The Bank of Thailand Model of the Thai Economy*

Olarn CHAIPRAVAT,** Kanitta MEESOOK** and Siri GANJARERNDEE**

I General Description of the Model

There are two main blocks in the model——real and financial sectors. The two sectors are linked through incomes, prices and interest rates which are themselves endogenously determined in the model. There are two production sectors——agriculture and non-agriculture; five income and expenditure sectors ——households, private business, state enterprises, government and foreign; four financial institutions——commercial banks, finance and securities companies, the Government Savings Bank and the Bank of Thailand. The demand for and supply of real goods and services as well as financial assets and liabilities are behaviorally or technically specified for each sector according to accepted theoretical concepts of real and portfolio behaviors of decision-making entities. All demand and supply equations are solved simultaneously in the general equilibrium framework. Unless otherwise indicated by special legal requirements or institutional practices in the Thai context, prices and interest rates are determined jointly by demand-supply interactions through market clearing equations for real goods and financial assets. The model explains the process of determining domestic price, output, employment, interest rate and external balance in a small, open, primary-exporting and market-oriented economy.

II Real Block

There are four sub-blocks in the real sector——production and import, do-

mestic expenditure and export, domestic price determination and income distribution. Each of these sub-blocks will be described verbally according to the equations specified symbolically in Section V.

II.1 Production and Import

Production in Agriculture Thailand is primarily an agricultural country with favorable endowments of fertile agricultural land relative to its farm population. It is a food surplus country which has been exporting its crops and other industrial raw materials such as rice, maize, sugar, tapioca, rubber and tin. The export structure is relatively diversified with new cash crops such as maize, sugar, tapioca and light manufactured goods such as textiles, canned pineapples, electronic components and leather goods emerging as major export commodities during the past two decades. Demand-supply situations in the world commodity markets together with their price incentives or disincentives as well as public infrastructural developments within the country——highways, dams and irrigation systems——have provided farmers with market signals and opportunities which they respond relatively quickly and efficiently. The output and export increase was made possible mostly by planted area expansion into cleared forest lands. This practice will be increasingly difficult in the future as virgin lands are being used up.

Equation 1 represents planted area response of the farmers to farm holding area, rainfall during planting season and lagged net real prices of farm products after adjustments for indirect taxes and domestic price levels. Equation 2 determines harvested area as a function of planted area and rainfall during growing season. The harvested area is entered into the agricultural production function (Equation 3) together with labor and fixed capital stock as well as time which captures the average annual rate of technical progress of about 2.27 per cent. Apart from technical progress the estimated output equation exhibits the constant returns to scale to land, labor and capital.

Production in Non-Agriculture Production function in non-agricultural sector is most difficult to estimate because of paucity of data for employment and capital stock. There is no systematically designed, continuous time-series data for labor employment in Thailand. The National Statistical Office (NSO) periodically collects cross section data on labor force and sectoral employment while National Population Census is undertaken once in every ten years. These cross section data are utilized for the years in which they are available, while for missing years employment figures are calculated from the inverted production function. The NSO cross section data are, however, likely to be available on a continuous basis for future years. Labor employment in non-agricultural sector is subtracted from total labor force to derive available supply of labor for agricultural activities. No usable data

on unemployment are available.

Real capital stock series are derived by using available values of stocks of financial assets to control values of total capital stock and allocating this total to various sectors by benchmark estimates of capital-labor ratios obtained from cross-section surveys of manufacturing establishments and estimated employ ments from the labor force surveys. The 1972 benchmark estimates of existing capital stocks are then rolled over backward and forward by using gross investment data and estimated deprecia- tion rate.

Assuming the non-agricultural produc- tion function to be constant returns to scale for labor and capital, the rate of technical progress is estimated as 5.18 per cent per annum (Equation 4). The esti- mated size of output elasticity to capital is somewhat higher than that of labor (0.55 vs. 0.45) in the Cobb-Douglas production function. Equations 5–8 are definitional identities linking real outputs with their nominal values through price deflators.

Wage Rate and Demand for Labor Non- agricultural wage rate in nominal terms is estimated to be a function of average labor productivity and the domestic price level with one-year lag for both variables. It is assumed that the wage rate is institutionally and collectively determined by workers, employers and the Government, taking into consider- ation productivity and price increases. The estimated elasticity of wage rate to the domestic price, *ceteris paribus*, is about

unity while that of labor productivity is only slightly less than unity (Equation 9). It should be noted that due to relatively poor and volatile data on employment, the goodness of fit of this and other equations involving employment variables is only moderate.

With the assumption of Cobb-Douglas production function and profit maximiz- ing behavior on the part of producers for given wage rate, net producer price (after indirect taxes) and capital stock, the demand for labor in non-agricultural sector will be a function of time, wage rate, net price and capital stock. It can be seen from Equation 10 that the de- mand for labor is relatively more elastic with respect to real wage rate (1.23) but less elastic with respect to capital stock (.86). Given much higher wage rate or labor productivity in non-agricultural sector than that in agricultural sector, it can be assumed that any amount of labor demanded by non-agricultural producers will be fully satisfied by relatively un- limited supply of workers who want to earn higher wages. Those who cannot be absorbed into non-agricultural activi- ties will remain on farm and work in this sector (Equation 11).

Price Relationships Equations 12 and 13 relate net producer prices to GDP deflators *less* indirect taxes in agricultural and non-agricultural sectors. Import taxes are conceptually allocated to non- agricultural activities, and export taxes to agricultural commodities. In the Thai context, this seems to be a reasonable approximation.

GDP price deflator for agricultural products is determined primarily by gross export price of agricultural commodities due to relatively large proportions of agricultural outputs which are exported ——about 20 per cent for rice, 70 per cent for maize, 75 per cent for sugar and almost 100 per cent for tapioca and rubber. For non-exportable agricultural products, their gross producer prices are determined by the domestic price of final goods (Equation 14). It is assumed that the *f.o.b.* export price of agricultural exports in terms of the U.S. dollars is determined exogenously in the world commodity markets. Being a small exporter in the large world commodity markets, this assumption of Thailand as a price-taker seems reasonable. The only possible exception is rice in which Thailand has relatively large share in the world trade and therefore can influence the world price through its export policies. This influence is, however, quantitatively small as indicated in another study.[1] The export price in local currency, however, is directly influenced by the exchange rate policy as indicated by Equation 15.

The export prices in terms of local currency are determined largely by the domestic cost and price structures. Export price of non-agricultural goods is

determined by GDP price deflator of the same sector as well as the import price of raw materials and fuels (Equation 18). The price of service exports is determined by the domestic price level and agricultural export price to partially reflect the freight rate charged on Thai ships carrying agricultural exports (Equation 17). The export prices in U.S. dollars are influenced by the exchange rate (Equations 18, 19). These dollar prices of Thai products must compete with similar exports from other countries and the domestic price levels of importing countries.

C.I.F. import prices in local currency are related to given import prices in U.S. dollars through the exchange rate and gross prices with landed prices through import duty rates for raw materials and fuels, consumer goods, capital goods and services (Equations 22–28). The price taking, small country assumption is obviously reasonable as far as Thailand's imports are concerned. Other equations (20, 21, 29, 30) are definitional.

Import Demand The import demand for raw materials and fuels is dependent on non-agricultural output, gross import price including duty, and net producer price for non-agricultural products. It is obvious from Equation 31 that some reduction in import volume is possible if import price rises much faster than net producer price. This phenomenon was evident in 1974 when the crude oil price rose substantially after the oil shock. The partial elasticity of raw material import with respect to non-agricultural

---

1) Chaipravat, Olarn and Sayan Pariwat, "An Economic Model of World Rice Markets." A paper presented at the Second (1976) Pacific Basin Central Bank Conference on Econometric Modelling at the Bank of Korea, Seoul. This Conference's *Proceedings,* 1976.

output is about .82, reflecting somewhat high but not too excessive reliance on raw material and fuel imports of the Thai economy (Equation 31). For capital goods, the import dependency of domestic investment is quite high (elasticity of about .94 in Equation 32). The degree of substitution between imported and domestically produced capital goods is not so high, because it requires faster rise in import price relative to domestic price to induce some import savings (elasticity of -1.19 for import price compared with 1.43 for domestic price in Equation 32). Consumer goods, on the other hand, exhibit a high degree of substitution between imports and locally produced goods because even a slower rise in the import price relative to the domestic price can result in import saving (partial elasticity of $-.86$ for import price compared with that of .18 for domestic price in Equation 33). The degree of depency on imports for real private consumption is also modest (elasticity is about .77). The import of non-factor services, on the contrary, has much higher elasticity (1.77) with respect to real private consumption as shown in Equation 34. Equations 35–37 are definitional, linking import volumes with their nominal values in local and foreign currencies.

II.2 Domestic Expenditure and Export

Real Consumption Expenditures For private households, real consumption is determined by a distributed lag function of realized, real disposable income and "expected" real rate of return on financial wealth holdings. When the "expected" future real rate of returns on financial assets after adjustment for inflation declines as in the hyper-inflationary years of 1973 and 1974 (inflation rates of 15–25 per cent), while nominal interest rates on deposits at financial institutions and government securities are adjusted upward only marginally (by 1 per cent), people will feel that their real future wealth income becomes smaller and adjust their consumption pattern accordingly (Equation 38). Real government consumption expenditure is determined by the domestic price level for given appropriations of nominal expenditures (Equation 39).

Real Investment Expenditures A partial stock adjustment model is used to explain the behavior of real fixed capital stock in agricultural business sector with output and lagged real net producer prices as determinants (Equation 40). The lag structure of price variables is similar to that in the planted area equation (Equation 1). Real net fixed investment (or net change in capital stocks) in non-agricultural business sector is determined by the degree of capacity utilization (approximated by output-capital stock ratio) and the rate of net profit (after corporate income taxes) to capital owners relative to average cost of borrowings from commercial banks, finance companies and foreign sources[2] (Equation 42). The positive coefficient of the dummy variable in Equation 42, which repre-

sents the establishment of first finance companies in 1969, seems to offer a suggestive, though not yet conclusive, evidence that an integration of unorganized lending activities into the organized financial structure may have *lowered* the average lending rate for the entire economy; i.e., the organized and unorganized markets, due to economy of scale, professionalization, official control, competition, pooling of resources and lowering of overall risk of lendings for the newly organized financial institutions. The lowering of average lending rate for all borrowers must have stimulated the private fixed investments.

The private inventory build-up behavior is also postulated to be of the partial stock adjustment type with expected output and the real rate of returns on holding inventories relative to commercial bank lending rate as determinants (Equation 44). All other equations in this investment block are identities relating real capital stocks to their gross investments and depreciations as well as nominal values of these investments (Equations 41, 43, 45, 46–63).

Exports The volume of agricultural exports is basically determined by this sector's output in the previous and current calendar years. Most of the major commodities such as rice, maize and sugar have their crop years overlapping the calendar years. Crops are planted and harvested in one calendar year but marketed in the subsequent calendar year. Attempts have been made to include the world demand factors in Equation 64, but it is obvious from the standard error of the relative price's coefficient that this factor is statistically not so significant.

The volume of non-agricultural exports, on the other hand, is basically determined by importing countries' real income[3] and Thailand's export price relative to domestic price level of these countries (both in terms of the U.S. dollars) playing an important role. It can be seen that if Thailand's export price in terms of the U.S. dollars is not competitive enough, for example, as a result of the faster rate of increase in her domestic price relative to the world price, the volume of export for non-agricultural products will decline. The faster rate of growth of the world income will obviously result in a greater volume of export from Thailand (Equation 65). The volume of services export is also specified as demand-determined, except that Malaysia is included as another importing country because of its large

---

2) No information on interest rates in unorganized financial markets is available. It is, therefore, assumed that such rates move roughly in line with lending rates of the organized markets. Given relatively high degree of interdependence and competitiveness among organized financial institutions as well as between organized and unorganized markets, this assumption seems reasonable in the Thai context.

---

3) Three countries——Japan, the U.S. and West Germany——are included in the construction of "world" income and price in U.S. dollars using their shares in non-agricultural exports from Thailand as weights.

share in Thai tourist business (Equation 66). The remaining equations in this export sub-block are definitional.

II.3 Determination of Domestic Price

The real aggregate demand and supply equation for domestic goods and services is used as a market clearing condition to determine the domestic price level. This equilibrating price variable will adjust itself so that this market for final goods and services may be cleared. The nominal identity for aggregate demand and supply in turn determines GDP deflator for the non-agricultural sector (Equations 70 and 71).

II.4 Income Distribution

Equations in this sub-block are expressed mostly in nominal values. Equation 72 specifies gross labor income as a product of nominal wage rate and employment in the non-agricultural sector. Rental income for non-agricultural households is related to the real fixed capital stock in the private business sector (Equation 73). Interest income to non-farm households is a function of interest rates and outstanding financial assets

held by these households (Equation 74). Direct taxes on non-agricultural households is a function of last year's gross labor income (Equation 76), while corporate income tax is determined by previous year's gross profits of non-agricultural private businesses and a structural shift in tax rates since 1974 (Equation 91).

A sector's surplus or deficit is determined by the difference between that sector's net income and expenditure (Equations 93–100 for households, private business, state enterprises, government and foreign sectors). The sum of these sectoral surpluses and deficits must be equal to zero as total income is equal to total expenditure. Other equations in this sub-block are either definitional identities or selected ratios, which are used as crude indicators of sectoral income distribution such as disposable income per person (Equations 102, 103, 104), average labor productivity (Equations 105, 106, 107), capital-labor ratios (Equations 108, 109, 110), output-capital ratios (Equations 111, 112) and factor income shares in non-agricultural sector (Equations 113, 114, 115).

III Financial Block

The financial sector consists of four organized financial institutions: commercial banks, finance companies, the Government Savings Bank and the Bank of Thailand. Demand and supply equations of important items on the balance

sheets of these institutions are estimated in view of observed behaviors of all market participants including the five real sectors whose portfolio adjustments affect and are affected by those of the four financial sectors. As the model is

expanded, more financial institutions such as the Bank for Agriculture and Agricultural Cooperatives, the Industrial Finance Corporation of Thailand, insurance companies and others will be explicitly analyzed.

Although the balance sheets of the included financial institutions are available in details, those of the real sectors are not readily available because no national wealth survey has ever been taken in Thailand. The values of outstanding total wealths (assets or liabilities) of households, private business, state enterprises, government and foreign sectors cannot be used as determinants and constraints in their portfolio behavior equations at this stage. It is hoped that the on-going program to compile the flow of funds data for the Thai economy currently undertaken by the National Economic and Social Development Board and the Bank of Thailand will provide the necessary information on the real sectors' total wealths in the future. These wealth constraints will be approximated by their flow variables such as savings, incomes and investments in this model.

