	.610700	.570390	.608800
1971	.898740	.895200	.895200	.895180	.888700
1972	1.00000	1.00000	1.00000	1.00000	1.00000
1973	1.03640	1.02120	1.03170	.881170	1.02820
1974	1.22310	1.24320	1.26910	1.09540	1.23390
1975	1.49230	1.53260	1.56430	1.40710	1.51580
1976	1.60540	1.60670	1.63820	1.40140	1.59300
1977	1.81930	1.78080	1.82470	1.47450	1.76720
1978	2.07780	2.05980	2.10720	1.64370	2.02020
	1	2	3	4	5

	Pimob$	Pimr	Pimrb	Pimrb$	Pims
1960	.710400	1.51190	1.49340	1.47210	.916400
1961	.703000	1.54800	1.53170	1.52000	.924500
1962	.682100	1.43750	1.39280	1.38010	.874700
1963	.679200	1.38430	1.37550	1.37900	.867900
1964	.662900	1.38720	1.37500	1.37500	.873600
1965	.670300	1.36640	1.35860	1.35860	.858000
1966	.652800	1.34470	1.33780	1.33780	.850100
1967	.629100	1.35650	1.34860	1.34860	.821300
1968	.568600	1.30090	1.29110	1.29110	.786100
1969	.556400	1.27150	1.25800	1.25800	.783700
1970	.608800	1.16120	1.16040	1.16040	.907300
1971	.888700	1.14700	1.14920	1.14920	.950100
1972	1.00000	1.00000	1.00000	1.00000	1.00000
1973	1.03880	1.18750	1.18590	1.19810	1.16030
1974	1.25960	2.02880	2.06550	2.10860	1.84730
1975	1.54710	1.84590	1.88210	1.92100	2.01550
1976	1.62430	2.01690	2.01430	2.05380	1.97060
1977	1.81070	2.07500	2.07060	2.12160	2.11330
1978	2.06670	2.17370	2.15860	2.20830	2.24980
	1	2	3	4	5

	Pims$	Pm	Pmb	Pnd	Ps
1960	.903300	.775900	.757770	.765300	.836800
1961	.917400	.801800	.781640	.791100	.841700
1962	.866800	.826800	.810460	.828000	.847200
1963	.870100	.829900	.812820	.830300	.848400
1964	.873600	.861400	.841780	.837600	.861500
1965	.858000	.863300	.844200	.858200	.873800
1966	.850100	.909000	.892760	.905300	.898400
1967	.821300	.914300	.898620	.949500	.924500
1968	.786100	.922500	.900970	.954300	.943100
1969	.783700	.939500	.920660	.969200	.938600
1970	.907300	.958800	.952440	.958700	.941400
1971	.950100	.977400	.977040	.956300	.978100
1972	1.00000	1.00000	1.00000	1.00000	1.00000
1973	1.17220	1.15660	1.15110	1.16260	1.10170
1974	1.88580	1.40340	1.37660	1.42960	1.33500
1975	2.05720	1.44770	1.45080	1.49940	1.38810
1976	2.00930	1.48760	1.50310	1.56230	1.45610
1977	2.16940	1.62780	1.62590	1.66310	1.57710
1978	2.30160	1.80500	1.81230	1.83700	1.70200
	1	2	3	4	5

	PI	POP	PR	PROg	Q
1960	46306.0	26.3900	674.000	246.000	121580.
1961	50377.0	27.2100	834.000	233.000	128320.
1962	54009.0	28.0500	1044.00	258.000	140250.
1963	56999.0	28.9200	1282.00	421.000	152890.
1964	61380.0	29.8200	1914.00	264.000	165230.
1965	69538.0	30.7400	2025.00	351.000	176670.
1966	83891.0	31.7400	2760.00	473.000	196580.
1967	87854.0	32.4700	3407.00	599.000	216590.
1968	93386.0	33.5500	3947.00	734.000	235890.
1969	102387.	34.5200	4193.00	950.000	254730.
1970	108720.	35.5500	3873.00	946.000	277270.
1971	115022.	36.8200	4621.00	1104.00	290820.
1972	132504.	38.3600	5234.00	1252.00	298600.
1973	178170.	39.9500	6583.00	1340.00	318410.
1974	217845.	41.3300	10525.0	2579.00	340830.
1975	242130.	42.3900	10261.0	2502.00	366300.
1976	274258.	43.2100	10725.0	2522.00	401270.
1977	313272.	44.2700	13949.0	2411.00	435700.
1978	378440.	45.2200	19731.0	2748.00	491300.
	1	2	3	4	5

	Qad	Qas	Qmd	Qms	r
1960	35519.0	35519.0	86061.0	86061.0	8.52070
1961	36742.0	36742.0	91583.0	91583.0	5.19120
1962	38849.0	38849.0	101400.	101400.	3.84805
1963	41851.0	41851.0	111040.	111040.	7.98835
1964	42193.0	42193.0	123030.	123030.	7.33310
1965	44887.0	44887.0	131780.	131780.	3.98415
1966	51537.0	51537.0	145040.	145040.	1.33745
1967	49780.0	49780.0	166810.	166810.	3.86214
1968	54181.0	54181.0	181700.	181700.	7.75186
1969	58275.0	58275.0	196460.	196460.	7.28797
1970	58592.0	58592.0	218680.	218680.	8.80023
1971	61104.0	61104.0	229720.	229720.	9.04023
1972	62745.0	62745.0	235850.	235850.	3.65950
1973	72850.0	72850.0	245560.	245560.	-5.66830
1974	72773.0	72773.0	268060.	268060.	-9.77600
1975	78755.0	78755.0	287550.	287550.	-.315450
1976	83797.0	83797.0	317480.	317480.	6.93855
1977	83086.0	83086.0	352620.	352620.	3.35365
1978	93710.0	93710.0	397590.	397590.	1.29660
	1	2	3	4	5

	rf	R	Rw	S	Sc
1960	1.03550	5.00000	4.18000	9549.55	424.000
1961	1.02940	5.00000	3.58000	10458.2	539.000
1962	1.01160	6.50000	3.77000	11915.6	663.000
1963	.960000	8.00000	3.95000	13479.0	820.000
1964	1.03190	8.00000	4.32000	14684.7	1297.00
1965	.934300	7.50000	4.81000	18699.8	1278.00
1966	1.15110	7.00000	6.12000	25905.3	1788.00
1967	.894100	7.00000	5.46000	25218.5	2259.00
1968	.940400	7.00000	6.36000	27697.4	2591.00
1969	1.01560	9.00000	9.76000	33290.0	2729.00
1970	1.15720	10.0000	8.52000	34389.3	2431.00
1971	.987400	9.00000	6.58000	32809.7	3013.00
1972	.900300	8.50000	5.46000	38460.7	3509.00
1973	.900800	9.00000	9.24000	61187.7	4203.00
1974	.995700	10.5000	11.0100	76605.3	6455.00
1975	1.04780	10.5000	6.99000	85381.2	5161.00
1976	.974800	9.50000	5.58000	85698.2	5460.00
1977	.871700	9.00000	6.00000	114402.	7388.00
1978	1.00060	10.7500	8.73000	142197.	10760.0
	1	2	3	4	5

	Sd	Sf	Sg	Sp	t
1960	9988.30	-38.7462	1827.20	6161.60	1.00000
1961	11305.0	-846.839	1907.20	7007.90	2.00000
1962	11574.0	341.595	2210.40	6340.20	3.00000
1963	12364.0	1115.05	2578.20	6107.60	4.00000
1964	14265.0	419.654	2759.30	6631.20	5.00000
1965	18183.0	516.786	3057.10	9633.30	6.00000
1966	26401.0	-495.660	3658.60	15770.0	7.00000
1967	24065.0	1153.53	4581.50	10912.0	8.00000
1968	24964.0	2733.39	4345.30	10485.0	9.00000
1969	29480.0	3810.04	4152.40	13741.0	10.0000
1970	29399.0	4990.28	2883.50	13892.0	11.0000
1971	29494.0	3315.72	1840.60	13298.0	12.0000
1972	37398.0	1062.70	2095.00	19196.0	13.0000
1973	59806.0	1381.67	3833.00	36659.0	14.0000
1974	70937.0	5668.31	11116.0	35573.0	15.0000
1975	70874.0	14507.2	6876.40	37822.0	16.0000
1976	75092.0	10606.2	3512.10	42078.0	17.0000
1977	89791.0	24611.0	5883.30	43911.0	18.0000
1978	116750.	25447.0	9059.80	62549.0	19.0000
	1	2	3	4	5

	ta	tc	tda	tdm	tea
1960	.498000E-02	.307100	0.	.711200E-01	0.
1961	.527000E-02	.267400	0.	.729500E-01	0.
1962	.480000E-02	.266300	0.	.745800E-01	0.
1963	.569000E-02	.249600	0.	.737200E-01	0.
1964	.591000E-02	.186500	0.	.749900E-01	0.
1965	.557000E-02	.243000	0.	.901600E-01	0.
1966	.540000E-02	.214100	0.	.879750E-01	0.
1967	.282000E-02	.190800	0.	.825280E-01	0.
1968	.286000E-02	.196600	0.	.825380E-01	0.
1969	.565000E-02	.202700	0.	.829600E-01	0.
1970	.751000E-02	.232900	0.	.791900E-01	0.
1971	.845000E-02	.212300	0.	.812040E-01	0.
1972	.695000E-02	.191600	0.	.879520E-01	0.
1973	.350000E-02	.228500	0.	.939760E-01	0.
1974	.373000E-02	.264900	0.	.911590E-01	0.
1975	.461000E-02	.353600	0.	.898800E-01	0.
1976	.443000E-02	.348200	0.	.835500E-01	0.
1977	.460000E-02	.336600	0.	.904850E-01	0.
1978	.401000E-02	.327300	0.	.849450E-01	0.
	1	2	3	4	5

	tem	tia	timc	timf	timi
1960	.160250	.168240	.189000	.502430	.174490
1961	.143010	.168740	.200660	.550920	.189940
1962	.122650	.143940	.216050	.571090	.157640
1963	.127720	.152170	.250050	.525800	.156550
1964	.147630	.156610	.240270	.400550	.170900
1965	.131250	.160780	.245020	.220260	.163350
1966	.893100E-01	.161130	.262000	.167110	.181360
1967	.717200E-01	.667600E-01	.275170	.265740	.176840
1968	.845800E-01	.629100E-01	.313540	.287730	.189850
1969	.760600E-01	.121930	.316520	.272830	.184690
1970	.407000E-01	.163550	.328570	.221120	.173310
1971	.179300E-01	.223960	.323040	.109150	.194940
1972	.136400E-01	.224020	.270570	.795900E-01	.190230
1973	.274700E-01	.142320	.292830	.744500E-01	.208000
1974	.103600	.151530	.261670	.385800E-01	.170940
1975	.293600E-01	.225860	.227790	.295300E-01	.158910
1976	.216800E-01	.222380	.222030	.283300E-01	.189240
1977	.222900E-01	.193120	.238070	.275700E-01	.215970
1978	.211500E-01	.166140	.245090	.445900E-01	.200620
	1	2	3	4	5

	timo	timr	tm	tp	Tc
1960	.284180	.102520	.179530	.100000E-01	207.000
1961	.348290	.100650	.181690	.103000E-01	223.000
1962	.196000	.123980	.175210	.990000E-02	278.000
1963	.225460	.960400E-01	.176190	.100000E-01	320.000
1964	.169570	.987100E-01	.178840	.102000E-01	357.000
1965	.220500	.953300E-01	.178040	.105000E-01	492.000
1966	.237790	.946400E-01	.172930	.950000E-02	591.000
1967	.204030	.954200E-01	.172090	.108000E-01	650.000
1968	.194630	.973300E-01	.179510	.117000E-01	776.000
1969	.245360	.100750	.175550	.116000E-01	850.000
1970	.278830	.898100E-01	.159680	.130000E-01	902.000
1971	.374900	.869400E-01	.152400	.139000E-01	981.000
1972	.364950	.890400E-01	.151980	.130000E-01	1003.00
1973	.169770	.905200E-01	.157490	.109000E-01	1504.00
1974	.211700	.696800E-01	.174390	.105000E-01	2788.00
1975	.267110	.681200E-01	.149540	.122000E-01	3628.00
1976	.200750	.904700E-01	.140070	.122000E-01	3734.00
1977	.138860	.913800E-01	.153340	.131000E-01	4695.00
1978	.110570	.966600E-01	.147330	.149000E-01	6458.00
	1	2	3	4	5

	Tp	TfGtH	TfGtW	TfHtG	TfHtW
1960	461.000	106.000	8.00000	164.100	51.0000
1961	521.000	148.000	11.0000	170.900	47.0000
1962	532.000	203.000	6.00000	171.600	42.0000
1963	569.000	165.000	17.0000	178.000	51.0000
1964	625.000	167.000	26.0000	179.100	64.0000
1965	731.000	199.000	17.0000	219.100	71.0000
1966	797.000	236.000	21.0000	210.300	72.0000
1967	947.000	254.000	23.0000	222.900	91.0000
1968	1093.00	273.000	19.0000	254.300	101.000
1969	1185.00	253.000	25.0000	229.800	127.000
1970	1416.00	285.000	18.0000	247.000	146.000
1971	1597.00	342.000	21.0000	276.000	149.000
1972	1716.00	436.000	18.0000	517.000	131.000
1973	1950.00	280.000	25.0000	398.000	130.000
1974	2278.00	363.000	44.0000	490.000	152.000
1975	2952.00	210.000	34.0000	687.000	189.000
1976	3359.00	316.000	31.0000	936.000	230.000
1977	4112.00	321.000	36.0000	1115.00	232.000
1978	5652.00	332.000	1.00000	1215.00	243.000
	1	2	3	4	5

	TfWtG	TfWtH	Wa	Wm	Yad
1960	726.000	104.000	.579330	.437170	23278.0
1961	459.000	145.000	.614120	.463640	23891.0
1962	811.000	148.000	.620300	.502470	23663.0
1963	1011.00	196.000	.632870	.524870	24482.0
1964	670.000	195.000	.634490	.575850	22627.0
1965	667.000	217.000	.734480	.614080	26066.0
1966	787.000	288.000	.911170	.696570	31523.0
1967	1048.00	264.000	.842150	.768490	26363.0
1968	1426.00	241.000	.876700	.800850	27753.0
1969	1186.00	217.000	.948130	.852370	29691.0
1970	972.000	204.000	.889730	.920580	23810.0
1971	794.000	280.000	.927730	.952770	24151.0
1972	626.000	761.000	1.11980	1.01160	30871.0
1973	594.000	2529.00	1.66090	1.21210	43397.0
1974	562.000	4041.00	1.84980	1.47070	38988.0
1975	647.000	1323.00	2.02050	1.59450	41332.0
1976	768.000	331.000	2.21450	1.77090	43078.0
1977	701.000	675.000	2.32990	2.05220	37776.0
1978	1197.00	371.000	2.67140	2.43570	38974.0
	1	2	3	4	5

	Yas	Ymd	Yms
1960	28227.0	46861.0	41912.0
1961	29135.0	49965.0	44721.0
1962	31330.0	56175.0	48508.0
1963	34110.0	62062.0	52434.0
1964	34610.0	69629.0	57646.0
1965	35931.0	73478.0	63613.0
1966	40873.0	80165.0	70815.0
1967	39834.0	94026.0	80555.0
1968	43706.0	102850.	86892.0
1969	47018.0	111250.	93923.0
1970	48332.0	126280.	101760.
1971	50537.0	132940.	106551.
1972	49519.0	133760.	114707.
1973	56237.0	136750.	123909.
1974	56962.0	150960.	132988.
1975	62081.0	162180.	141433.
1976	65898.0	179430.	156611.
1977	65537.0	201070.	173304.
1978	75059.0	227870.	191781.
	1	2	3

APPENDIX 3

A NOTE ON THE ESTIMATION OF BENCHMARK CAPITAL STOCK

Often when working with a macro-econometric model, we need to construct a series of aggregate capital stock.[1] The best known technique for measuring capital stock is the perpetual inventory method, which typically assumes that the stock is depreciated at a constant rate, say d per year, and thus has a theoretically infinite life. The determination of capital stock and its depreciation can be expressed as follows:

$$K_t = K_{t-1} + I_t - D_t \qquad \ldots(1)$$

$$D_t = d.K_{t-1} \qquad \ldots(2)$$

where K_t = capital stock measured at the end of period t at constant prices (deflated by the investment deflator)

I_t = gross fixed investment at constant prices

D_t = depreciation at constant prices (deflated by the investment deflator)

If we can obtain an initial (or benchmark) value for the stock (possibly from other sources) and can assume an appropriate value of d then we can estimate the time series of capital stock[2] from equations (1) and (2).[3] But if we cannot obtain a benchmark, or if the benchmark is doubtful, then the following is an alternative method which may be applicable.

