

# A SIMULATION MODEL FOR PERFORMANCE EVALUATION OF DEVELOPING ECONOMIES

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## I. INTRODUCTION

**T**HE OBJECTIVES OF this paper are: (a) to demonstrate that simple economic models for developing economies can be fruitfully used to deduce important and significant policy conclusions, and they need not be rejected simply because they are models or because they are simple; (b) to suggest that projections, whenever they are made, should be preceded by an evaluation exercise as demonstrated in the paper; and (c) to show that the division of the economy into the conventional sectors as followed in the national income accounts do not always provide a clue to the problems of developing countries. An alternative sectoral classification is presented which is shown to have great serviceability for analytical purposes and for policy formulation.

Anyone familiar with the data situation in developing countries will have no difficulty in sympathizing with Gunnar Myrdal's criticism of applying sophisticated econometric models to these economies.<sup>1</sup>

It has not been an uncommon experience of honest econometricians to throw up their arms in despair when tried to build complex econometric models for developing economies. Yet it is not infrequently that one comes across such models, into the construction of which considerable amount of national resources and very scarce national skill are being put in. Because of the scarcity of data, these models have to be built on heroic assumptions which make them useless from the practitioner's point of view. The end product of most of these efforts is nothing more than the creation of an intellectual curiosity with very little practical use in planning or policy formulation.

Yet Tinbergen's justification of the quantitative methods is not without grounds (see [2]). Unless we use quantitative methods the data situation will never improve. Secondly, in the hands of a skilled economist, even very simple statistical methods

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<sup>1</sup> "But to construct such models in the air, out of uncritically conceived concepts that are inadequate to reality and usually logically not consistent, and so pretend to knowledge when none has been established, does not represent scientific progress; it comes near to being an intellectual fraud" [1, p. 31].

may yield valuable results. Thirdly, it is only by quantitative method that the question of choice between various feasible alternatives can be made.

The present paper is prepared to substantiate the claim that even very simple quantitative models can render valuable service as powerful tools for policy decisions and planning. The four sector model, based on marginal modification of the existing data and on a set of static assumptions as developed in this paper, is extremely simple to work out and can be assembled with a minimum of cost and time and by medium level technicians. Yet the policy conclusions and guidance that can be derived from it will have immense value to the policymakers and planners of the developing countries.

It is certainly a great waste of national resources of the developing countries to put the highly trained econometricians in the construction of complex models. The quantity and the quality of data do not justify such effort. Apart from demonstrating the skill of the econometricians, it does not serve any other useful purpose. Their talent and time would be much better spent if they worked with simple models which can provide practical guidance to the governments. The time for indulging in the pastime of complex, theoretical model-building has not yet come in the developing countries. At the present stage of data availability and because of the time lag and the cost, not much benefit could be derived from such exercises by the developing countries. A much better case can be made from a simpler model which shows the interrelationships and trends of a few major key variables, and which can be computed quickly and can give a broad indication of what is going wrong and in what direction the policy emphasis has to be shifted. Delayed advice, however excellent, is as good as no advice; a simpler model which can give an indication of the need for policy change, sufficiently early, is very much in demand by the decision-makers in developing countries.

The cumbersomeness and the delayed presentation of the complex, sophisticated models have resulted in the projection departments in the planning offices in the developing countries being put up in a corner as a side show adding glamour rather than substance to the plans. In actual practice, the priorities and the policy shifts are decided in the sectoral ministries. Whenever a crisis develops in any part of the country, the solutions adopted as a result tend to be ad hoc sectoral solutions often unrelated to other sectors. Such intuitive response often leads to overreactions, generating a crisis in other sectors or trading it off with a future crisis of much bigger dimension. There is need, therefore, to develop a simpler model which gives a sufficient indication of the major interrelationships in the economy without being too complex as an aid to the intuitive judgment of the decision-makers.

## II. THE RATIONALE FOR AN EVALUATION MODEL

The main use that has been made so far of economic models is for making projections. Unfortunately, projections for developing economies have generally proved to be grossly erroneous. This is necessarily so not only because the statistical bases of the models used for projection are weak but also because of the rapid structural changes that take place in developing countries. Because of the lack of statistical

data, many assumptions have to be made in working out the models which can never be verified. The projections, based on such unverified assumption, may fail to give even a weak indication of the direction in which an economy is moving. In so far as these projections influence policy and planning, they may cause great harm to an economy.

This danger will be considerably minimized if a proper evaluation of the performance of the economy is undertaken before a projection is made. The advantage that models for evaluation have over the projection models is that the assumptions underlying the models can be tested and suitably altered by trial and error.

If an evaluation model, after a series of experimentation with alternative assumptions, is found to give a good fit with the observed data for a number of years, then it can be set up as a standard for that economy. If it is found that, for the subsequent period, the economy is performing too poorly or too well as compared to this standard, a basis then becomes available for investigating the causes for such deviation.

In the absence of such a performance evaluation model, the comparison that is generally made is with the past trend. This comparison however may give an erroneous evaluation. For example, if the current year's growth is 6 per cent while last year's growth was 5 per cent, the performance may be regarded as satisfactory. But if the warranted growth rate as given by the evaluation model is 7 per cent, then the performance must be regarded as not so good. In other words, the evaluation should assess whether the economy realized its fullest potentials or not, and not just whether the past trend was maintained.

