Aggregate Demand and Macroeconomic Imbalances in Thailand: Simulations with the Siam1 Model

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In the latter half of the seventies, Thailand was able to maintain high GDP rates of growth. These were, however, associated with growing dependence on foreign borrowing and chronic budgetary deficits. The average growth rate between 1974 and 1979 was close to 8%. But the current account deficit reached in 1979 8% of GDP, while the central government deficit was close to 4% of GDP and inflation was around 15%. These macroeconomic imbalances were further exacerbated with the oil price increase of 1979-80, and future growth is endangered by the exhaustion of new agricultural land. This paper focuses on the demand side adjustments of the Thai economy to lower agricultural growth and to higher energy prices. It draws the implications of the demand responses on the time path of the resource gap, the current account deficit and on the public sector savings gap.

The analysis uses an economy-wide model built around a social accounting matrix. It is a fix-price (prices do not respond to excess demand but are cost determined) model which is demand driven for industry, energy and services and is supply driven for agriculture. It is closed at the macroeconomic level by assuming exogenous real investment. The model is used to generate two types of results: (1) time paths for the endogenous variables under different assumptions on the paths of exogenous variables, policy parameters and structural parameters and (2) elasticities at one point in time of the endogenous variables with respect to all predetermined parameters and variables. These elasticities measure the direct and indirect effects of, say, variations in energy prices on the consumer price index.

Results of two simulations are reported in the paper. The first one shows that in the absence of any major policy response to higher energy prices and to lower agricultural growth, the resource gap would still be about 5% of GDP by 1984, and would only vanish by 1990. The current account deficit, however, would remain as high as 6.5% of GDP by 1984 and would be reduced to 3.2% by 1990. The public sector savings gap, on the contrary, would gradually increase reaching 6.2% of GDP by 1990. In the second simulation, a set of policy measures are assumed to be implemented. They are aimed at (i) increasing government revenues, (ii) discouraging energy imports and consumption, (iii) encouraging exports, (iv) increasing government savings. Under these assumptions, the resource
gap diminishes more rapidly becoming a surplus (2% of GDP) by 1990, while the current account deficit vanishes towards the end of the decade. The public sector savings gap diminishes to 4.5% of GDP by 1985, reaching 3.3% by 1990.

These results show that in both simulations improvement in the macroeconomic imbalances takes place. It is, however, less pronounced and occurs later in the decade in the first simulation.
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I. Introduction

During the past five years (1975-79), the Thai economy has experienced an impressive average annual GDP growth rate of 8.7% at constant market prices. Given the downward trend in the rate of population growth, this implies that GDP (constant market prices) per capita grew at an annual rate of 6.3% during the same period. If maintained, these rates imply a doubling of real income per capita approximately every 11 years.

This impressive growth, however, did not take place in an economy where the basic macroeconomic equilibria were holding. Looking at the Investments Savings balance, the gap has increased between 1976 and 1979. The ratio of investment to GDP grew from 23.23% to 27.85% between these two years, whereas the ratio of gross national savings to GDP was stable at 20%-21%. At the end of the seventies, the gap between gross national savings and gross investment was thus around 7% of GDP. On the average, the deficit in the capital account of the government has been larger than the deficit for the private sector. The average gap for the government has been around 2.75% of GDP, compared to 2.05% for the private sector. It follows that the growth performance of the Thai economy was associated with an insufficient generation of savings, the situation being worse for the government than for the private sector.

Looking at the external balance, the current account deficit was slightly over 8% of GDP in 1979, reaching 2.25 billion dollars which is double the 1978 figure. The bulk of this deficit is in the goods trade balance. However, this is not due to soaring imports and lagging exports. The performance of Thai exports has, in fact, been impressive; they increased in constant price, at an annual rate of 15.2%, while imports increased at 11.6% during the same period (1975-79). Basically, the gap is due to the deterioration of the terms of trade experienced by Thailand in the past five years. From 100 in 1975, the
terms of trade have shifted to 87.8 in 1979. This decline has since been exacerbated by the recent increases in oil prices.\footnote{1} In constant 1972 prices, the average share of exports in GDP was 19.7% between 1975 and 1979, whereas the share of imports\footnote{2} was 17.3% which would normally indicate a rather healthy situation. The same ratios in current prices, however, are 20.9 and 25.5 for exports and imports respectively. Given the degree of openness of the economy, adverse movements in world prices can clearly be crucial for the external balance. Another point worth noting is that although the service balance is positive, the factor service balance is negative and has been increasingly so. The main negative item is the balance of investment income.

Together with the above mentioned domestic and external imbalances, two other phenomena which will have deep effects on the Thai economy are emerging. The first of these is higher energy costs (mentioned above). The 1979-80 increases are, of course, not the first experience of this shock: just as Thailand appeared to be recovering from the 1973-74 shock, the present one is at hand. It is more or less probable that oil prices will continue to rise. For a country which is the fifth largest oil importer of the nonproducing developing countries, this situation must be taken seriously. Given the present external and government deficits, it is hard to see a lengthy postponement of domestic oil price increases. However, passing on the increases in world prices means higher costs to the economy which could reduce growth and make Thai exports less competitive in world markets. It could also lead to social unrest.

The second phenomenon which will presumably have a profound effect on the Thai economy is the exhaustion of new agricultural land. In the past,

\footnote{1}{Oil imports in 1979 were 22.7% of total imports.}

\footnote{2}{For exports and imports: goods and nonfactor services.}
new land has allowed a high growth in agriculture generated agricultural exports and helped alleviate rural poverty, all in the context of extensive agriculture. Unless changes occur in agricultural techniques, the exhaustion of new land resources will mean lower rates of growth in that sector. This will add to the other problems of the Thai economy.

If not dealt with, present macroeconomic disequilibria, higher energy costs, and the land constraint can have strong adverse effects on the growth of the economy and on future development. The natural question arises as to what would be the macroeconomic picture in the medium term if present trends remain. This leads to the question of what kind of adjustment is needed to allow the economy to overcome the present disequilibria, the adverse effect of oil prices and the land constraint. The latter question has, in fact, two parts. The first concerns what policy measures can help alleviate the disequilibria given the present structure\(^1\) of the economy. The second is what kind of structural change would allow the economy to overcome present and emerging problems\(^2\) in the long run.

The analysis presented below deals with the macroeconomic outcome of present trends and of different policy measures given the present structure of the economy. The policy measures considered are essentially fiscal measures. The question of structural change itself is not dealt with, but directions and quantification of the impact of marginal structural change are considered.

The analysis is based on a macroeconomic model, SIAM\(^1\), which is built around a social accounting matrix (SAM). Given this accounting framework, the

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1/ A structure is defined here as the set of values taken by the technological and behavioral parameters governing the economy. Thus, the values taken by the input-output coefficients, by the marginal propensities to spend, by the different import and export elasticities define the structure of the economy. Consequently a change in these parameters is considered to be a structural change.

2/ This leads naturally to the question of the policy measures which would induce these structural changes.
model traces the flows of incomes from activities to factors of production, from these to institutions, and from institutions back to activities.

The paper is divided into two parts. In Section II the tools: the SAM and the model, are presented. In Section III an analysis of the outcome of present trends is given, then a set of possible policy measures is defined and their implications drawn. Finally, calculations of the direction and magnitude of impact of selected marginal changes in exogenous variables, policy and structural parameters are presented. Some conclusions follow.

II. The Tools of Analysis

SIAM I is a macro-model built to analyze the performance of the Thai economy in the medium run. It takes into account two main features: (1) a small open economy (2) still dominated by agriculture.

Given these features and the emerging problems facing the Thai economy, the model is designed mainly to address the following questions:

(1) What would be the impact of trends in world prices on the performance of exports, on imports and on the current account deficit?

(2) What would be the outcome of specific fiscal and trade policies on the balance of payments and on the public sector savings gap?

(3) What are the impacts of different investment programs on the current account deficit and on the rates of growth of the economy?

(4) How does the performance of the agricultural sector spill over on the rest of the economy?

To address the above questions without entering into too many details, SIAM I is kept at a fairly aggregated level. It assumes an economy with one factor
of production, three institutions, four activities, three commodities and the rest of the world. Institutions—households, companies and government—have separate current accounts. Their capital accounts are, however, consolidated into one account. The four activities are agriculture, manufacturing, energy and services, which produce domestic goods. These are either mixed with imports, resulting in a composite good traded on the domestic market, or they are exported. No exports of energy are assumed to take place. The rest of the world accounts for international trade and financial transfers.

In the rest of this section we present first, the SAM and the accounting framework of the model economy; second, we describe the economics of the model; and third, its relations are presented.
A. The Social Accounting Matrix

The accounting of a model economy is best understood with the use of a social accounting matrix. First, a SAM gives a clear and synthetic picture of the flows in the economy at a point in time. Second, it gives a consistent accounting framework basic to any modeling effort. Table 1 shows a SAM for the Thai economy in the year 1975, consistent with the simplified description of the economy outlined above.

Table 1, like any SAM, is such that a figure in a cell is a payment from the column to the row account. For example, the intersection of column 4 and row 5 is a payment of government to the consolidated capital account and is thus government savings (6,877 million bahts). Another feature of accounting, also intrinsic to SAMs, is that all accounts must balance, hence each row sum has to be equal to the corresponding column sum. For example, the sum of row 2 gives total receipt of households and the sum of column 2 is the split of this receipt onto different items.

In rows/columns 6 to 21, the SAM gives the production activities (rows/columns 6 to 9) and the commodities (rows/columns 10 to 21). The sum of column 6 is the total cost of the agricultural sector which is equal to its total production given as the sum of row 6. This total production (148,625) is either delivered to the domestic market (118,900) or exported (29,725). The deliveries to the domestic market are then combined with imports of agricultural product (1,495), to which are added indirect taxes (852), forming the total supply of the composite agricultural good on the domestic market (121,247).

1/ For a detailed account of the SAM approach, see Pyatt, Roe and associates (1977), Social Accounting for Development Planning, with Special Reference to Sri Lanka, Cambridge, Cambridge University Press.
# Table 1

## A SOCIAL ACCOUNTING MATRIX OF THE TAIWAN ECONOMY 1975

(In Millions of Dollars)

<table>
<thead>
<tr>
<th>Institutions</th>
<th>Current Account</th>
<th>Consolidated Capital Account</th>
<th>Production Activities</th>
<th>Commodity Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Factors</td>
<td>Households</td>
<td>Companies</td>
<td>Government</td>
</tr>
<tr>
<td>Total</td>
<td>237,478</td>
<td>239,129</td>
<td>31,276</td>
<td>83,120</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Factor</th>
<th>Households</th>
<th>Companies</th>
<th>Government</th>
<th>Agriculture</th>
<th>Manufacturing</th>
<th>Energy</th>
<th>Services</th>
<th>Indirect Taxes</th>
<th>Rest of World</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>237,478</td>
<td>239,129</td>
<td>31,276</td>
<td>83,120</td>
<td>268,625</td>
<td>285,957</td>
<td>27,895</td>
<td>185,866</td>
<td>222,267</td>
<td>31,399</td>
</tr>
</tbody>
</table>

Note: Investment figures include the statistical discrepancy.
In turn, this sum of column 10 is equal to the sum of row 10 which is the aggregate demand for the composite agricultural good. The other activities and commodities are organized similarly except that no account is taken of energy exports.

In row/column 22 indirect taxes are accounted for. In row 22/column 10 to 21, the different sources of indirect taxes are given. They are levied either on domestically traded goods, or on internationally traded goods. In the latter case they are tariffs on imports or taxes on exports.

Finally, row 23 gives flows out of the country in the form of transfers (columns 2 and 4), or imports (columns 12, 15, 18, 21). In column 23 accounts for flows from abroad into the country. They are, in row 1 net factor income; 1/ in rows 2 and 4, the transfers to households and government respectively; and in rows 11, 14 and 20, exports. The figure in row 5/column 23 is the current account deficit which is also equal to the savings gap.

B. Economics of the Model

Given the accounting framework defined above, a full model is obtained by specifying agents' behavior and market adjustments. This is done here. Generally, a model can rely on either behavioral assumptions or on accounting-type relations. SIAM, in fact, has very few behavioral assumptions built into it.

Households, companies and government are assumed to allocate their total receipts on their different outlays according to some utility maximization 2/ assuming unchanged relative prices. Thus, Engel-curve-type relations

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1/ The factor income balance is in deficit while net factor income is actually a flow out of the country. It is therefore entered with a negative sign.

2/ For companies and government this is more a convenient allocation rule than a truly behavioral assumption.
are used to allocate total receipts of each of these institutions' current account. Given these total receipts, the postulated assumptions allow the determination of transfers between institutions, savings and government and private consumption.

Firms are assumed to determine intermediate demands through input-output coefficients. Given firms' intermediate demands, household and government consumption, and exogenously given investment, total aggregate demands are thus determined. These demands are for composites composed of both imports and domestically produced goods.

Given aggregate demands for the composite goods, the question is then the determination of their composition between imports and domestically produced goods. The assumption introduced here is that given a level of aggregate demand for a composite good, the share of imports to domestically produced goods is obtained through cost minimization.1/

Agricultural exports are assumed to be the excess of agricultural production over the domestic demand for the domestic agricultural products. Exports of manufactures and services are assumed to be sensitive to the ratio of the world price of exports to the supply price of the Thai exports. These are, in fact, demand functions of the rest of the world for Thai manufactures and services.

We now turn to the assumptions on market adjustments. First, factor markets are not modeled. Net prices or value-added coefficients in current prices in manufacturing, energy, and services are assumed exogenous. On the product markets production is demand-determined for the sectors mentioned above. Agricultural production is assumed exogenous and, for this sector, the model is supply-determined. However, the agricultural net price is assumed endogenous.

1/ This is again a convenient allocation rule and not a behavioral assumption.
SIAM1 is a fixed-price model. Given import prices, tariffs and net prices in manufacturing, energy and services, domestic prices and prices of the composite goods are determined on a cost basis. The fixity of prices does not mean they are constant. It simply means they do not react to excess demand, they are purely cost-determined.

