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AN ECONOMETRIC MODEL OF FLOW-OF-FUNDS

FUMIMASA HAMADA

CONTENTS

I. INTRODUCTION

Every economist is more or less curious to know how the genral economic interdependence works in an actual economy. So far many macroeconometric models have been proposed and studied, and the Brookings Model and F.R.B.-M.I.T. Model, among others, embody a recent remarkable development in macroeconometric models: they have been developed so as not only to include considerably disaggregated markets for commodities but also to deal with financial behaviors as closely related to non-financial behaviors as possible. This tendency, obviously, reflects recent intensive studies of actual price-formation mechanisms in their relation to the market structures of an economy, a fantastic goal for economists all over the world. The author himself cannot help being drawn to this endeavor.

Nevertheless, these models are not the exceptions in lacking explicit treatment

* The author is an associate professor, in the Department of Economics at Keio University. This study was done while he was a Fulbright Research Scholar and postdoctoral visiting fellow at Yale University in the 1968–69 academic year. He is grateful to James Tobin, William C. Brainard, Gary Fromm and Stephen Taylor for their useful comments and suggestions. He is naturally responsible for all the remaining errors. His thanks are due Charles W. Bischoff and other Yale men for their moral encouragement and useful assistance. This paper is a revised and extended version of my original paper (12). Funds for this study were by The Fulbright Commission in Japan and in the United States and the Department of Economics at Yale; computations were done at Yale Computer Center.

of supply of products from the viewpoint of producers' rationality. In other words, they are still of the so-called "demand-leading" type: investment in plant and equipment merely plays a role in giving an accelerated impact to final demands, or, as another round-about effect, in changing compensations of employees through labor-capital substitution, when a production function is introduced into the model which is supposed to determine labor employment. However, as is well known, gross fixed investment will raise production capacity, which will reflect producers' rational behavior for the following periods. This rational reaction from the supply-side would certainly make a difference in determining the level and change of GNP and other important indicators of economic activity.

In this study, the supply behavior of final products is explicitly taken into account from the viewpoint of producers' rationality in the relation to price-formation. Financial transactions are also explicitly analysed as intersectoral transactions because they are originally intersectoral, and aggregation over economic sectors, such as households, producers, financial insitutions, would lead to the obscuring of the nature of financial transactions.

This model includes ninety-seven equations, most of which are dynamic and nonlinear. Despite its dynamic characteristics, multiplier analysis, in this paper, is confined merely to the first period. Analysis of dynamic multipliers will be studied in its sequel. Nevertheless, some interesting results have been obtained: (i) the impact multiplier of government current expenditures for GNP is significantly higher than that of supply of money; (ii) the behavior of supply of final products seems to be considerably sensitive to the various types of impacts; (iii) the same is true about corporate profits and investment in inventories; (iv) the impact of transfer payments of government to individuals is naturally more effective on personal expenditures than on the activities of incorporated businesses; and (v) on the whole, fiscal policy appears to be more effective on the entire economy than does monetary policy. But it should be noted that this model is not designed for analysis of an economy under full employment, which would require more deliberate specification in equations for investment in plants and equipment, for labor-force participation (lacking in this model), for demand for and supply of money and securities, and so forth.

II. MAIN CHARACTERISTICS OF THE MODEL

II.1. Outline of the Model

The key subject in constructing this model is, as with many macroeconometric models, to make clear the mechanism of determination of GNP or income for the economy as a whole. A simple version of the Keynesian multiplier model does obviously have its own usefulness in showing a clear-cut description of the income-determination mechanism of an actual economy; but it is also true that if we attempt to compare an estimate for the impact multiplier derived from it with that derived from a large-scale model taking into account many behavioral relation-

ships simultaneously, there will certainly be a significant difference between the two. This fact seems to tell us that there is a need not only for the disaggregation of commodity markets, but also for the explicit and simultaneous treatment of factors which have so far been kept in the background of the economic structure in question: that is, financial behaviors by sector, producers' behavior of supply of final products, and so forth.

