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A MACROECONOMIC MODEL OF DIFFERENTIAL GROWTH EFFECTS OF NATIONAL SECTORAL SAVING AND FOREIGN BORROWING: AN APPLICATION TO THAI DATA

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A MACROECONOMIC MODEL OF DIFFERENTIAL GROWTH EFFECTS OF NATIONAL SECTORAL SAVING AND FOREIGN BORROWING: AN APPLICATION TO THAI DATA

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ABSTRACT

Little attention has been given to possible differences in the growth impact of individual components of aggregate saving and investment finance from both domestic and foreign sources. Essentially, the differential growth effects of national sectoral saving, namely, household saving, private business and public saving, have not been well explored. Additionally, the income growth effect of foreign borrowing has not been focused on much in available studies.

The main objective of this study is to test two hypotheses: (1) individual components of national sectoral saving in Thailand have different growth effects; (2) foreign borrowing in Thailand has a positive income growth effect.

Assuming a perfectly elastic supply of foreign borrowing, demand for foreign borrowing reflects an _ex ante_ excess demand gap in the market for goods and services. A macroeconomic model of the investment-saving type and of six structural and five identity equations is developed for a small open economy facing current account deficits under a fixed exchange rate system. Based on this framework, theoretical arguments are carefully developed to rationalize the differential growth effects of national sectoral saving and the positive growth effect of foreign borrowing.

The model is fitted to annual time-series data on Thailand for the period 1961-1982. The two-stage least squares technique is employed to estimate the model. Three rigorous tests of model validity are performed by using *ex post* dynamic simulation procedure. Judging from the good statistical fit of each equation and the results of three tests of model validity, the macroeconometric model can be regarded as a reasonable representation of the salient aspects of saving and growth performance of the Thai economy.

Major empirical findings are: (1) national sectoral saving has differential growth effects in Thailand. Specifically, household saving has the largest growth effect, private corporate net saving has a negative growth effect, and public saving has virtually no growth effect; (2) foreign borrowing has a positive growth effect in Thailand; and (3) foreign borrowing does not substitute for public saving as has been argued by radical critics.

This study suggests that (1) the Thai government should consider an encouragement of household saving and improvements in the allocative efficiency of private business saving and public saving; (2) foreign borrowing for investment projects should continue in Thailand.

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CHAPTER I

INTRODUCTION

1.1 Statement of the Problem

1.1.1 Need for More Research on Differential Growth Effects of National Sectoral Savings

The effects of investment and, by extension, saving, on the growth rate of real national income has been well examined in both theoretical and empirical literature (Mikesell and Zinser, 1973; Fry, 1980). However, in these studies saving is treated as a single variable, that is, as an aggregate for the entire economy. Little attention has been given to possible differences in the impacts of individual components of aggregate saving and investment finance on income growth. Specifically, the saving aggregate can be decomposed according to its source, namely, domestic and foreign saving. Domestic saving can be further broken down into household, business and public saving, whereas foreign saving can be disaggregated into aid, foreign direct investment, foreign loans and other inflows.

Papanek (1973) had recognized the fact that components of investment finance, especially various forms of foreign resource inflows, are not homogeneous. He argued that their quantitative effects on growth need not necessarily be the same. By formulating a growth rate of output equation based on the hypothesis that investment is a major determinant of growth, and then treating the components of investment finance, namely, foreign aid, foreign investment, other inflows and domestic savings, as separate independent variables in explaining this growth, he took the first step in examining the differential growth effects of individual components of investment finance. Cross-country regression analysis was performed by fitting the growth rate equation to data on thirty-four countries for the 1950s, and on fifty-one countries for the 1960s. He found that foreign aid, defined as net transfers received by the government plus official long-term borrowing, which disproportionately went to countries with low savings rates and serious balance-of-payments problems, had a more significant and stronger growth effect than domestic savings and the other forms of foreign resource inflows.

Gupta (1975) also studied the differential growth effects of components of investment finance, by developing a simultaneous equations model in which the saving ratio, the growth rate of output, and demographic factors are jointly determined. The specification of his growth equation is identical to the one used by Papanek. The equation was estimated by the method of two-stage least squares using cross-section data for the 1960s on forty developing countries. Gupta's empirical findings partly contradicted those of Papanek. Specifically, he found that foreign aid had a more significant effect on growth than domestic saving, but that this effect was not more significant than those of the other forms of foreign resource inflows. In fact, Gupta found that foreign aid had the smallest effect of the three types of foreign capital inflows.

Neither Papanek nor Gupta explored the differential growth effects of domestic saving disaggregated as to sectoral sources, despite the fact that its contribution to domestic investment finance in developing countries was generally greater than that of foreign resources. More specifically, domestic saving financed 85 percent of total investment in all developing countries during the 1960s and an even larger share in the 1970s (Moore, 1981). Knowledge of the different quantitative growth effects of household, private business and public saving will help in national policy formulation in developing countries, as they strive for rapid and sustained economic growth by increasing the national propensity to save, and by improving the efficiency in allocation of investible funds.

1.1.2 Inquiry into the Relationship between Foreign Borrowing and the Growth Rate of Real Gross National Product (GNP)

Despite the dominance of domestic saving in investment finance of developing economies, foreign resource inflows play an equally important role by filling the domestic investment-savings gap and by increasing the country's foreign exchange reserves to enhance its import capacity. Nevertheless, there has been a continuing debate in the literature on external finance and economic development over the relationship between foreign capital inflows and economic growth. The available cross-country and time-series studies on the impact of foreign aid and foreign capital inflows on domestic saving and on the rate of economic growth have failed to reach a consensus.

In the earlier literature (Rosentein-Rodan, 1961; Chenery and Strout, 1966), foreign capital flows were treated as aid, and purely supplemented domestic saving by their full amount, thereby enhancing capital formation and growth in the recipient developing countries. In this case, there was an unequivocal positive relationship between foreign capital inflows and growth. More recent cross-country studies, except that of Papanek (1973), suggested that financial foreign aid did not necessarily lead to a higher rate of growth of gross domestic product (GDP) (IBRD, 1968; OECD, 1968) and, in some cases, may have actually had a contrary effect (Mosley, 1980). Some cross-country studies showed that the growth impact of foreign aid varied among recipient countries (Gulati, 1978; Mosley, 1980). Only in relatively poor countries was there a positive relationship between foreign aid and income growth. The relationship was found to be either negative or statistically insignificant in the other recipient countries.

In contrast, time-series analyses of a few countries in Asia, i.e., Pakistan, the Republic of China, and the Republic of Korea, seemed to suggest that aid contributed to growth in both low- and middle-income developing countries (Jacoby, 1966; Brecher and Abbas, 1972; and Krueger, 1978). A more recent analysis of foreign aid and economic development in the Asian region in the 1970s, based on an extended version of the Papanek model (1973) fitted to pooled time-series and cross-country data, as well as another study by Mosley (1980), showed that foreign aid had contributed significantly to GDP growth (Dowling and Hiemenz, 1982).

Most of the studies mentioned above emphasized the relationship between foreign aid and growth rate of GDP and were based on cross-country analysis. However, a significant share of foreign capital inflows are loans which entail debt service obligations at a later date. With the increasing concern about the rapid and sustained rise in external borrowing of developing countries in recent years, it is of interest and useful for policy implication to have a detailed study of the growth impact of foreign borrowing on real GNP for a specific country, using time-series analysis.

1.1.3 Need for a Case Study: Thailand

Explicit and precise policy conclusions for individual countries call for a case study of a specific country within a time-series context. Thailand is a middle-income developing country whose prime economic objective is to attain rapid and sustained economic growth and thus bring about improvement in the living standard of her people. However, like other developing countries in recent years, it has experienced a sustained rise in foreign borrowing, which has brought about a heavy burden of debt service payments. The need for domestic resource mobilization on a larger scale and for improvement in the efficiency of both domestic and foreign resource allocation has never been more urgent. In this regard, research on the two economic problems stated earlier will be both relevant and useful for policy recommendations for the case of Thailand.

Two related issues addressed by the present study are as follows:

1) Do savings from the three economic sectors (household, business and government) of Thailand have different effects on the growth of real national income?

2) Has the foreign borrowing of Thailand contributed positively to the growth rate of its real GNP? If so, to what extent has this been the case?

The above questions will be answered by fitting a model of national sectoral savings and foreign borrowing to data for Thailand and applying statistical tests on the coefficients.

Domestic saving is greater than national saving by the amount of net factor income payments abroad. With the rapid rise in net factor income payments abroad, the distinction between domestic and national saving has become nontrivial. The present study thus chooses to analyze the behavior of national saving in Thailand; in particular the sectoral composition of national saving will be a main focus of this study.

1.2 Objectives of the Study

The main objective of the present study is to answer the two questions above by testing the following hypotheses.

1) The three types of national saving distinguished as to source, namely, household saving, private corporate net retained earnings, and public saving, each expressed as a ratio to GNP, have different effects on real GNP growth in Thailand.

2) Foreign Borrowing, also expressed as a ratio to GNP, is positively related to real GNP growth in Thailand.

Since this study covers the period 1961-1982 in which Thailand experienced turbulent events such as the two oil shocks in 1973-1974 and 1979-1980 and other exogenous shocks in the 1970s, it is also useful to explore the impact of these two oil shocks, and the subsequent petro-dollar recycling on investment, saving and growth in Thailand.

1.3 Research Methodology and Sequence of Analysis

In order to test the two hypotheses stated above and simultaneously examine the impact of the two oil shocks, the following methodology and sequence of research will be pursued.

1) Theoretical arguments for differential growth effects of national sectoral savings and the positive growth effect of foreign borrowing will be developed within the framework of a small open developing economy, faced with a current account deficit under a fixed exchange rate system. Assuming a perfectly elastic supply of foreign funds for borrowing, demand for foreign borrowing would then reflect the ex ante excess demand gap in the market for goods and services.

In particular, based on the above theoretical framework, a macroeconometric model of six structural and five identity equations is set up. The structural equations explain the growth rate of income, the domestic investment ratio, the household saving ratio, the private corporate business net saving ratio, the public saving ratio, and the planned change-in-international-reserve ratio. Five identity equations are specified to define the foreign borrowing ratio, the current account deficit ratio, the increase in the current account deficit ratio, other foreign resource inflows ratio, and the private business net profit ratio.[1]

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[1]From here on, the ratio of any variable to real GNP will simply be referred to as that variable's "ratio," i.e., the reference to real GNP as the denominator will be dropped for the sake of brevity.

2) The above model will be fitted to annual time-series data on Thailand for the period 1961-1982. The two-stage least squares technique is employed to estimate each structural equation of the model.

3) In order to examine the empirical impacts of the two oil shocks and other exogenous shocks, dummy variables will be used. Specifically, D75 and D792 are dummy variables used to account for the staggered impacts of the 1973-74 and 1979-80 oil shocks, respectively.[2] The impact of petro-dollar recycling on investment during 1977-1979 is taken into account by using dummy variable D779. The effect of the world-wide commodity boom in 1974 is also taken into account by the use of dummy variable D74.

4) Three rigorous tests of the validity of the model as a whole will be performed by using ex post dynamic simulation procedure.

1.4 Sources of Data

The data used in estimating the model were obtained from official publications of the Bank of Thailand (BOT),

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[2]The impact of the first oil price shock on the Thai economy in 1973-74 was delayed to 1975. The high prices of some of Thailand's major exports in 1974 were able to offset the recessionary impact. The variable D75 takes on a value of one if the year is 1975 and zero if not. Thailand was already in a weakened balance of payments and debt position when the successive oil price increases of 1979-80 hit the world economy. Coupled with the prolonged world recession that followed, the Thai economy experienced a deep and prolonged recession in 1979-1982. D792 thus takes on a value of one during the 1979-1982 period, and zero for any other year.

the National Economic and Social Development Board of Thailand (NESDB), and the International Monetary Fund (IMF).

Details on the nature of the data and the definition of variables used are discussed in Appendix B.

1.5 Outline of the Study

Chapter II will briefly review certain historical aspects of the Thai economy that are relevant to the study. Chapter III will present a theoretical macroeconomic model developed to test the two hypotheses mentioned earlier and to examine the impact of the oil shocks. Chapter IV will present a discussion of the empirical findings obtained from estimation of the model described in Chapter III. Chapter V deals with three tests of the validity of the model, using dynamic simulation. Chapter VI concludes the study and summarizes the major findings, along with a discussion of policy recommendations and suggested areas for further research.

CHAPTER II

A BRIEF REVIEW OF SOME ASPECTS OF THE THAI ECONOMY RELEVANT TO THE STUDY

In order to place this study in perspective, the following chapter will give a brief review of the Thai economy focusing on economic growth, individual national sectoral savings, investment, foreign borrowing, and official international reserves.

2.1 Economic Growth

Throughout the period of the study, i.e., 1961-1982, the Thai economy had expanded at a rapid and steady rate. The annual average growth rate of real GNP in Thailand during the past two decades amounted to 7 percent (Table 2.1). The GNP growth rate in real terms was around 7.4 percent in the period 1961-1972, whereas in 1973-1982 it averaged 6.6 percent per year. During the period of the first oil shock, the real GNP annual growth rate averaged around 7.4 percent in 1973-1975, and was 6.8 percent in 1975. However, during the period of 1979-1982 in which the Thai economy suffered from the recessionary impact of the second oil shock, the annual average growth rate of real GNP declined to 4.7 percent. Judging from the above historical real GNP growth rates, one may conclude that the impact of the first oil-shock was only slightly felt

TABLE 2.1

GROSS NATIONAL PRODUCT, GROSS DOMESTIC PRODUCT, AND NET FACTOR INCOME FROM ABROAD THAILAND, 1961-1982

(Billions of 1975 baht)

Year	GNP	GDP	Net Factor Income from Abroad	Growth Rate of GNP (%)	Growth Rate of GDP (%)
1961	108.2	108.5	-.25	5.3	5.3
1962	116.9	117.2	-.33	8.0	8.1
1963	126.9	127.1	-.17	8.6	8.4
1964	135.1	135.5	-.37	6.5	6.6
1965	146.1	146.2	-.06	8.1	7.9
1966	163.8	164.0	-.20	12.1	12.2
1967	176.9	176.7	.13	8.0	7.8
1968	192.2	191.8	.44	8.6	8.5
1969	207.1	207.0	.15	7.8	7.9
1970	220.8	220.4	.42	6.6	6.5
1971	230.7	230.7	.04	4.5	4.7
1972	241.3	241.7	-.43	4.6	4.8
1973	263.9	264.5	-.62	9.4	9.4
1974	279.7	278.9	.79	6.0	5.4
1975	298.6	298.8	-.22	6.8	7.1
1976	323.7	324.8	-1.14	8.4	8.7
1977	346.3	348.1	-1.82	7.0	7.2
1978	378.9	383.3	-4.42	9.4	10.1
1979	399.5	406.6	-7.10	5.4	6.1
1980	422.1	430.0	-7.90	5.7	5.8
1981	444.4	457.1	-12.68	5.3	6.3
1982	454.7	469.3	-14.60	2.3	2.7
Average: 1961-1982	--	--	--	7.0	7.2

Source: International Monetary Fund, International Financial Statistics.

by the Thai economy. However, this is not necessarily true. The impact of the first oil shock may have just been as bad as the second oil shock, except that there were other factors compensated for the staggered impacts of the first oil shock, e.g., the commodity boom in 1974.

The picture was somewhat different when the growth rate of real GDP was considered. In 1973-1975, the growth rate of real GDP averaged 7.3 percent, which was slightly higher than the 7.2 percent average growth rate during 1961-1982. The real GDP growth rate averaged 5.2 percent, 7.4 percent, and 6.9 percent in 1979-1982, 1961-1972, and 1973-1982 respectively.

Based on these statistics, it can be concluded that, after the period 1961-1972 and excpet in the period of the first oil shock (1973-1975), the growth rate of real GNP had been consistently lower than that of real GDP. In the national income accounts, this reflects that GNP was consistently less than GDP by the portion of net factor income payments to the rest of the world--remittances and interest payments on foreign debt--during 1973-1982, except in 1974 when GNP was greater than GDP as the Thai economy received a substantial amount of net income from abroad, in the order 798 million baht.

The steadily increasing amount of net factor income payments abroad since 1976 (see Table 2.1) reflects the increasing amount of foreign debt service payments and the increasing dependence of the Thai economy on external financial sources. Hence, there is an immediate need for promoting national saving to finance economic development.

2.2 National Sectoral Saving

Nominal gross national saving had increased from 11,305 million baht in 1961 to 159,561 million baht in 1982 (see Table 2.2). While the average ratio of gross national saving to GNP was around 22 percent for the 1961-1982 period, it had actually increased from 21 percent in the 1961-1972 period to 23 percent in 1973-1982 (Table 2.3). During 1961-1982, the average ratios to GNP of gross national saving, household saving, private business net saving and public saving were 22.1, 11.5, 1.0, and 3.2 percent, respectively. It should be noted that during the commodity boom which overlapped with the first oil shock in 1973-1974, the gross national saving ratio had reached a high of 27.6 percent as a result of increases in the household saving and public saving ratios of 15.6 and 4.3 percent, respectively, while private corporate net saving ratio slightly declined to 0.9 percent. However, in 1981-1982, gross national saving ratio had declined to 20.3 percent due to declines in household and public saving ratios to 10.5 and 0.4 percent, respectively, while private business net retained earnings ratio increased to 1.6 percent (see Table 2.3).

TABLE 2.2

NATIONAL SAVING AND DOMESTIC INVESTMENT
THAILAND, 1961-1982

(millions of current baht)

Year	Household Savings	Net Retained Earnings	Public Saving	Gross National Saving	Gross Domestic Investment
1961	6,907	97	2,350	11,305	8,919
1962	6,341	141	2,732	11,574	11,737
1963	6,077	265	3,133	12,369	14,620
1964	6,658	293	3,764	14,274	14,988
1965	9,600	310	4,026	18,182	17,012
1966	15,768	574	4,871	26,397	23,908
1967	10,923	791	5,867	23,886	25,685
1968	10,044	1,079	5,631	24,296	29,435
1969	12,820	1,343	4,844	27,887	33,877
1970	13,872	1,029	4,060	29,245	35,606
1971	13,429	1,682	2,979	29,648	34,887
1972	17,869	1,717	3,598	36,026	33,679
1973	36,712	1,630	5,963	59,050	51,711
1974	38,427	3,253	15,832	75,187	67,441
1975	37,815	4,000	8,038	70,867	75,747
1976	42,071	4,281	4,691	75,084	78,444
1977	44,062	5,455	11,816	89,942	102,240
1978	57,387	7,724	12,268	111,807	126,950
1979	67,830	9,405	9,186	128,308	160,287
1980	87,985	11,576	7,022	157,223	186,258
1981	80,386	13,707	8,633	161,985	194,479
1982	85,936	10,952	-2,976	159,561	177,772
Average 1961-1982	32,224	3,696	5,833	61,550	68,440

Source: Office of The National Economic and Social Development Board, National Income of Thailand.

TABLE 2.3

RATIO OF NATIONAL SECTORAL SAVING AND INVESTMENT TO GNP
THAILAND, 1961-1982

Year	Household Saving Ratio	Net Retained Earnings Ratio	Public Saving Ratio	Gross National Saving Ratio	Gross Domestic Investment Ratio
1961	11.73	.16	3.99	19.20	15.15
1962	9.96	.22	4.29	18.17	18.43
1963	8.93	.39	4.61	18.18	21.49
1964	8.93	.39	5.05	19.14	20.09
1965	11.39	.37	4.78	21.57	20.18
1966	15.56	.57	4.81	26.04	23.59
1967	10.08	.73	5.41	22.04	23.70
1968	8.54	.92	4.79	20.66	25.03
1969	9.80	1.03	3.70	21.31	25.89
1970	10.18	.76	2.98	21.45	26.12
1971	9.33	1.17	2.07	20.60	24.24
1972	11.05	1.06	2.23	22.27	20.82
1973	17.09	.76	2.78	27.50	24.08
1974	14.18	1.20	5.84	27.74	24.89
1975	12.66	1.34	2.69	23.73	25.37
1976	12.51	1.27	1.40	22.32	23.32
1977	11.27	1.40	3.02	23.00	26.15
1978	12.35	1.66	2.64	24.07	27.33
1979	12.41	1.72	1.68	23.48	29.33
1980	13.08	1.72	1.04	23.38	27.70
1981	10.52	1.79	1.13	21.19	25.44
1982	10.48	1.34	-.36	19.46	21.69
Average: 1961-1982					
	11.46	1.00	3.21	22.12	23.64

Source: Calculated from Table 2.2

Given the annual average growth rates of real GNP in 1961-1982, in 1973-1974 and 1981-1982 of 7.0, 7.7 and 3.8 percent respectively, it is interesting to note that during the same periods, the gross national saving ratio, the household saving ratio and the public saving ratio all moved in the same direction as the growth rate of real GNP, while the private business net saving ratio moved in the opposite direction.