The major differences between a projection model and a performance evaluation model are:

(a) The projection model obtains its parameters by summarizing the trend for the recent past, calculating the values up to the latest year of available data. In an economy where rapid structural changes are taking place, such methods cannot give an accurate estimate of the parameters. The number of observations are generally too few and the deviation too large to justify the derivation of least square trends or other standard statistical estimation procedures.<sup>2</sup>

In the evaluation model used in this study, the parameters are estimated by using all available materials by a process of simulation. The possibility of error is minimized by testing a series of alternative estimates and comparing them with the observed values of GDP. Out of the resulting series of estimates of the parameters obtained by simulation trials, two sets which give the nearest higher and lower values to the actual GDP are accepted for constituting the evaluation range.

(b) The accuracy of projected values can be judged only after several years. The warranted values obtained from the evaluation models by hypotheses do not differ much from the observed values at least for the first few years of the evaluation period.

(c) The objective of projection models is to give some idea of the future values

<sup>2</sup> For the model of the Thai economy presented below for illustration, only one observation for 1963 was available for each of the parameters.

under a given set of assumptions. The objective of evaluation models is to find out why the economy did not perform as well as it should have or performed better than what was expected. The former is concerned with the future, the latter with the past. One predicts the future values, the other provides the standard values, with which the actual performance is to be compared.

### III. A FORMAL STATEMENT OF THE MODEL

The evaluation model presented below is based on the assumption that the equilibrium condition, that savings and investments are equal, is strictly maintained, and the ex-ante and the ex-post saving investment equality is established at least within a year. In other words, it assumes the process of growth with balance resulting from equality of demand and supply of both consumer goods and capital goods. The deflections from equality of demand and supply are regarded as random movements which cancel out when aggregated over time.

This assumption of balanced growth does not mean that the system is necessarily expanding in an orderly fashion eternally. It is perfectly possible to conceive of atrophy and decay of a system in a perfectly balanced manner. All that is important is how this balance between investment and savings is achieved. If it is achieved by reducing investment when savings fall short, or by immobilizing savings or exporting them when they are in excess, nothing but a balanced decay or stagnation would be the inevitable consequence.

#### A. Symbols Used in the Model

##### Sectors:

- Sector 1: the agricultural consumption goods sector;
- Sector 2: the industrial consumption goods sector;
- Sector 3: the capital goods sector;
- Sector 4: the export sector.

##### Variables and identities: (*i* being a common name for the sectors)

- $Y_i$ : output of sector *i*;
- $S_d$ : domestic savings;
- $S_f$ : foreign investment, an exogenous variable;
- $S$ :  $S_d + S_f$  = total savings = total investment = demand for capital goods;
- $Y_3$ : domestic output of capital goods;
- $F$ : imports;
- $F_I$ :  $rF$  = imported capital goods,  $r$  being the proportion of capital goods in total imports;
- $(1-r)F$ : imported consumer goods;
- $Y_3 + rF$ : total supply of capital goods.

##### In equilibrium:

- Supply of capital goods = demand for capital goods;
- i.e.,  $Y_3 + rF = S_d + S_f$ ;

$$Sd = Y_3 + rF - S_f;$$

$L_i$ : employment in sector  $i$ ;

$W_i$ : wage-income in sector  $i$ ;

$P_i$ : non-wage-income in sector  $i$  = property income, profits, rents interests, and income of self-employed persons.

For indicating the time dimension of the variables, a time indicator  $t$  is added to the suffix.

*Parameters:*

$\beta_i$ : output/capital ratio of sector  $i$ ;

$\alpha_i$ : labor/capital ratio of sector  $i$ ;

$w_i$ : wage rate in sector  $i$ .

### B. Equations of the Model

The suffix  $i$  represents the sectors 1,2,3, and 4 respectively.

$$Y_{it} = \beta_i K_{it}. \quad (1)$$

$$K_{it} = 0.97K_{i(t-1)} + S_{i(t-1)}. \quad (2)$$

Equation (2) is based on the assumption that the capital used in a sector consists of capital obtained from the preceding period reduced by 3 per cent for wastage, and augmented by the addition of savings of the preceding year invested in the sector.

$$S_{i,t} = m_{it} \cdot S_t, \quad (3)$$

where

$$m_{it} = \frac{P_{it}}{K_{it}} / \sum_i \frac{P_{it}}{K_{it}} \quad \left( \begin{array}{l} \text{the ratio in which the total savings} \\ \text{are distributed among the sector} \end{array} \right)$$

$$= \frac{\beta_i / \alpha_i - w_i}{\sum_i \{ \beta_i / \alpha_i - w_i \}}.$$

$$S_t = Y_{3t} + rF_t. \quad (4)$$

$$F_t = Y_{4t} + S_{ft}, \quad (5)$$

= exports + foreign investment.

$$P_{it} = Y_{it} - W_{it}. \quad (6)$$

$$W_{it} = w_i L_{it}. \quad (7)$$

$$L_{it} = \alpha_i K_{it}. \quad (8)$$

Thus the model consists of eight variables, interrelated with each other by eight linear equations and one exogenous variable.

The model also assumes the equality of demand and supply of both the consumer goods and the producer goods. We assume that the entire wage-income is being spent on consumption and the savings are originating from non-wage-income only, then the equilibrium condition that the supply of consumer goods = the demand for consumer goods gives us the relation:

$$F_c + Y_1 + Y_2 = W_1 + W_2 + W_3 + W_4 + P_1 - S_1 + P_2 - S_2 + P_3 - S_3 + P_4 - S_4, \quad (9)$$

where

- $F_c$  is the imported consumer goods;  
 $Y_1$  and  $Y_2$  are the agricultural and industrial consumer goods;  
 $W_i$  are the wage-incomes in the four sectors which are assumed to be spent entirely on consumer goods;  
 $P_i$  are the non-wage-incomes; and  
 $S_i$  are the savings which are assumed to come entirely from non-wage-incomes.