Once the composite goods prices and domestic prices are determined, they jointly determine the net price of agriculture. The domestic prices of manufactures and services, with export taxes, give the supply price of exports of manufactures and services. Subsequently, the ratio of the world price to the corresponding Thai supply price determines exports for manufactures and services.

At this stage, prices, investment, exports of manufactures and services and agricultural production are given. The rest of the model is then a quasi-standard multisectoral Keynesian model. All the remaining variables are determined simultaneously in order to find the level of activity which equalizes injections and leakages.

The main features distinguishing SIAM1 from a standard Keynesian model are the way agriculture is treated and the way imports are modeled.

As mentioned, agriculture is the only supply-determined sector, hence it contradicts the usual assumption of demand driven production. Thus, agricultural exports are not true injections since they do not contribute to increase aggregate demand and do not increase levels of activity. They simply adjust to equalize supply and demand.
The main difference on the import side is that these are not considered to be purely competitive. Rather they are more or less substitutable to domestic supply according to whether an elasticity of substitution is close to infinity or to zero. Furthermore, this specification allows the existence of a wedge between world and domestic prices for traded goods. The resulting relative autonomy of movements of domestic prices vis-a-vis world prices. This is dependent, however, on the value of the elasticity of substitution.

To summarize, SIAM\textsuperscript{1} could be described as a quasi-orthodox, standard Keynesian model. It is thus a fixed-price demand model. It assumes, however, a supply-determined agriculture and imports which are neither pure complements or purely competitive.

C. Relations of SIAM\textsuperscript{1}

The above points give a general feeling of the model and of its working. In the following a description of the variables and the relations is given. All variables with a bar are exogenous variables, and \( t \) is the time subscript.

Let \( \hat{P}_{it} \), \( i = 1, 2, 3, 4 \) be the \textbf{prices of domestic goods}; \( V_{jt} \), \( j = 1, 2, 3, 4 \) are the \textbf{net prices} with \( V_{1t} \) endogenous and the others exogenous; \( P_{it} \), \( i = 1, 2, 3, 4 \) are the \textbf{prices of the composite goods}; with \( \bar{a}_{ij} \), \( i,j = 1, 2, 3, 4 \) denoting the \textbf{input-output coefficients}, the prices of domestic goods are given by

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\textsuperscript{1/} For an account of this approach, see DeMelo and Robinson (1978), "Tradability in Trade Theory," World Bank; and Dervis, DeMelo and Robinson, Planning Models and Development Policy, Chapter 7, (forthcoming).
Let \( \tilde{\tau}_{it} \), \( i=1,2,3,4 \) be the rates of indirect taxation on domestic goods traded domestically, hence the market prices of these goods \( \tilde{P}_{Dit} \), \( i=1,2,3,4 \) are given by

\[
\tilde{P}_{Dit} = P_{Dit} (1 + \tilde{\tau}_{it}), \quad i=1,2,3,4
\]

Landed prices of imports denoted by \( P_{mit} \), \( i=1,2,3,4 \) are obtained via world prices \( \bar{\pi}_{mit} \), \( i=1,2,3,4 \) and tariff rates \( \bar{\tau}_{mit} \), \( i=1,2,3,4 \)

\[
P_{mit} = (1 + \bar{\tau}_{mit}) \bar{\pi}_{mit}, \quad i=1,2,3,4
\]

This specification assumes that the supply of imports is perfectly elastic at the given prices.

The prices of the composite goods, \( P_{it} \), \( i=1,2,3,4 \) are obtained using the cost function of the cost minimization rule used to allocate aggregate demand between imports and domestic goods.\(^1\) Assuming a constant elasticity of substitution (CES) aggregation of imports and domestic goods, the specification of the cost function is

\[
P_{it} = \frac{1}{\bar{v}_{i}} \left\{ \bar{\sigma}_{i} \left( P_{mit} (1-\bar{\sigma}_{i}) + (1-\bar{\sigma}_{i})^{1/\bar{\sigma}_{i}} \tilde{P}_{Dit} \right) \right\}^{1/(1-\bar{\sigma}_{i})}, \quad i=1,2,3,4
\]

\(^1\) See relations (15) and (16).
where \( \delta \) is a distribution parameter, \( \gamma \) is a scale parameter and \( \sigma \) is the elasticity of substitution. A \( \sigma \) close to zero means that there is not much scope for substitution between imports and domestic goods regardless of their relative prices. This is a case close to purely complementary imports. When \( \sigma \) goes to infinity imports and domestic goods become pure substitutes and their ratio is highly sensitive to their relative prices.

In SIAM, the domestic price of agricultural goods \( PD_{it} \) is determined by the exogenous world price of exports of these goods, with an allowance for export taxes. However, because of lack of market information, it is assumed that the current domestic price of agriculture \( PD_{it} \) adjusts to both the current world price and the world price of last period. Hence, with \( \pi_{it}^e \), the world price of agricultural exports and \( \pi_{1(t-1)}^e \), the export tax on these goods:

\[
PD_{it} = \frac{1}{2} \left( \frac{\pi_{it}^e + \pi_{1(t-1)}^e}{1 + \pi_{1(t-1)}^e} \right).
\]  

(5)

This specification assumes that Thai exporters of agricultural goods are price takers, so that they bear the burden of any export taxes. One might argue that Thailand is a large rice exporter and, hence, can influence its world price. However, considering agricultural exports as a whole, the price taking assumption seems reasonable.\(^1\)

Exports of manufactures and services are assumed to be sensitive to relative world and Thai prices. The former are exogenous and the latter or supplier's prices, \( PD_{2t} \) and \( PE_{4t} \), respectively, are linked to the corresponding domestic prices \( PD_{2t} \) and \( PD_{4t} \) with an allowance for export taxes:

\(^1\) This seems also to be the relevant assumption in "Thailand: Towards a Development Strategy of Full Participation," IBRD (1980).
\[ PE_{2t} = (1 + \bar{\tau}_{2t}) PD_{2t}, \quad PE_{4t} = (1 + \bar{\tau}_{4t}) PD_{4t} \]

where \( \bar{\tau}_{2t} \) and \( \bar{\tau}_{4t} \) are the export tax rates.

All the preceding relations determine prices without any reference to quantities; this is the fix-price nature of the model. However, prices intervene in the determination of quantities and incomes. In the following the relations determining these variables are described.

Let \( Z_t \) be GNP at factor cost. \( Z_t \) is allocated between the different recipients of incomes assuming their shares vary with the level of GNP.

Let \( R_{1t} \) be compensation of employees,
\( R_{2t} \) income from unincorporated enterprise,
\( R_{3t} \) income from property excluding dividends,
\( R_{4t} \) operating surplus of companies including the provision for fixed capital consumption,
\( R_{5t} \) government income from property and entrepreneurship,

then
\[ R_{it} = \left( -\frac{0}{\rho_i} + \frac{-1}{\rho_i} e^{-\gamma r_t} / Z_t \right) \left. \right|_{i=1,2,\ldots,5} \]

with \( \rho_i \) and \( -\gamma \) being parameters satisfying
\[ \sum_{i=1}^{5} \rho_i = 1 \quad \text{and} \quad \sum_{i=1}^{5} -\gamma \rho_i = 0 . \]

These constraints ensure that the adding up property \( \sum R_{it} = Z_t \) is always fulfilled.

The allocation of the total of households' resources \( TR_{H_i} \) is treated in the same way as above.

---

1/ For the determination of \( Z_t \), see relation (24).

2/ For the determination of \( TR_{H_i} \), see relation (20).
Let

\[ H_{lt} = \text{interest on consumers' debt}, \]
\[ H_{2t} = \text{personal taxes and other current transfers to government}, \]
\[ H_{3t} = \text{households' savings}, \]
\[ H_{4t} = \text{consumption of the agriculture composite good}, \]
\[ H_{5t} = \text{consumption of manufactures}, \]
\[ H_{6t} = \text{consumption of energy}, \]
\[ H_{7t} = \text{consumption of services}, \]
\[ H_{8t} = \text{current transfers to the rest of the world}, \]

then the allocation relations are

\[ H_{it} = \left( \tilde{h}_{i}^0 + \tilde{h}_{i}^1 e^{-\tilde{\beta} H_{t}} / TRH_t \right) TRH_t, \quad i=1,2,\ldots,8 \quad (8) \]

with, again, \( \sum \tilde{h}_{i}^0 = 1 \) and \( \sum \tilde{h}_{i}^1 = 0 \) in order to ensure that \( \sum_{i=1}^{8} H_{it} = TRH_t \) always holds.

The same type of relations are used to allocate the total income of companies \( \text{TIC}_t \).

Let

\[ C_{1t} = \text{dividends}, \]
\[ C_{2t} = \text{corporate taxes}, \]
\[ C_{3t} = \text{corporate savings}, \]

then

\[ C_{it} = \left( \tilde{c}_{i}^0 + \tilde{c}_{i}^1 e^{-\tilde{\gamma} C_{t}} / \text{TIC}_t \right) \text{TIC}_t, \quad i=1,2,3 \quad (9) \]

with \( \sum \tilde{c}_{i}^0 = 1 \) and \( \sum \tilde{c}_{i}^1 = 0 \) so that \( \sum C_{it} = \text{TIC}_t \).

Finally, total government revenue \( \text{GREV}_t \), is allocated again in the same way:

---

1/ For the determination of \( \text{TIC}_t \), see relation (21).

2/ For the determination of \( \text{GREV}_t \), see relation (22).
Let

\[ G_{1t} = \text{transfers to households}, \]
\[ G_{2t} = \text{interest on public debt}, \]
\[ G_{3t} = \text{government savings}, \]
\[ G_{4t} = \text{government consumption of manufactures}, \]
\[ G_{5t} = \text{government consumption of energy}, \]
\[ G_{6t} = \text{government consumption of services}, \]
\[ G_{7t} = \text{government transfers to the rest of the world}, \]

then

\[ G_{it} = \left( \frac{-0 + -1}{g_{1i} + e^{-\beta} G_{REVt}} \right) G_{REVt}, \quad i=1,2,\ldots,7 \tag{10} \]

with \( \sum_{i=1}^{7} g_{1i} = 1 \) and \( \sum_{i=1}^{7} \frac{-1}{g_{1i}} = 0 \) ensuring that \( \sum_{i=1}^{7} G_{it} = G_{REVt} \).

These allocation rules with the above constraints on the parameters do not imply that the government budget is balanced. In fact, GREV is allocated between current outlays and savings. Government capital expenditure is not included. Thus, depending on the relative value of government savings and government investment, there may be either a deficit or a surplus.

Some comment on the postulated allocation relations is in order here. First, it is easily seen that the expression between brackets is a budget share and that it is dependent on total income (or expenditure). Second, \( g_{1i}, c_{i}, h_{1i}^{0}, \) and \( \rho_{i}^{0} \) have the interpretation of budget shares for total expenditures tending to zero. Hence, for very low levels of total expenditures the budget shares will tend to be very close to the value of these parameters. Third, for total expenditures becoming very large, the expressions between brackets will tend towards \( \frac{-0 + -1}{g_{1i} + e^{-\beta} G_{REVt}} \), \( \frac{-0 + -1}{c_{i} + e^{-\beta} G_{REVt}} \), \( \frac{-0 + -1}{h_{1i}^{0} + e^{-\beta} G_{REVt}} \), and \( \frac{-0 + -1}{\rho_{i}^{0} + e^{-\beta} G_{REVt}} \). Hence, these sums can be
interpreted as limit budget shares for very high levels of total expenditures. Implicit to this is the idea that $-1, -1, \bar{h}_i$, and $-1$, give the maximum possible variation of the budget shares. Fourth, the latter parameters can be either positive or negative which allows us to feature declining budget shares. Finally, the parameters $\beta$ indicate the level of total expenditures where budget shares are the most sensitive to variations of total expenditures. Near that level, they either increase or decrease more steeply, and beyond that level they start tapering off.

Let $X_{d}^{j}$, $j=1,2,3,4$ be production in constant prices; $X_{d}^{0}$ is exogenous agricultural production, and $X_{d}^{i}$, $i=2,3,4$ are endogenous production levels of manufacturing, energy, and services respectively.

Then the value of the aggregate demand for the agricultural composite good $P_{1t}U_{1t}$, is the sum of households' consumption $H_{4t}$, investment demand $P_{1t} \bar{\bar{\theta}}_{1t} t$ and total intermediate demand $\sum_{j=1}^{4} \alpha_{1j} P_{1t} X_{d}^{j}$, hence

$$U_{1t} = \frac{1}{P_{1t}} \left( H_{4t} + P_{1t} \bar{\theta}_{1t} t + \sum_{j=1}^{4} \alpha_{1j} P_{1t} X_{d}^{j} \right)$$

(11)

where $\bar{\bar{\theta}}_{1t}$ is total investment demand in constant prices, and $\bar{\theta}_{1t}$ is the share of it which has to be supplied by agriculture. For manufacturing it is

$$U_{2t} = \frac{1}{P_{2t}} \left( H_{5t} + G_{4t} + P_{2t} \bar{\bar{\theta}}_{2t} t + \sum_{j=1}^{4} \alpha_{2j} P_{2t} X_{d}^{j} \right)$$

(12)

where $H_{5t}$ is household consumption of manufactures, $G_{4t}$ is government consumption, $P_{2t} \bar{\bar{\theta}}_{2t} t$ is investment demand, and $\sum_{j=1}^{4} \alpha_{2j} P_{2t} X_{d}^{j}$ is intermediate demand. Similarly,

1/ There is an inflexion point when total expenditure is equal to $\beta/2$. 
aggregate demand for the energy composite good is

$$U_{3t} = \frac{1}{P_{3t}} \left( H_{6t} + G_{5t} + \frac{P_{3t}}{3t} \bar{I}_t + \sum_{j=1}^{4} \alpha_{3j} P_{3t} x_{j}^{d} \right) \tag{13}$$

The notations are the same as before, but investment demand here covers only changes in stocks. Finally, the aggregate demand for services will be

$$U_{4t} = \frac{1}{P_{4t}} \left( H_{7t} + G_{6t} + \sum_{j=1}^{4} \alpha_{4j} P_{4t} x_{j}^{d} \right) \tag{14}$$

with obviously no investment demand.

