AN ECONOMETRIC ANALYSIS OF THE INDONESIAN ECONOMY*

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This paper is an econometric study of the Indonesian economy. Our intention is to evaluate the interactions within the Indonesian economy, to forecast the selected economic variables under given assumptions, and to measure the effects of various policies. This is to be achieved through an econometric analysis which uses the available statistics and which provides an analytical framework for the present national income statistics.

I. GENERAL SURVEY

1. Introduction

Studies on developing countries seem to have been accelerated after the North-South problem began to be discussed, but so far there have been few positive studies which are time-consuming and hence unattractive. At the present stage, it is doubtful whether a model analysis has much aided in our understanding of the so-called "vicious circle" in Asian countries. The diversity of the economic structure itself, political and social instability, and the incompleteness of a statistical system can be cited as reasons for this. These bottlenecks impede model analysis. As the organization of statistical data should be done in conjunction with model analyses, it is hoped that econometric studies will be attempted.

Indonesia is a large country comprised of about 10,000 islands, with a population in excess of 100,000,000 persons. The country is heterogenous in racial, religious, and economic composition. It is, therefore, extremely difficult to ascertain the economic interactions, even were the political situation stabilized and statistical data complete. The model used in this analysis contains 30 equations, one of the large macro-models of the economy of

* This paper is a summary of the results of a study conducted under the auspices of the Institute of Asian Economic Affairs, with some revisions and supplements. With the assistance of the Institute, the author was able to continue econometric analyses of Asian countries including Japan, India, the Philippines, and Indonesia, for the past four years. Taking this opportunity, I wish to express my thanks to the then president Seiichi Tōbata, directors Masakazu Shibusawa and Hideo Tajima, and other persons concerned. The author visited Indonesia as a member of TAB Mission of the United Nations, and had the opportunity to make analyses as a consultant to the ECAFE office, with the staff members of the Research and Planning Division. I wish to express my thanks for the kind assistance given by Dr. Hiroshi Kitamura, Division Chief of ECAFE, and Professor Kartono Gunawan of the Universitas Indonesia.

developing countries.[1] Nevertheless, it may be criticized for not including important structural problems. We shall leave the improvement of the model to the future. Even with political instability, steady long-term efforts must be made by econometric studies. There are indications that the Bappenas at Djakarta intends to revise its 8-year program. It will give great pleasure to the author, should this study serve as a cornerstone for the progress of future studies.[2]

The economic situation in Indonesia during the observation period will be treated below, the formulation of models will be treated in Part II, various simulation analyses (forecasting and analysis of policy effects for the period until 1970) will be given in Part III, and the conclusion in Part IV.

2. *A General Economic Survey of Indonesia*

An ECAFE report pointed out the following as bottlenecks in the Indonesian economy in the 1950's[3]: (1) a decline in the rate of operation in the manufacturing industries; (2) stagnant exports; (3) a shortage in the supply of consumer goods; and (4) an inflationary tendency. These factors may be both causes and results of the existence of vicious circles, and the conclusion seems to be much too simple. However, in another more detailed analysis Douglas S. Paauw also supported this observation.[4]

During the observation period (1951–59), gross national product in real terms increased by 30%, an indication of a fairly high annual growth rate of more than 3%. During this period, primary industry registered a steady increase of 40%, though some recession was witnessed in 1956 and 1959, while secondary industry showed a high rate of growth during the period from 1951 to 1957 (almost a twofold increase) but a sharp decline (about 40%) set in during the period 1958–59. The reason for this recession can be seen in various factors such as political instability (rebellion in Sumatra and other

1 When I discussed my work with the staff members of Bappenas, Universitas Indonesia, Leknas with regard to the framework of this model, I was told that when large-scale studies are carried on in the future, an understanding of (1) the structure of the inter-islands and (2) the dual structure of urban and rural areas will become an important problem.

2 Prof. Gunawan of the Universitas Indonesia is now being transferred to Bappenas for conducting econometric analysis.

3 ECAFE Secretariat, *Long-term Macro-economic Projections for Selected ECAFE Countries 1961–1980,* EGPT. 4/WP. 3, submitted to the Fourth Group of Experts on Programming Techniques, Bangkok, 16 June-7 July, 1965.

4 There is a few literature on economic studies in Indonesia. Among those, *Indonesia* (New Haven, Conn., Human Relations Area Files, 1963) edited by Ruth T. McVey is a reliable one. Chapter 5 of this book "From Colonial to Guided Economy" by Douglas S. Paauw is a relevant survey in detail of the Indonesian economy, though no model analysis was included, which applies a scalpel of sharp criticism on the distortion of data. See also a paper entitled "Economic Development: Analysis and Case Studies" by A Pepelasis, L. A. Mears, and I. Adelman in *Indonesia* (Djakarta, Pembangunan, 1961) edited by Leon A. Mears, Chapter 14.

places), insufficient imports of raw materials and parts, etc. Needless to say, an understanding of the reason for this decline is very important for the discussion of later developments in the Indonesian economy. Influenced by both primary and secondary industries, tertiary industry witnessed a favorable expansion except for a sharp decrease in 1958. From our estimates, it is clear that capital formation in each sector did not necessarily keep step with industrial income, but the average investment maintained a high level in 1956–57 and declined in 1958–59 below the level prevailing in the first part of the 1950's, as is indicated in Table 1. Apart from the primary and tertiary industries for which a larger substitutability between production factors can be anticipated, the low level of investments in the manufacturing industries are detrimental to rapid economic growth as the products of the industries can be produced essentially by investment in the industry. Moreover, as the decline in income had been accelerated, the rate of operation of the industrial capital must have been lowered.

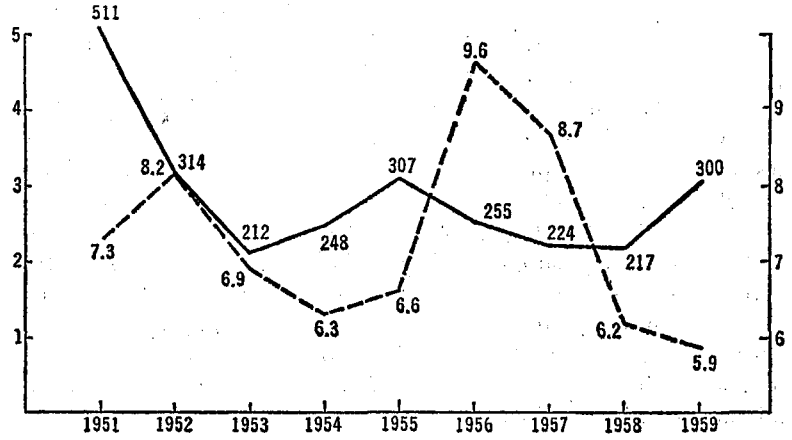
Table 1. Investment Activity in Each Industrial Sector
(in Rs. 100 million based on 1955 prices)

	Investments in Primary Industries (I_p^{I})	Investments in Secondary Industries (I_p^{II})	Investments in Tertiary Industries (I_p^{III})
1951–55 average	13.7	57.7	8.3
1956–57 average	19.8	62.9	15.5
1958–59 average	11.9	55.8	8.0

Turning our attention from production to foreign trade, we note that exports increased about 20% during the period between 1951 and 1957, those of mineral products in particular registering an almost twofold increase. However, shipments of other products tended to be stagnant though showing some fluctuations. Total exports, which showed a favorable increase, tended to become stagnant after 1958 when a sharp decrease was witnessed, suggesting that exports are closely related to domestic production activities. Imports decreased after reaching a peak in 1956. As for imports of raw materials, investment goods continued to increase until 1956, but then a decreasing tendency set in. The same trend was seen in imports of consumer goods as in total imports. Import activity was related to production activity, and there existed a strong correlation between imports for the period and foreign currency holdings at the end of the preceding period, as is illustrated in Figure 1. The above observation suggests the existence of vicious circles such as low production⟶low exports⟶low level of foreign currency holdings ⟶decrease in imports⟶low production. Vicious circles noted here can be analyzed by the model to be explained in Part II.

The development of the government sector is indicated in Table 2, in which the period under observation has been divided into a number of subdivisions, including two—1952–53 and 1958–59—characterized by political

Figure 1. Changes in Total Imports and Foreign Currency Holdings



Note: —— foreign currency holdings (Rs. 100 million)
····· total imports (Rs. 1,000 million)

Table 2. Balance of Government Finance in Terms of 1955 Prices

(in Rs. 100 million)

	D_e	G_c	G_i	G	R	$G-R$
1951	51	147	17	164	183	▲19
1952–53 average	45	181	18	198	167	31
1954–57 average	43	153	33	186	154	32
1958–59 average	87	255	20	275	186	89

tension. From this table, it is clearly seen that the increasing government deficit ($G-R$) was brought about mainly by the expansion of current expenditure (G_c), and that during the years of political tension, defense expenditure (D_e) increased, while government investment (G_i) decreased, resulting in an adverse relationship between expenditure and revenue. Receipts of indirect taxes accounted for more than half of government revenue, while direct taxes accounted for only 15% and other items for 30%. Owing to the delay in the establishment of a tax system, deficits in government financing were covered by loans from the Bank of Indonesia. The supply of currencies registered a nearly fourfold increase during this period, and the price level advanced two and a half times. From this it is evident that political tension is directly responsible for inflationary tendencies.

Further, the heavy dependence on indirect taxes suggests the existence of a vicious inflationary circle, e.g., a decrease in production and imports⟶a decrease in receipts of indirect taxes⟶a decrease in tax receipts as a whole⟶an increase in deficits in government finance⟶an increase in the currency supply⟶a rise in prices⟶a decline in exports⟶a decrease in foreign currency holdings⟶a decrease in imports⟶a decrease in production. The above can be shown by a simulation analysis based on our econometric model.

As stated above, consumption expenditures in real terms advanced only about 20% during the observation period due to inflation and to the stagnation in the private sectors. Also, as the population increased by about 20%, the per capita real standard of living remained virtually unchanged.

In this paper, important economic indicators for Indonesia, which are connected with the above-mentioned economic survey, will be examined. The variables are: sectoral outputs and income (Y^{I}, Y^{II}, Y^{III}, Y, V), capital formation(I_p^{I}, I_p^{II}, I_p^{III}, I_p, I, G_i), exports, imports and foreign currency holdings (X_m, X_o, X, M_s, M_r, M_c, M, F), balance of government finance (D_e, G_c, G_i, G, T_i, T_d, R_o, R), currency supply, prices, population, consumption, etc. The econometric models below are formulated to highlight significant causal connections among these variables. It is hoped that the models will demonstrate the existence of the vicious circle and help to draw to our attention possible measures for eliminating them. The computations will be treated in the next part and the following section.

II. FORMULATION OF MODELS

1. *Specific Characteristics of Models for the Indonesian Economy*

By 1965, several simple models, ECAFE Model No. I, Institute of Asian Economic Affairs Model, and more detailed ECAFE Model No. II had been formulated and tested. ECAFE Model No. I, which was published in 1964, included the following 8 equations.[5]

ECAFE Model No. I for the Indonesian Economy

$$Y_t = Y_{d,t} + T_t$$

$$Y_{d,t} = C_t + I_t + E_t - M_t$$

$$C_t = \blacktriangle 35.32 + 1.101\, Y_{d,t} \qquad r = 0.99$$

$$Y_{d,t} = 159.55 + 0.6250 \sum_{i=0}^{t-1} I_i \qquad r = 0.97$$

$$M_t = 36.57 - 0.1241\, Y_{d,t} \qquad r = 0.54$$

$$E_t = 10.7(1.0425)^t$$

$$B_t = E_t - M_t$$

$$T_t = \blacktriangle 0.29 + \blacktriangle 0.1017t$$

(The symbols of the variables are: Y, gross national product (GNP); Y_d, gross domestic product (GDP); T, net factor income from abroad; C, private consumption expenditure; I, gross domestic capital formation; E, exports of goods and services; M, imports of goods and services; B, national surplus on current account; and t, time.)

The ECAFE Secretariat conducted, as a part of its economic projections for Asian countries for the fiscal year 1964, economic forecasts for the periods until 1970 and 1980 under various assumptions. The nations for which this model was tested included the following 10 countries whose income statistics are relatively complete: Burma, Ceylon, Formosa (Taiwan), India, Indonesia, Korea, Malaysia, Pakistan, the Philippines, and Thailand.