III.1 Commercial Banks

Commercial banks are the oldest and most important financial institutions in Thailand. At present there are 16 locally incorporated and 14 branches of foreign banks in the country. Since foreign banks are not allowed to open subbranches, their role is quite limited. In fact more than 95 per cent of deposits and

lendings are made by the Thai banks that have the nation-wide branch networks of about 1300 banking offices. All Thai banks have head-offices in Bangkok but mobilize deposits mostly from upcountry branches. As a policy directive, the Bank of Thailand has in recent years requested and encouraged commercial banks to lend more to upcountry customers, particularly to farmers and small investors. A certain proportion of the banks' deposits is earmarked by the authorities for investments in government securities as well as cash reserve requirements. Maximum interest rates on deposits are legally set by the Bank of Thailand, and commercial banks always pay interests at these maximum rates. Although the maximum lending rate is set at 15 per cent per annum by the Civil Code (not the Commercial Banking Act), commercial banks' average lending rate is usually about 2-3 per cent below this maximum rate. The average lending rate is, therefore, determined by demand-supply interactions in the commercial bank loan markets which must remain competitive with those of other financial institutions like the finance companies as well as the unorganized markets. Due to the underdeveloped nature of secondary markets for government securities, their interest rates are also fixed by the authorities through primary issues of these securities. The Bank of Thailand is, however, currently trying to improve domestic money and capital markets for government and private papers in order to achieve more effective and market

oriented implementation of financial and credit policies.

Legal Requirements and Free Deposits
The balance sheet of commercial banking system is stated in Equation 116. This identity determines the capital funds which includes undistributed profits of the banks as a residual. There are two sub-identities for changes in net *foreign* position and in *domestic cash* position of the banks (Equations 117 and 121). Change in foreign assets other than discounts of export bills is determined as a residual in Equation 117 as the banks always maintain relatively large net foreign liabilities in their portfolios. Commercial bank borrowing from the Bank of Thailand through the latter's last resort loan window is determined as a residual from Equation 121. Other borrowings from the Central Bank in the form of concessionary rediscounts of agricultural, industrial and export bills for promotional purpose are determined behaviorally in Equations 150 and 151. Total holding of government bonds is conceptually divided into mandatory holding to satisfy secondary reserve requirement, compulsory holding to satisfy branching requirement and voluntary demand by the commercial banks (Equation 122). The required proportions of deposits to be held in bonds as secondary reserve and branching requirements are used as policy instruments by the Bank of Thailand and represented by $ZK1$ and $ZM1$ in Equations 127 and 129. The conventional cash reserve ratio to total deposits is represented by $ZK2$ and the

proportion of deposits which must be held in the form of balances at the Agricultural Bank for farm credit policy is shown as $ZM2$ in Equations 128 and 130. That part of total deposits which is not required by the authorities to be held in the form of non-earning or low earning assets is conceptually defined as "free deposits" which the commercial banks can use to acquire earning assets according to their portfolio preferences (Equations 131 and 132).

Cash and Near-Cash Assets Modern portfolio adjustment theory as pioneered by H. Markowitz and others is used to specify demand and supply equations for financial assets and liabilities in the financial block. The theory is modified by technical, institutional and legal peculiarities of the Thai financial system. In some cases, partial stock adjustment or expectation forming theories are also assumed and empirically estimated. Equation 135 explains commercial bank holding of cash in hand as a function of total deposits and its opportunity cost in the form of interest rate on the short term Treasury bills. The commercial bank demand for excess cash balance at the Bank of Thailand is estimated as a function of total deposits and change in bank lendings to private, foreign and finance company sectors (Equation 136). It should be noted that as bank notes and deposits at the Central Bank are interest-free obligations, the Bank will be willing to supply an unlimited amount of such liabilities to anybody who wishes to hold them. The same argument holds true

for demand deposits at the commercial banks. The stock of narrowly defined money or M_1 is, therefore, determined by the demand of the private sector.[4] Commercial banks can also place deposits at call with the finance companies who pay interests on these deposits. Equation 137 shows the commercial bank demand for these deposits as a function of their "free deposits," interest rate on call deposits at finance companies relative to competing rates of returns on other assets such as Treasury bill rate, government bond rate, interbank lending rate, commercial bank loan rate and foreign rate of interest. It is generally assumed that own rate should carry more weight than competing rates, and that the best weighting scheme is searched for empirically by using goodness of fit criteria.

Government Securities The demand for Treasury bills is found to be a function of free deposits, lendings, Treasury bill rate relative to Government bond and foreign interest rates (Equation 138). The voluntary demand for Government bonds is similarly determined by a distributed lag function of free deposits and bank lendings as well as bond rate relative to Treasury bill rate and the rediscount rate from the Bank of Thailand (Equation 139). The lag structure is estimated by the Polynomial Distributed Lag technique. Since the Thai Government usually has large budget deficits,

the supply of government securities is practically unlimited for investments by financial institutions and private sectors. The Bank of Thailand acts ultimately as an underwriter for unsold government securities.

Loans, Overdrafts and Discounts The relationship between non-official borrowers and the commercial banks is not one-way as those between the Bank of Thailand or the Government and the banks. These borrowers have options to acquire their alternative fundings from finance companies, other financial institutions, unorganized markets or foreign sources. The bank loan markets are therefore competitive and demand-supply interactions play a crucial role in determining the amount of lendings as well as their interest rates.

There are five main types of borrowings or lendings from the commercial banks: loans and overdrafts, discounts of domestic bills, discounts of import bills and trust receipts, discounts of export bills and interbank loans. The private sector's demand for loans and overdrafts from the banks is determined by a distributed lag function of *GDP* as well as the bank's lending rate relative to the finance company's lending rate (Equation 140). The private sector's demand for discounts of domestic bills is a function of *GDP* and the bank's lending rate relative to that of the finance companies (Equation 141). The private sector's demand for import bills and trust receipts depends on the value of imports and the bank's lending rate relative to the

---

4) To dramatize this point the word "money stock" is always used to denote M_1 instead of the conventional "money supply" in our model.

foreign rate of interest (Equation 142). Foreigners' demand for discounts of export bills from commercial banks is a function of the value of exports and the bank's lending rate relative to the foreign interest rate (Equation 143). Commercial banks in turn determine their supply of loans, overdrafts and discounts of all bills on the basis of their own portfolio preferences. This supply is determined by a distributed lag function of free deposits and the bank's lending rate relative to government bond and foreign interest rates (Equation 144). The market clearing identity between these demand and supply equations yields an equilibrium solution for the commercial bank's lending rate (Equation 145).

The supply of interbank loans from commercial banks to finance companies which has substantially increased in importance for both institutions is found to be a function of bank total deposits and the interbank rate relative to the bank's lending rate, foreign rate and government bond rate (Equation 146). This supply equation together with the demand equation for interbank loans by the finance companies jointly determine the interbank interest rate in Equation 166.

Foreign Exchange Transactions Commercial banks and money changers are the only authorized agents in foreign exchange to deal with the general public. These foreign exchange transactions have provided the commercial banks with a major source of income. The banks are allowed to buy or sell foreign exchanges

and cover their deficit or surplus positions with the Bank of Thailand through the Exchange Equalization Fund (EEF). Previously the EEF unilaterally quoted a daily exchange rate between Baht and the U.S. dollar and agreed to buy or sell an unlimited amount of foreign exchanges with the commercial banks under the fixed exchange rate regime. This system has been replaced by a more flexible and market oriented regime of daily fixing of exchange rate since November 1, 1978. The daily face-to-face session between the EEF and all commercial banks determines that day's interbank exchange rate on the multilateral bid-offer basis. The EEF will of course intervene to implement the authorities' exchange rate policy in this daily session.

Equation 148 behaviorally describes net foreign exchange transactions of the commercial banks with their customers as a function of the net foreign exchange surplus or deficit of exporters, importers and others that is adjusted for the flow of foreign exchanges channelled directly through the Bank of Thailand. The commercial banks in turn buy or sell foreign exchanges with the EEF to decrease or increase their domestic cash position. The net foreign exchange sales to the EEF is determined by the banks' net transactions of foreign exchanges with their customers, net domestic cash inflow and increase in banks' foreign liabilities. Net sales to the EEF is identically equal to commercial banks' increase in their domestic cash position as a result of such sales.

Borrowings from the Central Bank On the finding side commercial banks rediscounts of export bills at the Bank of Thailand is estimated to be a function of the banks' discounts of export bills together with the Central Bank's rediscount rate relative to its loan window rate (Equation 150). The rediscounts of domestic bills with the BOT is determined by free deposits, bank lendings, rediscount rate and interbank rate (Equation 151).

Deposits As maximum rates of interest on bank deposits are fixed by the authority usually at lower levels than market rates, the private sector's (mostly households) demand for all types of deposits effectively determines the amount of deposits received by the banks. The private sector's holding of demand deposits is a function of *GDP*, number of banking offices and the average interest rate on call deposits at the finance companies, savings and time deposit rates at the commercial banks (Equation 152). The private sector's demand for savings deposits is determined by a distributed lag function of household savings, number of banking offices, and own rate of interest relative to finance companies' short-term promissory note rate and the Government Savings Bank's savings and time deposit rates (Equation 153). The same sector's demand for time deposits at the commercial banks similarly depends on household savings, the number of bank branches, own rate relative to competing rates paid at the finance companies and the GSB (Equation 154). In addition, other fi-

nancial institutions also maintain deposits with the commercial banks. This type of deposits is found to be a function of *GDP* and own rate relative to the interbank rate (Equation 156).

Foreign and Other Borrowings Apart from borrowings from the Bank of Thailand, the commercial banks also borrow from foreign banks and other domestic financial institutions. Foreign borrowings is found to be dependent on bank discounts of import bills, which can be refinanced by foreign banks, the foreign interest rate relative to the BOT loan rate and a distributed lag function of commercial bank foreign assets in which they maintain compensatory or working balances (Equation 156). Commercial bank borrowings from other domestic financial institutions is determined by bank free deposits, the interbank rate relative to BOT loan rate and the foreign interest rate (Equation 157).

Net Domestic Cash Inflow Not all of commercial bank deposits are "primary" deposits in the sense that they arise directly as a result of depositors placing currency (notes and coins) into the banks. Some deposits are "induced" or "derived" by bank lending activities. It is necessary, therefore, to specify the amount of net domestic cash inflow into the commercial banking system as a result of increase in primary deposits *minus* cash outflow induced by expansion of bank lendings to non-official sectors. The most important source of domestic cash inflow into the commercial banks is the amount of cash deficit incurred by the Government who,

through the Central Bank, initially finances its deficit by injecting "high powered" money in the form of currency notes or draw-down of government balances at the Central Bank into the economy. Some of this "high powered" money will flow into the commercial banking system as primary deposits from the general public. Increase in bank lendings will, on the other hand, result in the reverse flow of domestic cash. A higher bank deposit rate will, *ceteris paribus*, induce more domestic cash inflow, while a higher deposit rate at finance companies will result in less cash inflow for the banks. Inflation is also found to have the negative effect on domestic cash inflow into the banking system because people tend to hold less financial assets whose rates of returns are rather fixed and speculate on real goods whose rates of returns are increased by inflation (Equation 158).

III.2 Finance and Securities Companies

First finance companies were established in 1969. The number of these companies has increased rapidly during the past decade and stands at about 113 at present. These non-bank financial intermediaries have become the second most important institution after the commercial banks. Their combined total assets now account for about 30 per cent of the commercial banks and are still growing faster than the banking sector. Although most of the finance companies are headquartered in Bangkok

and their branching activities are severely restricted by the authorities, they are able to compete for funds with the commercial banks because there is no restriction on interest rates paid on promissory notes issued by these companies. These deposit substitutes are attractive form of investments for large savers as there is a minimum size of 50,000 baht for the promissory notes. Finance companies generally adjust their interest rates according to market conditions and competitive pressures.

Legal Requirements and Uses of Funds[5] Equation 159 represents the balance sheet of these companies whose capital funds are determined as a residual from this identity. The Bank of Thailand imposes a minimum "liquidity ratio" to total promissory notes issued by the finance companies. This ratio $ZK3$ in Equation 160 is equivalent to the minimum reserve ratio of the commercial banks. The companies practically keep all of their required liquid assets in interest-bearing government securities. The concept of "free" promissory notes is similarly

---

defined in Equations 161 and 162.

Finance companies' investments in corporate securities are determined by their free promissory notes and the rate of return on corporate shares relative to the lending rate for business loans and discounts (Equation 163). The private sector's demand for loans and discounts from finance companies is a function of the value of total investments and own lending rate relative to those of commercial bank and foreign loans (Equation 164). The supply of finance companies' loans is determined by their free promissory notes and own lending rate relative to the rate of return on corporate securities. The market clearing equation for these loans and discounts determines the equilibrium lending rate of the finance companies (Equation 165).

Sources of Funds Funding equations are similar to those of commercial banks and assumed to be determined by the demand of the private sector. The promissory notes at call are determined by a distributed lag function of *GDP*, the number of finance company offices, the inflation rate and own rate of interest relative to competing rates of commercial bank savings deposits, GSB savings and time deposits and short-term promissory notes of the finance companies themselves (Equation 166). Short term promissory notes (one year or less) are influenced by household savings, the number of offices, the inflation rate, own rate of interest relative to time deposit rate at commercial banks (Equation 167). Private sector's demand for long term (more than one year) promissory notes depends on household savings, number of offices, inflation rate, own rate of interest relative to time deposit rate of commercial banks. It should be observed from the promissory notes equations that the higher inflation rate, unless adequately offset by rising interest rates, induces people to shift their portfolio preferences from financial to real assets, thus aggravating further price pressure as a result of this increased speculative demand for real goods. There is a possibility of self-generating inflation psychology which can only partially be moderated by more realistic and high interest rate policies on the part of the monetary authorities.

Due to equity interests of commercial banks in finance companies, the latter institution have borrowed more and more from the first through the expanding and relatively competitive interbank loan markets. Finance company's demand for interbank loans from commercial banks is determined by lendings of these companies to the private sector and the interbank rate relative to foreign and Government bond rates. This demand equation together with its supply (Equation 146) determines the interbank rate in Equation 169. Foreign borrowings of the finance companies depends on their lendings, free promissory notes, the foreign interest rate relative to own lending rate, the interbank rate, the commercial bank lending rate and the inflation rate (Equation 170).

III.3 Government Savings Bank (GSB)

GSB is fully owned by the Government, and its main function is to mobilize funds from the public to finance government deficit. It is the third largest financial institution after the commercial banks and finance companies. Equation 171 is the balance sheet identity which determines GSB's holding of currency notes as a residual. There is no reserve requirement for GSB deposits.

Almost all of the mobilized funds are used to purchase government securities as shown in Equation 172. Funding sources for GSB are determined by the demand of the private sector as in the case of commercial banks and finance companies. The private sector's demand for savings and time deposits at GSB is determined by a distributed lag function of household savings, own rate relative to competing rates at commercial banks and finance companies (Equation 173). The private sector's demand for savings and premium savings bonds, which pay nominal rate of interest but have lottery prizes, is a distributed lag function of household savings and the average interest rate on alternative earning assets (Equation 174).