Note that $\bar{I}_t$ is gross investment in constant prices,

also, the relation $\sum_{i=1}^{3} \bar{I}_{it} - \bar{I}_t = \bar{I}_t$ holds, and hence $\sum_{i=1}^{3} \bar{I}_{it} = 1$.

The question which arises at this stage is that of the composition of these aggregate demands and their relative import intensity.

The following allocation rule is assumed: given prices and aggregate demand, the import intensity is determined by minimizing costs.\(^1\)/ The problem is then the following:

$$\text{Min } (P_{M} M + P_{D} D)$$

subject to

$$\gamma \left[ \delta_{M} - \rho + (1 - \delta_{D} - \rho) \right] - \frac{1}{\rho} - U = 0$$

where $D$ is domestic goods, $M$ is imports and a CES function is assumed for the aggregation of the two. There is in this function a distribution parameter $\delta$, \(^1\)/ See Dervis, DeMelo and Robinson, Chapter 7, (forthcoming).
a scale parameter $\tilde{\gamma}$ and a substitution one $\tilde{\rho}$. The elasticity of substitution, $\tilde{\sigma}$ is defined as $1/(1+\tilde{\rho})$.

The above problem leads to the following allocation relations which determine for each vector of prices and each level of aggregate demand the amount of imports and domestic demand required:

$$D_{it} = \gamma_{i} - 1 (1 - \delta_{i}) \tilde{\sigma} \left( \frac{P_{i}}{P_{B_{i}}} \right) \tilde{\sigma} U_{i}$$  \hspace{1cm} (15)

$$M_{it} = \gamma_{i} - 1 \delta_{i} \tilde{\sigma} \left( \frac{P_{i}}{P_{M_{i}}} \right) \tilde{\sigma} U_{i} , \hspace{1cm} i=1,2,3,4$$  \hspace{1cm} (16)

Relation (4) determining the prices of the composite goods is obtained as the dual of the cost minimization problem considered here. For this reason the parameters used here and there are the same.

Exports of agricultural products are obtained as the excess of production over domestic demand for the domestic goods

$$E_{it}^{d} = \tilde{x}_{it} - D_{it}$$  \hspace{1cm} (17)

where the three variables are in constant prices.

Exports of manufactures and services are assumed to be sensitive to the ratio of the world price to the domestic suppliers' price:

$$E_{it} = E_{it}^{e} \left( \frac{\pi_{it}^{e}}{P_{E_{it}}} \right) \tilde{\eta}_{i} , \hspace{1cm} i=2,4$$  \hspace{1cm} (18)

where $\pi_{it}^{e}$ is the world price (exogenous), $\tilde{\eta}_{i}$ is a constant elasticity and $EB_{it}$ is a parameter giving the value of exports where $\pi_{it}^{e} = PE_{it}$ . $EB_{it}$ may vary with time in order to catch the movements in the world GDP growth.
As mentioned, production is demand-determined in manufacturing, energy and services:

\[
X_{it}^d = E_{it} + D_{it} \quad \text{for} \quad i=2,4
\]

\[
X_{3t}^d = D_{3t}
\]

These relations equalize supply to demand

The remaining relations of the model are accounting relations. Total households' resources \( TRH_t \), are defined as

\[
TRH_t = \sum_{i=1}^{3} R_{it} + C_{1t} + G_{1t} + F_{2t}
\]

where \( F_{2t} \) are current transfers from the rest of the world to households and are exogenous. This relation states that \( TRH_t \) is equal to factor incomes paid to households \( \sum_{i=1}^{3} R_{it} \), plus dividends \( C_{1t} \), plus transfers from government \( G_{1t} \), plus transfers from abroad.

Total income of companies \( TIC_t \), is obtained as the sum of their gross operating surplus \( R_{4t} \), the interest on consumers' debt \( H_{1t} \) and the interest on public debt \( G_{2t} \):

\[
TIC_t = R_{4t} + H_{1t} + G_{2t}
\]

Government receives a factor income \( R_{5t} \) (which is government income from property and entrepreneurship), direct taxes from households \( H_{2t} \), corporate taxes \( C_{2t} \), net indirect taxes \( NIT_t \) and transfers from abroad \( F_{4t} \). Total government revenue is thus

\[
GREV_t = R_{5t} + H_{2t} + C_{2t} + NIT_t + F_{4t}
\]

\( F_{4t} \) is exogenous.
Net indirect taxes are given as the sum of taxes on domestic goods

\[ \sum_{i=1}^{4} \tau_{it}PD_{it}D_{it}, \text{duties on imports} \quad \sum_{i=1}^{3} \tau_{im}^{m}M_{it}, \text{and taxes on exports} \]

\[ \sum_{i=1}^{2} PD_{it}\tau_{it}E_{it}, \text{thus} \]

\[ NIT_t = \sum_{i=1}^{4} \tau_{it}PD_{it}D_{it} + \sum_{i=1}^{3} \tau_{im}^{m}M_{it} + \sum_{i=1}^{2} PD_{it}\tau_{it}E_{it} \tag{23} \]

GNP at current factor cost \( Z_t \), is obtained as the sum of value added at factor cost in the four sectors and the net factor income from abroad \( \bar{F}_{lt} \):

\[ Z_t = V_{lt}X_{lt} + \sum_{i=1}^{3} \bar{V}_{it}X_{it} + \bar{F}_{lt} \tag{24} \]

Another obvious feature of the model is that the sum of leakages must be equal to that of injection at an equilibrium level of activity. The economy considered being an open economy, this can be put another way: equilibrium implies that the "savings gap" is equal to the current account deficit. This is indeed the case here where the preceding relations imply

\[ SG_t = TG_t \]

where \( SG_t \) is the savings gap defined as

\[ SG_t = \sum_{i=1}^{3} P_{it}\bar{G}_{it} - (H_{3t} + C_{3t} + G_{3t}) \tag{25} \]

and \( TG_t \), the current account deficit:

\[ TG_t = \left( H_{8t} + C_{7t} + \sum_{i=1}^{4} \pi_{im}^{m}M_{it} \right) - \left( \sum_{i=1,3,4} \bar{P}_{it} + \pi_{it}^{e}E_{it} + PE_{2t}E_{2t} + PE_{4t}E_{4t} \right) \tag{26} \]
Gross national savings are equal to the sum of households savings $H_{3t}$, government savings $G_{3t}$ and savings of corporations $C_{3t}$. Finally, $H_{8t}$ are transfers from households to the rest of the world and $C_{7t}$ are transfers from government to the rest of the world.

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1/ Gross domestic savings (GDS) are defined as gross national savings (GNS) plus public and private transfers to abroad minus the sum of net factor income and public and private transfers from abroad: $\text{GNS} = H_{3t} + G_{3t} + C_{3t}$ and $\text{GDS} = \text{GNS} + H_{8t} + C_{7t} - F_{1t} - F_{3t} - F_{4t}$. 
III. Simulation Experiments with SIAMI

This section describes some simulation experiments with the SIAMI model. In evaluating those, it should be emphasized that they are outcomes of simulations and not forecasts of the future development of the Thai economy. In this context, it is important to keep in mind the limitations of the model in its present form.

One of the major limitations is the assumed exogeneity of investment in constant prices. This assumption has been made for lack of an acceptable framework to endogenize investment at the present stage. The implication is that the investment-savings balance cannot be affected through endogenous changes in investment. Other features of the SIAMI model are the fix-price\(^1\) assumption, the absence of factor markets and of money.

In stressing these limitations, two points are in order. First there is no, and there cannot be in the foreseeable future, a general multi-purpose economy-wide model. Hence, one has to select a few questions and devise a model which may give some insights on them, having some crude, but hopefully as neutral as possible, assumptions on what is left outside the model. This was the stand taken when starting the SIAMI model which as a macroeconomic tool is primarily designed to shed light on the foreign trade side\(^2\) and on resource mobilization. The second point to make, which is corollary of the first one, is that the questions addressed in SIAMI are not the only ones the Thai economy is facing. Shifting the attention to other questions like employment, income distribution, and industrial structure, there is

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1. By fix-price is meant the nonresponsiveness of prices to excess demand; prices are cost determined.

2. The simulated effects on foreign trade are conditional on the assumption about the behavior of investment.
a need to complement, extend or change the SIAM model. This would also mean providing some treatment to endogenize investment, introduce capacity limitation, determine net prices, and according to the problem at hand, bring money or other aspects in the model.

Apart from the modeling aspects, there is the implementation question which involves the quantification of parameters, the choice of a base year, the calibration of the model, and the assumptions on future paths of exogenous variables. This is always a difficult matter. However, it should be noted that, at the time the simulations presented here were produced, the model did not track well the high growth rates of the economy in the late 1970s. This implies that while the simulation results reported in the following can be compared to each other, comparisons between simulated growth rates, etc., in the future with actual rates in the past have to be made with great caution.

Given these caveats and the type of framework presently available, we now ask whether the Thai economy can maintain its high rate of growth given the present disequilibrium, higher oil prices and the exhaustion of new agricultural land. The question is whether given the present structure of the economy, high rates of growth will generate unsustainable domestic and external macroeconomic imbalances.

The question is treated here by simulating the working of the Thai economy with SIAM over the period 1980-90. This is done by looking at the growth performance, savings and investment ratios, and external disequilibrium, as well as government finances. These macroeconomic aspects are considered under two alternative assumptions. Under the first, it is assumed that present trends in policy variables, and exogenous domestic and world variables will remain the same or what they are expected to be. Under the second alter-
native, it is assumed that the government will implement fiscal and trade policy measures in order to correct the present disequilibrium. However, in both cases, the trends in world prices are assumed to be the same and no structural change takes place. This last assumption of no structural change is rather restrictive and furthermore, in an uncertain world, future world prices may well be different. Therefore, one would like to know how changes in world variables and structural parameters would modify the macroeconomic picture of the economy derived in the simulation experiments considered. Some indication of the amount and direction of these modifications is gained by looking at the elasticities of relevant endogenous variables with respect to exogenous variables as well as with respect to the parameters.

In this section, we first define the two simulation experiments and discuss the outcomes. Next, we describe the derivation of the elasticities of endogenous variables with respect to parameters and to exogenous variables. Then we present how, in one of the simulations, changes in these can modify the derived path of the economy.

A. "Laisser-aller" versus Policy Intervention

The "laisser-aller" case is taken to be the reference simulation. A complete description of its underlying assumptions is given in Appendix 2. Basically, it is assumed that gross investment in constant prices grows exponentially at 5% a year and that gross agricultural production grows at 4.5% a year. During the first half of the seventies, gross capital formation

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1. Changes relative to basic predictions.
2. By "laisser-aller" we do not mean "laisser-faire."
3. Including the statistical discrepancy.
in constant 1962 prices actually grew at slightly more than 5% a year, while between 1975 and 1979, and in constant 1972 prices, this rate almost reached 12%. Given the present imbalances, higher energy costs and a less buoyant world economy, we have arbitrarily assumed a growth rate of 5%. This assumption is contrary to what one would expect according to the accelerator principle. Indeed, in this latter case a lower growth rate of the economy would be associated with a lower level of investment. However, if one believes that investment is purely autonomous, there would be no reason to expect a decrease in its rate of growth. In assuming a growth rate of 5% we somehow stand in between the two positions of purely autonomous or purely induced investment. According to the index of agriculture production given by the Bank of Thailand, the rate of growth of gross agricultural production was 5.3% between 1970 and 1979, and 4.8% between 1975 and 1979. Given the exhaustion of new agricultural land, the assumed rate of 4.5% is in line with expected trends.

Tables A2.2 and A2.3 in Appendix 2 give the assumed indirect tax rates and pattern of government outlays in the reference simulation. It amounts to maintaining indirect tax rates at their 1979 value except for energy where the rate of duties on imports and the rate of indirect taxation on domestic demand are assumed to drop in 1979 and 1980 and go back up to 1978 values by 1984. This is to take account of the lags in passing on increases in oil prices. The shares of government outlays on the different items are assumed to follow the trend of the period 1960-79, which means a rapidly declining share of savings and a high and increasing share of expenditure on

1. This implies a gradual reduction in the investment/GDP ratio.
3. The trend mentioned here is not a "time trend," rather the variation in shares resulting from variations in government revenue.
services. For convenience, this reference simulation will be referred to below as LA ("laisser-aller").

In the second simulation, government is assumed to implement fiscal and trade policy measures, aimed at (a) increasing its revenue through indirect taxation, (b) discouraging energy imports and consumption through higher prices, (c) encouraging exports through reductions in taxes on exports, and (d) correcting the imbalance in the government savings gap by increasing the share of savings in its total current outlays. More specifically, it is assumed that indirect tax rates on domestic demand for domestic goods and services increase at 4% per annum, except for energy where the increase is 6%. This is also the assumed growth rate for the rates of duty on imports of energy, otherwise the rates of duty on imports remain the same as for 1979. Furthermore, the rate of duty on imports of energy and the indirect tax rate on domestic demand of domestic energy are not assumed to drop in 1979-80 and catch up later; in 1979 they remain at 1978 values and increase afterwards at the 6% rate mentioned above. Tax rates on exports are assumed to decrease at an annual rate of 6%. The pattern of government outlays is also assumed to change. Instead of having a lower share of savings with higher government revenues, this share is assumed to increase, the shares of all other items except the "interest on public debt" decreasing. Apart from the above measures, it is also assumed that agricultural production will be able to grow at 5% instead of the 4.5% of the reference simulation. Another assumption is that the world demand for Thai exports of manufactures and services will be pushed up by the expansion of world GDP more than in LA. This is expressed by having the parameters $EB_2$ and $EB_4$ of relations 18 grow at 15% and 14% respectively, instead of 13%. With these last two assumptions, one would expect a higher rate of growth of investment. However because of higher taxes, there would
also be some disincentive to invest. Therefore it was assumed that the growth rate of gross investment, in constant prices, remains the same as in LA, namely 5%. Again for convenience, this second simulation will be referred to in the following as PI (policy intervention).