5 ECAFE Secretariat, *op. cit.*

A model which was published in 1964 by the Institute of Asian Economic Affairs covered 10 countries, and was of almost the same scale as the above-mentioned ECAFE Model. The projections yielded by the model were as follows (unit is million U. S. dollars):

Institute of Asian Economic Affairs Model for the Indonesian Economy

$$Y_t = Y_{d,t} + T_t$$

$$Y_{d,t} = C_t + G_t + I_t + X_t - M_t$$

$$Y_{d,t} = \underset{(0.39574)}{4533.00 + 0.37037 \sum_{j=0}^{t-1} I_j} \qquad \bar{r} = 0.8782$$

$$C_t + G_t = \underset{(1.1616)}{322.60 + 0.9000\, Y_t} \qquad \bar{r} = 0.8740$$

$$X_t = 8.84(1.0434)^t$$

$$M_t = 8.92(1.0488)^t$$

$$T_t = \blacktriangle 7.00 + \blacktriangle 8.7t$$

(The variables are the same as already mentioned. The growth rates of exports X_t and imports M_t were computed based on the values estimated from the foreign trade matrix.)

The Institute of Asian Economic Affairs made projections for the period until 1980, while the supposition of marginal capital coefficient was changed.[6]

The above simple models were built to make aggregate projections, and the same model was applied to each country. No adjustment was made to take account of the structural characteristics of each country. It was, therefore, to be expected that these models would be too simple for a structural analysis of the Indonesian economy. In these two models, several equations representing production function, consumption function, import function, etc., performed poorly. Undoubtedly, these simple models were inadequate for approximating the economy realistically.[7] A model which made detailed adjustments for various problems was first formulated in ECAFE Model No. II.[8] Model No. II, introduced in 1964, reduced the problems of the Indonesian economy in the 1960's to: (1) stagnant exports, (2) a decline in the rate of operation in the manufacturing industry, (3) inflation, and (4) a leveling-off of private consumption, as already stated in the preceding part. The model was formulated to consider these points, and the number of equations increased to 18. Thus, the work resulted in the reestimation of data, which was more consistent internally, and in a new set of estimations and simulations.

ECAFE Model No. II for the Indonesian Economy

6 See Akira Ōnishi, "Aggregate Economic Projections for Asian Countries," *The Developing Economies,* II-3 (Sept. 1964), especially Section II.

7 Above two models are in a causal connection which is represented by the following relationship: determination of GDP by production function—explanation of demand components other than investment—determination of investment of this period as residual. It seems to me that this fact gave these models specially interesting characteristics peculiar to the supply-ceiling type model, but it is hard to say that the nature of the models was completely evidenced in the paper.

8 ECAFE Secretariat, *op. cit.*

(1) Government revenue function (R)

$$R_t = 2.71 + \underset{(0.08225)}{0.09358}(V + M_r + M_c + M_s)_{t-1} + u_{1,t}$$

$\hat{R}=0.8266$, $\hat{S}=0.82$ ($N=5$, 1954–58)

(2) Government non-military current expenditure function ($G_c - D_c$)

$$(G_c - D_c)_t = \blacktriangle 11.76 + \underset{(0.660)}{1.500^{***}} R_t + u_{2,t}$$

$\hat{R}=0.9350$, $\hat{S}=1.06$ ($N=8$, 1952–59)

(3) Currency supply function (H)

$$H_t = 71.97 + \underset{(5.55)}{10.63^{**}}(G_c + G_i - R)_t + u_{3,t}$$

$\hat{R}=0.9082$, $\hat{S}=19.66$ ($N=9$, 1951–59)

(4) Production function for primary industries (Y_1)

$$Y_{1,t} = 57.52 + \underset{(0.1107)}{0.2854^{***}} \sum_{j=0}^{t-1} I_{p,j} + u_{4,t}$$

$\hat{R}=0.9479$, $\hat{S}=1.82$ ($N=8$, 1952–59)

(5) Production function for secondary industries (Y_2)

$$Y_{2,t} = \blacktriangle 4.52 + \underset{(0.441)}{5.293^{***}} M_{r,t} + \underset{(0.06684)}{0.04313} \sum_{j=0}^{t-1} (I_p + G_i)_j + u_{5,t}$$

$\hat{R}=0.9627$, $\hat{S}=1.15$ ($N=8$, 1952–59)

(6) Income explanatory equation for tertiary industries (Y_3)

$$Y_{3,t} = 11.52 + \underset{(0.2205)}{0.3221^{*}}(Y_1 + Y_2)_t + u_{6,t}$$

$\hat{R}=0.8560$, $\hat{S}=2.02$ ($N=9$, 1951–59)

(7) GNP explanatory equation (V)

$$V_t = \blacktriangle 5.28 + \underset{(0.117)}{1.111^{***}}(Y_1 + Y_2 + Y_3 + Y_n)_t + u_{7,t}$$

$\hat{R}=0.9957$, $\hat{S}=1.41$ ($N=9$, 1951–59)

(8) Price level function (P)

$$P_t = 55.84 + \underset{(0.0703)}{0.4899^{***}} \left(\frac{H \cdot P}{V} \div \frac{H_{1955} P_{1955}}{V_{1955}} \right)_{t-1} + u_{8,t}$$

$\hat{R}=0.9307$, $\hat{S}=11.52$ ($N=8$, 1952–59)

(9) Mineral products export function (E_m)

$$E_{m,t} = 1.76 + \underset{(0.0304)}{0.1548^{***}} Y_{2,t-1} + \underset{(2.625)}{1.867} \left(\Delta \frac{P_{E,m}}{P} \right)_t + u_{9,t}$$

$\hat{R}=0.9405$, $\hat{S}=0.32$ ($N=8$, 1952–59)

(10) Other products export function (E_o)

$$E_{o,t} = 6.84 + \underset{(0.7785)}{0.5465} \left(\frac{P_A}{P} \right)_t + \underset{(0.10373)}{0.02630} (\Delta Y_1)_t + u_{10,t}$$

$\hat{R}=0.6744$, $\hat{S}=0.28$ ($N=8$, 1952–59)

(11) Investment goods import function (M_s)

$$M_{s,t} = \blacktriangle 5.95 + \underset{(1.2198)}{0.8324}(E_m + E_o)_t + u_{11,t}$$

$\hat{R}=0.6282$, $\hat{S}=0.56$ ($N=8$, 1952–59)

(12) Consumer goods import function (M_c)

$$M_{c,t}=2.05+0.01137^{***}F_{t-1}+u_{12,t}$$
$$(0.00635)$$

$\hat{R}=0.9196$, $\hat{S}=0.57$ ($N=9$, 1951–59)

(13) Raw materials import function (M_r)

$$M_{r,t}=\blacktriangle 2.94+0.6288(E_m+E_o)_t+0.001002(\Delta E^*)_{t-1}+u_{13,t}$$
$$(1.2806)\qquad(0.004209)$$

$\hat{R}=0.6936$, $\hat{S}=0.52$ ($N=7$, 1953–59)

(14) Domestic capital formation function (I_p+G_i)

$$(I_p+G_i)_t=1.51+2.853^{***}M_{s,t}+u_{14,t}$$
$$(1.095)$$

$\hat{R}=0.9681$, $\hat{S}=0.87$ ($N=9$, 1951–59)

(15) Private consumption expenditure definitional equation (C)

$$C_t=V_t-(G_c+I_p+G_i+E_m+E_o-M_s-M_c-M_r)_t$$

(16) Exports in dollar definitional equation (E^*)

$$E^*_t=(P_{E,m}\ E_m+P_{E,o}\ E_o)_t$$

(17) Foreign currency holdings definitional equation (F)

$$F_t=E^*_t-\{P_m(M_s+M_c+M_r)\}_t+W_t+F_{t-1}$$

(18) Per capita consumption definitional equation (A)

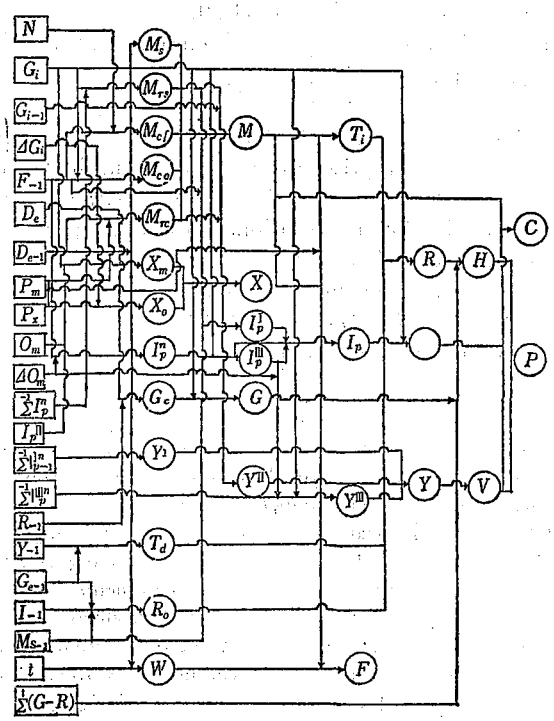
$$A_t=\left(\frac{C}{N}\right)_t$$

(The symbols denote as follows: $\hat{R}$, estimated value of correlation co-efficient; $\hat{S}$, estimated value of standard deviation of error terms (adjusted for the degree of freedom); N, the number of observation period; *, significant at 10 percent level; **, significant at 5 percent level; ***, significant at 1 percent level; Δ, increase; D_e, defense expenditure; G_c, total government expenditure; G_i, government investment; I_p, private investments; Y_n, net factor income from abroad; $P_{E,m}$, export prices of mineral products; P_A, world agricultural product price index; $P_{E,o}$, export price of other products; P_m, import price index; W, net foreign savings or net capital inflow from abroad.)

Figure 2 shows the flow chart of this model. The graph is divided into three parts, the government sector, the private production sector, and the private consumption sector, forming a recursive model where the private consumption sector is decided after prior settlement of government and private production sectors. In the structural equations, structural coefficients of (1) government revenue, (5) the production of secondary industry, (9) exports of mineral products, (10) exports of other products, (11) imports of investment goods, and (13) imports of raw materials were not significant. The model was a recursive type, and in view of the fact that the least square method was adopted for estimation, the result of the estimation cannot necessarily be said to have been favorable. In particular, (a) the decline in exports following the rise of domestic prices was not explained by this model, due to the inadequency of equations (9) and (10); (b) as imports of investment goods and raw materials were not explained satisfactorily, and as capital accumulation was represented significantly in the production function of the secondary industry, the difficulty in imports due to the shortage of foreign currency holdings and the consequent

stagnancy in the manufacturing production and investments cannot be said to have been illustrated. From the above, the initial description of economic problems and the evaluation of vicious circles cannot be said to have been confirmed. In the following part, our econometric models will be introduced so as to cover these points. Table 3 compares number of equations, observation

Figure 2. Flow Chart of FCAFE Model II



Notes: 1) I. GOVERNMENT SECTOR—R, government revenue; G_e, government purchases of goods and services; D_e, defense expenditure; G_i, government investment; G_e+G_j-R, deficits of government finance; H, currency supply.
II. PRIVATE SECTOR (Production)—Y_1, primary industries income; Y_2, secondary industries income; Y_3, tertiary industries income; Y_n, net factor income from abroad; V, GNP; P_y, price level.
III. PRIVATE SECTOR (Expenditure)—I_p, private investment; I_p+G_i, gross domestic capital formation; M_r, imports of raw material; M_c, imports of consumer goods; M_s, imports of investment goods; P_m, import price; F, foreign currency holdings; W, net foreign savings or net capital inflow from abroad; E_m, exports of mineral products; E_o, exports of other products; P_A, world price of agricultural products; P_{Em}, export prices of mineral products; P_{Eo}, export prices of other products; E^*, export in dollar; C, private consumption; A, per capita consumption; N, population.

2) → relations in this period; ⋯→ relations with some time-lag; ○ jointly dependent variables; □ exogenous variables.

period, etc., among the above-mentioned three models as well as ICU Model No. I and ICU Model No. II as seen below.