Since  $Y_i = W_i + P_i$ ,

$$F_c + Y_1 + Y_2 = F_c + W_1 + P_1 + W_2 + P_2, \quad (10)$$

$$F_c = W_3 + P_3 + W_4 + P_4 - \sum_1^4 S_{di}, \quad (11)$$

$$= Y_3 + Y_4 - S_d. \quad (12)$$

Relation (12) suggests that an increase in the import of consumption goods is possible without creating a disequilibrium only if domestic savings are reduced or if domestic production of capital goods and/or exports are increased.

For, a rise in domestic savings ( $S_d$ ) with non-wage-income remaining constant, would imply a fall in consumption out of non-wage-income and, therefore, a fall in the demand for consumption goods. If  $S_d$  rises higher than  $Y_3 + Y_4$ , then this would indicate that the income generated in these two sectors is not sufficient to clear the consumption goods available in the market.  $F_c$  then will become negative, which would imply, that export of consumption goods or decrease in saving would be needed to establish equilibrium in the demand and supply of consumption goods.

Similarly, if  $Y_3 + Y_4$  rises above  $S_d$ , then this would imply that income generated has led to an excessive demand for consumer goods, so that equilibrium could be established either by increasing domestic savings or by increasing imports of consumption goods.

From relation (11), we get

$$W_3 + W_4 = F_c + S_d - P_3 - P_4$$

or

$$w_3 L_3 + w_4 L_4 = F_c + S_d - P_3 - P_4. \quad (13)$$

Wage-employment in sectors 3 and 4 can be increased, so long as wage rates remain constant, by reducing the non-wage-earners' incomes  $P_3$  and  $P_4$  (without reducing the domestic savings in all sectors), that is, by reducing the consumption of non-wage-earners and also by increasing imports of consumption goods (wage goods).

For, the decrease in  $P_3$  and  $P_4$ , keeping savings constant, would imply that the consumption of the non-wage-earners would fall, thus increasing the availability of these goods for the wage-earners, provided, of course, that these goods are wage

goods and not luxury consumption goods. Similarly, increase in savings ( $S_d$ ) would imply decline in consumption of non-wage-earners, since all savings are assumed to come from their income, and, thus would lead to an increased supply of wage goods which, in turn, would lead to a rise in employment, if wage rate does not rise. Similarly, a rise in imported wage goods  $F_c$  would make possible a larger volume of employment in these two sectors.

In the consumer goods sector,

$$Y_1 + Y_2 = W_1 + P_1 + W_2 + P_2,$$

or

$$w_1L_1 + w_2L_2 = (Y_1 + Y_2) - (P_1 + P_2). \quad (14)$$

Thus, a rise in employment in these sectors could be effected by either reducing non-wage-income ( $P_1 + P_2$ ) and/or by increasing the production of wage goods,  $Y_1$  and  $Y_2$ .

Combining equations (13) and (14), we get

$$\begin{aligned} w_1L_1 + w_2L_2 + w_3L_3 + w_4L_4 &= F_c + S_d + Y_1 + Y_2 \\ &\quad - (P_1 + P_2 + P_3 + P_4), \\ \text{i.e., } wL &= F_c + S_d + Y_1 + Y_2 - P, \end{aligned} \quad (14a)$$

where  $w$  is the average wage rate and  $L$  is the total employment in all the sectors and  $P$  is the total non-wage-income. Thus, employment will be seen to be determined by savings and the availability of wage goods positively, and by non-wage-income negatively.

Let the imported consumption goods be divided into wage goods  $F'_c$  and luxury goods  $F''_c$ ; and domestic consumption goods into domestic luxury goods  $Y''_1$  and  $Y''_2$  and domestic wage goods  $Y'_1$  and  $Y'_2$ .

Then (14a) becomes

$$wL = F'_c + F''_c + Y'_1 + Y''_1 + Y'_2 + Y''_2 + S_d - P.$$

We assume that the wage-earners buy only wage goods, and the non-wage-earners buy only luxury goods. Then,

$$wL = F'_c + Y'_1 + Y'_2 \quad (14b)$$

$$\therefore P - S_d = F''_c + Y''_1 + Y''_2. \quad (14c)$$

Thus employment will be seen to be determined by the availability of wage goods, imported and domestically produced; while by relation (14c), the savings ( $S_d$ ) are reduced by the increase in the availability of luxury goods, imported or domestically produced.

Thus, if luxury goods are imported, they affect employment adversely in two ways: firstly, they prevent imports of wage goods, thus reducing employment; secondly, they reduce savings and thus prevent generation of employment through investment. Thus import of luxury goods and nonessential commodities along with remittance of income abroad are the main sources of leakage from the system which prevent the fullest realization of the employment potential generated by industrial

development. It is not capital intensity as such, but these leakages which are responsible for the failure of employment generation. If foreign capital is used for industrial development, then of course, the remittance of income abroad cannot be stopped altogether. Nevertheless it can be reduced by adopting appropriate measures. In any case, if employment creation becomes a national objective then importation of non-wage consumption goods can hardly be justified.