During the 1961-1962 period, the average shares of household saving, private business net saving, public saving and depreciation allowance in gross national saving were 52, 6, 9 and 33 percent, respectively. Household saving apparently plays a major role in financing economic development through domestic resources.

2.2.1 Household Saving

The nominal value household saving had increased from 6,907 million baht in 1961 to 85,936 million baht in 1982 (Table 2.2). The level of nominal household saving in 1982 was around 12 times its level in 1961. The average growth rate of nominal household saving during 1961-1982 was around 15.8 percent, which is slightly higher than the growth rate of aggregate national saving (see Table 2.4). The average ratio of household saving to GNP during the same period was around 11 percent, or half the average ratio of aggregate national saving to GNP. At the same time, the average household saving ratio for the period before

TABLE 2.4

GROWTH RATES OF NATIONAL SECTORAL SAVING
AND DOMESTIC INVESTMENT
THAILAND, 1961-1982

(percent)

Year	Growth Rate of Household Saving	Growth Rate of Net Retained Earnings	Growth Rate of Public Saving	Growth Rate of National Saving	Growth Rate of Domestic Investment
1961	13.1	-5.8	9.4	13.2	5.5
1962	-8.2	45.4	16.3	2.4	31.6
1963	-4.2	87.9	14.7	6.9	24.6
1964	9.6	10.6	20.1	15.4	2.5
1965	44.2	5.8	7.0	27.4	13.5
1966	64.3	85.2	21.0	45.2	40.5
1967	-30.7	37.8	20.5	-9.5	7.4
1968	-8.0	36.4	-4.0	1.7	14.6
1969	27.6	24.5	-14.0	14.8	15.1
1970	8.2	-23.4	-16.2	4.9	5.1
1971	-3.2	63.5	-26.6	1.4	-2.0
1972	33.1	2.1	20.8	21.5	-3.5
1973	105.5	-5.1	65.7	63.9	53.5
1974	4.7	99.6	165.5	27.3	30.4
1975	-1.6	23.0	-49.2	-5.7	12.3
1976	11.3	7.0	-41.6	6.0	3.6
1977	4.7	27.4	151.9	19.8	30.3
1978	30.2	41.6	3.8	24.3	24.2
1979	18.2	21.8	-25.1	14.8	26.3
1980	29.7	23.1	-23.6	22.5	16.2
1981	-8.6	18.4	22.9	3.0	4.4
1982	6.9	-20.1	-134.5	-1.5	-8.6
Average: 1961-1982					
	15.8	27.6	9.3	14.5	15.8

Source: Calculated from Table 2.2

the first oil shock (1961-1972) was around 10.5 percent, which is slightly lower than its average ratio of 12.6 percent for 1973-1982. It is interesting to note that during the commodity boom which overlapped with the first oil shock in 1972-1974, the Thai economy had experienced higher household saving ratios, especially in 1973, when the ratio went up to 17 percent. However, the household saving ratio was down to 13 percent in 1975.

National saving may be channeled to investment via three routes, namely, financial intermediaries, government appropriation and self-finance. The bulk of national saving is mobilized to investment by financial intermediaries. According to Table 2.5, it is obvious that the main portion of household saving, which itself comprises half of gross national saving, is in the form of financial assets. Specifically, during the period 1967-1980, the average ratio of household financial assets to household savings amounted to 71 percent whereas the average ratio of the sum of household demand and time deposits to household saving was around 34 percent.

2.2.2 Private Business Net Retained Earnings

In general, private business net profit after tax may be either retained by the corporation or paid out to shareholders as dividends. It should be noted that during the 1961-1982 period, the average ratio of private corporate net retained earnings to GNP in Thailand was around

TABLE 2.5

SAVING, FINANCIAL ASSETS, DEMAND AND TIME DEPOSIT HOLDINGS OF HOUSEHOLDS IN THAILAND 1967-1980

(millions of current baht)

Year	Total Household Saving	Acquisition of Financial Assets	Demand and Time Deposits	Financial Assets as a % of Total Saving	Bank Deposits as a % of Total Saving
1967	10,992	6,159	2,670	.56	.24
1968	10,402	6,747	3,183	.65	.31
1969	13,992	7,780	3,110	.56	.22
1970	13,803	8,330	3,542	.60	.26
1971	13,082	10,381	5,397	.79	.41
1972	17,930	17,930	9,227	.95	.49
1973	37,008	25,251	9,592	.68	.26
1974	37,795	27,281	13,059	.72	.34
1975	38,086	20,274	12,907	.53	.34
1976	42,412	26,953	16,949	.64	.40
1977	44,395	36,159	21,262	.81	.48
1978	57,690	52,691	18,659	.91	.32
1979	68,090	45,234	18,873	.66	.28
1980	88,333	71,395	40,860	.81	.46
Average: 1967-1980	---	---	---	.71	.34

Notes: Financial assets are composed of currency, demand and time deposits, public authority securities, government non-budgetary accounts, and credit and capital market instruments.

Source: National Accounts Division, Office of the National Economic and Social Development Board (NESDB) and Research Department, Bank of Thailand (BOT), Flow of Fund Accounts of Thailand, 1982 edition.

1 percent, while the average ratio of corporate dividends to GNP was only 0.4 percent. These figures suggest that Thai corporations tend to save a significant portion of their net income.

Net retained earnings in the whole of Thailand had increased from around 97 million baht to 10,952 million baht in 1982. The latter figure is nearly 112 times larger than the former. The annual average growth rate of net retained earnings was around 27.6 percent, which was substantially higher than the growth rates of household and public saving of 15.8 and 9.3 percent, respectively (Table 2.4).

Given the fact that private corporations tend to save a large portion of their net income, and that the average rate of increase of their net retained earnings has been high, it is of interest to study the investment efficiency and growth effect of these investible funds, which are mainly channeled to finance investment through self-financing.

2.2.3 Public Saving

Public saving is defined as the excess of public sector revenues over public consumption. This is the sum of general government saving and government enterprise saving. This sum increased steadily from 1961 to 1967. Thereafter, growth of public saving fluctuated widely. In 1974 and 1977, public saving growth rates amounted to 165.5 and 151.9

percent, respectively, but became negative for the first time in 1982, when its annual growth rate declined to -134.5 percent. It should be noted that in 1974, the year of the commodity boom, public saving rose tremendously because of increases in export tax revenues, despite the oil price hike during the same year. The recessionary impact of the second oil price hike in 1979-1982, however, was felt substantially, as public saving declined significantly over the period, except in 1981. In 1982, public consumption exceeded revenues by 2,976 million baht.

In the 1961-1982 period, the average annual growth rate of public saving was 9.3 percent, which was substantially lower than the growth rates of household and business saving of 15.8 and 27.6 percent, respectively. The average share of public saving in gross national product for the same period was around 3 percent, which is again substantially lower than the share of household savings (11 percent) but slightly higher than that of private business net saving (1 percent).

The main portion of government revenues is derived from household and private corporate taxes. Therefore, public saving used to finance public investment represents appropriation of domestic resources by the government. It is of interest to compare the investment efficiency of public saving and to that of of household and business saving, as they use different investment channels.

2.3 Gross Domestic Investment

Economic growth requires a rapid rate of capital formation. Over the period 1961-1982, gross domestic investment in nominal terms in Thailand had increased quite rapidly at an average of 15.8 percent per year. In 1971, 1972 and 1982, however, the annual growth rates were negative, i.e., -2, -3.5, and -8.6 percent, respectively (Table 2.4). It should be noted that the average annual growth rate in 1973-1975 was 32.1 percent, which was significantly higher than the average annual growth rate of 4.0 percent for 1980-1982. These statistics may reflect differences in the investment climate during the first and second oil shock.

During the 1961-1982 period, the average gross national saving ratio was 22.1 percent, while the gross domestic investment ratio was slightly higher at 23.6 percent. Therefore, on the average, the investment-saving gap or the resource gap was 1.5 percent of GNP or 6,890 million baht (in current prices) for the period under study. The gap relative to GNP rose sharply in 1975 and declined in 1976. Thereafter, it rose even more sharply than in 1975, especially in 1979 when the gap was 5.8 percent of GNP. It should be noted that the Thai economy had experienced an investment boom during the same period, especially during the petro-dollar recycling years 1977-1979. The investment ratio went up to 29 percent in 1979, while national saving ratio declined slightly to 23 percent. However, in 1982, the prolonged recessionary impact of the second oil shock was felt and the gap as a ratio of GNP fell to 2.2 percent.

2.4 Foreign Borrowing

Modern theories of the current account balance suggest that the size of the investment-saving gap determines the external financial dependence of the country. During the 1961-1982 period, the investment-saving gap of the Thai economy was covered by foreign borrowing and other external financial resources, namely, reduction in international reserves and foreign direct investment.

Over the same period, foreign borrowing (of both private and public sectors, and commercial banks) averaged 2.6 percent of GNP (see Table 2.6). The movement of the foreign borrowing ratio seemed to follow a pattern similar to that of the investment-saving gap ratio. It rose sharply in 1975 and declined in 1976. Thereafter, it rose sharply from 4.5 percent in 1977 to 6.4 percent in 1979, and then declined to 3.3 percent in 1982. It should be noted that during the same period, i.e., in 1977-1979, petro-dollar recycling gave rise to massive liquidity in the international financial market, which led to a world-wide investment boom and subsequent sharp rise in foreign borrowing by many developing countries, including Thailand.

Looking at the data on domestic and foreign interest rates in Table 2.6, it is noteworthy that throughout the

TABLE 2.6

RESOURCE GAP, DOMESTIC AND FOREIGN INTEREST RATES
THAILAND, 1961-1982

Year	Investment-Saving Gap as a % of GNP	Foreign Borrowing as a % of GNP	Domestic Bank Rate (%)	Euro Dollar Rate at London (%)	U.S. Federal Fund Rate (%)
1961	-4.1	1.4	8.0	3.58	1.96
1962	0.2	2.3	8.0	3.77	2.68
1963	3.3	2.1	8.0	3.95	3.18
1964	1.0	2.1	8.0	4.32	3.50
1965	-1.4	0.5	7.0	4.81	4.07
1966	-2.5	1.5	7.0	6.12	5.12
1967	1.7	1.9	7.0	5.46	4.22
1968	4.4	0.9	7.0	6.36	5.67
1969	4.6	1.7	11.0	9.76	8.21
1970	4.7	1.9	9.0	8.52	7.18
1971	3.6	0.1	9.0	6.58	4.66
1972	-1.5	1.2	8.0	5.46	4.43
1973	-3.4	1.9	10.0	9.24	8.73
1974	-2.9	2.5	11.0	11.10	10.50
1975	1.6	2.8	10.0	6.99	5.82
1976	1.0	2.3	9.0	5.58	5.05
1977	3.1	4.5	9.0	6.00	5.54
1978	3.2	5.4	12.5	8.73	7.93
1979	5.9	6.4	13.75	11.96	11.20
1980	4.3	5.5	14.25	14.36	13.36
1981	4.3	5.4	15.25	16.51	16.38
1982	2.2	3.3	13.25	13.11	12.26

Notes: 1) Saving in column (1) is gross national saving. The investment-saving gap as a percentage of GNP was calculated from Table 2.3.

2) Figure for foreign borrowing in any year was calculated by adding up item 2, item 3, item 4, item 5 and items I.2-I.3 in the balance of payments accounts.

Sources: Data on balance of payments were obtained from the Bank of Thailand, Quarterly Bulletin, various years.

Data on foreign interest rates were obtained from International Monetary Funds, International Financial Statistics.

entire period of the study, i.e., 1961-1982, except 1980 and 1981, foreign interest rates were consistently lower than the bank rates in Thailand. The assumption of the model, to be presented in the next chapter, that excess demand for domestic saving spills over into foreign saving, is consistent with this finding for the case of the Thai economy during the period under consideration.

2.5 Official International Reserves

Official international reserves are defined as assets held by a government in order to service international debt. Generally, the international resserves of Thailand are composed of major foreign currencies such as the U.S. dollar, Deutschemark, Swiss franc and Japanese yen; short-term foreign securities, gold, Special Drawing Rights and the reserve position in the International Monetary Fund. The economic stability and the ability to service the debt of a country may be measured by the size of the international reserves.

In the 1960s, Thailand's balance of payments account was in surplus except for the year 1969, when Thailand had a deficit of 913 million baht. In the 1970s, the situation was reversed. Thailand had a continuing deficit in the balance of payments account during the periods 1970-1971, and 1975-1979 (see Table 2.7). However, Thailand met the balance of payments problem without substantially slowing growth or adopting restrictive import measures. The country borrowed externally and drew down its international reserves to finance the deficits.

TABLE 2.7

CURRENT ACCOUNT BALANCE, BALANCE OF PAYMENTS, INTERNATIONAL RESERVES AND FOREIGN BORROWING THAILAND, 1961-1982

(million of current baht)

Year	Current Account Balance	Balance of Payments	Official[1] Reserves (million $)	Foreign[2] Borrowing
1961	592	1,646	454.4	825
1962	-543	1,295	523.4	1,444
1963	-1,293	949	576.1	1,444
1964	-453	1,430	660.3	1,593
1965	-316	1,985	739.3	454
1966	590	3,304	923.6	1,477
1967	-1,039	1,313	1,008.5	2,049
1968	-2,954	449	1,021.0	1,016
1969	-4,169	-913	984.9	2,166
1970	-5,197	-2,652	905.7	2,594
1971	-3,633	-335	877.0	178
1972	-1,063	3,991	1,052.5	1,874
1973	-997	864	1,295.2	3,968
1974	-1,785	8,012	1,858.4	6,849
1975	-12,368	-2,858	1,775.1	8,254
1976	-8,978	-83	1,892.9	7,664
1977	-22,392	-7,538	1,914.9	17,459
1978	-23,445	-13,298	2,557.3	25,242
1979	-42,591	-7,925	3,129.0	35,136
1980	-42,409	5,179	3,054.9	37,229
1981	-56,049	2,531	2,752.4	40,997
1982	-23,138	3,314	2,676.6	26,870

Notes: [1]Official reserves are composed of major foreign currencies, short-term foreign securities, gold, Special Drawing Rights and reserve position in the International Monetary Fund.

[2]Foreign borrowing = foreign borrowing by the private sector + foreign borrowing of central and local government including government enterprises.

Source: The Bank of Thailand, Quarterly Bulletin.

CHAPTER III

A MACROECONOMIC MODEL OF DIFFERENTIAL GROWTH EFFECTS OF NATIONAL SECTORAL SAVING AND FOREIGN BORROWING

The present model is designed to test whether saving emanating from the three national sectors, namely, household, private corporate business, and government, have had different effects on the growth of real income, and whether foreign borrowing has had a positive impact on income growth.

A macroeconomic model of the investment-saving type is developed for a small open economy facing a chronic current account deficit under a fixed exchange rate system, with demand for foreign borrowing reflecting the *ex ante* excess demand gap in the market for goods and services. An equation is formulated to account for the differential effects of national sectoral saving ratios, and the effect of foreign borrowing ratio on the growth rate of real income, based on the hypothesis that components of investment finance are a constraint on growth.

An investment function is defined to represent independent investment decisions in the economy. Separate functions are specified for each sectoral saving variable (household saving ratio, net retained earnings ratio, and public saving ratio) to account for differences in their behavior. The analysis of each sectoral saving decision is preceded by a discussion of the different ways through which each is channeled to investment finance.

Foreign borrowing, as well as other foreign resource inflows, represents external finance available for consumption and investment. Given a perfectly elastic supply of foreign funds for borrowing, the required ratio is determined from the interaction of national sectoral saving and the investment ratios of the economy. The model is completed by an equation for the planned change-in-international-reserves ratio and four identity equations.

This chapter is divided into two parts. The first part describes the model in detail. The second part discusses the implications of the model.

3.1 The Model

Before proceeding to a detailed discussion of each equation in the model, the basic assumptions of the model need to be stated.

The case under consideration is a small open developing economy in which domestic prices and interest rates are functions of world prices and interest rates, under a fixed exchange rate system. Domestic output is supply-determined, specifically by the stock of capital, and the economy normally operates at a level close to full capacity, given the infrastructure and the current availability of labor resources. Equilibrium in the goods and services market is maintained via adjustments in the current account balance.

A deficit in the country's current account means it imports capital, and thus has a capital account surplus. In other words, the level of investment in the country exceeds the level of saving. In this case, the foreign resource inflows, and specifically, foreign borrowing, is in effect a transfer of goods and services to the country, equal in value to its current account deficit, financed through the direct sale of obligations in the foreign securities market, and through other external resources (Borts, 1964).

The above small open developing economy may be viewed as being composed of four sectors: the household sector, the private business sector, the public sector and the foreign sector. It is hypothesized that each sector can be differentiated by its saving behavior and by the main channel through which its saving flows into investment, thereby exerting a distinctive effect on real income growth. These differences are the topic of the next section.

3.1.1 Differential Growth Effects of National Sectoral Saving

The above hypothesis can be represented by the following equation:

$$GRGNP = GRGNP(SHG, SBG, SGGG, FBG, FOFSG) \qquad (3.1)$$

where GRGNP is the growth rate of real GNP; and the explanatory variables are the ratio to GNP of household saving (SHG), private business net retained earnings (SBG), public saving (SGGG), foreign borrowing (FBG), and other foreign resource inflows (FOFSG).

The equation is in accord with the modern capital-oriented growth model, which treats the formation of capital as a prime determinant of economic growth (see Papanek, 1973; Gupta, 1975). The sectoral composition of saving, is considered to be, in turn, a constraint on the composition of investment and, therefore, on growth. Specifically, the growth rate of income is determined not only by the total amount of saving and investment, but also by the efficiency of saving and investment which is influenced by the compositions of investment finance.

The same equation further implies that components of the total saving ratio, i.e., household saving ratio (SHG), private business net retained earning ratio (SBG), public saving ratio (SGGG), foreign borrowing ratio (FBG) and other foreign resource inflows ratio (FOFSG), will each have different determinants, and different channels by which to finance investment. Thus, each will have distinctive quantitative effects on investment efficiency, and on real income growth.

In order to focus on the question of the relative efficiency of investment finance from the various sectoral saving sources, the overall level of saving is constrained to be equal to the level of investment, which, in turn, is determined by an independent investment demand function.

The following sections will discuss the determinants of investment and of the national sectoral saving ratios, as well as differences among investment channels of the various saving sectors. This is followed by a discussion of the planned change-in-international-reserves ratio, and of the investment channels and determinants of foreign borrowing. Identity equations for the current account deficit ratio (CAG), the increase in current account deficit ratio (CCAG), other foreign resource inflows ratio (FOFSG) and private net profit after tax ratio (CYNTG) will then be specified.

3.1.2 Gross Domestic Investment Ratio (IDG)

Since the decisions to save and to invest are made by different, though overlapping groups of transactors, they are normally not consistent with each other. It is only at equilibrium that planned aggregate saving always equals planned investment. An investment function is thus formulated below to reflect the independent investment decision of the economy.