Table 3. Comparison of Models for the Indonesian Economy

Name of Models	Method of Estimation	Number of Equation	Observation Period	Forecasting Period
ECAFE No. I	DLS	8	1952–59	1960–80
Institute of Asian Economic Affairs	DLS	7	1953–59	1960–70
ECAFE No. II	DLS	18	1951–59	1960–70
ICU No. I	TLS	13	1952–59	1960–70
ICU No. II	ILS and TLS	30	1952–59	1960–70

Note: DLS.....Direct least square method
ILS.....Interaction least square method
TLS.....Two-stage least square method.

2. *Formulation of Models for the Indonesian Economy*

(ICU Model No. I and ICU Model No. II)

As stated in the foregoing paragraph, some of the problems which were taken up at the time of formulation of ECAFE Model No. II, such as (1) an inflationary tendency, (2) stagnant exports, (3) a non-improving level of consumption, and (4) a lower rate of operation in the manufacturing industry, were not actually proved. The structural equations were estimated by repeating simulation tests under strict standard of estimation. In formulating models, a simple model with about ten equations was estimated by the two-stage least square method as the first approach. Taking this model as the prototype, a larger model with about 30 equations was estimated.

The prototype model involved 13 equations. This model will be called ICU Model No. I. Structural equations are shown below.

Econometric Model for the Indonesian Economy
(ICU Model No. I)

(1) Private consumption expenditure definitional equation (C)

$$C_t = V_t - G_{c,t} - I_t - X_t + M_t$$

(2) GNP estimate equation (V)

$$V_t = \underset{(0.051)}{4.36 + 1.064^{*}_{*}Y_t} + u_t$$

$$\hat{R}=0.9921,\ \hat{S}=1.51$$

(3) Production function (Y)

$$Y_t = \underset{(0.0237)}{91.98 + 0.4057^{***}} \sum_{j=0}^{t-1} I_j^n + \underset{(0.720)}{3.977^{***}} G_t + u_t$$

$$\hat{R}=0.9903,\ \hat{S}=1.56$$

(4) Investment function (I)

$$I_t = \underset{(0.134)}{2.71 + 1.024^{***}} M_t + \underset{(0.0376)}{0.1159^{***}} (\Delta V)_t + u_t$$

$$\hat{R}=0.9689,\ \hat{S}=0.43$$

(5) Import function (M)

$$M_t = \blacktriangle 14.46 + \underset{(0.00260)}{0.01363^{***}} F_{t-1} + \underset{(0.0522)}{0.1066^{**}} (\Delta V)_t + \underset{(0.482)}{1.367^{***}} X_t + u_t$$

$\hat{R}=0.9102$, $\hat{S}=0.58$

(6) Export function (X)

$$X_t = 2.82 + \underset{(0.01589)}{0.08703^{***}} Y_t + \blacktriangle \underset{(0.00610)}{0.02010^{***}} P_t + u_t$$

$\hat{R}=0.9237$, $\hat{S}=0.20$

(7) Price level function (P)

$$P_t = \blacktriangle 116.62 + \underset{(1.113)}{2.309^{**}} H_t + \underset{(0.478)}{1.436^{***}} V_t + u_t$$

$\hat{R}=0.9500$, $\hat{S}=9.10$

(8) Currency supply function (H)

$$H_t = 6.87 + \underset{(0.0423)}{0.3174^{***}} \sum_{j=0}^{t-1} (G-R)_j + \underset{(0.1292)}{0.9525^{***}} (G-R)_t + u_t$$

$\hat{R}=0.9890$, $\hat{S}=0.76$

(9) Government non-military current expenditure function ($G_e - D_e$)

$$(G_e - D_e)_t = \blacktriangle 2.93 + \underset{(0.173)}{1.046^{***}} D_{e,t} + \underset{(0.2442)}{0.6308^{***}} R_{t-1} + u_t$$

$\hat{R}=0.9453$, $\hat{S}=0.89$

(10) Government revenue function (R)

$$R_t = 2.84 + \underset{(0.0975)}{0.4123^{***}} G_{e,t} + \underset{(0.3252)}{0.7149^{**}} M_t + \underset{(0.03917)}{0.05006^{*}} \sum_{j=0}^{t-1} (G-R)_j + u_t$$

$\hat{R}=0.9106$, $\hat{S}=0.74$

(11) Increase in GNP definitional equation (ΔV)

$$\Delta V_t = V_t - V_{t-1}$$

(12) Government expenditure definitional equation (G)

$$G_t = G_{e,t} + G_{i,t}$$

(13) Private investment definitional equation (I_p)

$$I_{p,t} = I_t - G_{i,t}$$

(The symbols denote as follows: $\sum I^n{}_j$, net capital stock after depreciation; F, foreign currency holdings; D_e, defense expenditure; $\hat{R}$, estimated value of multiple correlation coefficient; $\hat{S}$, estimated value of standard deviation of error terms.)

This model was estimated by the two-stage least square method with the good fit of each equation. The result of the final test was fairly favorable as indicated in Table 4. Except for private investments, the correlation coefficient between estimated values and actual values was more than 0.8, and the rate of errors was small, registering less than 2.4% in GNP. A relatively good fit was found for GNP, national income, private consumption, government revenue, government expenditure, exports, etc., while the fit was relatively poor for investments, imports, the currency supply, the price level, etc. A recursive analysis of this model is illustrated in Figure 3. A special feature of this model was that X, M, P, H, R are determined simultaneously and connections among the economic indicators in this period can be evaluated in full. First, production income, GNP and its increase, and current government

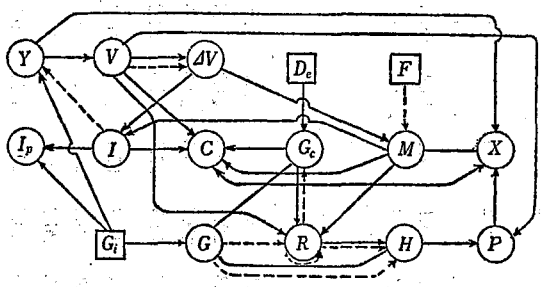
Table 4. Result of Final Test of ICU Model No. I for the Indonesian Economy

	C			V			Y			I			I_p			M		
1952	83.4	84.1	0.8	114.1	114.0	▲0.1	101.7	103.0	1.3	11.6	12.2	5.2	9.7	10.3	6.2	8.9	9.3	4.5
1953	87.0	86.3	▲0.8	119.4	117.8	▲1.3	108.4	106.6	▲1.7	11.2	10.5	▲ 6.3	9.6	8.9	▲ 7.3	8.1	7.2	▲11.1
1954	96.2	98.2	2.1	127.1	129.7	2.0	116.7	117.8	0.9	10.7	11.8	10.3	7.3	8.4	15.1	7.3	7.5	2.7
1955	103.1	103.1	—	130.7	131.8	0.8	120.3	119.8	▲0.4	10.5	10.2	▲ 2.9	7.7	7.4	▲ 3.9	7.2	7.1	▲ 1.4
1956	107.9	108.7	0.7	136.9	137.9	0.7	123.8	125.5	1.4	12.5	12.3	▲ 0.2	9.2	9.0	▲ 2.2	9.3	8.7	▲ 6.5
1957	117.7	112.0	▲4.8	145.9	144.2	▲1.2	133.5	131.4	▲1.6	14.1	11.9	▲15.6	10.4	8.2	▲21.2	9.3	8.3	▲10.8
1958	103.0	104.4	1.4	140.5	142.7	1.6	129.2	130.0	0.6	8.4	9.4	11.9	6.1	7.1	16.4	6.0	6.7	11.7
1959	104.7	101.6	▲3.0	146.7	143.2	▲2.4	130.9	130.5	▲0.3	9.7	9.5	▲ 2.1	8.0	7.8	▲ 2.5	5.8	6.6	13.8
Correlation Coefficient	0.9764			0.9843			0.9918			0.7288			0.6808			0.8805		
	X			P			H			C_c			G			R		
1952	10.4	10.4	—	77.6	66.7	▲14.0	8.7	8.5	2.3	17.5	16.6	▲5.1	19.5	18.5	▲5.1	15.8	16.2	2.5
1953	10.6	10.5	▲0.9	77.0	77.5	0.6	9.9	10.8	9.1	18.7	17.7	▲5.3	20.3	19.3	▲4.9	17.6	15.3	▲13.1
1954	11.3	11.1	▲1.8	78.7	98.5	25.2	13.9	12.5	▲10.1	16.2	16.1	▲0.6	19.6	19.5	▲0.5	14.5	15.1	4.1
1955	10.9	11.2	2.8	100.0	101.3	1.3	12.2	12.4	1.6	13.5	14.4	6.7	16.3	17.2	5.5	14.2	14.3	0.7
1956	11.4	11.5	0.9	113.3	110.1	▲ 2.8	11.8	12.4	5.1	14.4	14.1	▲2.1	17.7	17.4	▲1.7	16.3	15.5	▲ 4.9
1957	12.3	11.7	▲4.9	123.4	125.5	1.7	15.3	15.2	▲ 0.7	17.0	16.9	▲0.6	20.8	20.6	▲1.0	16.7	16.4	▲ 1.7
1958	11.2	11.4	1.8	134.6	134.8	0.1	21.8	20.1	▲ 7.8	24.0	24.2	0.8	26.2	26.5	1.1	17.3	18.5	6.9
1959	11.1	11.3	1.8	154.5	143.5	▲ 7.1	22.6	23.6	4.4	27.0	27.4	1.5	28.7	29.1	1.41	9.8	20.1	1.5
Correlation Coefficient	0.8677			0.9441			0.9810			0.9913			0.9890			0.8386		

Note: Figures in the left column of each variable indicate the actual value and those in the middle column interpolated value; those in the right column the rate of relative errors of interpolated value to actual value. Correlation coefficient is the relation between interpolated value and actual value.

expenditures are determined: then, imports, government revenues, currency supply, price level and exports are obtained simultaneously. Finally, investments and consumption are determined.

Figure 3. Flow Chart of ICU Model I for the Indonesian Economy



Note: → relations of this period; ⋯→ relations with a time-lag
○ endogenous variables; □ exogenous variables.

However, Model No. I was much too simple, as all three industrial sectors were lumped together. There was no explanatory equation for foreign currency holdings, and they were treated as an exogenous variable. For this reason, we decided to formulate a larger model, taking ICU Model No. I as the prototype.

ICU Model No. II was formulated with 30 equations. Structural equations are mentioned below. The estimation was made by a joint use of the interaction least square method and two-stage least square method. The results of the estimation are shown below, and the graph of recursive analysis is illustrated in Figure 4. The results of interpolation in the final test are shown in comparison with actual values. The rate of relative errors and the correlation coefficient between actual values and interpolated values in the final year are also shown for reference.