The equilibrium condition for the capital goods sector requires that:

the supply of capital goods = the demand for capital goods;

$$\text{i.e., } F_I + Y_3 = S_d + S_f,$$

where

$F_I$  is imported capital goods;

$Y_3$  is the domestic output of capital goods;

$S_d$  is domestic savings; and

$S_f$  is foreign investment.

But,

$$F_I + Y_3 = F_I + W_3 + P_3,$$

$$\therefore W_3 = S_d + S_f - F_I - P_3,$$

or

$$w_3 L_3 = S_d + S_f - F_I - P_3. \quad (15)$$

Thus, with the wage rate constant, employment in the capital goods sector can be increased by increasing domestic savings and foreign investment, and by reducing import of capital goods, as well as reduction in non-wage-incomes without reducing  $S_d$ . If foreign investment is increased without an increase of import of capital goods, employment will be higher because more labor-intensive techniques existing in the country, or domestically produced capital goods, will be used. Similarly, reduction of non-wage-income without reduction of savings implies reduction of consumption of the non-wage-earners, thus releasing more consumption goods for the wage-earners, permitting employment of larger number of workers.

These attributes of the model follow from the identities that are imposed on it by the equilibrium conditions. For considering the dynamic equilibrium properties of the model, we can express the system of equations in their reduced forms, showing the output of the sectors in year  $t$  as a function of labor. Thus,

$$Y_{it} = 0.97 \frac{\beta_i}{\alpha_i} L_{i(t-1)} + m_i \frac{\beta_3 \beta_i}{\alpha_3} L_{3(t-1)} + r \frac{\beta_i \beta_4}{\alpha_4} m_i L_{4(t-1)} + r m_i \beta_i S_{f(t-1)}. \quad (16)$$

It is clear from equation (16) that, if  $\alpha_3$  and  $\alpha_4$  (i.e., the coefficients of labor intensity in the capital goods and the export sectors) are increased, then output will decline. Both  $Y_i$  and  $\alpha_3$  and  $\alpha_4$  can be increased at the same time if  $\beta$  and/or  $S_{ft}$  increase sufficiently to more than compensate the decline in  $Y_i$ , caused by the increase in  $\alpha_3$  or  $\alpha_4$ . Increase in both  $\alpha_3$  and  $\alpha_4$  and  $\beta$  implies use of such technology which is both employment generating and output or productivity increasing. For example, the high yielding varieties of seeds increase both employment and output.



Similarly light tractors have often been found to increase both output and employment. These cases may not be easy to find, and, increase in  $\alpha_3$  or  $\alpha_4$  without an increase in  $\beta$  or  $S_{jt}$  will in general lead to a fall in income.

Equation (16) shows us that income and employment cannot be increased at the same time if productivity or foreign investment does not increase.

Expressing equation (16) in terms of employment, we get

$$L_{it} = 0.97 L_{i(t-1)} + \frac{m_i \beta_3 \alpha_i}{\alpha_3} L_{3(t-1)} + \frac{rm_i \alpha_i \beta_4}{\alpha_4} L_{4(t-1)} + rm_i \alpha_i S_{j(t-1)}. \quad (17)$$

Taking partial derivatives, we get

$$\begin{aligned} \frac{\partial L_{1t}}{\partial \alpha_1} &= \frac{m_1 \beta_3}{\alpha_3} L_{3(t-1)} + \frac{rm_1 \beta_4}{\alpha_4} L_{4(t-1)} + rm_1 S_{j(t-1)}, \\ \frac{\partial L_{2t}}{\partial \alpha_2} &= \frac{m_2 \beta_3}{\alpha_3} L_{3(t-1)} + \frac{rm_2 \beta_4}{\alpha_4} L_{4(t-1)} + rm_2 S_{j(t-1)}, \\ \frac{\partial L_{3t}}{\partial \alpha_3} &= \frac{rm_3 \beta_3}{\alpha_4} L_{4(t-1)} + rm_3 S_{j(t-1)}, \\ \frac{\partial L_{4t}}{\partial \alpha_4} &= \frac{m_4 \beta_3}{\alpha_3} L_{3(t-1)} + rm_4 S_{j(t-1)}. \end{aligned}$$

All the partial derivatives being positive, above equations suggest that, if the labor intensity is increased, employment will rise. The presence of  $\alpha_3$  and  $\alpha_4$  in the denominator suggests, however, that the employment effect of this increase in labor intensity will be considerably reduced if it is introduced in the capital goods and the export sectors as well. The employment effect will be much greater if the consumer goods sector alone is affected by it. This conclusion is brought out clearly by considering the sign of the second cross-partial derivatives with respect to  $\alpha_3$  and  $\alpha_4$ .

Thus,

$$\frac{\partial^2 L_{1t}}{\partial \alpha_1 \partial \alpha_3}, \frac{\partial^2 L_{1t}}{\partial \alpha_1 \partial \alpha_4}, \frac{\partial^2 L_{2t}}{\partial \alpha_2 \partial \alpha_3}, \frac{\partial^2 L_{2t}}{\partial \alpha_2 \partial \alpha_4}, \frac{\partial^2 L_{3t}}{\partial \alpha_3 \partial \alpha_4}, \frac{\partial^2 L_{3t}}{\partial \alpha_4 \partial \alpha_3}$$

are all negative. Therefore, an increase in the labor intensity in the capital goods and the export sectors will in the long run have a decelerating effect on employment. This will be so because an increase in the labor intensity in these two sectors (the capital generating sectors) will lead to a rise in the wage-income and a fall in the non-wage-income, causing a fall in the saving or investment ratio,  $m_i$ , in these sectors. A fall in the saving ratio in these sectors will lead to a decline in demand for capital goods causing a deceleration in the growth of employment and income. Thus, if the long-period growth in income and employment is kept in view, then it may not be wise to increase the labor intensity in the capital goods and the export sectors, but to limit such effort in the consumption goods sector alone.