III.4 Bank of Thailand and Balance of Payments

The Bank of Thailand acts basically as a residual absorber for net foreign exchange inflows or outflows after all private market participants and commercial banks have bought and sold foreign exchanges among themselves. The Exchange Equalization Fund buys or sells foreign exchanges on the BOT behalf with the commercial banks during daily exchange rate fixing sessions. The Bank of Thailand also underwrites primary issues of Government securities and generally accommodate commercial bank borrowings through both concessionary rediscount and last resort loan windows. The Central Bank can, however, attempt to alter portfolios of commercial banks, finance companies and other real sectors through changes in various monetary policy instruments such as reserve ratios, rediscount and loan rates, maximum rates on deposits at commercial banks, government security yields, exchange rate and others. Unremitted earnings of the Bank of Thailand are added into the capital funds of the Bank. Practically all liabilities of the Bank are demand-determined as they are interest-free: notes and deposits held by Government, commercial banks and the private sector.

Equation 176 shows the private sector's demand for currency notes issued by the Central Bank to be a function of GDP and the average rate of return on alternative earning assets. Other demand equations are specified previously in the relevant sectors. Equation 178 represents the net private capital inflows from abroad which are demand-determined by that part of private business sector's deficit which is not financed by changes in commercial bank lendings as well as domestic lending rates and the foreign interest rate. These capital flows are

converted into U.S. dollars and combined with other current and capital account items to derive the overall balance of payments position of the country. The last two equations (183 and 184) show the amount of government cash deficit which must be ultimately financed by the Central Bank and change in official international reserves after net commercial bank financing of the overall balance of payments deficit.

IV Concluding Remarks

The current version of the model is reestimated using revised national account data for the new base year (1972) and a new set of calculated values of real capital stocks in different sectors which are more compatible with cross-sectionally observed values of sectoral capital-output ratios. All equations are estimated with Ordinary Least Square Method and Polynomial Distributed Lag Technique. The model has been simulated statically and dynamically for the historical sample period. The entire system simulation results are on the whole quite satisfactory.

Dynamic properties of the model are examined by artificially freezing values of all exogenous variables for a number of years to obtain a control solution of the system. This solution is asymptotically stable over time and will be used as a basis for comparison with various shock solutions. Policy shocks are being imposed on the model. The results of simulation once-for-all shocks and sustained shocks will be subsequently reported to assess structural reasonableness and stability of the model.

Notation of Variables in Thailand's Model

Exogeneous variables are designated by an asterisk (*) sign. Where both nominal and real values of a variable are use the associated price deflator is also given for reference.

Notations for the Real Sector

I. *Consumption Expenditure*

Nominal	Real	Associated Price Deflator	
$CONGV*$	$CONGVR$	PD	Consumption by Government Sector
$CONHH$	$CONHHR$	PD	Consumption by Private Sector

II. *Dummy Variable*

$DUMMY2*$　　　Dummy variable　　　(1973–76 = 1, otherwise = 0)

DUMMY3*	Dummy variable	(1974–75 = 1, otherwise = 0)	
DUMMY4*	Dummy variable	(1972–74 ≐ 1, otherwise = 0)	
DUMMY69*	Dummy variable	(1960–68 = 0, thereafter = 1)	
DUMMY70*	Dummy variable	(1960–69 = 0, thereafter = 1)	
DUMMY7172*	Dummy variable	(1971–72 = 1, therewise = 0)	
DUMMY74*	Dummy variable	(1960–73 = 0, thereafter = 1)	

III. *Output*

Nominal	Real	Associated Price Deflator	
GDP	*GDPR*	*PGD*	Total Output
GDPAG	*GDPAGR*	*PGDAG*	Agricultural Output
GDPNA	*GDPNAR*	*PGDNA*	Non-agricultural Output

Definitional Relationship:

$$GDP = GDPAG + GDPNA$$

IV. *Investment Expenditure*

Nominal	Real	Associated Price Deflator	
IFXBP	*IFXBPR*	*PD*	Fixed investment in private business,
IFXBPAG	*IFXBPAGR*	*PD*	Fixed investment in private business, agriculture
IFXBPNA	*IFXBPNAR*	*PD*	Fixed investment in private business, non-agriculture
IFXBS	*IFXBSR*	*PD*	Fixed investment in state enterprises,
IFXBSAG*	*IFXBSAGR*	*PD*	Fixed investment in state enterprises, agriculture
IFXBSNA*	*IFXBSNAR*	*PD*	Fixed investment in state enterprises, non-agriculture
IFXBU	*IFXBUR*	*PD*	Fixed investment in business sector,
IFXBUNA	*IFXBUNAR*	*PD*	Fixed investment in business sector, non-agriculture
IFXGV	*IFXGVR*	*PD*	Fixed investment in government sector,
IFXGVAG*	*IFXGVAGR*	*PD*	Fixed investment in government sector, agriculture
IFXGVNA*	*IFXGVNAR*	*PD*	Fixed investment in government sector, non-agriculture
IFXTO	*IFXTOR*	*PD*	Total fixed investment,

217

INVBP	*INVBPR*	*PD*	Investment in inventories

Definitional Relationships:

$$IFXBP \equiv IFXBPAG + IFXBPNA$$
$$IFXBS \equiv IFXBSAG + IFXBSNA$$
$$IFXGV \equiv IFXGVAG + IFXGVNA$$
$$IFXBU \equiv IFXBP + IFXBS$$
$$IFXTO \equiv IFXBU + IFXGV$$

V. *Capital Stock*

Real

KFXBPAGR	Fixed capital stock in private business, agriculture
KFXBPNAR	Fixed capital stock in private business, non-agriculture
KFXBSAGR	Fixed capital stock in state enterprises, agriculture
KFXBSNAR	Fixed capital stock in state enterprises, non-agriculture
KFXGVAGR	Fixed capital stock in government sector, agriculture
KFXGVNAR	Fixed capital stock in government sector, non-agriculture
KFXTOR	Total fiixed capital stock
KFXTOAGR	Total fixed capital stock, agriculture
KFXTONAR	Total fixed capital stock, non-agriculture
KIVBPR	Stock of inventories

Definitional Relationships:

$$KFXTOAGR \equiv KFXBPAGR + KFXBSAGR + KFXGVAGR$$
$$KFXTONAR \equiv KFXBPNAR + KFXBSNAR + KFXGVNAR$$

VI. *Imports*

Nominal	Real	Associated Price Deflator	
MGS	*MGSR*	*PM*	Imports of goods and services
MGS$	*MGSR*	*PM$*	Imports of goods and services, in U.S. dollars
MRM	*MRMR*	*PMRM*	Imports of raw materials and fuels
MK	*MKR*	*PMK*	Imports of capital goods
MC	*MCR*	*PMC*	Imports of consumers' goods
MS	*MSR*	*PMS*	Imports of services

Definitional Relationships:

$$MGSR \equiv MRMR + MKR + MCR + MSR$$
$$MGS \equiv PMRM \cdot MRMR + PMK \cdot MKR + PMC \cdot MCR + PMS \cdot MSR$$

VII. *Population and Employment*

NEMAG	Available supply of labor in agriculture
NEMNA	Employment in non-agriculture
NLF*	Labor force

Definitional Relationship:

$$NLF^* = NEMAG + NEMNA$$

VIII. *Price Indices*

PD	Domestic price level
PGDAG	GDP deflator for agricultural products
PGDNA	GDP deflator for non-agricultural products
PTXNA	GDP deflator for non-agricultural minus import and indirect taxes
PM$	Average price of imported goods and services, in U.S. dollars
PM	Average price of imported goods and services
PMRM$*	Price of imported raw materials and fuels, in U.S. dollars
PMRM	Price of imported raw materials and fuels
PMTRM	Price of imported raw materials and fuels, including import taxes
PMK$*	Price of imported capital goods, in U.S. dollars
PMK	Price of imported capital goods
PMTK	Price of imported capital goods, including import taxes
PMC$*	Price of imported consumers' goods, in U.S. dollars
PMC	Price of imported consumers' goods
PMTC	Price of imported consumers' goods, including import taxes
PMS$*	Price of imported services, in U.S. dollars
PMS	Price of imported services
PMTS	Price of imported services, including import taxes
PX$	Average price of exports of goods and services, in U.S. dollars
PX	Average price of exports of goods and services
PTXAG	Net producer price for agricultural products excluding indirect taxes
PXGAG	Price of export of agricultural products
PXGAG$*	Price of export of agricultural products, in U.S. dollars
PXGNA	Price of export of non-agricultural products
PXGNA$	Price of export of non-agricultural products, in U.S. dollars
PXS	Price of export of services
PXS$	Price of export of services, in U.S. dollars
PDW$1*	Weighted average of consumer price index in Japan, U.S.A., and West Germany

PDW\$2*   Weighted average of consumer price index in Japan, U.S.A.,
West Germany and Malaysia

GDPWR1*   Weighted average of *GDP* in Japan, U.S.A., and West Germany

GDPWR2*   Weighted average of *GDP* in Japan, U.S.A., West Germany and
Malaysia

IX. *Tax Revenues and Other Incomes to Government*

TMNA	Total import tax revenue
TMRM	Import tax on raw materials and fuels
TMK	Import tax on capital goods
TMC	Import tax on consumers' goods
TOIAG	Business and other indirect taxes in agricultural sector
TOINA	Business and other indirect taxes in non-agricultural sector
TCYBPNA	Corporate income tax
TDRHH	Income tax on households
TPRBSNA*	Direct taxes on state enterprises
TPTGVNA*	Property income accrued to government
TXAG*	Export taxes
TAX	Government net revenue (less transfer)
TIME*	Time trend

Definitional relationship:

$$TMNA \equiv TMRM + TMK + TMC$$

X. *Exports*

Nominal	Real	Associated Price Deflator	
XGS	*XGSR*	*PX*	Exports of goods and services
XGS\$	*XGSR*	*PX\$*	Exports of goods and services, in U.S. dollars
XGAG	*XGAGR*	*PXGAG*	Exports of agricultural products
XGNA	*XGNAR*	*PXGNA*	Exports of non-agricultural products
XS	*XSR*	*PXS*	Exports of services

XI. *Wage Rates*

Nominal	Real	Associated Price Deflators	
WGRNA	*WGRNAR*	*PD*	Gross wage rate in non-agriculture

XII. *Income and Income Shares*

Nominal	Real or \$	Associated Price Deflator	

YDSHH	*YDSHHR*	*PD*	Disposable income of all households
YDSHHAG			Disposable income of agricultural household
YDSHHNA			Disposable income of non-agricultural household
YGPBPNA			Gross profits accrued to non-agricultural private businesses
YINHHNA			Interest income accrued to non-agricultural households
YIPGVNA*			Interest on public debts
YKNHHNA			Capital income accrued to non-agricultural households
YLBNA			Labor income in non-agricultural sector
YRDBPNA			Retained earnings and depreciation allowance, non-agricultural private businesses
YRDBSNA*			Retained earnings and depreciation allowance, non-agricultural state enterprises
YRTHHNA			Rent income accrued to non-agricultural households
YTRBPFO	*YTRBPFO$**		Net transfer from private business to foreign sector
YTRBSFO	*YTRBSFO$**		Net transfer from state enterprises to foreign sector
YTRGVFO	*YTRGVFO$**		Net transfer from government to foreign sector
YTRHHFO	*YTRHHFO$**		Net transfer from households to foreign sector
YTRHHGV*			Net transfer from households to government sector

Definitional Relationships:

$$YKNHHNA \equiv YINHHNA + YRTHHNA$$
$$YGPBPNA \equiv YRDBPNA + TCYBPNA$$

XIII. *Exogeneous Variables, Hitherto Unspecified*

ER1* — Average rainfall during planting season
ER2* — Average rainfall between the time of planting and harvesting
ERHAG* — Holding area of paddy land

XIV. *Endogeneous Variables, Hitherto Unspecified*

UHAAG	— Total harvested area in agriculture
UPAAG	— Total planted area in agriculture
USVBP	— Private business's nominal net surplus or deficit
USVBS	— State enterprises' nominal net surplus or deficit
USVBU	— Business sector's nominal net surplus or deficit
USVFO	— Foreign sector's nominal net surplus or deficit
USVFO$	— Foreign sector's nominal net surplus or deficit, in U.S. dollars
USVGV	— Government sector's nominal net surplus or deficit
USVHH	— Household nominal savings
UDYPAG	— Nominal disposable household income per employed person in agriculture
UDYPNA	— Nominal disposable household income per employed person in non-agriculture
URDYPNAAG	— Relative disposable income per person in non-agriculture vs. agriculture
ULPAG	— Output per employed person (average labor productivity in agriculture)
ULPNA	— Output per employed person (average labor productivity in non-agriculture)
URLPNAAG	— Relative average labor productivity in non-agriculture vs. agriculture
UKLRAG	— Real fixed capital stock-employment ratio in agriculture
UKLRNA	— Real fixed capital stock-employment ratio in non-agriculture
URKLRNAAG	— Relative capital-labor ratio in non-agriculture vs. agriculture
UOKRAG	— Output-real fixed capital stock ratio (converse of capital-output ratio) in agriculture
UOKRNA	— Output-real fixed capital stock ratio in non-agriculture
ULYSNA	— Gross labor income (including direct taxes) as proportion of *GDP* in non-agricultural sector
UITSNA	— Indirect taxes as proportion of *GDP* in non-agricultural sector
UGKSNA	— Gross capital income as proportion of *GDP* in non-agricultural sector

XV. *Policy Instruments, Hitherto Unspecified*

*ZTBAG**	— Business tax rate in agricultural sector
*ZTBNA**	— Business tax rate in non-agricultural sector
*ZTRMNA**	— Average import tariff rate
*ZTRMRM**	— Import tariff rate for raw materials and fuels
*ZTRMK**	— Import tariff rate for capital goods
*ZTRMC**	— Import tariff rate for consumers' goods

ZXR$\$$ — Exchange rate in domestic currency per U.S.\$

XVI. *Financial Variables Used in Real Sector* (For Reference)

FTDHBCB — Time deposits at commercial banks of private sector

FSDHBCB — Saving deposits at commercial banks of private sector

FTDHBFC — Long term (more than one year) promissory notes of finance companies held by private sector

FSDHBFC — Short term (one year or less) promissory notes of finance companies held by private sector

FDDHBFC — At call promissory notes of finance companies held by private sector

FSTHBGS — Private sector's holding of saving and time deposits at GSB

FGBHHGV — Government bonds held by private sector

RTDCB* — Interest rate on time deposits at commercial banks

RSDCB* — Interest rate on saving deposits at commercial banks

RTDFC* — Interest rate on long term P/N at finance companies

RSDFC* — Interest rate on short term P/N at finance companies

RDDFC* — Interest rate on at call P/N at finance companies

RSTGS* — Interest rate on saving and time deposits at GSB

RGBHH* — Rate of return to households on holding of government bonds

RFO* — Foreign market rate of interest

RLCB — Interest rate on commercial bank loans

RRFAHHR — Expected real rate of return on financial assets held by private sector

Notation of the Financial Sector

1. *Commercial Banks* (CB):

FNCCBBT: Cash on hand of commercial banks

FBLCBBT: Total balance at the Bank of Thailand (BOT)