Econometric Model for the Indonesian Economy
(ICU Model No. II)

(1) Production function for primary industries (Y^{I})

$$Y^{I}_t = 55.91 + \underset{(0.0205)}{0.1736^{***}} \sum_{i=0}^{t-1} I_{p,\,i}{}^{n} + u_{1,\,t}$$

$\hat{R}=0.9545$, $\hat{S}=1.98$

(2) Production function for secondary industries (Y^{II})

$$Y^{II}_t = \blacktriangle 11.49 + \underset{(0.1027)}{0.3693^{***}} M_{r,\,t} + \underset{(0.0800)}{0.1558^{**}} I_{p,\,t}{}^{II} + \underset{(0.0913)}{0.2746^{***}} G_{i,\,t} + u_{2,\,t}$$

$\hat{R}=0.8888$, $\hat{S}=1.64$

(3) Production function for tertiary industries (Y^{III})

$$Y^{III}_t = 26.33 + \underset{(0.01746)}{0.07291^{***}} \sum_{i=0}^{t-1} I^{III}{}_{p,\,i} + \underset{(0.0543)}{0.2000^{***}} G_{i,\,t} + \underset{(0.0817)}{0.2947^{***}} (\Delta O_m)_t + u_{3,\,t}$$

$\hat{R}=0.9458$, $\hat{S}=1.13$

(4) GDP definitional equation (Y)

$$Y_t = Y^{I}_t + Y^{II}_t + Y^{III}_t$$

(5) GNP explanatory equation (V)

$$V_t = 4.15 + \underset{(0.108)}{1.066^{***}} Y_t + u_{5,t}$$

$\hat{R}=0.9657$, $\hat{S}=3.12$

(6) Private consumption expenditure definitional equation (C)

$$C_t \equiv V_t - I_t - G_{g,t} - (X_t - M_t)$$

(7) Primary industries investments function (I_p^{I})

$$I_{p,\,\mathrm{I}\,t} = \blacktriangle 7.11 + \underset{(0.2272)}{0.3719^{*}} M_{s,t} + \underset{(1.049)}{2.197^{**}} M_{rs,t} + \underset{(0.00956)}{0.03349^{***}} F_{t-1} + u_{7,t}$$

$\hat{R}=0.8473$, $\hat{S}=2.19$

(8) Secondary industries investment function (I_p^{II})

$$I_{p,\,\mathrm{II}\,t} = 30.18 + \underset{(0.01459)}{0.06509^{***}} F_{t-1} + \underset{(0.267)}{1.048^{***}} (\Delta O_m)_t + u_{8,t}$$

$\hat{R}=0.9156$, $\hat{S}=3.81$

(9) Tertiary industries investments function (I_p^{III})

$$I_{p,\,\mathrm{III}\,t} = \blacktriangle 8.76 + \underset{(0.0811)}{0.4385^{***}} G_{i,t} + \underset{(0.0764)}{0.1372^{*}} I_{p,\,t}^{\mathrm{II}} + u_{9,t}$$

$\hat{R}=0.8985$, $\hat{S}=1.69$

(10) Private investments definitional equation (I_p)

$$I_{p,t} \equiv I_{p,\,t}^{\mathrm{I}} + I_{p,\,t}^{\mathrm{II}} + I_{p,\,t}^{\mathrm{III}}$$

(11) Gross domestic capital formation definitional equation (I)

$$I_t \equiv I_{p,t} + G_{i,t}$$

(12) Mineral products export function (X_m)

$$X_{m,t} = \blacktriangle 7.75 + \underset{(0.1281)}{0.3591^{***}} G_{i,t} + \underset{(0.0509)}{0.1675^{***}} (O_m)_t + \underset{(0.1094)}{0.2577^{**}} I_{p\,\mathrm{II},\,t-1} + u_{12,t}$$

$\hat{R}=0.8832$, $\hat{S}=2.73$

(13) Other products export function (X_o)

$$X_{o,t} = 65.92 + \underset{(0.1006)}{0.3957^{***}} (\Delta G_i)_t + \underset{(0.0535)}{0.1078^{**}} P_{x,t} + u_{13,t}$$

$\hat{R}=0.9010$, $\hat{S}=2.34$

(14) Total exports definitional equation (X)

$$X_t \equiv X_{m,t} + X_{o,t}$$

(15) Investment goods import function (M_s)

$$M_{s,t} = \blacktriangle 1.58 + \underset{(0.0849)}{0.3211^{***}} G_{i,t} + \underset{(0.00703)}{0.03727^{***}} F_{t-1} + u_{15,t}$$

$\hat{R}=0.9081$, $\hat{S}=1.74$

(16) Function for imported raw materials for consumpion (M_{rc})

$$M_{rc,t} = 55.55 + \blacktriangle \underset{(0.0722)}{0.3176^{***}} D_{g,t-1} + \blacktriangle \underset{(0.0526)}{0.1629^{***}} P_{m,t} + u_{16,t}$$

$\hat{R}=0.8829$, $\hat{S}=2.68$

(17) Function for imported raw materials for investment (M_{rs})

$$M_{rs,t} = 0.82 + \underset{(0.02228)}{0.07026^{***}} G_{i,t} + \underset{(0.000987)}{0.001791^{*}} \sum_{i=0}^{t-1} I_{p,\,ni} + \underset{(0.0339)}{0.1022^{***}} (\Delta O_m)_t + u_{17,t}$$

$\hat{R}=0.8871$, $\hat{S}=0.48$

(18) Consumer goods (food) import function (M_{cf})

$$M_{cf,t}=\underset{(0.01498)}{\blacktriangle 84.69}+\underset{(0.03300)}{0.09293^{***}}N_t+u_{18,t}$$

$$\hat{R}=0.8742,\ \hat{S}=2.94$$

(19) Consumer goods (others) import function (M_{co})

$$M_{co,t}=\underset{(0.00526)}{\blacktriangle 1.17}+\underset{(0.0635)}{0.1954^{***}}G_{i,t}+u_{19,t}$$

$$\hat{R}=0.8736,\ \hat{S}=1.30$$

(20) Total imports definitional equation (M)

$$M_t=M_{s,t}+M_{rs,t}+M_{rc,t}+M_{cf,t}+M_{co,t}$$

(21) Foreign currency holdings definitional equation (F)

$$F_t=\frac{1}{11.48}\{P_{x,t}X_t-P_{m,t}M_t\}+W_t+F_{t-1}$$

(22) Government non-military current expenditure function (G_c)

$$G_{c,t}-D_{e,t}=\underset{(0.182)}{\blacktriangle 28.32}+\underset{(0.2598)}{1.049^{***}}D_{e,t}+0.6237^{**}R_{t-1}+u_{22,t}$$

$$\hat{R}=0.9406,\ \hat{S}=9.33$$

(23) Government expenditure definitional equation (G)

$$G_t=G_{c,t}+G_{i,t}$$

(24) Increase in government investments definitional equation (ΔG_i)

$$\Delta G_{i,t}=G_{i,t}-G_{i,t-1}$$

(25) Indirect tax receipts function (T_i)

$$T_{i,t}=\underset{(0.270)}{3.31}+\underset{(0.270)}{1.026^{***}}M_t+\underset{(7.74)}{57.42^{***}}Q_t+u_{25,t}$$

$$\hat{R}=0.9434,\ \hat{S}=5.57$$

(26) Direct tax receipts function (T_d)

$$T_{d,t}=\underset{(0.01738)}{\blacktriangle 0.19}+\underset{(0.0453)}{0.07453^{***}}G_{c,t}+\underset{(0.0453)}{0.1423^{***}}Y_{t-1}+u_{26,t}$$

$$\hat{R}=0.9182,\ \hat{S}=1.47$$

(27) Other government revenue function (R_o)

$$R_{o,t}=\underset{(0.1156)}{\blacktriangle 50.10}+\underset{(0.671)}{0.2942^{***}}I_{t-1}+\underset{(0.0554)}{2.131^{***}}M_{s,t-1}+\underset{(0.0554)}{0.1822^{***}}G_{c,t-1}+u_{27,t}$$

$$\hat{R}=0.9389,\ \hat{S}=3.99$$

(28) Government revenue definitional equation (R)

$$R_t=T_{i,t}+T_{d,t}+R_{o,t}$$

(29) Currency supply function (H)

$$H_t=\underset{(0.1042)}{70.03}+\underset{(0.1042)}{0.9091^{***}}(G_t-R_t)+\underset{(0.0355)}{0.3278^{***}}\sum_{i=0}^{t-1}(G_i-R_i)+u_{29,t}$$

$$\hat{R}=0.9920,\ \hat{S}=6.53$$

(30) Price level function (P)

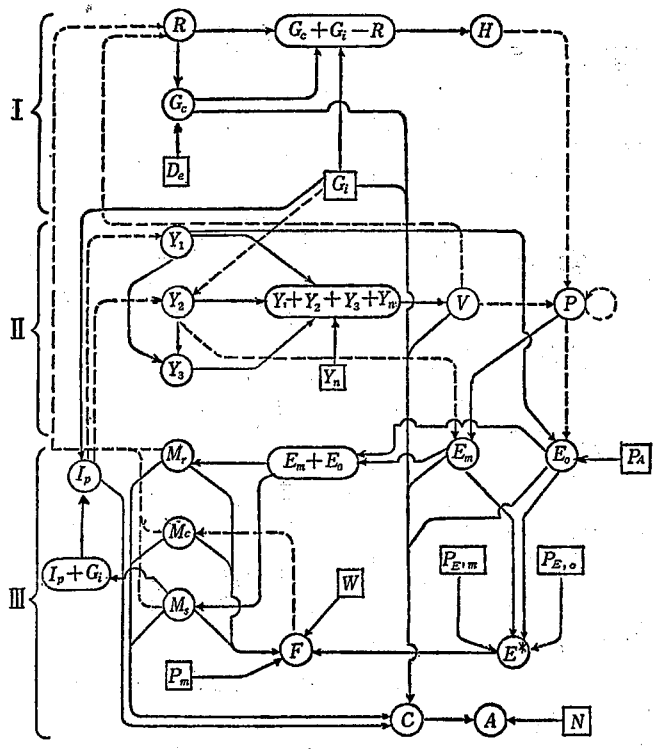
$$P_t=\underset{(0.0866)}{\blacktriangle 96.06}+\underset{(0.0866)}{0.3321^{***}}H_t+\underset{(0.383)}{1.170^{***}}V_t+u_{30,t}$$

$$\hat{R}=0.9506,\ \hat{S}=9.04$$

(The symbols denote as follows: $\hat{R}$, estimated value of multiple correlation coefficient; $\hat{S}$, estimated value of standard deviation of error terms; *, signi-

ficant at 10 percent level; **, significant at 5 percent level; ***, significant at 1 percent level; G_i, government investments; O_m, production index of mining; P_x, export prices; D_e, defense expenditure; P_m, imports prices; N, total population; Q, dummy variables.)

Figure 4. Flow Chart in This Period



Note: □ predominated variables; ○ jointly dependent variables.

As regards structural equations now obtained, the relative errors ratios in the final year were mostly less than 8% (Y^{I}, Y^{III}, Y, V, T_i, T_d, R, G_c, G, H, P, M_{rs}, M_{rc}, M_{ef}, M, X_o, X), and even those terms which registered the relative errors ratios of more than 8% showed good fit during the period under survey. The correlation coefficient between actual value was over 8% with only one exception (M_{ef}).

The main structural equations will be examined below.

(A) Production function (Y^{I}, Y^{II}, Y^{III})

$$Y^{I}=55.91+0.1736^{***}\sum^{-1} I_p^{In}+u$$

$$Y^{II}=\blacktriangle 8.65+0.3821^{***}M_r+0.1122^{*}I_p^{II}+0.2209^{**}G_{i,-1}+u$$

$$Y^{III}=26.33+0.07291^{***}(\sum^{-1} I_p^{IIIn}+I_p^{III})+0.2000^{***}G_i+0.2947^{***}(\Delta O_m)+u$$

In ECAFE Model No. II, Y^{I} was explained by $\sum_{j=0}^{t-1} I_{p,j}$, Y^{II} by M_r and $\sum_{j=0}^{t-1}(I_p+G_i)_j$ and Y^{III} by $(Y^{I}+Y^{II})$; private investment was not classified by

Table 5. Results of Final Test for ICU Model No. II for the Indonesian Economy

	N[4]	O_m	P_x	P_m	D_e	G_i	W[5]	$\bar{\Sigma}^1 I_p{}^{In}$	$\bar{\Sigma}^1 I_p{}^{IIn}$	$\bar{\Sigma}^1 I_p{}^{IIIn}$	$\bar{\Sigma}^1 I_p{}^{n}$	Y^I[2]	
1952	803.3	79	122	123	39.1	19.3	▲ 428	13.3	51.0	4.0	68.3	58.8	58.2
1953	819.7	90	88	105	50.6	16.4	▲ 294	34.4	122.4	13.6	170.4	61.3	61.9
1954	836.8	95	99	87	46.1	33.7	▲ 501	49.9	178.5	19.8	248.2	66.3	64.6
1955	854.4	100	100	100	39.4	28.1	▲ 311	61.1	223.3	32.1	316.5	67.6	66.5
1956	872.7	105	89	72	38.7	32.7	▲ 301	73.7	268.3	41.8	383.8	67.2	68.7
1957	891.6	123	71	68	49.0	37.4	▲ 266	87.5	313.9	53.4	454.8	68.7	71.1
1958	911.2	126	64	79	82.4	22.9	▲ 158	107.5	375.2	69.1	551.8	78.4	74.6
1959	931.5	141	91	71	91.1	16.9	▲ 400	118.9	411.0	74.7	604.6	76.1	76.6
Rate of Errors (%)[1]	—	—	—	—	—	—	—	—	—	—	—	0.6	
Correlation Coefficient[3]	—	—	—	—	—	—	—	—	—	—	—	0.9553	