3.1.2.1 Determinants of Investment

Due to time lags in the production of capital goods and to limitations in the supply of available funds for investment, the investment expenditures appropriated for a given project are likely to be spread over a number of years. Often the additional capital goods required cannot be obtained within the given period without incurring an additional cost, and will therefore be received at a later date. Given that the adjustment of capital stock does not occur immediately, the behavior of the gross domestic investment ratio (IDG) can be described as a process of investors' pursuing a desired target investment ratio (IDG*).

The IDG*, in turn, is assumed to depend on lagged variables representing financial, economic and technological conditions and constraints existing at the time an investment decision is formulated (Evans, 1969). More specifically, IDG* is assumed to depend on the previous period's real lending rate (AR2L1) and the previous period's growth rate of real income (GRGNPL1). The AR2L1 variable implies that investment funds are borrowed and lent at the real rate of interest anticipated at the time an investment decision is made. The GRGNPL1 variable reflects the accelerator mechanism, i.e., an increase in the previous period's growth rate of real income tends to create an expectation of greater future profit, and to encourage a higher planned investment expenditure for the following period. In functional form, this is expressed by:

$$IDG^* = IDG^*(AR2L1, \quad GRGNPLI) \tag{3.2}$$

or more specifically,

$$IDG^* = a_0 + a_1 AR2L1 + a_2 GRGNPL1 \tag{3.3}$$

With β as the adjustment coefficient and IDGLI as the ratio of actual investment in the previous period, the adjustment process may be expressed as follows:

$$IDG - IDGLI = \beta\ (IDG^* - IDGLI) \qquad (3.4)$$

Substituting for IDG* in equation (3.4), the following equation is obtained:

$$IDG = \beta a_0 + \beta a_1 AR2L1 + \beta a_2 GRGNPLI + (1 - \beta) IDGLI \qquad (3.5)$$

or simply,

$$IDG = IDG(AR2L1,\ GRGNPL1,\ IDGL1) \qquad (3.6)$$

Assuming that public investment tends to increase when the private demand for investment is low, and vice versa, and since private investment constitutes the major proportion of gross domestic capital formation, the behavior of the gross domestic investment ratio (IDG) may be characterized hypothetically as being dependent on the previous period's real lending rate (AR2L1), the previous period's growth rate of real income (GRGNPL1), and the previous period's investment ratio (IDGL1), as expressed in equation (3.6) above.

3.1.3 Household Saving

3.1.3.1 Investment Channel of Household Saving

Most of household saving is in the form of financial assets, as was noted in the preceding chapter. Channeled into investment through financial intermediaries, these investible funds are hypothesized to be more efficiently allocated among competing investment opportunities via the market mechanism, as compared to other investible funds, i.e., private business net retained earnings and public saving, which are primarily channeled to investment via self-financing and government appropriation, respectively.[1] Thus the effect of household saving on growth is hypothesized to be greater than those of the other sectors' saving.

3.1.3.2 Determinants of Household Saving Ratio (SHG)

The household saving decision is expressed in equation (3.7) below.

$$SHG = SHG\ (HYNTTG,\ AR5,\ GRGNP,\ DR1) \qquad (3.7)$$

The household saving ratio (SHG) depends on the ratio of its current disposable income ratio to GNP (HYNTTG), in accord with the Keynesian saving function and the permanent income hypothesis, which states that saving behavior is determined by permanent income, where permanent income is proxied for by current income.

In theories of saving, much attention has also been given to the role of the rate of interest (AR5), which is

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[1]Both business and government also have access to financial intermediaries, and may therefore also channel their investible funds through these. However, it can be assumed that their holdings of financial securities represent only a small portion of their total investible funds.

generally specified in real terms as the nominal rate minus the expected rate of increase in prices. The argument of classical economists that saving is positively related to the rate of interest is based on the reasoning that a rise in the interest rate increases the opportunity cost of present consumption. Therefore, consumers substitute future consumption for present consumption, and hence increase present saving.

At the same time, however, an increase in the interest rate reduces the amount of saving in the current period that is required to provide the same level of consumption in the future. According to the life-cycle saving model which was proposed by Modigliani, Brumberg and Ando (1954; 1963), individuals attempt to spread their consumption evenly over their life span by saving enough during their earning years to maintain the same consumption standard during retirement. Consequently, an increase in the interest rate which results in higher interest earnings may, in fact, lead to a negative response in the household saving ratio (SHG).

Whether a rise in the interest rate would lead to a positive or negative response in the household propensity to save (SHG) is, therefore, an empirical issue.

The life-cycle saving model can also be used to justify the inclusion of the growth rate of real income (GRGNP) as a determinant of the household saving ratio (SHG). Specifically, the model argues that in a society with a growing population and a growing per capita income, aggregate net personal saving is positive because the working population tends to be larger relative to the retired population. Also, the higher the level of current per capita income of the working group, the larger will be the amount of saving necessary to maintain an individual's consumption level in retirement.

The number of children supported by a typical family might also affect the household saving ratio (SHG), i.e., a higher dependency ratio (DR1) is likely to reduce the household average propensity to save, since present consumption needs of younger, child-raising households are bound to be relatively higher (Leff, 1969).

In summary, the behavior of the household saving ratio is expected to be influenced by the real rate of interest (AR5), the current disposable income ratio (CYNTG), the growth rate of real income (GRGNP) and the population dependency ratio (DR1).

3.1.4 Private Business Net Retained Earnings

3.1.4.1 Investment Channel of Private Business Net Retained Earnings

The availability of internal funds--retained earnings and depreciation allowances--plays an important role in determining a firm's rate of investment, since the use of internal funds does not increase its external debt or expose it to risks of subsequent overextension to creditors. A typical risk-averse firm thus tends either to rely heavily on internal funds with a relatively small amount of debt, or to issue equities in financing an investment project. However, equities are most likely to be successfully issued when the marginal efficiency of investment in the project is high (Duesenberry, 1958).

Given that capital markets in developing countries are not well developed, there is often a wide margin between what the capital market can earn from relending funds for investment projects with high rates of return, and what it has to pay for the cost of funds, as reflected by the market interest rate. Households, in general, do not have any immediate investment opportunities other than to lend funds to the capital market and earn the low interest rates. The private business corporation, on the other hand, would not lend out its internal funds, if the market interest rate is lower than the rate of return it can earn on a certain investment project. It would rather use the funds to finance its investment project, which may, however, not yield as high a rate of return as those investment projects financed by investible funds allocated by the financial intermediaries.[2]

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[2]Part of the internal funds may still go to investment in lower-yielding projects, but for non-profit motives, e.g., goodwill, empire-building, etc.

The above argument implies that investible funds from private business net retained earnings, which are channeled to investment through self-financing, may be less efficiently allocated and may have a lesser impact on income growth than funds that are channeled through financial intermediation, such as household saving. Since the internal funds may be expected to finance capital-intensive and lower-yielding investment projects, this is likely to lead to an increase in the overall incremental capital-output ratio.[3]

Moreover, an increase in business net saving is at the expense of household saving, i.e., the increase in retained profit might have otherwise been paid out as dividends to shareholders, thereby, increasing household income, and consequently boosting household saving and economic growth. Investment financed from business saving, therefore, represent a diversion of funds from more to less efficient outlets of utilization. An increase in the business net saving ratio (SBG) is therefore expected to lead to a relatively smaller increase in the growth rate of real income (GRGNP) than that for the household saving ratio (SHG).

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[3]A crude measure of capital productivity or average investment efficiency referred to in macroeconomic literature is an incremental-capital-output-ratio (ICOR). This ratio shows the link between the size of investment and generated incremental output. High returns on investment implies low ICORs while high ICORs are associated with low returns on investment.

3.1.4.2 Determinants of Private Business Net Retained Earnings Ratio (SBG)

In the present model, the firm's saving decision is represented by the following function:

$$SBG = SBG\ (CYNTG,\ GRGNPL1) \tag{3.8}$$

The firm, unlike the household, may allocate its net corporate income after tax and depreciation allowances between dividend payments and net retained earnings. Therefore, it is hypothesized that the firm's net saving ratio (SBG) depends on its current net corporate profit after tax (CYNTG) (Turnovsky, 1964).

Changes in the planned level of investment also influence the level of the firm's retained earnings. If the amount required for investment is anticipated to increase, the firm would then decide to increase its retained earnings in order to avoid resorting to external financing. Planned investment expenditure is likely to increase if the firm perceives a higher rate of return on investment. The growth rate of income in the previous period (GRGNPL1) serves as an indicator of expected rate of return on investment. As national income rises, people tend to consume more, thereby brightening business prospects. Hence, the growth rate of income in the previous period is included in explaining the behavior of the net retained earning ratio (SBG) (Duesenberry, 1958).

Since an increase in the growth rate of real GNP is hypothesized to generate an increase in the business propensity to save (SBG) with a lag as discussed above, the income growth due to business net saving, through its effect on SBG, will also be self-reinforcing but to a lesser extent than in the case of household saving, precisely because of this lagged effect.

In sum, the behavior of the private business retained earning ratio (SBG) is governed by the current net profit after tax ratio (CYNTG), and the growth rate of real income in the previous period (GRGNPL1).

3.1.5 Public Saving

3.1.5.1 Investment Channel of Public Saving

Public saving is derived from the excess of public revenue over public current expenditure. Since public revenue is primarily sourced through various taxes on private activities, public saving represents government net resource mobilization, or government appropriation of domestic resource for public investment. Investible funds from public saving are often used to fiance social overhead capital projects which often have low rates of return and long gestation periods.

The growth effect of the public saving ratio (SGGG) is therefore expected to be relatively less than that of the household saving ratio (SHG), given that public saving is channeled via government appropriation, rather than through financial intermediaries, to finance public investment primarily in low-return long-term projects.

3.1.5.2 Determinants of the Public Saving Ratio (SGGG)

Assuming that the government is pursuing a target growth path, the fiscal behavior of the public sector is hypothesized to be influenced by the nation's income growth target, current economic conditions, and accessibility of alternative public sources of revenue, such as taxation and borrowing from domestic and foreign sources.

Specifically, it is hypothesized that the current planned saving ratio of the public sector (SGGG) depends on the growth gap (TARQDLN), i.e., the previous year's target growth rate minus the previous year's actual growth rate of real income, and on the current planned foreign borrowing ratio (FBG). This is summarized in the following function:

$$SGGG = SGGG\ (TARQDLN,\ FBG) \qquad (3.9)$$

The rationale for including TARQDLN in explaining the behavior of SGGG is that during the period in which the growth rate falls short of the target, e.g., during a recession, government revenue from taxation is less than anticipated, while at the same time, government expenditure is likely to be increased to stimulate economic recovery; the planned saving ratio will therefore decrease.

The inclusion of the foreign borrowing ratio (FBG) in public saving ratio (SGGG) function is based on the assumption that the government has an almost inexhaustible backlog of consumption programs to be undertaken should funds become available. These consumption expenditures are, however, foregone in favor of the public investment required to fulfill the growth target. Given access to borrowing from foreign sources, a government may somewhat be relieved of the restrictions imposed by its investment commitment, and thus be able to spend a larger share of its total revenues on consumption, than would be the case were such external resources not potentially available (Papanek, 1972; Dacy, 1975; Heller, 1975).

In sum, the public saving ratio is hypothesized to be determined by the previous period's growth gap (TARQDLN), and the foreign borrowing ratio (FBG).

3.1.6 Changes in International Reserves

External finance can be in the form of unilateral transfers, foreign direct investment, foreign borrowing, and reduction in foreign exchange reserves. In the present model, unilateral transfers are implicitly treated as additions to gross national product. Foreign direct investment is treated as an exogenous variable. The next two sections, changes in international reserves and foreign borrowing are discussed.

3.1.6.1 Determinants of the Planned Change-in-International-Reserves Ratio (CRPG)

The demand for international reserves arises from the need for insurance against future temporary balance-of-payments disturbances (Brown, 1964; Heller, 1966; Olivera, 1969). A country may plan to draw down its reserves temporarily if the year's current account deficit is unexpectedly and substantially greater than that of the previous year, i.e., there is an unplanned increase in the current account deficit ratio (CCAG > 0). The reverse is true in the case of an unplanned decrease in the current account deficit, or an unexpected increased surplus in the current account balance (CCAG < 0), the country may then plan to accumulate international reserves. Specific benefits to be derived from a reduction in reserves to finance a payment deficit include avoidance of additional foreign borrowing and costly and protracted adjustments by the economy.

In general, the target ratio of change-in-international reserves (CRPG*) is affected by: (1) the volume of trade, i.e., the level of international reserves tends to grow with the imports values; and (2) the movement in the change-in-international-reserves ratio (CRPG) which is affected by any unexpected change in the current account balance in the short-run. In this model, it is assumed that in the absence of unanticipated influences on the current account, the current account deficit ratio (CAG) will remain constant. Therefore, any change in the CAG is assumed to be unexpected. The target ratio of change-in-international-reserves (CRPG*) is determined by an unplanned increase in the current account deficit ratio (CCAG) as follows:

$$CRPG^* = CRPG^*(CCAG) \tag{3.10}$$

or specifically,

$$CRPG^* = a_0 + a_1 CCAG \tag{3.11}$$

With γ as the adjustment coefficient, and CRPGL1 as the ratio of actual change-in-international-reserves in the previous period, the adjustment process may be expressed as follows:

$$CRPG - CRPGL1 = \gamma(CRPG^* - CRPGLI) \tag{3.12}$$

Substituting for CRPG* in the above equation, the following equation is obtained:

$$CRPG = \gamma a_0 + \gamma a_1 CCAG + (1 - \gamma)CRPGL1 \tag{3.13}$$

or simply,

$$CRPG = CRPG(CCAG, CRPGL1) \tag{3.14}$$

Equation (3.14) states that the determinants of the planned change-in-international-reserves ratio (CRPG) are the increase in the current account deficit ratio (CCAG), and the previous period's change-in-international-reserves ratio (CRPGL1).

3.1.7 Foreign Borrowing

As discussed earlier, there are four ways in which a given investment decision can be financed: financial intermediation, self-financing, government appropriation (taxation), and external financing. The discussion of the following section focuses on foreign borrowing as a form of external financing.

3.1.7.1 The Investment Channel of Foreign Borrowing

In a closed developing economy, the available supply of domestic saving sets the limit to investment and growth. However, when external finance from foreign saving becomes available, this enables the economy to invest and accumulate further and to grow beyond the level made possible by domestic resources alone.

The contribution of foreign saving to economic development is through its dual role of supplementing national saving and enhancing the import capacity of the economy. Unlike other foreign resource inflows, a steady inflow of foreign borrowing entails an increasing burden of debt service obligations. Foreign borrowing, therefore, entails an increasing claim on domestic resources and foreign exchange reserves of the country, reducing their availability for future consumption and investment. Because of this, foreign borrowing is generally earmarked in national economic development plans to finance private or public investment projects with high rates of return. Therefore, as long as foreign borrowing can generate more net output than that represented by the cost of borrowing, there should not be a problem of debt servicing capacity in the long run.

In order to examine its impact on economic growth, the foreign borrowing ratio (FBG) is included as an explanatory variable along with other variables in equation (3.1). It is hypothesized that the foreign borrowing ratio positively contributes to the growth rate of real income (GRGNP).

3.1.7.2 Determination of the Foreign Borrowing Ratio (FBG)

Foreign borrowing is the borrowing of real resources from abroad. Assuming a perfectly elastic supply of foreign funds, the size of foreign borrowing reflects the *ex ante* excess demand gap in the local market for goods and services. Thus, the required foreign borrowing is a function of the imbalance in the country's current account. The underlying determinants of the imbalance in the current account can be explained in national income accounting terms as follows:

$$GDP = C^P + I + G + X - M \tag{3.15}$$

Equation (3.15) indicates that the expenditure side of the gross domestic product (GDP) consists of private consumption (C^P), public and private business investment

(I), government consumption expenditure (G) and net exports of goods and nonfactor services (X-M). Gross national product (GNP) is less than gross domestic product (GDP) by the amount of net factor income payments to the rest of the world (O), i.e., remittances and interest payments on foreign debt:

$$GNP = C^P + I + G + X - M - O \tag{3.16}$$

Alternatively, GNP plus net unilateral transfers (U) can be expressed as the sum of private consumption (C^P) and gross private saving, the latter being disaggregated into household saving (S^H), net private business saving (S^B), depreciation allowances (PCFC) and net taxes (T):

$$GNP + U = C^P + S^H + S^B + PCFC + T \tag{3.17}$$

Adding unilateral transfers (U) to the left side of equation (3.16), the right side of equation (3.16) and of (3.17) can be equated to each other, i.e.,

$$C^P + I + G + X - M - O + U = C^P + S^H + S^B + PCFC + T \tag{3.18}$$

The C^P's cancel out. Rearranging the remaining terms, and defining government saving (S^G) as the difference between net taxes (T) and government consumption expenditure (G), i.e., $S^G = (T - G)$,

$$(M + O) - (X + U) = I - S^H - S^B - PCFC - S^G \tag{3.19}$$

The left side of equation (3.19) is the current account deficit (CA). The equation (3.19) represents the flow equilibrium condition in the goods and services market, where the current account deficit equals the excess of public and private gross investment (I) over national saving (S^H - S^B - PCFC - S^G).

In any open macroeconomic system, the current account deficit (surplus) represents national dissaving (saving) vis-à-vis the rest of the world (see Sachs, 1981). In other words, the current account deficit of the home country must be financed by foreign saving, via net capital inflows (NKF) and reductions in the international reserves (CR) of the country, i.e.,

$$(M + O) - (X + U) = NKF - CR \qquad (3.20)$$

Where NKF can further be disaggregated into foreign borrowing (FB) and foreign direct investment (FDI):

$$NKF = FB + FDI \qquad (3.20a)$$

Equation (3.20) is thus a national balance equation which implies that, for the general equilibrium of the economy to hold, planned excess demand in the goods and services market must equal planned excess supply in the securities and money markets.

As implied by equation (3.19), the fundamental determinants of imbalance in the current account are the investment and saving decisions of the household, private business, and government sectors. Analysis of foreign borrowing in a macroeconomic context thus necessarily focuses on the relationship between the home country's current account and its overall saving-investment decision.

Equating the right side of equations of (3.19) and (3.20), and substituting the sum of foreign direct investment (FDI) and foreign borrowing (FB) for net capital inflows (NKF), the following equation represents the demand for foreign borrowing:

$$FB = I - S^H - S^B - S^G - PCFC - FDI + CR \qquad (3.21)$$

Dividing equation (3.21) through by GNP, each variable can then be expressed as a ratio to GNP:

$$FBG = IDG - SHG - SBG - SGGG - PCFCG - FDIG + CRPG \qquad (3.22)$$

3.1.8 Identity Equations

In order to close the model, the four identity equations are required.

1) The current account deficit ratio (CAG) is defined as the ratio of domestic investment-national saving gap:

$$CAG = IDG - SHG - SBG - SGGG - PCFCG \qquad (3.23)$$

where PCFCG is the depreciation allowances ratio.

2) The increase in the current account deficit ratio (CCAG) is defined as the current account deficit of the

current period (CAG) minus the previous period's current account deficit (CAGL1):

$$CCAG = CAG - CAGL1 \quad (3.24)$$

3) The ratio of other foreign saving inflows (FOFSG) is equal to the sum of the foreign direct investment ratio (FDIG), which is exogenous, and the absolute value of the decline in the international reserves ratio (CRPG):

$$FOFSG = FDIG - CRPG \quad (3.25)$$

4) The private corporate net profit ratio (CYNTG) is defined as the sum of private business net retained earnings ratio (SBG) and the dividend ratio (DVDG), which is an exogenous variable:

$$CYNTG = SBG + DVDG \quad (3.26)$$

The estimating equations of the model are presented in Appendix A, together with the variable definitions.