We lag equation (2) by one period:

$$D_{t-1} = d.K_{t-2} \qquad \ldots(3)$$ [4]

Subtracting equation (3) from equation (2), we obtain

$$D_t - D_{t-1} = d.(K_{t-1} - K_{t-2}) \qquad \ldots(4)$$

Now we lag equation (1) by one period and re-arrange it:

$$K_{t-1} - K_{t-2} = I_{t-1} - D_{t-1} \qquad \ldots(5)$$

Substituting (5) into (4), we then have

$$D_t - D_{t-1} = d.(I_{t-1} - D_{t-1})$$

or $$D_t = d.(I_{t-1} - D_{t-1}) + D_{t-1} \qquad \ldots(6)$$

Without any difficulty, we can apply a single-equation regression method to obtain $\hat{d}$, an estimate of d . We then use $\hat{d}$ to obtain a benchmark capital stock by inverting equation (2) and rewriting it as

$$K_{t-1} = D_t/\hat{d} \qquad \ldots(7)$$

We now have two options for estimating the stock series: we can use equation (1), applying actual depreciation with the benchmark from (7); or we can apply the following equation, again using the benchmark from (7):

$$K_t = (1-\hat{d}).K_{t-1} + I_t \qquad \ldots(8)$$

Two points should be noted. First, the benchmark stock should be derived from different years so as to permit experimentation with alternative initial capital stocks. It has been found (see Choudhry et al., 1972, p. 151) that "...forward calculation from an early benchmark was better than the other way around, because the error in the estimate of the benchmarks tends to expand as we move back, and contract as we move forward. So that as one moves forward, the series becomes less sensitive to a mismeasurement of the benchmark...".

Secondly, the data used for depreciation are capital consumption allowance estimates from national accounts, and these may be of doubtful accuracy; inasmuch as they do not represent real depreciation. The standard method of estimating capital consumption allowances, as described in the U.N. Yearbook of National Accounts Statistics, is as follows: Consumption of fixed capital is calculated from the charges for wear and tear, foreseen obsolescence and the expected rate of accidental damage not made good by repair in all fixed assets, valued at current replacement cost. Charges are not included in respect of unforeseen obsolescence or the depletion of natural resources.

Although the method for calculating depreciation may be considered satisfactory, measurement error may, of course, be present for various reasons in actual data.

Empirical results

Equation (6) was applied to estimate the values of d in the agricultural and non-agricultural sectors of Thailand. The equations fitted to 1954-78 annual data are as follows:

$$Da_t = \underset{(2.3875)}{.037359} \; (Ia_{t-1} - Da_{t-1}) + Da_{t-1} \qquad \ldots(9)$$

$\text{R-bar}^2 = .9125$; Se = 140.06; D.W. = 1.9645;

$$Dm_t = \underset{(5.1788)}{.040182} \; (Im_{t-1} - Dm_{t-1}) + Dm_{t-1} \qquad \ldots(10)$$ [5]

$\text{R-bar}^2 = .9793$; Se = 470.59; D.W. = 2.2233

where a and m represent the agricultural and non-agricultural sectors, respectively. D.W. is the Durbin-Watson statistic. Se is the standard error of estimate. The figures in brackets are t-ratios. The

Cochrane-Orcutt method was used in order to correct for first-order autocorrelation, which was prominent in the OLS results.

The estimated rates of depreciation are 0.037359 in the agricultural sector and 0.040182 in the non-agricultural sector. These estimates seem quite reasonable.

We now apply equation (7) to obtain benchmark estimates of capital stock for 1952:

$$Ka_{1952} = (1/0.037359)Da_{1953}$$
$$= (1/0.037359)(326.95)$$
$$= 8{,}751.57 \text{ millions of 1972 baht (20 baht} \approx \$US\ 1).$$

$$Km_{1952} = (1/0.040182)Dm_{1953}$$
$$= 27{,}880.64 \text{ millions of 1972 baht.}$$

The series of stock estimates based on equation (1), and using these benchmarks, are reported for comparison with the estimates by Trescott (1967) and Chaipravat et al. (1979) in Tables A.1 and A.2.

Note that Trescott used a survey method with assumptions about the rates of depreciation and some other assumptions. His series was for the period 1945-65, in 1956 prices. We have converted his series into 1972 prices. His series of both stocks were accumulated from benchmarks for 1952-53.

From Tables A.1 and A.2, we find that our 1953 estimates of both capital stocks are very close to those of Trescott. However, his stocks grow more slowly than ours. This may be due to his assumptions about the rates of depreciation, which are higher than our estimated rates.

The series of capital stocks developed by Chaipravat et al. may be too high, since their total capital-output ratio was sometimes greater than 6. The usual range of the total capital-output ratio is between 2.5 and 3.5. (See Taylor, 1979, pp.87-88.)

Table A.1 Capital Stocks and Capital-Output Ratios in Agriculture (in billions of baht, at 1972 prices)

Year	Ka	Ka!	Ka+	Ka/Ya	Ka!/Ya	Ka+/Ya	Ya[6]
1952	8.7516	9.7469	-	.4637	.5165	-	18.872
1953	9.6191	10.153	-	.4419	.4664	-	21.768
1954	10.491	10.559	-	.5202	.5236	-	20.168
1955	11.341	10.830	-	.4935	.4713	-	22.981
1956	12.206	11.236	-	.5216	.4802	-	23.400
1957	13.255	11.777	-	.5772	.5128	-	22.965
1958	14.527	12.454	-	.6029	.5169	-	24.096
1959	16.096	13.267	-	.6492	.5351	-	24.794
1960	17.966	14.485	46.332	.6365	.5132	1.6414	28.227
1961	19.809	15.703	45.636	.6799	.5390	1.5664	29.135
1962	21.788	17.057	45.201	.6954	.5444	1.4427	31.330
1963	23.945	18.817	45.147	.7020	.5517	1.3236	34.110
1964	26.116	20.441	45.408	.7546	.5906	1.3120	34.610
1965	28.530	21.930	45.764	.7940	.6104	1.2737	35.931
1966	30.928	-	46.523	.7567	-	1.1382	40.873
1967	33.299	-	48.231	.8359	-	1.2108	39.834
1968	35.604	-	50.067	.8146	-	1.1455	43.706
1969	37.663	-	51.658	.8010	-	1.0987	47.018
1970	40.090	-	53.816	.8295	-	1.1135	48.332
1971	42.120	-	55.800	.8335	-	1.1041	50.537
1972	44.540	-	56.951	.8923	-	1.1409	49.919
1973	46.887	-	58.474	.8337	-	1.0398	56.237
1974	49.605	-	60.582	.8708	-	1.0636	56.962
1975	52.503	-	63.175	.8457	-	1.0176	62.081
1976	55.743	-	66.421	.8459	-	1.0079	65.898
1977	60.484	-	70.323	.9229	-	1.0730	65.537
1978	65.676	-	74.556	.8750	-	.9933	75.059

where Ka = our estimate of fixed capital stock in agriculture

Ka! = Trescott estimate of fixed capital stock in agriculture

Ka+ = Chaipravat et al. estimate of fixed capital stock in agriculture

Ya = agricultural value added output.

Table A.2 Capital Stocks and Capital-Output Ratios in Non-Agriculture (in billions of baht, at 1972 prices)

Year	Km	Km!	Km+	Km/Ym	Km!/Ym	Km+/Ym	Ym
1952	27.881	29.241	-	1.1681	1.2251	-	23.868
1953	32.131	32.219	-	1.2306	1.2340	-	26.110
1954	36.520	34.926	-	1.3462	1.2875	-	27.128
1955	40.380	37.769	-	1.3752	1.2863	-	29.362
1956	44.456	40.747	-	1.4605	1.3387	-	30.438
1957	50.585	45.350	-	1.6112	1.4444	-	31.396
1958	56.218	49.547	-	1.7616	1.5525	-	31.913
1959	62.517	54.149	-	1.6861	1.4605	-	37.077
1960	70.021	59.835	419.47	1.6707	1.4276	10.008	41.912
1961	77.627	66.468	414.33	1.7358	1.4863	9.2647	44.721
1962	87.030	74.455	411.38	1.7941	1.5349	8.4806	48.508
1963	99.012	85.420	410.88	1.8883	1.6291	7.8361	52.434
1964	112.58	97.604	412.79	1.9530	1.6932	7.1608	57.646
1965	126.47	110.33	415.51	1.9880	1.7344	6.5319	63.613
1966	144.44	-	421.59	2.0397	-	5.9534	70.815
1967	166.35	-	431.86	2.0650	-	5.3611	80.555
1968	189.73	-	444.89	2.1835	-	5.1200	86.892
1969	216.02	-	461.08	2.2999	-	4.9091	93.923
1970	241.10	-	478.12	2.3693	-	4.6985	101.76
1971	264.13	-	492.46	2.4789	-	4.6218	106.55
1972	283.72	-	506.72	2.4735	-	4.4175	114.71
1973	306.33	-	524.49	2.4722	-	4.2329	123.91
1974	333.07	-	544.07	2.5045	-	4.0911	132.99
1975	359.10	-	565.12	2.5390	-	3.9956	141.43
1976	386.18	-	587.55	2.4658	-	3.7517	156.61
1977	423.91	-	619.07	2.4461	-	3.5721	173.30
1978	464.47	-	654.77	2.4219	-	3.4142	191.78

where Km = our estimate of fixed capital stock in non-agriculture

Km! = Trescott estimate of fixed capital stock in non-agriculture

Km+ = Chaipravat et al. estimate of fixed capital stock in non-agriculture

Ym = non-agricultural value added output.

FOOTNOTES TO APPENDIX 3

1. The series of aggregate capital stock may, in fact, not exist for a number of reasons as indicated during a series of debates between the two Cambridges on capital theory (see Harcourt, 1972; Jones, 1979). But to consider something concrete about the marginal productivity of capital, capital-output ratio, and so on, an aggregate series of capital stock seems to be the only tool available.

2. The usual method for estimating a capital stock benchmark can be found in Brown (1964) and Rymes (1967). It involves the appropriate assumption of depreciation rates. For example, we may assume that machinery and equipment have an average economic life of 20 years. With linear depreciation, a piece of capital depreciates one twentieth of its value a year, and hence at the end of its twentieth year has no value left. We thus have the following formulae for the calculation of benchmark capital:

$$K_t = I_t + (N-1)/N.I_{t-1} + (N-2)/N.I_{t-2} + \ldots$$
$$\ldots + 2/N.I_{t-N+2} + 1/N.I_{t-N+1}$$

where N = average life of capital.

3. Harberger (1974) suggested that benchmark capital may be obtained by the following formula:

$$K = I/(g_y + d)$$

where g_y is the rate of growth of output and d is to be appropriately assumed. This method is suitable provided that the economy grew at a fairly constant rate over the period of estimation.

4. Depreciation might be assumed as $D_t = d.(K_t+K_{t-1})/2$ in our model. The estimated result would then be slightly different.

5. Ia = Ipa + Iga and Im = Ipm + Igm, where p and g represent the private and government sectors, respectively.

6. The data for Ya, Ym, Ia, Im, Da, and Dm were obtained from the national accounts for Thailand.

APPENDIX 4

ESTIMATION OF OTHER CAPITAL STOCKS

1. The estimation of Kpa, Kga, Kpm, and Kgm

We obtained the 1960 benchmarks for private capital stocks in agriculture (Kpa) and in non-agriculture (Kpm) from the following equation:

$$Kpj_{1960} = 1/N.\left(\sum_{i=1960}^{1978} Ipj_i/Ij_i\right).Kj_{1960}$$

where j = a (agriculture) or m (non-agriculture)

N = number of periods (1960-78) = 19

p = private

Thus,

$$Kpa_{1960} = .67798.(17,965.58) = 12,180.30 \text{ millions of baht.}$$

$$Kpm_{1960} = .71832.(70,021.04) = 50,297.51 \text{ millions of baht.}$$

We then assumed that the rates of depreciation of the private stocks are the same as those of the aggregated ones. The series of private stocks were thus calculated from the following identities:

$$Kpa = (1-da).Kpa_{-1} + Ipa$$

$$Kpm = (1-dm).Kpm_{-1} + Ipm$$

where $da = .037359$ (see Appendix 1)

$dm = .040182$ (see Appendix 1).

The government capital stocks were calculated residually from

$Kga = Ka - Kpa$

$Kgm = Km - Kpm$

2. The estimation of Kd (stock of consumer durable goods)

We obtained the benchmark for the stock of consumer durable by using Brown's formula (see footnote 2, Appendix 3):

$$K_t = I_t + (N-1)/N.I_{t-1} + (N-2)/N.I_{t-2} + \ldots$$
$$\ldots + 2/N.I_{t-N+2} + 1/N.I_{t-N+1}$$

where N is the average life expectancy for durable goods, which is assumed to be 20 years.

Three consecutive benchmarks were obtained for the years 1972-1974, and these were then used to estimate the depreciation rate for durable goods (dd) according to the perpetual inventory assumption. (See Appendix 3.) The estimated value of dd was 0.0667 (after some adjustment). The Kd series was then calculated by the perpetual inventory method:

$$Kd = (1-dd) . Kd_{-1} + Cd$$

The adjustment to the estimated value of dd was made to reduce the discrepancy between the benchmark of capital, obtained from Brown's formula, and the stock series obtained by the perpetual inventory procedure.

APPENDIX 5

ESTIMATION OF THE RAINFALL INDEX

The rainfall index (rf) was constructed from data published in Government of Thailand, Agricultural Statistics of Thailand Crop Year 1978/1979. The index is a weighted average of annual rainfall in 4 regions:

$$rf = \sum_{i=1}^{4} w_i (rf_i/\overline{rf}_i)$$

where rf_i = actual annual rainfall in milimetre in the i^{th} region

$\overline{rf}_i$ = arithmetic mean of 1950-78 of annual rainfall in the i^{th} region

w_i = weight assigned to the i^{th} region which is calculated from the agricultural output share of that region in 1975

w_1 = 33.94 percent for Central Plain

w_2 = 24.43 percent for Northern region

w_3 = 26.20 percent for Northeastern region

w_4 = 15.43 percent for Southern region.

APPENDIX 6

SELECTED VARIABLES FROM THE HISTORICAL SIMULATION

The 12 selected variables from the historical simulation are reported in Chart 8.1, Chapter 8. These are GDP, P, Yas, Yms, Cp, I, E, IM, K, Nm/N, BOP and Gdef. The rest is presented in this appendix. The predicted values are shown in comparison with the actual values. The definitions of variables are given in Appendix 1.

Note that the computer printout displays all variables in capital letters. S1 at the end of a variable symbol indicates a simulated value.

The following statistical criteria are applied in analysing the forecasting ability of the model (see the discussion in Chapter 8):

(1) Correlation Coefficient

(2) Root-Mean-Square Error: $RMSE = \sqrt{1/T \sum_{t=1}^{T} (P_t - A_t)^2}$

(3) Mean Absolute Error: $MAE = 1/T \sum_{t=1}^{T} |P_t - A_t|$

(4) Mean Error: $ME = 1/T \sum_{t=1}^{T} (A_t - P_t)$

(5) Coefficient of Regression Actual on Predicted Values

(6) Theil's Inequality Coefficient:

$$U = RMSE \Big/ \left[\sqrt{1/T \sum_{t=1}^{T} P_t^2} \quad \sqrt{1/T \sum_{t=1}^{T} A_t^2} \right]$$

The values of U are between 0 and 1.

P_t denotes the predicted values and A_t indicates the actual values.

The square of the numerator of the inequality coefficient, which is the Mean-Square-Error (MSE), can be decomposed as follows:

(7) Fraction of error due to bias:

$$U^M = (\bar{P} - \bar{A})^2/MSE$$

(8) Fraction of error due to different variation:

$$U^S = (S_P - S_A)^2/MSE$$

(9) Fraction of error due to different co-variation:

$$U^C = [2.(1-r).S_P.S_A]/MSE$$

where $\bar{P}$, $\bar{A}$, S_P and S_A are the means and standard deviations of the P and A series, respectively, and r is the coefficient of correlaion between P and A.

Note that $U^M + U^S + U^C = 1$.

An alternative decomposition of MSE is:

(10) Fraction of error due to bias:

$$U^M = (\bar{P} - \bar{A})^2/MSE$$

(11) Fraction of error due to difference of regression coefficient from unity:

$$U^R = (S_P - r.S_A)/MSE$$

(12) Fraction of error due to residual variance:

$$U^D = [(1 - r^2).S_A{}^2]/MSE$$

Note that $U^M + U^R + U^D = 1$.