	Y^{II}		Y^{III}		Y		V		T_i		T_d		R_o	
1952	10.9	11.9	32.0	33.8	101.7	103.9	114.1	115.1	93.0	90.4	23.5	24.8	41.3	38.4
1953	11.9	13.6	35.2	34.3	108.4	109.8	119.4	121.3	83.2	69.7	26.1	26.9	67.2	66.4
1954	12.2	11.8	38.2	36.9	116.7	113.3	127.1	125.0	69.3	73.0	30.7	28.2	45.5	39.6
1955	16.5	15.5	36.2	36.5	120.3	118.5	130.7	130.5	67.8	73.8	30.9	28.4	43.6	49.9
1956	18.1	17.2	38.5	38.3	123.8	124.2	136.9	136.5	93.1	86.8	27.6	27.1	42.3	41.6
1957	21.5	21.1	43.3	44.3	133.5	136.5	145.9	149.5	83.7	98.5	28.1	28.4	54.9	51.2
1958	14.4	16.7	36.4	37.4	129.2	128.7	140.5	141.3	73.8	73.6	29.7	31.8	69.5	72.3
1959	13.9	11.5	40.9	40.1	130.9	128.2	146.7	140.7	119.2	115.9	35.9	36.9	42.8	51.6
Rate of Errors (%)[1]	▲17.1		▲ 1.9		▲ 2.0		▲ 4.1		▲ 2.8		2.9		20.6	
Correlation Coefficient[3]	0.9009		0.9494		0.9781		0.9705		0.8662		0.8935		0.9117	

N, Total population; O_m, Production index of mining; P_x, Export prices; P_m, Import prices; D_e, Defence expenditure; G_i, Government investments; W, Net foreign savings or net capital inflow from abroad; $\bar{\Sigma}^1 I_{p\ In}$, Accumulated investments in primary industry; $\bar{\Sigma}^1 I_{p\ IIn}$, Accumulated investments in secondary industry; $\bar{\Sigma}^1 I_{p\ IIIn}$, Accumulated investments in tertiary industry; $\bar{\Sigma}^1 I_p{}^n$, Accumulated private investments; Y^I, Income of primary industry; Y^{II}, Income of secondary industry; Y^{III}, Income of tertiary industry; Y, National income; V, Gross national product; T_i, Receipts of indirect taxes; T_d, Receipts of direct taxes; R_o, Other receipts.

	R		G_c		G		H		P		M_s		M_{rs}	
1952	157.8	153.6	175.3	165.7	194.6	185.0	86.6	92.8	77.6	69.4	22.3	23.7	2.9	3.2
1953	176.5	163.0	187.0	171.2	203.4	187.6	99.3	96.5	77.0	77.9	17.4	14.0	3.4	3.4
1954	145.5	140.8	161.9	167.8	195.6	201.5	139.3	138.3	78.7	96.1	16.0	17.7	4.0	4.1
1955	142.3	152.1	135.1	140.2	163.2	168.3	122.3	116.1	100.0	95.2	15.8	16.8	4.6	3.9
1956	163.0	155.5	144.0	145.8	176.7	178.5	118.2	127.7	113.3	106.1	22.9	19.4	4.7	4.3
1957	166.7	178.1	170.1	169.1	207.5	206.5	153.3	140.2	123.4	125.6	20.3	22.8	5.8	6.1
1958	173.0	177.7	239.5	251.6	262.4	274.5	217.7	213.6	134.6	140.2	11.7	13.7	3.0	3.7
1959	197.9	204.4	270.2	269.2	287.1	286.1	225.8	230.5	154.5	145.0	12.8	10.9	5.0	4.6
Rate of Errors (%)[1]	3.2		▲ 0.4		▲ 0.4		2.0		▲ 6.2		▲14.9		▲ 8.0	
Correlation Coefficient[3]	0.8953		0.9828		0.9804		0.9897		0.9508		0.8366		0.8941	

	M_{rc}		M_{cf}		M_{co}		M		X_m		X_o		X	
1952	17.0	19.5	25.6	26.3	13.7	13.9	81.5	86.6	29.3	25.6	76.6	80.1	103.9	105.7
1953	28.3	26.0	12.8	11.2	7.5	7.9	69.2	62.5	32.4	32.0	75.2	74.3	107.6	106.3
1954	25.4	25.3	10.7	9.2	7.2	10.1	63.2	66.4	33.1	35.7	84.7	83.4	117.8	119.1
1955	27.6	24.6	7.6	12.5	10.9	9.5	66.2	67.3	31.0	32.0	77.7	74.5	108.7	106.5
1956	33.0	31.3	22.9	16.3	12.8	11.1	96.2	82.4	34.3	34.9	75.6	77.3	109.9	112.2
1957	31.8	32.2	16.8	21.7	11.8	13.2	86.9	96.0	46.3	40.1	75.0	75.4	121.3	115.5
1958	21.9	27.1	16.9	15.0	8.4	7.6	62.0	67.1	38.7	39.8	64.9	67.1	103.6	106.9
1959	19.1	17.8	14.9	15.2	7.2	5.9	59.1	54.4	31.4	34.1	75.7	73.4	107.1	107.5
Rate of Errors (%)[1]	▲ 6.6		2.0		▲18.0		▲ 7.9		8.6		▲ 3.0		0.4	
Correlation Coefficient[3]	0.8823		0.7891		0.8298		0.8480		0.8714		0.9012		0.8900	

R, Total government revenue; G_c, Government current expenditure; G, Government expenditure; H, Currency supply; P, Price level; M_s, Import of investment goods; M_{rs}, Imports of raw materials for investments; M_{rc}, Imports of raw materials for consumption; M_{cf}, Imports of food; M_{co}, Imports of other consumer goods; M, Total imports; X_m, Exports of mineral products; X_o, Exports of other products; X, Total exports.

Notes: (1) Rate of errors in the final year=(interpolated value—actual value)÷actual value.
(2) Items with figures in two columns are endogenous variables; figures in the left column indicate actual value and those in the right column interpolated value.
(3) Correlation coefficient between actual value and interpolated value.
(4) In case when figures are indicated in one column, they are predominated variables, indicating actual values.
(5) W is treated as exogenous variable.

industrial sectors and was used as an explanatory variable in the production functions of primary and secondary industries. It was explained that this was attributed to a lack of industrial investment statistics. The new model, we believe, made a significant step forward in that it can evaluate investment by industries. As a result, tertiary industry was explained by an original explanatory variable of income, but not through a market equation. In the ECAFE Models the structural parameters of the investment function was not significant, while significant parameters were obtained both for the private and government investment functions. The finding that imports of raw materials constitute a principal factor for short-term fluctuation in the output of secondary industry through changes in the rate of operation was also observed in the present case.

For reference: ECAFE Model No. II

$$Y^{I}=57.52+0.2854^{***}\sum_{j=0}^{t-1} I_{p,\,j}+u$$

$$Y^{II}=\blacktriangle 4.52+5.293^{***}M_r+0.04313\sum_{j=0}^{t-1}(I_p+G_i)_j+u$$

$$Y^{III}=11.52+0.3221^{*}(Y^{I}+Y^{II})_t+u$$

(B) Investment Function (I_p^{I}, I_p^{II}, I_p^{III})

$$I_p^{I}=\blacktriangle 9.11+0.3719^{*}M_{s,\,-1}+2.197^{**}M_{rs}+0.03349^{***}F_{-1}+u$$

$$I_p^{II}=30.18+0.06509^{***}F_{-1}+1.048^{***}(\Delta O_m)+u$$

$$I_p^{III}=\blacktriangle 8.76+0.4385^{***}G_i+0.1372^{*}I_p^{II}+u$$

For reference: ECAFE Model No. II

$$(I_p+G_i)=1.51+2.853^{***}M_s+u$$

As in the case of ECAFE Models, an estimation was made to examine the importance of the influences of imports of investment goods and raw materials on investments and further of foreign currency holdings upon capital formation. Investment in tertiary industry was explained in connection with investment in secondary industry and public investment. In manufacturing industry, the increase in production of mineral products (ΔO_m) was added in explanatory variables as an indicator of the tendency of demand. Consequently, on the whole, investment functions were divided by industries, and the analysis can be said to have become more detailed by the use of explanatory variables of various kinds.

(C) Government Revenue and Expenditure

$$T_i=15.88+0.8609^{***}M+53.22^{***}Q+u$$

$$T_d=\blacktriangle 0.19+0.07453^{***}G_{i,\,-1}+0.1423^{***}Y_{-1}+u$$

$$R_o=\blacktriangle 50.60+0.2942^{***}I_{-1}+2.131^{***}M_{s,\,-1}+0.1822^{*}G_{c,\,-1}+u$$

$$R=T_i+T_d+R_o$$

$$(G_c-D_e)=\blacktriangle 28.32+1.049^{***}D_e+0.6237R_{-1}+u$$

$$G=G_c+G_i$$

In the present case, government revenues were divided into three parts; indirect taxes (T_i), direct taxes (T_d), and other revenues (R_o). Therefore, the analysis was improved compared with a single government revenue function (the fit was not good) in the ECAFE Models. Indirect taxes were explained

by imports, and dummy variables. The improvement in the fit of equation (25) by the addition of a dummy variable is to be expected because the tax system underwent a change during the period under observation, i. e., functioned as an exogenous change in the structural determinants of the equation (25). As for direct taxes, government investment was used as an indicator of income at tax sources and the degree of urgency of the assessment. Current government non-military expenditures were explained by the military expenditures, and government receipts, etc. In comparison with the ECAFE Models, this model is advantageous in analyzing in more detail the balance of government finance through estimation of functions of revenues by leading sources.

For reference: ECAFE Model No. II

$$R=2.71+0.09358(V+M_r+M_c+M_s)_{-1}+u$$

$$(G_c-D_e)=\blacktriangle 11.76+1.500^{***}R+u$$

(D) Inflation (H, P)

$$H=69.22+0.9392^{***}(G-R)+0.3220^{***}\sum_{j=0}^{-1}(G-R)_j+u$$

$$P=\blacktriangle 96.98+0.3303^{***}H+1.179^{***}V+u$$

As in the case of ECAFE Models, the currency supply was explained by deficits in government finance; the price level, by the relationship between the currency supply and GNP. GNP registered "positive" coefficient to the price level, and this may be attributed to a sharp increase in the velocity of circulation. In the ECAFE Models, the currency supply which is regarded as a stock variable was explained by government deficits in this period which is a flow variable.

For reference: ECAFE Model No. II

$$H=71.97+10.63^{***}(G_c+G_i-R)+u$$

$$P=55.84+0.4899^{***}\left(\frac{V_{1955}}{H_{1955}\,P_{1955}}\times\frac{H\cdot P}{V}\times 100\right)_{-1}+u$$

(E) Exports (X_m, X_o, X)

$$X_m=\blacktriangle 7.75+0.3591^{***}G_i+0.1675^{***}(\Delta O_m)+0.2577^{**}I_p^{II}{}_{-1}+u$$

$$X_o=65.92+0.3957^{***}(\Delta G_i)+0.1078^{**}P_x+u$$

$$X=X_m+X_o$$

For reference: ECAFE Model No. II

$$E_m=1.76+0.1548^{***}Y^{II}{}_{2,\,-1}+1.867\left(\Delta\frac{P_{E,\,m}}{P}\right)+u$$

$$E_o=6.84+0.02630(\Delta Y^{I})+0.5465\left(\frac{P_A}{P}\right)+u$$

$$E=E_m+E_o$$

(F) Imports (M_s, M_{rc}, M_{rs}, M_{cf}, M_{co}, M)

$$M_s=\blacktriangle 1.58+0.3211^{***}G_i+0.03727^{***}F_{-1}+u$$

$$M_{rc}=55.55+\blacktriangle 0.3176^{***}D_{e,\,-1}+\blacktriangle 0.1629^{***}P_m+u$$

$$M_{rs}=0.82+0.07026^{***}G_i+0.001791\sum_{j=0}^{-1}I_j^{pn}+0.1022^{***}(\Delta O_m)+u$$

$$M_{cf}=\blacktriangle 84.69+0.07102^{***}F_{-1}+0.09293^{***}N+u$$

$$M_{co}=\blacktriangle 1.77+0.02321^{***}F_{-1}+0.1954^{***}G_i+u$$

$$M=M_s+M_{rc}+M_{rs}+M_{cf}+M_{co}$$

In the case of ECAFE Models, both X_m and X_o were explained by indicators of supply capacity and of relative differences in prices, but functions could not be said to have been significant. In this Model, exports of mineral products (X_m) were explained mainly by indicators of supply (the production index for mining industry, private capital formation in the secondary industry, and public investments). However, we could not obtain any significant indicators of prices. Exports of other items (X_o) were the function of exports prices and increased public investment. The reason why the coefficient of export price (P_x) is positive is that there was buyers' market. We hypothesized that inflation causes a decline in exports and attempted to measure empirically the relationship between the two, but our hypothesis was not demonstrated through this study, and has remained unproven since the ECAFE Models were formulated. We reached the conclusion that, judging from the results of previous studies and current research, there is a minimal influence of inflation on exports in Indonesia. The reason for this is the dual structure of the Indonesian economy which caused marked price rise in major cities and a slight rise in other areas of the country.