3.2 Implications of the Model

In any time period, due to the aforementioned lagged response of planned investment expenditures to investment decisions, the gross domestic investment ratio (IDG) is determined by lagged explanatory variables as expressed in equation (3.6), and is thus given as a datum. National sectoral saving ratios are then determined according to equations (3.7), (3.8) and (3.9). The resulting resource gap ratio is the current account deficit ratio (CAG), given by identity (3.23). This deficit requires foreign resource inflows to fill the gap, assuming domestic prices and interest rates to be functions of world prices and interest rates, respectively. Therefore, an increase in national saving will be at the expense of foreign resource inflows, the latter being the sum of foreign borrowing, foreign direct investment and reductions in international reserves.

More specifically, equation (3.22) for foreign borrowing (FBG) implies that, for equilibrium in the output and loanable funds markets to hold simultaneously, the required foreign saving must be equal to the excess demand for national saving. In other words, an excess of ex ante domestic investment over national saving will show up in two ways: (1) in the loanable funds market, as excess demand for borrowing; and (2) in the goods and services market, as excess demand for output. Given depreciation allowances (PCFCG) and foreign direct investment (FIG), the excess demand for funds is the demand for foreign borrowing, and the excess demand for goods and services is the demand for imports. In the present model, demand for foreign borrowing means borrowing real resources from abroad.

The overall amount of investment is determined by equation (3.6), which in turn determines the overall amount of saving according to equation (3.22) of FBG. The latter equation is an equilibrium condition which states that planned total investment is equal to total planned saving. Equation (3.1) of the growth rate of real GNP (GRGNP), implies that GRGNP will depend not only on the total amount of investment which determines the total amount of saving required, but also on the efficiency of the sectoral composition of aggregate saving, namely, household saving, private corporate net saving, public saving, foreign borrowing and other foreign saving. Sectoral saving, in turn, determines the composition of investment and has differential growth effects on GNP growth.

Since household saving is channeled to investment mainly via financial intermediaries which supposedly allocate investible funds via the market mechanism and hence provide for a relatively more efficient allocation than other investment channels (namely, self-finance from private corporate retained earnings, and government appropriation of public saving), and given the simultaneous interdependence of the household saving ratio and the growth rate of real income (GRGNP), it is hypothesized that the household saving ratio has the strongest impact on income growth (GRGNP).

In the present model, the total causal effects of foreign borrowing on national sectoral saving can be disaggregated into direct and indirect effects. The direct effect of foreign borrowing on national saving is taken into account in equation (3.9) for the public saving ratio (SGGG). FBG enters equation (3.9) directly as an independent variable in explaining the behavior of SGGG. The indirect causal effects of FBG on SHG, SBG and SGGG are captured via the GRGNP and GRGNPL1 variables, which enter the national sectoral saving ratio equations as explanatory variables, while GRGNP is partly determined by FBG as expressed in equation (3.1).

In the present model, the impact of the foreign borrowing ratio on growth depends on its total effects on the national sectoral saving ratios, which in turn partly determine the growth rate of income (GRGNP) according to the Harrod-Domar growth model.

Identity equation (3.22) of FBG states that foreign resource inflows, specifically foreign borrowing, and national resources are additive, i.e., foreign resources supplement national saving. Foreign borrowing allows the release of more resources for more productive investment, and hence permits a higher growth rate of income (GRGNP) to be attained than would be possible with national resources alone. A higher growth rate of income (GRGNP) in turn generates a higher propensity to save in the domestic economy, which further fuels income growth.

Consequently, the effect of foreign resource inflows, specifically the foreign borrowing ration (FBG), on income growth (GRGNP) is hypothesized to be positive as they enhance the availability of domestic resources for investment both directly and indirectly.

CHAPTER IV

DISCUSSION OF EMPIRICAL FINDINGS FROM MODEL ESTIMATION

In this chapter, using annual time-series data for Thailand over the period 1961-1982, the econometric results obtained from the estimation of the macroeconomic model developed in the previous chapter will be presented, along with some comments. The sources and construction of data for the variables used in model estimation are discussed in Appendix B. The results of two-stage least squares estimation of the model are presented below for each equation. It should be noted that the number in parentheses below each coefficient estimate is the t-value. An asterisk is used to denote the t-value of a coefficient that is significant at the 10 percent level. $\bar{R}^2$s are the usual R^2 adjusted for the inclusion of additional variables. All Durbin-Watson and Durbin h statistics indicate no serial correlation of error terms at the 5 percent significance level.

The presentation of empirical findings is divided into four sections. The first section deals with the empirical evidence of differential growth effects of national sectoral saving ratios and empirical estimates of the household saving ratio, private corporate business net saving ratio, and public saving ratio equations. The second section presents empirical evidence on the income growth effect of the foreign borrowing ratio. The third section discusses empirical evidence on the impacts of the oil price shocks in 1973-74 and 1979-80 on national sectoral saving and on the growth rate of real income. The last section deals with the empirical estimation of the investment ratio and the change-in-international-reserves ratio equation.

4.1 Empirical Evidence of the Differential Growth Effects of National Sectoral Saving

The regression result for equation (4.1) expressing GNP growth rate as a function of the different sectoral saving ratios is given below:

$$\begin{aligned} GRGNP = & \underset{(-.27)}{-.00638} + \underset{(3.53)^{*}}{.73561}\ SHG - \underset{(-1.80)^{*}}{1.8908}\ SBG + \underset{(.60)}{.18926}\ SGGG \\ & \underset{(2.01)^{*}}{.59542}\ FBG + \underset{(.87)}{.36312}\ FOFSG - \underset{(-1.81)^{*}}{.02011}\ D792 \end{aligned} \qquad (4.1)$$

$$\bar{R}^2 = .4943 \qquad D.W. = 1.6973$$

The Thai household saving ratio (SHG) coefficient is statistically significant and shows the greatest positive effect on the growth rate of real income (GRGNP) among the national sectoral saving ratios. This holds true for both the structural coefficient and the elasticity at the mean. The value of its structural coefficient is 0.73561, which indicates that the direct growth effect of SHG is quite substantial, that is, a 10 percentage point increase in SHG will be accompanied by a 7 percentage points rise in the rate of growth of real GNP in Thailand. In terms of its elasticity at the mean, the value is 1.2, which indicates that, on the average, a 10 percent increase in Thai SHG correspond to a 12 percent rise in the growth rate of income of Thailand.

The growth effect of the public saving ratio (SGGG), although positive, is not statistically significant at the 10 percent level, i.e., SGGG has no statistically significant effect on the growth rate of real GNP (GRGNP) for Thailand during the period.

It is interesting to note that the estimated coefficient of the private corporate net saving ratio (SBG) (-1.8908) has a significant negative sign, which is a surprising result. However, the value of its elasticity at the mean is around 0.2 which is quite negligible as compared with that of SHG.[1]

In summary, the above empirical results suggest that sectoral saving have different income growth effects. Specifically, the result confirms the hypothesis that the household saving, expressed as a ratio to GNP, has the strongest positive relationship with the growth rate of real GNP. However, the negative growth impact of private business net retained earnings is a surprising result.

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[1]Coefficients of variables FBG and D792 in equation (4.1) will be discussed later under proper headings.

The empirical estimates for each national sectoral saving ratio equation are provided below to gain additional insights.

4.1.1 Empirical Estimation of the Household Saving Ratio Equation

$$\underset{}{SHG} = \underset{(-.29)}{-.02601} + \underset{(1.72)}{.18939}\ HYNTTG - \underset{(-9.36)^{*}}{.29901}\ AR5 + \underset{(2.38)^{*}}{.317}\ GRGNP$$

$$\underset{(-1.34)}{-.04581}\ DR1 + \underset{(2.91)^{*}}{.02643}\ D75 \qquad (4.2)$$

$$\bar{R}^2 = 0.7814 \quad D.W. = 1.6424$$

Although not all the estimated structural coefficients are statistically significantly at the 10 percent level, each has the expected sign. The overall goodness of fit of the equation to the data is given by the $\bar{R}^2$ of .7814. Regression equation (4.2), therefore, explains almost 80 percent of the variation in the household saving ratio or average propensity to save (SHG), which is quite high. The result in general is satisfactory.

An increase in the household average propensity to save (SHG) provides more investible funds via financial intermediaries to increase income growth (GRGNP) through a greater rate of investment. A higher growth rate of income (GRGNP) in turn induces a higher household propensity to save (SHG) as argued by the life-cycle saving hypothesis presented in the preceding chapter.

In examining the effect of interest rates on the household saving ratio (SHG), this study tried three alternative measures of the expected real interest rate, based on the three alternative assumptions regarding the expected inflation rate, i.e., (1) the expected inflation rate is equal to actual current inflation rate; (2) the expected inflation rate is equal to the previous period's actual inflation rate; and (3) the expected inflation rate is equal to that forecast by a time-series model (the rational expectations hypothesis; see Appendix B, section A.4.3).

The econometric results show significant negative coefficients for the real expected interest rate under all three alternative assumptions, although the magnitude of the coefficients appears to be rather small.

In equation (4.2) above, the ex post real deposit rate (AR5), derived as the nominal deposit rate (ID5) minus the actual current inflation rate, is assumed to be a proxy for the unobserved ex ante rate. This assumption is considered to be appropriate for saving and investment decisions in the present macroeconomic model. The same assumption was also made by Sachs (1981) and Mishkin (1981). It is noted that the coefficient of AR5 exhibits a significant negative relationship with the SHG.

The empirical finding of the negative response of the SHG to an increase in the real rate of interest (AR5) suggests that Thai households may have a life-cycle saving motivation and the income effect (from a change in interest earnings) of the interest rate change dominates the substitution effect, so that there is a net negative effect of interest rate changes on household saving.

It is noted that the elasticity at the mean of the disposable income ratio (HYNTTG) is 1.3, the highest among those of the estimated structural coefficients. Hence, on the average, an increase in HYNTTG tends to have the strongest effect on the household saving ratio (SHG). This empirical finding tends to support the Keynesian saving hypothesis which argues that saving behavior is determined by current income. It should be noted, however, that the structural coefficient estimate for HYNTTG is not statistically significant at the 10 percent level.

4.1.2 Empirical Estimation of the Private Corporate Net Saving Ratio Equation

Evidence regarding corporate saving, especially in developing countries is rather hard to come by because of inadequate data and lack of systematic study in this field. The theoretical determinants of the private corporate saving rate are less well established and it is an area in which very little research has been done in developing countries.

One generalization which has been made, however, is that corporate saving is positively related to the rate of growth of national income. As argued in the preceding chapter, SBG is also positively related to the growth rate of real income in the previous period (GRGNPL1), which serves as a proxy for the rate of return on investment. The empirical estimation of the private corporate net saving ratio equation, as shown below, tends to support this latter proposition.

$$\underset{(-2.46)^{*}}{SBG = -.00161} + \underset{(39.05)^{*}}{.78327\ CYNTG} + \underset{(1.81)^{*}}{.01256\ GRGNPL1} \qquad (4.3)$$

$$\bar{R}^2 = .9865 \qquad D.W. = 1.8133$$

These results suggest that key determinants of the corporate net saving ratio (SBG) are the previous period's growth rate of real GNP (GRGNPL1) and the corporate net profit ratio (CYNTG). Both estimated coefficients have a significant positive sign as expected. However, the effect of CYNTG on net retained earning ratio is more pronounced than the effect of GRGNPL1, since the elasticity at the means for CYNTG is around 1.1, while that for GRGNPL1 is only 0.1. On the average, a 10 percent increase in the growth rate of real GNP for the previous period will lead to only a 1 percent increase in the net retained earnings ratio (SBG).

The estimated structural coefficient of CYNTG is 0.78 which suggests that the Thai private corporate sector in general tends to save a substantial portion of the increase in net profit after tax. Apparently, almost four-fifths of an increase in corporate net profit after tax will be saved as internal funds and only one-fifth distributed as dividends to shareholders.

4.1.2.1 Empirical Evidence on Low Investment Efficiency of Private Net Retained Earnings

We have argued that self-financed investment is often not as productive as investment financed from outside sources (see section 3.1.4.1). It is hypothesized that investible funds from net retained earnings are often used to finance lower-yielding projects and, as a consequence, significantly increase the overall incremental capital-output ratio (ICOR).

In order to test the above hypothesis, we regressed the national ICOR, which was used as a proxy for average investment efficiency,[2] on the national sectoral saving ratios, namely, the household saving ratio (SHG), the private net retained earnings ratio (SBG), the public saving ratio (SGGG), the foreign borrowing ratio (FBG) and the other foreign resource inflows (FOFSG). Data for the sample

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[2]The variable ICOR is used for convenience in calculation. However, it contains several defects, e.g., it does not take into account the degree of dependence of capital productivity upon the labor factor and the marginal product of labor. Neither does it take into account the time dimension of returns to capital, etc. Interpretation of the results should be treated with caution.

period 1961 to 1982 for Thailand and the ordinary least squares method were used. The regression results are as follows:

$$\underset{(3.19)^*}{\text{ICOR} = 5.1004} - \underset{(-2.09)^*}{28.304}\ \text{SHG} + \underset{(3.08)^*}{212.08}\ \text{SBG} - \underset{(-.27)}{4.658}\ \text{SGGG}$$

$$- \underset{(-1.57)}{24.265}\ \text{FBG} - \underset{(-1.06)}{23.70}\ \text{FOFSG} \qquad (4.3a)$$

$$\bar{R}^2 = .2579 \qquad \text{D.W.} = 2.63$$

It can be seen that while coefficients of SHG, SGGG, FBG and FOFSG have negative signs, although only the coefficient of SHG is statistically significant at the 10 percent level, the coefficient of SBG has a positive sign. The magnitude of the structural coefficient (28.30) of SHG is the largest value among those of the four variables mentioned above. The same is true for the magnitude of the elasticity at the mean value of SHG which is 0.94. It suggests that, on the average, a 10 percent increase in the household saving ratio (SHG) will be accompanied by a 9.4 percent decrease in the overall capital-output ratio (ICOR).

Of interest is the coefficient of SBG which exhibits a positive sign as expected and the level of significance is quite high. The magnitude of its structural coefficient and the elasticity at the mean are 212.08 and 0.61, respectively. The latter value indicates that a 10 percent increase in the private net retained earning ratio (SBG) will lead to a 6.1 percent increase in the overall capital-output ratio (ICOR).

Empirical evidence provided by equation (4.3a) tends to support the hypothesis that SHG has a higher investment efficiency effect, while SBG which causes a pronounced increase in the ICOR may have the lowest investment efficiency effect as compared to other components of investment finance.

The above empirical findings--i.e., (1) the high average propensity to save of the private corporate sector, and (2) the low investment efficiency of corporate net saving--tend to support the hypothesis that self-financed investment is not an efficient channel in allocating investible funds. This is the basis for the argument that, among national sectoral saving, the growth impact of SBG is relatively less than that of other national sectoral saving ratios, especially that of SHG.

4.1.3 Empirical Estimation of the Public Saving Ratio Equation

The estimated equation (4.4) for the public saving ratio is presented below:

$$\underset{}{SGGG} = \underset{(13.22)^*}{.032614} + \underset{(.86)}{.09514}\ FBG - \underset{(-4.24)^*}{.30118}\ TARQDLN + \underset{(2.30)^*}{.01926}\ D74$$

$$- \underset{(-5.44)^*}{.02508}\ D792 \qquad (4.4)$$

$$\bar{R}^2 = .7294 \qquad D.W. = 1.2216$$

The estimated coefficient of the foreign borrowing ratio (FBG), while it has the positive sign, is statistically insignificant. This empirical finding has important implications regarding the role of foreign borrowing in the process of economic growth in Thailand. The above econometric results suggest that foreign borrowing does not substitute for public saving in Thailand.

It is noted that the intercept term, which is the average propensity to save, of the public saving ratio (SGGG) in the regression equation (4.4) has a significant positive sign with a value of 0.032614, compared with its historical arithmetic mean value .032068. This empirical evidence confirms that, on the average, Thai public saving is around 3 percent of gross national product.

Furthermore, the statistically significant intercept term indicates that the behavior of the public saving ratio (SGGG) is also influenced by some autonomous factors, i.e., socio-political factors.

According to the regression equation (4.4), the estimated coefficient of TARQDLN, which serves as a proxy for the compensatory fiscal policy, exhibits a strongly significant negative sign, as expected. The value of the coefficient, which is -0.30118, indicates that a 10 percentage point decrease in the previous period's growth gap (TARQDLN) will lead to an increase in the public saving ratio (SGGG) by 3 percentage points. It appears, therefore, that the Thai government followed a compensatory fiscal policy during the period. The impact of compensatory financing on Thai SGGG, however, is rather mild.

The significant TARQDLN also tends to support the theoretical argument in Chapter III that, similar to the private net retained earnings ratio (SBG), an increase in the current growth rate of real GNP (GRGNP) will generate an increase in the public propensity to save (SGGG) in the next period. Consequently, both SBG and SGGG are argued to have less growth effect, especially SBG, than that for the household saving ratio (SHG), since unlike SHG, SBG and SGGG respond to GRGNP with a one-year lag.

4.2 Empirical Evidence on the Income Growth Effect of Foreign Borrowing

The hypothesis that foreign borrowing, expressed as a ratio to GNP, positively contributes to growth has found support from the empirical evidence in the regression equations (4.1) and (4.4).

According to the estimated equation (4.1), the foreign borrowing ratio exerts a significant positive effect on the growth rate of real GNP of Thailand, albeit rather small, as the values of its structural coefficient and elasticity at the mean are 0.59542 and 0.14296 respectively. On the average, a 10 percent increase in FBG will lead to only a 1.4 percent increase in Thai GRGNP.

The above significant positive growth effect of Thai FBG is consistent with the empirical finding from the estimated equation (4.4), where no statistically significant effect on the Thai public saving ratio (SGGG) was found for the FBG variable.

As discussed in Chapter III, the impact of FBG on GRGNP would work not only directly as expressed in equation (4.1), but also through its effect on national saving, specifically, on SGGG, which in turn determines GRGNP in the usual manner of the Harrod-Domar model. In other words, the impact of the foreign borrowing ratio (FBG) on income growth (GRGNP) could be diluted because it effects a substitution for public saving ratio (SGGG). However, the above empirical evidence indicates a statistically insignificant relationship between FBG and SGGG for the Thai data. An increase in Thai foreign borrowing can thus be expected to supplement, rather than supplant, national saving and to promote the economic growth process in Thailand.

The above empirical finding of the positive growth effect of foreign borrowing is in sharp contrast with the conclusions of radical critics (see Rahman, 1967; Griffin, 1970; Weisskopf, 1972) who have argued that foreign resource inflows, via a negative causal relationship with domestic saving, have a negative impact on the economic development process in recipient countries.

4.3 Empirical Evidence on the Effects of Oil Price Shocks on National Sectoral Saving and the Growth Rate of Real Income of Thailand

4.3.1 Impact of Oil Shocks on National Sectoral Saving

4.3.1.1 Positive Impact of First Oil Shock on Thai Household Propensity to Save

In the preliminary estimates of the Thai household propensity to save equation, both oil-shock dummies D75 and D792 were included to account for the impacts of the two oil shocks in 1975 and in 1979-1982, respectively. However, dummy variable D792 was dropped from the equation in the final estimate, as its coefficient turned out to be insignificant at the 10 percent level, which suggests that Thai SHG was not affected significantly by the second oil shock.

It is interesting to note that the coefficient of D75, which represents the impact of the first oil shock on SHG, has a significant positive sign (see equation (4.2)). The statistical result indicates that there was a significant shift upward in the Thai household saving ratio by 2.6 percentage points in 1975.

It is notable that the first oil price shock had led the Thai economy to experience high inflation rates and accompanying negative real interest rates. Consequently, during those periods of price instability, Thai consumers saved more probably in order to maintain their consumption standard in the future.[3]

4.3.1.2 No Impact of Oil Shocks on Thai Net Retained Earnings Ratio

In the early estimates of Thai SBG, two oil-shock dummy variables, i.e., D75 and D792 were included in the regression to capture the impact of the oil shocks on SBG. Both estimated coefficients of D75 and D792 were not statistically significant at the 10 percent level, although they had the expected negative sign. This empirical result suggests that the propensity to save of the private business sector (SBG) was not affected by the oil price hikes (referred to in equation (4.3)).