The recommendation often made of increasing labor intensity for creating em-

ployment, therefore, requires serious qualification. By reducing capital accumulation, it will lead to a reduction in employment generating capacity and prevent a structural change of the economy, thus preventing the future employment potential of the economy.

Equation (17), on the other hand, indicates that a much better method is to increase  $\beta_3$  and  $\beta_4$ , the output/capital ratio in the capital goods and the export sectors, by introducing more productive methods per unit of capital, or to increase foreign savings.

The reason why growth of industries and increase in the industrial output in developing countries failed to generate enough employment is not because labor productivity was high, but because it was not high enough, and, also, because of the leakage of potential savings from the system by high import of consumption goods as well as high return to foreign investment, and the failure to produce sufficient wage goods. The distortion in the output-mix with a high proportion of luxury consumption goods and little emphasis on wage goods and capital goods is a consequence of the unequal income and property distribution, and is largely responsible for the failure of our industrialization effort to generate enough employment particularly through the indirect effect on savings and investment in the other sectors.

#### IV. AN EVALUATION MODEL FOR THAILAND

The use of the performance evaluation model for a developing economy is illustrated below by working out a four sector equilibrium model in a simple form for the economy of Thailand. The four sectors are (1) consumption goods produced in the agricultural sector; (2) consumption goods produced in the industrial sector; (3) the capital goods sector; and (4) the export sector.

No information was available as to the proportion in which the savings were distributed among the four sectors. Several assumed schemes of distribution were tried. The following three among these gave more plausible results: namely, distribution in proportion to (a) the non-wage-income generated in each sector; (b) the capital stock in each sector; (c) the non-wage-income per unit of labor employed in each sector; and (d) the non-wage-income per unit of capital employed in each sector.

The simulation results obtained by using assumption (d) gave the narrowest range of values to the observed GDP value and was used in the evaluation process.

The parameters used in the model were the output/capital ratios ( $\beta$ ), the labor/capital ratios ( $\alpha$ ), and the wage rate ( $w$ ) in each of the sectors. Several alternatives of each of these were computed from the 1963 sample surveys of industrial and agricultural production and the national income accounts. A number of sample surveys were conducted in 1963 such as the census of industries, the household expenditure surveys, the farm expenditure surveys, etc. These sources were used to obtain the alternative estimates of the parameters.

Each set of the parameters gave a corresponding set of values for the total GDP

and for each of the sectors. Two of these sets which were closest to the observed values of GDP were chosen to represent the evaluation standard.

The parameters of these two sets were assumed to have remained constant throughout the period. The values of the parameters, which have been adopted after a number of experimentation for the evaluation model, are shown in Table I.

TABLE I  
VALUES OF PARAMETERS

	Output in Baht per Baht of Capital	Persons Employed per Million Bahts of Capital	Wages per Employee per Year in Bahts
I. Upper bound			
1. Agricultural consumer goods	.645558	206.608	2,753
2. Industrial consumer goods	.420644	37.365	5,722
3. Capital goods	.357906	22.991	7,099
4. Exports	.631289	193.038	2,947
II. Lower bound			
1. Agricultural consumer goods	.467203	149.526	1,929
2. Industrial consumer goods	.420644	37.365	5,722
3. Capital goods	.357906	22.991	7,099
4. Exports	.491926	150.423	2,172

#### A. *Reclassification of Output and Labor*

Since the classification followed in the national income accounts of Thailand does not provide the output of the four sectors we are interested in, a reclassification of the data had to be undertaken for 1963, which has been used as the base year. In reclassifying the traditional sectoral output into the four sectors used in our model, namely, agricultural consumer goods, industrial consumer goods, capital goods, and the export sectors, various separation ratios were used which were obtained from official and non-official statistical sources. The results of this exercise are given in Table II followed by a summary statement of the procedure.

TABLE II  
OUTPUT RECLASSIFIED BY SECTORS, 1963

Sector	(Million bahts)	
	Output at Market Price	Output at 1962 Prices
1. Agricultural consumer goods	21,856	22,178
2. Industrial consumer goods	26,348	26,737
3. Capital goods	8,714	8,842
4. Exports	11,161	11,325
Total	68,079	69,082

The national income accounts of Thailand allocate the GDP among ten sectors. The output for 1963 for each of these sectors was divided into three classes, namely, agricultural consumer goods, industrial consumer goods, and capital goods. The proportions obtained from a detailed breakdown given in the *FAO Year Book*

of *Agricultural Statistics* and in the *Census of Industries* were used in making the allocation to these groups. For example, the national income accounts give the output of the agricultural sector including fishing, mining, and forestry for 1963 as 25,382 million bahts. From the commodity list given in the *FAO Year Book*, 90 per cent of the output could be regarded as consumer goods and 10 per cent as materials for industrial production. Further, the *Census of Industries* (1963) gives the output by industries, 82 per cent of which could be classified as consumer goods and 18 per cent as capital goods. Using these proportions, the total output of the agricultural sector was allocated among the three sectors in the proportion of 90 per cent for consumer goods, 8.2 per cent as materials for industrial consumer goods, and 1.8 per cent as materials for capital goods. Similar procedure was followed for the other nine sectors obtaining separation ratios in each case from various sources.