The model, which will be shown here, has been designed so as to include as many behavioral relations of several important economic sectors as possible, to the extent that its workability could be maintained without violating the essential features of the model.

For this purpose, the economy as a whole is divided into six sectors: individuals (households and unicorporated businesses), incorporated businesses, private financial intermediaries, the Bank of Japan, general government and foreign trade sectors. The market as a whole is also decomposed into markets for final products, i.e., labor, money and securities, each of which will be dealt with explicitly with the exception of the market for labor. It is natural that the emphasis is on financial and non-financial (i.e., physical) transactions between the three private sectors (individuals, incorporated businesses and private financial intermediaries) in the model-construction. In effect, about 75 per cent of all the equations (72 equations out of 97) are concerned with explanation of the behaviors of these three sectors.

To deal with various types of transactions among several economic sectors explicitly, it is rather convenient to introduce variables which are exogenous within certain sectors but endogenous in the model. By doing so, we have a legible equality of net in- and outflow of funds, caused by financial and non-financial transactions for the current period and, consequently, of assets-debts balance at the end-of-period for each sector.

Thus the model involves, firstly, specification of structural equations to explain behavioral pattern of financial and non-financial transactions for each sector, subject to the constraints above; secondly, the setting up of two equalities of demand for and supply of money and securities; and thiraly, an explicit representation of the dynamic adjustment process of the gap between potential—not technical but rational—supply of final products and demand for them in terms of price-movements for several time periods.

Aside from the dynamic process with respect to markets for final products, dynamic interdependency among sectors is taken tino account, particularly in the treatment of the loan behavior of private financial intermediaries and the demand for money by incorporated businesses. A direct (not open-market) operationor loan by the Bank of Japan makes private financial intermediaries change their financial assets-debts structures for the current period and consequently forces them to change their loans for the next period. These affect, through changes in trade-credit granted to individuals, household consumption, investment in dwellings, investment of unincorporated businesses in plants and equipment, and so forth.

It is also assumed that there may be inelasticity in the demand for money or downwards-rigidity in the financial transactions of incorporated businesses with private financial intermediaries, bringing about changes in trade-credit received from individuals for the next period, which also effect the consumption and investments of the Individuals sector.

II.2. Four Markets

In this model, the market structures with respect to final products, money and securities are explicitly shown. Since the nominal wage rate is assumed to be exogenously determined, labor employment is supposed to be determined, given the level of production for the current period and gross stock in fixed capital at the beginning-of-period. The following is a briefly summarizes the three markets.

A) Market for Final Products

Supply of final products is assumed to be determined with real wage rate, gross stock in fixed capital at the beginning-of-period and rate of neutral technical progress as given. This can be deduced under the assumption of profit-maximization; that is, define X as output level, L as labor input, GK_{-1} as gross stock in fixed capital at the beginning-of-period, then we can write a production function which is linear-homogeneous with respect to L and GK_{-1} as below:

$$X = f(L, GK_{-1}, t), \tag{1}$$

where t is a time variable which to express productivity changes subject to neutral technical progress in the Hicksian sense. The first condition ofr profit-maximization is:

$$\frac{\partial X}{\partial L} = \frac{w^*}{p}, \tag{2}$$

where w^* is money wage rate and p, the price of output; p is assumed to be predetermined at least for the current period. From equations (1) and (2), we can deduce a function for the desired output of real wage rate, the gross stock, and the price of output:

$$X^* = f^*\left(\frac{w^*}{p}, GK_{-1}, t\right), \tag{3}$$

where X^* is the desired level of output.(1)

(1) Kuh (19), Knowles and Warden, Jr. (18), Okun (28) and Anderson and Babcock (2) have so far analysed potential putput in terms of technical condition and full employment for the U. S. economy. Particularly, Kuh (19) introduced a dynamic production function to derive the long-run production-relation from it, and combining the latter with a labor participation equation he arrived at production capacity under full employment. However, all these attempts are obviously concerned with production capability, from the viewpoint of technology for the nation as a whole. Similarly, there is a need to derive the desired level of potential output from the viewpoint of producers' rationality, and these two concepts do not necessarily coincide with each other.