One explanation which could be advanced for the above result is that although costs of production had increased due to higher oil prices, prices of output had been increased as well to catch up with the higher cost. This

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[3]The first oil price shock in 1973-1974 had a delayed recessionary impact in 1975 because of the 1973-74 commodity boom, when some of Thailand's major exports enjoyed a surge in international market prices. Subsequently, household saving ratio increased sharply in 1973-1974. Excluding the years 1966, 1973-74 and 1980, the household saving ratio in 1975 was the highest ratio since 1961 (see Table 2.3).

is, in fact, consistent with the prevailing high inflation rates during the two oil-shock periods. Hence, firms' average propensity to save need not have changed.

4.3.1.3 Substantial Negative Impact of Second Oil Shock on Thai Public Propensity to Save

The dummy variable of the first oil shock (D75) was dropped in the preliminary estimates, as its estimated coefficient was not statistically significant. The estimated equation (4.4) of Thai SGGG thus includes only the dummy variable for the second oil shock, i.e., D792, which exhibited a statistically significant negative sign as expected. The coefficient of D792 is -0.02508, which suggests that there was a substantial downward shift in the Thai public propensity to save during 1979-1982. Specifica-ly, other things being equal, Thai SGGG had declined from 0.03261 (the estimated intercept) to 0.00753 in 1979-1982. In other words, Thai public saving had declined from 3 percent of GNP to less than 1 percent of GNP during the period.

The above empirical result indicates that the second oil shock in 1979-1982 had a significant negative impact on the Thai public propensity to save (SGGG). This is consistent with historical events during that period of prolonged recession for the Thai economy. The severe external shock of the second round of oil price increases and the deep and prolonged world recession that followed had caused the current actual growth rate of income of Thailand to decline substantially and lag behind her target growth rates. In order to rapidly stimulate the economy immediately in short run, the government of Thailand expanded its activities by significantly increasing its current consumption expenditure, and as a result, the public saving ratio (SGGG) declined sharply during the period of the second oil shock.

4.3.2 Substantial Negative Impact of Second Oil Shock on Thai Growth Rate of Real GNP

The estimated equation (4.1) indicates that the growth rate of real GNP of Thailand was significantly affected by the second oil shock in 1979-1982. The coefficient of D792, which is -0.02011, indicates that the second oil shock coincided with a two percentage point decline in GRGNP. In the preliminary estimates of Thai GRGNP, D75 had been included in the regression equation. However, the variable D75 was dropped as it was not statistically significant at the 10 percent level.

The above empirical result is consistent with the historical experience of Thailand, where the second oil shock had a more pronounced recessionary effect on the investment climate and the growth rate of income than the first oil shock. It is noted that Thailand weathered the first oil shock more smoothly than the second oil shock. The main reasons accounting for this were Thailand's strong balance of payments, reserve and debt positions at the outset of the first oil shock due to high export prices in 1972-74. Only in 1975 was there a serious worsening of the Thai balance of payment. In contrast, Thailand was already in a weakened position on its balance of payments and international reserves when the successive oil price increases of 1979-1980 hit the world economy. The prolonged world recession that followed resulted in still higher deficits, and further deterioration of the reserve position and the debt ratio, and led to a less favorable investment climate and a lower growth rate of real GNP than was the case in the first oil shock in 1975.

4.4 Empirical Estimation of the Gross Domestic Investment Ratio Equation and the Change-in-International-Reserve Ratio Equation

4.4.1 Empirical Estimation of the Gross Domestic Investment Ratio Equation

The regression results of the estimation of the gross domestic investment ratio equation are presented in equation (4.5) below:

$$\text{IDG} = \underset{(2.78)^*}{.07876} + \underset{(6.75)^*}{.64774}\ \text{IDGLI} + \underset{(0.47)}{.08501}\ \text{GRGNPL1}$$

$$- \underset{(-1.63)}{.10235}\ \text{AR2L1} + \underset{(2.73)^*}{.02761}\ \text{D779}$$

$$\bar{R}^2 = 0.7220 \qquad \text{D.W.} = 1.8582$$

Durbin h statistic = -0.4955

The above empirical results suggest that there is indeed a lag in the adjustment of the domestic investment ratio. The above equation implies a reaction coefficient (β) of 0.35226, where the coefficient of IDGL1 is equal to ($1-\beta$). This means that it takes about three years to complete the adjustment process of the investment ratio to its explanatory variables, namely, the previous period's real lending rate (AR2L1), and the previous period's income growth rate (GRGNPL1).

The positive significant impact of petro-dollar recycling during 1977-1979 on the investment ratio is indicated by the coefficient of D779 in equation (4.5) above and conforms to expectations.

The second half of the 1970s was the period when the world system focused its attention on the problem of recycling petro-dollars. Governments, commercial banks, the World Bank, and the IMF all joined in facilitating the flow of credit to the oil-importing developing countries. The high degree of liquidity of commercial banks made funds readily available, while continuing high inflation made the real rate of interest very low or even negative. These factors, no doubt, helped to explain the high investment ratios and heavy external borrowing in 1977-1978, and, together with some degree of complacency arising from Thailand's experience in weathering the first oil shock, may help to explain also why the boom continued in the face of a deteriorating world economic situation and worsening balance of payments.

The lag structure of the investment ratio function is one of the key characteristics of the present model used to explain the process of foreign borrowing determination and distinguishes the accounting relationship, as expressed in the identity equation of FBG, from the behavior relationship between the foreign borrowing ratio (FBG) and the national sectoral saving ratios. The effort to distinguish between those two types of relationships helps to understand the positive impact of FBG on the income growth rate (GRGNP), as is hypothesized in the study.

4.4.2 Empirical Estimation of the Change-in-International-Reserves Ratio Equation

The estimated equation (4.6) for CRPG in the case of Thailand is presented below:

$$
\begin{aligned}
CRPG = \underset{(0.01)}{0.00002} + \underset{(8.74)^*}{0.94417}\, CPRGL1 - \underset{(-4.48)^*}{.32954}\, CCAG \\
+ \underset{(3.21)^*}{0.02202}\, D74 - \underset{(-2.74)^*}{0.02087}\, D75 \qquad (4.6)
\end{aligned}
$$

$\bar{R}^2 = 0.7782$ D.W. = 2.2973

Durbin h statistic = -0.96417

Regression equation (4.6) seems to fit the actual data well as indicated by its $\bar{R}^2$. Examining equation (4.6) in detail, it is found that the adjustment of CRPG does occur with a lag. The coefficient of the lagged dependent variable (CRPGL1) exhibits the expected sign and is statistically significant. Since the value of the coefficient is 0.94417, and equal to one minus the reaction coefficient, the reaction coefficient of CRPG can be computed as 0.05583. This finding suggests that only one-seventeenth of the adjustment of CRPG to the change in the explanatory variable, namely, increase in the current account deficit ratio (CCAG), takes place within a given year. The adjustment process of the change-in-international reserves ratio is very much slower than the adjustment process of the gross domestic investment ratio. The reaction coefficient of the latter is 0.35226.

Unexpected increases in the current account deficit ratio from the previous period (CCAG) also have a significant negative effect on CRPG. The structural coefficient of CCAG is .32954. This implies that, within a year, an unexpected increase in the current account deficit ratio (CCAG) of 10 percentage points will reduce CRPG by 3.3 percentage points. This result suggests that the Thai monetary authority draws down its international exchange reserves to finance an unexpected increase in the current account deficit.

CHAPTER V

TEST OF MODEL VALIDITY

The explanatory power of each of the estimated equations presented in Chapter IV may be acceptable by conventional standards, i.e., relatively high adjusted $\bar{R}^2$s, coefficients of key explanatory variables with correct signs and high t-values, and Durbin-Watson statistics and Durbin h statistics which indicate no serial correlation in the error terms. These characteristics provide no guarantee, however, that the present model will perform satisfactorily as a unit, since there are interdependencies in the model that have to be taken into account when evaluating the model as a whole.

This chapter deals with three rigorous tests of the validity of the present macroeconometric model as a whole. The chapter is divided into two sections. The first section outlines the procedure of *ex post* dynamic simulation, followed by a discussion of the performance of the model based on three tests. These are: (1) tracking actual data; (2) reproducing historical turning points; and (3) checking the overall sensitivity of the model. The three tests are performed within the context of *ex post* dynamic simulation of the model over the sample period. The second section then provides an evaluation of model validity.

5.1 *Ex Post* Dynamic Simulation

Ex post dynamic or historical simulation can be described as a simulation process in which actual values for all current and lagged exogeneous variables are used, but only initial actual values for the lagged endogenous variables are used. Applying the above procedure to the present model, the model then starts to generate historical simulated values or solution values in the first simulation period for the endogenous variables, namely, the household saving ratio (SHG), the net retained earnings ratio (SBG), the public saving ratio (SGGG), the gross domestic investment ratio (IDG), the change-in-international-reserves ratio (CRPG), the growth rate of real income (GRGNP), the demand for foreign borrowing ratio (FBG), the current account deficit ratio (CAG), the increase in current account deficit ratio (CCAG), the other foreign resource inflows ratio (FOFSG) and the net private business profit ratio (CYNTG). The historical simulated values of endogenous variables obtained are then used to generate solution values for the second period. The process is repeated for each succeeding period until the end of the estimation period.

5.1.1 Data Tracking Ability of the Model

By performing an *ex post* dynamic simulation as discussed above, one can test the validity of the model by examining how closely each endogenous variable tracks its corresponding historical data series. One of the quantitative measures most often employed to test how closely each individual endogenous variable tracks its corresponding data series is the root-mean-square (RMS) simulation error. The RMS error is a measure of the deviation of the simulated variable from its actual time path. The magnitude of this simulation error is then evaluated by comparing it with the historical average annual values of the variable in question. In general, we expect the RMS error of each endogenous variable to be smaller than its corresponding historical mean value. Another simulation error statistic is the RMS percent error, which measures the deviation of the simulated variable from its actual time path in percentage terms. The RMS simulation errors in both forms are generally considered a rather good measure of simulation performance.

Table 5.1 shows the RMS error and RMS percent error for each individual endogenous variable in the present model, along with the means of its historical and simulated average annual values.

Comparing the RMS simulation error with the historical mean value of each variable, it is observed that except in the case of CRPG, CAG, CCAG and FOFSG, the RMS error for each variable is much smaller than its corresponding historical mean value. CRPG, CAG, CCAG, FOFSG, SGGG and FBG show quite large RMS percentage simulation error,

TABLE 5.1

RESULTS OF HISTORICAL SIMULATION, 1961-1982

Variable	Historical mean value	Simulated mean value	RMS error	RMS % error
GRGNP	.07091	.0693	.01364	18.48
IDG	.23637	.23364	.01810	8.32
SHG	.11456	.11405	.01094	9.36
SBG	.00998	.00989	.00153	36.56
SGGG	.03207	.03015	.01078	92.77
CRPG	.00815	.00422	.01259	109.14
FBG	.01703	.01288	.01214	367.93
CAG	.01523	.01501	.01914	154.40
CCAG	.00230	.00337	.01767	605.31
FOFSG	-.00180	.00212	.01259	84.80
CYNTG	.01362	.01353	.00153	20.79

especially CCAG with a 605 percent error. The large error of CCAG is not a surprising result or unexpected, since behavior of CCAG is mainly subject to exogenous shocks to CAG which are not captured by the model.

Except for the foreign borrowing ratio (FBG), the simulated values of key variables of the model, such as the household saving ratio (SHG), gross domestic investment ratio (IDG) and the growth rate of real income (GRGNP) appear to be quite satisfactory. Their RMS error and RMS percent error are relatively low, especially those of SHG and IDG. FBG is derived as a residual or serves as an adjustment mechanism in the domestic market, and hence tends to absorb any exogenous shocks which may not be predicted by the model. As a consequence, large errors of FBG are to be expected.

The satisfactory historical simulation result of SHG, IDG and GRGNP tends to strengthen the empirical results provided by the present study with reference to the hypothesis that the household saving ratio yields the greatest sectoral effect on the income growth rate and that foreign borrowing contributes positively to income growth.

However, RMS error simulation is only one measure of model performance. The ability of the model to duplicate turning points or rapid changes in the historical data is an important criterion for model evaluation as well.

5.1.2 Ability to Reproduce Historical Turning Points

Figures 5.1 to 5.11 present graphically the results obtained from historical simulation. In each figure the simulated series of an endogenous variable is compared with the actual data series. The total number of historical turning points are also listed. The number of turning points correctly simulated; number of simulated turning points within a one year lead or lag; and the number of historical turning points missed by the simulated series are included.

In general, it is observed that, in each case, the simulated series of the endogenous variable seems to reproduce the corresponding general long-run behavior of the actual series very well. In addition, most short-run fluctuations in the actual series are also reproduced quite well. Most turning points of the actual series are reproduced, although almost half the endogenous variables have simulated series which appear to not track their corresponding historical data so closely in view of their large RMS and RMS percentage errors.

Specifically, despite the simplistic nature of the present model and the large RMS errors for some endogenous variables, the present model generally simulates turning points in the historical data quite well, especially the simulated series of the household saving ratio (SHG), private business net retained earnings ratio (SBG), the

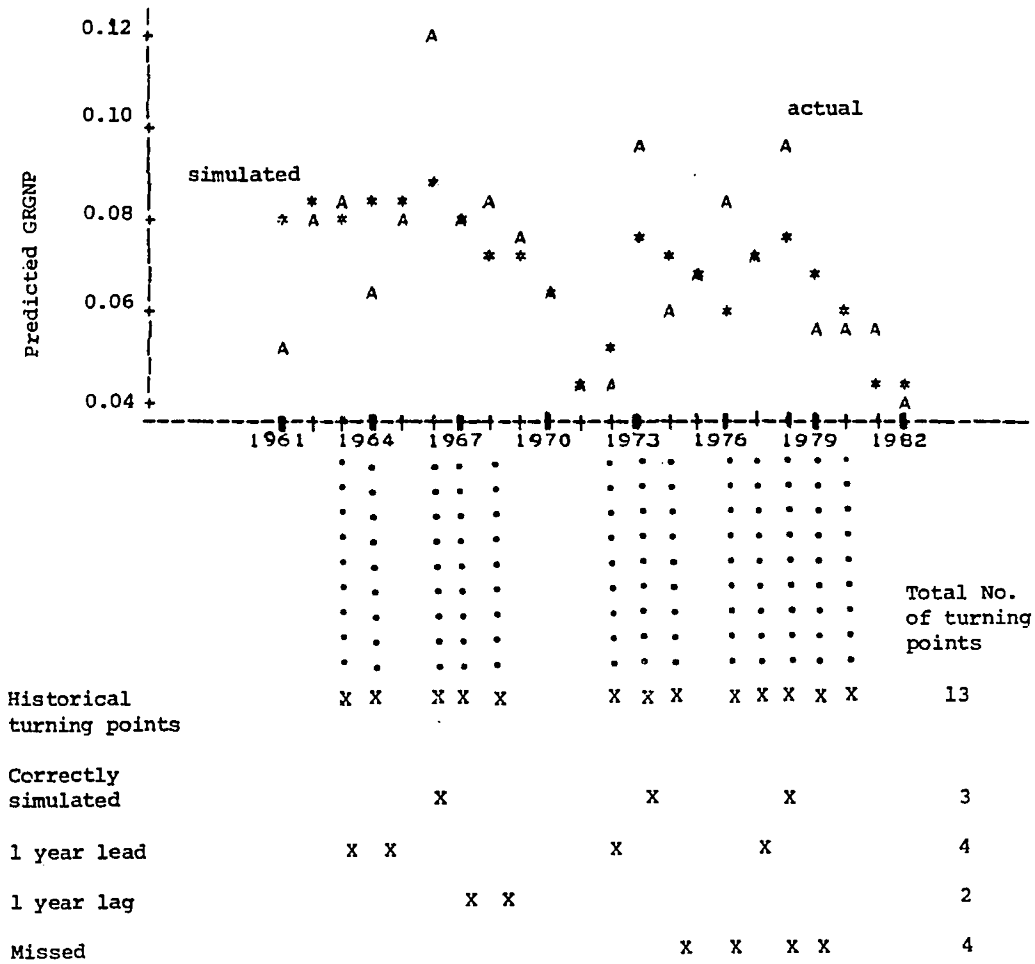
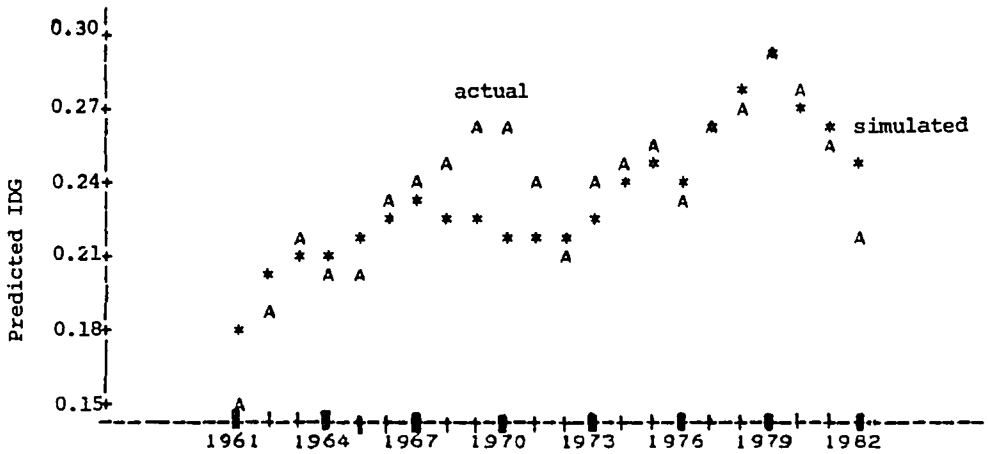
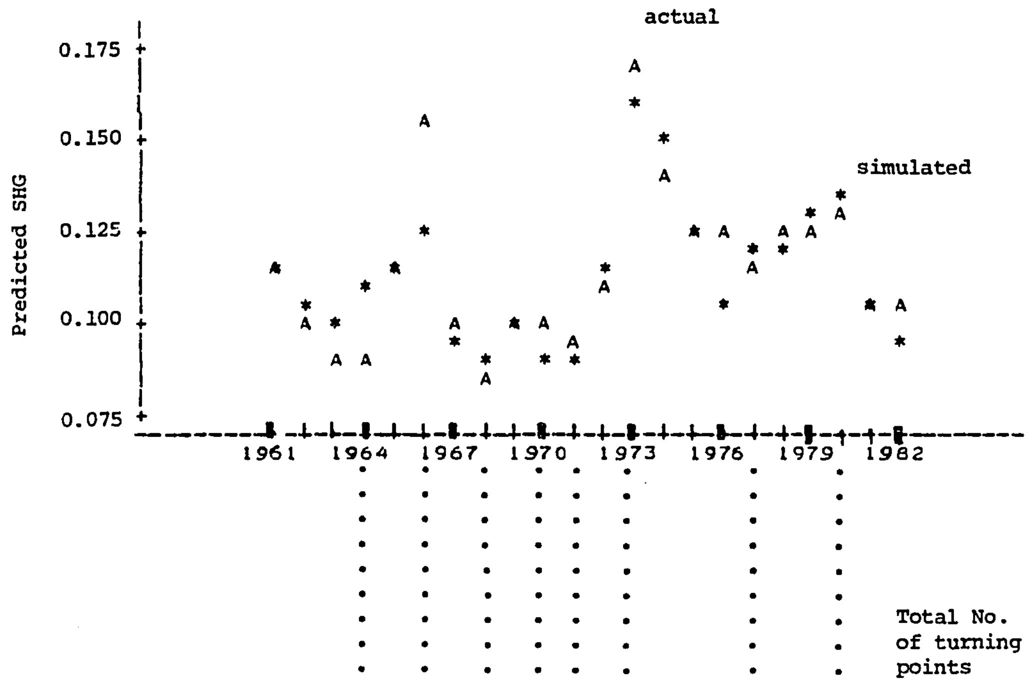


Figure 5.1 Historical simulation of the growth rate of real GNP (GRGNP)



