Simulation Experiment for Japanese Economy: 1953-1957

KEI MORI*

1. Introduction

This is a research-report concerning the simulation experiment with respect to the Model III which was constructed by the members of Econometric Research Project for Studies of Japanese Industrial Structure, TCER[1] [9]. The Model III is estimated on the basis of quarterly data during five years from 1953 to 1957, and consists of 19 linear or non-linear difference equations. This simulaneous equations system was solved by iterative method using IBM 650.

The applicability of the Model is tested by comparing factual data during the estimated period with the calculated value. The Model is modified through examining the result of the simulation test. This kind of procedure is repeated until the satisfactory result has been obtained.

Furthermore, it is possible to forecast the effect of various economic policies upon the national economy through the simulation experiments.

2. Econometric Models

Our fundamental phylosophy of model building is based on Klein-Goldberger-Model, and Model III mainly consists of structural equations on expenditure aspect, and some considerations are taken into distribution aspect.

The variables are defined as follows:
(endogenous variables)

C =Personal consumption expenditures
I_H =Personal house investment
I_F =Private fixed investment
D_H=Private house consumption charges
D_F=Private fixed capital consumption charges
K_H=End-of-year stock of private house
K_F=End-of-year stock of private capital
M =Imports of goods and services
W_1=Private wage income
P_c =Corporate profits
S_c =Corporate savings
P =Nonwage-nonpersonal private enterprises income
Y =Net private national income

* Faculty of Engg., Keio Univ., Koganei, Tokyo
1) Tokyo Center for Economic Research.

GNP $=$ Gross national products
GNP* $=$ Gross national private products
B_c $=$ End-of-year corporate surplus

(exogenous variables)

G $=$ Government expenditure for goods and services
Z $=$ Personal tax+corporate tax+social insurance charges+ Government enterprises surplus+transfer income
N $=$ Number of persons in labour force
L $=$ Industrial funds supply increase
E $=$ Exports of goods and services
T_c $=$ Corporate income taxes
W_2 $=$ Wage income of government employee
T_G $=$ Government enterprises surplus
A $=$ Personal enterprises income
T $=$ Indirect taxes less subsidies
D_G $=$ Government capital consumption charges
e $=$ Statistical discrepancy

Furthermore, the variables concerning inventory are in some cases treated as endogenous variables, and in other cases as exogenous variables.

J $=$ Private inventory investment
X $=$ Sales
K_J $=$ End-of-year stock of private inventory

where N is represented as 1,000 persons unit, all other variables are real values of billion yen units.

For the convenience we present here the modified model (1) of TCER Model III which showed an excellent result in simulation test. Each structural equation is estimated by least squares method.

(2.1) $$C_t = 218.6 + 0.313(Y - S_c - Z)_t + 0.492(C_{\max})_t = -4$$

$$R = 0.986 \qquad S = 23.4$$

(2.2) $$I_{Ht} = -65.5 + 0.016\,\text{GNP}_t + 0.0016 N_t$$
$$\phantom{I_{Ht} = -65.5 +} (0.007) \qquad (0.00096)$$

$$R = 0.912 \qquad S = 2.3$$

(2.3) $$I_{Ft} = -289.3 + 0.308 P_{ct} + 0.244 L_{t-2} + 0.060 K_{Ft}$$
$$\phantom{I_{Ft} = -289.3 +} (0.193) \quad (0.069) \quad (0.011)$$

$$R = 0.959 \qquad S = 23.9$$

(2.4) $$D_H = -22.8 + 0.019\frac{(K_{Ht} + K_{Ht-1})}{2}$$

$$R = 0.965 \qquad S = 2.4$$

$$(2.5) \qquad D_{Ft} = -162.2 + 0.041 \frac{(K_{Ft} + K_{Ft-1})}{2}$$
$$\phantom{(2.5) \qquad D_{Ft} = -162.2 +} (0.002)$$

$$R = 0.972 \qquad S = 22$$

$$(2.6) \qquad K_{Ht} = K_{Ht-1} + I_{Ht} - D_{Ht}$$

$$(2.7) \qquad K_{Ht} = K_{Ft-1} + I_{Ft} - D_{Ft}$$

$$(2.8) \qquad M_t = -119.7 + 0.304 I_{Ft} + 0.372 J_t + 0.132(C + I_H + G + E)_t$$
$$ (0.193) \qquad (0.049)$$