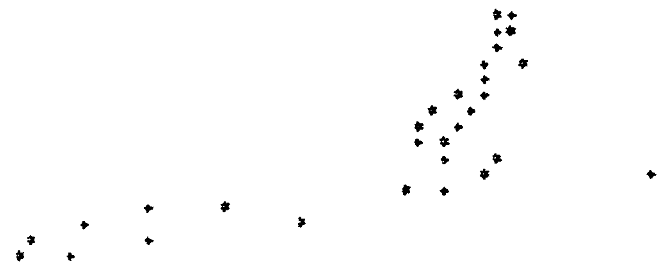
COMPARISON OF ACTUAL AND PREDICTED SERIES
****

ACTUAL: BOC PREDICTED: BOCS1

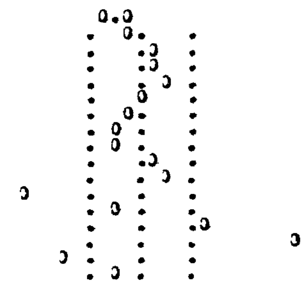
SAMPLE = 4 19

CORRELATION COEFFICIENT = .8779 (SQUARED = .7703)
ROOT-MEAN-SQUARED ERROR = 4248.
MEAN ABSOLUTE ERROR = 2914.
MEAN ERROR = -66.66
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .7983
THEIL'S INEQUALITY COEFFICIENT = .2318
FRACTION OF ERROR DUE TO BIAS = .2452E-03
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .3570E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9641
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .1766
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .8231

PLOT OF ACTUAL(*) AND FITTED(+) VALUES



PLOT OF RESIDUALS(0)



	ACTUAL	FITTED	RESIDUAL
1963	-1115.	-432.9	-682.
1964	-419.7	-958.9	539.
1965	-516.8	-1060.	543.
1966	495.7	-1262.	.176E+04
1967	-1154.	-1321.	167.
1968	-2733.	-1712.	-.102E+04
1969	-3810.	-2219.	-.159E+04
1970	-4990.	-2978.	-.201E+04
1971	-3316.	-4668.	.135E+04
1972	-1063.	-3272.	.221E+04
1973	-1382.	7202.	-.858E+04
1974	-5668.	-3582.	-.209E+04
1975	-.1451E+05	-.1908E+05	.457E+04
1976	-.1061E+05	-.2225E+05	.116E+05
1977	-.2461E+05	-.1911E+05	-.551E+04
1978	-.2545E+05	-.2309E+05	-.236E+04

COMPARISON OF ACTUAL AND PREDICTED SERIES
****

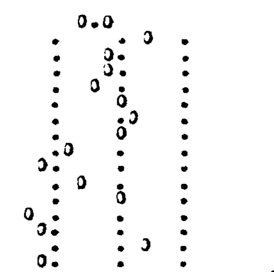
ACTUAL: CA PREDICTED: CAS1

SAMPLE = 4 19

CORRELATION COEFFICIENT = .9911 (SQUARED = .9823)
ROOT-MEAN-SQUARED ERROR = 921.4
MEAN ABSOLUTE ERROR = 676.1
MEAN ERROR = -244.1
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = 1.015
THEIL'S INEQUALITY COEFFICIENT = .1592E-01
FRACTION OF ERROR DUE TO BIAS = .7022E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .2771E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9021
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .1048E-01
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .9193

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

PLOT OF RESIDUALS(0)



	ACTUAL	FITTED	RESIDUAL
1963	.1728E+05	.1692E+05	361.
1964	.1828E+05	.1851E+05	-226.
1965	.1846E+05	.1870E+05	-237.
1966	.1977E+05	.2017E+05	-399.
1967	.2110E+05	.2112E+05	-13.7
1968	.2279E+05	.2260E+05	187.
1969	.2413E+05	.2408E+05	47.2
1970	.2677E+05	.2765E+05	-879.
1971	.2787E+05	.2908E+05	-.121E+04
1972	.2673E+05	.2739E+05	-662.
1973	.2727E+05	.2733E+05	-57.8
1974	.2905E+05	.3044E+05	-.139E+04
1975	.3088E+05	.3199E+05	-.111E+04
1976	.3350E+05	.3303E+05	475.
1977	.3474E+05	.3591E+05	-.118E+04
1978	.4228E+05	.3990E+05	.239E+04

COMPARISON OF ACTUAL AND PREDICTED SERIES
****

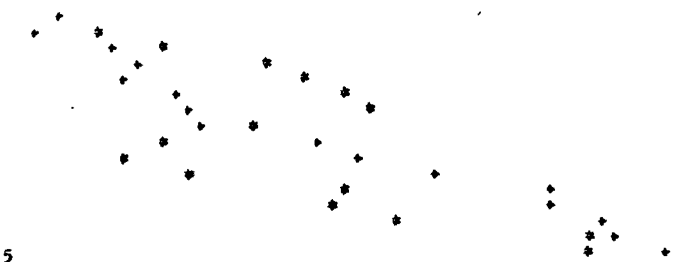
ACTUAL: CD PREDICTED: CDS1

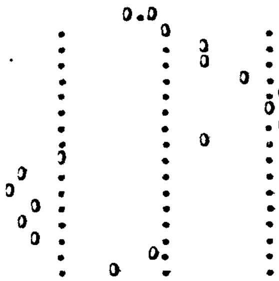
SAMPLE = 4 19

CORRELATION COEFFICIENT = .6977 (SQUARED = .4867)
ROOT-MEAN-SQUARED ERROR = 1537.
MEAN ABSOLUTE ERROR = 1430.
MEAN ERROR = -336.3
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .4965
THEIL"S INEQUALITY COEFFICIENT = .1228
FRACTION OF ERROR DUE TO BIAS = .4221E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .1550
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .8028
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .4728
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .4850

PLOT OF ACTUAL(*) AND FITTED(+) VALUES PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	3814.	3821.	-7.18
1964	4204.	3549.	655.
1965	4933.	4311.	622.
1966	5998.	4617.	.138E+04
1967	6405.	4507.	.190E+04
1968	6856.	5045.	.181E+04
1969	7035.	5192.	.184E+04
1970	5828.	5289.	539.
1971	4847.	6456.	-.162E+04
1972	4551.	6881.	-.233E+04
1973	5179.	7745.	-.257E+04
1974	6850.	8915.	-.206E+04
1975	6670.	9031.	-.236E+04
1976	7412.	9501.	-.209E+04
1977	9361.	9649.	-288.
1978	9389.	.1019E+05	-804.





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

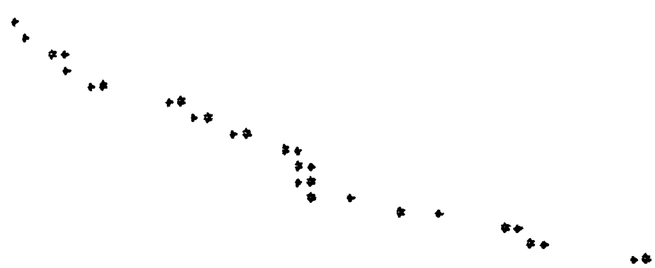
ACTUAL: CG PREDICTED: CGS1

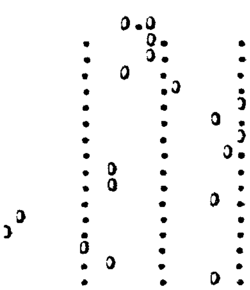
SAMPLE = 4 19

CORRELATION COEFFICIENT = .9966 (SQUARED = .9932)
ROOT-MEAN-SQUARED ERROR = 548.1
MEAN ABSOLUTE ERROR = 464.2
MEAN ERROR = -104.2
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9723
THEIL"S INEQUALITY COEFFICIENT = .1533E-01
FRACTION OF ERROR DUE TO BIAS = .3615E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .7988E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .8840
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .1029
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .8609

PLOT OF ACTUAL(*) AND FITTED(+) VALUES PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	8343.	8464.	-121.
1964	8681.	8815.	-134.
1965	9654.	9957.	-304.
1966	.1022E+05	.1011E+05	105.
1967	.1133E+05	.1079E+05	535.
1968	.1381E+05	.1337E+05	436.
1969	.1495E+05	.1436E+05	604.
1970	.1629E+05	.1579E+05	496.
1971	.1736E+05	.1772E+05	-360.
1972	.1789E+05	.1826E+05	-371.
1973	.1836E+05	.1802E+05	341.
1974	.1853E+05	.1962E+05	-.109E+04
1975	.2139E+05	.2255E+05	-.117E+04
1976	.2493E+05	.2550E+05	-573.
1977	.2560E+05	.2602E+05	-422.
1978	.2969E+05	.2933E+05	362.





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

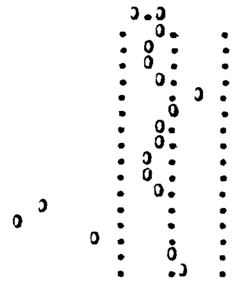
ACTUAL: CND   PREDICTED: CNDS1

SAMPLE =   4   19

CORRELATION COEFFICIENT =   .9972   (SQUARED =   .9943   )
ROOT-MEAN-SQUARED ERROR =   2396.
MEAN ABSOLUTE ERROR =   1528.
MEAN ERROR =   -1315.
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED =   .9718
THEIL"S INEQUALITY COEFFICIENT =   .1428E-01
FRACTION OF ERROR DUE TO BIAS =   .3010
FRACTION OF ERROR DUE TO DIFFERENT VARIATION =   .7317E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION =   .6258
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY =   .8994E-01
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE =   .6090

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	.4555E+05	.4586E+05	-315.
1964	.4821E+05	.4915E+05	-949.
1965	.5116E+05	.5224E+05	-.103E+04
1966	.5537E+05	.5614E+05	-773.
1967	.6002E+05	.5917E+05	841.
1968	.6354E+05	.6344E+05	105.
1969	.6723E+05	.6800E+05	-776.
1970	.7277E+05	.7348E+05	-703.
1971	.7855E+05	.7976E+05	-.120E+04
1972	.8424E+05	.8513E+05	-892.
1973	.9098E+05	.9166E+05	-676.
1974	.9564E+05	.1012E+06	-.554E+04
1975	.1018E+06	.1083E+06	-.653E+04
1976	.1096E+06	.1129E+06	-.330E+04
1977	.1185E+06	.1183E+06	203.
1978	.1253E+06	.1257E+06	555.



COMPARISON OF ACTUAL AND PREDICTED SERIES
****

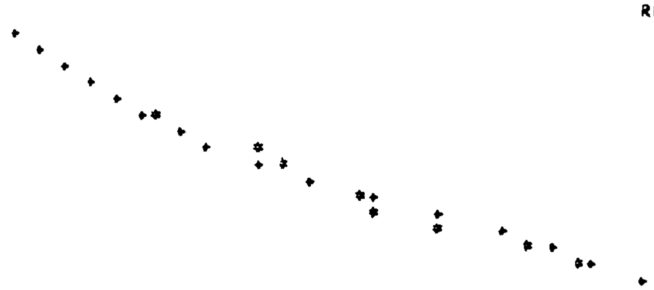
ACTUAL: CS   PREDICTED: CSS1

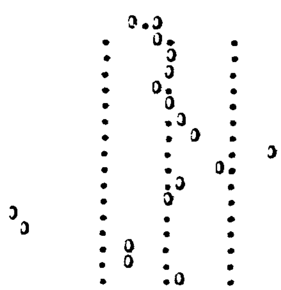
SAMPLE =   4   19

CORRELATION COEFFICIENT =   .9921   (SQUARED =   .9842   )
ROOT-MEAN-SQUARED ERROR =   944.8
MEAN ABSOLUTE ERROR =   594.4
MEAN ERROR =   -170.1
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED =   .9445
THEIL"S INEQUALITY COEFFICIENT =   .2200E-01
FRACTION OF ERROR DUE TO BIAS =   .3242E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION =   .1276
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION =   .8400
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY =   .1710
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE =   .7966

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	.1108E+05	.1126E+05	-180.
1964	.1200E+05	.1193E+05	74.9
1965	.1283E+05	.1285E+05	-20.3
1966	.1362E+05	.1382E+05	-203.
1967	.1452E+05	.1456E+05	-44.2
1968	.1591E+05	.1566E+05	249.
1969	.1711E+05	.1677E+05	339.
1970	.1938E+05	.1787E+05	.151E+04
1971	.2028E+05	.1943E+05	849.
1972	.2146E+05	.2122E+05	238.
1973	.2340E+05	.2341E+05	-12.6
1974	.2372E+05	.2605E+05	-.233E+04
1975	.2596E+05	.2818E+05	-.222E+04
1976	.2919E+05	.2970E+05	-517.
1977	.3057E+05	.3117E+05	-593.
1978	.3303E+05	.3289E+05	136.





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

ACTUAL: EA PREDICTED: EAS1

SAMPLE = 4 19

CORRELATION COEFFICIENT = .6207 (SQUARED = .3852)
ROOT-MEAN-SQUARED ERROR = 644.5
MEAN ABSOLUTE ERROR = 525.2
MEAN ERROR = 75.88
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .7829
THEIL'S INEQUALITY COEFFICIENT = .3329E-01
FRACTION OF ERROR DUE TO BIAS = .1386E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .6568E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9205
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .4535E-01
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .9408

PLOT OF ACTUAL(*) AND FITTED(+) VALUES PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	2236.	2812.	-577.
1964	3218.	2977.	241.
1965	3158.	3057.	101.
1966	4127.	3190.	937.
1967	3143.	3304.	-161.
1968	3300.	3429.	-129.
1969	3617.	3590.	26.9
1970	4140.	3787.	353.
1971	4785.	3859.	926.
1972	3866.	4011.	-145.
1973	3841.	4275.	-434.
1974	5401.	4329.	.107E+04
1975	4863.	4244.	618.
1976	4977.	4444.	533.
1977	3541.	4672.	-.113E+04
1978	3992.	5010.	-.102E+04

COMPARISON OF ACTUAL AND PREDICTED SERIES
****

ACTUAL: EM PREDICTED: EMS1

SAMPLE = 4 19

CORRELATION COEFFICIENT = .9282 (SQUARED = .8615)
ROOT-MEAN-SQUARED ERROR = 3275.
MEAN ABSOLUTE ERROR = 2657.
MEAN ERROR = 402.0
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = 1.009
THEIL'S INEQUALITY COEFFICIENT = .5551E-01
FRACTION OF ERROR DUE TO BIAS = .1507E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .4523E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9397
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .4489E-03
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .9845

PLOT OF ACTUAL(*) AND FITTED(+) VALUES PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	.1001E+05	.1117E+05	-.116E+04
1964	.1191E+05	.1220E+05	-289.
1965	.1317E+05	.1371E+05	-535.
1966	.1641E+05	.1527E+05	.114E+04
1967	.2025E+05	.1649E+05	.377E+04
1968	.2081E+05	.1778E+05	.303E+04
1969	.2104E+05	.1941E+05	.162E+04
1970	.2070E+05	.2153E+05	-827.
1971	.2330E+05	.2300E+05	295.
1972	.2978E+05	.2569E+05	.408E+04
1973	.2500E+05	.3021E+05	-.521E+04
1974	.2237E+05	.2857E+05	-.620E+04
1975	.2457E+05	.2839E+05	-.382E+04
1976	.3351E+05	.3134E+05	.217E+04
1977	.3998E+05	.3417E+05	.581E+04
1978	.4081E+05	.3824E+05	.257E+04

COMPARISON OF ACTUAL AND PREDICTED SERIES
****

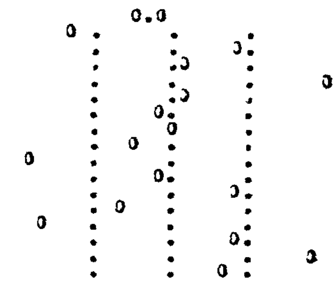
ACTUAL: g_p PREDICTED: g_pSI

SAMPLE = 4 19

CORRELATION COEFFICIENT = .7268 (SQUARED = .5282)
ROOT-MEAN-SQUARED ERROR = 4.790
MEAN ABSOLUTE ERROR = 3.795
MEAN ERROR = .2193
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .6948
THEIL"S INEQUALITY COEFFICIENT = .2878
FRACTION OF ERROR DUE TO BIAS = .2096E-02
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .3678E-02
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9942
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .1772
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .8207

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

PLOT OF RESIDUALS(O)



	ACTUAL	FITTED	RESIDUAL
1963	-1.552	4.672	-6.22
1964	2.886	-.9108	3.80
1965	4.646	3.960	.686
1966	7.179	-1.723	8.90
1967	-.9034	-1.737	.834
1968	-.6003	.2577	-.858
1969	2.024	2.280	-.255
1970	-.6249	1.966	-2.59
1971	1.544	9.596	-8.05
1972	8.637	9.166	-.529
1973	20.20	16.67	3.53
1974	18.85	21.83	-2.97
1975	2.779	9.909	-7.13
1976	3.344	-.2403E-01	3.37
1977	8.449	.4151E-01	8.41
1978	8.708	6.109	2.60

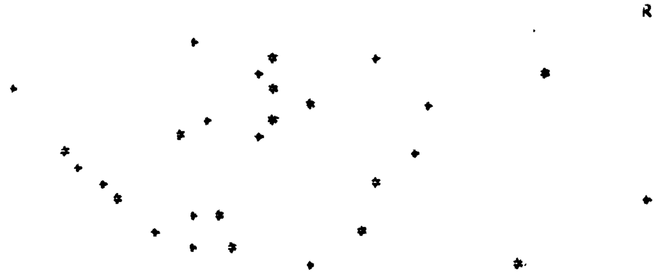
COMPARISON OF ACTUAL AND PREDICTED SERIES
****

ACTUAL: g_Y PREDICTED: g_YSI

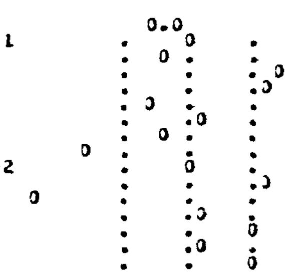
SAMPLE = 5 19

CORRELATION COEFFICIENT = -.1579 (SQUARED = .2493E-01)
ROOT-MEAN-SQUARED ERROR = 3.504
MEAN ABSOLUTE ERROR = 2.655
MEAN ERROR = .1853
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = -.1374
THEIL"S INEQUALITY COEFFICIENT = .2174
FRACTION OF ERROR DUE TO BIAS = .2797E-02
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .8262E-02
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9889
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .6348
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .3624

PLOT OF ACTUAL(*) AND FITTED(+) VALUES



PLOT OF RESIDUALS(O)