We now turn to the macroeconomic picture generated by the two simulations. With GDP at constant market prices as an indicator of growth, the economy grows between 1980 and 1990 at an average rate of 6.7% per annum under the assumptions of LA and of 7.1% per annum under PI. Per capita these percentages are 4.5 and 4.9 respectively. As indicated on page 2 above, these growth rates can only with great caution be compared to those of the past, but probably they do imply a slowdown in the rate of growth of the economy, at least in the early eighties. As between LA and PI, the growth performance can be compared; the higher rates obtained under PI being due to the assumptions of a higher rate of growth of agricultural production, of a more buoyant world demand for Thai manufactures, and, of lower export taxes leading to more competitive Thai exports of manufactures. These assumptions on exports and agriculture appear to be more important than the conservative measures of higher domestic taxation, higher tariffs on imports of energy and lower government spending.

The differences between the two simulations with regard to the savings and investment ratios are indicated in Table 2. As indicated before, the assumption on the ratio of growth of real investment is arbitrary, and is the same in the two alternatives. The difference between the two investment ratios is therefore mainly due to the higher GDP growth rate under PI. With regard to savings, domestic savings are higher than national savings, which means that the balance of transfers and factor-income services with the rest of the world is in deficit. As pointed out in the introduction, this is
mainly due to the increasingly negative balance of investment income. The
different pattern of government outlays between LA and PI results in a higher
share of government savings in PI. This change in government behavior
explains also the higher savings generated in PI. With regard to movements in
the savings-investment balance, it is tempting to draw conclusions from Table
2, but they would be conditional on the assumed rate for investment growth and
it is preferable not to elaborate on this point.

Looking at foreign trade (Table 3), and keeping in mind the depen-
dence of imports on investment through aggregate demand, the general trend is
a high but decreasing rate of growth of exports and a lower but increasing
rate of growth of imports. In PI, both these rates are higher than in LA. On
the export side, manufactures and services continue to perform well, but this
is mainly due to the assumption on world demand through the parameters EB₂ and
EB₄ of relations 18. Agricultural exports are still growing in constant
prices between 1981 and 1984, but they decrease between 1984 and 1987 in LA
and in 1987-90 in PI. The difference between the two simulations is due to
the higher growth of agricultural production in PI. Agricultural exports are
determined residually in SIAM, as the excess of agricultural production over
domestic agricultural demand. Higher rates of growth of the sectors other
than agriculture lead to a growth of intermediate demand for agricultural
goods higher than that of production. This results naturally, after a while,
in having a smaller surplus available for exports, hence decreasing rates of
agricultural exports. On the import side, imports of manufactures and ser-

1. Total sectoral domestic aggregate demands are allocated between demand for
imports and demand for domestically-produced goods. This procedure assumes a
relative stability in the composition of final demand and in the import
intensity of each component. Investment having a higher import content than
the other components, the import implications of large variations in the share
of investment will not be adequately simulated.
vices increase faster than other imports. They are, like agricultural
imports, higher in PI than in LA, because of the higher rate of growth of the
economy in PI. Imports of energy after slowing down between 1981 and 1987,
accelerate again after 1987. The slowdown is partially due to the coming on
stream of gas\(^2\) from the Gulf of Thailand by 1982. Although the economy grows
faster in PI than in LA, the rate of growth of imports of energy in 1987-1990
is lower in PI, due to the increases in duties on imports of energy and the
rate of domestic indirect taxes on energy.

Table 4 shows how the trade balance looks in LA and PI for 1981,
1984, 1987 and 1990 and gives information on the current account deficit and
the terms of trade. On the average for the whole decade these deteriorate
slightly, but they are essentially stable.\(^3\) The trade balance improves faster
than the current account deficit, again due to the deficit of the factor-
income balance. Another aspect worth noting is that although agricultural
exports in constant prices decrease their current price value still increases
until 1990, pointing to the fact that the rate of increase in world agricultu-
ral prices still more than compensates for the drop in quantities.

As can be expected from the assumptions underlying the two simula-
tions, the share of government revenue in GDP is higher and increases faster
in PI than in LA (see Table 5). The increase in LA is due to the fact that
the fastest growing sectors, manufacturing and services, are also relatively
the most heavily taxed. In PI, the higher rates of taxation and rate of

---

1. The implied average elasticity of imports with respect to GDP is .87 in LA
   and .96 in PI.

2. This is taken into account by modifying the share parameter of the demand
   relation for imports (relations 16).

3. In comparison to the drop between 1975 and 1978 where they moved from 100
to 87.83.
growth of the economy accentuates the increase in the share of government revenue. The increase in the share of government revenue leads to a higher share of government expenditure, but this is associated with a decreasing share of government savings in LA and an increasing share in PI. This is due to the assumption introduced in PI of a share of government savings in government revenue increasing with the latter. These trends in the revenue, savings and current expenditure shares lead to a decreasing share of the public sector savings gap in GDP in PI, whereas it increases in LA. Finally, in Table 5 the structure of government revenues and expenditures are given. On the revenue side, the predominance of indirect taxes is without challenge although the share of corporate taxes is increasing. On the expenditure side, services are naturally the predominant item.

From both simulations it appears that the macroeconomic disequilibria which are presently plaguing the Thai economy can be dramatically reduced towards the end of the decade. The major difference between the two alternatives is that the improvement in LA is less pronounced than in PI and it also takes place later. Hence one would expect a less sustainable financial situation under LA than under PI.

However, this means that exports of manufactures and services will keep growing fast and the rates of growth of imports will be modest. At any rate the trade balance will have to bear the bulk of the adjustment in the current account deficit as factor payments in the form of investment income will continue to grow. A worrying aspect is the acceleration of the rates of growth of imports and the deceleration of those of exports towards the end of the decade (see Table 4). On the savings side, the behavior of government

---

1. This statement is conditional on the assumption on investment behavior.
savings appears to be a crucial factor in the speed of adjustment. Increasing government revenues would probably not be sufficient to reduce the public sector savings gap share in GDP because of the present declining trend in the share of government savings in GDP. Actions to increase this share would help in accelerating the process of adjustment.

Although on these assumptions some improvement in the current account situation as well as in the savings-investment balance occur in the late 1980s, Thailand will experience severe external and savings-investment disequilibria during the first part of the decade. Whether these and the associated rates of growth are sustainable depends largely on the availability of foreign savings, of the acceptable accumulation of foreign debt and of realistic levels for the debt service ratio. The main question is then whether Thailand would be able to emerge from the first part of the eighties without sacrificing its financial stability.

At the end of these simulations we would like to stress once more that the results presented here are simulation results and not forecasts. They represent, within the framework of the model, the likely outcome of the assumptions envisaged and they depend on them. To narrow down the model to a forecasting tool one would need a less open model and hence a higher degree of closure. A particular example in that respect is the determination of investment. Presently in SIAM1, investment is exogenous and no feedback is assumed to exist from the rest of the model to investment. Introducing such feedback with an investment demand function would make the model more closed and probably more suited for forecasting.
B. Direct and Indirect Effects of Marginal Changes in Exogenous Variables, Policy Parameters, and Structural Parameters

The preceding analysis focusses on the possible adjustments of the economy given its structure, and some predictions on world prices, growth of investment and of agricultural production. It is hard, however, to assume that no structural change at all would take place or that exogenous variables will be exactly predicted.

One way to gain some insight on the possible effects of changes in these variables and parameters is to consider how and by how much their marginal change can affect the paths derived in the simulations considered previously. Any change in these parameters would have direct and indirect effects. We first present how elasticities measuring these direct and indirect effects are derived and then illustrate their use with a few examples.

Basically, any non-optimization model could in principle be written as a set of n equations in n endogenous variables, \( y_1, y_2, \ldots, y_n \), m exogenous variables, \( x_1, x_2, \ldots, x_m \), p policy parameters, \( \tau_1, \tau_2, \ldots, \tau_p \), and s structural parameters, \( a_1, a_2, \ldots, a_s \). Let \( h_i(\cdot) \) be an equation of the model, then the whole model is:

\[
h_i(y_1, y_2, \ldots, y_n; x_1, x_2, \ldots, x_m; \tau_1, \tau_2, \ldots, \tau_p; a_1, a_2, \ldots, a_s) = 0 \quad (27)
\]

for \( i = 1, 2, \ldots, m \).

Using implicit derivation and assuming a non-singular Jacobian at each solution point then one can compute the following elasticities:

\[
\frac{\partial y_i}{\partial x_j} \cdot \frac{x_j}{y_i}, \quad i = 1, 2, \ldots, n; \quad j = 1, 2, \ldots, m
\]

\[
\frac{\partial y_i}{\partial \tau_j} \cdot \frac{\tau_j}{y_i}, \quad i = 1, 2, \ldots, n; \quad j = 1, 2, \ldots, p
\]

and

\[
\frac{\partial y_i}{\partial a_j} \cdot \frac{a_j}{y_i}, \quad i = 1, 2, \ldots, n; \quad j = 1, 2, \ldots, s
\]

(28)
These elasticities measure the direct and indirect effects of a change in the exogenous variables, the policy parameters and the structural parameters on endogenous parameters. However, these elasticities are not constant.

We turn now to a more general specification for these elasticities. Let \( h(\tau) = \| d_1(\tau) \|, \) \( i=1,2,...,n \) be the vector of functions in (27) and \( y = \| x_1 \|, x = \| x_j \|, \tau = \| \tau_j \| \) and \( \alpha = \| \alpha_j \| \) the vectors of endogenous and exogenous variables, and, policy and structural parameters respectively.

Then by implicit derivation

\[
\frac{\partial h}{\partial y} \begin{bmatrix} \frac{\partial y}{\partial x'} & \frac{\partial y}{\partial \tau} & \frac{\partial y}{\partial \alpha} \end{bmatrix} + \begin{bmatrix} \frac{\partial h}{\partial y} & \frac{\partial h}{\partial x'} & \frac{\partial h}{\partial \tau} & \frac{\partial h}{\partial \alpha} \end{bmatrix} = 0
\]

Assuming \( \frac{\partial h}{\partial y} \), the Jacobian matrix, to be non-singular, then

\[
\begin{bmatrix} \frac{\partial y}{\partial x'} & \frac{\partial y}{\partial \tau} & \frac{\partial y}{\partial \alpha} \end{bmatrix} = - \left( \frac{\partial h}{\partial y} \right)^{-1} \begin{bmatrix} \frac{\partial h}{\partial y} & \frac{\partial h}{\partial x'} & \frac{\partial h}{\partial \tau} & \frac{\partial h}{\partial \alpha} \end{bmatrix}
\]

It is then straightforward to derive the matrices of elasticities we are looking for.

One may also be interested in the elasticities of derived variables with respect to all independent variables and parameters. For example, changes may be sought of in the terms of trade, the consumer's price index or any other derived variable. Let \( V = \| v_i \|, i=1,2,...,d \) be the vector of these variables, their most general specification would be:

\[
V = F(y(x,\tau,\alpha),x,\tau,\alpha),
\]

where \( F(\ ) \) is a vector of order \( d \), of functions and where \( y(x,\tau,\alpha) \) is also a vector of functions but of order \( n \). By derivation of the system of functions \( F(\ ) \), it is straightforward to derive the elasticities of \( V \) with respect to any independent variable.
Table 6 presents some selected elasticities, for 1984 and for the simulation of PI (policy intervention). The first three columns are elasticities with respect to three exogenous variables: the world price of energy ($\pi_3^e$), the world price of agriculture ($\pi_1^e$), and the gross production of agriculture ($\bar{x}_1$). The next four columns are elasticities with respect to the input-output coefficients describing the intermediate demand of the different sectors for energy. These elasticities measure the impact of marginal structural changes. Finally, the last three columns give elasticities with respect to three policy parameters, namely the rates of import duties on agricultural goods, manufactures and energy.

An interesting figure in the table is cell (1,1). It measures the elasticity of the consumers price index (CPI) with respect to the world price of energy ($\pi_3^e$). A one percent increase in $\pi_3^e$ generates a 0.263% increase in CPI. As a rough approximation, a 10% increase in energy prices would add 2.63% to the CPI. This is probably a conservative figure as the model does not produce any demand-pull inflation. Columns 2 and 3 show how dependent the economy is on agricultural variables. A one percent increase in the world price of agriculture improves the trade balance by more than 3.7% (cell (3,2)); likewise, a one percent increase in gross agricultural production could improve the trade balance by more than 8.4%. These effects work partially through the impacts of agricultural production and the world price of agriculture on agricultural exports, shown in cells (12,2) and (12,3). Another elasticity worth noting is that of the trade balance with respect to the world price of energy. It is negative, meaning that an increase in $\pi_3^e$ would improve the trade balance. This works in three ways:

---

1/ Because the elasticity measures marginal changes and depends on the level of the variables.
(1) higher energy prices mean less imports of energy (cell (10,1)); (2) it also means higher domestic prices and higher costs to the economy which leads to a slowing down of aggregate demand and hence of imports; and (3) the slowing down of aggregate demand means, in particular, a slowing down in domestic aggregate demand for agricultural goods and consequently more agricultural surplus for exports, (cell (12,1)).

Consider now a marginal change in the input-output coefficients of intermediate deliveries of the energy sector. Lowering these coefficients would induce a significant improvement in the trade balance (row 3/columns 4,5,6,7). The predominant impact of lower coefficients is lower demand for imports (rows 8-11/columns 4-7) and higher exports of manufactures and services (rows 13-14/columns 4-7). The higher exports result from lower domestic prices due to lower energy costs.