Estimating the structural parameters included in equation (1) directly and substituting the values estimated into the right-hand side of equation (3), we can get the estimates for the potential supply of output X^* in the observation periods. It should be noted that this potential supply is not technically optimal but rather that rationally desired by the producers. Moreover, equation (1) does not allow for changes in the degree of utilization in terms of the number of machines, equipment or plants, but it does take into account changes in the degree of utilization of hours, given the number of machines, equipment or plants for the unit period.

Demand for final products is the sum of the sectors' demands for them; that is, those for consumer goods, investment goods, the goods demanded by the general government sector, exports and imports (negative), each of which depends on behavioral patterns by sector. Let us define the sum of the volume of final demands as D^* then the potential excess supply of final products E is:

$$E = X^* - D^* . \tag{4}$$

Suppose that the potential excess supply could not be cleared up instantaneously and that it takes some time for this excess to be disposed of through the price-movements toward equilibrium. It might be possible to assume further that this excess is revealed both as change in the degree of utilization, which will soon be shown, on the one hand, and as passive (or unintended) investment in inventories on the other hand. In general, it is not obvious how the excess would be split into these two portions, but it might be conceivable to assume that the portion held in the form of passive investment in inventories depends on the level of this excess itself and on the price-level of output, indicating the general market conditions under which these passive changes in inventory -holdings would be swept away sooner or later, the availability of funds of the producers and wholesalers, and so forth.

Thus the passive investment in inventories could be shown as follows:

$$U = a_0 + a_1 E + a_2 U_{-1} + a_3 p_w + a_4 M^*_{c-1} \tag{5}$$

where U is the passive investment in inventories; p_w, wholessale price; and M^*_{c-1}, the beginning-of-period balance of excess money holdings in the incorporated businesses sector (explained in the next chapter).[2] The sign-condition expected for the constant are:

$$a_1, a_3 \text{ and } a_4 > 0 \; ; \quad 0 < a_2 < 1 ,$$

and consequently the degree of utilization ρ, in terms of product-capacity basis, can be defined as:

(2) Needless to say, U could be negative, zero and positive subject to the sign of $(X^* - D^*)$, so that a negative value, for instance, implies that producrs are forced into passive dis-investment in inventories because of greater demand for output compared with the desired level, and at the same time they should raise the degree of utilization to the level greater than unity.

$$\rho = \frac{D^* + U}{X^*} \tag{6}$$

In equation (5), a simple lag-distribution is taken into account to involve the dynamic adjustment process of the appropriation of the excess into the two portions. As will be seen later in equation (7–4), the estimate for *ai* tells us that the average period of the adjustment is about one year.

It is further assumed that the existence of passive investment in inventories for the current period would cause a decline in the price of output toward the new equilibrium, for the next period and later on. Since the passive investment in inventories is supposed to be carried out with an eye toward the final products, market, two basic price-formation equations are set up here at the present stage: those for the price of consumer goods and those for wholesale price. Other prices are assumed to be dependent, in principle, on wholesale price or to be exogenously determined outside the model, so that the average price of final products, which eventually indicates the GNP implicit price deflator, corresponds to that of those prices above.

To explain this process graphically, let us take a horizontal axis as labor employment (man-hours) and a vertical axis as marginal productivity of labor in Fig. 1. If money wage rate and the price of output for the current period are w^* and p_0 respectively, real wage rate is w^*/p_0, and consequently the desired labor employment is L_0^*, which is derived as another solution from equations (1) and (2).