	ACTUAL	FITTED	RESIDUAL
1964	6.600	6.689	-.887E-01
1965	7.900	9.580	-1.68
1966	12.20	7.662	4.54
1967	7.790	3.799	3.99
1968	8.480	10.27	-1.79
1969	7.920	6.923	.996
1970	6.493	7.592	-1.10
1971	4.661	10.18	-5.52
1972	4.799	4.802	-.335E-02
1973	9.427	5.205	4.22
1974	5.442	13.79	-8.35
1975	7.141	6.686	.454
1976	9.334	6.054	3.28
1977	7.340	6.664	.675
1978	11.72	8.567	3.15

COMPARISON OF ACTUAL AND PREDICTED SERIES
****

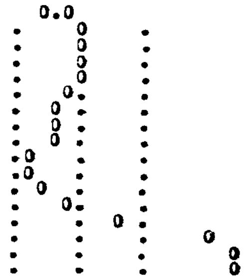
ACTUAL: GDEBT PREDICTED: GDEBTS1

SAMPLE = 4 19

CORRELATION COEFFICIENT = .9981 (SQUARED = .9963)
ROOT-MEAN-SQUARED ERROR = 3009.
MEAN ABSOLUTE ERROR = 2006.
MEAN ERROR = 699.2
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = 1.067
THEIL'S INEQUALITY COEFFICIENT = .2646E-01
FRACTION OF ERROR DUE TO BIAS = .5400E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .5165
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .4295
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .4871
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .4589

PLOT OF ACTUAL(*) AND FITTED(+) VALUES PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	.1026E+05	.1007E+05	138.
1964	.1209E+05	.1208E+05	19.0
1965	.1448E+05	.1422E+05	259.
1966	.1755E+05	.1737E+05	190.
1967	.2014E+05	.2076E+05	-623.
1968	.2380E+05	.2472E+05	-925.
1969	.2880E+05	.2996E+05	-.116E+04
1970	.3582E+05	.3693E+05	-.111E+04
1971	.4329E+05	.4532E+05	-.204E+04
1972	.5263E+05	.5486E+05	-.223E+04
1973	.5928E+05	.6094E+05	-.166E+04
1974	.5780E+05	.5850E+05	-700.
1975	.6571E+05	.6408E+05	.163E+04
1976	.8419E+05	.7854E+05	.565E+04
1977	.1018E+06	.9494E+05	.685E+04
1978	.1276E+06	.1207E+06	.686E+04



COMPARISON OF ACTUAL AND PREDICTED SERIES
****

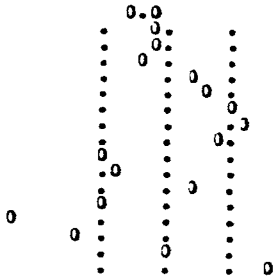
ACTUAL: GEX PREDICTED: GEXS1

SAMPLE = 4 19

CORRELATION COEFFICIENT = .9972 (SQUARED = .9944)
ROOT-MEAN-SQUARED ERROR = 1750.
MEAN ABSOLUTE ERROR = 1429.
MEAN ERROR = -157.6
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9935
THEIL'S INEQUALITY COEFFICIENT = .2079E-01
FRACTION OF ERROR DUE TO BIAS = .8107E-02
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .2327E-02
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9896
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .7323E-02
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .9846

PLOT OF ACTUAL(*) AND FITTED(+) VALUES PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	.1144E+05	.1181E+05	-373.
1964	.1256E+05	.1303E+05	-472.
1965	.1436E+05	.1495E+05	-595.
1966	.1681E+05	.1615E+05	659.
1967	.1832E+05	.1719E+05	.114E+04
1968	.2181E+05	.2005E+05	.176E+04
1969	.2453E+05	.2256E+05	.197E+04
1970	.2697E+05	.2566E+05	.130E+04
1971	.2806E+05	.2980E+05	-.174E+04
1972	.3179E+05	.3300E+05	-.122E+04
1973	.3486E+05	.3426E+05	602.
1974	.3905E+05	.4089E+05	-.184E+04
1975	.4921E+05	.5331E+05	-.410E+04
1976	.6289E+05	.6525E+05	-.236E+04
1977	.7398E+05	.7395E+05	34.2
1978	.9444E+05	.9174E+05	.270E+04



COMPARISON OF ACTUAL AND PREDICTED SERIES
****

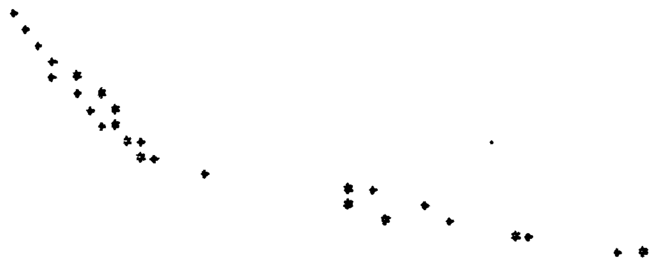
ACTUAL: GREV   PREDICTED: GREVS1

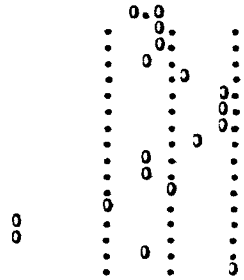
SAMPLE =   4   19

CORRELATION COEFFICIENT =   .9899   (SQUARED =   .9800   )
ROOT-MEAN-SQUARED ERROR =   2695.
MEAN ABSOLUTE ERROR =   1952.
MEAN ERROR =   -536.3
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED =   .9402
THEIL"S INEQUALITY COEFFICIENT =   .4093E-01
FRACTION OF ERROR DUE TO BIAS =   .4732E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION =   .1110
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION =   .8417
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY =   .1573
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE =   .7954

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	9965.	.1053E+05	-561.
1964	.1073E+05	.1103E+05	-303.
1965	.1197E+05	.1280E+05	-835.
1966	.1373E+05	.1301E+05	728.
1967	.1575E+05	.1379E+05	.195E+04
1968	.1815E+05	.1609E+05	.206E+04
1969	.1953E+05	.1732E+05	.221E+04
1970	.1995E+05	.1869E+05	.126E+04
1971	.2060E+05	.2141E+05	-807.
1972	.2244E+05	.2347E+05	-.103E+04
1973	.2821E+05	.2817E+05	34.3
1974	.4053E+05	.4334E+05	-.280E+04
1975	.4129E+05	.4772E+05	-.643E+04
1976	.4441E+05	.5078E+05	-.637E+04
1977	.5639E+05	.5756E+05	-.116E+04
1978	.6867E+05	.6598E+05	.259E+04





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

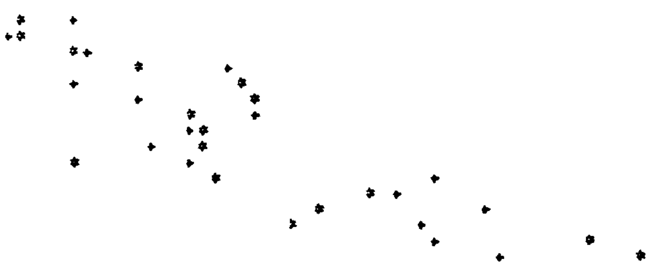
ACTUAL: IPA   PREDICTED: IPAS1

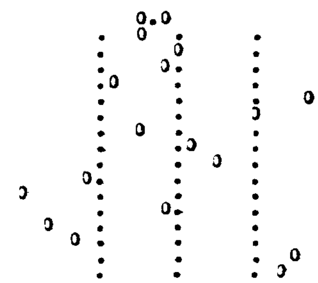
SAMPLE =   4   19

CORRELATION COEFFICIENT =   .7718   (SQUARED =   .5956   )
ROOT-MEAN-SQUARED ERROR =   439.4
MEAN ABSOLUTE ERROR =   360.3
MEAN ERROR =   -46.04
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED =   .8249
THEIL"S INEQUALITY COEFFICIENT =   .7511E-01
FRACTION OF ERROR DUE TO BIAS =   .1098E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION =   .9507E-02
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION =   .9795
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY =   .6157E-01
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE =   .9275

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	1997.	2168.	-171.
1964	1961.	1933.	27.7
1965	2178.	2223.	-45.2
1966	2438.	2785.	-347.
1967	2852.	2161.	690.
1968	2879.	2447.	433.
1969	2653.	2854.	-201.
1970	2663.	2625.	38.4
1971	2691.	2488.	202.
1972	2194.	2643.	-449.
1973	2746.	3560.	-814.
1974	3350.	3407.	-56.7
1975	3128.	3778.	-650.
1976	3014.	3529.	-515.
1977	4170.	3573.	597.
1978	4372.	3845.	527.





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COMPARISON OF ACTUAL AND PREDICTED SERIES
*****************************************

     ACTUAL: IPM          PREDICTED: IPMS1

SAMPLE =          4       19

CORRELATION COEFFICIENT =     .9163                          (SQUARED =    .8396    )
ROOT-MEAN-SQUARED ERROR =     4023.
MEAN ABSOLUTE ERROR =     3241.
MEAN ERROR =    -916.1
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED =     .8086
THEIL"S INEQUALITY COEFFICIENT =     .7553E-01
FRACTION OF ERROR DUE TO BIAS =     .5135E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION =     .8108E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION =     .8671
ALTERNATIVE DECOMPOSITION  (LAST 2 COMPONENTS):
     FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY =     .2150
     FRACTION OF ERROR DUE TO RESIDUAL VARIANCE =     .7331
```

PLOT OF ACTUAL(*) AND FITTED(+) VALUES — PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	.1054E+05	.1108E+05	-537.
1964	.1239E+05	.1206E+05	323.
1965	.1246E+05	.1371E+05	-.125E+04
1966	.1592E+05	.1423E+05	.169E+04
1967	.2032E+05	.1522E+05	.510E+04
1968	.2221E+05	.1912E+05	.309E+04
1969	.2532E+05	.2302E+05	.230E+04
1970	.2519E+05	.2606E+05	-870.
1971	.2482E+05	.2726E+05	-.244E+04
1972	.2097E+05	.2562E+05	-.465E+04
1973	.2618E+05	.2892E+05	-.275E+04
1974	.3192E+05	.3909E+05	-.716E+04
1975	.2980E+05	.3820E+05	-.841E+04
1976	.2856E+05	.3375E+05	-.519E+04
1977	.3900E+05	.3372E+05	.528E+04
1978	.4113E+05	.4031E+05	815.

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COMPARISON OF ACTUAL AND PREDICTED SERIES
*****************************************

     ACTUAL: IMA          PREDICTED: IMAS1

SAMPLE =          4       19

CORRELATION COEFFICIENT =     .5457                          (SQUARED =    .2973    )
ROOT-MEAN-SQUARED ERROR =     337.0
MEAN ABSOLUTE ERROR =     258.4
MEAN ERROR =    -27.17
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED =     .2562
THEIL"S INEQUALITY COEFFICIENT =     .1444
FRACTION OF ERROR DUE TO BIAS =     .6498E-02
FRACTION OF ERROR DUE TO DIFFERENT VARIATION =     .3951
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION =     .5984
ALTERNATIVE DECOMPOSITION  (LAST 2 COMPONENTS):
     FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY =     .7764
     FRACTION OF ERROR DUE TO RESIDUAL VARIANCE =     .2171
```

PLOT OF ACTUAL(*) AND FITTED(+) VALUES — PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	943.4	951.3	-7.89
1964	930.4	749.5	181.
1965	980.8	921.1	59.7
1966	1045.	1038.	6.90
1967	1153.	1046.	107.
1968	1153.	948.0	205.
1969	1333.	840.7	493.
1970	1138.	729.6	408.
1971	1015.	766.9	250.
1972	942.0	801.8	140.
1973	991.3	1194.	-202.
1974	910.9	1255.	-344.
1975	1036.	1411.	-375.
1976	1198.	2037.	-839.
1977	1466.	1947.	-481.
1978	1553.	1588.	-35.4

COMPARISON OF ACTUAL AND PREDICTED SERIES
****

ACTUAL: IMC PREDICTED: IMCS1

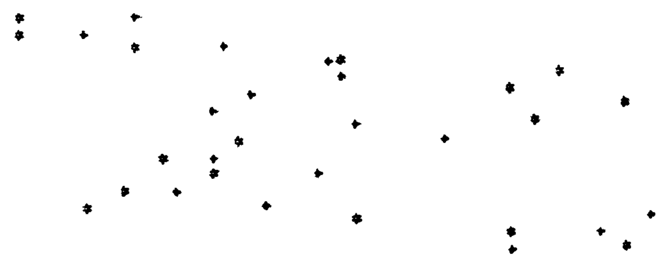
SAMPLE = 4 19

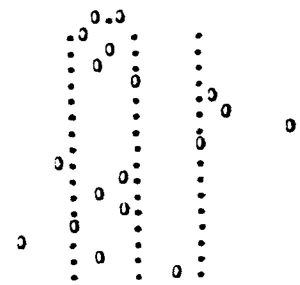
CORRELATION COEFFICIENT = .5325 (SQUARED = .2835)
ROOT-MEAN-SQUARED ERROR = 813.4
MEAN ABSOLUTE ERROR = 674.7
MEAN ERROR = -18.45
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .7152
THEIL"S INEQUALITY COEFFICIENT = .6308E-01
FRACTION OF ERROR DUE TO BIAS = .5146E-03
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .8565E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9138
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .5903E-01
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .9405

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	5074.	5607.	-533.
1964	5095.	5361.	-265.
1965	5572.	5987.	-414.
1966	6490.	6416.	74.2
1967	7465.	6525.	940.
1968	7217.	6097.	.112E+04
1969	7729.	5904.	.182E+04
1970	7362.	6563.	798.
1971	6020.	6949.	-933.
1972	5725.	5943.	-213.
1973	5938.	6384.	-446.
1974	5554.	5764.	-210.
1975	5343.	6166.	-823.
1976	6555.	7865.	-.131E+04
1977	7261.	7657.	-396.
1978	7757.	7264.	493.





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

ACTUAL: IMF PREDICTED: IMFS1

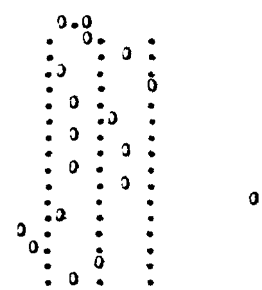
SAMPLE = 4 19

CORRELATION COEFFICIENT = .9718 (SQUARED = .9443)
ROOT-MEAN-SQUARED ERROR = 235.9
MEAN ABSOLUTE ERROR = 179.0
MEAN ERROR = -10.13
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9597
THEIL"S INEQUALITY COEFFICIENT = .4115E-01
FRACTION OF ERROR DUE TO BIAS = .1843E-02
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .2726E-02
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9954
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .2891E-01
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .9692

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	1224.	1275.	-51.1
1964	1529.	1403.	126.
1965	1409.	1592.	-184.
1966	2008.	1755.	253.
1967	1695.	1818.	-123.
1968	2114.	2042.	72.0
1969	2118.	2249.	-130.
1970	2575.	2474.	101.
1971	2669.	2801.	-132.
1972	3116.	2994.	122.
1973	3840.	3162.	678.
1974	3185.	3337.	-152.
1975	3280.	3615.	-335.
1976	3548.	3849.	-301.
1977	4128.	4141.	-12.9
1978	4515.	4609.	-93.7



COMPARISON OF ACTUAL AND PREDICTED SERIES
****

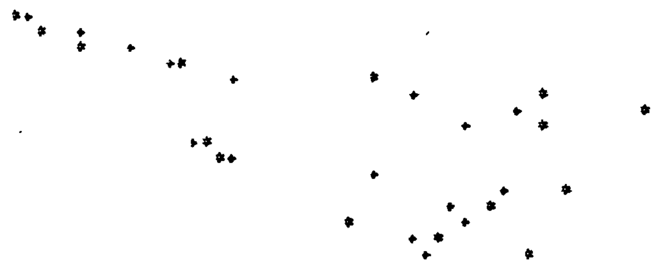
ACTUAL: IMI   PREDICTED: IMIS1

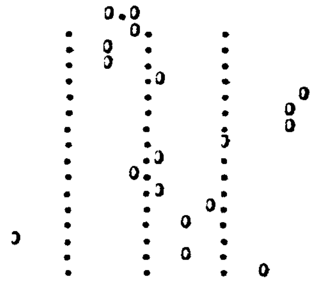
SAMPLE =   4   19

CORRELATION COEFFICIENT =   .9477   (SQUARED =   .8982   )
ROOT-MEAN-SQUARED ERROR =   1315.
MEAN ABSOLUTE ERROR =   1037.
MEAN ERROR =   565.2
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED =   1.166
THEIL"S INEQUALITY COEFFICIENT =   .5394E-01
FRACTION OF ERROR DUE TO BIAS =   .1355
FRACTION OF ERROR DUE TO DIFFERENT VARIATION =   .2373
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION =   .5772
ALTERNATIVE DECOMPOSITION   (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY =   .1231
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE =   .6914