Finally, columns 8-10 show how a marginal change in rates of import duties affect the endogenous variables considered. It appears that changes in these policy parameters have little influence. However, imports of agricultural goods appear to be relatively sensitive to the tariff rate on agricultural imports.1/ Government revenues and net indirect taxes are also relatively responsive to the tariff rate on imports of manufactures. This is partially due to the importance of imports of manufactures and the level of the tariff rate (15%). Finally, a one percent increase in the rate of duties on imports of manufactures generates a .177% increase in government savings. This obviously works through an increase in government revenues and the pattern of government outlays.

1/ The level of the tariff rate on agricultural imports is 35.8%.
IV. Conclusion

In this paper we have been concerned with the trade-offs between macroeconomic imbalances and growth in the context of the Thai economy in the 1980s. For this purpose a macroeconomic model was built and used to simulate two possible paths of the Thai economy.

The macroeconomic model SIAM\(^1\), based on a SAM, was the tool used for the analysis. Hence, the model covers the main flows of incomes from activities to factors, factors to institutions and back to activities. SIAM\(^1\) is mainly a Keynesian model which is demand driven in manufacturing, energy and services, although agriculture output is given and the agricultural sector is supply determined. This is not only a convenient way of modeling the agricultural sector, it also allows us to put a global constraint on the supply side of the economy, thus checking any unreasonable growth in demand and the economy. In fact, high rates of growth are obtained here at the cost of lower agricultural exports as well as, more obviously, of more imports.

A model such as SIAM\(^1\) is essentially macroeconomic, but it is also semiaggregate as it assumes more than two sectors. Two questions underlie these models concerning (1) their closure, whether at the macro or micro level, and (2) the speed of adjustments. SIAM\(^1\) is closed at the macroeconomic level by assuming that it is investment driven. It could easily be transformed into a savings-driven model if the current account deficit is exogenized and investment is endogenized. But clearly the implications of the closure rule adopted here requires further analysis.\(^1\) This is also the case for the microeconomic closures adopted. Product markets are closed by assuming that production adjusts to demand and factor markets are dealt with by postulating exogenous net prices and

\(^1\) The analysis of the elasticities in Section III would be a good starting point.
agricultural prices determined via world prices. These microeconomic closures are certainly two directions in which the model could be improved. Finally, all adjustments are assumed to take place in the year; savings adjust to investment, production to demand and demand to prices in the "elementary" period to solve the model, that is, the year. This is clearly a convenient but nevertheless awkward assumption. As a matter of fact, it is not easy to introduce different adjustment periods in a model, to know the length of these periods, or to identify them. These micro and macroeconomic closures of models, as well as the question of adjustment periods, require further analysis in order to improve modeling capacity.

We have yet to reach an ideal applied model. Despite their numerous drawbacks, the applied models are useful as long as they provide insight to the problems at hand. And as Kornai put it, "We cannot expect our model to give final, decisive answers; it can be considered an accomplishment if it only inspires interesting thoughts, if it furnishes additional points of view for a decision." The first simulation reported here assumes that no specific policy measures are implemented in order to adjust to the disequilibria; the second assumes the implementation of specific fiscal and trade measures. It appears that the economy will under both paths gradually correct the disequilibria which presently prevail. The main question is how far the imbalances can go without endangering the financial stability of Thailand. Indeed under the first simulation, the resource gap would still be about 5% of GDP by 1984 and would vanish by 1990. The current account deficit, however, would remain as high as 6.5% of GDP by 1984 and would be reduced to 3.2% by 1990. The public sector savings gap on the contrary would gradually increase reaching 6.2% of GDP by 1990. Under

the second simulation the resource gap diminishes more rapidly becoming a surplus (2% of GDP) by 1990, while the current account deficit vanishes towards the end of the decade. The public sector savings gap diminishes to 4.5% of GDP by 1985 reaching 3.3% by 1990.
Table 2
The Savings and Investment Ratios

<table>
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</thead>
<tbody>
<tr>
<td>Share of gross investment in GDP</td>
<td>33.9</td>
<td>33.53</td>
<td>32.00</td>
<td>31.25</td>
<td>30.40</td>
<td>29.44</td>
<td>28.80</td>
<td>27.83</td>
</tr>
<tr>
<td>Share of national savings in GDP</td>
<td>24.20</td>
<td>24.23</td>
<td>24.60</td>
<td>24.75</td>
<td>25.1</td>
<td>25.84</td>
<td>25.6</td>
<td>27.53</td>
</tr>
<tr>
<td>i) share of households</td>
<td>12.56</td>
<td>12.15</td>
<td>12.35</td>
<td>11.82</td>
<td>12.22</td>
<td>11.56</td>
<td>12.16</td>
<td>11.37</td>
</tr>
<tr>
<td>iii) share of government</td>
<td>2.47</td>
<td>2.98</td>
<td>2.49</td>
<td>3.27</td>
<td>2.32</td>
<td>3.82</td>
<td>1.83</td>
<td>4.72</td>
</tr>
<tr>
<td>Share of domestic savings in GDP</td>
<td>25.50</td>
<td>25.43</td>
<td>27.40</td>
<td>27.35</td>
<td>28.60</td>
<td>28.74</td>
<td>28.9</td>
<td>29.93</td>
</tr>
</tbody>
</table>

a/ Investment figures include any statistical discrepancy.

b/ GDP at current market prices.
Table 3

Rates of Growth of Imports and of Exports of Goods and Nonfactor Services
(at constant prices)

<table>
<thead>
<tr>
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<tbody>
<tr>
<td></td>
<td>LA PI</td>
<td>LA PI</td>
<td>LA PI</td>
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<tr>
<td>Exports</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture</td>
<td>5.56 7.58</td>
<td>-1.67 1.16</td>
<td>-8.52 -2.49</td>
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<tr>
<td>Manufacturing</td>
<td>13.44 15.12</td>
<td>13.94 15.30</td>
<td>13.46 14.63</td>
</tr>
<tr>
<td>Imports</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture</td>
<td>2.80 3.20</td>
<td>5.16 5.47</td>
<td>5.87 6.07</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>5.99 7.04</td>
<td>5.92 7.07</td>
<td>6.50 7.64</td>
</tr>
<tr>
<td>Energy</td>
<td>3.95 4.35</td>
<td>3.92 4.07</td>
<td>5.63 5.52</td>
</tr>
<tr>
<td>Services</td>
<td>5.79 7.06</td>
<td>6.07 7.37</td>
<td>6.93 7.95</td>
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</table>
Table 4

Trade Balance and Current Account
(million bahts)

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LA</td>
<td>PI</td>
<td>LA</td>
<td>PI</td>
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<tr>
<td>Exports</td>
<td>146,296.0</td>
<td>149,686.7</td>
<td>252,772.9</td>
<td>269,920.8</td>
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<tr>
<td>Agriculture</td>
<td>45,666.1</td>
<td>46,619.8</td>
<td>71,773.9</td>
<td>83,983.1</td>
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<tr>
<td>Manufacturing</td>
<td>56,699.6</td>
<td>58,421.7</td>
<td>101,648.2</td>
<td>178,962.8</td>
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<tr>
<td>Services</td>
<td>43,930.3</td>
<td>44,645.2</td>
<td>79,350.8</td>
<td>139,452.6</td>
</tr>
<tr>
<td>Imports</td>
<td>201,108.3</td>
<td>205,025.8</td>
<td>297,547.5</td>
<td>428,558.0</td>
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<tr>
<td>Agriculture</td>
<td>2,464.8</td>
<td>2,100.8</td>
<td>3,616.2</td>
<td>5,100.6</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>131,211.9</td>
<td>133,782.2</td>
<td>192,664.0</td>
<td>275,188.6</td>
</tr>
<tr>
<td>Energy</td>
<td>54,401.8</td>
<td>54,951.4</td>
<td>82,238.6</td>
<td>120,975.6</td>
</tr>
<tr>
<td>Services</td>
<td>13,029.8</td>
<td>14,191.4</td>
<td>19,028.7</td>
<td>27,293.2</td>
</tr>
<tr>
<td>Trade Balance&lt;sup&gt;a/&lt;/sup&gt;</td>
<td>54,812.3</td>
<td>55,339.1</td>
<td>44,774.6</td>
<td>26,159.5</td>
</tr>
<tr>
<td>Trade Balance as a percentage of GDP&lt;sup&gt;a/&lt;/sup&gt;</td>
<td>8.4</td>
<td>8.1</td>
<td>4.6</td>
<td>1.8</td>
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<tr>
<td>Current Account</td>
<td>62,936.4</td>
<td>63,366.5</td>
<td>72,264.7</td>
<td>56,199.7</td>
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<tr>
<td>Current Account as a percentage of GDP</td>
<td>9.7</td>
<td>9.3</td>
<td>7.4</td>
<td>3.2</td>
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<tr>
<td>Terms of Trade&lt;sup&gt;b/&lt;/sup&gt;</td>
<td>78.9</td>
<td>79.5</td>
<td>79.60</td>
<td>80.4</td>
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</table>

<sup>a/</sup> Negative signs denote surplus.

<sup>b/</sup> 1975 = 100
## Table 5

**Public Finances**

<table>
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<tbody>
<tr>
<td><strong>Share of Government Revenue in GDP</strong>&lt;sup&gt;a/&lt;/sup&gt;</td>
<td>14.9</td>
<td>18.0</td>
<td>15.40</td>
<td>19.21</td>
<td>15.60</td>
<td>20.63</td>
<td>16.00</td>
<td>22.26</td>
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<tr>
<td>Indirect Taxes (domestic)</td>
<td>7.86</td>
<td>10.23</td>
<td>7.82</td>
<td>11.20</td>
<td>7.78</td>
<td>12.35</td>
<td>7.76</td>
<td>13.63</td>
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<tr>
<td>Duties on Imports</td>
<td>2.50</td>
<td>3.36</td>
<td>2.64</td>
<td>3.38</td>
<td>2.59</td>
<td>3.43</td>
<td>2.57</td>
<td>3.53</td>
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<tr>
<td>Taxes on Exports</td>
<td>.52</td>
<td>.42</td>
<td>.58</td>
<td>.38</td>
<td>.60</td>
<td>.33</td>
<td>.61</td>
<td>.28</td>
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<tr>
<td>Personal Taxes</td>
<td>1.38</td>
<td>1.36</td>
<td>1.45</td>
<td>1.38</td>
<td>1.48</td>
<td>1.41</td>
<td>1.52</td>
<td>1.43</td>
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<tr>
<td>Corporate Taxes</td>
<td>1.70</td>
<td>1.71</td>
<td>2.01</td>
<td>2.01</td>
<td>2.31</td>
<td>2.31</td>
<td>2.65</td>
<td>2.63</td>
</tr>
<tr>
<td>Government Income from Prop-</td>
<td>.80</td>
<td>.77</td>
<td>.75</td>
<td>.72</td>
<td>.71</td>
<td>.67</td>
<td>.68</td>
<td>.63</td>
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<tr>
<td>erty and Entrepreneurship</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transfers from Abroad</td>
<td>.14</td>
<td>.15</td>
<td>.15</td>
<td>.14</td>
<td>.15</td>
<td>.13</td>
<td>.15</td>
<td>.13</td>
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<tr>
<td><strong>Share of Government Expenditure in GDP</strong></td>
<td>12.43</td>
<td>15.00</td>
<td>12.91</td>
<td>15.93</td>
<td>13.28</td>
<td>16.80</td>
<td>14.17</td>
<td>17.53</td>
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<tr>
<td>Transfers to Households</td>
<td>.08</td>
<td>.09</td>
<td>.08</td>
<td>.09</td>
<td>.08</td>
<td>.09</td>
<td>.07</td>
<td>.08</td>
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<tr>
<td>Interest on Public Debt</td>
<td>1.23</td>
<td>1.50</td>
<td>1.30</td>
<td>1.62</td>
<td>1.37</td>
<td>1.81</td>
<td>1.59</td>
<td>2.11</td>
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<tr>
<td>Manufacturing</td>
<td>.97</td>
<td>1.18</td>
<td>1.02</td>
<td>1.23</td>
<td>1.04</td>
<td>1.25</td>
<td>1.10</td>
<td>1.20</td>
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<td>Energy</td>
<td>.30</td>
<td>.36</td>
<td>.32</td>
<td>.38</td>
<td>.32</td>
<td>.37</td>
<td>.36</td>
<td>.34</td>
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<tr>
<td>Services</td>
<td>9.84</td>
<td>11.86</td>
<td>10.18</td>
<td>12.60</td>
<td>10.46</td>
<td>13.27</td>
<td>11.03</td>
<td>13.79</td>
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<tr>
<td>Transfers Abroad</td>
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<td>.01</td>
<td>.01</td>
<td>.01</td>
<td>.01</td>
<td>.01</td>
<td>.01</td>
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<tr>
<td><strong>Share of Government Savings in GDP</strong></td>
<td>2.47</td>
<td>3.00</td>
<td>2.49</td>
<td>3.28</td>
<td>2.32</td>
<td>3.83</td>
<td>1.84</td>
<td>4.73</td>
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<tr>
<td><strong>Share of Public Investment in GDP</strong></td>
<td>8.00</td>
<td>8.00</td>
<td>8.00</td>
<td>8.00</td>
<td>8.00</td>
<td>8.00</td>
<td>8.00</td>
<td>8.00</td>
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<tr>
<td><strong>Share of Public Sector Savings Gap in GDP</strong></td>
<td>5.53</td>
<td>5.00</td>
<td>5.51</td>
<td>4.72</td>
<td>5.68</td>
<td>4.17</td>
<td>6.16</td>
<td>3.27</td>
</tr>
</tbody>
</table>

<sup>a/</sup> GDP is at current market prices.
Table 6

Selected Elasticities with Respect to Exogenous Variables and Parameters

<table>
<thead>
<tr>
<th>1984 PI/Simulation</th>
</tr>
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<tbody>
<tr>
<td>(1) CPI</td>
</tr>
<tr>
<td>( \frac{\pi^m}{\pi^e} )</td>
</tr>
<tr>
<td>.262</td>
</tr>
<tr>
<td>-.143</td>
</tr>
<tr>
<td>-.708</td>
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<tr>
<td>-0.059</td>
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<td>-0.071</td>
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<td>.041</td>
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<td>.075</td>
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<td>.003</td>
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<td>.058</td>
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<td>.161</td>
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<td>-0.139</td>
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<td>-0.408</td>
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<tr>
<td>-0.074</td>
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<tr>
<td>-.075</td>
</tr>
<tr>
<td>.045</td>
</tr>
<tr>
<td>.069</td>
</tr>
</tbody>
</table>
Table 6 (cont'd)