$$R = 0.954 \qquad S = 22.7$$

$$(2.9) \qquad W_t = 29.6 + 0.049\, \mathrm{GNP}^* + 0.344\, \mathrm{GNP}^*_{t-1}$$
$$ (0.031) \qquad (0.043)$$

$$R = 0.936 \qquad S = 19.9$$

$$(2.10) \qquad P_{ct} = -130.4 + 0.761 P_t - 0.197 P_{t-1}$$
$$\phantom{(2.10) \qquad P_{ct} = -130.4 +} (0.123) \quad (0.124)$$

$$R = 0.964 \qquad S = 18.5$$

$$(2.11) \qquad S_{ct} = 53.2 + 0.930(P_c - T_c)_t - 0.022 B_{ct-1}$$
$$\phantom{(2.11) \qquad S_{ct} = 53.2 +} (0.037) \qquad (0.003)$$

$$R = 0.991 \qquad S = 5.1$$

$$(2.12) \qquad P_t = Y_t - (W_1 + W_2 + T_G + A)_t$$

$$(2.13) \qquad Y_t = \mathrm{GNP} - (T + D_H + D_F + D_G + e)_t$$

$$(2.14) \qquad \mathrm{GNP}_t = (C + I_H + I_F + J + G + E - M)_t$$

$$(2\text{-}15) \qquad \mathrm{GNP}^*_t = \mathrm{GNP}_t - (W_2 + T_G + D_G)_t$$

$$(2\text{-}16) \qquad B_{ct} = B_{ct-1} + S_{ct}$$

R is represented as multiple correlation coefficient, S, as adjusted standard deviation of residual of each equation, and numerical values in parenthises under coefficients, as standard error of estimates.

The space limit makes it impossible to refer to the implication of all the structural equations, and therefore we confine them to the following three equations. Details are referred to (10).

Consumption function depends on disposable income and the maximum value of consumption before the 4th period, i.e. $(C_{\max})_t = -4$. $C_{\max}$ is only one irreversible or nonlinear term in the modified model (1).

In the fixed investment function, profit principle is accepted and the available fund for investment as a constrained factor and the fixed capital as a production capacity are introduced.

Usually the coefficient of fixed capital is negative value apriori, as is seen in the U.S. and other countries. But in our case, the estimated

coefficient of fixed capital turned out positive value.

If we try to search for the reason, it will be found in the following economic state in Japan. Primarily the fixed capital has been scarce relative to labor force, and therefore the propensity to invest is very high.

In addition to it, once the plant of new technology happens to be installed, the replacement investment is induced to replace the old plant connected with it to new one, and at the same time the competitive investment among the rival firms takes place in order to compete with it. If such investment mechanism continues, the general scarcity will naturally disappear.

After reaching such a saturation point, the sign of the coefficient might be alternated.

As to *import function*, the final demand is devided into fixed investment, inventory investment and other items, and each inducement effect upon import is estimated.

As a result the inducement effect of the fixed investment proved to be distinctly strong. The import function is applicable, though the policy against foreign currency is neglected, but it does not mean that import is not connected with it. The influence of foreign currency reserve is indirectly considered through the fixed investment related to it.

The original model is 19 equations system which consists of the following three equations and 16 equations from (2.1) to (2.16).

(2.17) $$J_t + 0.5X_t = \underset{(0.219)}{0.300} \left(\sum_{\tau=1}^{2} \mathrm{GNP}_{t-\tau} - \sum_{\tau=3}^{4} \mathrm{GNP}_{t-\tau} \right) + \underset{(0.215)}{0.592L_{t-1}}$$

$$+ \underset{(0.898)}{1.165}(P_{t-2} - P_{t-3}) + 854.1$$

$$R = 0.759$$

(2.18) $$X_t = \mathrm{GNP}_t - J_t$$

(2.19) $$K_{Jt} = K_{Jt-1} + J_t$$

The last modified model (2) is the equation system which introduces the following linear consumption function instead of nonlinear one.