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	5191.	6317.	-127.
1964	6638.	7253.	-615.
1965	7411.	8114.	-702.
1966	9027.	8914.	112.
1967	.1246E+05	.1002E+05	.244E+04
1968	.1534E+05	.1318E+05	.216E+04
1969	.1720E+05	.1497E+05	.223E+04
1970	.1534E+05	.1417E+05	.118E+04
1971	9638.	9344.	295.
1972	9783.	.1006E+05	-274.
1973	.1256E+05	.1241E+05	147.
1974	.1593E+05	.1482E+05	.112E+04
1975	.1451E+05	.1381E+05	706.
1976	.1208E+05	.1412E+05	-.205E+04
1977	.1370E+05	.1305E+05	647.
1978	.1520E+05	.1342E+05	.178E+04





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

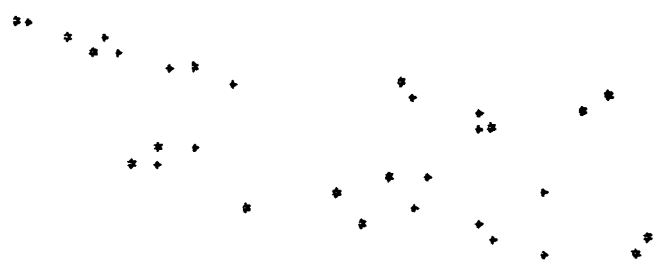
ACTUAL: IMO   PREDICTED: IMOS1

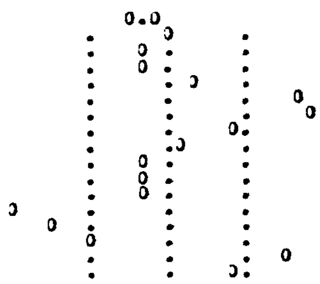
SAMPLE =   4   19

CORRELATION COEFFICIENT =   .8433   (SQUARED =   .7112   )
ROOT-MEAN-SQUARED ERROR =   551.6
MEAN ABSOLUTE ERROR =   513.3
MEAN ERROR =   30.74
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED =   1.006
THEIL"S INEQUALITY COEFFICIENT =   .7331E-01
FRACTION OF ERROR DUE TO BIAS =   .2226E-02
FRACTION OF ERROR DUE TO DIFFERENT VARIATION =   .9023E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION =   .9075
ALTERNATIVE DECOMPOSITION   (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY =   .8458E-04
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE =   .9977

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	2435.	2478.	-42.8
1964	2767.	2985.	-218.
1965	2882.	3057.	-175.
1966	3485.	3325.	160.
1967	4745.	3729.	.102E+04
1968	5910.	4765.	.114E+04
1969	5736.	5183.	553.
1970	5267.	5188.	78.3
1971	3293.	3463.	-170.
1972	3121.	3303.	-182.
1973	4635.	4868.	-234.
1974	4295.	5527.	-.123E+04
1975	3828.	4799.	-971.
1976	4484.	5124.	-640.
1977	6145.	5266.	879.
1978	6035.	5509.	525.





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

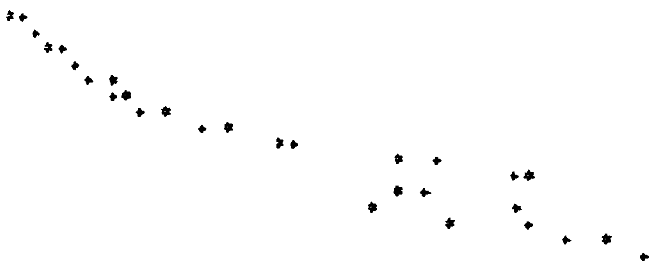
ACTUAL: IMR   PREDICTED: IMRS1

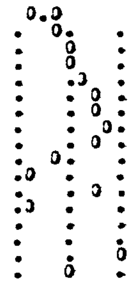
SAMPLE =   4   19

CORRELATION COEFFICIENT = .9788   (SQUARED = .9581)
ROOT-MEAN-SQUARED ERROR = 858.3
MEAN ABSOLUTE ERROR = 587.3
MEAN ERROR = -171.7
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9249
THEIL"S INEQUALITY COEFFICIENT = .5470E-01
FRACTION OF ERROR DUE TO BIAS = .3909E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .6792E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .8930
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .1261
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .8348

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	1597.	1782.	-135.
1964	2026.	2108.	-81.3
1965	2363.	2466.	-103.
1966	2946.	2815.	131.
1967	3513.	3021.	492.
1968	3939.	3476.	463.
1969	4663.	4089.	575.
1970	5795.	5351.	445.
1971	6755.	7034.	-273.
1972	9131.	9717.	-585.
1973	.1149E+05	.1112E+05	367.
1974	8894.	9560.	-666.
1975	8557.	.1121E+05	-.266E+04
1976	.1004E+05	.1155E+05	-.152E+04
1977	.1300E+05	.1219E+05	811.
1978	.1371E+05	.1367E+05	42.1





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

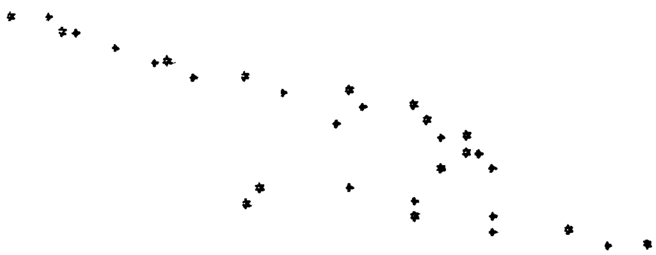
ACTUAL: IMS   PREDICTED: IMSS1

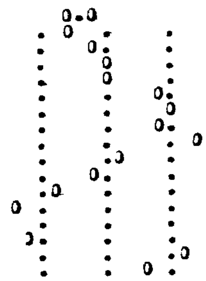
SAMPLE =   4   19

CORRELATION COEFFICIENT = .9211   (SQUARED = .8485)
ROOT-MEAN-SQUARED ERROR = 516.0
MEAN ABSOLUTE ERROR = 413.7
MEAN ERROR = -12.40
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9840
THEIL"S INEQUALITY COEFFICIENT = .5527E-01
FRACTION OF ERROR DUE TO BIAS = .5773E-03
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .2688E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9725
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .1479E-02
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .9979

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	1339.	1608.	-269.
1964	1751.	1816.	-64.8
1965	2104.	2155.	-50.5
1966	2462.	2418.	43.8
1967	3070.	2680.	390.
1968	3894.	3343.	551.
1969	4378.	3925.	453.
1970	4473.	3767.	707.
1971	4732.	4589.	143.
1972	4739.	4824.	-85.2
1973	4557.	4974.	-417.
1974	3166.	3864.	-698.
1975	3089.	4322.	-.123E+04
1976	4319.	4909.	-590.
1977	5539.	4949.	590.
1978	5115.	5781.	334.





COMPARISON OF ACTJAL AND PREDICTED SERIES
****

ACTUAL: ING PREDICTED: INGS1

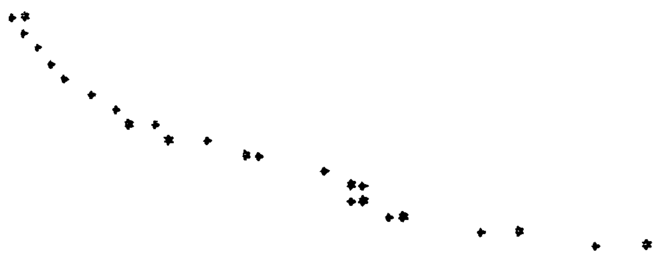
SAMPLE = 4 19

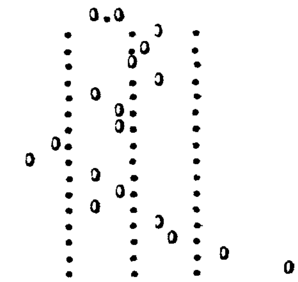
CORRELATION COEFFICIENT = .9961 (SQUARED = .9923)
ROOT-MEAN-SQUARED ERROR = 171.7
MEAN ABSOLUTE ERROR = 124.8
MEAN ERROR = 8.366
REGRESSION COEFFICIENT OF ACTJAL ON PREDICTED = 1.059
THEIL'S INEQUALITY COEFFICIENT = .3122E-01
FRACTION OF ERROR DUE TO BIAS = .2375E-02
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .3281
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .6695
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .2870
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .7106

PLOT OF ACTJAL(*) AND FITTED(+) VALUES

PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDJA-
1963	464.0	390.8	73.2
1964	491.0	467.7	23.3
1965	578.0	587.9	-9.93
1966	788.0	716.6	71.4
1967	804.0	905.5	-102.
1968	1068.	1109.	-41.2
1969	1320.	1347.	-26.8
1970	1442.	1661.	-219.
1971	1790.	2079.	-289.
1972	2460.	2583.	-123.
1973	3135.	3155.	-19.8
1974	3419.	3520.	-101.
1975	3452.	3373.	78.9
1976	3813.	3708.	105.
1977	4836.	4576.	260.
1978	6013.	5560.	453.





COMPARISON OF ACTJAL AND PREDICTED SERIES
****

ACTUAL: IT PREDICTED: ITS1

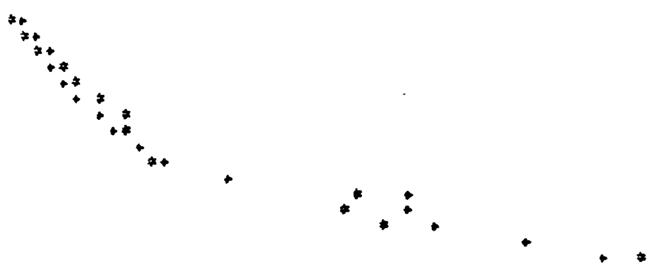
SAMPLE = 4 19

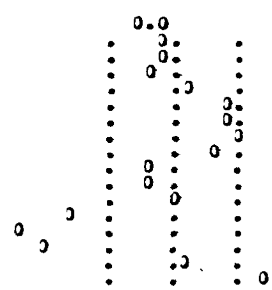
CORRELATION COEFFICIENT = .9884 (SQUARED = .9769)
ROOT-MEAN-SQUARED ERROR = 2059.
MEAN ABSOLUTE ERROR = 1571.
MEAN ERROR = -337.0
REGRESSION COEFFICIENT OF ACTJAL ON PREDICTED = .9546
THEIL'S INEQUALITY COEFFICIENT = .4073E-01
FRACTION OF ERROR DUE TO BIAS = .2530E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .4797E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9252
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .8475E-01
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .8885

PLOT OF ACTJAL(*) AND FITTED(+) VALUES

PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	7649.	8165.	-516.
1964	8826.	9150.	-324.
1965	9725.	.1057E+05	-846.
1966	.1113E+05	.1057E+05	558.
1967	.1256E+05	.1088E+05	.168E+04
1968	.1416E+05	.1245E+05	.171E+04
1969	.1541E+05	.1353E+05	.137E+04
1970	.1577E+05	.1469E+05	.108E+04
.971	.1621E+05	.1703E+05	-824.
1972	.1778E+05	.1870E+05	-917.
.973	.2273E+05	.2279E+05	-64.6
.974	.3224E+05	.3534E+05	-.310E+04
.975	.3112E+05	.3589E+05	-.477E+04
.976	.3344E+05	.3734E+05	-.390E+04
.977	.4372E+05	.4335E+05	371.
.978	.5173E+05	.4913E+05	.251E+04





COMPARISON OF ACTUAL AND PREDICTED SERIES

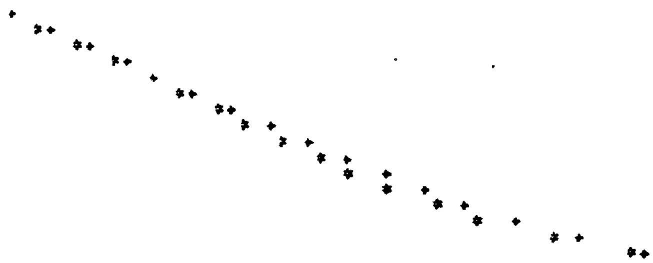
ACTUAL: KA   PREDICTED: KAS1

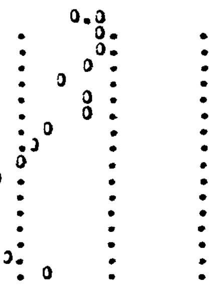
SAMPLE = 4 19

CORRELATION COEFFICIENT = .9989   (SQUARED = .9979)
ROOT-MEAN-SQUARED ERROR = 1557.
MEAN ABSOLUTE ERROR = 1306.
MEAN ERROR = -1306.
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9491
THEIL"S INEQUALITY COEFFICIENT = .1750E-01
FRACTION OF ERROR DUE TO BIAS = .7030
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .1641
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .1329
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .1708
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .1262

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	.2394E+05	.2409E+05	-144.
1964	.2612E+05	.2630E+05	-189.
1965	.2853E+05	.2888E+05	-343.
1966	.3093E+05	.3179E+05	-859.
1967	.3330E+05	.3373E+05	-429.
1968	.3560E+05	.3596E+05	-352.
1969	.3765E+05	.3867E+05	-.100E+04
1970	.4009E+05	.4146E+05	-.137E+04
1971	.4212E+05	.4368E+05	-.156E+04
1972	.4454E+05	.4650E+05	-.195E+04
1973	.4689E+05	.4950E+05	-.252E+04
1974	.4960E+05	.5192E+05	-.232E+04
1975	.5250E+05	.5493E+05	-.242E+04
1976	.5574E+05	.5819E+05	-.245E+04
1977	.6043E+05	.6225E+05	-.176E+04
1978	.6568E+05	.6679E+05	-.112E+04





COMPARISON OF ACTUAL AND PREDICTED SERIES

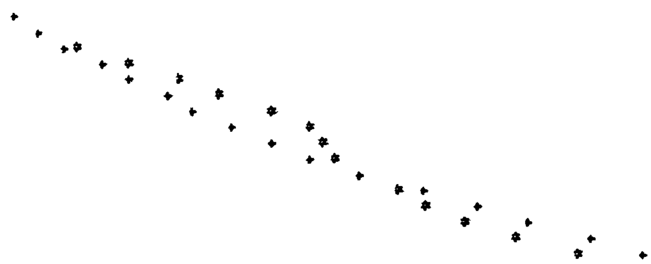
ACTUAL: KD   PREDICTED: KDS1

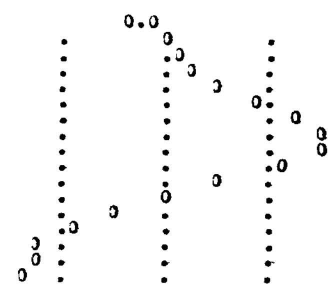
SAMPLE = 4 19

CORRELATION COEFFICIENT = .9781   (SQUARED = .9567)
ROOT-MEAN-SQUARED ERROR = 4635.
MEAN ABSOLUTE ERROR = 3912.
MEAN ERROR = 672.6
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .8202
THEIL"S INEQUALITY COEFFICIENT = .4896E-01
FRACTION OF ERROR DUE TO BIAS = .2106E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .4062
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .5727
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .5039
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .4750

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	.1852E+05	.1852E+05	-7.20
1964	.2149E+05	.2084E+05	643.
1965	.2499E+05	.2376E+05	.123E+04
1966	.2932E+05	.2679E+05	.253E+04
1967	.3377E+05	.2951E+05	.425E+04
1968	.3837E+05	.3259E+05	.578E+04
1969	.4285E+05	.3561E+05	.724E+04
1970	.4582E+05	.3852E+05	.730E+04
1971	.4761E+05	.4242E+05	.519E+04
1972	.4898E+05	.4647E+05	.251E+04
1973	.5089E+05	.5111E+05	-220.
1974	.5435E+05	.5662E+05	-.227E+04
1975	.5740E+05	.6187E+05	-.448E+04
1976	.6093E+05	.6725E+05	-.627E+04
1977	.6627E+05	.7241E+05	-.614E+04
1978	.7124E+05	.7777E+05	-.553E+04





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

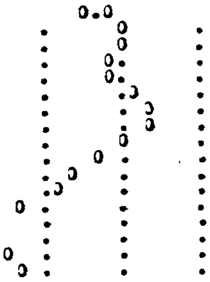
ACTUAL: KM PREDICTED: KMSL

SAMPLE = 4 19

CORRELATION COEFFICIENT = .9990 (SQUARED = .9980)
ROOT-MEAN-SQUARED ERROR = .1249E+05
MEAN ABSOLUTE ERROR = 9006.
MEAN ERROR = -7554.
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9277
THEIL'S INEQUALITY COEFFICIENT = .2188E-01
FRACTION OF ERROR DUE TO BIAS = .3659
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .4671
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .1670
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .4791
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .1550

PLOT OF ACTUAL(*) AND FITTED(+) VALUES PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	.9901E+05	.9961E+05	-597.
1964	.1126E+06	.1132E+06	-629.
1965	.1265E+06	.1288E+06	-.230E+04
1966	.1444E+06	.1457E+06	-.122E+04
1967	.1663E+06	.1636E+06	.270E+04
1968	.1897E+06	.1857E+06	.405E+04
1969	.2160E+06	.2120E+06	.398E+04
1970	.2411E+06	.2402E+06	891.
1971	.2641E+06	.2678E+06	-.368E+04
1972	.2837E+06	.2924E+06	-.859E+04
1973	.3063E+06	.3175E+06	-.111E+05
1974	.3331E+06	.3498E+06	-.168E+05
1975	.3591E+06	.3824E+06	-.233E+05
1976	.3862E+06	.4125E+06	-.253E+05
1977	.4239E+06	.4437E+06	-.198E+05
1978	.4645E+06	.4826E+06	-.181E+05