CPI : Consumers Price Index
TT : Terms of Trade
TB : Trade Balance
GDPCFC : Gross Domestic Product at Constant Factor Cost
TRH : Total Resources of Households
GREV : Government Revenue
NIT : Net Indirect Taxes
M1 : Imports of Agricultural Goods in Constant Prices
M2 : Imports of Manufactures in Constant Prices
M3 : Imports of Energy in Constant Prices
M4 : Imports of Services in Constant Prices
E1 : Exports of Agricultural Goods in Constant Prices
E2 : Exports of Manufactures in Constant Prices
E4 : Exports of Services in Constant Prices
H3 : Households' Savings
C3 : Corporate Savings
G3 : Government Savings
I : Gross Investment in Current Prices

\( \pi_m^m \) : World Price of Energy
\( \pi_e^m \) : World Price of Agricultural Goods
\( \bar{X}_1 \) : Gross Agricultural Production
\( a_{31} \) : Intermediate Delivery of Energy to Agriculture (I-O coefficient)
\( a_{32} \) : Intermediate Delivery of Energy to Manufacturing (I-O coefficient)
\( a_{33} \) : Intermediate Delivery of Energy to Energy (I-O coefficient)
\( a_{34} \) : Intermediate Delivery of Energy to Services (I-O coefficient)
\( \tau_m^1 \) : Tariff Rates on Imports of Agricultural Goods
\( \tau_m^2 \) : Tariff Rates on Imports of Manufactures
\( \tau_m^3 \) : Tariff Rates on Imports of Energy
Appendix 1: A Base Year SAM for the SIAM\textsuperscript{1} Model

1. The purpose of this note is to give a brief presentation of a small Social Accounting Matrix of the Thai economy for the year 1975.

2. The distinctive features of this particular SAM are:
   
   i) it is consistent with the national accounts figures of 1975;
   
   ii) it distinguishes four activities\textsuperscript{1/}(sectors of production):
   
   - agriculture,
   - manufacturing,
   - energy,
   - services;

   ii) it distinguishes three commodities for each activity:
   
   - composite goods and services traded on the domestic market,
   - imported goods,
   - exported goods.

3. The three main sources of data used to build the SAM are:

   i) the national accounts figures for 1975 as revised in the 1979 issue of the \textit{National Accounts of Thailand};

   ii) The input-output matrix for 1975 published by NESDB\textsuperscript{2/} which assumes competitive imports and is at purchasers' prices and;

   iii) the statistical bulletin (monthly) of the Bank of Thailand (BOT).

   In the following, the main assumptions used to get a balanced SAM consistent with the National Accounts are described.

---

\textsuperscript{1/} Agriculture includes: crops, livestock, forestry and fisheries. Manufacturing includes all manufacturing (mining and quarrying and construction included); it excludes petroleum products. Energy includes petroleum products and electricity and water supply. Services include wholesale and retail trade, transportation and communication, banking, insurance and real estate services, public administration and defense.

\textsuperscript{2/} NESDB: National Economic and Social Development Board.
4. There is only one factor of production which receives the value-added created by the four activities (row 1, columns 6, 7, 8 and 9). This is gross value-added at factor cost as it includes depreciation and excludes indirect taxes.

The figures for agriculture and services are those of the national accounts. The split between manufacturing and energy is based on the decomposition of GDP at factor cost given in the input-output table. (National accounts do not provide separate GDP at factor cost for manufacturing and services.)

5. Three types of institutions are considered: Households (including private non-profit institutions); Companies and; Government. Their current accounts are distinguished while their capital accounts are consolidated. The three current accounts and the consolidated capital account are given in rows and columns 2, 3, 4 and 5.

5.1. Row 2 gives the receipts of households from the different sources. The figures in all the cells of this row are consistent with the national accounts figures. The dividends, however, have been taken out of property income and put as transfer from companies to households (row 2, column 3).

5.2. Row 3 gives the receipts of companies. In cell (3,1) the operating surplus (including provision for the consumption of fixed capital) appears. It is derived residually. Cells (3,2) and (3,4) give respectively the interest on consumers' debt and the interest on the public debt.

5.3. In row 4, all receipts of government appear:

i) (4,1) is government income from property and entrepreneurship;

ii) cell (4,2) is the sum of direct taxes on households and other
current transfers from households;

iii) cell (4,3) is direct taxes on corporations and;

iv) cell (4,22) is net indirect taxes.

5.4. The consolidated capital account is in row 5. It receives:

i) the savings of Households and private non-profit institutions (cell (5,2));

ii) the savings of Corporations, including the provision for the consumption of fixed capital (cell (5,3));

iii) the savings of Government (cell (5,4)) and;

iv) "foreign savings" (cell (5,23)).

All figures in the row 5 are from the National Accounts.

6. Rows 10, 13, 16 and 19 give the aggregate demand respectively for:

- agricultural commodities
- manufacturing
- energy
- services.

6.1. Column 2 in rows 10, 13, 16 and 19 gives the split of private consumption expenditure between the four sectors considered. We have taken the average propensities to consume out of total private consumption expenditure given in the I-0 table and applied them to the figure of total private consumption expenditure given in the National Accounts. The first assumption is that purchasers' prices and market prices used in the National Accounts are the same. The second assumption is that on the interval considered, average and marginal propensities are equal.

6.2. Column 4 in rows 10, 13, 16 and 19 gives the split of government consumption expenditure between the different sectors. The assumptions made are the same as for private consumption expenditure, except where government
consumption of agricultural products has been put to zero. In fact, according
to the I-O table it appears to be negligible.

6.3. Column 5 in rows 10, 13, 16 and 19 gives the split of total gross
investment between sectors of origin. The same procedure was used as for
private and government consumption. It was, however, performed separately
for increases in stocks and for fixed capital formation. Quite obviously,
no fixed investment uses energy or services production and there is no accumu-
lation of stocks in services.

6.4 The last elements in final demand are exports. It is reasonably
assumed that there are no exports of energy. Thus, exports consists of
agricultural, manufacturing, and service exports. Total exports of goods and
services (nonfactor) are given in the National Accounts as 57,014 million bahts. From
Thailand: Towards a Development Strategy of Full Participation (1980),
it is possible to compute the value of agricultural exports (Tables 3.2 and 3.3
of the Appendix) which amount to 31,359 million bahts. Manufacturing exports
are also obtained from the same source and their value is 14,139 million bahts.
Exports of nonfactor services are computed as the difference between total exports
of goods and services, and agricultural and manufacturing exports. Their value
is 11,516 million bahts.

6.5 These three figures of exports appear in cells (11,23), (14,23) and
(20,23). They include export taxes paid by the Rest of the World to exports
which repay them to the account of indirect taxes.

6.6 The export taxes on agricultural and manufacturing exports are assumed
to be respectively 1,634 million bahts and 471 million bahts (cells (22,11) and
(22,14)). (See para. 7)

1/ In fact, in 1975, 230 million bahts of petroleum products have been exported,
this figure being 98 million bahts in 1976 and negligible afterwards. (See
BCT Statistical Bulletin, Dec. 1979, p. 54) Here, for 1975 we have considered
the 230 million bahts to be exports of manufactures.

2/ These exports include export taxes.
6.7 The value of exports coming out of the agricultural sector is thus 31,359 - 1,634 = 29,725 million bahts and this figure enters cell (6,11). Likewise, the value of manufacturing exports to the manufacturing sector is 25,655 - 471 = 25,184 million bahts and this figure enters cell (7,14). It is assumed that no export taxes are levied on exports of services. Hence, the figure in cell (9,20) is identical with that in cell (20,23).

7. To get the aggregate demand for the composite good in the four sectors one must add intermediate demand to the nonexport final demand determined above in paras. 6.1, 6.2 and 6.3. This implies the use of the interindustrial flows. This was done in several steps which are described below. However, for this, information on indirect taxes and on imports is needed. Here indirect taxes are considered.

7. Net indirect taxes as given in the National Accounts are 31,119 million bahts. For FY'75 import duties are 8,270 and export taxes are 2,105 million bahts (source: Thailand: Towards a Development Strategy of Full Participation (1980), Table 5.6 of Appendix). Using these three figures indirect taxes on domestic trade would be 20,744 million bahts. Now there is the problem of splitting domestic and international trade indirect taxes on the different items.

7. For FY'75 import duties are split according to Table 7.1. To bring consistency with the SAM classification, it is assumed that duties on foodstuffs and on agricultural imports are the same. Likewise, petroleum products are assumed to cover energy imports. The remaining duties are assumed to fall on imports of manufacturing products.
Table 7.1

<table>
<thead>
<tr>
<th>Import Duties</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum products</td>
<td>374</td>
</tr>
<tr>
<td>Foodstuffs</td>
<td>394</td>
</tr>
<tr>
<td>Machinery</td>
<td>3,488</td>
</tr>
<tr>
<td>Textiles</td>
<td>443</td>
</tr>
<tr>
<td>Other</td>
<td>3,571</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8,270</strong></td>
</tr>
</tbody>
</table>

In millions of bahts.


In the SAM import duties on agricultural imports (394) appear in cell (22,12), those on manufacturing imports (7,502) in cell (22,15) and finally import duties on energy imports (374) are put in cell (22,18).

Figures for export taxes for the fiscal year 1975 are given in Table 7.2.

Table 7.2

<table>
<thead>
<tr>
<th>Export Taxes</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice premium</td>
<td>795</td>
</tr>
<tr>
<td>Rice duty</td>
<td>514</td>
</tr>
<tr>
<td>Rubber</td>
<td>325</td>
</tr>
<tr>
<td>Other</td>
<td>471</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,105</strong></td>
</tr>
</tbody>
</table>

In millions of bahts


For consistency with the SAM classification, the rice premium and the rice duty as well as taxes on rubber are considered as taxes on agricultural exports.
With this approximation, indirect taxes paid on the agricultural composite good are 852 (cell (22,10)); on the composite manufacturing good, 12,072 (cell (22,13)); on energy, indirect taxes are given in cell (22,16) with a value of 312; and finally, on services, indirect taxes are given in cell (22,19) with a value of 7,508 (all figures being in millions of bahts).

8. If "unallocated" imports given by the I-O table are dropped, total imports from this source (98,554 million bahts) are still higher than the figure given in the National accounts which is 70,795 million bahts. 1/

Furthermore, according to the I-O table, no imports of nonfactor services are supposed to take place. A first disaggregation of imports (Table 8.1) is obtained by applying the shares implicit in the I-O table to total imports given in the National Accounts.

<table>
<thead>
<tr>
<th>Table 8.1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Imports excluding tariffs</strong></td>
</tr>
<tr>
<td>Agriculture</td>
</tr>
<tr>
<td>Manufacturing</td>
</tr>
<tr>
<td>Energy</td>
</tr>
<tr>
<td>Services</td>
</tr>
</tbody>
</table>

In millions of bahts.

1/ Does not include import duties.
8.1 The figures for agriculture and energy in Table 8.1 are close to corresponding figures given by the BOT (Statistical Bulletin, Dec. 1979, pgs. 46-49). Therefore it is assumed that imports of "manufacturing" or the figure 55,623 includes imports of services. Using the balance of total services: 6,160.8 (BOT, Statistical Bulletin, Dec. 1979, p. 76) and the balance of net factor services: -219, the figure for the balance of nonfactor services is obtained: 5,941.8. Given that exports of services are 11,516 (para. 6.3) imports of services are derived 5,574.2 and from this figure and the previous figure of "imports of manufactures" in Table 8.1, a final figure for imports of manufactures is obtained: 50,048.8 (Table 8.2).

Table 8.2

<table>
<thead>
<tr>
<th>Imports excluding Tariffs</th>
<th>Final Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>1,101</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>50,049</td>
</tr>
<tr>
<td>Energy</td>
<td>14,071</td>
</tr>
<tr>
<td>Services</td>
<td>5,574</td>
</tr>
</tbody>
</table>

In millions of bahts.

The figures of Table 8.2 are in cells (23,12), (23,15), (23,18) and (23,21) of the SAM.

8.2 Consider now imports as an addition to supply. Their value in that respect has to include import duties. So by adding import duties to the value of imports before duties, the value of the supply of imported goods is obtained.
In cell (12,10) the value of imported agricultural goods including duties is given. For manufacturing imports the figure is given in cell (15,13), for energy imports it is put in cell (18,16) and for services it is in cell (21,19).

9. Now we return to the derivation of interindustrial flows, aggregate demand, intermediate demand and gross production. The approach followed is to get, in a first step, good estimates of total intermediate sectoral demands and total intermediate sectoral costs. A second step is to use these marginals and estimate a new matrix of interindustrial flows consistent with them by applying the RAS method. In fact the procedure involves more than two stages because of the need to adjust some figures and ratios to information from different sources.

9.1 The first step was the aggregation of the (33 x 33) interindustrial matrix into a (4 x 4) matrix. In fact only the (32 x 32) first sectors were aggregated and the last sector: "Unallocated" was dropped. The matrix obtained in this way and the implied intermediate demand are given in Table 9.1.

<table>
<thead>
<tr>
<th></th>
<th>Agriculture</th>
<th>Manufacturing</th>
<th>Energy</th>
<th>Services</th>
<th>Intermediate Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>17,762</td>
<td>52,595</td>
<td>-0-</td>
<td>5,790</td>
<td>76,147</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>28,782</td>
<td>77,176</td>
<td>762</td>
<td>17,341</td>
<td>124,061</td>
</tr>
<tr>
<td>Energy</td>
<td>6,306</td>
<td>6,417</td>
<td>17,890</td>
<td>7,594</td>
<td>38,207</td>
</tr>
<tr>
<td>Services</td>
<td>15,544</td>
<td>9,456</td>
<td>1,202</td>
<td>17,131</td>
<td>43,333</td>
</tr>
</tbody>
</table>

All figures are in millions of bahts.