(2.20) $$C_t = 162.2 + \underset{(0.0404)}{0.742}(Y - S_c - Z)_t$$

$$R = 0.962 \qquad S = 47.78$$

The applicability of the modified model (2), as is shown in figure 3, took a turn for the worse. This fact shows the importance of $C_{\max}$. In order to evaluate more precisely the role which the nonlinear term plays, C_{t-4} term corresponding to $C_{\max}$ must be introduced in (2.20). In this

stage, however, the simulation test of the model involving (2.21) has not been performed yet.

$$(2.21) \qquad C_t = 321.66 + 0.3943(Y - S_c - Z)_t + 0.3076C_{t-4}$$
$$ (0.0703) (0.1109)$$

$$R = 0.980 \qquad\qquad S = 21.6$$

The modified model 2 is linear system and the original model and the modified model 1 are nonlinear system, but these two are to be expressed in linear form with respect to the reduced form as follows.

$$(2.22) \qquad\qquad Y_t = -B^{-1}\Gamma Z_t$$

where Y_t is column vector of endogenous variables and Z_t is column vector of predetermined variables. In case of the modified model (1), B is the 16×16 dimensional matrix of estimated coefficient of endogenous variables, and is the 16×16 dimensional matrix of estimated coefficient of predetermined variables.

3. *Simultaneous Difference Equation System*

The econometric model is in many cases expressed by such simultaneous linear difference equation system that the unit period is an year or a quarter. The econometric model has to consist of nonlinear relations because the mechanism which controls economic phenomenon is considered to be non-linear. The actual economic model is, however, confined to be linear or simple nonlinear under the restriction on statistical inference.

If econometric model is regarded as a simultaneous linear difference equation system, it is written as follows.

$$(3.1) \qquad \begin{bmatrix} P_{11}(E) & P_{12}(E) & \cdots & P_{1m}(E) \\ P_{21}(E) & P_{22}(E) & \cdots & P_{2m}(E) \\ \vdots & \vdots & & \vdots \\ P_{m1}(E) & P_{m2}(E) & \cdots & P_{mm}(E) \end{bmatrix} \cdot \begin{bmatrix} Y_{1t} \\ Y_{2t} \\ \vdots \\ Y_{mt} \end{bmatrix} + \begin{bmatrix} K_{1t} \\ K_{2t} \\ \vdots \\ K_{mt} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ \vdots \\ 0 \end{bmatrix}$$

where E is difference operator and $P_{ij}(E)$ is polynomial in the term of E. Y_{it} is ith endogenous variable and K_{it} is nonhomogenous term at t period. Furthermore, this expression is rewritten as follows.

$$(3.2) \qquad\qquad P(E)Y_t + K_t = 0$$

where, $P(E)$ is $(m \times m)$ dimensional square matrix. Y_t and K_t are m dimensional column vectors.

And if there is no multiple characteristic root in the following homogeneous system,

$$(3.3) \qquad\qquad P(E)Y_t = 0$$

the solutions $x_1, x_2, \cdots, x_w$ or determinantial equation are characteristic roots of (3.3)

$$(3.4) \qquad\qquad |P(X)| = 0$$

We will show the relation between $P(E)$ and $P(X)$ as follows.

(3.5)
$$P(E)_{xt} = (a_0 E^n + a_1 E^{n-1} + \cdots + a_{n-1} E + a_n) x^t$$
$$= a_0 x^{t+n} + a_1 x^{t+n-1} \cdots + a_{n-1} x^{t+1} + a_n x^t$$
$$= X_t P(x)$$

The general solution of (3.3) can be expressed as follows.

(3.6)
$$Y_t = \sum_{j=1}^{w} V_j x_{ji}^t P^*(x_j) \qquad (j=1, 2, \cdots, w)$$

where $P_i^*(x)$ is an arbitrary column vector drawn from the adjointed matrix $P^*(x)$ of the matrix $P(x)$ and V_j is arbitrary constant, which is given by the initial conditions and w is equal to the number of initial conditions.

The general solution of non-homogenous system of (3.2) is the sum of general solution of homogenous system (3.3) and the stationary solution of (3.2). Therefore we have:

(3.7)
$$Y_t = \sum_{j=1}^{w} V_j x_j^t P^*(x_j) + [P(1)]^{-1} K_t$$

Because of the complexity of finding the characteristic root of the multi-dimensional diterminantial equation of this kind, it is very difficult but not always impossible to obtain the solution of the econometric model which we usually treat, from the above procedure.

In order to judge whether the model is stable or not, it would be sufficient to know whether the maximum value of absolute characteristic root is smaller than unity or not. However, as is easily seen, it is not easy to find even one dominant root.

The numerical solution of the difference equation system can be solved completely by using the iterative method. Therefore this seems to be the best method to find the solution of econometric models.