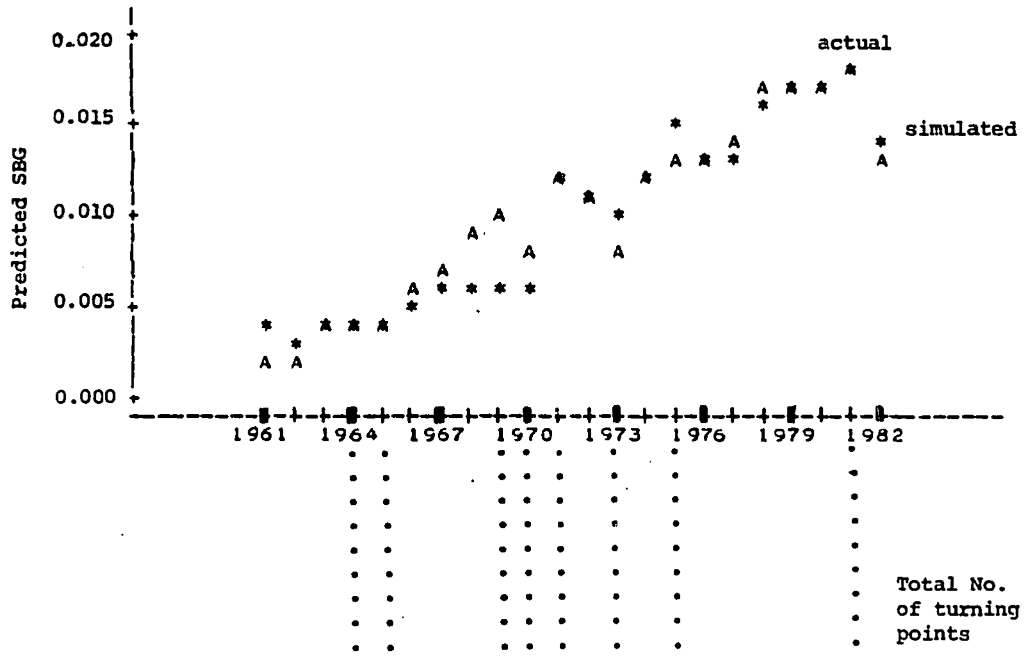
								Total No. of turning points
Historical turning points	X	X	X	X	X	X	X	7
Correctly simulated					X	X	X	3
1 year lead								0
1 year lag								0
Missed	X	X	X	X				4

Figure 5.2 Historical simulation of the gross domestic investment ratio (IDG)



									Total No. of turning points
Historical turning points	X	X	X	X	X	X	X	X	8
Correctly simulated		X	X		X	X		X	5
1 year lead	X			X			X		3
1 year lag									0
Missed									0

Figure 5.3 Historical simulation of the household saving ratio (SHG)



									Total No. of turning points
Historical turning points	X	X	X	X	X	X	X	X	8
Correctly simulated	X	X		X	X	X	X	X	7
1 year lead									0
1 year lag									0
Missed			X						1

Figure 5.4 Historical simulation of the net retained earnings ratio (SBG)

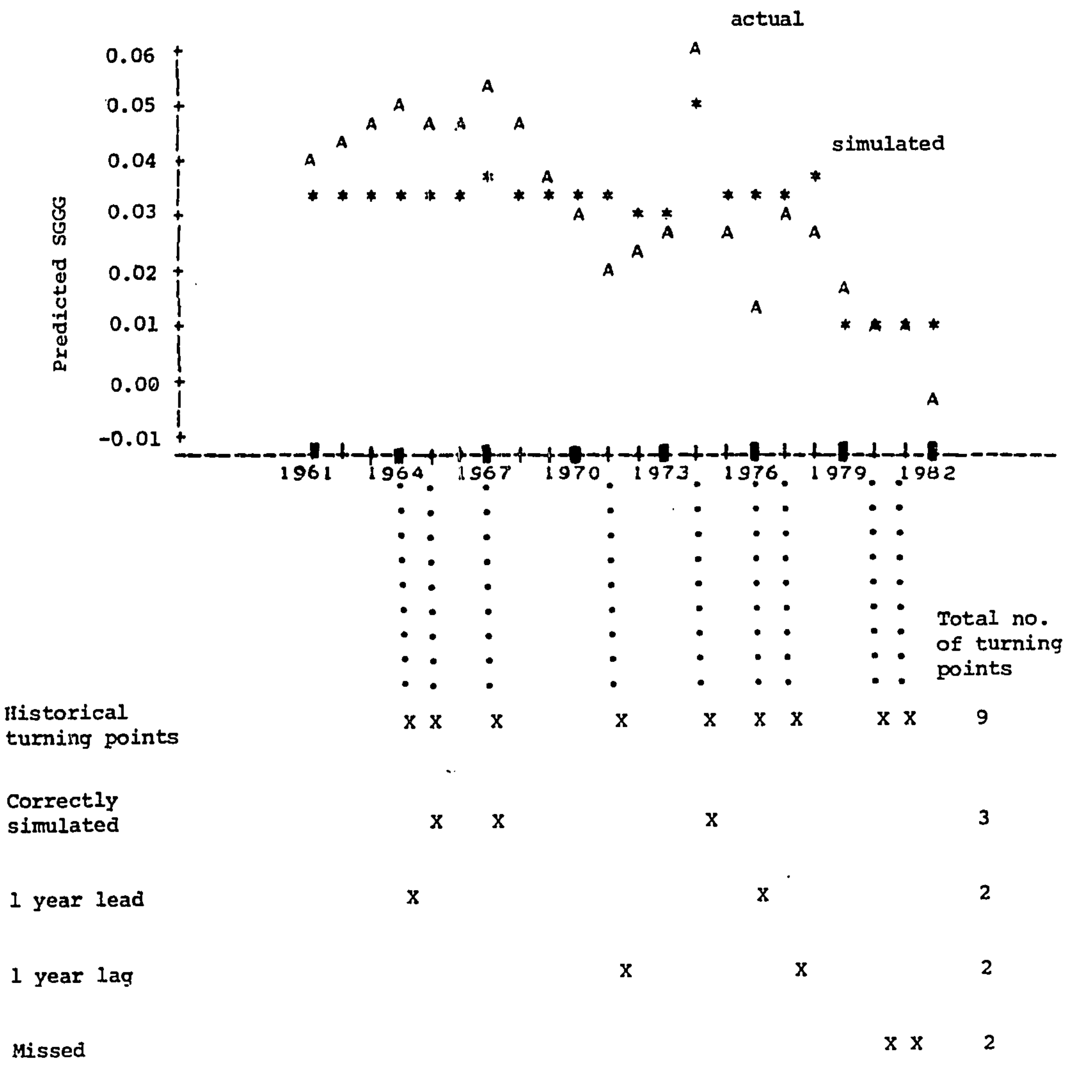
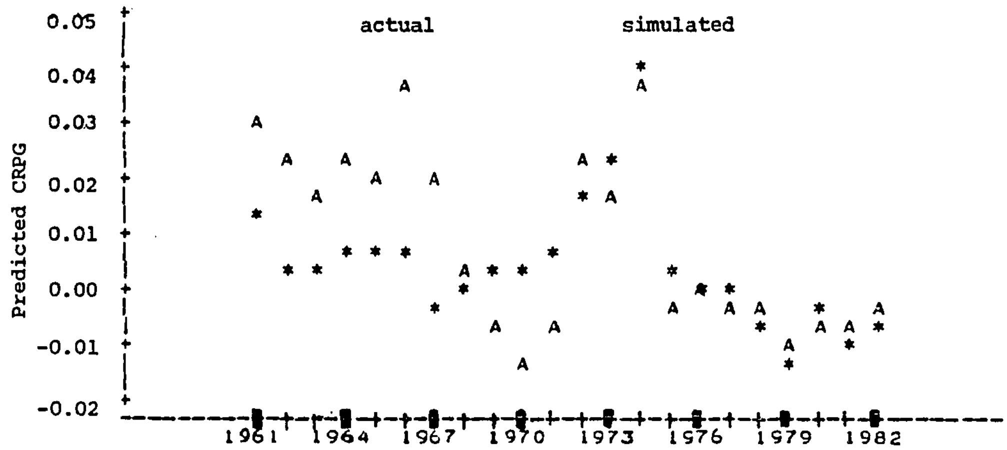
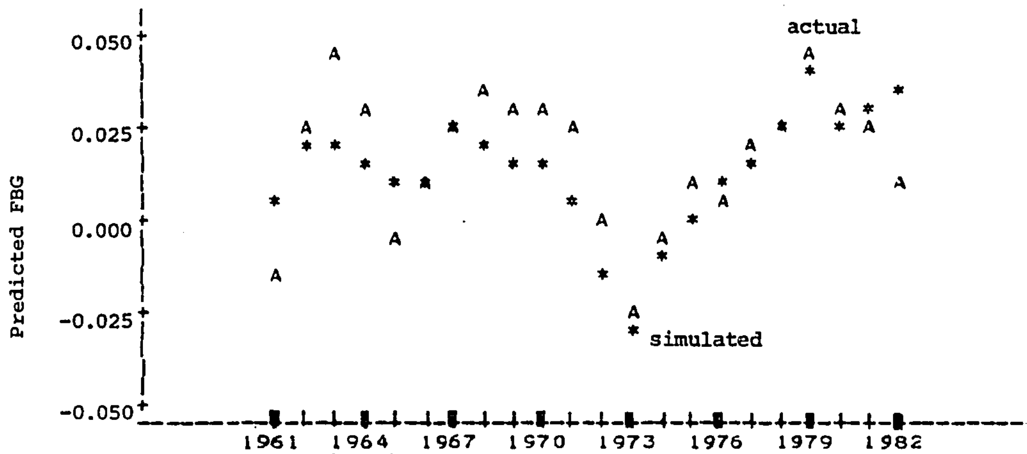


Figure 5.5 Historical simulation of the public saving ratio (SGGG)



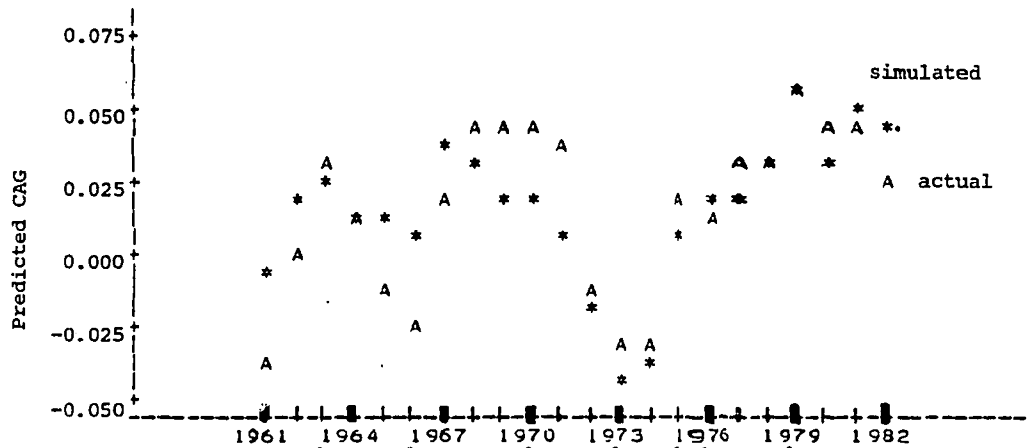
		Total No. of turning points
Historical turning points	X X X X X X X X X X X X X X X	15
Correctly simulated	X X X X X X X X X	9
1 year lead		0
1 year lag		0
Missed	X X X X X X	6

Figure 5.6 Historical simulation of the change-in-international-reservers ratio (CRPG)



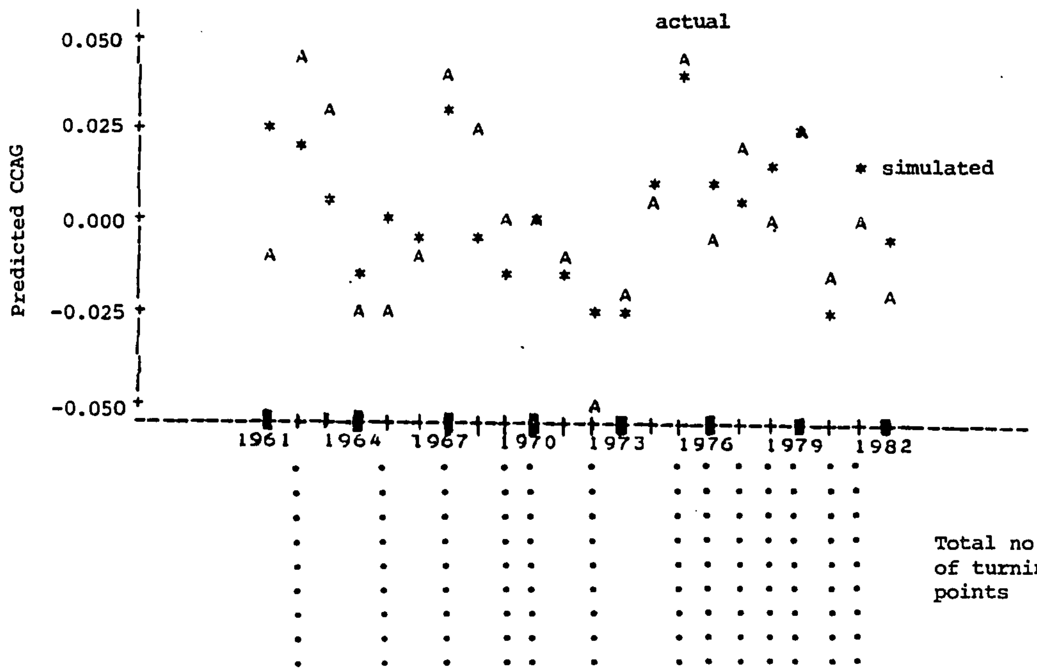
								Total No. of turning points
Historical turning points	X	X	X	X	X	X	X	7
Correctly simulated	X	X		X		X		4
1 year lead			X					1
1 year lag								0
Missed					X		X	2

Figure 5.7 Historical simulation of the foreign borrowing ratio (FBG)



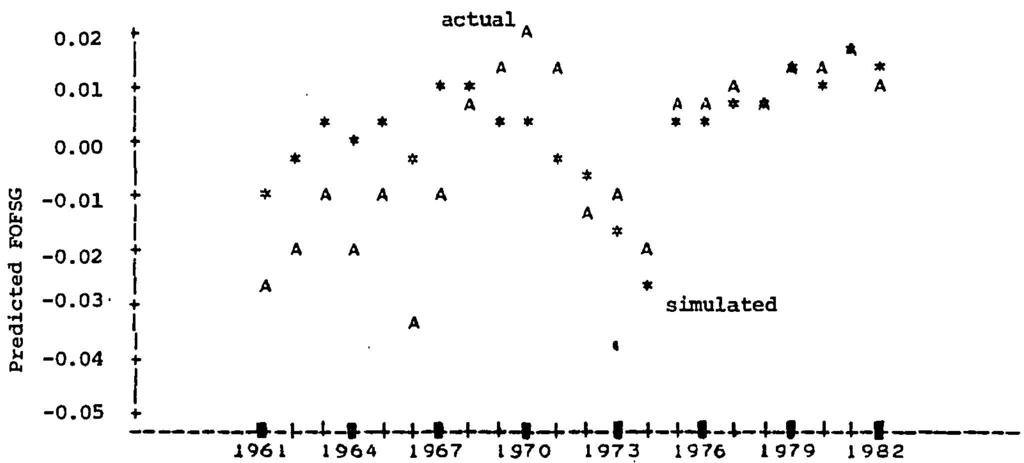
								Total No. of turning points
Historical turning points	X	X	X	X	X	X	X	7
Correctly simulated	X	X	X	X			X	5
1 year lead								0
1 year lag								0
Missed					X	X		2

Figure 5.8 Historical simulation of the current account deficit ratio (CAG)



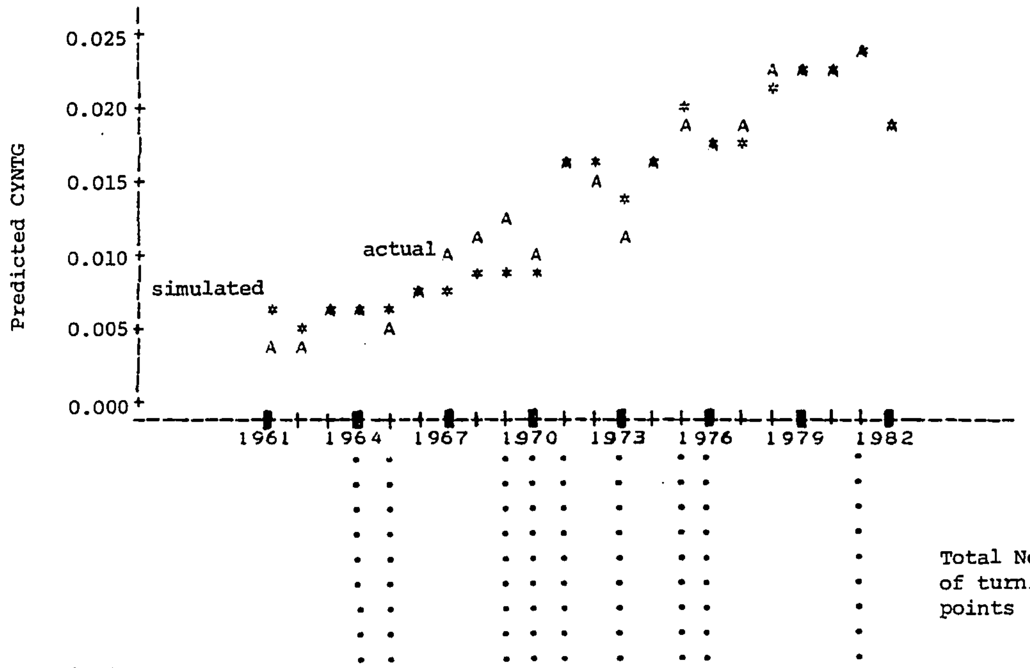
														Total no. of turning points
Historical turning points	X	X	X	X	X	X	X	X	X	X	X	X	X	13
Correctly simulated			X	X	X		X				X	X	X	7
1 year lead		X												1
1 year lag						X	X							2
Missed	X								X	X				3

Figure 5.9 Historical simulation of the increase in the current account deficit ratio (CCAG)



												Total No. of turning points
Historical turning points	X	X	X	X	X	X	X	X	X	X	X	11
Correctly simulated	X	X	X	X				X			X	6
1 year lead												0
1 year lag												0
Missed					X	X	X		X	X		5

Figure 5.10 Historical simulation of the other foreign saving ratio (FOFSG)



										Total No. of turning points
Historical turning points	X	X	X	X	X	X	X	X	X	9
Correctly simulated				X	X	X	X		X	5
1 year lead										0
1 year lag										0
Missed	X	X	X				X			4

Figure 5.11 Historical simulation of the private net profit after tax ratio (CYNTG)

change-in international-reserves ratio (CRPG), and the current account deficit ratio (CAG). Each simulated series of these four endogenous variables reproduces correctly at least 60 percent of the turning points in the historical data (see Table 5.2). The simulated series of the growth rate of real GNP (GRGNP), reproduced the general long-run behavior of the actual series quite well, although did not reproduce every short-run turning points. It is also noted that variable IDG, which has relatively low RMS error and RMS percent error, simulates the turning points (including one year lead or lag) in the historical data poorer than other endogenous variables.

5.1.3 Model Sensitivity

The third test of model performance consists of examining the sensitivity of the simulation results to changes in the starting period of the dynamic simulation.

In order to test for model sensitivity, a few ex post dynamic simulation experiments with alternative initial dynamic simulation periods are undertaken. The results indicate that whether simulation period begins in 1961, in 1967, in 1971, or in 1983 (static simulation), the model's simulation performance with reference to most endogenous variables, in terms of tracking actual actual data ability is not drastically affected (see Table 5.3).