2/ NESDB, Input-Ouput Table, Competitive Imports 1975.
Table 9.1 gives a first estimate of total intermediate demand. However, the fourth column includes the intermediate demand of the wholesale and retail trade sector, whereas the fourth row does not include any delivery of that sector to other sectors. In fact, total deliveries of wholesale and retail trade are lumped together in the published input-output table. Thai value is 71,908 million bahts. This figure should be added to the intermediate demand of services. The figure in the last row and last column of Table 9.1, which is total intermediate demand of services becomes: $115,241 (43,333 + 71,908)$.

9.2 Using the above estimate of total intermediate demand and total non-export final demand, total aggregate demand for the composite goods are calculated. The aggregate demands have to be equal to aggregate supplies, hence, given imports and taxes, one can compute the domestic supply of domestic goods. With the figures of exports, this allows for computation of the gross production of each sector. Having determined previously the vector of value added(s), it is then easy to compute the vector of total intermediate costs (Table 9.2).

<table>
<thead>
<tr>
<th>Total Intermediate Costs</th>
<th>First estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>90,934</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>157,430</td>
</tr>
<tr>
<td>Energy</td>
<td>26,681</td>
</tr>
<tr>
<td>Services</td>
<td>78,611</td>
</tr>
</tbody>
</table>

In millions of bahts.
9.3 The intermediate costs of Table 9.2 are consistent with the other figures of the SAM, however, they are not equal to the intermediate costs obtained by adding up the different columns of Table 9.1. An obvious, next step would be to take the figures of Table 9.2, the intermediate demand from Table 9.1 (with 115,241 for services) and to apply the RAS method on the interindustrial flows of Table 9.1. This would give a complete, balanced SAM.

This, however, would give a distorted view of some basic ratios in the Tai economy essentially in two respects.

(1) The figure used for agricultural exports before taxes (cell (6,11)) corresponds to the trade classification used by the Bank of Thailand. However, the classification underlying the input-output table is the industrial classification. For the latter classification any processing of an agricultural product is an activity of the manufacturing sector. Hence, when an exportable agriculture good is even slightly processed and then exported, it becomes, according to the industrial classification, manufactured export. Thus, the figure in row 1, column 2 of Table 9.1: 52,595 contains deliveries of essentially agricultural goods, which are slightly processed by the manufacturing sector and then exported. But, in fact, these goods are already included in the figure in cell (6.11) of the SAM, which gives agricultural exports. Consequently, the intermediate demand of agricultural goods as given in Table 9.1 is an overestimation of actual domestic intermediate demand.

(2) Imports of energy, as given in cell (18,16) of the SAM are equal to 14,445 million bahts. The figure given by the Bank of Thailand (Statistical Bulletin, Dec. 1979, p. 49, "Fuel and Lubricants") for imports of fuel and lubricants is 14,233 million bahts. However, imports of energy as given in the input-
output table are 19,588 million bahts. Given the aggregate demand for energy (obtained by adding total final demand for energy, to total (intermediate demand)), the equality between aggregate demand and aggregate supply and the chosen figure of imports: 14,445, this would lead to an overestimation of domestic demand for domestic energy. Subsequently we would overestimate domestic production of energy.

In order to take account of the above distortions a reestimation of the vectors of total intermediate demand and of total intermediate costs was undertaken. The flows of intermediate demand of manufacturing from agriculture and of energy from energy have also been revised. With the two new marginal vectors, the RAS method was applied on the modified interindustrial matrix in order to get a final matrix of interindustrial flows. In that way the whole SAM is balanced.

The new vectors of intermediate demand and of intermediate costs are given in Table 9.3. The basic assumptions underlying them are:

i) Agricultural exports are 20% of gross agricultural production; this implies a gross production of 148,625 million bahts and a domestic demand for domestic goods of 118,900. Consequently aggregate supply and aggregate demand are 121,247 million bahts and total intermediate demand of agricultural goods if then 40,210 million bahts.

ii) The first row of Table 9.1 is modified to take account of the new figure for total intermediate demand. Intermediate demands of agricultural goods are assumed to be 17,191; 17,473; 5,546 for agriculture, manufacturing and energy, and service, respectively.

iii) Taking account of the difference between the figure of imports of energy given in the input-output table (19,588) and the figure chosen in
the SAM (14,445)\textsuperscript{1/}, gross production of energy is estimated to be 27,895 million bahts.

Table 9.4 gives the matrix of interindustrial flows obtained after application of the RAS method. This matrix is consistent with the rest of the SAM, which is thus balanced.

<table>
<thead>
<tr>
<th>Table 9.3</th>
<th>Total Intermediate Demand</th>
<th>Total Intermediate Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>40,210</td>
<td>54,997</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>94,296</td>
<td>127,665</td>
</tr>
<tr>
<td>Energy</td>
<td>32,835</td>
<td>21,309</td>
</tr>
<tr>
<td>Services</td>
<td>109,300</td>
<td>72,670</td>
</tr>
</tbody>
</table>

Figures are expressed in millions of bahts.

<table>
<thead>
<tr>
<th>Table 9.4</th>
<th>Agriculture</th>
<th>Manufacturing</th>
<th>Energy</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>11,875</td>
<td>22,105</td>
<td>-0-</td>
<td>6,230</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>13,149</td>
<td>67,751</td>
<td>648</td>
<td>12,749</td>
</tr>
<tr>
<td>Energy</td>
<td>3,227</td>
<td>6,541</td>
<td>16,812</td>
<td>6,255</td>
</tr>
<tr>
<td>Services</td>
<td>26,746</td>
<td>31,268</td>
<td>3,849</td>
<td>47,436</td>
</tr>
</tbody>
</table>

Figures are expressed in millions of bahts.

\textsuperscript{1/} The 230 million bahts of exports of petroleum products are also taken into account. See footnote 1, p. 4.
Appendix 2: Data Base of the Reference Simulation

In order to define a reference simulation on the period 1980-1990, one has to make assumptions on four sets of variables and parameters. These are: (1) the structural parameters; (2) the policy parameters; (3) the rest of the world variables; and (4) the domestic variables.

The Structural Parameters

They are mainly behavioral and technical parameters and could be classified into three groups:

(1) The parameters of the allocation relations 7, 8 and 9

To get an idea about their order of magnitude, the relations are estimated on time series from national account data. Then keeping the \( \bar{\beta} \)'s, the \( \bar{\gamma}^i, i=1, \ldots, 5 \), the \( \bar{c}_i, i=1, 2, 3 \) and the \( \bar{h}^i, i=1, \ldots, 8 \) to their estimated values, the \( \bar{h}^0, i=1, \ldots, 8 \), the \( \bar{c}_i, i=1, 2, 3 \) and the \( \bar{\rho}^0, i=1, \ldots, 5 \) are adjusted (using the appropriate entries in the SAM of 1975) in order to reproduce the data of that year (see Table A2.1).

(2) The input-output coefficients \( \alpha_{ij}, i,j=1, 2, 3, 4 \) in relations 1 and 11 to 14 are obtained from the SAM of 1975 using their definition. The parameters allocating gross investment demand over sectors are also obtained from the SAM. They are \( \bar{\delta}_1, \bar{\delta}_2, \) and \( \bar{\delta}_3 \) of the aggregate demand relations 11 to 14.

(3) The parameters of the import demand functions (relations 15 and 16) and of the related price functions (relation 4) are the elasticities of substitution \( \sigma_1, \sigma_2, \sigma_3, \sigma_4 \) the share parameters \( \delta_1, \delta_2, \delta_3, \delta_4 \) and the scale parameters \( \gamma_1, \gamma_2, \gamma_3, \gamma_4 \). The elasticities of substitution for the base scenario were assumed to be .8, 2.0, .15, 2.0 for agriculture, manufacturing,
energy and services respectively. Using 1975 as the base year for prices, and the imports ratios implicit in the SAM, the elasticities of substitution determine the share and scale parameters.

However, the share parameter for energy is independently changed in 1982 and onward to take account of the coming on stream of domestic gas production.

The parameters of the export-demand relations are the elasticities \( \eta_i \) and the scale parameters \( EB_i \). Using relative price movements on the period 1975-1979 an estimate for \( \eta_2 \) is obtained, 2.57. \( EB_2 \) is determined subsequently using the SAM figure for exports and the ratio of the ratio of the world price and the Thai price of exports of manufactures, as observed in 1975. The same procedure is followed to estimate \( EB_4 \), but with \( \eta_4 = 2.0 \).

The Policy Parameters

The second set of assumptions is on the policy parameters. These are, on the one side, the indirect tax rates on domestically and internationally traded goods and, on the other side, they are the parameters allocating government revenue.

(1) Implicit in the SAM of 1975 are all indirect tax rates for that year. These base year values are either maintained or lowered to take account of recent trends (see Table A2.2).

(2) A first value of the parameters allocating government revenue (relation 10) is obtained by estimating the set of relations using a time series (1970-1979) and nonlinear least squares. The result is a rapidly declining share of government savings, of transfers to households and of transfers abroad. For the base scenario the same trend in the shares is maintained but at a much slower rate and the drop is dampened (see Table A2.3). The adopted assumption
here leads to a somewhat optimistic view on the savings gap and hence on the current account deficit.

The Rest of the World Variables

Linkages between the domestic economy and the rest of the world are caught through export and import prices, parameters reflecting the performance of Thai exports of manufactures and services and net factor income and other transfers.

(1) The import price of agricultural products ($p_{1m}$) is obtained in the following way. For 1980-1982, 1985 and 1990 it is assumed to follow the same trend as a Laspeyres index of projected prices of cereals, fruits and vegetables and coffee, cocoa and tea.\(^1\) Between 1982 and 1985 a linear trend with 10.1% growth is used to complete the series. In summary, the import price of agricultural products is assumed to grow at a rate between 10% and 11% after 1982 (see Table 2.4).

(2) The import prices of manufactures and services ($p_{2m}$, $p_{4m}$) are assumed to increase at the same rate as the projected trend in the International Price Index (IPI). This is a decreasing rate\(^2\) from 10.5% between 1979-1980, to 5.7% between 1989-1990 (see Table A2.4).

(3) The import price of energy ($p_{3m}$) is obtained by following the projected trend in oil prices. These are assumed to be $28\, $ a barrel in 1980, $47.3\, $ in 1985, and $73.6\, $ in 1990, or an increase of 63% in the decade\(^3\) (see Table A2.4).

---


2/ See Projections of IBRD, Table 16.

(4) The export price of agricultural products ($\pi^e_1$) is assumed to follow the same trend as a Laspeyres index of projected prices of rice, rubber, maize, jute and other agricultural products\(^1\) (see Table 2.5).

(5) The world prices of exports of manufactures and services ($\pi^e_2$, $\pi^e_4$) are assumed to increase at the same rate as the projected IPI\(^2\) (see Table A2.5).

(6) In relation 18 the world demand for Thai exports of manufactures and services are dependent only on relative prices. However, one may think that they also depend on the overall world activity and on the success of Thai exporters over and above price changes. In order to catch these two aspects, the parameters $EB_i$ are assumed to grow at an exponential rate:

$$EB_{it} = EB_{i(to)}(1 + r_i)^{t-to}, \ i=2,4$$

The growth rates in the base scenario are assumed to be 13%.

(7) Net factor income outflow is obtained via a debt model. It is based on assumptions on (a) investment income receipts; (b) interest payments on medium- and long-term debt; and (c) interest payments on short-term debt and profit.

(8) Inflow of private transfers are assumed to remain at a nominal value of 300 million bahts.

(9) Finally, public transfer nominal inflows are assumed to grow at 13% annually.\(^3\)

\(^1\) See Report No. 814/80, p. 19, Table 10; p. 14, Table 6.

\(^2\) See Projections of IBRD, Table 16.

\(^3\) This seems to be the relevant rate for aid increases from donor countries.
The Domestic Variables

The last set of assumptions is on some domestic trends within the Thai economy. The relevant variables here are gross investment demand in constant prices, $I_t$, gross agricultural production in constant prices, $X_{1t}$, and the net prices of manufacturing, energy and services $V_{2t}$, $V_{3t}$, $V_{4t}$ respectively.

1. **Gross investment demand in constant prices** $I_t$ is assumed to grow exponentially at an annual rate of 5%.

2. **Gross agricultural production in constant prices** $X_{1t}$ is also assumed to grow exponentially but at the lower rate, 4.5%.

3. **Net prices** are defined as the ratio of sectoral GDP at current factor cost over gross production in constant prices. If $L_j$ is employment, $K_j$ is capital, $W_j$ is nominal average wage, and $r_j$ is the nominal users cost of capital, then:

$$
\bar{V}_j = \frac{V_j X_{jd}}{X_{jd}} = \frac{W_j L_j + r_j K_j}{X_{jd}} = W_j \left( \frac{L_j}{X_{jd}} \right) + r_j \left( \frac{K_j}{X_{jd}} \right), \quad j=2, 3, 3
$$

This means that net prices are determined by the mix of labor-output, the capital-output, wage, and the cost of capital. A refined assumption on the trends of the $\bar{V}_j$, $j=2, 3, 4$ would require some predictions on all of the mentioned variables. In the base scenario a crude but reasonable assumption is adopted:

(a) $\bar{V}_2$ and $\bar{V}_4$ or net prices of manufacturing and services are assumed to have a 0% real growth and a nominal growth parallel to the GDP deflator for OECD North countries (see Table A2.6).