4. Computational Programming

This computational programming is written in 650 Fortran, i.e. Automatic Coding System for IBM 650[2].

TABLE 1.

	Required Time
Compile (Fortran → SOAP II)	20 minutes
Assemble (SOAP II → Object)	20 minutes

Compiling and assembling time required for the program of modified model (1) is shown in table 1. The calculation procedure in indicated in

2) As is well known, in order to transform the source program written in Fortran to the object program, it is necessary to pass the program into machine twice, i.e., compiling and assembling.

chart 1.

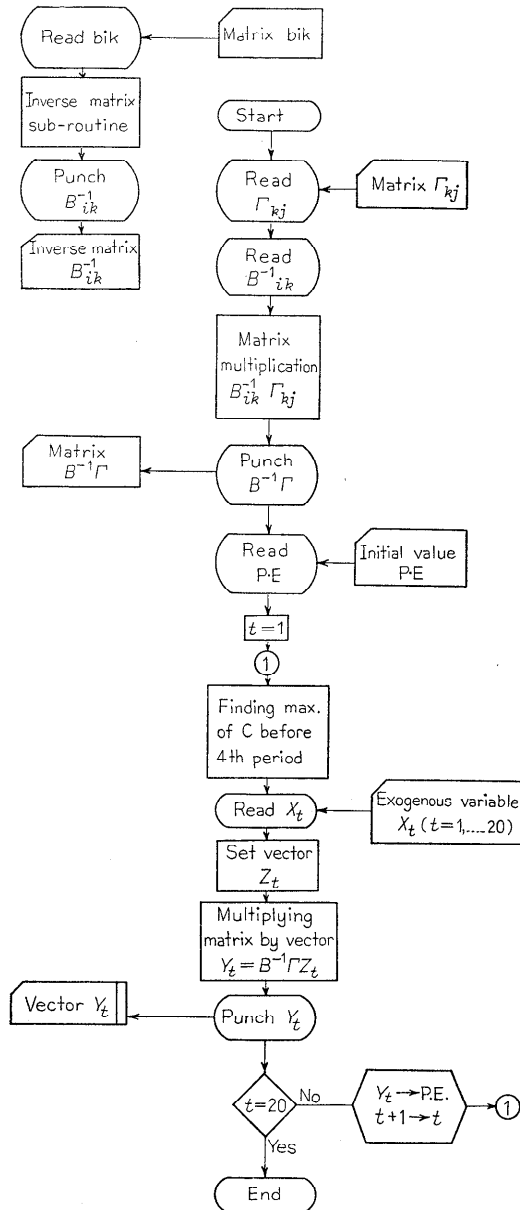(1) Using sub-routine, invest the coefficient matrix of endogenous variables B_{ik} [3].

Read bik ← Matrix bik

Inverse matrix sub-routine

Punch B_{ik}^{-1}

Inverse matrix B_{ik}^{-1}

Start

Read Γ_{kj} ← Matrix Γ_{kj}

Read B_{ik}^{-1}

Matrix multiplication $B_{ik}^{-1} \Gamma_{kj}$

Matrix $B^{-1}\Gamma$ ← Punch $B^{-1}\Gamma$

Read P·E ← Initial value P·E

$t = 1$

①

Finding max. of C before 4th period

Read X_t ← Exogenous variable X_t ($t=1,\ldots 20$)

Set vector Z_t

Multiplying matrix by vector $Y_t = B^{-1}\Gamma Z_t$

Vector Y_t ← Punch Y_t

$t = 20$ — No → $Y_t \rightarrow$ P.E. $t+1 \rightarrow t$ → ①

Yes

End

CHART 1. Flow Chart

3) IBM program library sub-routine was used for the inversion of the estimated coefficient matrix B of endogenous variables. Reading B_{ik}^{-1} needs the special read-routine.

(2) Read both inverse matrix B_{ik}^{-1} and coefficient matrix of predetermined variables Γ_{kj}, multiply B_{ik}^{-1} by Γ_{kj}, and punch the reduced form matrix $B_{ij}^{-1} \Gamma_{kj}$ as an intermediate result.

(3) Read the set of the initial values of predetermined endogenous variables (P.E.).

(4) Find the maximum value of C before the 4th period.

(5) Read one set corresponding to the calculation, successively selecting from the whole set of endogenous variables prepared for this iteration.

(6) Set both the set of initial values of predetermined endogenous variables and the set of exogenous variables with the vector of predetermined variables.