COMPARISON OF ACTUAL AND PREDICTED SERIES
****

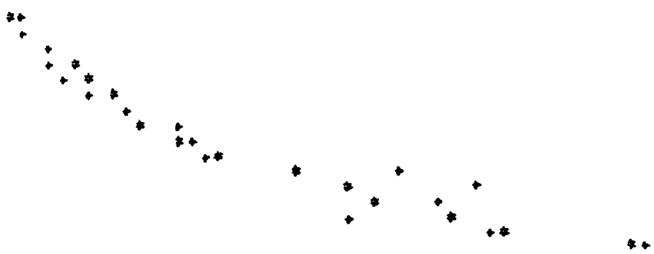
ACTUAL: M PREDICTED: MSL

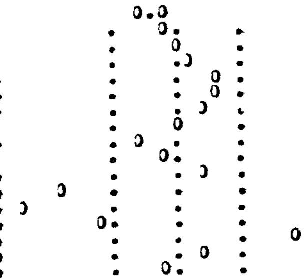
SAMPLE = 4 19

CORRELATION COEFFICIENT = .9606 (SQUARED = .9228)
ROOT-MEAN-SQUARED ERROR = 3832.
MEAN ABSOLUTE ERROR = 2659.
MEAN ERROR = -715.9
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .8914
THEIL'S INEQUALITY COEFFICIENT = .6708E-01
FRACTION OF ERROR DUE TO BIAS = .3491E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .6410E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9010
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .1455
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .8196

PLOT OF ACTUAL(*) AND FITTED(+) VALUES PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	.1020E+05	.1088E+05	-682.
1964	.1094E+05	.1108E+05	-143.
1965	.1292E+05	.1252E+05	403.
1966	.1466E+05	.1250E+05	.215E+04
1967	.1571E+05	.1338E+05	.233E+04
1968	.1729E+05	.1598E+05	.130E+04
1969	.1799E+05	.1828E+05	-283.
1970	.1945E+05	.2175E+05	-.230E+04
1971	.2145E+05	.2239E+05	-948.
1972	.2483E+05	.2357E+05	.126E+04
1973	.2994E+05	.3726E+05	-.732E+04
1974	.3321E+05	.4262E+05	-.941E+04
1975	.3498E+05	.3982E+05	-.484E+04
1976	.4063E+05	.3383E+05	.680E+04
1977	.4430E+05	.4300E+05	.130E+04
1978	.5291E+05	.5397E+05	-.107E+04





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

ACTUAL: NA PREDICTED: NAS1

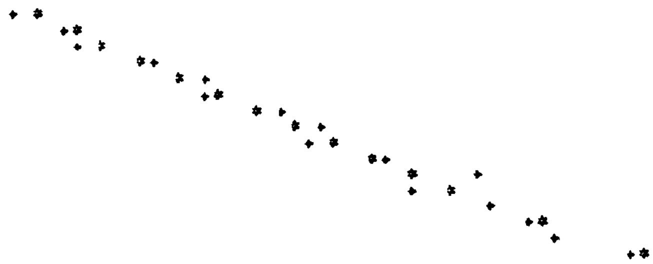
SAMPLE = 4 19

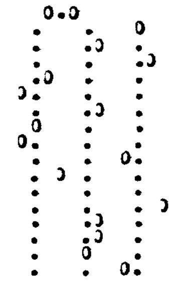
CORRELATION COEFFICIENT = .9892 (SQUARED = .9785)
ROOT-MEAN-SQUARED ERROR = .1505
MEAN ABSOLUTE ERROR = .1168
MEAN ERROR = -.1478E-01
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9774
THEIL'S INEQUALITY COEFFICIENT = .5233E-02
FRACTION OF ERROR DUE TO BIAS = .9639E-02
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .6629E-02
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9837
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .2365E-01
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .9667

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	12.76	12.63	.129
1964	12.95	12.93	.232E-01
1965	13.15	12.97	.181
1966	13.35	13.44	-.920E-01
1967	13.56	13.72	-.155
1968	13.77	13.74	.291E-01
1969	13.98	14.12	-.144
1970	14.19	14.37	-.175
1971	14.41	14.31	.104
1972	14.63	14.70	-.637E-01
1973	14.86	15.26	-.403
1974	15.03	14.90	.139
1975	15.32	15.27	.443E-01
1976	15.55	15.53	.214E-01
1977	15.66	15.67	-.909E-02
1978	16.15	16.07	.954E-01





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

ACTUAL: NM PREDICTED: NMS1

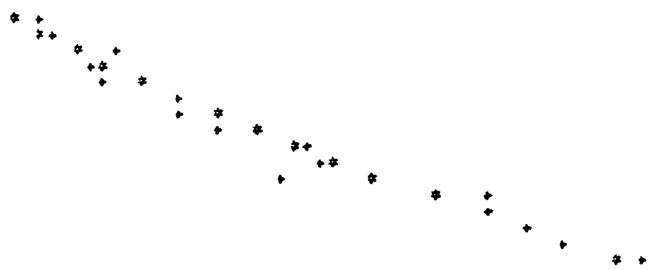
SAMPLE = 4 19

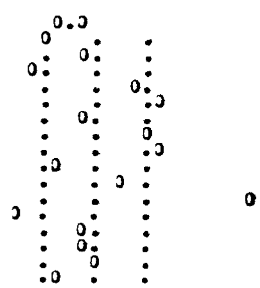
CORRELATION COEFFICIENT = .9855 (SQUARED = .9712)
ROOT-MEAN-SQUARED ERROR = .1505
MEAN ABSOLUTE ERROR = .1163
MEAN ERROR = .1466E-01
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9674
THEIL'S INEQUALITY COEFFICIENT = .1496E-01
FRACTION OF ERROR DUE TO BIAS = .9478E-02
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .1158E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9789
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .3652E-01
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .9540

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	3.686	3.815	-.129
1964	3.826	3.849	-.236E-01
1965	3.970	4.152	-.132
1966	4.120	4.028	.924E-01
1967	4.276	4.112	.164
1968	4.438	4.467	-.291E-01
1969	4.606	4.462	.144
1970	4.780	4.604	.176
1971	4.961	5.065	-.104
1972	5.148	5.084	.633E-01
1973	5.342	4.939	.403
1974	5.651	5.840	-.189
1975	5.842	5.886	-.442E-01
1976	6.035	6.056	-.217E-01
1977	6.234	6.225	.859E-02
1978	6.478	6.573	-.951E-01





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

ACTUAL: NDPI   PREDICTED: NDPIS1

SAMPLE = 4 19

CORRELATION COEFFICIENT = .9886 (SQUARED = .9774)
ROOT-MEAN-SQUARED ERROR = .1471E+05
MEAN ABSOLUTE ERROR = .1094E+05
MEAN ERROR = -3170.
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9656
THEIL"S INEQUALITY COEFFICIENT = .4354E-01
FRACTION OF ERROR DUE TO BIAS = .4644E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .2270E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9309
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .4951E-01
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .9040

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	.5599E+05	.6074E+05	-.474E+04
1964	.6025E+05	.6324E+05	-.300E+04
1965	.6821E+05	.7191E+05	-.370E+04
1966	.8244E+05	.7628E+05	.616E+04
1967	.8614E+05	.7719E+05	.895E+04
1968	.9137E+05	.8511E+05	.625E+04
1969	.1002E+06	.9270E+05	.755E+04
1970	.1063E+05	.1013E+06	.503E+04
1971	.1124E+06	.1221E+06	-.971E+04
1972	.1295E+05	.1393E+05	-.982E+04
1973	.1747E+05	.1735E+05	.123E+04
1974	.2136E+05	.2373E+05	-.237E+05
1975	.2363E+06	.2753E+06	-.390E+05
1976	.2671E+06	.2864E+05	-.192E+05
1977	.3046E+05	.3002E+05	.436E+04
1978	.3672E+05	.3445E+05	.227E+05

COMPARISON OF ACTUAL AND PREDICTED SERIES
****

ACTUAL: NFA   PREDICTED: NFAS1

SAMPLE = 4 19

CORRELATION COEFFICIENT = .8742 (SQUARED = .7642)
ROOT-MEAN-SQUARED ERROR = 3832.
MEAN ABSOLUTE ERROR = 2659.
MEAN ERROR = -715.9
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .6582
THEIL"S INEQUALITY COEFFICIENT = .9386E-01
FRACTION OF ERROR DUE TO BIAS = .3491E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .2352
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .7299
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .4501
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .5150

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	.1123E+05	.1192E+05	-682.
1964	.1267E+05	.1282E+05	-143.
1965	.1465E+05	.1425E+05	400.
1966	.1795E+05	.1580E+05	.215E+04
1967	.1904E+05	.1672E+05	.233E+04
1968	.1949E+05	.1819E+05	.130E+04
1969	.1858E+05	.1886E+05	-283.
1970	.1592E+05	.1822E+05	-.230E+04
1971	.1558E+05	.1653E+05	-943.
1972	.1995E+05	.1869E+05	.126E+04
1973	.2164E+05	.2897E+05	-.732E+04
1974	.2979E+05	.3920E+05	-.941E+04
1975	.2840E+05	.3324E+05	-.484E+04
1976	.2748E+05	.2068E+05	.680E+04
1977	.2085E+05	.1956E+05	.129E+04
1978	9879.	.1094E+05	-.107E+04

COMPARISON OF ACTUAL AND PREDICTED SERIES
****

ACTUAL: NI PREDICTED: NIS1

SAMPLE = 4 19

CORRELATION COEFFICIENT = .9889 (SQUARED = .9778)
ROOT-MEAN-SQUARED ERROR = .1571E+05
MEAN ABSOLUTE ERROR = .1135E+05
MEAN ERROR = -3506.
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9545
THEIL"S INEQUALITY COEFFICIENT = .4138E-01
FRACTION OF ERROR DUE TO BIAS = .5257E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .5036E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .8970
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .8635E-01
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .8510

PLOT OF ACTUAL(*) AND FITTED(+) VALUES PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	.5753E+05	.6238E+05	-.485E+04
1964	.6219E+05	.6500E+05	-.282E+04
1965	.7035E+05	.7391E+05	-.356E+04
1966	.8505E+05	.7847E+05	.653E+04
1967	.8959E+05	.7965E+05	.994E+04
1968	.9534E+05	.8779E+05	.755E+04
1969	.1045E+06	.9583E+05	.859E+04
1970	.1105E+06	.1048E+06	.573E+04
1971	.1171E+06	.1260E+06	-.839E+04
1972	.1339E+06	.1436E+06	-.967E+04
1973	.1783E+06	.1766E+06	.154E+04
1974	.2205E+06	.2424E+06	-.219E+05
1975	.2465E+06	.2891E+06	-.427E+05
1976	.2789E+06	.3043E+06	-.254E+05
1977	.3187E+06	.3187E+06	-42.6
1978	.3875E+06	.3656E+06	.219E+05

COMPARISON OF ACTUAL AND PREDICTED SERIES
****

ACTUAL: PA PREDICTED: PAS1

SAMPLE = 4 19

CORRELATION COEFFICIENT = .9802 (SQUARED = .9609)
ROOT-MEAN-SQUARED ERROR = .8150E-01
MEAN ABSOLUTE ERROR = .6775E-01
MEAN ERROR = -.9616E-02
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9099
THEIL"S INEQUALITY COEFFICIENT = .3469E-01
FRACTION OF ERROR DUE TO BIAS = .1392E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .1215
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .8646
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .1915
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .7946

PLOT OF ACTUAL(*) AND FITTED(+) VALUES PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	.7201	.7965	-.764E-01
1964	.7225	.7489	-.263E-01
1965	.8178	.8377	-.199E-01
1966	.9054	.8135	.919E-01
1967	.8696	.7829	.867E-01
1968	.8378	.7947	.431E-01
1969	.8575	.8038	.538E-01
1970	.7964	.7478	.486E-01
1971	.8071	.8478	-.407E-01
1972	1.000	1.041	-.411E-01
1973	1.332	1.298	.342E-01
1974	1.488	1.560	-.722E-01
1975	1.515	1.717	-.201
1976	1.588	1.729	-.141
1977	1.693	1.654	.388E-01
1978	1.748	1.680	.679E-01

COMPARISON OF ACTUAL AND PREDICTED SERIES
****

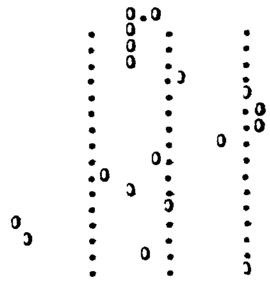
ACTUAL: PC   PREDICTED: PCSL

SAMPLE =   4   19

CORRELATION COEFFICIENT =   .9880   (SQUARED =   .9761   )
ROOT-MEAN-SQUARED ERROR =   .5397E-01
MEAN ABSOLUTE ERROR =   .4424E-01
MEAN ERROR =   -.7098E-02
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED =   .9345
THEIL"S INEQUALITY COEFFICIENT =   .2281E-01
FRACTION OF ERROR DUE TO BIAS =   .1729E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION =   .1124
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION =   .8704
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY =   .1544
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE =   .8183

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	.8254	.8540	-.286E-01
1964	.8324	.8636	-.312E-01
1965	.8498	.8821	-.323E-01
1966	.8890	.8784	.106E-01
1967	.9295	.8687	.608E-01
1968	.9372	.8674	.698E-01
1969	.9467	.8826	.641E-01
1970	.9434	.9037	.397E-01
1971	.9556	.9657	-.101E-01
1972	1.000	1.043	-.429E-01
1973	1.155	1.180	-.259E-01
1974	1.411	1.411	-.675E-03
1975	1.477	1.590	-.114
1976	1.539	1.642	-.103
1977	1.645	1.667	-.222E-01
1978	1.806	1.753	.522E-01



COMPARISON OF ACTUAL AND PREDICTED SERIES
****

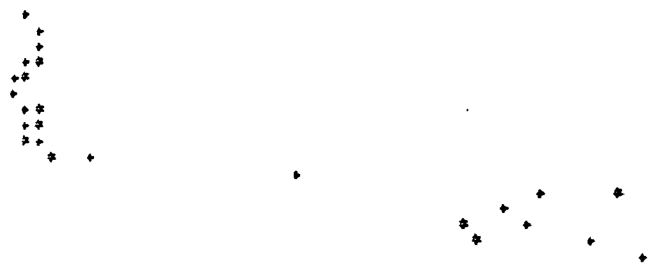
ACTUAL: PE   PREDICTED: PES1

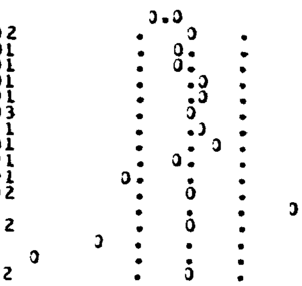
SAMPLE =   4   19

CORRELATION COEFFICIENT =   .9854   (SQUARED =   .9711   )
ROOT-MEAN-SQUARED ERROR =   .8690E-01
MEAN ABSOLUTE ERROR =   .5227E-01
MEAN ERROR =   -.1517E-01
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED =   .9589
THEIL"S INEQUALITY COEFFICIENT =   .3044E-01
FRACTION OF ERROR DUE TO BIAS =   .3450E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION =   .2408E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION =   .9413
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY =   .5608E-01
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE =   .9093

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	.9598	.9636	-.381E-02
1964	.9695	.9832	-.136E-01
1965	.9759	.9921	-.162E-01
1966	.9797	.9578	.219E-01
1967	.9485	.9279	.206E-01
1968	.9378	.9372	.573E-03
1969	.9780	.9496	.284E-01
1970	.9938	.9520	.418E-01
1971	.9629	.9913	-.284E-01
1972	1.000	1.099	-.995E-01
1973	1.510	1.506	.425E-02
1974	2.183	2.018	.164
1975	1.937	1.933	.444E-02
1976	1.850	1.995	-.145
1977	1.889	2.130	-.241
1978	2.223	2.220	.248E-02





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

ACTUAL: Pi PREDICTED: PiS1

SAMPLE = 4 19

CORRELATION COEFFICIENT = .9942 (SQUARED = .9884)
ROOT-MEAN-SQUARED ERROR = .4716E-01
MEAN ABSOLUTE ERROR = .3902E-01
MEAN ERROR = .1973E-01
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = 1.031
THEIL'S INEQUALITY COEFFICIENT = .2094E-01
FRACTION OF ERROR DUE TO BIAS = .1751
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .8599E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .7390
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .5049E-01
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .7644

PLOT OF ACTUAL(*) AND FITTED(+) VALUES PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	.7439	.7595	-.156E-01
1964	.7290	.7685	-.395E-01
1965	.7384	.7670	-.236E-01
1966	.7698	.7625	.726E-02
1967	.7668	.7511	.157E-01
1968	.7761	.7291	.470E-01
1969	.7730	.7253	.477E-01
1970	.8192	.7675	.517E-01
1971	.8332	.8925	-.593E-01
1972	1.000	.9986	.144E-02
1973	1.167	1.106	.615E-01
1974	1.403	1.309	.935E-01
1975	1.559	1.487	.721E-01
1976	1.624	1.560	.636E-01
1977	1.649	1.640	.829E-02
1978	1.794	1.806	-.113E-01