(b) $\bar{V}_3$, net price of energy is assumed to have a 3% real growth and the same nominal growth as the GDP deflator for OECD North countries. The assumption of a 3% real growth is there to catch the growing production of gas (Table A2.6).
Table A2.1.1

Parameters of the Allocation Relations

Households: \( h_i = \left( h_i^0 + h_i^1 e^{-\beta_h/POP_t} \right) TRH \)

\( \beta_h = 2769.10 \)

<table>
<thead>
<tr>
<th></th>
<th>( h_i^0 )</th>
<th>( h_i^1 )</th>
<th>( h_i^0 + h_i^1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest on consumers' debt</td>
<td>0.004</td>
<td>0.013</td>
<td>0.017</td>
</tr>
<tr>
<td>Taxes</td>
<td>0.012</td>
<td>0.012</td>
<td>0.024</td>
</tr>
<tr>
<td>Savings</td>
<td>0.150</td>
<td>0.02</td>
<td>0.17</td>
</tr>
<tr>
<td>Consumption</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Agriculture</td>
<td>0.833</td>
<td>-0.044</td>
<td>0.789</td>
</tr>
<tr>
<td>b) Manufacturing</td>
<td>0.324</td>
<td>-0.109</td>
<td>0.215</td>
</tr>
<tr>
<td>c) Energy</td>
<td>0.266</td>
<td>0.086</td>
<td>0.352</td>
</tr>
<tr>
<td>d) Services</td>
<td>0.032</td>
<td>-0.019</td>
<td>0.013</td>
</tr>
<tr>
<td>Transfers Abroad</td>
<td>0.211</td>
<td>-0.002</td>
<td>0.209</td>
</tr>
</tbody>
</table>
### Table A2.1.2

Parameters of the Allocation Relations

Companies: $C_i = \frac{-\beta_c}{TIC} \left( \frac{-1}{c_i} + \frac{1}{c_i e^T} \right) TIC$

<table>
<thead>
<tr>
<th></th>
<th>$-\frac{c}{c_i}$</th>
<th>$-\frac{1}{c_i}$</th>
<th>$-\frac{0}{c_i} + \frac{1}{c_i}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dividends</td>
<td>.042</td>
<td>.013</td>
<td>.055</td>
</tr>
<tr>
<td>Corporate taxes</td>
<td>.068</td>
<td>.118</td>
<td>.186</td>
</tr>
<tr>
<td>Corporate savings</td>
<td>.890</td>
<td>-.131</td>
<td>.759</td>
</tr>
</tbody>
</table>

$\beta_c = 28240$

### Table A2.1.3

Parameters of the Allocation Relations

Factors: $R_i = \frac{-\beta_{e}}{Z} \left( \frac{-1}{\rho_i} + \frac{1}{\rho_i e^T} \right) Z$

$\beta_{e} = 1294410$

<table>
<thead>
<tr>
<th></th>
<th>$-\frac{0}{\rho_i}$</th>
<th>$-\frac{1}{\rho_i}$</th>
<th>$-\frac{0}{\rho_i} + \frac{1}{\rho_i}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compensation of employees</td>
<td>.265</td>
<td>.133</td>
<td>.398</td>
</tr>
<tr>
<td>Income from unincorporated enterprise</td>
<td>.532</td>
<td>-.200</td>
<td>.332</td>
</tr>
<tr>
<td>Income from property</td>
<td>.097</td>
<td>-.033</td>
<td>.064</td>
</tr>
<tr>
<td>Operating surplus of companies</td>
<td>.096</td>
<td>.103</td>
<td>.199</td>
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<tr>
<td>Government income from property and entrepreneurship</td>
<td>.010</td>
<td>-.003</td>
<td>.007</td>
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Table A2.2

% Rates of Indirect Taxes

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<th>Year</th>
<th>$\tau_{m1}$</th>
<th>$\tau_{m2}$</th>
<th>$\tau_{m3}$</th>
<th>$\tau_{m4}$</th>
<th>$\tau_{e1}$</th>
<th>$\tau_{e2}$</th>
<th>$\tau_{e4}$</th>
<th>$\tau_1$</th>
<th>$\tau_2$</th>
<th>$\tau_3$</th>
<th>$\tau_4$</th>
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<tbody>
<tr>
<td>1980</td>
<td>1.0</td>
<td>1.2</td>
<td>.03</td>
<td>0.0</td>
<td>3.5</td>
<td>3.4</td>
<td>0.0</td>
<td>.7</td>
<td>1.0</td>
<td>0.0</td>
<td>4.3</td>
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<tr>
<td>1981</td>
<td></td>
<td>.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1982</td>
<td></td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.0</td>
<td></td>
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<tr>
<td>1983</td>
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<td></td>
<td></td>
<td></td>
<td>1.0</td>
<td></td>
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<tr>
<td>1984</td>
<td></td>
<td>2.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1985 - 1990</td>
<td></td>
<td>2.7</td>
<td></td>
<td></td>
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</table>
Table A2.3

Parameters of the Allocation Relations

Government:  \( g_i = \left( \frac{-0}{g_i} + \frac{-1}{g_i} e^\gamma \right) G \)

\( \beta_g = 750,000 \)

<table>
<thead>
<tr>
<th></th>
<th>(-0) (g_i)</th>
<th>(-1) (g_i)</th>
<th>(-0 + -1) (g_i)</th>
</tr>
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<tbody>
<tr>
<td>Transfers to Households</td>
<td>.005</td>
<td>-.005</td>
<td>.000</td>
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<tr>
<td>Interest on Public Debt</td>
<td>.083</td>
<td>.155</td>
<td>.238</td>
</tr>
<tr>
<td>Government Savings</td>
<td>.166</td>
<td>-.500</td>
<td>.334</td>
</tr>
<tr>
<td>Consumption: Manufacturing</td>
<td>.065</td>
<td>.030</td>
<td>.095</td>
</tr>
<tr>
<td></td>
<td>.020</td>
<td>.020</td>
<td>.040</td>
</tr>
<tr>
<td>Services</td>
<td>.660</td>
<td>.301</td>
<td>.961</td>
</tr>
<tr>
<td>Transfers Abroad</td>
<td>.001</td>
<td>-.001</td>
<td>.000</td>
</tr>
</tbody>
</table>
Table A2.4

Import Prices $^a/$: 1975 = 1

<table>
<thead>
<tr>
<th>Year</th>
<th>$^m \pi_1$ Agriculture</th>
<th>$^m \pi_2$, $^m \pi_4$ Manufacturing, Services</th>
<th>$^m \pi_3$ Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>1.377</td>
<td>1.281</td>
<td>2.935</td>
</tr>
<tr>
<td>1981</td>
<td>1.417 (2.90)</td>
<td>1.690 (9.00)</td>
<td>3.275 (14.25)</td>
</tr>
<tr>
<td>1982</td>
<td>1.654 (16.72)</td>
<td>1.825 (8.00)</td>
<td>3.597 (11.58)</td>
</tr>
<tr>
<td>1983</td>
<td>1.779 (7.55)</td>
<td>1.953 (7.00)</td>
<td>3.950 (9.83)</td>
</tr>
<tr>
<td>1984</td>
<td>1.913 (7.55)</td>
<td>2.084 (6.75)</td>
<td>4.338 (9.83)</td>
</tr>
<tr>
<td>1985</td>
<td>2.057 (7.55)</td>
<td>2.220 (6.50)</td>
<td>4.740 (9.83)</td>
</tr>
<tr>
<td>1986</td>
<td>2.185 (6.72)</td>
<td>2.360 (6.30)</td>
<td>5.178 (9.23)</td>
</tr>
<tr>
<td>1987</td>
<td>2.321 (6.22)</td>
<td>2.505 (6.15)</td>
<td>5.656 (9.23)</td>
</tr>
<tr>
<td>1988</td>
<td>2.463 (6.22)</td>
<td>2.655 (6.00)</td>
<td>6.180 (9.23)</td>
</tr>
<tr>
<td>1989</td>
<td>2.615 (6.22)</td>
<td>2.810 (5.85)</td>
<td>6.752 (9.23)</td>
</tr>
<tr>
<td>1990</td>
<td>2.777 (6.22)</td>
<td>2.971 (5.70)</td>
<td>7.376 (9.23)</td>
</tr>
<tr>
<td>avg. growth rate</td>
<td>7.27</td>
<td>6.72</td>
<td>9.65</td>
</tr>
</tbody>
</table>

$^a/$ Figures between brackets are rates of growth.
Table A2.5

Export Prices: 1975 = 1

<table>
<thead>
<tr>
<th>Year</th>
<th>( \pi_1 ) Agriculture</th>
<th>( \pi_2 ), ( \pi_4 ) Manufacturing &amp; Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>1.208</td>
<td>1.550</td>
</tr>
<tr>
<td>1981</td>
<td>1.277 (5.71)</td>
<td>1.690 (9.00)</td>
</tr>
<tr>
<td>1982</td>
<td>1.465 (14.72)</td>
<td>1.825 (8.00)</td>
</tr>
<tr>
<td>1983</td>
<td>1.581 (7.90)</td>
<td>1.953 (7.00)</td>
</tr>
<tr>
<td>1984</td>
<td>1.706 (7.90)</td>
<td>2.084 (6.75)</td>
</tr>
<tr>
<td>1985</td>
<td>1.841 (7.90)</td>
<td>2.220 (6.50)</td>
</tr>
<tr>
<td>1986</td>
<td>1.965 (6.78)</td>
<td>2.350 (6.30)</td>
</tr>
<tr>
<td>1987</td>
<td>2.097 (6.78)</td>
<td>2.505 (6.15)</td>
</tr>
<tr>
<td>1988</td>
<td>2.239 (6.78)</td>
<td>2.655 (6.00)</td>
</tr>
<tr>
<td>1989</td>
<td>2.391 (6.78)</td>
<td>2.810 (5.85)</td>
</tr>
<tr>
<td>1990</td>
<td>2.552 (5.73)</td>
<td>2.970 (5.70)</td>
</tr>
</tbody>
</table>

avg. growth rate | 7.77 | 6.72 |

\( a/ \) Figures between brackets are rates of growth.

\( b/ \pi_2 \) and \( \pi_4 \) are world prices, not supply prices, of Thai exports.
### Table A2.6

<table>
<thead>
<tr>
<th>Year</th>
<th>$V_2$ Manufacturing</th>
<th>$V_3$ Energy</th>
<th>$V_4$ Services</th>
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</thead>
<tbody>
<tr>
<td>1980</td>
<td>1.417</td>
<td>1.627</td>
<td>1.417</td>
</tr>
<tr>
<td>1981</td>
<td>1.513 (6.77)</td>
<td>1.785 (9.71)</td>
<td>1.513 (6.77)</td>
</tr>
<tr>
<td>1982</td>
<td>1.603 (5.95)</td>
<td>1.946 (9.02)</td>
<td>1.603 (5.95)</td>
</tr>
<tr>
<td>1983</td>
<td>1.687 (5.25)</td>
<td>2.106 (8.22)</td>
<td>1.687 (5.25)</td>
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<tr>
<td>1984</td>
<td>1.773 (5.10)</td>
<td>2.276 (8.07)</td>
<td>1.773 (5.10)</td>
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<tr>
<td>1985</td>
<td>1.859 (4.85)</td>
<td>2.456 (7.90)</td>
<td>1.859 (4.85)</td>
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<tr>
<td>1986</td>
<td>1.947 (4.73)</td>
<td>2.645 (7.70)</td>
<td>1.947 (4.73)</td>
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<td>1987</td>
<td>2.037 (4.62)</td>
<td>2.847 (7.64)</td>
<td>2.037 (4.62)</td>
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<td>1988</td>
<td>2.129 (4.52)</td>
<td>3.060 (7.48)</td>
<td>2.129 (4.52)</td>
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<td>1989</td>
<td>2.222 (4.37)</td>
<td>3.286 (7.39)</td>
<td>2.222 (4.37)</td>
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<tr>
<td>1990</td>
<td>2.317 (4.28)</td>
<td>3.525 (7.27)</td>
<td>2.317 (4.28)</td>
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Figures between brackets are rates of growth (%).
<table>
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<tr>
<th>No.</th>
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<td>D. Emmerson (consultant)</td>
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<td>Britain's Pattern of Specialization in Manufactured Goods with Developing Countries and Trade Protection</td>
<td>V. Cable, I. Rebelo</td>
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<td>426</td>
<td>Worker Adjustment to Liberalized Trade: Costs and Assistance Policies</td>
<td>G. Glenday, G. Jenkins, J. Evans</td>
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<td>H. Glismann, F. Weiss</td>
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<td>E. Verrydt, J. Waelbroeck</td>
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<td>Agrarian Reforms in Developing Rural Economies Characterized by Interlinked Credit and Tenancy Markets</td>
<td>A. Braverman, T.N. Srinivasan (consultant)</td>
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<td>G. Fields (consultant)</td>
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<td>A. Carroll</td>
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<td>436</td>
<td>Exchange Rate Adjustments under Generalized Currency Floating: Comparative Analysis among Developing Countries</td>
<td>R.M. Bautista</td>
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<td>The Newly-Industrializing Developing Countries after the Oil Crisis</td>
<td>B. Balassa</td>
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<td>The Process of Industrial Development and Alternative Development Strategies</td>
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<td>Monitoring Rural Development in East Asia</td>
<td>G. Deboeck, R. Ng</td>
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<td>Higher Education in Developing Countries: A Cost-Benefit Analysis</td>
<td>G. Psacharopoulos (consultant)</td>
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<td>441</td>
<td>Policy Interventions for Technological Innovation in Developing Countries</td>
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<td>442</td>
<td>An Economic and Political Analysis of Alternative Trade Adjustment Policies in Three Archetype Developing Economies</td>
<td>J. de Melo, S. Robinson</td>
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<td>A General Equilibrium Analysis of Foreign Exchange Shortages in a Developing Economy</td>
<td>K. Dervis, J. de Melo, S. Robinson</td>
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<td>G. Feder, R. Just, D. Silberman (consultants)</td>
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<td>L. Westphal</td>
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<td>446</td>
<td>The Political Economy of Specialised Farm Credit Institutions</td>
<td>J. Von Pischke, P. Heffernan, D. Adams (consultants)</td>
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Grais, Wafik.
Aggregate demand and macroeconomic imbalances in Thailand: simulations with