(7) Multiply the matrix of reduced form coefficient $B_{ik}^{-1} \Gamma_{kj}$ by the vector of predetermined variables Z_t.

(8) Punch the product $B_{ik}^{-1} \Gamma_{kj} t$ as a calculated result Y_t.

(9) Set a part of the calculated vector Y_t with the set of predetermined endogenous variables for the next period.

(10) If the number of time of calculation becomes given number, stop the iteration. Otherwise put back the program to (4).

The time required for the calculation is shown in table 2.

TABLE 2

		Required time
Sub Routine	Inverting Matrix B^{-1}	9 minutes
Main Routine	Multiplying Matrix $B^{-1}\Gamma$	8 minutes
	Iterative calculation; 20 times	8 minutes

The net time required to perform from (1) to (10) is 40 minutes, and the one required to obtain all the results shown in this research is about 6 hours.

5. *Simulation Test*

By simulation we mean that we *analogize* the various corresponding solution of the econometric model, which have obtained through operating the econometric model under the program for policy experiment, that is the list concering the possible policies, *with* the corresponding changes of the behavior of real world, in which the possible failure accompanying the experiment would definitely be fatal to our living. This is constructed through the following three stages: abstraction of the mechanism controlling the real world, model-building and estimation of the model on the basis of factual data. The sufficient condition for the analogy is that the econometric model expresses the real world accuralely. And the necessary condition is that the model should be so simple as to

be treatable. As our model is undoubtedly satisfied with the latter, we have only to notice the former.

Therefore, it should be basically important to test the applicability of the model. We obtain the dynamic solution of the model under the pseudo-realistic situation, and examine whether the solution is fit for the behavior of the real world or not. We call this kind of test the simulation test.

With respect to the applicability of econometric model, the following tests have been performed so far.

First is the structural test that the endogenous variable is solved by substituting the factual data into *the explanatory variables* in the right hand of each structural equation.

Second is the reduced form test that the endogenous variables are solved by substituting the factual data into *the vector of predetermined variables* in the right hand of reduced form equation (2.22).

There are found some demerits in these tests. The first weak point in the former is that both *current endogenous variables* to be solved and *predetermined endogenous variables* to have been solved before one or more periods are included in *explanatory variables* which the factual data are to be substituted. And the second in the former is that the structural test ignores the simultaneous relation of the model.

Though the reduced form test is devised to remove the second weak point of structural test, i.e., the ignorance of simultaneity, the first weak point of it is left in the alleviative form, that is, *the predetermined endogenous variables* to have been solved before one or more periode are included in *the predetermined variables* which the factual data are to be substituted.

The final test, i.e., simulation test, is that the vector of endogenous variables are solved by substituting *the endogdnous variables* solved before one or more periods into *the predetermined endogenous variables* in *the vector of predetermined variables* in the right hand of the reduced form equation (2.22).

5.1. *Simulation Test*

As a result of simulation test 1, the original model was found to be too unapplicable to perform the simulation experiment, and to be the unstable oscillation system. The amplitude of oscillation expands explosively and all the time series of the endogenous variables alternate the signs in each period.

It is easily recognized from the pattern of this oscillation test that the maximum value of absolute characteristic root is larger than unity, and its sign is negative.

If there was no irreversible term in the consumption function, the oscillation could be more exclusive.

The extreme type of divergent oscillation was seen especially in the distribution aspect.

It should be noted that this test clarified unapplicability of this original model, which had never been discovered in the conventional test, i.e., structural test.

5.2. *Simulation Test (modified model 1)*

We have concluded for the following reasons that it was inventory investment function that made the original model very unstable.

The first reason is that (2.17) has two terms based on accelaration principles.