TABLE 5.2

OVERALL SIMULATION OF HISTORICAL TURNING POINTS, 1961-82

	Variables										
	GRGNP	IDG	SHG	SBG	SGGG	CRPG	FBG	CAG	CCAG	FOFSG	CYNTG
Historical turning points	13	7	8	8	9	15	7	7	13	11	9
Correctly simulated	3	3	5	7	3	9	4	5	7	6	5
1 year lead	4	0	3	0	2	0	1	0	1	0	0
1 year lag	2	0	0	0	2	0	0	0	2	0	0
Missed	4	4	0	1	2	6	2	2	3	5	4
% correctly simulated	23	43	62	88	33	60	57	71	54	54	55
% correctly simulated including 1 year lead or lag	69	43	62	88	77	60	71	71	77	54	55
% missed	31	57	38	12	22	40	29	29	23	45	44

TABLE 5.3

TEST OF MODEL SENSITIVITY

Initial Dynamic Simulation Period: 1961

STATISTICS OF FIT

Variable	RMS Error	RMS % Error
SHG	0.0109407	9.62687
SBG	0.00152667	36.5548
SGGG	0.0107779	92.7709
IDG	0.0180957	8.32123
CRPG	0.0125855	109.144
GRGNP	0.0136442	18.4780
FBG	0.0121365	367.93
CAG	0.01914	154.398
CCAG	0.017666	605.306
FOFSG	0.0125855	84.8028
CYNTG	0.00152667	20.7922

Initial Dynamic Simulation Period: 1967

STATISTICS OF FIT

Variable	RMS Error	RMS % Error
SHG	0.0111161	9.81296
SBG	0.00144208	36.2517
SGGG	0.0106863	97.106
IDG	0.0171928	8.01336
CRPG	0.0157522	1217.33
GRGNP	0.0141815	19.7446
FBG	0.0119747	143.832
CAG	0.0182871	70.8728
CCAG	0.0179305	613.05
FOFSG	0.0157522	131.113
CYNTG	0.00144208	20.3315

Initial Dynamic Simulation Period: 1971

STATISTICS OF FIT

Variable	RMS Error	RMS % Error
SHG	0.0110094	9.68681
SBG	0.00146159	36.3879
SGGG	0.0104562	92
IDG	0.0149857	7.42751
CRPG	0.00892105	434.838
GRGNP	0.0146663	20.9359
FBG	0.0107083	237.611
CAG	0.0150768	67.648
CCAG	0.0165146	668.591
FOFSG	0.00892105	59.2862
CYNTG	0.00146159	20.423

Initial Dynamic Simulation Period: 1983

STATISTICS OF FIT

Variable	RMS Error	RMS % Error
SHG	0.0110771	9.72403
SBG	0.00144038	35.9992
SGGG	0.0104524	91.8298
IDG	0.0153573	7.50579
CRPG	0.00941842	303.503
GRGNP	0.0147685	20.8544
FBG	0.0106714	245.685
CAG	0.0154547	67.0912
CCAG	0.0154547	461.454
FOFSG	0.00941842	68.3853
CYNTG	0.00144038	20.1469

In other words, except in the case of the variable CRPG, there are no drastic changes in RMS errors and RMS percent erros of simulated endogenous variables in the present model, especially those of the simulated endogenous variables such as SHG, SBG, SGGG, IDG, GRGNP and CYNTG.

5.2 Evaluation of Model Validity

So far, the validity of the present model has been evaluated in terms of three criteria:

1) The model's ability to track corresponding actual data as measured by the RMS simulation error and the RMS percent error. Given the simplicity and highly aggregative nature of the model, the results appear reasonable. Simulated series of key endogenous variables such as SHG, IDG, and GRGNP have low RMS and RMS percent errors. On the other hand, variables SBG, SGGG, CRPG, FBG, CAG, CCAG, FOFSG were poorly simulated.

2) The model's ability to duplicate turning points or rapid changes in the actual data. Here, the obtained results especially those for SHG, SBG, CRPG and CAG, are quite good both in terms of reproducing general long-run trends and most short-run fluctuations of the actual data series during the estimation period of 1961 to 1982.

3) The sensitivity of the model to different initial periods in which the dynamic simulation is begun. It appears that the present model in general is not overly sensitive to the choice of year in which the dynamic

simulation is initiated. Specifically, RMS and RMS percentage simulation errors for GRGNP, SHG, SBG, SGGG, IDG, and CYNTG do not change significantly. On the other hand, other variables, namely, FBG, CCAG, CAG, especially CRPG have their RMS and RMS percentage simulation change drastically.

In sum, the above simulation results strengthen the results of the empirical testing of the two hypotheses in Chapter IV that (1) the household saving ratio has the greatest income growth effect, among the different national sectoral saving ratios; and (2) foreign borrowing contributes positively to the growth rate of income.

Judging from the good statistical fit of most equations and the result of the above three tests of the model's validity, it can be concluded that the present model can be deemed as a reasonable representation of some aspects of Thailand's saving and growth performance over the period under study.

CHAPTER VI

SUMMARY AND CONCLUSION

This chapter summarizes the empirical results, discusses the policy implications of the major results, and suggests areas for further research.

The major objective of the present study has been to analyze the differential growth effects of national sectoral saving and of foreign borrowing in the case of Thailand. This study has gone a step further than the works of Papanek (1973) and Gupta (1975) by focusing on national sectoral saving and foreign borrowing disaggregates, and by giving a more formal argument both theoretically and empirically for their different quantitative growth effects within a time series context.

More specifically, using the framework of a small open developing economy, a formal theoretical analysis was carefully developed to rationalize the differential growth effects of national sectoral saving and the positive growth effect of foreign borrowing. In order to provide rigorous empirical evidence to support the arguments, a simultaneous econometric equations model which was based on the preceding theoretical analysis and which allows for the interaction among investment, sectoral saving and income growth was set forth. Annual Thai data from 1961-1982 were applied to estimate the macroeconomic model.

Based on standard statistics for each structural equation and the historical simulation performance of the model, the empirical results in general were found to be satisfactory on both an individual equation basis and as a whole model, although not every structural coefficient was statistically significant and not every simulated series of endogenous variables performed well. The present macroeconometric model can be regarded as a reasonable representation of some aspects of saving and growth performance of the Thai economy during 1961-1982.

6.1 Summary of Empirical Findings

The major findings of this study from the model estimation are as follows:

1) The components of national sectoral saving, each expressed as a ratio to GNP, have different growth effects in Thailand. In particular, household saving has the largest growth effect; private corporate net saving has a negative growth effect, and public saving has virtually no growth effect.

2) Foreign borrowing, expressed as a ratio to GNP, has a positive relationship with the growth rate of real GNP in Thailand; and

3) foreign borrowing does not substitute for public saving contrary to what has been argued by radical critics.

Additional findings are listed below:

4) The growth effect of the household saving ratio is greater than that of the foreign borrowing ratio.

5) The household saving ratio shifted upward by 2.6 percentage points in 1975 after the first oil shock.

6) The private corporate net retained earnings ratio was not affected by the oil shocks.

7) The public saving ratio shifted downward by 2.5 percentage points in the second oil shock period.

8) The growth rate of Thailand's real GNP declined by 2 percentage points in the second oil shock period.

9) The impact of the first oil shock which was captured by the dummy variable (D75) caused a downward shift in the change-in-internationa-reserves ratio by 2.1 percentage points in 1975, *ceteris paribus*.

10) The impact of the commodity boom in 1974 which was captured by the dummy variable (D74) caused increases in the public saving ratio and the change-in-international-reserves ratio of 1.9 percentage points and 2.2 percentage points, respectively, *ceteris paribus*.

11) An increase in the real deposit rate leads to a decline in the household saving ratio, while an increase in the growth rate of real GNP leads to an increase in the household saving ratio.

It is noted that while there are numerous quantitative studies on the effect of the real interest rate on aggregate saving including the level of household saving and the household propensity to save in developing countries, the available empirical evidence is inconclusive, especially with respect to the sign of the interest rate coefficient.

12) An increase in the private corporate net profit of previous period's growth rate of real GNP led to a higher private corporate net saving ratio.

13) The behavior of the public saving ratio is influenced by both socio-political and economic factors. The latter refers to compensatory fiscal policies.

14) The existence of a lagged adjustment process of Thai gross domestic investment ratio was detected.

15) An unexpected increase in the current account deficit ratio leads to a decline in the monetary authority's international reserves ratio.

6.2 Policy Implications

1) The empirical finding that Thai household saving has the greatest effect on the growth rate of real GNP, among sectoral saving, suggests that in order to achieve higher and sustained economic growth successfully, the Thai government may consider measures to encourage household saving. This would not only increase the level of national saving, but also at the same time improve the efficiency of domestic resource allocation.

Additionally, the Thai government should consider improvement in the allocative efficiency of private business net saving and public saving. With regard to private business net saving, the Thai government should encourage more participation in the capital market by the private business sector so that a larger proprotion of retained earnings will be channeled through financial intermediaries. Corporation ownership should be made more available to the public which also implies that family-owned corporations should be discouraged, so that there would be a pressure from shareholders over the management to utilize the retained earnings more productively. In improving the allocative efficiency of public saving, government should consider increasing public investment projects which are labor-intensive. The number of public investment projects which are highly capital-intensive and have low rates of return and long gestation periods, should be reduced.

2) The second and third major empirical findings are that: (1) Thai foreign borrowing has a positive relationship with the growth rate of real GNP, and (2) foreign borrowing does not substitute for public saving. What this suggests is that an increase in Thailand's foreign borrowing may not lead to a decrease in the growth rate of real national income, contrary to what is often argued by the radical critics. Therefore foreign borrowing for investment projects could continue. However, an explicit and precise evaluation of national debt servicing capacity of the country requires a more detailed study on the benefit and cost of external debt.

6.3 Further Research

It is hoped that this study will encourage more research in the area of allocative efficiency of both domestic and foreign resources. Empirical estimates are influenced by the data base of a specific country, model specification and the time frame of analysis. Interpretation of the results should be treated with caution. Empirical research using a better model and better data, and in the context of cross-country analysis, is highly encouraged to check the robustness of the empirical results of this study.

More specifically, the present study encourages further research on the following aspects:

1) Empirical estimates of the relationship between the household saving ratio and *ex ante* real deposit rate, with better specification and estimation techniques for expected inflation rates, in order to check the robustness of the direction of the relationship, whether positive or negative.

2) Empirical investigation of the growth effect of private corporate net saving, in order to check the robustness of its negative growth effect as found by the present study.

3) Empirical investigation of the growth effect of public saving and whether it contributes to growth or not.

APPENDIX A

SUPPLEMENT TO CHAPTER III

A.3.1 The System of Simultaneous Equations

The structure of the complete model can be represented as follows:

$$\mathrm{GRGNP} = \mathrm{GRGNP}(\mathrm{SHG}, \mathrm{SBG}, \mathrm{SGGG}, \mathrm{FBG}, \mathrm{FOFSG}) \tag{3.1}$$

$$\mathrm{IDG} = \mathrm{IDG}(\mathrm{AR2L1}, \mathrm{GRGNPL1}, \mathrm{IDGL1}) \tag{3.6}$$

$$\mathrm{SHG} = \mathrm{SHG}(\mathrm{HYNTTG}, \mathrm{AR5}, \mathrm{GRGNP}, \mathrm{DR1}) \tag{3.7}$$

$$\mathrm{SBG} = \mathrm{SBG}(\mathrm{CYNTG}, \mathrm{GRGNPL1}) \tag{3.8}$$

$$\mathrm{SGGG} = \mathrm{SGGG}(\mathrm{TARQDLN}, \mathrm{FBG}) \tag{3.9}$$

$$\mathrm{CRPG} = \mathrm{CRPG}(\mathrm{CCAG}, \mathrm{CRPGL1}) \tag{3.14}$$

$$\mathrm{FBG} = \mathrm{IDG} - \mathrm{SHG} - \mathrm{SBG} - \mathrm{SGGG} - \mathrm{PCFCG} - \mathrm{FDIG} + \mathrm{CRPG} \tag{3.22}$$

$$\mathrm{CAG} = \mathrm{IDG} - \mathrm{SHG} - \mathrm{SBG} - \mathrm{SGGG} - \mathrm{PCFCG} \tag{3.23}$$

$$\mathrm{CCAG} = \mathrm{CAG} - \mathrm{CAGLI} \tag{3.24}$$

$$\mathrm{FOFSG} = \mathrm{FDIG} - \mathrm{CRPG} \tag{3.25}$$

$$\mathrm{CYNTG} = \mathrm{SBG} + \mathrm{DVDG} \tag{3.26}$$

Exogenous variables: AR2L1, GRGNPL1, IDGL1, HYNTTG, AR5, DR1, TARQDLN, CRPGL1, PCFCG, CAGL1, FDIG, DVDG

Endogenous variables: GRGNP, SHG, SBG, SGGG, FBG, FOFSG, IDG, CRPG, CAG, CCAG, CYNTG

A.3.2 Definition of Variables

A.3.2.1 Exogenous Variables

AR2L1:	real lending rate for the previous period
AR5:	real interest rate on time deposit
CAGL1:	current account deficit ratio for the previous period
CRPGL1:	change in international reserve as a percentage of GNP for the previous period
DR1:	population dependncy ratio
D74:	dummy variable for commodity boom in 1974
D75:	dummy variable for the delayed recessionary impact of the first oil shock in 1975
D779:	dummy variable for the impact of petro-dollar recycling in 1977-1979.
D792:	dummy variable for the prolonged recessionary impact of the second oil shock in 1979-82
DVDG:	private corporate dividends distributed as a percentage of GNP
FDIG:	foreign direct investment as a percentage of GNP
GRGNPL1:	growth rate of real income in the previous period
HYNTTG:	household disposable income as a percentage of GNP
IDGLI:	gross domestic investment ratio for the previous period
PCFCG:	depreciation allowance as a percentage of GNP

TARQDLN:	target growth rate of real GNP in the previous period (TRQDL) minus actual growth rate of real GNP in the previous period (GRGNPL1)

A.3.2.2 Endogenous variables:

CAG:	current account deficit as a percentage of GNP
CCAG:	increase in the current account deficit as a percentage of GNP
CRPG:	planned change in international reserves as a percentage of GNP
CYNTG:	private net profit after tax and depreciation as a percentage of GNP
FBG:	foreign borrowing as a percentage of GNP
FOFSG:	other foreign saving as a percentage of GNP
GRGNP:	annual growth rate of real GNP
IDG:	gross domestic investment as a percentage of GNP
SBG:	private net retained earnings as a percentage of GNP
SGGG:	public saving as a percentage of GNP
SHG:	household saving as a percentage of GNP

APPENDIX B

SUPPLEMENT TO CHAPTER IV

DATA CONSTRUCTION AND SOURCES

A.4.1 Nature of the Saving Data

There are both direct and indirect methods of estimating gross national saving (GNS) in a developing country (Mikesell and Zinser, 1973; Iwasaki, 1984).

A.4.1.1 The Direct Method

Employing the direct or balance sheet method, gross national saving is estimated by the net change in national assets, during the period, calculated as:

GNS = change in physical assets
+ change in financial assets
- change in financial liabilities

Since any change in domestic financial assets is offset by an equal change in the opposite direction in domestic financial liabilities, then GNS is simply the change in physical assets of the country minus the net change in its foreign financial liabilities:

GNS = change in physical asset
- net change in financial liabilities
to the rest of the world (A.4.1)

Due to data limitations, GNS is usually not estimated by this direct method.

A.4.1.2 The Indirect Methods

There are two commonly used indirect methods of estimating GNS:

1) Gross national saving (GNS) is estimated by deducting foreign saving (FS) from gross domestic investment (GDI), the former being defined as the balance of payments on goods and nonfactor services (M - X) less net factor income from abroad (NFI):

$$GNS = GDI - FS$$

$$\text{or} \quad GNS = GDI - (M - X - NFI) \qquad (A.4.2)$$

Similarly, gross domestic saving (GDS) is defined as gross domestic investment (GDI) minus the balance of payments on goods and nonfactor services (M - X):

$$GDS = GDI - (M - X) \qquad (A.4.3)$$

2) Gross national saving (GNS) may also be calculated as the difference between the gross national product (GNP) and total consumption expenditures (C) of the nation, i.e.,

$$GNS = GNP - C \qquad (A.4.4)$$

An estimate of gross private saving (GPS) in turn is obtained by subtracting government saving from GNS, the former being defined as government revenue (R) minus government current expenditures (G).

$$GPS = GNS - (R - G) \tag{A.4.5}$$

In general, estimates of saving in developing countries are subject to a substantial margin of error. The technique generally employed is to deduct foreign saving (FS) from gross domestic investment (GDI). The reliability of such estimates of gross national saving depends on the accuracy of the estimates of foreign saving (FS) and gross domestic investment (GDI), the latter being much more problematic. Gross national saving is then broken down into public and private saving.

Fortunately, official statistics in the case of Thailand break down aggregate saving into household saving, private business saving, and general government and state enterprise saving. Two estimates of gross national saving (GNS) based on the above indirect methods are also available from official publication.

The Bank of Thailand (BOT) Quarterly Bulletin provides a gross domestic saving (GDS) statistic derived by deducting gross domestic investment (GDI) from foreign saving (FS) or the balance of payments on goods and nonfactor services (M - X), where gross national saving (GNS) is treated as being equal to gross domestic investment (GDI).

The National Economic Social Development Board (NESDB) National Income of Thailand, calculates gross national saving (GNS) as the sum of direct estimates for capital consumption allowances (PCFC), household saving (SH), private corporation and government enterprise saving (SCGE), and general government saving (SG). Sectoral saving is calculated as the difference between revenue (income) and current expenditure for each sector of the economy.

The two estimates of gross national saving (GNS), based on the two indirect methods, may thus be readily compared.

For the present purpose, saving statistics provided by the NESDB are used, since this conceptual framework is more relevant to the present model. However, in order to obtain a separate estimate of private corporate saving (SB) alone, and thereby be able to combine the saving of general government and of state enterprise into public sector saving (SGG), a further disaggregation of the corporate sector saving (SCGE) in the national income statistics into private corporate saving and state enterprise saving is required. The Bank of Thailand's publication provides such disaggregation.

It is noted the estimation of capital consumption allowances (PCFC) is based on the expected economic life of physical capital, and on a calculation of loss in value due to normal wear and tear, irreparable accidental damage, and foreseeable obsolescence. Any estimate of capital consumption is necessarily arbitrary, since there is no way to precisely determine each year's wear and tear in capital stock, or what is called the true rate of depreciation. Consequently, capital consumption or depreciation may be a major source of error or statistical discrepancy in estimating gross national saving (GNS). Since the present study is only concerned with the behavior of net saving (i.e., gross saving minus capital consumption) of the private business sector and public sector, it seems appropriate to treat total capital consumption allowances (PCFC) as an exogenous variable and not attempt to distribute it among sectors of the economy. Data for PCFC are obtained from the NESDB National Income of Thailand.

A.4.2 Definition of Variables Used

Statistical data used in the present study cover the period from 1961 to 1981. Real variables are valued at 1975 constant prices.

A.4.2.1 Foreign Borrowing Ratio

The foreign borrowing ratio (FBG) is derived from the identity equation of the model, i.e.,

$$FBG = IDG - SHG - SBG - SGGG - PCFCG - FDIG + CRPG \quad (A.4.6)$$

A. 4.2.2 Public Saving Ratio

The public sector saving ratio (SGGG) is calculated as the sum of the general government saving ratio and the state enterprise saving ratio, data for which are obtained from the NESDB National Income of Thailand.