FRCCBBT: Required balance at BOT

FEBCBBT: Excess balance at BOT

FERCBBT: Excess reserve of commercial banks (excess balance at BOT +cash on hand)

FBLCBOF: balance at other financial institutions in Thailand including bank for agriculture and agricultural co-operatives (BAAC)

FCDCBBA: Required deposits at BAAC to satisfy the agricultural credit policy

FDDCBFC: Balances at finance companies

FTBCBGV: Commercial banks' investment in treasury bills

FGBCBGV: Commercial banks total holding of government bonds

FCQCBGV: Compulsory holdings of government bonds to satisfy secondary reserve and branching requirements

FRBCBGV: Holding of government bonds as required secondary reserve

FBCCBGV: Holding of government bonds to satisfy branching requirement

FBVCBGV: Voluntary investment in government bonds

FLOCBBU: Private business demand for commercial bank loans and overdrafts

FLOCBFC: Finance companies demand for commercial bank loans and overdrafts

FDDCBBU: Private business demand for discounts of domestic bills

FDMCBBU: Private business demand for discounts of import bills and trust receipts

FRRCB: Total required reserve (deposits at BOT and government bonds) of commercial banks

FDXCBFO: Foreign sector's demand for discounts of export bills

FFXCB*: Commercial banks' fixed and other assets

FFQCBFO: Foreign assets of commercial banks excluding discounts of export bills

FFACBFO: Total foreign assets of commercial banks including discounts of export bills

FLDCBBF: Total commercial bank londings to private, foreign and finance company sectors

FLNCBBU: Commercial bank supply of loans, overdrafts and discounts to private and foreign sectors (excluding finance companies)

FDTGVCB*: Total deposits of Central Government at commercial banks

FDTFOCB*: Total foreign deposits at commercial banks

FDTOFCB: Total deposits of other financial institutions in Thailand at commercial banks

FDFXXCB: Free deposits of commercial banks

FDTHBCB: Total deposits of private sector at commercial banks

FDTXXCB: Total deposits at commercial banks

FDDHBCB: Private sector's holding of demand deposits at commercial banks

FSDHBCB: Private sector's holding of saving deposits at commercial banks

FTDHBCB: Private sector's holding of time deposits at commercial banks

FLDBTCB: Commercial bank borrowings from BOT

FLNBTCB: Commercial bank borrowings from BOT in form of loans

FRXBTCB: Commercial bank borrowings from BOT in form of rediscounts of export bills

FRNBTCB: Commercial bank borrowings from BOT in form of rediscounts of domestic bills

FLROFCB: Commercial bank borrowings from other financial institutions in Thailand

FLRFOCB: Foreign borrowings of commercial banks

FCACB: Capital accounts of commercial banks

FMLCB*: Commercial bank other miscellaneous liabilities

FMACB*: Commercial bank other miscellaneous assets

FFLFOCB: Commercial bank foreign liabilities

FXSCBHB: Net foreign exchange operations of commercial banks with customers

FXSCBBT: Net foreign exchange sales of commercial banks to the Exchange Equalization Fund (EEF)

FCICB: Commercial bank net cash inflow from domestic sources

ENBCB*: Number of commercial bank branches including head-offices

RLNBT*: Bank of Thailand's loan rate to commercial banks

RRDBT*: Bank of Thailand's rediscount rate to commercial banks

RTB*: Rate of return on holding of treasury bills

RGB*: Rate of return on holding of government bonds

RFO*: Foreign market rate of interest

RTDCB*: Interest rate on time deposits at commercial banks

RSDCB*: Interest rate on saving deposits at commercial banks

RIB: Interbank rate of interest among financial institutions

RLCB: Interest rate on commercial bank loans, overdrafts and discounts

II. Government Savings Bank (GSB):

FNCGSBT: Cash on hand of GSB

FBLGSBT*: Balance at BOT

FBLGSCB*: Balance at commercial banks

FLDGSBU*: Total loans, overdrafts and discounts to private business

FGSGSGV: GSB holding of government securities

FFXGS*: Fixed and other assets of GSB

FMAGS*: GSB's other miscellaneous assets

FDDHBGS*: Private sector's holding of demand deposits at GSB

FSTHBGS: Private sector's holding of saving and time deposits at GSB

FSBHBGS: Private sector's holding of saving bonds and premium saving bonds at GSB

FCAGS*: GSB's capital account

FDTXXGS: Total deposits at GSB

FDTQQGS*: Other deposits at GSB

FMLGS*: GSB's other miscellaneous liabilities

RSTGS*: Interest rate on saving and time deposits at GSB

III. Bank of Thailand (BOT):

FNCXXBT: Notes in circulation

FNCHBBT: Notes held by public

FNCOTBT*: Notes held by others

FDDTHBBT*: Private sector's deposits at BOT

UGD: Government deficit (−) or surplus (+)

UGNBTGV: Net financing of government deficit by the Bank of Thailand

UFNBTFO$, UFNBTFO: Change in official international reserves held by the Bank of Thailand and Exchange Equalization Fund, in U.S. dollars or bahts

IV. Finance Companies:

FRBFCGV: Compulsory holdings of liquid assets as a proportion of total P/N issued

FDTXXFC: Total promissory notes issued by finance companies

FDFXXFC: Free promissory notes of finance companies

FDDCBFC: Commercial banks holding of finance company promissory notes

FTDHBFC: Long term (more than one year) promissory notes of finance companies held by private sector

FSDHBFC: Short term (one year or less) promissory notes of finance

companies held by private sector

FDDHBFC: At call promissory notes of finance companies held by private sector

FLDFCBU: Finance companies lending to private sector

FLAFC: Voluntary investment in liquid assets

FLOCBFC: Finance companies demand for commercial bank loans and overdrafts

FLRFOFC: Foreign borrowings of finance companies

FCAFC*: Finance companies' capital account

FFXFC*: Fixed and other assets of finance companies

FMLFC*: Other miscellaneous liabilities of finance companies

ENBFC*: Number of finance companies

RTDFC*: Interest rate on long term P/N of finance companies

RSDFC*: Interest rate on short term P/N of finance companies

RDDFC*: Interest rate on at call P/N of finance companies

RSH*: Rate on return on liquid assets

V. *Balance of Payments*:

FKDDFO\$, FKDDFO: Total foreign capital movement in U.S. dollars and bahts

FKPOFO\$*, FKPOFO: Private portfolio investment from foreign sector

FKBSFO\$*, FKBSFO: Net long term loans and credits to state enterprises from foreign sector

FKGVFO\$*, FKGVFO: Net foreign capital inflow to government sector

FKFBPFO\$, FKFBPFO: Foreign short and long term capital inflow to private business except portfolio investment

ESDR\$*, ESDR: Allocation of SDR in balance of payments account

EADJBP\$*, EADJBP: Errors and omissions in balance of payments account

UBP\$, UBP: Balance of payments

UBA\$, UBA: Balance of payments adjusted for foreign exchange transactions which are not channelled through commercial banks

VI. *Variables Undefined Elsewhere*

EADJGV *: Adjustment factor linking change in Central Government cash position with government deficit or surplus in national accounts

EADJM1*: Other miscellaneous components in the money stock

EADJOT *: Miscellaneous sources of financing of government deficit

ZXR\$*: Exchange rate in domestic currency per U.S. dollar

ZK1*: Required bond reserve ratio to total commercial bank deposits

ZK2*: Required cash reserve ratio to total commercial bank deposits

ZK3*: Required liquid asset ratio to total P/N issued by finance companies

ZM1*: Ratio of required bond holding to total commercial bank deposits as a condition for branching expansion

ZM2*: Ratio of required balance at BAAC to total commercial bank deposits as a fulfilment of agricultural

credit policy

FM 1: Money stock (narrowly defined)

FGBHHGV *: Government bonds held by private sector

V The Structure of the Macro-econometric Model of Thailand[6]

V.1 The Real Sector

Equations in the Real Sector

I. *Production and Import*

A. *Production*

A.1 *Production in Agriculture*

  1. *Total Planted Area*

$$\ln UPAAG = -11.1993$$
$$(-8.062)$$
$$+2.00926 \ln ERHAG*$$
$$(16.395)$$
$$+.0913 \ln ER1*$$
$$(2.211)$$
$$+.20264 \ln\left(\frac{PTXAG-1}{PD-1}\right)$$
$$(2.189)$$
$$+.10132 \ln\left(\frac{PTXAG-2}{PD-2}\right)$$
$$(2.189)$$

$R^2 = .95325 \quad SE = .03928$

$DW = 1.8799 \quad N = 15(1962-76)$

Rem: *PDL* on $\dfrac{PTXAG-i}{PD-i}$

  2. *Total Harvested Area*

$$\ln UHAAG = -1.41095$$
$$(-2.853)$$
$$+.99325 \ln UPAAG$$
$$(41.883)$$
$$+.20326 \ln ER2*$$
$$(3.409)$$

$R^2 = .9910 \quad SE = .0190$

$DW = 2.860 \quad N = 17(1960-76)$

  3. *Agricultural Production Function*

$$\ln GDPAGR = .02269 \ TIME*$$
$$(4.839)$$
$$+.75292 \ln UHAAG$$
$$(7.750)$$
$$+.24268\cdot$$
$$(2.207)$$

---

6) The model is always being improved. This is February 9, 1979 version.

$$\ln\left(\frac{NEMAG \cdot KFXTOAGR-1}{UPAAG}\right)$$

$R^2 = .9742 \quad SE = .0423$

$DW = .343 \quad N = 17(1960-76)$

Rem: Constant returns to scale for land, labor and capital

A.2 *Production in Non-agriculture*

  4. *Non-agricultural Production Function*

$$\ln\frac{GDPNAR}{NEMNA} = .05178 \ TIME*$$
$$(11.269)$$
$$+.55451 \ln\frac{KFXTONAR-1}{NEMNA}$$
$$(49.313)$$

$R^2 = .9175 \quad SE = .0679$

$DW = .719 \quad N = 10(1960, 66, 67,$
$69, \ 70-73, \ 75,$
$76)$

Rem: Constant returns to scale for labor and capital

or $\ln GDPNAR = .05178 \ TIME*$
$+.55451 \ln KFXTONAR_{-1}$
$+.44549 \ln NEMNA$

Note: For remaining years in which survey data on employment are not available, employment figures are generated by this relationship using actual values of real capital stock and output.

  5. *Gross Domestic Output*

$GDPR = GDPAGR + GDPNAR$

  6. *Nominal Value of Output in Agriculture*

$GDPAG = PGDAG \cdot GDPAGR$

  7. *Nominal Value of Output in Non-*

agriculture

$$GDPNA = PGDNA \cdot GDPNAR$$

8. *Nominal Value of Total Output*

$$GDP = GDPAG + GDPNA$$

B. *Wage Rate Determination and Demand for Labor*

9. *Wage Rate Determination in Non-agricultural Sector*

$\ln WGRNA$

$$= \underset{(86.085)}{.93091} \ln \frac{GDPNAR-1}{NEMNA-1}$$

$$+ \underset{(6.073)}{.99889} \ln PD_{-1}$$

$R^2 = .8787 \quad SE = .1286$

$DW = 2.268 \quad N = 17(1960-76)$

10. *Demand for Labor in Non-agricultural Sector*

$\ln NEMNA = \underset{(12.843)}{.06457} TIME*$

$$+ \underset{(25.754)}{.85913} \ln KFXTONAR_{-1}$$

$$- \underset{(-7.742)}{1.22846} \ln \frac{WGRNA}{PTXNA}$$

$R^2 = .9547 \quad SE = .0575$

$DW = .420 \quad N = 17(1960-76)$

11. *Available Supply of Labor in Agricultural Sector*

$$NEMAG = NLF* - NEMNA$$

C. *Price Relationships*

12. *Net Producer Price for Agricultural Products Excluding Indirect Taxes*

$$PTXAG = PGDAG - ZTBAG*$$
$$- (TXAG*/GDPAGR)$$

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

$$PTXNA = PGDNA - ZTBNA*$$
$$- (TMNA/GDPNAR)$$

14. *Determination of Agricultural Price Deflator*

$\ln PGDAG = \underset{(-2.668)}{-.06675}$

$$+ \underset{(19.333)}{1.10297} \ln PXGAG$$

$$+ \underset{(6.546)}{.85597} \ln (PD/PXGAG)$$

$R^2 = .9684 \quad SE = .0482$

$DW = 1.386 \quad N = 17(1960-76)$

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

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

Exchange rate is 20.913 Baht/ U.S.\$ in 1972.

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

$\ln PXGNA = \underset{(-.091)}{-.006712}$

$$+ \underset{(6.667)}{1.12891} \ln PGDNA$$

$$+ \underset{(2.799)}{.48301} \ln(PMTRM/PGDNA)$$

$R^2 = .8003 \quad SE = .1335$

$DW = 1.5525 \quad N = 17(1960-76)$

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

$\ln PXS = \underset{(1.723)}{.041354}$

$$+ \underset{(18.587)}{1.027826} \ln PD$$

$$+ \underset{(8.049)}{.77760} \ln (PXGAG/PD)$$

$R^2 = .9758 \quad SE = .0462$

$DW = 1.7572 \quad N = 17(1960-76)$

18. *Export Price for Non-agricultural Products in U.S. dollars*

$$PXGNA\$ = PXGNA \bigg/ \frac{ZXR\$*}{20.913}$$

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

$$PXS\$ = PXS \bigg/ \frac{ZXR\$*}{20.913}$$

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

$$PX = XGS/XGSR$$

21. *Average Export Price Index for Goods and Services in U.S. dollars*

$$PX\$ = PX \Big/ \frac{ZXR\$^*}{20.913}$$

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

$$PMRM = PMRM\$^* \cdot (ZXR\$^*/20.913)$$

23. *Price of Imported Raw Materials and Fuels including Import Taxes*

$$PMTRM = PMRM(1 + ZTRMRM^*)$$

24. *Landed Price of Imported Capital Goods in Local Currency*

$$PMK = PMK\$^* \cdot (ZXR\$^*/20.913)$$

25. *Price of Imported Capital Goods including Import Taxes*

$$PMTK = PMK(1 + ZTRMK^*)$$

26. *Landed Price of Imported Consumer Goods in Local Currency*

$$PMC = PMC\$^* \cdot (ZXR\$^*/20.913)$$

27. *Price of Imported Consumer Goods including Import Taxes*

$$PMTC = PMC(1 + ZTRMC^*)$$

28. *Price of Imported Non-factor Services in Local Currency (no Taxes)*

$$PMS = PMS\$^* \cdot (ZXR\$^*/20.913)$$

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

$$PM = MGS/MGSR$$

30. *Average Import Price Index of Goods and Services in U.S. dollars*

$$PM\$ = PM \Big/ \frac{ZXR\$^*}{20.913}$$

D. *Import Demand*

31. *Import Demand for Raw Materials*

and Fuels

$$\ln MRMR = .18008$$
$$(.084)$$
$$+ .81749 \ln GDPNAR$$
$$(4.591)$$
$$- .99339 \ln PMTRM$$
$$(-6.173)$$
$$+ 2.23627 \ln PTXNA$$
$$(4.345)$$