The second is the following two reasons from the statistical point of view. The standard error of estimated coefficients of these terms, which is most sensible to vary the oscillation property of the system, is larger relative to the values of the coefficients, i.e., the estimates, which are most critical, are statistically unstable. Furthermore, this inventory investment function is judged to be unapplicable, as is seen in that the value of multiple correlation coefficient is the lowest.
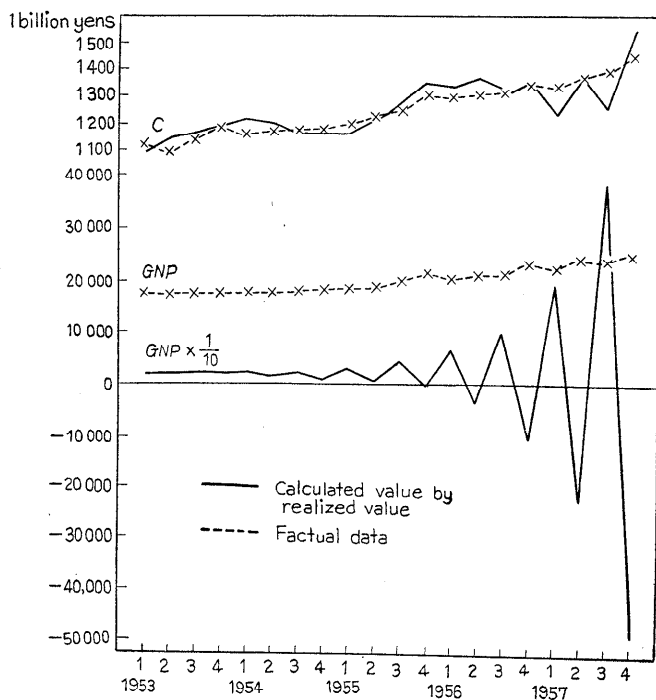

FIG. 1. Original Model

The third is that the data of inventory investment are unreliable, because there is difficulty in collecting the data in spite of its importance and the concept of inventory investment is ambiguous.

For the above three reasons, we remove inventory investment function (2.17) and related definitions (2.18) and (2.19).
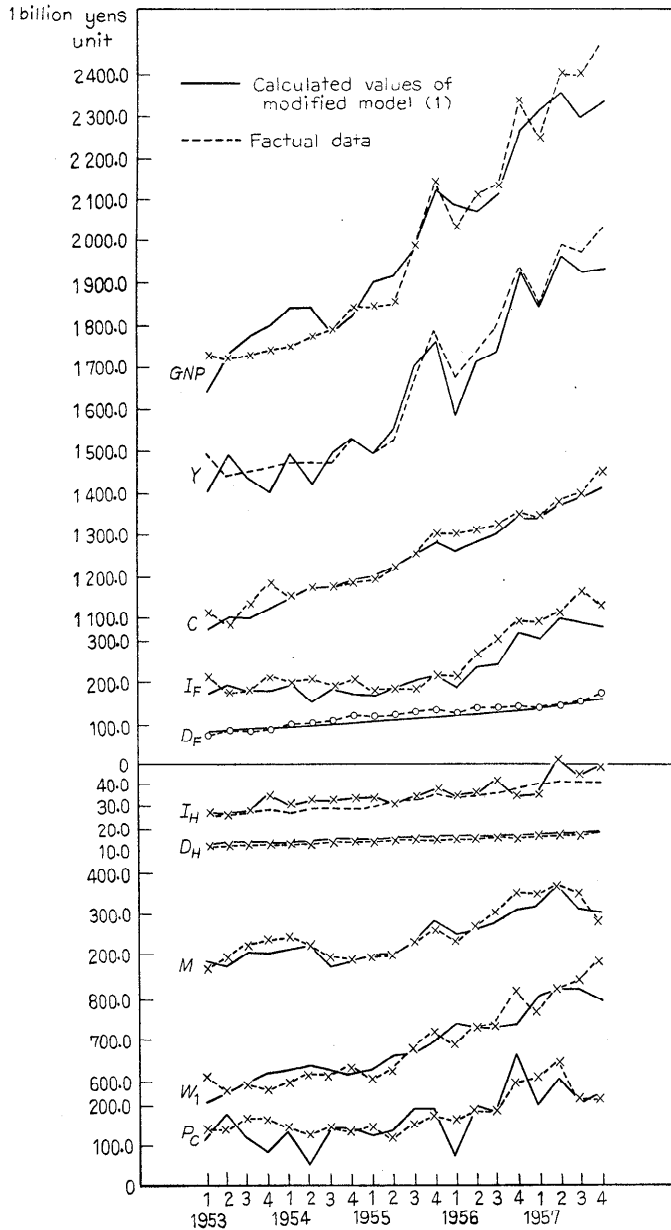
FIG. 2. Modified Model (1)

Consequently we treat the inventory investment as exogenous variables.

The modified model (1) is the one which has been improved in such manner and the simulation of the modified model (1) is shown in figure 2.

This result shows that the modified model (1) catches accurately the behaviors of endogenous variables. But in details, the gross national product, as a general index, is underestimated as a whole.