A.4.2.3 Change-In-International-Reserves Ratio

Data for change in international reserves ratio (CRPG) are obtained from balance of payments account's item I of monetary movements, excluding private institutes' net liabilities and assets. Specifically,

$$CRPG = (\text{net IMF accounts} + \text{central institutions' assets} + \text{monetary gold} + \text{SDRs})/GNP \quad (A.4.7)$$

A.4.2.4 Household Disposable Income Ratio

The household disposable income ratio (HYNTTG) is calculated as the household income ratio (HDIG) minus the household direct tax ratio (HDTG) and other current transfers from the household sector to general government (HOTG), i.e.,

$$HYNTTG = HDIG - HDTG - HOTG \quad (A.4.8)$$

A.4.2.5 Private Corporate Business Net Profit Ratio

Private corporate net profit after tax (CYNT) is calculated as dividends received by households and private non-profit institutions (DVD), plus net saving of private corporations and government enterprises (SCGE), minus net saving of government enterprises (SGE).

$$CYNT = DVD + SCGE - SGE \qquad (A.4.9)$$

Dividing throughout by nominal GNP, the private corporate net profit after tax ratio (CYNTG) is obtained:

$$CYNTG = CYNT/GNP = (DVD + SCGE - SGE)/GNP \qquad (A.4.10)$$

A.4.2.6 Expected Real Deposit Rate

The expected real deposite rate (AR5) in the household saving function is calculated as the difference between the commercial bank's nominal 3- to 6-month time deposit rate of interest (ID5) and the expected inflation rate ($\dot{P}^*$), i.e.,

$$AR5 = ID5 - \dot{P}^* \qquad (A.4.11)$$

The estimation of the expected inflation rate ($\dot{P}^*$) will be discussed in section A.4.3.

A.4.2.7 Expected Real Lending Rate

The expected real lending rate for the previous period (AR2L1) is calculated as the difference between the previous period's nominal bank rate (Bank of Thailand) (ID2L1) and the previous period's actual inflation rate ($\dot{P}_{-1}$), i.e.

$$AR2L1 = ID2L1 - \dot{P}_{-1} \qquad (A.4.12)$$

A.4.2.8 Household Saving Ratio

NESDB's national income statistics provide data on the saving of households and private non-profit institutions (SH), so that the household saving ratio (SHG) may be calculated as follows:

$$SHG = SH/GNP \qquad (A.4.13)$$

A.4.2.9 Private Business Net Saving After Tax Ratio

Private business saving after tax and depreciation allowances (SB) is calculated as the difference between saving of private corporations and government enterprises (SCGE), and saving of government enterprises (SGE), data for which were obtained from the Bank of Thailand:

$$SB = SCGE - SGE \qquad (A.4.14)$$

Business saving ratio (SBG) = (SCGE-SGE)/GNP (A.4.15)

A.4.2.10 Growth Rate of Real GNP

Data on GNP in 1975 constant prices were obtained from the International Monetary Fund International Financial Statistics.

The annual growth rate of real GNP was then calculated in the usual way from this time series.

A.4.2.11 Target Growth Rate of Real GNP

The target growth rate of real GNP (TRQD) is proxied for by the target growth rate of real GDP, as stated in the National Economic Development Plan. Four such plans were successfully in effect during the period under study, with the target growth rate of real GDP given as:

First National Plan, 1961-66:	5.5 percent per annum
Second National Plan, 1967-71:	8.5 percent per annum
Third National Plan, 1972-76:	7.0 percent per annum
Fourth National Plan, 1977-81:	7.0 percent per annum
Fifth National Plan, 1982-86:	6.6 percent per annum.

A.4.2.12 Incremental Capital-Output Ratio

The incremental capital-output ratio (ICOR) is derived by using the ratio of real gross fixed capital formation (RGFKF) to the change in real GDP from the previous period ($RGDPN-RGDPN_{-1}$), all expressed in 1975 constant prices, as a proxy.

Since depreciation allowances had been steadily rising during the sample period, it makes no difference whether real gross or net fixed capital formation is used to calculate ICOR.

A.4.2.13 Current Account Deficit Ratio

The current account deficit ratio (CAG) is derived from the investment-saving gap identity of the present model, i.e.,

$$CAG = IDG - SHG - SBG - SGGG - PCFCG \qquad (A.4.16)$$

where IDG is gross domestic investment ratio.

A.4.2.14 Actual Inflation Rate

The actual inflation rate ($\dot{P}$) is calculated as the annual rate of change in the Thai GDP price deflator (PGDP) for Thailand, i.e.,

$$\dot{P} = (PGDP - PGDP_{-1})/PGDP_{-1} \qquad (A.4.17)$$

A.4.3 Estimation of the Expected inflation rate ($\dot{P}^*$)

Irving Fisher (1930) stated that the nominal interest rate (i) is the real rate of interest (r) plus the expected rate of inflation ($\dot{P}^*$), i.e.,

$$i = r + \dot{P}^* \qquad (A.4.18)$$

Alternatively, ex ante real interest rate is the difference between nominal interest rate (i) and the expected inflation rate ($\dot{P}^*$), i.e.,

$$r = i - \dot{P}^* \qquad (A.4.19)$$

However, the expected inflation rate ($\dot{P}^*$) is not directly observable. The use of proxy variables derived from implicit models of expectations formation is required.

The expected inflation rate ($\dot{P}^*$) in the present study estimation is proxied for by three alternative measures:

1) The expected current inflation rate is assumed to be equal to the current actual inflation rate, i.e.,

$$\dot{P}^* = \dot{P} \tag{A.4.20}$$

2) The expected inflation rate ($\dot{P}^*$) is equal to the actual inflation rate in the previous period ($\dot{P}_{-1}$), i.e., $\dot{P}^* = \dot{P}_{-1}$. This case allows that economic agents may not have perfect information about the future, and cannot therefore effectively forecast future rates of inflation.

In the case of Thailand, where the capital market is not yet well developed, there is less perceived need for the use of sophisticated models for prediction of future interest rates. Hence, expectations based on the previous period's inflation rate are not improbable.

3) According to Muth (1961), the rational expectation hypothesis assumes that "expectations, since they are informed predictions of future events, are essentially the same as the predictions of the relevant economic theory," i.e.,

$$\dot{P}^*_t = E(\dot{P}_t/Q_{t-1}) \tag{A.4.21}$$

where the variable $\dot{P}_t^*$ is the psychological expectation of the inflation rate prevailing at time t. $E(\dot{P}_t^*/Q_{t-1})$ is the conditional mathematical expectation of $\dot{P}_t$ formed using the economic model and information about the exogeneous and endogeneous variables available as of time t-1.

Specifically, the rational expectations hypothesis states that the expected rate of price change is the mathematical expectation of future inflation, i.e., the psychological expectation ($\dot{P}_t^*$) and the objective conditional expectation $E(\dot{P}_t/Q_{t-1})$ are equal.

Both Muth (1983) and Wallis (1983) demonstrate that in an econometric model with rational expectations, expectations of endogeneous variables are functions of the expectations of exogeneous variables, which in turn are functions of the past values of exogeneous variables themselves. A common practice in estimating the rational expectations of exogeneous variables is that of extrapolation of a time series based on the Box-Jenkins procedure (1976).

The Box-Jenkins procedure is used to model and forecast time-series data by means of an autoregressive integrated moving average (ARIMA) model. An ARIMA model is a general class of stochastic process which can represent any time series in economics and business, since economic time-series data in general have elements of both the autoregressive (AR) process and the moving average (MA) or white noise process. Therefore, an observation at a given time is a function of its past values and/or the current and past values of the random disturbance, both with nonseasonal and seasonal lags.

In the present model, the domestic price level, which is proxied for by the GDP deflator (PGDP), is assumed to be a function of world prices and is thus an exogeneous variable. The Thai inflation rate ($\dot{P}$), which is defined as the percentage change in the GDP deflator over the previous year, is thus an exogeneous variable as well.

It is assumed that the expectation formulation model of the Thai inflation rate is rational, i.e., the expected rate of price change ($\dot{P}^*$) is the mathematical expectation of the future inflation rate based on the stochastic behavior of the inflation series as identified by the time series methodology of Box-Jenkins' ARIMA model.

The 1951-1982 inflation rate time series for Thailand appears to be nonstationary. Therefore, before modeling the time series, the data are transformed to a stationary process by first differencing the series on a nonseasonal basis. Examinations of autocorrelation and partial autocorrelation functions of the time series suggest several tentative ARIMA models. Estimation of structural parameters of tentative models and diagnostic checks point to an ARIMA (1,1,3) model, with the following specification:

ARIMA (1,1,3)

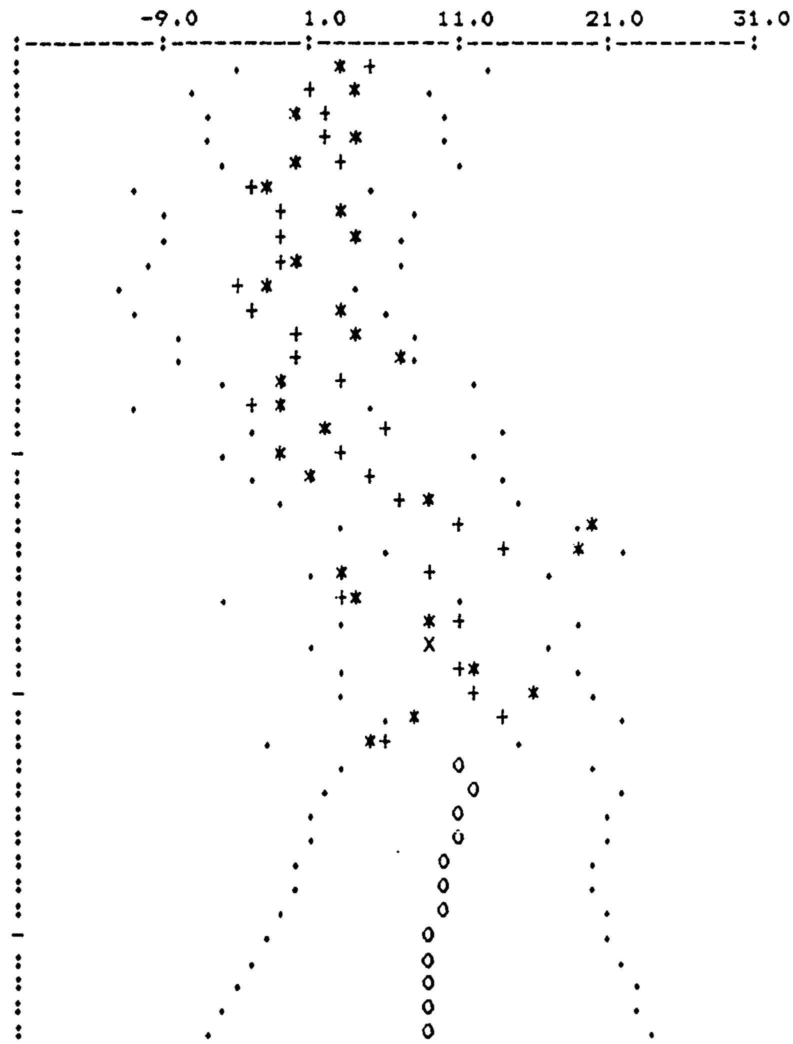
$$\Delta \dot{P} - \underset{(8.11)}{.7562} (\Delta \dot{P})_{-1} = U_t - \underset{(9.67)}{1.1199} U_{t-1} - \underset{(2.32)}{.5344} U_{t-2}$$

$$+ \underset{(6.33)}{.825} U_{t-3} \qquad \text{(A.4.22)}$$

where $\Delta \dot{P}$ = first differencing of the inflation rate, and U_t is the stochastic disturbance term. The residual variance or mean square error of the above equation is 17.766; the numbers in parentheses are t-values.

The expected inflation rate is then obtained from the forecast value at lead 1 of the above ARIMA (1,1,3) model. The relationship between the expected inflation rate thus obtained and the actual inflation rate is illustrated in Appendix Figure A.4.1 below.

OBS.	DATA	
1954	3.00000	
5	4.40000	
6	.200000	
7	4.40000	
8	-.100000	
9	-1.50000	
10	2.70000	
11	3.80000	
12	.200000	
13	-1.70000	
14	3.00000	
15	4.50000	
16	7.30000	
17	-1.00000	
18	-.700000	
19	2.10000	
20	-.600000	
21	1.50000	
22	8.60000	
23	20.3000	
24	18.8000	
25	2.80000	
26	3.90000	
27	8.70000	
28	8.60000	
29	11.6000	
30	16.4000	
31	8.00000	
32	4.80000	
33	11.2436	F
34	11.9981	F
35	11.2444	F
36	10.6744	F
37	10.2434	F
38	9.91738	F
39	9.67086	F
40	9.48443	F
41	9.34344	F
42	9.23682	F
43	9.15619	F
44	9.09521	F



Data - *
Forecasts at Lead 1 - +
Estimated 95% Confidence Limits - •
Forecast Function - 0
Overlap - X

Appendix Figure A.4.1. Forecast of Inflation Rate under Rational Expectation Hypothesis

BIBLIOGRAPHY

Borts, G. H. (1964). "A Theory of Long-Run International Capital Movements." Journal of Political Economy 72 (August): 341-51.

Box, G. E. P. and Jenkins, G. M. (1976). Time Series Analysis: Forecasting and Control. Revised ed. San Francisco: Holden-Day.

Brecher, J. and Abbas, S. (1972). Foreign Aid and Industrial Development in Pakistan. London: Cambridge University Press.

Brown, W. M. (1964). The External Liquidity of an Advanced Country. Princeton Studies in International Finance, No. 14. Princeton: Princeton University Press.

Chenery, H. B. and Strout, A. M. (1966). "Foreign Assistance and Economic Development." American Economic Review 56 (September): 679-733.

Dacy, D. C. (1975). "Foreign Aid, Government Consumption, Saving and Growth in Less-Developed Countries." Economic Journal 85, 339 (September): 548-561.

Dowling, J. M. and Hiemenz, U. (1982). "Aid, Savings and Growth in the Asian Region." Economics Office Report Series, Report No. 3. Manila: Asian Development Bank.

Duesenberry, J. S. (1958). Business Cycles and Economic Growth. New York: McGraw-Hill.

Evans, M. K. (1969). Macroeconomic Activity: Theory, Forecasting, and Control. New York: Harper & Row.

Fisher, I. (1930). The Theory of Interest. New York: Macmillan.

Fry, M. J. (1980). "Saving, Investment, Growth and the Cost of Financial Repression." World Development 8 (April): 317-27.

Fry, M. J. (1984). "Financial Saving, Financial Intermediation and Economic Growth." In Domestic Resource Mobilization through Financial Development, pp. 55-70, Vol. 2, Appendix 3. Manila: Asian Development Bank.

Griffin, K. B. and Enos, J. L. (1970). "Foreign Assistance: Objectives and Consequences." Economic Development and Cultural Change 18 (April): 317-37.

Gulati, U. (1978). "Effects of Capital Imports on Savings and Growth in Less Developed Countries." Economic Inquiry 16 (October): 563-69.

Gupta, K. L. (1970). "Personal Saving in Developing Nations: Further Evidence." Economic Record 46 (June): 243-49.

Gupta, K. L. (1975). "Foreign Capital Inflow, Dependency Burden and Savings Rates in Developing Countries: A Simultaneous Equation Model." Kyklos 28: 358-72.

Heller, H. R. (1966). "Optimal International Reserves." Economic Journal 76 (June): 296-311.

Heller, P. S. (1975). "A Model of Public Fiscal Behavior in Developing Countries: Aid, Investment, and Taxation." American Economic Review 65 (June): 429-45.

IBRD (1968). "Economic Growth, Trade and the Balance of Payments in the Developing Countries 1960-65." IBRD Staff Papers. Washington, D.C.

International Monetary Fund (various years). International Financial Statistics. Washington, D.C.

Iwasaki, Y. (1984). "Methods of Estimating Saving and Their Implications." In Domestic Resources Mobilization through Financial Development, pp. 2-20, Vol. 2, Appendix. Manila: Asian Development Bank.

Jacoby, N. (1966). U.S. Aid to Taiwan: A Study of Foreign Aid, Self-Help and Development. New York: Praeger Publishers.

Johnson, D. W. and Chiu, J. (1968). "The Saving-Income Relation in Underdeveloped and Developed Countries." Economic Journal 78 (June): 321-33.

Krueger, A. O. (1978). Foreign Trade and Economic Regimes and Economic Development: Liberalization Attempts and Consequences. A Special Conference Series on Foreign Trade Regimes and Economic Development. Vol. 10. Cambridge: Ballinger Publishing Co.

Krueger, A. O. (1979). The Development Role of the Foreign Sector and Aid. Cambridge, Mass.: Council on East Asian Studies, Harvard University.

Leff, N. H. (1969). "Dependency Rates and Saving Rates." American Economic Review 59 (December): 886-96.

Mikesell, R. F. and Zinser, J. E. (1973). "The Nature of the Savings Function in Developing Countries: A Survey of the Theoretical and Empirical Literature." Journal of Economic Literature 2 (March): 1-26.

Mishkin, F. S. (1981). "The Real Interest Rate: An Empirical Investigation." National Bureau of Economic Research. Working Paper No. 622.

Modigliani, F. and Ando, A. (1963). "The Life-Cycle Hypothesis of Saving: Aggregate Implications and Tests." American Economic Review 53 (March): 55-84.

Modigliani, F. and Brumberg, R. (1954). "Utility Analysis and the Consumption Function: An Interpretation of Cross Section Data." In K. Kurihara, ed., Post Keynesian Economics. New Brunswick: Rutgers University Press.

Moore, B. J. (1981). "Domestic Savings in Selected Developing Asian Countries." Economic Staff Paper No. 2. Manila: Asian Development Bank.

Mosley, P. (1980). "Aid, Savings and Growth Revisited." Oxford Bulletin of Economics and Statistics 42 (May): 79-95.

Muth, J. F. (1961). "Rational Expectations and the Theory of Price Movements." Econometrica 29:315-35.

Muth, J. F. (1983). "Estimation of Economic Relationships Containing Latent Expectation Variables." In Rational Expectations and Econometric Practice. Vol. 2. Minneapolis: The University of Minnesota Press.

OECD (1968). "Development Assistance, Efforts and Policies." Annual Review.

Olivera, H. H. G. (1969). "A Note on the Optimal Growth of International Reserves." Journal of Political Economy 77 (March/April): 245-248.

Papanek, G. F. (1972). "The Effects of Aid and Other Resource Transfers on Savings and Growth in Less Developed Countries." Economic Journal 82 (September): 934-50.

Papanek, G. F. (1973). "Aid, Foreign Private Investment, Savings, and Growth in Less Developed Countries." Journal of Political Economy 81 (Jan./Feb.): 120-130.

Pindyck, R. S. and Rubinfeld, D. L. (1981). Econometric Models and Economic Forecasts. Second edition. Tokyo: McGraw-Hill Kogakusha, Ltd.

Rahman, M. A. (1968). "Foreign Capital and Domestic Savings: A Test of Haavelmo's Hypothesis with Cross Country Data." Review of Economics and Statistics 50 (February): 137-38.

Rosentein-Rodan, P. N. (1961). "International Aid for Underdeveloped Countries." Review of Economics and Statistics 43 (May): 107-38.

Sachs, J. D. (1981). "The Current Account and Macro-economic Adjustments in the 1970s." Brooking Papers on Economic Activity 1:201-68.

Salop, J. and Spitaller, E. (1980). "Why Does the Current Account Matter?" International Monetary Fund Staff Papers 29: 101-34.

Schatz, R. E. (1974). "Optimal Holdings of International Reserves for A Developing Country." Ph.D. dissertation, University of Hawaii at Manoa.

Thailand. Bank of Thailand (various years). Quarterly Bulletin. Bangkok.

Thailand. Office of the National Economic and Social Development Board (various years). National Income of Thailand. Bangkok.

Turnovsky, S. J. (1967). "The Allocation of Corporate Profits between Dividends and Retained Earnings." Review of Economic and Statistics 49 (November): 583-89.

Wallis, K. F. (1983). "Econometric Implications of the Rational Expectations Hypothesis." In Rational Expectations and Econometric Practice. Vol. 2. Minneapolis: The University of Minnesota Press.

Weisskopf, T. (1972). "The Impact of Foreign Capital Inflows on Domestic Savings in Underdeveloped Countries." Journal of International Economics 81 (February): 21-28.