The total exports for 1963 were similarly classified into the three sectors using the detailed SITC classification. From the total for each of the three sectors, the exports were taken out to obtain the value of domestic consumption. The percentages in which the sectoral output were distributed among the three sectors are shown in Table III.

TABLE III  
PROPORTION FOR REALLOCATION OF SECTORAL OUTPUT

				(%)
	Agricultural Consumer Goods	Industrial Consumer Goods	Capital Goods	Total
A. Material goods:				
1. Agriculture, fishing, forestry, mining	90.0	8.2	1.8	100
2. Industry	—	82.0	18.0	100
3. Construction	—	—	100.0	100
4. Electricity, gas, water	—	82.0	18.0	100
B. Services:				
5. Transport, storage	58.4	26.5	15.1	100
6. Wholesale and retail trade	38.3	50.6	11.1	100
7. Banking, insurance	38.3	50.6	11.1	100
8. Ownership of dwelling	—	82.0	18.0	100
9. Public administration	58.4	26.5	15.1	100
10. Services	—	100.0	—	100
C. Exports:				
11. Exports	94.0	5.0	1.0	100

Similarly, the labor forces working in these sectors were separated and reclassified into four sectors by using various output/labor ratios. The distribution of the labor force into these sectors is shown in Table IV.

Foreign investment was taken to be autonomous. It was estimated by fitting a trend line graphically to the observed differences between imports and exports for the years from 1959 to 1963.

The nearest lower values and the nearest higher values of GDP to the actual values obtained from the simulation exercises are shown in Table V and in Figure 1.

TABLE IV  
SECTORAL DISTRIBUTION OF LABOR FORCE

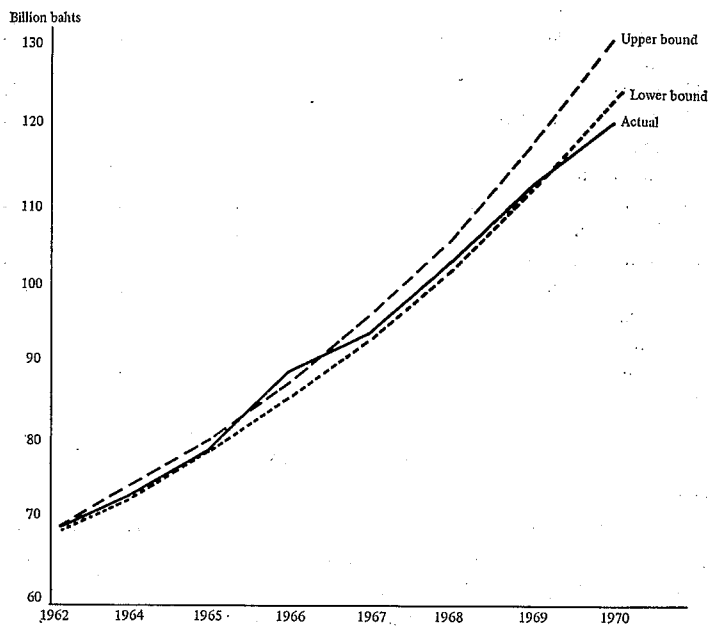
Sector	Million Persons
1. Agricultural consumer goods	7.098
2. Industrial consumer goods	2.375
3. Capital goods	0.568
4. Exports	3.463
Total	13.504

TABLE V  
GROSS DOMESTIC PRODUCT: THAILAND 1963-70 AT  
1962 PRICES ACTUAL AND SIMULATED

Year	Upper Values	Lower Values	Actual Values
1963	69.1	69.1	69.1
1964	74.3	73.9	73.6
1965	80.4	79.5	79.5
1966	87.6	86.0	89.1
1967	96.1	93.5	94.2
1968	105.9	102.1	102.7
1969	117.3	112.0	112.4
1970	130.4	123.2	119.6 <sup>a</sup>

<sup>a</sup> Provisional.

Fig. 1. Gross Domestic Product of Thailand



This range is used as the evaluation standard for the Thai economy for the years from 1962 to 1970.

### B. *The Evaluation Process*

Having set up the standard using the model, the next step in the evaluation exercise would be to compare the actual performance of the economy in each of the four sectors with those obtained from the model. In Table VI, the actual values

TABLE VI  
GROWTH OF THE THAI ECONOMY, 1963-70  
(Monetary unit in billion bahts: at 1962 prices)

Year	Population (Million)	GDP	Foreign Invest- ment	Exports	Imports	Sav- ings	Gross Capital Formation	Agri. Produc- tion	Non- agri. Produc- tion	Manu- facture tion
1963	28.9	69.1	2.39	11.16	13.35	13.62	14.60	24.6	43.5	9.6
1970	34.4	119.6	5.80	22.27	29.61	30.43	30.46	39.0	84.6	19.0
Percentage growth	18.1	73.1	142.7	99.5	121.8	123.5	108.6	58.5	94.4	97.9

of the major variables of the Thai economy, expressed at 1962 prices, are presented. Comparing the growth of population with the growth of these variables, one would indeed feel very satisfied with the progress made by the Thai economy. The GDP shows a growth of 9 or 10 per cent per year which very few developing countries have been able to achieve. Even agriculture shows a growth rate of about 7 per cent per year which is a rare performance. The performance of the economy judged by the trend would indeed score very high. This sense of satisfaction, however, would give place to a sense of serious concern if the performance of the economy is evaluated by reference to our model. The evaluation process set out below would not only enable us to detect the danger points developing in the economy, but would permit us to suggest the shift in policies that are called for to eliminate the trouble spots.