$R^2 = .99532 \quad SE = .04326$

$DW = 1.706 \quad N = 17(1960-76)$

32. *Import Demand for Capital Goods*

$$\ln MKR = -.38487$$
$$(-.755)$$
$$+ .93657 \ln IFXTOR$$
$$(18.770)$$
$$- 1.19034 \ln PMTK$$
$$(-10.312)$$
$$+ 1.42976 \ln PD$$
$$(6.375)$$

$R^2 = .9868 \quad SE = .06059$

$DW = 1.496 \quad N = 17(1960-76)$

33. *Import Demand for Consumer Goods*

$$\ln MCR = .27273$$
$$(.335)$$
$$+ .77052 \ln CONHHR$$
$$(10.847)$$
$$- .86085 \ln PMTC$$
$$(-16.318)$$
$$+ .18724 \ln PD$$
$$(1.587)$$

$R^2 = .9628 \quad SE = .0490$

$DW = 1.979 \quad N = 17(1960-76)$

34. *Import Demand for Services*

$$\ln MSR = -12.41924$$
$$(-19.845)$$
$$+ 1.76662 \ln CONHHR$$
$$(32.125)$$
$$- 1.09578 \ln (PMS/PD)$$
$$(-7.738)$$

$R^2 = .98537 \quad SE = .07234$

$DW = 1.315 \quad N = 17(1960-76)$

35. *Total Demand for Import of Goods and Services*

$MGSR = MRMR + MKR + MCR$
$+ MSR$

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

$MGS = PMRM \cdot MRMR$
$+ PMK \cdot MKR + PMC \cdot MCR$
$+ PMS \cdot MSR$

37. *Nominal Value of Imported Goods and Services in U.S. dollars*

$MGS\$ = MGS / ZXR\$*$

II. *Domestic Expenditure and Export*

E. *Real Consumption Expenditures*

38. *Real Private Consumption Expenditure*

$CONHHR = 2513.90425$
(1.890)
$+ .56082\ YDSHHR$
(66.821)
$+ .28041\ YDSHHR_{-1}$
(66.821)
$+ 374.40929\ RRFAHHR$
(4.905)

$R^2 = .9973 \qquad SE = 1464.0663$
$DW = 1.6227 \qquad N = 16(1961-76)$
Rem: *PDL* on $YDSHHR_i$

$RRFAHHR$
$=$"Expected" real rate of
return on financial assets
held by private sector
$= [(RSDCB* \cdot FSDHBCB_{-1}$
$+ RTDCB* \cdot FTDHBCB_{-1}$
$+ RSTGS* \cdot FSTHBGS_{-1}$
$+ RDDFC* \cdot FDDHBFC_{-1}$
$+ RSDFC* \cdot FSDHBFC_{-1}$
$+ RTDFC* \cdot FTDHBFC_{-1}$
$RGBHH* \cdot FGBHHGV_{-1}*)/$
$(FSDHBCB_{-1} + FTDHBCB_{-1}$
$+ FSTHBGS_{-1}$
$+ FDDHBFC_{-1}$

$+ FSDHBFC_{-1}$
$+ FTDHBFC_{-1}$
$+ FGBHHGV_{-1}*)]$
$- \left[\dfrac{PD - PD_{-1}}{PD_{-1}} \cdot 100 \right]$

39. *Real Government Consumption Expenditure*

$CONGVR = CONGV* / PD$

F. *Real Investment Expenditures*

40. *Private Business Build-up of Agricultural Fixed Capital Stock*

$\ln KFXBPAGR = - .05719$
$\qquad\qquad (-.201)$
$+ .84294 \ln KFXBPAGR_{-1}$
(14.974)
$+ .16205 \ln GDPAGR$
(5.158)
$+ .06551 \ln \left(\dfrac{PTXAG_{-1}}{PD_{-1}} \right)$
(3.429)
$+ .03275 \ln \left(\dfrac{PTXAG_{-2}}{PD_{-2}} \right)$
(3.429)

$R^2 = .99712 \qquad SE = .0078$
$DW = 2.453 \qquad N = 15(1962-76)$

Rem: *PDL* on $\ln \left(\dfrac{PTXAG_{-i}}{PD_{-i}} \right)$

41. *Real Gross Fixed Investment in Agriculture, Private Business*

$IFXBPAGR = (KFXBPAGR$
$- KFXBPAGR_{-1})$
$+ .035\ KFXBPAGR_{-1}$

42. *Real Net Fixed Investment in Non-agricultural Sector, Private Business (or Gross Fixed Investment by Transformation)*

$IFXBPNAR - .035\ KFXBPNAR_{-1}$
$= -599.6335 + 1964.4741 \cdot$
$\quad (-.510) \quad (4.087)$
$\dfrac{GDPNAR}{KFXBPNAR_{-1}} .$

$$\left[\frac{100(YRDBPNA}{}\right.$$

$$\left.+\frac{YKNHHNA+YTRBPFO)}{GDPNAR}\right.$$

$$-(.7\ RLCB+.2\ RLFC$$

$$\left.+.1\ RFO^*)\right]$$

$$+6499.2592\ DUMMY69^*$$
$$(3.357)$$

$R^2=.85941 \quad SE=2750.885$

$DW=.746 \quad N=16(1961\ 76)$

Rem: .035 is Depreciation Rate

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

$KFXBPNAR$

$$=(1-.035)\ KFXBPNAR_{-1}$$
$$+IFXBPNAR$$

44. *Private Business Build-up of Stock of Inventories*

$KIVBPR=.92605\ KIVBPR_{-1}$
(7.773)

$$+.0659GDPR(GDPR/GDPR_{-1})$$
$$(1.652)$$

$$+.00287\left[\frac{PD-PD_{-1}}{PD_{-1}}\cdot 100\right.$$
$$(4.306)$$

$$\left.-RLCB\right]\cdot GDPR$$

$R^2=.9876 \quad SE=2354.419$

$DW=2.757 \quad N=16(1961-76)$

Rem: $GDPR(GDPR/GDPR_{-1})$ is "Expected" Output

45. *Investment in Inventories*

$INVBPR=KIVBPR-KIVBPR_{-1}$

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

$IFXBUR=IFXBPAGR$
$$+IFXBPNAR+(IFXBSAG^*$$
$$+IFXBSNA^*)/PD$$

47. *Gross Fixed Investment, Government Sector*

$IFXGVR=(IFXGVAG^*$
$$+IFXGVNA^*)/PD$$

48. *Total Gross Fixed Investment*

$IFXTOR=IFXBUR+IFXGVR$

49. *Real Fixed Capital Stock in Agriculture, Government Sector*

$KFXGVAGR$

$$=(1-.035)\ KFXGVAGR_{-1}$$
$$+IFXGVAGR$$

50. *Real Fixed Capital Stock in Agriculture, State Enterprises*

$KFXBSAGR$

$$=(1-.035)\ KFXBSAGR_{-1}$$
$$+IFXBSAGR$$

51. *Real Fixed Capital Stock in Non-agriculture, Government Sector*

$KFXGVNAR$

$$=(1-.035)\ KFXGVNAR_{-1}$$
$$+IFXGVNAR$$

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

$KFXBSNAR$

$$=(1-.035)\ KFXBSNAR_{-1}$$
$$+IFXBSNAR$$

53. *Total Real Fixed Capital Stock in Agriculture*

$KFXTOAGR=KFXBPAGR$
$$+KFXBSAGR+KFXGVAGR$$

54. *Total Real Fixed Capital Stock in Non-agriculture*

$KFXTONAR=KFXBPNAR$
$$+KFXBSNAR+KFXGVNAR$$

55. *Total Real Fixed Capital Stock of the Economy*

$KFXTOR$

$$=KFXTOAGR+KFXTONAR$$

56. *Nominal Value of Private Consumption Expenditure*

$CONHH=PD\cdot CONHHR$

57. *Nominal Value of Private Business Fixed Investment in Agriculture*

$$IFXBPAG = PD \cdot IFXBPAGR$$

58. *Nominal Value of Private Business Fixed Investment in Non-agriculture*

$$IFXBPNA = PD \cdot IFXBPNAR$$

59. *Nominal Value of Change in Inventories*

$$INVBP = PD \cdot INVBPR$$

60. *Nominal Value of Gross Fixed Investment by Private Business*

$$IFXBP = IFXBPAG + IFXBPNA$$

61. *Nominal Value of Gross Fixed Investment by State Enterprises*

$$IFXBS$$
$$= IFXBSAG* + IFXBSNA*$$

62. *Nominal Value of Gross Fixed Investment by Government*

$$IFXGV$$
$$= IFXGVAG* + IFXGVNA*$$

63. *Nominal Value of Total Gross Fixed Investment*

$$IFXTO$$
$$= IFXBP + IFXBS + IFXGV$$

G. *Exports*

64. *Export Volume of Agricultural Products*

$$XGAGR = -1578.2814$$
$$(-.605)$$
$$+ 2643.8827 \frac{PDW\$1*}{PXGAG\$*}$$
$$(.667)$$
$$+ .29298 (.3 GDPAGR$$
$$(5.124)$$
$$+ .7 GDPAGR_{-1})$$

$R^2 = .7273 \qquad SE = 1966.518$
$DW = 1.085 \qquad N = 16(1961-76)$

65. *Export Volume of Non-agricultural Products*

$$XGNAR = -10368.1732$$
$$(-4.486)$$

$$+ 11118.1911 \, GDPWR1*$$
$$(4.497)$$
$$+ 11122.4458 \frac{PDW\$1*}{PXGNA\$}$$
$$(2.749)$$

$R^2 = .8195 \qquad SE = 1653.967$
$DW = .674 \qquad N = 16(1961-76)$

66. *Export Volume of Non-factor Services*

$$\ln XSR = 8.23135$$
$$(112.698)$$
$$+ 1.63902 \ln GDPWR2*$$
$$(12.344)$$
$$- 1.18873 \ln \left(\frac{PXS\$}{PDW\$2*} \right)$$
$$(-5.034)$$

$R^2 = .9521 \qquad SE = .1185$
$DW = 1.154 \qquad N = 16(1961-76)$

67. *Export Volume of Goods and Services*

$$XGSR$$
$$= XGAGR + XGNAR + XSR$$

68. *Nominal Export Value of Goods and Services in Local Currency*

$$XGS = PXGAG \cdot XGAGR$$
$$+ PXGNA \cdot XGNAR + PXS \cdot XSR$$

69. *Nominal Export Value of Goods and Services in U.S. dollars*

$$XGS\$ = XGS/ZXR\$$$

III. *Determination of Domestic Price*

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

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

or

$$PD =$$
$$\frac{CONGV* + IFXGVAG*}{(GDPR + MGSR}$$
$$\frac{+ IFXGVNA* + IFXBSAG*}{- CONHHR - IFXBPAGR}$$
$$\frac{+ IFXBSNA*}{- IFXBPNAR - INVBPR - XGSR)}$$

71. *Nominal Value of Aggregate Demand and Supply Identity to Determine Non-agricultural Price Deflator*

$$GDP+MGS$$
$$=CONHH+CONGV*$$
$$+IFXBP+IFXBS+IFXGV$$
$$+INVBP+XGS \quad \text{or}$$

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

IV. *Income Distribution*

72. *Gross Labor Income in Non-agricultural Sector*

$$YLBNA=NEMNA\cdot WGRNA$$

73. *Rental Income Accrued to Non-agricultural Households*

$$YRTHHNA=-7592.4907$$
$$(-13.467)$$
$$+.03561\ KFXBPNAR_{-1}$$
$$(19.860)$$
$$R^2=.9633 \quad SE=268.867$$
$$DW=1.291 \quad N=16(1961-76)$$

74. *Interest Income Accrued to Non-agricultural Households*

$$YINHHNA=350.1870+1.38557\cdot$$
$$\quad\quad (4.170) \quad\quad (47.181)$$
$$\left[\frac{RTDCB*}{100}\cdot FTDHBCB_{-1}\right.$$
$$+\frac{RSDCB*}{100}\cdot FSDHBCB_{-1}$$
$$+\frac{RSTGS*}{100}\cdot FSTHBGS_{-1}$$
$$+\frac{RDDFC*}{100}\cdot FDDHBFC_{-1}$$
$$+\frac{RSDFC*}{100}\cdot FSDHBFC_{-1}$$
$$+\frac{RTDFC*}{100}\cdot FTDHBFC_{-1}$$
$$\left.+\frac{RGBHH*}{100}\cdot FGBHHGV_{-1}*\right]$$

$$R^2=.9933 \quad SE=246.754$$
$$DW=.568 \quad N=16(1961-76)$$

75. *Capital Income Accrued to Non-agricultural Households*

$$YKNHHNA$$
$$=YRTHHNA+YINHHNA$$

76. *Direct Taxes on Households in Non-agricultural Sector*

$$\ln TDRHH=-5.21848$$
$$(-21.651)$$
$$+1.12669\ \ln YLBNA_{-1}$$
$$(51.034)$$
$$R^2=.9943 \quad SE=.0461$$
$$DW=1.145 \quad N=16(1961-76)$$

77. *Import Taxes on Raw Materials and Fuels*

$$TMRM=ZTRMRM*\cdot PMRM\cdot MRMR$$

78. *Import Taxes on Capital Goods*

$$TMK=ZTRMK*\cdot PMK\cdot MKR$$

79. *Import Taxes on Consumer Goods*

$$TMC=ZTRMC*\cdot PMC\cdot MCR$$

80. *Total Import Taxes (on Non-agricultural Sector)*

$$TMNA$$
$$=TMRM+TMK+TMC$$

81. *Other Indirect Taxes on Non-agricultural Output*

$$TOINA=ZTBNA*\cdot GDPNAR$$

82. *Other Indirect Taxes (excluding Export Taxes) on Agricultural Output*

$$TOIAG=ZTBAG*\cdot GDPAGR$$

83. *Disposable Household Income in Non-agricultural Sector*

$$YDSHHNA=YLBNA$$
$$+YKNHHNA-TDRHH$$
$$-YTRHHFO-YTRHHGV*$$

84. *Net Transfers from Households to Foreigners in Local Currency*

233

$YTRHHFO = YTRHHFO\$^* \cdot$
$$ZXR\$^*$$

85. Disposable Household Income in Agricultural Sector
$YDSHHAG = GDPAG - TXAG^*$
$$- TOIAG$$

86. Nominal Disposable Income of All Households
$YDSHH$
$$= YDSHHAG + YDSHHNA$$

87. Real Disposable Income of All Households
$YDSHHR = YDSHH/PD$

88. Gross Profits Accrued to Non-agricultural Private Business
$YGPBPNA = GDPNA - TMNA$
$- TOINA - YLBNA$
$- YKNHHNA - TPTGVNA^*$
$+ YIPGVNA^* - TPRBSNA^*$
$- YRDBSNA^* - YTRBPFO$
$- YTRBSFO$