In comparison with the three-part division (imports of investment goods, imports of consumer goods, and imports of raw materials) in the ECAFE Models, the new model divided these components into five parts: imports of investment goods, of raw materials for consumption, of raw materials for investments, of food and of other consumer goods. Foreign currency holdings performed well vis-à-vis imports of consumer goods as was the case with the ECAFE Models. In explaining imports of raw materials for investments, consideration was given to the various sources of demand, using government investments, private stocks[9] and mining production.

For reference: ECAFE Model No. II

$$M_s=\blacktriangle 5.95+0.8324(E_m+E_o)+u$$

$$M_c=2.05+0.01\overset{**}{1}37F_{-1}+u$$

$$M_r=\blacktriangle 2.94+0.6288(E_m+E_o)+0.001002(\overset{*}{\Delta E})_{-1}+u$$

$$M=M_s+M_c+M_r$$

(G) Others (capital balance, W)

$$W=206.41+\blacktriangle 9.\overset{***}{3}79D_{e,-1}+48.\overset{***}{1}7t+\blacktriangle 9.\overset{***}{3}87G_i+u$$

The external balance of capital flow was treated as an exogenous variable in the ECAFE Models, but we treated it endogenously in this model.

Facts to be observed from estimated results of the above-mentioned economic model of Indonesia are as follows:

(1) Existence of a vicious circle; namely: stagnant capital formation ⟶ stagnant production and exports ⟶ low level of foreign currency holdings ⟶low level of imports⟶stagnant capital formation ($I_p^{II}\downarrow\rightarrow X_m\downarrow\rightarrow F\downarrow\rightarrow I_p^{II}\downarrow$).

9 I chose capital stock as an explanatory variable because imports of parts for making up depreciation is largely due to the volume of capital stock accumulated by the previous year.

(2) The vicious circle results in a low level of imports, real income, and capital stocks which in turn results in a reduction in government revenues. On the other hand, current government consumption expenditures increase mainly due to larger defense expenditures. Government finance tends to show chronic deficits, and this is a main factor contributing to inflation; ($Y\downarrow \rightarrow T_d\downarrow$ and from $M\downarrow \rightarrow T_i\downarrow$ to $R\downarrow$; on the other hand, $D_e\uparrow \rightarrow G_c\uparrow$, $(G-R)\uparrow \rightarrow H\uparrow \rightarrow P\uparrow$).

The vicious circle and deficit spending of the government are reasons why the Indonesian living standard has failed to rise. A simulation analysis on this aspect will be made below.

III. SIMULATION ANALYSES

1. Results of Forecasting for the Period up to 1970

Results of forecasting for the period up to 1970, using the above-mentioned models, will be described below. For the convenience of comparison, the results of long-term forecasting used various models as shown in Table 6. For economic forecasting, the method of extrapolating exogenous variables, the designation of initial conditions, and the estimation of parameters anticipated to change in the future are important.

(1) In the case of ECAFE Model No. I, because marginal propensity to import was "negative," and the marginal propensity to consume was greater than unity, the use of these unusual coefficients for long-term extrapolation during the period of observation was considered inadvisable. Therefore, the average propensity to consume of 0.924 and the average propensity to import of 0.0641 were employed. The estimated value of average growth rate of GNP for the period up to 1970 was about 2.5%.

(2) In the model analysis by the Institute of Asian Economic Affairs, a similar procedure was adopted to get an average rate of growth for import by eliminating the unusual tendencies in the 1950's. Two propensities to consume (government and private) were calculated by the estimation of two consumption functions. For exports and imports, the result of special analyses of the trade matrix was utilized. The marginal capital coefficient ranged from 2.51 to 2.70. The average growth rate was estimated at 2.65–2.29% for the period up to 1970.

(3) In ECAFE Model No. II, exogenous variables and constant terms in each equation were designated as data variables; and (a) G_c, G_i, G_e and R (economic policies), (b) H (financial policy), (c) M_r, M_c, and M_s (import restriction policy), (d) P_M, $P_{E,O}$, $P_{E,M}$ (as the parameters standing for changes in foreign exchange rate), (e) W (as new grant induction policy) a total of 12 variables were designated as policy variables. Among these variables, those which were estimated by the mean value for the past or by the extension of trend were N, Y_n, P_A, P_M, $P_{E,O}$, $P_{E,M}$, W, etc. Equations for Y_2 and R were revised, and the values for G_i and D_e were fixed by new treatments. These specifications can be summarized as follows: (i) The government will be successful in the revision of the taxation system from 1960 as was announced at Dekon; (ii)

Table 6. Comparison of Forecastings by Various Indonesian Economic Models (GNP)

Name of Models	Details on Forecasting	1960	1970	1980	1970 1) / 1960	1980 1) / 1970	Unit	Base Year of Prices
ECAFE Model No. I	Consumption and Import Functions Revised	230.4	295.5	346.7	1.2826 (2.52%)	1.1733	Rs. 1,000 million	1959
Institute of Asian Economic Affairs Model	k=2.51	4,446	5,779	8,572	1.2998 (2.65%)	1.4833	$ 1 million	1960
	k=2.70	4,446	5,575	8,053	1.2539 (2.29%)	1.4445		
ECAFE Model No. II	Strong Efforts for Development, and a Favorable Turn of International Environments Assumed	142.5	192.8	—	1.3529 (3.07%)	—	Rs. 1,000 million	1955
ICU Model No. I	Some Weak Efforts for Development Assumed	148.8	190.0	—	1.2769 (2.48%)	—	Rs. 1,000 million	1955
ICU Model No. II	Forecasting Adopted	141.5	179.7	—	1.2699 (2.42%)	—		
	Tentative Computation (I)	141.5	175.7	—	1.2417 (2.19%)	—		
	Tentative Computation (II)	141.5	177.7	—	1.2558 (2.30%)	—	Rs. 1,000 million	1955
	Tentative Computation (III)	141.5	191.8	—	1.3555 (3.09%)	—		
	Tentative Computation (IV)	135.9	161.0	—	1.1847 (1.71%)	—		

Note: Details of models and their origins show 1 and 2 of Section II. 1) Figures in parentheses indicate the average growth rate. Tentative computation IV is the case when D_e decline and G_i remains on the same level; tentative computation I and II are the case when both D_e and G_i increase; tentative computation III is the case when both D_e and G_i register a high growth rate. These are test computations for reference.

defense expenditures will not be increased from 1963; (iii) the government will increase investments after 1960, even if Treasury accounts register deficits; (iv) import policy will not be altered, no new import restriction measures will be adopted; (v) from 1960 the government will succeed in pegging export prices, while on the other hand, import prices in dollar terms will decline; (vi) the government will succeed in realizing a larger scale capital inflow; (vii) international prices of agricultural products will remain stationary at the 1960 level. Assuming favorable overseas environments and government efforts for economic development, the growth rate for the period up to 1970 is estimated at 3.1%.

(4) In ICU Model No. I, the equations were revised, the values of M, X, P were adjusted to the 1960 data and economic forecasting was made on the conditions that accumulated deficits in the government finance will not exceed the value of GNP in 1970, that government expenditures will not exceed 40% of GNP, and that private capital will not show an extreme decrease until 1970. As for the three exogenous variables, D_e is assumed to increase until 1966 and is fixed at 17 billion rupees after 1966, and G_i to increase 300 million rupees a year until 1969 and 200 million rupees in 1970; W is held constant at the mean of the past magnitude; P_X and P_M are fixed at 75 and 93, respectively. In ICU Model No. I, efforts at economic development by the government are anticipated to be slightly weaker than in ECAFE Model No. II, and the average growth of GNP is estimated at 2.48%.

The results of forecasts done by ICU Model No. II are shown in Table 6 in comparison with the forecasts by other models, and representative cases are shown in Table 7. The initial conditions for forecasting, as well as the specification of structural changes and the estimation of exogenous variables are mentioned below. (1) The estimated values for 1960 were compared with the actual values, and the constant terms were shifted to eliminate large observation errors, in those equations which showed considerably large difference from actual values. The revisions were made in the following eleven terms (figures in parentheses indicate new constant terms). M_s (▲2.78), M_{rc} (73.26), M_{co} (▲0.62), X_o (58.52), T_d (4.63), H (90.95), M_{rs} (▲0.03), M_{rf} (▲85.63), X_m (▲5.61), T_i (27.34), R_o (▲44.02). (2) As in the case of ICU Model No. I, while preventing the accumulations of deficits in the government finance and a sharp decline in private investments, D_e is estimated at 16 billion rupees a year from 1964, and G_i is estimated to increase by 400 million rupees a year during the period between 1963 and 1966 and by 300 million rupees a year from 1967; P_X and P_M are fixed and W is treated as an endogenous variable. Thus, somewhat strong efforts for economic development are presumed as compared with the Model No. I. (a) As is clear from Table 7, the growth rate is 2.42% for GNP, 2.02% for the population and 1.13% for private consumption. The standard of living cannot be expected to improve significantly by development efforts of this magnitude (for a more precise meaning of the living standard, see "Results of Policy Simulation" to be explained in the next paragraph). (b) Shares of each industry in GNP during the forecasting

Table 7. Results of the Forecasting for the Period Until 1970

	N	O_{min}	P_x	P_m	D_e	G_i	$\overset{-1}{\Sigma} I_p^{\mathrm{I}n}$	$\overset{-1}{\Sigma} I_p^{\mathrm{II}n}$	$\overset{-1}{\Sigma} I_p^{\mathrm{III}n}$	$\overset{-1}{\Sigma} I_p^{r}$	Y^{I}	Y^{II}	Y^{III}	Y	V	M_s	M_{rs}	M_{rc}	M_{cf}	M_{co}	M_r	M_c	M
1960	952.6	145	69	107	109.5	21.8	127.5	456.9	79.8	663.7	78.0	12.6	38.3	128.9	141.5	15.4	3.1	26.9	24.2	10.6	30.0	34.8	80.2
1961	974.5	153	58	84	118.0	38.0	135.7	497.1	85.6	718.4	79.5	14.2	43.7	137.4	150.4	22.1	4.7	24.8	29.0	14.7	29.5	43.7	95.3
1962	997.2	162	73	87	145.0	33.0	152.4	542.8	99.2	794.4	82.4	15.2	43.7	141.3	154.6	13.0	4.6	21.6	16.9	9.1	26.2	26.0	65.2
1963	1,027.7	170	67	93	150.0	40.0	161.7	595.2	108.6	845.5	84.0	10.5	45.7	140.2	153.4	15.1	5.1	12.1	18.8	10.3	17.2	29.1	61.4
1964	1,034.0	179	66	88	160.0	44.0	168.3	605.3	120.6	894.2	85.1	11.8	49.8	144.7	158.1	15.1	5.6	11.3	17.7	10.3	16.9	28.0	60.0
1965	1,053.8	187	69	89	160.0	48.0	175.5	633.3	133.9	942.7	86.4	11.1	49.4	146.9	160.5	15.0	5.8	7.9	16.8	10.2	13.7	27.0	55.7
1966	1,073.5	195	67	90	160.0	48.0	181.6	657.0	148.0	986.6	87.4	11.7	50.4	149.5	163.2	13.4	5.9	7.8	15.6	9.2	13.7	24.8	51.9
1967	1,093.3	204	67	89	160.0	53.0	186.3	677.2	161.4	1,024.9	88.3	12.0	52.8	153.1	167.0	15.0	6.4	7.9	17.4	10.2	14.3	27.6	56.9
1968	1,113.0	212	68	89	160.0	57.0	191.3	697.8	176.7	1,065.8	89.1	13.1	54.6	156.8	170.9	16.0	6.7	7.9	18.8	10.8	14.6	29.6	60.2
1969	1,132.8	220	67	89	160.0	60.0	197.3	716.4	193.1	1,106.8	90.2	14.1	56.4	160.7	175.0	17.2	7.0	7.9	21.1	11.6	14.9	32.7	64.8
1970	1,152.5	229	67	89	160.0	63.0	204.3	734.8	210.3	1,149.4	91.4	15.0	58.7	165.1	179.7	17.8	7.4	7.9	22.1	11.9	15.3	34.0	67.1