The data presented in Table V, and illustrated in Figure 1, show clearly that the actual GDP stayed within the two bounds during the period except in 1966 when it exceeded the upper bound by a small percentage points and in 1970 when it fell below the lower bound significantly. Throughout the period, however, it stayed closer to the lower bound except the year 1966. For the purpose of evaluation, we will, therefore, set up the hypothesis that the parametric values and their interrelationships, represented in the model by the lower bound values, are a true representation of Thai economy as they existed during this period. The extension of the lower boundary curve would then indicate the future potentialities of this economy. The question we ask then is: What factor or factors are responsible for the actual value of the GDP to fall below the lower bound?

(a) Foreign investment: One of the causes of this failure may be due to the foreign investment inflow being less than the warranted level.<sup>3</sup> A comparison of

<sup>3</sup> The word "warranted" will be used to indicate the "standard" or theoretical values given by the model.

the warranted foreign investment with the actual flow shows that the latter has exceeded the former in the last three years when the deceleration in the economy was the highest. Foreign investment, therefore, could not be held responsible for the decline.

(b) Exports: The data on exports show that the actual exports have been higher than even the upper bound values for the years from 1963 to 1967. Though the total exports have been rising throughout the period, it is from 1967 that they began to fall below the upper bound values and came closer and closer to the lower bound values, and by 1970 fell below the latter. This change in the trend in exports in relation to the warranted values will be found to be very similar to that of the GDP.

(c) Imports: One of the decelerating factor could be traced in the higher level of imports. Imports, however, do not necessarily lead to a decline in growth. If the imported goods are capital and developmental goods, they are likely to stimulate growth rather than retard it. It is only excessive imports of consumption goods, particularly import of non-wage consumption goods, which have a decelerating effect on growth. There has been a systematic increase in the proportion of imports of consumption goods in Thailand. The consumption propensity for imported goods has a tendency to rise with the rise in income. Imports of consumption goods, if allowed freely, will tend to rise at a faster rate than income, causing a leakage of the income flow from the system and thus depressing the demand for domestic goods. Investment, employment, and generation of income as a result are adversely affected by such leakage.

(d) Savings: The import of consumption goods, however, contributes only a small part of the total national expenditure, about 9 per cent only. The major part of the decelerating effect is produced by the fall in domestic savings. The savings income ratio in Thailand shows a rise with the rise in income till 1966 from 20 per cent to 25 per cent. Since 1966, however, it has declined below the lower bound from which it did not make a recovery till 1970.

The data on gross capital formation, given in the national income accounts of Thailand, are not comparable to the data on warranted production of capital goods given by our model. The former includes imported capital goods which, in 1970, constituted over 51 per cent of the total. Moreover, it includes residential construction constituting about 13 per cent of the total in 1970, which should be regarded as consumption goods rather than capital goods. Similarly, many of the services performed for the capital goods sector do not find a place in the national accounting of capital formation. The absolute values of these two series, therefore, are not comparable. They may nevertheless permit a comparison of their trends which perhaps has some validity.

This comparison shows that the growth in gross capital formation fell short of the lower bound values during 1964 and 1965 but almost caught up with it in 1966. Since then, however, it has not been able to keep pace with the warranted lower bound values and has been falling behind more and more. If the capital formation figures can be taken as a fair representation of the investment trend, then this failure of investment can be regarded as a proximate cause of the slower growth of GDP compared to the warranted rate.

(e) Production: The deceleration in output may occur not only due to rise in consumption and fall in exports which causes a fall in investment, but also due to a decline in productivity. Bottlenecks and breakdowns in the supply of factors of production may cause a fall in output reducing the growth of the economy. Unfortunately, the national income accounts present the production data by the conventional sectors such as agriculture, industry, transport, etc., and not by the agricultural consumption goods, capital goods, and export sectors that we have used in our model. Nevertheless, since 90 per cent of the agricultural output consists of consumption goods, the trend in it would give a fair representation of the trend in the latter.

One can conclude from a comparison of the trend obtained from the model with actual agricultural production, that the latter has kept pace with the upper bound values and, therefore, cannot be held responsible for the decelerating trend in the GDP.

For evaluating the performance of the industrial sector, we combined the output of the industrial consumer goods sector and the capital goods sector obtained from the model, and compared the total with the actual output of the nonagricultural sectors. The output of the nonagricultural sector is, of course, not the same as the output of the industrial capital and consumer goods sectors. It includes the output of all the service sectors while the industrial consumer and capital goods sector includes only a portion of it. Nevertheless their trend is comparable. As shown by the respective indices, the growth of the nonagricultural sectors have kept close to the upper bound of the industrial consumer and capital goods sector. Only after 1966, it shows a tendency of falling behind the upper bound indices though still remaining above the lower bound indices.

If the indices of the warranted output of the combined industrial sectors are compared with those of the actual output of the manufacturing sector, the latter will be found to remain far above the upper bound throughout the period except the year 1964.

It is safe to conclude therefore that the observed deceleration in GDP did not occur due to the failure in the industrial sector.