COMPARISON OF ACTUAL AND PREDICTED SERIES
****

ACTUAL: PM PREDICTED: PMS1

SAMPLE = 4 19

CORRELATION COEFFICIENT = .9853 (SQUARED = .9703)
ROOT-MEAN-SQUARED ERROR = .5743E-01
MEAN ABSOLUTE ERROR = .4677E-01
MEAN ERROR = -.5819E-02
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9272
THEIL'S INEQUALITY COEFFICIENT = .2439E-01
FRACTION OF ERROR DUE TO BIAS = .1027E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .1104
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .8793
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .1683
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .8214

PLOT OF ACTUAL(*) AND FITTED(+) VALUES PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	.8299	.8607	-.308E-01
1964	.8614	.8763	-.149E-01
1965	.8633	.8746	-.113E-01
1966	.9090	.8667	.423E-01
1967	.9143	.8586	.557E-01
1968	.9225	.8543	.682E-01
1969	.9395	.8791	.604E-01
1970	.9588	.9321	.267E-01
1971	.9774	1.002	-.244E-01
1972	1.000	1.041	-.405E-01
1973	1.157	1.175	-.181E-01
1974	1.403	1.447	-.432E-01
1975	1.448	1.588	-.141
1976	1.488	1.584	-.968E-01
1977	1.628	1.615	.124E-01
1978	1.805	1.743	.619E-01

COMPARISON OF ACTUAL AND PREDICTED SERIES
****

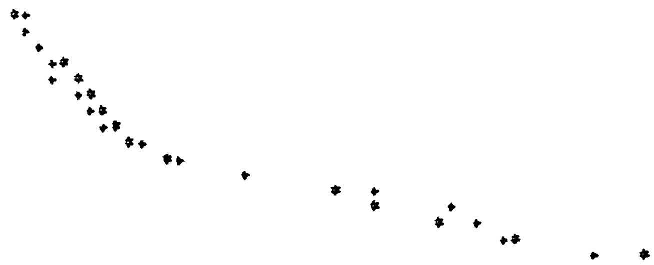
ACTUAL: PI   PREDICTED: PIS1

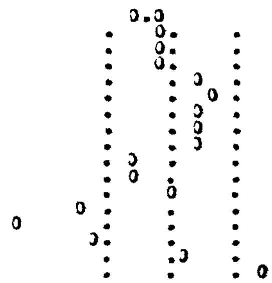
SAMPLE =   4   19

CORRELATION COEFFICIENT = .9890   (SQUARED = .9781)
ROOT-MEAN-SQUARED ERROR = .1490E+05
MEAN ABSOLUTE ERROR = .1108E+05
MEAN ERROR = -3203.
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9672
THEIL"S INEQUALITY COEFFICIENT = .4002E-01
FRACTION OF ERROR DUE TO BIAS = .4624E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .2111E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9327
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .4670E-01
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .9071

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	.5700E+05	.6179E+05	-.479E+04
1964	.6138E+05	.6441E+05	-.333E+04
1965	.6954E+05	.7328E+05	-.374E+04
1966	.8389E+05	.7767E+05	.622E+04
1967	.8785E+05	.7881E+05	.935E+04
1968	.9339E+05	.8705E+05	.634E+04
1969	.1024E+06	.9475E+05	.753E+04
1970	.1087E+05	.1036E+06	.510E+04
1971	.1150E+06	.1249E+06	-.985E+04
1972	.1325E+05	.1425E+06	-.996E+04
1973	.1782E+06	.1769E+06	.125E+04
1974	.2173E+05	.2418E+06	-.240E+05
1975	.2421E+06	.2816E+05	-.395E+05
1976	.2743E+06	.2938E+05	-.195E+05
1977	.3133E+05	.3088E+06	.442E+04
1978	.3784E+06	.3554E+05	.230E+05





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

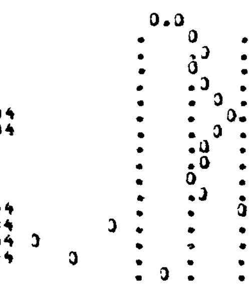
ACTUAL: PR   PREDICTED: PRS1

SAMPLE =   4   19

CORRELATION COEFFICIENT = .9533   (SQUARED = .9088)
ROOT-MEAN-SQUARED ERROR = 2317.
MEAN ABSOLUTE ERROR = 1482.
MEAN ERROR = -438.5
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .7345
THEIL"S INEQUALITY COEFFICIENT = .1306
FRACTION OF ERROR DUE TO BIAS = .3581E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .4075
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .5566
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .5453
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .4189

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	1282.	1267.	15.1
1964	1914.	1632.	282.
1965	2025.	1822.	203.
1966	2760.	2244.	516.
1967	3407.	2463.	944.
1968	3947.	2551.	.140E+04
1969	4193.	2966.	.123E+04
1970	3873.	3388.	485.
1971	4621.	3886.	735.
1972	5234.	5125.	109.
1973	6583.	6244.	339.
1974	.1053E+05	8430.	.210E+04
1975	.1025E+05	.1360E+05	-.334E+04
1976	.1073E+05	.1716E+05	-.644E+04
1977	.1395E+05	.1870E+05	-.475E+04
1978	.1973E+05	.2057E+05	-835.



COMPARISON OF ACTUAL AND PREDICTED SERIES
****

ACTUAL: QAS PREDICTED: QASSL

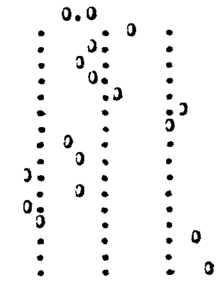
SAMPLE = 4 19

CORRELATION COEFFICIENT = .9968 (SQUARED = .9935)
ROOT-MEAN-SQUARED ERROR = 1263.
MEAN ABSOLUTE ERROR = 1030.
MEAN ERROR = -152.8
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9897
THEIL'S INEQUALITY COEFFICIENT = .9599E-02
FRACTION OF ERROR DUE TO BIAS = .1551E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .7864E-02
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9755
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .1640E-01
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .9570

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	.4185E+05	.4138E+05	475.
1964	.4219E+05	.4235E+05	-159.
1965	.4489E+05	.4539E+05	-502.
1966	.5154E+05	.5170E+05	-167.
1967	.4978E+05	.4949E+05	292.
1968	.5413E+05	.5275E+05	.143E+04
1969	.5828E+05	.5715E+05	.113E+04
1970	.5859E+05	.5922E+05	-625.
1971	.6110E+05	.6164E+05	-540.
1972	.6275E+05	.6413E+05	-.139E+04
1973	.7285E+05	.7341E+05	-559.
1974	.7277E+05	.7433E+05	-.156E+04
1975	.7875E+05	.7992E+05	-.116E+04
1976	.8380E+05	.8214E+05	.166E+04
1977	.8309E+05	.8597E+05	-.288E+04
1978	.9371E+05	.9175E+05	.196E+04



COMPARISON OF ACTUAL AND PREDICTED SERIES
****

ACTUAL: QMS PREDICTED: QMSSL

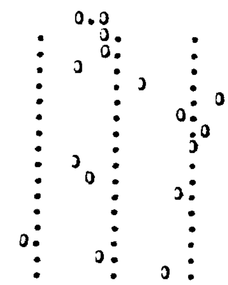
SAMPLE = 4 19

CORRELATION COEFFICIENT = .9946 (SQUARED = .9893)
ROOT-MEAN-SQUARED ERROR = 8879.
MEAN ABSOLUTE ERROR = 7381.
MEAN ERROR = -510.9
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9664
THEIL'S INEQUALITY COEFFICIENT = .1847E-01
FRACTION OF ERROR DUE TO BIAS = .3311E-02
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .7155E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9251
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .1002
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .8964

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	.1110E+06	.1131E+06	-.205E+04
1964	.1230E+06	.1252E+06	-.222E+04
1965	.1318E+06	.1362E+06	-.444E+04
1966	.1450E+06	.1426E+06	.244E+04
1967	.1668E+06	.1556E+06	.112E+05
1968	.1817E+06	.1739E+06	.781E+04
1969	.1965E+06	.1854E+06	.111E+05
1970	.2187E+06	.2094E+06	.923E+04
1971	.2297E+06	.2348E+06	-.505E+04
1972	.2359E+06	.2388E+06	-.300E+04
1973	.2456E+06	.2384E+06	.717E+04
1974	.2681E+06	.2858E+06	-.178E+05
1975	.2876E+06	.3048E+06	-.173E+05
1976	.3175E+06	.3271E+06	-.954E+04
1977	.3526E+06	.3543E+06	-.170E+04
1978	.3976E+06	.3916E+06	.603E+04



COMPARISON OF ACTUAL AND PREDICTED SERIES
****

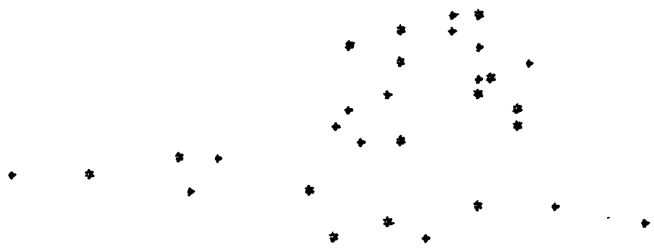
ACTUAL: r PREDICTED: rS1

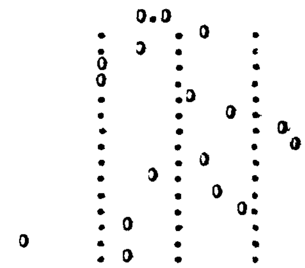
SAMPLE = 5 19

CORRELATION COEFFICIENT = .6469 (SQUARED = .4184)
ROOT-MEAN-SQUARED ERROR = 5.140
MEAN ABSOLUTE ERROR = 4.334
MEAN ERROR = -.2257
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .5046
THEIL"S INEQUALITY COEFFICIENT = .3777
FRACTION OF ERROR DUE TO BIAS = .1928E-02
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .8050E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9176
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .4086
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .5894

PLOT OF ACTUAL(*) AND FITTED(+) VALUES PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1964	7.333	5.943	1.39
1965	3.984	6.303	-2.32
1966	1.337	7.124	-5.79
1967	3.862	9.373	-5.51
1968	7.752	7.278	.474
1969	7.283	3.413	3.87
1970	8.800	1.702	7.10
1971	9.040	.7712	8.27
1972	3.660	1.895	1.76
1973	-5.668	-3.824	-1.84
1974	-9.776	-12.88	3.10
1975	-.3154	-5.157	4.84
1976	6.939	10.75	-3.81
1977	3.354	14.40	-11.0
1978	1.297	5.182	-3.89





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

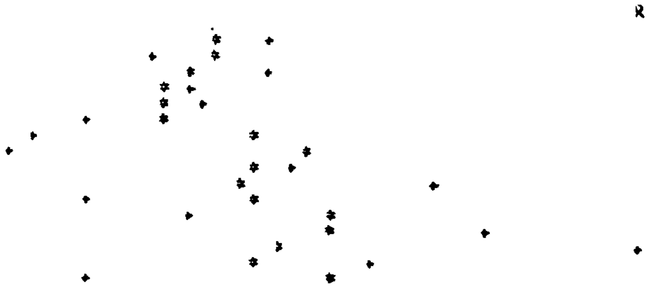
ACTUAL: R PREDICTED: RSL

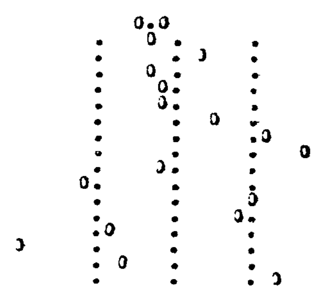
SAMPLE = 4 19

CORRELATION COEFFICIENT = .1159 (SQUARED = .1344E-01)
ROOT-MEAN-SQUARED ERROR = 3.797
MEAN ABSOLUTE ERROR = 3.104
MEAN ERROR = .2525
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .3844E-01
THEIL"S INEQUALITY COEFFICIENT = .2094
FRACTION OF ERROR DUE TO BIAS = .4730E-02
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .4304
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .5648
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .8907
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .1045

PLOT OF ACTUAL(*) AND FITTED(+) VALUES PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	8.000	9.067	-1.07
1964	8.000	6.579	1.42
1965	7.500	9.075	-1.58
1966	7.000	7.411	-.411
1967	7.000	7.877	-.877
1968	7.000	5.200	1.80
1969	9.000	4.165	4.84
1970	10.00	3.485	6.52
1971	9.000	9.619	-.619
1972	8.500	12.93	-4.43
1973	9.000	5.258	3.74
1974	10.50	7.481	3.02
1975	10.50	13.94	-3.44
1976	9.500	17.45	-7.95
1977	9.000	11.36	-2.36
1978	10.75	5.153	5.60





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

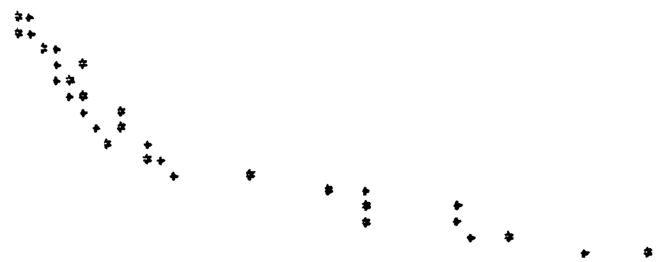
ACTUAL: S   PREDICTED: SSL

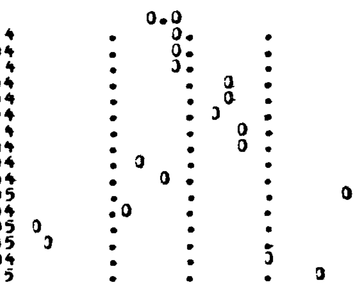
SAMPLE =   4   19

CORRELATION COEFFICIENT =   .9702   (SQUARED =   .9414   )
ROOT-MEAN-SQUARED ERROR =   9134.
MEAN ABSOLUTE ERROR =   7379.
MEAN ERROR =   542.1
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED =   .9626
THEIL'S INEQUALITY COEFFICIENT =   .7169E-01
FRACTION OF ERROR DUE TO BIAS =   .3523E-02
FRACTION OF ERROR DUE TO DIFFERENT VARIATION =   .1057E-02
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION =   .9954
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY =   .2363E-01
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE =   .9728

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	.1348E+05	.1564E+05	-.216E+04
1964	.1469E+05	.1575E+05	-.107E+04
1965	.1870E+05	.2035E+05	-.165E+04
1966	.2591E+05	.2153E+05	.437E+04
1967	.2522E+05	.2090E+05	.432E+04
1968	.2770E+05	.2463E+05	.306E+04
1969	.3329E+05	.2705E+05	.624E+04
1970	.3439E+05	.2891E+05	.548E+04
1971	.3281E+05	.3869E+05	-.588E+04
1972	.3846E+05	.4199E+05	-.353E+04
1973	.6119E+05	.4387E+05	.173E+05
1974	.7661E+05	.8426E+05	-.765E+04
1975	.8538E+05	.1023E+06	-.169E+05
1976	.8570E+05	.1016E+06	-.159E+05
1977	.1144E+06	.1057E+06	.875E+04
1978	.1422E+06	.1284E+06	.138E+05





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

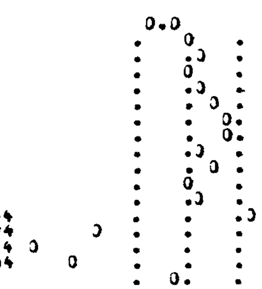
ACTUAL: SC   PREDICTED: SCSL

SAMPLE =   4   19

CORRELATION COEFFICIENT =   .9332   (SQUARED =   .8708   )
ROOT-MEAN-SQUARED ERROR =   1318.
MEAN ABSOLUTE ERROR =   880.5
MEAN ERROR =   -173.5
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED =   .7232
THEIL'S INEQUALITY COEFFICIENT =   .1343
FRACTION OF ERROR DUE TO BIAS =   .1835E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION =   .3222
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION =   .6594
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY =   .4877
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE =   .4940

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	820.0	811.3	8.66
1964	1297.	1114.	183.
1965	1278.	1155.	123.
1966	1788.	1463.	325.
1967	2259.	1647.	612.
1968	2591.	1692.	899.
1969	2729.	1945.	784.
1970	2431.	2133.	298.
1971	3013.	2503.	510.
1972	3509.	3370.	139.
1973	4203.	3910.	293.
1974	6455.	5016.	.144E+04
1975	5161.	7094.	-.193E+04
1976	5460.	9017.	-.356E+04
1977	7388.	9993.	-.260E+04
1978	.1075E+05	.1114E+05	-373.