	X_m	X_o	X	I_p^{I}	I_p^{II}	I_p^{III}	I_p	I	T_i	T_d	R_o	R	G_c	G	$G-R$	$\overset{-1}{\Sigma}(G-R)$	H	P	F	W	Ω	C
1960	41.3	67.9	109.2	12.5	53.9	8.2	74.6	96.4	149.6	43.4	61.0	254.0	272.6	294.4	40.4	349.4	241.4	198.1	339	130	▲91	101.7
1961	47.6	71.2	118.8	20.8	60.6	16.2	97.6	135.6	162.6	43.3	66.8	272.7	325.0	363.0	90.3	389.8	301.3	240.4	139	▲103	▲97	101.9
1962	49.0	64.4	113.4	13.9	48.7	12.4	75.0	108.0	136.7	48.4	102.2	287.3	392.0	425.0	137.7	480.1	374.9	284.5	135	▲231	227	99.8
1963	49.8	68.5	118.3	11.5	47.4	15.3	74.2	114.2	133.4	54.0	86.9	274.3	411.3	451.3	177.0	617.8	456.1	326.2	100	▲228	193	95.2
1964	52.4	67.2	119.6	12.2	46.1	16.9	75.2	119.2	132.2	55.2	96.7	284.1	423.7	467.7	183.6	794.8	519.3	365.3	64	▲264	228	97.8
1965	54.8	67.5	122.3	11.4	42.7	18.1	72.2	120.2	128.5	56.8	100.4	285.7	429.8	477.8	192.1	978.4	586.4	403.8	20	▲347	303	98.9
1966	55.3	65.7	121.0	10.1	39.9	17.8	67.8	115.8	125.2	57.6	101.6	284.4	430.8	478.8	194.4	1,170.5	650.4	441.0	20	▲299	299	101.6
1967	57.9	67.7	125.6	10.6	40.9	20.1	71.6	124.6	129.5	58.0	97.1	284.6	430.0	483.0	198.4	1,364.9	716.8	480.7	14	▲298	292	104.6
1968	60.9	67.4	128.3	11.7	39.5	21.7	72.9	129.9	133.0	58.5	102.9	294.4	430.1	487.1	192.7	1,563.3	775.3	516.4	20	▲287	293	108.1
1969	63.0	66.9	129.9	12.9	39.9	23.0	75.8	135.8	136.3	59.0	106.7	302.0	436.3	496.3	194.3	1,756.0	838.9	555.1	9	▲267	256	111.3
1970	65.7	66.9	132.6	13.8	40.2	24.5	78.5	141.5	138.3	60.0	112.1	310.4	441.0	504.0	193.6	1,950.3	900.8	593.5	16	▲247	254	114.8

Note: Ω indicates national surplus on current account in dollars.

period are shown in Table 8. It may be observed that the share of primary industry declines, the share of tertiary industry shows a slight advance, and the importance of secondary industries remains unchanged. (c) Noticeable changes are found in the advance of the relative share of mineral products in total exports, i. e., 49.5% in 1970 as against 37.8% in 1960. (d) Despite the efforts for economic development, the currency supply increased and the rise of prices was not checked, indicating the difficulty in checking the inflation. Deficits in government finance reached 13–14% every year. It is likely that the accumulated figure in the final year will almost equal GNP, and price will show a threefold advance during ten years.[10] (e) The total of government investment is estimated to reach 193,600 million rupees during the next eight years, while tax receipts will be about 10% of GNP. An increase in the government deficit, therefore, appears unavoidable. The anticipated public deficit and the inactivity of manufacturing industries are bottlenecks to economic development. Strenuous efforts are required for further growth.

Table 8. Industrial Structure during the Forecasting Period (%)

	Y_{I}	Y_{II}	Y_{III}
1960	60.5	9.8	29.7
1965	58.8	7.6	33.6
1970	55.4	9.1	35.5

2. *Results of Policy Simulation*

In this part, the effects of three kinds of policies will be explained through the method of simulation.

(1) An increase in defense expenditures (D_e). Defense expenditures in 1954 were changed from 46.1 to 92.2 billion rupees, this data being interpolated while the values of other exogenous variables were held constant.

(2) Decrease in government investments (G_i). The interpolation was applied after changing government investments in 1954 from 33.7 to zero.

(3) Increase in foreign currency holdings (F). Foreign currency holdings in 1954 doubled or increased by 256 million dollars by means of an increase in capital inflow (W).

In these simulations, net foreign savings or net inflow of foreign capital from overseas are treated as exogenous variables. Of the seven exogenous variables in ICU Model No. II (N, O_{min}, P_x, P_m, D_e, G_i, W), one of the three variables (D_e, C_i, W) was shifted in 1954. Results of the following interpolation are shown in Tables 9, 10, and 11. Further, the result of the interpolation based upon combined initial changes of an increase in defense expenditure and a decrease in government investment is shown in Table 12.

(1) The case of increased defense expenditures (D_e). In the same year that D_e increased, an increase in the currency supply (by 88.8%) and a rise in the

10 Prices used here are GDP deflator. Naturally, the rise in the cost of living in urban areas seems to be far greater.

Table 9. Simulation Results of Defense Expenditure (D_e) Changing Policy

	N	O_{min}	P_x	P_m	D_e	D_i	$\bar{\Sigma}^{1}I_p^{In}$	$\bar{\Sigma}^{1}I_p^{IIn}$	$\bar{\Sigma}^{1}I_p^{IIIn}$	$\bar{\Sigma}^{1}I_p^{n}$	Y^{I}	Y^{II}	Y^{III}	Y
1954	836.8	95	99	87	92.2	33.7	49.9	178.5	19.8	248.2	64.6	11.8	36.9	113.3
1955	854.4	100	100	100	39.4	28.1	61.1	223.3	32.1	316.5	66.5	9.9	36.5	112.9
1956	872.7	105	89	72	38.7	32.7	73.7	268.3	41.8	383.8	68.7	18.2	38.4	125.3
1957	891.6	123	71	68	49.0	37.4	91.7	322.3	54.6	468.6	71.8	21.3	44.5	137.6
1958	911.2	126	64	79	82.4	22.9	114.1	384.8	70.5	569.4	75.7	16.8	37.5	130.0
1959	931.5	141	91	71	91.1	16.9	126.5	421.6	76.3	624.4	77.9	11.6	40.2	129.7

	V	M_s	M_{rs}	M_{rc}	M_{cf}	M_{co}	M_r	M_c	M	X_m	X_o	X	I_p^{I}	I_p^{II}	I_p^{III}	I_p
1954	125.0	17.7	4.1	25.3	9.2	10.1	29.4	19.3	66.4	35.7	83.4	119.1	12.7	50.2	12.9	75.8
1955	124.6	16.8	3.9	10.0	12.5	9.5	13.9	22.0	52.7	32.0	74.5	106.5	14.4	51.7	10.7	76.8
1956	137.7	24.1	4.3	31.5	25.4	14.1	35.8	39.5	99.4	34.9	77.6	112.5	20.2	62.0	14.1	96.3
1957	150.6	23.7	6.1	32.2	23.4	13.8	38.3	37.2	99.2	42.3	75.4	117.7	25.2	72.2	17.5	114.9
1958	142.6	14.3	3.8	27.1	16.3	8.0	30.9	24.3	69.5	40.2	67.1	107.3	15.8	48.3	7.9	72.0
1959	142.3	11.0	4.7	17.8	15.5	6.0	22.5	21.5	55.0	34.4	73.4	107.8	13.0	58.4	6.7	78.1

	I	T_i	T_d	R_o	R	G_c	G	$G-R$	$\bar{\Sigma}^{1}(G-R)$	H	P	F	W	C
1954	109.5	73.0	28.2	39.6	140.8	262.3	296.0	155.2	37.6	227.1	125.4	250	▲501	82.6
1955	104.9	61.2	35.5	67.1	163.8	140.2	168.3	4.5	192.8	135.5	94.8	408	▲311	94.7
1956	129.0	101.5	26.3	57.2	185.0	153.1	185.8	0.8	197.3	133.5	109.5	356	▲301	108.2
1957	152.3	101.3	29.1	66.6	197.0	187.5	224.9	27.9	198.1	159.2	133.2	230	▲266	114.8
1958	94.9	75.7	33.4	78.9	188.0	263.4	286.3	98.3	226.0	234.3	148.5	192	▲158	103.1
1959	95.0	116.4	37.9	55.8	210.1	275.6	292.5	82.4	324.3	251.0	153.7	306	▲400	100.0

Table 10. Simulation Results of Government Investments (G_i) Changing Policy

	N	O_{min}	P_x	P_m	D_e	G_i	$\bar{\Sigma}^1 I_p^{In}$	$\bar{\Sigma}^1 I_p^{IIn}$	$\bar{\Sigma}^1 I_p^{IIIn}$	$\bar{\Sigma}^1 I_p^{n}$	Y^I	Y^{II}	Y^{III}	Y	V
1954	836.8	95	99	87	46.1	0	49.9	178.5	19.8	248.2	64.6	11.0	29.2	104.8	116.0
1955	854.4	100	100	100	39.4	28.1	57.6	228.7	19.8	306.1	65.6	7.9	35.6	109.1	120.6
1956	872.7	105	89	72	38.7	32.7	67.3	279.5	30.3	377.1	67.0	18.1	37.5	122.6	134.8
1957	891.6	123	71	68	49.0	37.4	87.1	341.0	44.3	472.4	70.1	21.3	43.5	134.9	147.8
1958	911.2	126	64	79	82.4	22.9	112.0	413.0	61.8	586.8	74.0	16.8	36.6	127.4	139.9
1959	931.5	141	91	71	91.1	16.9	127.4	461.2	69.7	658.3	78.0	10.5	39.2	127.7	140.3

	M_s	M_{rs}	M_{rc}	M_{cf}	M_{co}	M_r	M_c	M	X_m	X_o	X	I_p^I	I_p^{II}	I_p^{III}	I_p	I
1954	6.9	1.8	25.3	9.2	3.5	27.1	12.7	46.7	23.6	76.6	100.2	7.7	50.2	0	57.9	57.9
1955	16.2	3.8	24.6	11.5	9.2	28.4	20.7	65.3	32.0	87.8	119.8	9.7	50.8	10.5	71.0	99.1
1956	23.8	4.3	31.3	24.8	13.9	35.6	38.7	98.1	34.7	77.3	112.0	19.8	61.5	14.0	95.3	128.0
1957	23.5	6.1	32.2	23.2	13.7	38.3	36.9	98.7	42.1	75.4	117.5	24.9	72.0	17.5	114.4	151.8
1958	14.3	3.7	27.1	16.2	8.0	30.8	24.2	69.3	40.1	67.1	107.2	15.4	48.2	7.9	71.5	94.4
1959	11.0	4.7	17.8	15.4	6.0	33.2	21.4	54.9	34.4	73.4	107.8	11.7	58.3	6.7	76.7	93.6

	T_i	T_d	R_o	R	G_c	G	$G-R$	$\bar{\Sigma}^1(G-R)$	H	P	C	W	F
1954	56.1	28.2	39.6	123.9	167.8	167.8	43.9	37.6	122.6	80.3	88.1	▲501	236
1955	72.1	27.2	11.7	111.0	129.7	157.8	46.8	81.5	139.4	91.3	92.3	▲311	400
1956	100.3	25.0	36.7	162.0	120.2	152.9	▲9.1	128.3	102.0	95.6	108.6	▲301	352
1957	100.9	26.2	59.7	186.8	173.1	210.5	23.7	119.2	129.9	120.2	113.4	▲266	228
1958	75.5	31.9	75.7	183.1	257.0	279.9	96.8	142.9	206.1	136.0	101.0	▲158	191
1959	117.1	38.3	55.0	210.4	272.5	289.4	79.0	239.7	220.4	141.3	98.3	▲400	307