89. Net Transfers from Non-agricultural Private Business to Foreigners in Local Currency
$YTRBPFO$
$$= YTRBPFO\$^* \cdot ZXR\$^*$$

90. Net Transfers from State Enterprise to Foreigners in Local Currency
$YTRBSFO$
$$= YTRBSFO\$^* \cdot ZXR\$^*$$

91. Corporate Income Tax on Non-agricultural Private Business
$\ln TCYBPNA = -.49207$
$$(-1.505)$$
$+.79761 \ln YGPBPNA_{-1}$
$$(21.118)$$
$+.06361 DUMMY74^* \cdot$
$$(8.023)$$
$\ln (YGPBPNA_{-1})$
$R^2 = .9884 \quad SE = .0936$

$DW = 1.845 \quad N = 16(1961-76)$

92. Retained Earnings and Depreciation Allowance of Non-agricultural Private Business
$YRDBPNA = YGPBPNA$
$$- TCYBPNA$$

93. Households' Nominal Net Savings
$USVHH = YDSHH - CONHH$

94. Private Business' Nominal Net Surplus $(+)$ or Deficit $(-)$
$USVBP = YRDBPNA - IFXBP$
$$- INVBP$$

95. State Enterprises' Nominal Net Surplus $(+)$ or Deficit $(-)$
$USVBS = YRDBSNA^*$
$$- IFXBSAG^* - IFXBSNA^*$$

96. Business Sector's Nominal Net Surplus $(+)$ or Deficit $(-)$
$USVBU = USVBP + USVBS$

97. Government Net Tax Revenue (Less Transfers)
$TAX = TXAG^* + TOIAG$
$+ TMNA + TOINA$
$+ TDRHH + TCYBPNA$
$+ TPRBSNA^*$
$+ YTRHHGV^*$
$- YTRGVFO$
$+ TPTGVNA^*$
$- YIPGVNA^*$

98. Net Transfers from Government to Foreigners in Local Currency
$YTRGVFO$
$$= YTRGVFO\$^* \cdot ZXR\$^*$$

99. Government's Nominal Surplus $(+)$ or Deficit $(-)$
$USVGV = TAX - CONGV^*$
$$- IFXGVAG^* - IFXGVNA^*$$

100. Foreign Sector's Surplus (equal to Current Account Deficit in Balance

of Payments but Opposite in Sign)
in Local Currency

$$USVFO = YTRHHFO$$
$$+ YTRBPFO + YTRBSFO$$
$$+ YTRGVFO + MGS - XGS$$

101. Current Account Deficit in Balance of Payments in U.S. dollars

$$-USVFO\$ = -USVFO/ZXR\$*$$

102. Nominal Disposable Household Income Per Employed Person in Agriculture

$$UDYPAG$$
$$= YDSHHAG \bigg/ \frac{NEMAG}{1000}$$

103. Nominal Disposable Household Income Per Employed Person in Non-agriculture

$$UDYPNA$$
$$= YDSHHNA \bigg/ \frac{NEMNA}{1000}$$

104. Relative Disposable Income Per Person in Non-agriculture vs. Agriculture

$$URDYPNAAG$$
$$= UDYPNA/UDYPAG$$

105. Output Per Employed Person (Average Labor Productivity) in Agriculture

$$ULPAG$$
$$= GDPAGR \bigg/ \frac{NEMAG}{1000}$$

106. Output Per Employed Person (Average Labor Productivity) in Non-agriculture

$$ULPNA$$
$$= GDPNAR \bigg/ \frac{NEMNA}{1000}$$

107. Relative Agerage Labor Productivity in Non-agriculture vs. Agriculture

$$URLPNAAG = ULPNA/ULPAG$$

108. Real Fixed Capital Stock-Employment Ratio in Agriculture

$$UKLRAG$$
$$= KFXTOAGR_{-1} \bigg/ \frac{NEMAG}{1000}$$

109. Real Fixed Capital Stock-Employment Ratio in Non-agriculture

$$UKLRNA$$
$$= KFXTONAR_{-1} \bigg/ \frac{NEMNA}{1000}$$

110. Relative Capital-Labor Ratio in Non-agriculture vs. Agriculture

$$URKLRNAAG$$
$$= UKLRNA/UKLRAG$$

111. Output-Real Fixed Capital Stock Ratio (Converse of Capital-Output Ratio) in Agriculture

$$UOKRAG$$
$$= GDPAGR/KFXTOAGR_{-1}$$

112. Output-Real Fixed Capital Stock Ratio in Non-agriculture

$$UOKRNA$$
$$= GDPNAR/KFXTONAR_{-1}$$

113. Gross Labor Income (including Direct Taxes) as Proportion of GDP in Non-agricultural Sector

$$ULYSNA = YLBNA/GDPNA$$

114. Indirect Taxes as Proportion of GDP in Non-agricultural Sector

$$UITSNA$$
$$= (TMNA + TOINA)/GDPNA$$

115. Gross Capital Income (including Direct Taxes and Net Transfers to and from Government) as Proportion of GDP in Non-agricultural Sector

$$UGKSNA$$
$$= 1 - ULYSNA - UITSNA$$

V.2　The Financial Sector

I. *Commercial Banks*

116. *Commercial Bank Balance Sheet Identity*

$$FNCCBBT+FBLCBBT$$
$$+FBLCBOF+FTBCBGV$$
$$+FGBCBGV+FLDCBBF$$
$$+FFQCBFO+FFXCB*$$
$$+FMACB*=FLDBTCB$$
$$+FDTXXCB+FLRFOCB$$
$$+FLROFCB+FMLCB*$$
$$+FCACB$$

$FCACB$ is determined as a residual from this identity.

117. *Identity for Change in Net Foreign Position of Commercial Banks*

$$FFQCBFO-FFQCBFO_{-1}$$
$$=FXSCBHB+(FFLFOCB$$
$$-FFLFOCB_{-1})$$
$$-FXSCBBT-(FDXCBFO$$
$$-FDXCBFO_{-1})$$

$FFQCBFO$ if determined from this identity

118. *Identity for Total Foreign Assets of Commercial Banks*

$$FFACBFO$$
$$=FFQCBFO+FDXCBFO$$

119. *Identity for Total Foreign Liabilities of Commercial Banks*

$$FFLFOCB$$
$$=FLRFOCB+FDTFOCB*$$

120. *Identity for Commercial Bank Borrowings from the Bank of Thailand*

$$FLDBTCB=FLNBTCB$$
$$+FRXBTCB+FRNBTCB$$

121. *Identity for Change in Domestic Cash Position of Commercial Banks*

$$(FLNBTCB-FLNBTCB_{-1})$$
$$+FCICB+FXSCBBT$$

$$+(FRNBTCB-FRNBTCB_{-1})$$
$$+(FRXBTCB-FRXBTCB_{-1})$$
$$+(FLROFCB-FLROFCB_{-1})$$
$$+(FDTOFCB-FDTOFCB_{-1})$$
$$=(FNCCBBT-FNCCBBT_{-1})$$
$$+(FBLCBBT-FBLCBBT_{-1})$$
$$+(FBLCBOF-FBLCBOF_{-1})$$
$$+(FTBCBGV-FTBCBGV_{-1})$$
$$+(FGBCBGV-FGBCBGV_{-1})$$

This identity determines $FLNBTCB$ as a residual.

122. *Identity for Total Holding of Government Bonds by Commercial Banks*

$$FGBCBGV=FRBCBGV$$
$$+FBCCBGV+FBVCBGV$$

123. *Identity for Commercial Bank Balance at Bank of Thailand* (BOT)

$$FBLCBBT$$
$$=FRCCBBT+FEBCBBT$$

124. *Identity for Commercial Bank Excess Reserves (Excess Balance at* BOT *and Currency on Hand)*

$$FERCBBT=FEBCBBT$$
$$+FNCCBBT+FDDCBOF*$$

125. *Identity for Commercial Bank Balances at Other Financial Institutions (Bank for Agriculture and Agricultural Cooperatives* (BAAC) *as well as Finance and Securities Companies* (FC))

$$FBLCBOF$$
$$=FCDCBBA+FDDCBFC$$

126. *Identity for Required Reserves ("Primary" or Cash and "Secondary" or Government Bonds) of Commercial Banks*

$$FRRCB$$
$$=FRCCBBT+FRBCBGV$$

127. *Identity for Required Government*

Bond Holding as Secondary Reserve of Commercial Banks

$$FRBCBGV = ZK1^* \cdot FDTXXCB$$

128. Identity for Required Cash Balance as Primary Reserve of Commercial Banks

$$FRCCBBT = ZK2^* \cdot FDTXXCB$$

129. Identity for Commercial Banks' Holding of Compulsory Bonds to Satisfy Branching Requirement by BOT

$$FBCCBGV = ZM1^* \cdot FDTXXCB$$

130. Identity for Commercial Banks' Required Deposits at BAAC to Satisfy Agricultural Credit Policy by BOT

$$FCDCBBA = ZM2^* \cdot FDTXXCB$$

131. Identity for Total Deposits at Commercial Banks

$$FDTXXCB = FDTHBCB + FDTOFCB + FDTFOCB^* + FDTGVCB^*$$

132. Identity for Free Deposits at Commercial Banks

$$FDFXXCB = FDTXXCB - FRCCBBT - FRBCBGV - FBCCBGV - FCDCBBA$$

133. Identity for Private Sector's Deposits at Commercial Banks

$$FDTHBCB = FDDHBCB + FSDHBCB + FTDHBCB$$

134. Identity for Money Stock (M 1)

$$FM1 = FNCHBBT + FDDHBCB + FDDHBGS^* + FDDHBBT^* + EADJM1^*$$

135. Commercial Bank Demand for Cash on Hand

$$FNCCBBT = 289.85$$
$$(2.85)$$
$$+.018359 \, FDTXXCB$$
$$(29.76)$$

$$-36.2448 \, RTB^*$$
$$(-1.67)$$

$R^2 = .985 \qquad SE = 80$

$DW = 1.86 \qquad N = 18(1960\text{--}77)$

136. Commercial Bank Demand for Excess Cash Balance at BOT

$$FEBCBBT = 377.5169$$
$$(5.720)$$
$$+.01633 \, FDTXXCB$$
$$(4.896)$$
$$-.07024 \, (FLDCBBF$$
$$(-4.208)$$
$$-FLDCBBF_{-1})$$
$$+761.2 \, DUMMY3^*$$
$$(5.330)$$

$R^2 = .7892 \qquad SE = 172.733$

$DW = 1.351 \qquad N = 17(1961\text{--}77)$

137. Commercial Bank Holding of Deposits at Finance Companies

$$FDDCBFC = -462.3258$$
$$(-4.834)$$
$$+.00389 \, FDFXXCB$$
$$(7.53)$$
$$+57.3077[RDDFC^*$$
$$(3.845)$$
$$-.01 \, (RTB^* + RGB^* + RIB$$
$$+RLCB + RFO^*)]$$
$$-33.1865 \, DUMMY7172$$
$$(-1.531)$$

$R^2 = .9640 \qquad SE = 24.0739$

$DW = 3.113 \qquad N = 8(1969\text{--}76)$

The first finance company was established in 1969.

138. Commercial Bank Demand for Treasury Bills

$$FTBCBGV = -396.4866$$
$$(-5.782)$$
$$+.13762 \, FDFXXCB$$
$$(8.666)$$
$$-.08574 \, FLDCBBF$$
$$(-6.195)$$
$$+532.1975 \, (RTB^* - .4(RGB^*$$
$$(9.609)$$
$$+RFO^*))$$

$-1240.3216\ DUMMY70*$
$\qquad(-8.508)$

$R^2=.94501\qquad SE=134.869$

$DW=2.201\qquad N=16(1961-76)$

139. *Commercial Bank Voluntary Demand for Government Bonds*

$FBVCBGV=1949.5235$
$\qquad\qquad(8.733)$

$\quad+.29689\ FDFXXCB$
$\qquad(13.590)$

$\quad+.39585\ FDFXXCB_{-1}$
$\qquad(13.590)$

$\quad+.29689\ FDFXXCB_{-2}$
$\qquad(13.590)$

$\quad-.31120\ FLDCBBF$
$\qquad(-9.998)$

$\quad-.30545\ FLDCBBF_{-1}$
$\qquad(-12.451)$

$\quad-.14697\ FLDCBBF_{-2}$
$\qquad(-5.107)$

$\quad+1772.4574(RGB*$
$\qquad(12.227)$

$\quad-.9(RTB*+RRDBT*))$

$R^2=.9734\qquad SE=337.265$

$DW=1.545\qquad N=16(1962-77)$

Rem: *PDL* on $FDFXXCB_i$

140. *Private Sector's Demand for Commercial Bank Loans and Overdrafts*

$FLOCBBU=-6700.3892$
$\qquad\qquad(-7.200)$

$\quad+.12011\ GDP+.08007\ GDP_{-1}$
$\qquad(67.617)\qquad\quad(67.617)$

$\quad+.04004\ GDP_{-2}-.00468\cdot$
$\qquad(67.617)\qquad\quad(-4.381)$

$\quad(RLCB-.9\ RLFC)\cdot GDP$

$\quad-4387.7230\ DUMMY69*$
$\qquad(-3.959)$

$R^2=.9986\qquad SE=688.309$

$DW=1.981\qquad N=15(1962-76)$

Rem: *PDL* on GDP_i

141. *Private Sector's Demand for Discounts of Domestic Bills at Commercial Banks*

$FDDCBBU=-1917.9961$
$\qquad\qquad(-3.773)$

$\quad+.06351\ GDP-.00306(RLCB$
$\qquad(31.717)\qquad\quad(-5.580)$

$\quad-.99\ RLFC)\cdot GDP$

$\quad-4295.2474\ DUMMY69*$
$\qquad(-6.781)$

$R^2=.9934\qquad SE=427.8215$

$DW=1.908\qquad N=16(1961-76)$

142. *Private Sector's Demand for Discounts of Import Bills and Trust Receipts at Commercial Banks*

$FDMCBBU=1433.9773$
$\qquad\qquad(2.450)$

$\quad+.10055\ MGS-259.4447\cdot$
$\qquad(30.437)\qquad\quad(-2.475)$

$\quad(RLCB-.9\ RFO*)$

$R^2=.9841\qquad SE=342.905$

$DW=1.527\qquad N=17(1961-77)$

143. *Foreign Sector's Demand for Discounts of Export Bills at Commercial Banks*

$FDXCBFO=-423.3806$
$\qquad\qquad(-2.996)$

$\quad+.10742\ XGS-.00370\cdot$
$\qquad(3.512)\qquad\quad(-1.462)$

$\quad(RLCB-.01\ RFO*)\cdot XGS$

$\quad+270.3700\ DUMMY7172*$
$\qquad(1.608)$

$R^2=.9764\qquad SE=220.935$

$DW=1.916\qquad N=17(1691-77)$

144. *Commercial Bank Supply of Loans, Overdrafts and Discounts to Private and Foreign Sectors (excluding Finance Companies)*