With respect to the expenditure aspect which is the main part of models, the calculated value of private consumption expenditures catches well its strikingly stable tendency except in 1953, and also the fixed investment and import showed the satisfactory result, and the detailed feature as to house investment was unstisfactory, but its tendency was well controlled. Distribution aspect was somewhat out of balance, but as a whole it was not unsatisfactory.

Comparing the calculated value with the realized value about three factors in this distribution aspect of this model, the wage income was in the reverse phase partially but almost applicable as a whole, the corporate profit showed good tendency but there was found unaccurate movement locally, and the corporate saving was exceptionally unstable.

Above are the main endogenous variables in this model, and though it is meaningless to observe all other endogenous variables determined by definitions, it is helpful for clarifying the quantitative relation among all variables.

For example the stock of fixed capital, stock of house and corporate surplus, which are all stock variables, are calculated by definitions. The applicability of the model is indirectly proved by good applicability of them, as generally errors in flow-variables are accumulated in stock-variables.

Consequently, it is considered that the depreciations of fixed capital and house, which depend upon those stock variables, turned out to be applicable.

5.3. *Simulation test 3 (modified model 2)*

The modified model (2) is the one which the nonlinear consumption function of the modified model (1) was substituted for the linear consumption function, and the purpose of test 3 is to show how much nonlinear $C_{\max}$ term contributed to strengthen the persuasiveness of the modified model (1).

As a result, it is clear that, by eliminationg $C_{\max}$, not only the fittness of our consumption function for stable trend is strikingly weakened, but also the applicabilities of calculated time series of all other variables, especially the fixed investment depreciation of fixed capital, corporate saving ane corporate surplus, are unexpectedly destructed.
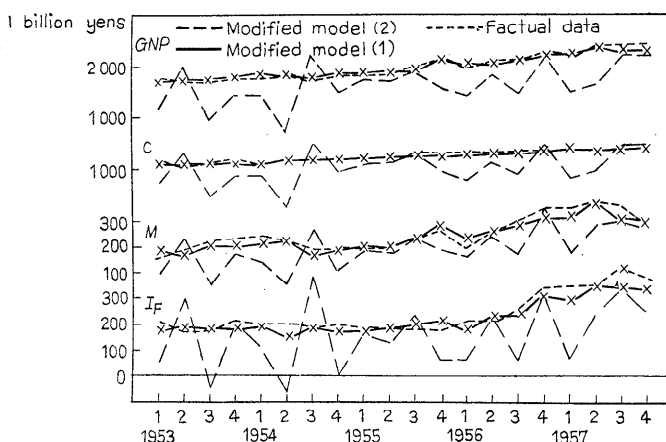
FIG. 3. Modified Model (2)

6. *Simulation Experiment*

6.1. *Measurement of Fiscal Policy Effect*

It is possible to know the effect of various fiscal policies upon the economic system through the simulation experiment. In our experiment, we tried to investigate through the modified model (1) how each time series of endogenous variables was influenced by successively adding 10 billion yen, as an increment, to each actual time series of instruments or controlled variables in the fiscal policy during our observed period, i.e., from the first quarter of 1955 to the fourth quarter of 1960.

Simulation experiments were performed in the following four cases

1) Multiplier effect of increasing the public investment by 10 billion yen.
2) Multiplier effect of increasing the indirect enterprise tax by 10 billion yen.
3) Multiplier effect of increasing the direct tax by 10 billion yen.
4) Multiplier effect of decreasing the direct tax by 10 billion yen.

As is shown in table 3, the multiplier effect upon each endogenous variables are considerably different. With respect to this, it is pointed out that the following two quantitative characteristics of multiplier, which have been unknown so far, are clarified.

First, though the multiplier has been meant the effect upon only the gross national products for national economy, every numerical value of multiplier on all the endogenoos variables could be calculated.

Second, the dynamic patterns of multiplier on all the endogenous variables were able to be examined.