Table 11. Simulation Results of Foreign Currency Holdings (F or W) Changing Policy

	D_e	G_i	Y^{I}	Y^{II}	Y^{III}	Y	V	M_s	M_{rs}	M_{rc}	M_{cf}	M_{co}	M	X_m	X_o	X	I_p^{I}	I_p^{II}	I_p^{III}
1954	46.1	33.7	64.6	11.8	36.9	113.3	125.0	17.7	4.1	25.3	9.2	10.1	66.4	35.7	83.4	119.1	12.7	50.2	12.9
1955	39.4	28.1	66.5	17.3	36.7	120.5	132.6	25.9	3.9	24.6	29.9	15.2	99.5	32.0	74.5	106.5	22.7	67.7	12.9
1956	38.7	32.7	70.1	17.0	38.5	125.6	138.0	18.1	4.4	31.3	13.9	10.3	78.0	39.0	77.3	116.3	18.4	51.4	12.6
1957	49.0	37.4	72.9	20.1	44.4	137.4	150.4	23.7	6.1	28.9	23.5	13.8	96.0	39.5	75.4	114.9	23.0	72.3	17.6
1958	82.4	22.9	76.4	16.9	37.6	130.9	143.6	14.5	3.8	27.1	16.5	8.1	70.0	40.2	67.1	107.3	15.9	48.5	7.9
1959	91.1	16.9	78.5	11.5	40.2	130.2	142.8	11.0	4.7	17.8	15.4	6.0	54.9	34.4	73.4	107.8	13.0	58.3	6.6

	I_p	I	T_i	T_d	R_o	R	G_c	G	$G-R$	$\bar{\Sigma}^{1}(G-R)$	H	P	F	W	C
1954	75.8	109.5	73.0	28.2	39.6	140.8	167.8	201.5	60.7	37.6	138.3	96.1	496	▲245	92.0
1955	103.3	131.4	101.5	26.4	44.9	172.8	140.2	168.3	▲4.5	98.3	96.6	91.3	246	▲311	104.8
1956	82.4	115.1	83.0	27.4	68.8	179.2	158.8	191.5	12.3	93.8	111.0	102.4	357	▲301	106.8
1957	112.9	150.3	98.5	29.5	50.8	178.8	191.5	228.9	50.1	106.1	150.4	130.0	233	▲266	114.3
1958	72.3	95.2	76.1	33.6	79.0	188.7	252.0	274.9	86.2	156.2	200.5	138.5	191	▲158	105.2
1959	77.9	94.8	116.4	37.2	54.2	207.5	276.0	292.9	85.4	242.4	227.5	146.5	306	▲400	100.4

Table 12. Simulation Results of Government Investments (G_i) and Defense Expenditure (D_e) Simultaneously Changing Policy

	D_e	G_i	Y^{I}	Y^{II}	Y^{III}	Y	V	M_s	M_{rs}	M_{rc}	M_{cf}	M_{co}	M	X_m	X_o	X	I_p^{I}	I_p^{II}
1954	79.8	0	64.5	11.2	29.2	104.9	116.1	8.1	1.8	25.3	11.5	4.2	50.9	23.2	70.1	93.3	8.5	52.3
1955	39.4	28.1	65.7	5.8	35.8	107.3	118.7	26.3	3.8	13.9	30.6	15.5	90.1	32.6	87.8	120.4	19.2	68.4
1956	38.7	32.7	68.7	12.9	37.5	119.1	131.1	13.0	4.3	31.3	4.2	7.1	59.9	39.2	77.3	116.5	13.8	42.5
1957	49.0	37.4	70.7	21.3	43.5	135.5	143.0	23.8	6.1	32.2	23.7	13.9	99.7	37.3	75.4	112.6	21.2	72.5
1958	82.4	22.9	73.9	16.6	36.6	127.1	139.6	13.2	3.7	27.1	14.7	7.3	65.4	40.3	67.1	107.4	14.5	46.3
1959	91.1	16.9	75.9	11.4	39.3	126.6	139.0	10.1	4.6	17.8	13.9	5.5	51.9	33.9	73.4	107.3	11.6	56.9

	I_p^{III}	I_p	I	T_i	T_d	R_o	R	G_c	G	$G-R$	$\bar{\Sigma}^{1}(G-R)$	H	P	F	W	C
1954	0	60.8	60.8	59.7	28.2	37.5	125.4	235.4	235.4	110.0	39.9	185.4	101.1	506	▲172	82.3
1955	12.9	100.5	128.6	93.4	32.3	27.4	153.1	130.6	158.7	5.6	149.9	122.7	83.5	109	▲661	89.7
1956	11.4	67.7	100.4	67.4	24.8	67.1	159.3	146.5	179.2	19.9	155.5	138.0	103.2	360	▲277	99.5
1957	17.6	111.3	148.7	101.7	27.7	33.3	162.7	171.4	208.8	46.1	175.4	169.0	127.4	199	▲267	109.7
1958	7.6	68.4	91.3	72.2	31.9	75.0	179.2	242.0	264.9	85.7	221.5	221.0	140.6	169	▲179	102.1
1959	6.5	75.0	91.9	113.8	35.9	48.5	198.2	270.1	287.0	88.8	307.2	251.5	150.0	311	▲388	97.3

price level (29.3%) were observed. This resulted in an inflation which saw a 25% rise in prices. As a consequence, GNP in the following year declined (5.9 or 4.5% vis-à-vis the pre-inflation year), and imports also experienced a downturn of 14.6%. With regard to the accumulation during five years, significant effects were the increase in the currency supply and the intensified inflation (see Table 9).

(2) The case of decreased government investments (G_i). In this case, production fell conspicuously in both the short-run and long-run. GNP decreased by 9.0, 9.9, 1.7, 1.7, and 1.4 respectively for the five years after 1954. The decrease in the 1954–55 period accounted for nearly 7% of the actual value of GNP for the year. The decline in GNP during the five years from 1954 to 1958 reached 23,700 million rupees. In comparison with the decrease in investments of 3,370 million rupees at the beginning, an overtime cumulative investment multiplier was estimated as 7.03 (237÷33.7). This indicates that the decline in government investments brought about the decrease of GNP to the extent of seven times the amount of the decrease in government investments (see Table 10). The decrease in government investments implies, at the same time, smaller government expenditures. This is the reason why we observed the declined level of prices during the successive five years compared with the results of the final test.

Thus, an increase in defense expenditures brings about a decline in production and an intensification of inflation on a short-run basis, and a tendency to intensify inflation in the long-run. On the other hand, the decline in government investments has the effect of decreasing production consistently. We can analyze the effects of the simultaneous changes in both variables in the next simulation.[11]

(3) In 1954, a government investment of 3,370 million rupees was eliminated and defense expenditures were increased by the amount equivalent to the reduced investment. In other words, the priority of government policy was shifted from economic growth to national defense. Net foreign savings or net inflows of foreign capital from overseas (W) were treated as an endogenous factor. As is shown in Table 13, the resulting decline in GNP during the six years from 1954 to 1959 amounted to 36,000 million rupees. That is to say, the shift of one unit from government investment to defense expenditures brings about a decline of eleven times the figure for the decreased investments in GNP within the six years. The currency supply also increases in the long-run, causing prices to rise (about 12% in the following year). Private consumption has to be curtailed by more than 10% at least during the three years (see Table 13).

The above simulation analysis will be instructive for understanding the economic influences of an increasing defense outlay. Next, the simulation analysis on the effects of an induction of foreign capital will be discussed.

(4) When W is increased and F is increased by 256 million dollars in 1954, GNP increases by 8,900 million rupees during the succeeding five years. Every

11 As ICU Model No. II is a non-linear model, effects cannot be simply added.

Table 13. Decrease in GNP due to Increased Armaments Expenditures

	Interpolated Value of GNP	Actual Value of GNP	Difference
1954	116.1	125.2	▲ 9.1
1955	118.7	130.7	▲12.0
1956	131.1	136.5	▲ 5.4
1957	143.0	149.7	▲ 6.7
1958	139.6	141.3	▲ 1.7
1959	139.0	140.7	▲ 1.7

industrial sector witnesses increase in production during the 3–4 years, and inflation slows down to some extent. If we assume that this 256 million dollars (2,939 million rupees converted at the rate of 11.48 rupees per dollar) is financed by borrowing at a six percent annual interest rate, the sum of the original fund plus the accumulated interest payments amounts to 3,939 million rupees (i. e., $2{,}939 \times 1.06^5$). The difference of 4,967 million rupees, the difference between the GNP increase of 8,900 million rupees and the total cost of 3,939 million rupees, is identified as a pure development effect. In other words, a loan of 100 million dollars with interest at 6% per annum produces profits of 1,900 million rupees (170 million dollars) during the five years. This makes it possible to measure the long-term economic effects of a loan, or, the shadow price.[12]

A brief summary of the simulations is given below. (a) An increase in defense expenditures brings about a decrease in production and a rise in prices in the short-run, and a rise in prices in the long-run. (b) A decline in government investments consistently causes a decline in production. (c) If government investments decrease by one unit and an increase in defense expenditures is effected, an elevenfold decrease in GNP will be brought about within six years. (d) The induction of one unit of foreign capital will produce 1.7 units of profit within six years, assuming that the interest is 6% per annum. Thus the importance of the shift of emphasis from national defense to economic development and the positive induction of foreign capital for economic growth has been shown.

IV. CONCLUSION

The findings of this paper are as follows:

(1) Based on time series data of the revised national income statistics, we have formulated ICU Model No. I with 13 equations and ICU Model No. II with 30 equations. Both models performed well, and provided useful economic insights into the complicated causal relationships within the Indonesian

12 In view of the fact that loans with interests added will be repaid in dollars, the shortage of foreign currency holding will become a problem. However, adapting the methods of development such as production sharing, etc., into consideration, it is presumed that the repayment of loans can be made by products; therefore, no premium is added to dollar.

economy.

(2) These two models include the production, expenditure, public finance, exports and imports sectors. The vicious circle in which a low level of investment gives rise to another low level of investment, and the process of inflationary development follows an unrelated increase in government expenditure, as well as the existence of causal relationships between the non-improving living standard and the above two factors, were demonstrated.

(3) By the use of ICU Model No. II, an economic forecast was made under various assumptions. Special attention was paid to the trends in defense expenditures and government investments as being the key variables in future development efforts. Even given a considerably optimistic assumption (an increase in defense expenditures and a rapid increase in government investments), the growth rate of GNP after 1960 is estimated to neither exceed 3.1% nor go under 1.7% at the lowest. The growth rate of population in the future is estimated to exceed 2%, and a rise in the living standard cannot be hoped for unless the government pays special attention to economic development. This suggests that economic crises can be expected in the near future if the existing political tension continues.

(4) An analysis using ICU Model No. II for the evaluation of government efforts at economic development reveals that when government investments are reduced but defense expenditures are increased in the same year, GNP will show a decrease of eleven times the above amount in the cumulative total for the subsequent six years. However, the economic effects of reduced defense expenditures and increased public investments will register eleven times the figure for the initial amount shifted. It is obvious that the effects of such a shift are significant for economic development.

(5) As regards the evaluation of the economic effects of an induction of foreign capital using ICU Model No. II, we find that the aggregate total of net increase in GNP after six years will be 1.5 times the amount induced from abroad, after deducting the interest payment of six percent per annum. If we could assume a more efficient way of production, a higher tax rate, etc., the net effects would become greater. Thus, effects of foreign capital induction are considered to be extremely large.

As stated above, quite large-scale macro-econometric models have been used in this paper. Further, large-scale models dividing exports, imports, and domestic production by items will be necessary for more detailed econometric studies which can evaluate the effects of economic cooperation by joint production in specified industries. Such studies have already been attempted, and the publication of these studies and their findings will be reserved for another occasion.[13]

[13] For this purpose, ICU Model No. III (179 equations) has been set up, coordinating macro-model (31 equations), micro-model for explanation of domestic production by items (42 equations); agricultural and aquatic products 13 items, mineral products 7 items, manufactured goods 22 items), export model (26 equations; 6 items) for explanation of export quantity and value and import model (80 equations; 21 items) for explanation of import quantity and value by countries of origin. The final test has shown satisfactory results.