$FLNCBBU=-1161.9035$
$\qquad\qquad(-1.134)$

$\quad+.44455\ FDFXXCB$
$\qquad(2.407)$

$\quad+.22228\ FDFXXCB_{-1}$
$\qquad(2.407)$

$\quad+.04435\ (RLCB-.01\ (RGB*$
$\qquad(1.987)$

$+ RFO*)) FDFXXCB$

$- 3532.8782 \, DUMMY7172*$
(-2.289)

$R^2 = .9963 \qquad SE = 2048.950$

$DW = 1.366 \qquad N = 17(1961-77)$

Rem: PDL on $FDFXXCB_i$

145. *Market Clearing Equation of Demand for and Supply of Bank Loans, Overdrafts and Discounts to Determine Interest Rate on Commercial Bank Lendings to Private and Foreign Sectors (RLCB)*

$FLNCBBU = FLOCBBU$

$+ FDDCBBU + FDMCBBU$

$+ FDXCBFO$ or

$RLCB = [- 6445.8851 \cdot$

$- 8682.9703 \, DUMMY69*$

$+ 3803.248 \, DUMMY7172*$

$+ .18362 \, GDP$

$+ .00724 \, RLFC \cdot GDP$

$+ .10742 \, XGS$

$+ .000037 \, RFO* \cdot XGS$

$+ .10055 \, MGS + 233.5 \, RFO*$

$+ .08007 \, GDP_{-1}$

$+ .04004 \, GDP_{-2}$

$- .44455 \, FDFXXCB$

$- .22228 \, FDFXXCB_{-1}$

$+ .00044 \, FDFXXCB(RGB*$

$+ RFO*)]/[259.4$

$+ .04435 \, FDFXXCB$

$+ .0037 \, XGS + .00774 \, GDP]$

146. *Supply of Interbank Loans from Commercial Banks to Finance Companies*

$FLOCBFC^s = - 539.3640$
(-17.388)

$+ .02542 \, FDTXXCB$
(8.640)

$+ .00034 \, (RIB - .99(RLCB$
(1.973)

$+ RFO* + RGB*)) \, FDTXXCB$

$R^2 = .9959 \qquad SE = 35.342$

$DW = 3.102 \qquad N = 8(1969-76)$

147. *Total Commercial Bank Lendings to Private, Foreign and Finance Company Sectors*

$FLDCBBF$

$= FLNCBBU + FLOCBFC$

148. *Net Foreign Exchange Operations of Commercial Banks with Customers*

$FXSCBHB = 83.27692$
$(.557)$

$+ .97639 \, UBAS \cdot ZXRS*$
(24.651)

$R^2 = .9743 \qquad SE = 601.235$

$DW = 2.220 \qquad N = 17(1961-77)$

149. *Net Foreign Exchange Sales or Purchases of Commercial Banks to or from the Exchange Equalization Fund (EEF) of BOT*

$FXSCBBT = 9.54 +$
$(.06)$

$+ .8061 \, FXSCBHB$
(11.77)

$- .1779 \, FCICB + .7443 \cdot$
$(-3.53) \qquad (7.97)$

$(FFLFOCB - FFLFOCB_{-1})$

$R^2 = .981 \qquad SE = 430.3$

$DW = 2.87 \qquad N = 17(1961-77)$

150. *Commercial Bank Rediscounts of Export Bills at the Bank of Thailand*

$FRXBTCB = - 461.6734$
(2.610)

$+ 1.87558 \, FDXCBFO$
(2.432)

$- .31977(RRDBT*$
(1.341)

$- .18 \, RLNBT*) \cdot FDXCBFO$

$R^2 = .90566 \qquad SE = 391.7060$

$DW = 1.3686 \qquad N = 17(1961-77)$

151. *Commercial Bank Rediscounts of*

Domestic Bills at BOT

$$FRNBTCB = 1719.36057$$
$$(2.730)$$

$$-.0299\ FDFXXCB$$
$$(-2.788)$$

$$+.04231\ FLDCBBF$$
$$(4.563)$$

$$-621.06381\ RRDBT*$$
$$(-4.124)$$

$$+194.98832\ RIB$$
$$(4.419)$$

$$-218.02283\ DUMMY70*$$
$$(-2.415)$$

$R^2 = .9748$ $SE = 90.757$

$DW = 2.802$ $N = 16(1961-76)$

152. *Private Sector's Demand for Demand Deposits at Commercial Banks*

$$FDDHBCB = 2359.0260$$
$$(2.331)$$

$$+.03002\ GDP$$
$$(6.649)$$

$$+4.15213\ ENBCB*$$
$$(1.951)$$

$$-767.2637(.3\ RDDFC*$$
$$(-4.664)$$

$$+.5\ RSDCB* + .2\ RTDCB*)$$

$$+1798.0324\ DUMMY69*$$
$$(4.653)$$

$R^2 = .9960$ $SE = 211.832$

$DW = 1.692$ $N = 16(1961-76)$

153. *Private Sector's Demand for Savings Deposits at Commercial Banks*

$$FSDHBCB = -3364.6592$$
$$(-7.222)$$

$$+.04632\ USVHH$$
$$(9.265)$$

$$+.03474\ USVHH_{-1}$$
$$(9.265)$$

$$+.02316\ USVHH_{-2}$$
$$(9.265)$$

$$+.01158\ USVHH_{-3}$$
$$(9.265)$$

$$+6.54926\ ENBCB*$$
$$(8.410)$$

$$+194.5594(RSDCB*$$
$$(2.929)$$

$$-.1(RDDFC* + RSTGS*))$$

$R^2 = .9977$ $SE = 116.345$

$DW = 2.398$ $N = 14(1963-76)$

Rem: *PDL* on *USVHH$_i$*

154. *Private Sector's Demand for Time Deposits at Commercial Banks*

$$FTDHBCB = -86124$$
$$(-8.52)$$

$$+.2230\ USVHH$$
$$(1.99)$$

$$+107.4\ ENBCB*$$
$$(13.42)$$

$$+5853(RTDCB*$$
$$(4.43)$$

$$-.1(RSDFC* + RSTGS*))$$

$R^2 = .994$ $SE = 1931.8$

$DW = 2.21$ $N = 14(1963-76)$

155. *Deposits at Commercial Banks Held by Other Financial Institutions*

$$FDTOFCB = -1323.7404$$
$$(-4.370)$$

$$+.0046\ GDP$$
$$(13.929)$$

$$+194.9956(RTDCB*$$
$$(3.242)$$

$$-.3\ RIB)$$

$R^2 = .9297$ $SE = 130.975$

$DW = 1.579$ $N = 17(1961-77)$

156. *Foreign Borrowings of Commercial Banks*

$$FLRFOCB = -1173.2722$$
$$(-3.771)$$

$$+.52113\ \frac{RLNBT*}{RFO*} \cdot$$
$$(3.917)$$

$$FDMCBBU$$

$$+.87402\ FFACBFO$$
$$(4.765)$$

$$+.43701\ FFACBFO_{-1}$$
$$(4.765)$$

$$-1340.8582\ DUMMY7172$$
$$(-2.266)$$

$R^2 = .9815$ $SE = 691.920$

$DW = 1.495$ $N = 17(1961-77)$

Rem: PDL on $FFACBFO_i$

157. *Commercial Bank Borrowings from other Financial Institutions in Thailand*

$FLROFCB$

$$= 28.61596 - .00080(RIB$$
$$\quad (.627) \qquad (-5.042)$$
$$- .99(RLNBT*$$
$$+ RFO*))FDFXXCB$$

$R^2 = .6042 \qquad SE = 129.028$

$DW = 1.991 \qquad N = 17(1961-77)$

158. *Net Cash Inflow from Domestic Sources into Commercial Banks*

$FCICB = -48239.4477$
$$\qquad\quad (-5.818)$$
$$- .36216(FLDCBBF$$
$$\qquad\quad (-4.298)$$
$$- FLDCBBF_{-1}) - .71145\ UGD$$
$$\qquad\qquad\qquad\qquad (-17.070)$$
$$- 201.3106\left(\frac{PD - PD_{-1}}{PD_{-1}} \cdot 100\right)$$
$$\quad (-5.765)$$
$$+ 6886.8414\ RTDCB*$$
$$\quad (5.710)$$
$$- 1622.9915\ RSDFC*$$
$$\quad (-1.965)$$
$$+ 14494.8744\ DUMMY69$$
$$\quad (2.168)$$

$R^2 = .9922 \qquad SE = 365.548$

$DW = 2.827 \qquad N = 14(1963-76)$

II. *Finance and Securities Companies*

159. *Identity for Balance Sheet of Finance Companies*

$FRBFCGV + FLAFC$
$$+ FLDFCBU + FFXFC*$$
$$= FDDHBFC + FSDHBFC$$
$$+ FTDHBFC + FDDCBFC$$
$$+ FLOCBFC + FLRFOFC$$
$$+ FMLFC* + FCAFC$$

This identity determines $FCAFC$ as a residual.

160. *Required "Liquid Assets" of Finance Companies Imposed by The Bank of Thailand (all in Government Bonds)*

$FRBFCGV = ZK3* \cdot FDTXXFC$

161. *Total Promissory Notes (or Deposits) Issued by Finance Companies*

$FDTXXFC = FDDHBFC$
$$+ FDDCBFC + FSDHBFC$$
$$+ FTDHBFC$$

162. *Free Promissory Notes of Finance Companies*

$FDFXXFC$
$$= FDTXXFC - FRBFCGV$$

163. *Other Liquid Assets Held by Finance Companies (mostly Corporate Securities)*

$FLAFC = 47.45344$
$$\qquad\quad (.806)$$
$$+ .09301\ FDFXXFC$$
$$\quad (3.276)$$
$$+ .00677(RSH*$$
$$\quad (1.464)$$
$$- RLFC)FDFXXFC$$
$$+ 138.4503\ DUMMY4*$$
$$\quad (1.650)$$

$R^2 = .9443 \qquad SE = 101.527$

$DW = 2.911 \qquad N = 8(1969-76)$

164. *Private Sector's Demand for Loans and Discounts from Finance Companies*

$FLDFCBU^d = 42123.7253$
$$\qquad\qquad (3.763)$$
$$+ .61671\ IFXTO$$
$$\quad (25.198)$$
$$+ 2355.1740\ DUMMY4$$
$$\quad (5.034)$$
$$- 4839.62348(RLFC$$
$$\quad (-5.053)$$
$$- .01(RLCB + RFO*))$$

$R^2 = .9965 \qquad SE = 555.241$

$DW=2.861$　$N=8(1969-76)$

165. *Supply of Loans and Discounts from Finance Companies to Private Sector together with Market Clearing Identity to Determine Finance Companies' Lending Rate (RLFC)*

$FLDFCBU^{\bullet}=274.58763$
　　　　　(3.981)

$+1.03678\ FDFXXFC$
　(24.455)

$+.02262(RLFC$
　(3.672)

$-.9\ RSH^{*})FDFXXFC$

$R^2=.9998$　$SE=126.0754$

$DW=2.553$　$N=8(1969-76)$

$FLDFCBU^{d}=FLDFCBU^{\bullet}$ or $RLFC$

$=[41849.135+.61671\ IFXTO$

$+48.3962\ RLCB$

$+48.3962\ RFO^{*}$

$+2355.174\ DUMMY4$

$-1.03678\ FDFXXFC$

$+.0204\ RSH^{*}\cdot$

$FDFXXFC]/[4839.62$

$+.02262\ FDFXXFC]$

166. *Private Sector's Demand for Promissory Note at Call at Finance Companies*

$FDDHBFC=-4493.4755$
　　　　　　(-21.946)

$+.01307\ GDP+.00871\ GDP_{-1}$
　(16.666)　　　　(16.666)

$+.00436\ GDP_{-2}$
　(16.666)

$+25.1768\ ENBFC^{*}$

$+132.54452\left(\dfrac{RDDFC^{*}-.05}{}\right.$

$\left.\dfrac{(RSDCB^{*}+RSTGS^{*}}{((PD-PD_{-1})/PD_{-1})\cdot100}+RSDFC^{*})\right)$

$R^2=.9986$　$SE=92.9082$

$DW=2.913$　$N=8(1969-76)$

Rem: PDL on GDP_t

167. *Private Sector's Demand for Short Term (One Year or Less) Promissory Notes at Finance Companies*

$FSDHBFC=-23468.8088$
　　　　　　(-39.246)

$+.30833\ USVHH$
　(45.814)

$+61.74279\ ENBFC^{*}$
　(21.768)

$+2513.7283(RSDFC^{*}$
　(29.938)

$-.1\ RTDCB^{*})$

$-218.4319\quad\dfrac{PD-PD_{-1}}{PD_{-1}}\cdot100$
　(-33.758)

$R^2=.9997$　$SE=98.967$

$DW=2.935$　$N=8(1969-76)$

168. *Private Sector's Demand for Long Term (More than One Year) Promissory Notes at Finance Companies*

$FTDHBFC=-1381.4500$
　　　　　　(-9.995)

$+.01345\ USVHH$
　(8.151)

$+5.08406\ ENBFC^{*}$
　(7.799)

$+137.9162(RTDFC^{*}$
　(7.522)

$-.1\ RTDCB^{*})$

$-11.2037\quad\dfrac{PD-PD_{-1}}{PD_{-1}}\cdot100$
　(-7.028)

$R^2=.9950$　$SE=23.612$

$DW=2.479$　$N=8(1969-76)$

169. *Finance Companies' Demand for Interbank Loans from Commercial Banks and Interbank Loan Market Clearing Identity to Determine Interbank Market Rate of Interest (RIB)*

$FLOCBFC^{d}=12.28176$
　　　　　　(.348)

$+.11382\ FLDFCBU$
　(4.819)

$$-.00622(RIB-.01(RFC^*$$
$$(-2.385)$$
$$+RGB^*))\cdot FLDFCBU$$

$R^2=.9862 \qquad SE=64.544$

$DW=1.549 \qquad N=8(1969-76)$

$FLOCBFC^d = FLOCBFC^* \quad$ or

$RIB=[551.6458$

$\quad +.11382\,FLDFCBU$

$\quad -.025419\,FDTXXCB$

$\quad +.0000622\,FLDFCBU(RFO^*$

$\quad +RGB^*)$

$\quad +.0003332\,FDTXXCB(RLCB$

$\quad +RFO^* +RGB^*)]/$

$[.0003365\,FDTXXCB$

$\quad +.006218\,FLDFCBU]$

$FLOCBFC^*$ is specified in Equation 146.

170. *Foreign Borrowings of Finance Companies*

$FLRFOFC=52.57143$
$\qquad (1.035)$

$\quad +.69611\,FLDFCBU$
$\qquad (5.860)$

$\quad -.76681\,FDFXXFC$
$\qquad (-5.392)$

$\quad -.09004(RFO^* -.1(RLFC$
$\qquad (-4.368)$

$\quad +RIB+RLCB))$

$\quad \cdot FLDFCBU\left|\dfrac{PD-PD_{-1}}{PD_{-1}}\cdot 100\right.$

$R^2=.9304 \qquad SE=76.880$

$DW=2.966 \qquad N=8(1969-76)$

III. *Government Savings Bank* (GSB)

171. *Identity for Balance Sheet of* GSB

$FNCGSBT+FBLGSBT^*$

$\quad +FBLGSCB^* +FLDGSBU^*$

$\quad +FGSGSGV+FFXGS^*$

$\quad +FMAGS^* =FDDHBGS^*$

$\quad +FSTHBGS+FSBHBGS$

$\quad +FDTQQGS^* +FMLGS^*$

$\quad +FCAGS^*$

This identity determines $FNCG\cdot SBT$ as a residual.