Concerning the first point, the multiplier effect of public investment on the gross national products showed 155% which is approximately in

TABLE 3

		GNP	Y	C	I_F	M	W_1	P_c	S_c
$\Delta G=10$	Immediate effect	1.17	1.16	0.12	0.26	0.23	0.05	0.85	0.79
	Stationary effect	1.55	1.48	0.56	0.24	0.28	0.59	0.49	0.37
$\Delta T=10$	Immediate effect	−0.32	−1.32	−0.12	−0.31	−0.11	−0.01	−0.99	−0.92
	Stationary effect	−0.76	−1.63	−0.53	−0.38	−0.19	−0.27	−0.76	−0.56
$\Delta Z=10$	Immediate effect	−0.37	−0.36	−0.35	−0.08	−0.07	−0.02	−0.27	−0.25
	Stationary effect	−0.78	−0.75	−0.80	−0.11	−0.14	−0.30	−0.24	−0.19
$\Delta Z=\Delta 10$	Immediate effect	0.37	0.36	0.35	0.08	0.07	0.02	0.27	0.25
	Stationary effect	0.77	0.72	0.24	0.13	0.14	0.29	0.25	0.18

accordance with the value, i.e. beyond 100% which is considered in the theory of public finance.

About the second point, it is clear that there are following four time patterns of multiplier effect.

1) After the immediate strong effect, it's time path slows down sharply within the transient period and recovers gradually from the bottom to the initial level and converges to the stationary level. This time pattern is found in the fixed investment and corporate profit.

2) After the immediate weak effect, it increases explosively, and after a short transient period, it settles on a certain level. This type is observed in wage income.

3) The type which approaches to the finite level asymptotically is seen in the multiplier of private consumption expenditures.

4) The multipliers on the gross national products, net national income, house investment and import maintain the steady levels during the whole period.

Furthermore, we tried to compare the effect of increasing direct tax with the effect of decreasing one in order to investigate whether the multiplier effect is irreversible or not. As a result, the irreversible effect is found in the stationary multiplier, especially in the consumption expenditures and fixed investment.

Consequently it is obvious from the above various properties of multipliers that the time patterns of them can never be neglected to design more effective fiscal policy.

6.2. Multiplier Effect of Balanced Budget

Furthermore, by using econometric model, it is possible to perform the calculation on some interesting topics in the theory of public finance, i.e., the measurement of multiplier effect of balanced budget and built-in stabilizer effect. If the initial state is the balanced budget, the state of balanced budget maintains even if the size of budget enlarges through both increases of taxes by 10 billion yen and increases of public invest-

TABLE 4.[4)]   Multiplier effect of balanced budget

		C	I_F	M	GNP
1955	1	$\varDelta 2.3$	1.8	1.6	8.0
	2	$\varDelta 1.2$	0.8	1.4	8.3
	3	$\varDelta 1.0$	1.1	1.5	8.7
	4	$\varDelta 1.3$	1.0	1.5	8.4
1956	1	$\varDelta 2.6$	0.8	1.3	7.1
	2	$\varDelta 2.1$	1.2	1.4	7.8
	3	$\varDelta 1.9$	1.2	1.4	8.0
	4	$\varDelta 2.0$	1.2	1.4	7.9
1957	1	$\varDelta 2.0$	1.3	1.5	7.9
	2	$\varDelta 2.4$	1.2	1.4	7.5
	3	$\varDelta 2.4$	1.3	1.4	7.7
	4	$\varDelta 2.4$	1.4	1.4	7.7

ment by the same amount. The multiplier effect of balanced budget indicates how the enlargement of the size influences on the economic system.

Though it is considered nearly 100% in the theory of public finance, it was somewhat a small value, i.e., 80% according to our experiment of TCER Model III.

Built-in stabilizer means the *ratio* of multiplier effect of public investment weakened through the existence of public finance mechanism to the one without its mechanism. A part of increases of national income caused by increases of public investment is obserbed in the form of increases of taxes under the given tax rate.

This effect can be calculated by comparing the multiplier effect in taxation-exogenous model with the effect in taxation-endogenous model. The value calculated by Goldberger was about 20% (3).

When we reflect upon the actual problem, it is necessary for Ikeda Cabinet to provide for a certain economic conclusion because it is worring about how to allocate the natural increase of fiscal revenue, i.e., 250 billion yen to 300 billion yen, to the social security expenditures, public investment or tax reduction in order to accomplish the target rate of growth.

It would be possible to choose more appropriate economic policy among the alternatives, which is designed by using another econometric model reinforced by adding the transfer expenditure function, social security function and all other tax functions.

Our next task is to build such a reinforced econometric model, and to perform the simulation experiment by using this

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4) In case of increasing the public investment and taxes by 10 billion yen. Numerical values in table 4 is shown in a billion yen unit.

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