### C. *Policy Implications*

Thus our model enables us to identify four areas of weakness in the Thai economy which prevented it to maintain the tempo of growth achieved during the years from 1963 to 1966. These are: (a) declining trend in exports; (b) excessive imports of consumer goods; (c) decline in the saving propensity; and (d) failure of investment to maintain its tempo of the 1963-66 period. These factors are not unrelated to each other. The decline in savings and the fall in the investment tempo could easily be traced to the fall in export earnings and to the rise in imports of consumption goods. The declining trend in exports and the rise in the import of consumer goods caused a proportionately increased leakage from the national income stream, depressing the saving ratio and lowering the investment activities.

The export sector in Thailand, though small, contributing only 16 per cent of



the total output, yet exerts a dominating influence on the growth factors of the economy. As shown above, the industrial and agricultural outputs were more or less maintained at par with the warranted level. It was the decline in the export sector alone which led to the decline in the growth generating investment. This peculiar feature of the Thai economy leads one to subscribe to the thesis of structural dualism which regards the export sector as a superimposition on a vast traditional base. In this base, production and consumption are carried out on traditional lines, total output being equilibrated to total consumption by changing the volume of consumption, by consuming more in years of good harvest and less in years of scarcity. Investment hardly exceeds in such societies the replacement requirement so that society remains at a constant level of stagnation. Saving in such societies, if there is any, is merely a temporary postponement of consumption or addition of a few more temples and other ways of social consumption. Rarely savings are used for addition to capacity except what is needed to accommodate the increased population into the existing structure.

When foreign trade is superimposed on such tradition-bound society, it opens out a channel for its surplus to be siphoned off as exports. The upper strata in such societies through whom the surplus is sent abroad get in return the pleasure of enjoying foreign luxuries added to their joys of native possessions. The craze for foreign luxury goods rapidly spreads from the upper strata to the middle strata and downward to the village level where the village craftsman and the village entertainer are squeezed hard in competition with the imported goods.

Not all the foreign exchange, earned by the exports and obtained as aid and foreign loan, are, however, spent on imports of consumption goods; about 46 per cent is spent on capital goods, on machinery, equipment, and materials for production. This is the amount that generates investment. Combining with certain amount of domestic savings, it adds to the productive capacity and generates growth. In our model, 24 per cent of the total investment comes from export earnings, 10 per cent from foreign credit, and 66 per cent from domestic savings. The importance of the component obtained by export, however, far exceeds its proportion in the total in so far as it acts as the catalyst which gathers together the other components and sets the investment in capacity creation by using modern technology into motion. The 10 per cent of foreign aid or loan is usually tied and allows little maneuverability to the nationals. More often than not, it is a hidden form of exploitation of the national market by foreign investors. The 66 per cent of domestic savings is mostly tied to traditional ways of production or becomes immobile without crucial foreign equipment and machinery. In Thailand, therefore, exports play a crucial role in generating investment in so far as it provides the vital element which gives life to the whole investment process. With exports declining the traditional economy continues and may even expand, but the vitality of the growth process is lost and the technological advance of the society is retarded.

For a country which has already established a modern technological base, with machine-making, chemical, electronic, and other modern industries well established, and operating with well-trained engineers and scientists, the need for exports is not

so urgent. Then, the need for capital goods can be domestically met. But in a country like Thailand which is just starting on the path of industrialization, exports are crucially important for obtaining the means of modernization.

Moreover, in a country like Thailand which wishes to industrialize by operating through the market forces, the exports are doubly important for generating and supporting investment for growth. In countries where the government is willing to take the initiative in mobilizing the resources and itself undertaking the necessary investment for industrialization, foreign resources may often be obtained by drastically cutting nonessential imports and developing rapidly local capital-goods industry which can then substitute partially the imports of foreign capital goods. Under such government initiative, local resources can be used to substitute foreign resources to some extent even if they are less efficient and costlier, the cost difference being paid by the state in some form of subsidy. Thailand has, however, eschewed such hard line of development and has preferred to follow the easier path of operating through the market forces. The success of this strategy, however, depends very largely on the success of expanding exports. In the absence of such expansion, it will be impossible to maintain the tempo of growth and the level of employment without drastic curtailment of imports of consumption goods and rigid control of investment allocation for capacity creation by producing capital goods. Expansion of capacity for the production of wage goods is equally necessary for the control of inflation and for preventing a rise in wages and costs. If such drastic administrative controls are precluded either because they are politically unacceptable or administratively not feasible, then the only alternative left to the state is to expand exports. Since the possibility of expansion of exports in agricultural materials and processing industries is limited and export in manufacturers has a greater chance of success, greater attention needs to be paid for the development of export industries, giving them protection and special incentives in the early stages and subsidizing the export drive. The advice given too often by foreign economists to develop only agriculture or to develop only labor-intensive industries will create more problems for Thailand of finding markets for the agricultural products and the high cost products of the labor-intensive industries. If Thailand has to compete in the world market, she must use the latest technological devices consistent with the capability of her labor force. The fact that her labor is cheap will give her an edge over the developed countries provided the laborers are equipped with efficient machineries so that their productivity is maintained at a competitive level.

#### REFERENCES

1. MYRDAL, G. *Asian Drama*, Vol. 1 (Penguin Books, 1968).
2. TINBERGEN, J. *Gunnar Myrdal on Planning Models* (Bangkok: U.N. Asian Institute for Economic Development and Planning, 1969).