172. GSB *Holding of Government Securities*

$FGSGSGV= -803.3$
$\qquad (6.69)$

$\quad +1.126\,FDTXXGS$
$\qquad (78.4)$

$R^2=.998 \qquad SE=229.4$

$DW=1.22 \qquad N=15(1963-77)$

173. *Private Sector's Demand for Savings and Time Deposits at* GSB

$FSTHBGS= -1141.0248$
$\qquad (-2.862)$

$\quad +.0850\,USVHH$
$\qquad (13.616)$

$\quad +.06375\,USVHH_{-1}$
$\qquad (13.616)$

$\quad +.0425\,USVHH_{-2}$
$\qquad (13.616)$

$\quad +.02125\,USVHH_{-3}$
$\qquad (13.616)$

$\quad +627.92714(RSTGS^*$
$\qquad (3.548)$

$\quad -.1(RTDFC^* +RTDCB^*))$

$\quad +1485.68895\,DUMMY69$
$\qquad (6.427)$

$R^2=.9905 \qquad SE=322.397$

$DW=1.771 \qquad N=14(1963-76)$

Rem: PDL on $USVHH_t$

174. *Private Sector's Demand for Savings and Premium Savings Bonds at* GSB

$FSBHBGS=3811.59086$
$\qquad (7.488)$

$\quad +.01032\,USVHH$
$\qquad (7.704)$

$\quad +.02064\,USVHH_{-1}$
$\qquad (7.704)$

$\quad -522.91726(.7\,RTDCB^*$
$\qquad (-6.508)$

$\quad +.2\,RGB^* +.1\,RTDFC^*)$

$\quad +854.46395\,DUMMY69$
$\qquad (9.765)$

$R^2 = .9474 \quad SE = 105.629$

$DW = 2.327 \quad N = 16(1961-76)$

Rem: *PDL* on $USVHH_i$

175. *Identity for Total Deposits and Bonds Issued by* GSB

$FDTXXGS$
$= FDDHBGS* + FSTHBGS$
$+ FSBHBGS + FDTQQGS*$

IV. *Bank of Thailand and Balance of Payments*

176. *Private Sector's Demand for Currency Notes*

$FNCHBBT = 5019.21683$
$\qquad (3.995)$
$+ .06641\, GDP$
$\qquad (36.797)$
$- 650.13758(.85\, RSDCB*$
$\qquad (-2.063)$
$+ .1\, RTDCB* + .03\, RDDFC*$
$+ .02\, RGB*)$

$R^2 = .9905 \quad SE = 548.571$

$DW = 1.124 \quad N = 16(1961-76)$

177. *Identity for Notes in Circulation*

$FNCXXBT = FNCHBBT$
$+ FNCCBBT + FNCGSBT$
$+ FNCOTBT*$

178. *Private Sector's Net Foreign Capital Inflow in Balance of Payments Account*

$FKFBPFO = -535.5470$
$\qquad (-.737)$
$- .19392(USVBP + FLOCBBU$
$\qquad (-2.255)$
$- FLOCBBU_{-1} + FLOCBFC$
$- FLOCBFC_{-1} + FDDCBBU$
$- FDDCBBU_{-1} + FDMCBBU$
$- FDMCBBU_{-1})$
$- 2054.3135\, DUMMY2*$
$\qquad (-1.361)$
$+ .00040(RLCB + RLFC$
$\qquad (1.883)$

$- .1\, RFO*) \cdot GDP$

$R^2 = .7693 \quad SE = 915.227$

$DW = 3.064 \quad N = 14(1963-76)$

179. *Total Net Capital Inflow in U.S. dollars*

$FKDDFO\$ = \dfrac{FKFBPFO}{ZXR\$*}$
$+ FKBSFO\$* + FKGVFO\$*$
$+ FKPOFO\$*$

180. *Identity for Overall Balance of Payments Position in U.S. dollars*

$UBP\$ = XGS\$ - MGS\$$
$- YTRHHFO\$*$
$- YTRGVFO\$*$
$- YTRBSFO\$*$
$- YTRBPFO\$* + FKDDFO\$$
$+ ESDR\$* + EADJBP\$*$

181. *Identity for Balance of Payments Adjusted for Foreign Exchange Transactions which are not Channelled through Commercial Banks (i.e. directly through the Bank of Thailand)*

$UBA\$ = UBP\$ + YTRBSFO\$*$
$- ESDR\$*$

182. *Linkage between Change in Central Government Cash Position and Government Sector's Deficit on the National Account Basis*

$UGD = USVGV + EADJGV*$

183. *Identity for Net Financing of Government Deficit by the Bank of Thailand*

$UGNBTGV = -UGD$
$- (FGBCBGV - FGBCBGV_{-1})$
$- (FTBCBGV - FTBCBGV_{-1})$
$- (FGSGSGV - FGSGSGV_{-1})$
$- (FGBHHGV*$
$- FGBHHGV_{-1}*)$
$- (FRBFCGV - FRBFCGV_{-1})$
$- EADJOT*$

184. *Identity for Change in Official International Reserves Held by the Bank of Thailand and Exchange Equalization Fund*

$UFNBTFO\$ = UBP\$$

$$-\left(\frac{FFACBFO}{ZXR\$^*}\right.$$

$$-\frac{FFACBFO_{-1}}{ZXR\$_{-1}^*}\right)$$

$$+\left(\frac{FFLFOCB}{ZXR\$^*}\right.$$

$$-\frac{FFLFOCB_{-1}}{ZXR\$_{-1}^*}\right)$$

Appendix: A Scheme for Defining Variable Names in the ASEAN Econometric Modelling[7]

Following an agreement reached at the First ASEAN Econometric Modelling Workshop in Bandung on May 26, 1977, the Bank of Thailand devised a notation scheme which can be mutually used by all ASEAN Central Banks in their modelling efforts to facilitate communication among the model builders. To this end, the Bank of Thailand has attempted to initiate various rules for defining variable names in a systematic way.

I. As a general rule, all variables should not end with character "R" or currency symbol such as $, £, ¥. However, in a case where "R" appears as the last character it indicates that the variable concerned is expressed in constant prices. Or, if the last character ends with $, £, ¥, etc., it indicates that the variable is measured in tasks of a foreign currency, not the domestic currency unit.

Example

   GDP: Gross domestic product, current prices. *GDPR*: Gross domestic product, constant prices. *PX\$*: Export

price index measured in terms of the foreign currency (U.S.$)

II. Wherever the break-down of economic aggregates into sectors is necessary, a two-character symbol is required to follow the variable name. For example, the classification of output according to productive sectors can be illustrated as follows:

Agriculture	*AG*
Mining and quarrying	*MQ*
Manufacturing	*MF*
Construction	*CO*
Electricity and water supply	*EW*
Transportation and communication	*TC*
Wholesale and retail trade	*WR*
Banking, insurance, and real estate	*BI*
Ownership of dwellings	*DW*
Public administration and defense	*PA*
Services	*SE*

If classification is made simply be dividing the economy into "agricultural" and "non-agricultural" sectors, NA may be used as a symbol for non-agricultural

---

7) Adapted from notations used in Project LINK and by Bank of Canada.

sector.

In addition to the above classification, many financial models find it useful to identify economic sector according to whether it is household, business, commercial banks, non-bank financial institutions, monetary authority, government, or foreign sector. Such a mode of classification can be demonstrated using symbols below:

Household sector	HH
Business sector	BU
Other financial institutions	OF
Monetary authority	BT or other suitable characters
Government	GV
Foreign sector	FO

The two-character sectoral name should follow a set of characters (maximum number of characters=3) representing the name of the variable according to Rule III.

Application

Notation as defined in II can be used in a variety of situations such as:

Gross domestic product originated from manufacturing industry *GDPMF*.

Explanation

GDP refers to gross domestic product at current prices.

MF refers to manufacturing industry.

Business fixed investment expenditure in non-agricultural sector *IFXNABU*.

Explanation

IFX refers to fixed investment.

NA refers to non-agricultural sector.

BU refers to business sector.

Household consumption expenditure on consumer durables; *CCDHH*.

Explanation

C refers to consumption expenditure.

CD refers to consumer durables.

HH refers to household sector.

If two sectors are involved, 2 sets of two-character sectoral names must be put adjacent to each other. For example *F/NC/CB/BT* represents a financial assets (F) — bank notes hold by commercial banks (CB) as an asset and issued by the Central Bank (BT) as a liability. BT can be defined in other manners such as *MA* (Monetary Authority of Singapore), *BN* (Bank Negara Malaysia), *BI* (Bank Indonesia), *BP* (Central Bank of the Philippines) etc. Normally, the sector which holds that financial instrument as an asset will come first (CB), followed by another sector which holds the same instrument as a liability (BT).

III. *First Character of the Symbol*

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

It is considered that in defining variable names in the ASEAN modelling efforts, the first element of the symbol should refer to economic aggregates or indicators according to the scheme below:

C : consumption expenditure

D : dummy variable

F : financial assets or liabilities (financial variables)

G : output or value added, usually

GDP

I :	investment expenditure
K :	capital stock
M:	imports
N :	persons, population, employment, etc.
P :	price or price index
R :	interest rate
T :	tax revenue
X :	exports
Y :	income
E :	exogenous variable, unclassified elsewhere
W:	wage rate, wage income, etc.
U :	endogenous variable, unclassified elsewhere
Z :	policy instrument, unclassified elsewhere

The variable name which begins with one of the above characters can be followed by a maximum number of 2 characters, making the entire variable name not more than 3 characters. These 3 characters together with a maximum of 2 sets of two-character sectoral name and the special last character R or $ constrain the total number of characters for each variable not exceeding eight.

IV. *Operator* (Optional)

In some cases, the variable that we are interested in is subject to either moving average, or difference, or lag, or percentage change, or moving sum. It is therefore, worthwhile to define an operator "J" in such a way that it can take into accounts all these operations. J is always followed by a numeral where the numeral refers to the number of periods,

including the current period, involved in the operation. After the numeral, one character is needed to indicate the type of operations. For example:

J2A(——)J: an operator

2: 2 periods are involved, including the current period

A: unweighted moving average

Thus J2A is a two period unweighted moving average.

Example; J2A(*GDP*): two period moving average of *GDP* at current prices

J3D(——)D: "differencing" operator; therefore J3D is a three-period difference

J2P: a two-period percentage change

J4S: a four-period moving sum.

V. *Notation used in the Bank of Thailand* (Example)

Financial sector

F/NC/CB/BT — Cash on hand of commercial banks,

F/BL/CB/BT — Balance at *BOT* of commercial banks,

F/TB/CB/GV — Bank holdings of treasury bills,

F/GB/CB/GV — Bank holdings of government bonds,

F/LO/CB/BU — Commercial bank loans and overdrafts to business,

R/RD/BT — Bank of Thailand's rediscount rate,

R/TB — Rate of return on holding

treasury bills,

R/GB — Rate of return on holding government bonds,

R/FO — Foreign rate of interest,

$R/TD/CB$ — Interest rate on time deposits at commercial banks,

Real Sector

CON/HH — Household consumption expenditure,

$CON/HH/R$ — Real private consumption expenditure,

$CON/GV/R$, CON/GV — (Real) Government consumption expenditure,

$IFX/BP/AG/R$, $IFX/BP/AG$ — (Real) Private business fixed investment in agricultural sector,

$GDP/NA/R$, GDP/NA — (Real) Gross

Domestic Product of non-agricultural sector,

PD — Domestic Price,

$PGDNA$ — GDP price deflator for non-agricultural products,

PX — Export Price,

$TCY/BP/NA$ — Corporate income taxes from private business in non-agricultural sector,

$Y/LB/NA$ — Gross labor income from non-agriculture,

$W/GR/NA$ — Gross wage rate from non-agriculture,

$U/SV/HH$ — Savings of households,

$U/SV/BP$ — Surplus or deficit of private business.

References

1. Chaipravat, Olarn, "A Macroeconometric Model of Thailand, with Special Emphasis on the Mechanism of Domestic Price Determination for a Small, Open Economy," *Central Bank Macroeconometric Modelling in Pacific Basin Countries, Proceedings of the First* (1975) *Pacific Basin Central Bank Conference on Econometric Modelling* held at the Federal Reserve Bank of San Francisco, FRB of San Francisco, 1976.

2. ————, "Domestic Price Determination in Thailand," *Proceedings of the Second* (1976) *Pacific Basin Central Bank Conference on Econometric Modelling,* the Bank of Korea, Seoul, July, 1977.

3. ————, "Domestic Price, Output, Employment and External Balance Determination of a Small, Open, Primary Exporting Economy: A Quantitative Study of Stabilization Policies in Thailand," *Trade and Employment in Asia and the Pacific,* ed. by Narongchai Akrasanee, Seiji Naya, and Vinyu Vichit-Vadakan, published by the Council for Asian Manpower Studies, Manila

and United Nations Asian Development Institute, Bangkok, and distributed by the University Press of Hawaii, Honolulu, 1977.

4. ————, and Siri Ganjarerndee, "Model of the Thai Monetary Sector: A Progress Report of the Bank of Thailand Financial Research Program." A working paper discussed at the First ASEAN Central Bank Workshop on Econometric Modelling, Bank Indonesia, Bandung, May 23–26, 1977 and published as Discussion Paper DP/77/21 by the Department of Economic Research, Bank of Thailand, Bangkok, May 10, 1977.

5. ————, Kanitta Meesook and Siri Ganjarerndee, "Impacts of Monetary, Fiscal, Debt Management and Exchange Rate Policy Changes in the Thai Economy, A Macroeconometric Model Simulation," *Proceedings of the Third* (1977) *Pacific Basin Central Bank Conference on Econometric Modelling, Volume one, The Reserve,* Bank of New Zealand, Wellington, June, 1978.

6. ————, and Siri Ganjarerndee, "Dynamic Properties of Bank of Thailand Model: Their

Implications for Policy Formulation." A paper presented at the Second ASEAN Central Bank Workshop on Econometric Modelling, Penang, Malaysia, October, 1978 and published as Discussion Paper DP/78/23 by the Department of Economic Research, Bank of Thailand, *Bangkok*, October 10, 1978.

7. Wilailuck Thaiutsa and Others, *Finance Company Portfolio Analysis: A Quantitative*

Approach. Research Report No. 2105 (in Thai), Department of Economics and Business Administration, Kasetsart University, Bangkok, November, 1978.

8. Jinachitra, Sataporn, *A Portfolio Adjustment Model of Commercial Banks in Thailand.* Bank of Thailand Paper No. 3, Bangkok, December, 1974.