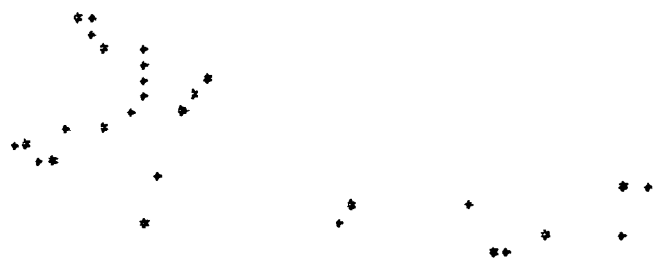
COMPARISON OF ACTUAL AND PREDICTED SERIES
****

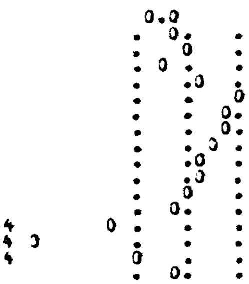
ACTUAL: SG   PREDICTED: SGS1

SAMPLE =   4   19

CORRELATION COEFFICIENT =   .9512   (SQUARED =   .9047   )
ROOT-MEAN-SQUARED ERROR =   1027.
MEAN ABSOLUTE ERROR =   685.2
MEAN ERROR =   -218.9
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED =   .8375
THEIL'S INEQUALITY COEFFICIENT =   .8989E-01
FRACTION OF ERROR DUE TO BIAS =   .4543E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION =   .1359
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION =   .8187
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY =   .2513
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE =   .7033

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(O)





	ACTUAL	FITTED	RESIDUAL
1963	2578.	2851.	-273.
1964	2759.	2839.	-79.5
1965	3057.	3508.	-451.
1966	3659.	3526.	133.
1967	4582.	3619.	963.
1968	4345.	3561.	784.
1969	4152.	3352.	800.
1970	2884.	2304.	579.
1971	1841.	1574.	267.
1972	2095.	1891.	204.
1973	3833.	3847.	-14.5
1974	.1112E+05	.1143E+05	-319.
1975	6876.	8527.	-.165E+04
1976	3512.	6666.	-.315E+04
1977	9883.	.1094E+05	-.106E+04
1978	9060.	9293.	-233.

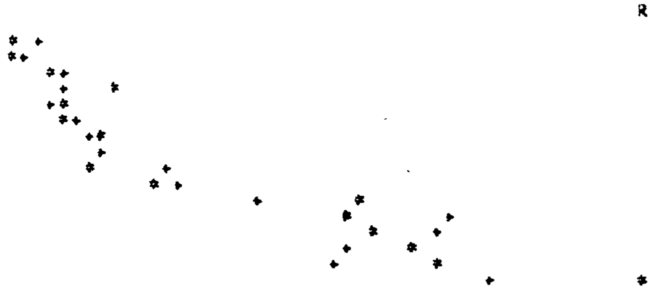
COMPARISON OF ACTUAL AND PREDICTED SERIES
****

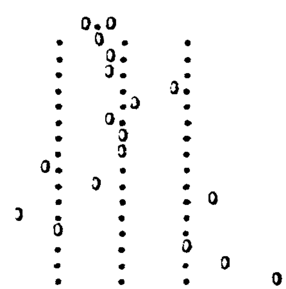
ACTUAL: SP   PREDICTED: SPS1

SAMPLE =   4   19

CORRELATION COEFFICIENT =   .9322   (SQUARED =   .8691   )
ROOT-MEAN-SQUARED ERROR =   5397.
MEAN ABSOLUTE ERROR =   4657.
MEAN ERROR =   837.9
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED =   1.083
THEIL'S INEQUALITY COEFFICIENT =   .1097
FRACTION OF ERROR DUE TO BIAS =   .1389E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION =   .1403
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION =   .8408
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY =   .3709E-01
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE =   .9440

PLOT OF ACTUAL(*) AND FITTED(+) VALUES   PLOT OF RESIDUALS(O)





	ACTUAL	FITTED	RESIDUAL
1963	6108.	8694.	-.259E+04
1964	6631.	7432.	-800.
1965	9633.	.1069E+05	-.105E+04
1966	.1577E+05	.1077E+05	.500E+04
1967	.1091E+05	9227.	.168E+04
1968	.1049E+05	.1212E+05	-.163E+04
1969	.1374E+05	.1329E+05	454.
1970	.1389E+05	.1397E+05	-75.1
1971	.1330E+05	.2006E+05	-.675E+04
1972	.1920E+05	.2118E+05	-.198E+04
1973	.3665E+05	.2850E+05	.815E+04
1974	.3557E+05	.4519E+05	-.962E+04
1975	.3782E+05	.4386E+05	-.603E+04
1976	.4203E+05	.3651E+05	.555E+04
1977	.4391E+05	.3489E+05	.902E+04
1978	.6255E+05	.4848E+05	.141E+05

COMPARISON OF ACTUAL AND PREDICTED SERIES
****

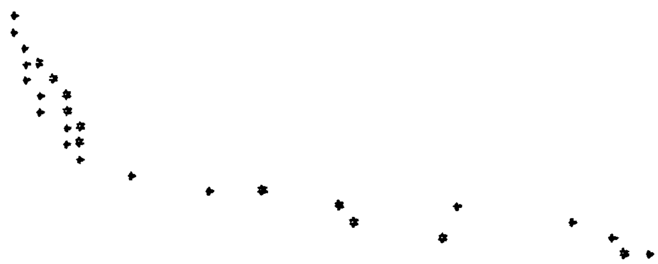
ACTUAL: TC PREDICTED: TCSL

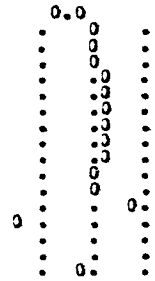
SAMPLE = 4 19

CORRELATION COEFFICIENT = .9669 (SQUARED = .9349)
ROOT-MEAN-SQUARED ERROR = 774.4
MEAN ABSOLUTE ERROR = 446.1
MEAN ERROR = -215.9
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .7459
THEIL"S INEQUALITY COEFFICIENT = .1362
FRACTION OF ERROR DUE TO BIAS = .7770E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .4665
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .4558
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .5765
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .3458

PLOT OF ACTUAL(*) AND FITTED(+) VALUES PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	320.0	316.2	3.77
1964	357.0	304.4	52.6
1965	492.0	442.8	49.2
1966	591.0	480.4	111.
1967	650.0	469.9	180.
1968	776.0	501.5	274.
1969	850.0	601.2	249.
1970	902.0	789.2	113.
1971	981.0	825.0	156.
1972	1003.	982.0	21.0
1973	1504.	1427.	77.3
1974	2788.	2233.	555.
1975	3628.	4808.	-.118E+04
1976	3734.	5977.	-.224E+04
1977	4695.	6295.	-.150E+04
1978	6458.	6731.	-273.





COMPARISON OF ACTUAL AND PREDICTED SERIES
****

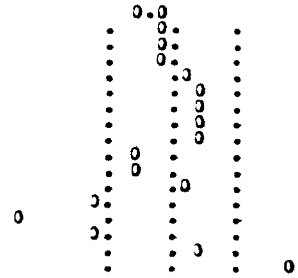
ACTUAL: TP PREDICTED: TPSL

SAMPLE = 4 19

CORRELATION COEFFICIENT = .9912 (SQUARED = .9825)
ROOT-MEAN-SQUARED ERROR = 186.6
MEAN ABSOLUTE ERROR = 137.3
MEAN ERROR = -33.46
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9979
THEIL"S INEQUALITY COEFFICIENT = .3901E-01
FRACTION OF ERROR DUE TO BIAS = .3213E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .2462E-02
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .9654
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .2500E-03
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .9676

PLOT OF ACTUAL(*) AND FITTED(+) VALUES PLOT OF RESIDUALS(0)

	ACTUAL	FITTED	RESIDUAL
1963	569.0	617.9	-48.9
1964	625.0	657.0	-32.0
1965	731.0	769.4	-38.4
1966	797.0	737.9	59.1
1967	947.0	851.1	95.9
1968	1093.	1018.	74.5
1969	1185.	1099.	85.9
1970	1416.	1347.	68.9
1971	1597.	1736.	-139.
1972	1716.	1852.	-136.
1973	1950.	1928.	21.6
1974	2278.	2539.	-261.
1975	2952.	3436.	-484.
1976	3359.	3584.	-225.
1977	4112.	4046.	66.1
1978	5652.	5296.	356.



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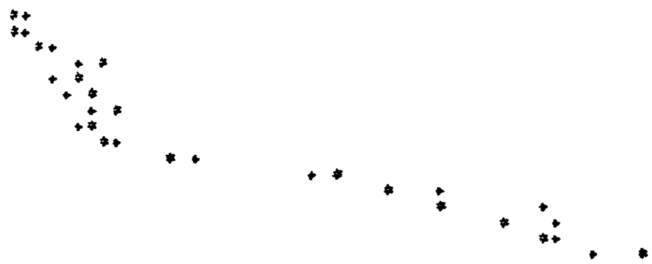
COMPARISON OF ACTUAL AND PREDICTED SERIES
*****************************************

     ACTUAL: WA          PREDICTED: WAS1

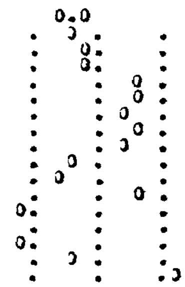
SAMPLE =       4      19

CORRELATION COEFFICIENT =      .9872                                   (SQUARED =      .9745     )
ROOT-MEAN-SQUARED ERROR =      .1152
MEAN ABSOLUTE ERROR =      .9323E-01
MEAN ERROR =     -.2055E-01
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED =      .9382
THEIL"S INEQUALITY COEFFICIENT =      .3341E-01
FRACTION OF ERROR DUE TO BIAS =      .3180E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION =      .8905E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION =      .8791
ALTERNATIVE DECOMPOSITION   (LAST 2 COMPONENTS):
     FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY =      .1381
     FRACTION OF ERROR DUE TO RESIDUAL VARIANCE =      .8301
```

PLOT OF ACTUAL(*) AND FITTED(+) VALUES



PLOT OF RESIDUALS(O)



	ACTUAL	FITTED	RESIDUAL
1963	.6329	.6917	-.589E-01
1964	.6345	.6661	-.316E-01
1965	.7345	.7720	-.375E-01
1966	.9112	.8254	.858E-01
1967	.8422	.7592	.830E-01
1968	.8767	.8166	.601E-01
1969	.9481	.8727	.754E-01
1970	.8897	.8386	.511E-01
1971	.9277	.9789	-.512E-01
1972	1.120	1.197	-.772E-01
1973	1.661	1.589	.718E-01
1974	1.850	2.007	-.157
1975	2.021	2.327	-.307
1976	2.215	2.365	-.150
1977	2.330	2.370	-.400E-01
1978	2.671	2.517	.154

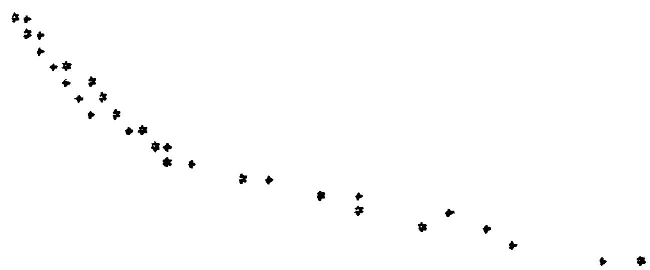
```
COMPARISON OF ACTUAL AND PREDICTED SERIES
*****************************************

     ACTUAL: WM          PREDICTED: WMS1

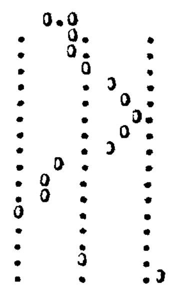
SAMPLE =       4      19

CORRELATION COEFFICIENT =      .9851                                   (SQUARED =      .9704     )
ROOT-MEAN-SQUARED ERROR =      .1039
MEAN ABSOLUTE ERROR =      .7770E-01
MEAN ERROR =     -.2150E-01
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED =      .9353
THEIL"S INEQUALITY COEFFICIENT =      .4051E-01
FRACTION OF ERROR DUE TO BIAS =      .4231E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION =      .7926E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION =      .8779
ALTERNATIVE DECOMPOSITION   (LAST 2 COMPONENTS):
     FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY =      .1298
     FRACTION OF ERROR DUE TO RESIDUAL VARIANCE =      .8274
```

PLOT OF ACTUAL(*) AND FITTED(+) VALUES



PLOT OF RESIDUALS(O)



	ACTUAL	FITTED	RESIDUAL
1963	.5249	.5469	-.221E-01
1964	.5759	.5926	-.167E-01
1965	.6141	.6166	-.252E-02
1966	.6966	.6595	.371E-01
1967	.7685	.6928	.757E-01
1968	.8009	.7113	.896E-01
1969	.8524	.7774	.749E-01
1970	.9206	.8787	.419E-01
1971	.9523	.9878	-.355E-01
1972	1.012	1.084	-.725E-01
1973	1.212	1.286	-.742E-01
1974	1.471	1.580	-.109
1975	1.595	1.868	-.273
1976	1.771	1.955	-.184
1977	2.052	2.056	-.393E-02
1978	2.435	2.305	.130

COMPARISON OF ACTUAL AND PREDICTED SERIES
****

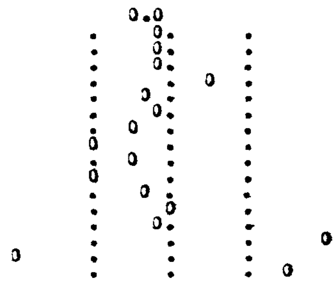
ACTUAL: YAD PREDICTED: YADS1

SAMPLE = 4 19

CORRELATION COEFFICIENT = .9937 (SQUARED = .9875)
ROOT-MEAN-SQUARED ERROR = 349.1
MEAN ABSOLUTE ERROR = 616.7
MEAN ERROR = -141.1
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = 1.031
THEIL"S INEQUALITY COEFFICIENT = .1295E-01
FRACTION OF ERROR DUE TO BIAS = .2751E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .9588E-01
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .8765
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .6564E-01
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .9067

PLOT OF ACTUAL(*) AND FITTED(+) VALUES PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	.2448E+05	.2469E+05	-208.
1964	.2263E+05	.2279E+05	-166.
1965	.2607E+05	.2626E+05	-195.
1966	.3152E+05	.3099E+05	531.
1967	.2635E+05	.2665E+05	-282.
1968	.2775E+05	.2790E+05	-147.
1969	.2969E+05	.3011E+05	-419.
1970	.2381E+05	.2474E+05	-933.
1971	.2415E+05	.2469E+05	-535.
1972	.3087E+05	.3182E+05	-947.
1973	.4340E+05	.4369E+05	-289.
1974	.3899E+05	.3896E+05	23.7
1975	.4133E+05	.4145E+05	-115.
1976	.4308E+05	.4123E+05	.135E+04
1977	.3779E+05	.3960E+05	-.133E+04
1978	.3897E+05	.3757E+05	.140E+04



COMPARISON OF ACTUAL AND PREDICTED SERIES
****

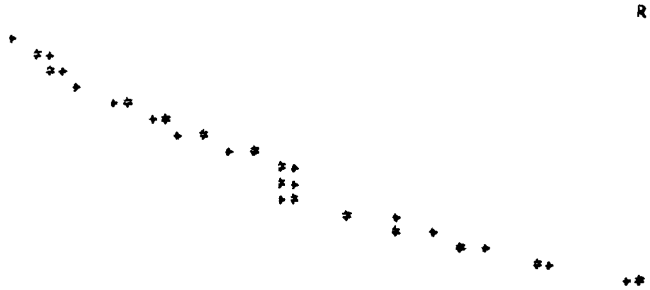
ACTUAL: YMD PREDICTED: YMDS1

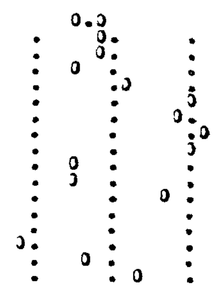
SAMPLE = 4 19

CORRELATION COEFFICIENT = .9944 (SQUARED = .9889)
ROOT-MEAN-SQUARED ERROR = 5380.
MEAN ABSOLUTE ERROR = 4354.
MEAN ERROR = -859.4
REGRESSION COEFFICIENT OF ACTUAL ON PREDICTED = .9584
THEIL"S INEQUALITY COEFFICIENT = .1967E-01
FRACTION OF ERROR DUE TO BIAS = .2551E-01
FRACTION OF ERROR DUE TO DIFFERENT VARIATION = .1063
FRACTION OF ERROR DUE TO DIFFERENT CO-VARIATION = .8682
ALTERNATIVE DECOMPOSITION (LAST 2 COMPONENTS):
FRACTION OF ERROR DUE TO DIFFERENCE OF REGRESSION COEFFICIENT FROM UNITY = .1401
FRACTION OF ERROR DUE TO RESIDUAL VARIANCE = .8344

PLOT OF ACTUAL(*) AND FITTED(+) VALUES PLOT OF RESIDUALS(O)

	ACTUAL	FITTED	RESIDUAL
1963	.6205E+05	.6312E+05	-.105E+04
1964	.6963E+05	.7089E+05	-.126E+04
1965	.7348E+05	.7639E+05	-.291E+04
1966	.8017E+05	.7953E+05	640.
1967	.9403E+05	.8807E+05	.595E+04
1968	.1029E+06	.9860E+05	.425E+04
1969	.1113E+06	.1051E+06	.611E+04
1970	.1263E+06	.1208E+06	.550E+04
1971	.1329E+06	.1357E+06	-.272E+04
1972	.1338E+06	.1362E+06	-.246E+04
1973	.1368E+06	.1331E+06	.365E+04
1974	.1510E+06	.1622E+06	-.112E+05
1975	.1622E+06	.1732E+06	-.110E+05
1976	.1794E+06	.1864E+06	-.695E+04
1977	.2011E+06	.2032E+06	-.211E+04
1978	.2279E+06	.2260E+06	.136E+04





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