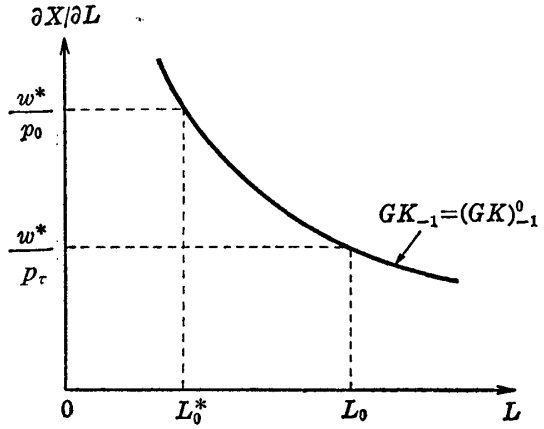

FIGURE 1

At the same time, we have the desired level of output from equation (3), with gross stock in fixed capital at the beginning-of-period (GK°_{-1}) as given. However, if the actual demand for output D_0^* were greater than the desired level of output X_0^* which is derived from equation (3) and if a part of the gap between X_0^* and D_0^* where held in the form of passive investment in inventories, as already mentioned above, the actual labor input for the current period would be:

$$L_0 = g(X_0, GK^\circ_{-1}, t_0) > L_0^* , \tag{7}$$

where function g is a solution of equation (1) with respect to L, and

$$X_0 = D_0^* + U_0 ,$$

where U_0 is the passive investment in inventories, which should be negative in this case for the current period.

For the actual level of output and labor employment to be in the equilibrium position, real wage rate should be w^*/p_τ, so that if the money wage rate were fixed at a certain level, the price of output would, other things being unchanged, have to rise to $p\tau$.[3] This adjustment process is assumed to start at the next period and go on for τ unit periods. In this sutdy this is dealt with in the combination of the passive investment and price-formation equations. Price-formation equations for the price of consumer goods p_c and for wholesale price p_w are as follows:

$$\Delta p_c = k_c[h_c(U_{-1}, U_{-2}, w^*) - p_{c-1}] , \tag{8}$$

$$\Delta p_w = k_w[h_w(U_{-1}, U_{-2}, \Delta i_d) - p_{w-1}] , \tag{9}$$

where k_c and k_w are the reaction-coefficients, functions h_c and h_w express the desired prices and Δi_d shows the change of interest rate on discounts. The estimates for k_c and k_w tell us that the average period of adjustment is about 15 months for the price of consumer goods and 24 months for wholesale price. The prices for fixed investment goods (p_i) and for inventories (p_j) are simply dependent on wholesale price:

$$p_i = h_i(p_w, w^*, i_L) , \tag{10}$$

$$\Delta p_j = k_j[h_j(p_w) - p_{j-1}] , \tag{11}$$

where i_L is the average interest rate on loans. The average period of adjustment for the price of inventories is about 10 months. Since the price p in Fig. 1 or in equation (3) is the average of the prices for all GNP ocmponents, all the prices (determined as shown above) are used to calculate the GNP implicit price deflator, combined with other prices which are assumed to be exogenously determined outside of the model.

B) Market for Money

In this model, money includes cash currency issued both by the Bank of Japan and by the government, postal transfer savings to the government, and deposit

(3) It should be noted that the equilibrium level of price would more exactly be somewhere between p_0 and p_τ, because increasing price would depress the demand for output. In the ordinary macroeconometric models, the changes in prices are supposed to be completely dependent on changes in final demands and cost of production. Since the simple version of the stock adjustment inventories equation implies that a constant fraction of the actual changes in inventories is, after all, unintended, this does not imply that to introduce unintended investment in inventories, (derived in such a simple way as that mentioned above) into the price-formation equation is to take into account the gap between supply of and demand for output. Eckstein and Fromm (7) recently analysed the price equation in an ingenious and sophisticated way, taking into account undesired drawdown of suppliers' inventory, build-up of unfilled orders, backlog and abandoned orders.

currency by private financial intermediaries. Supply of cash currency by the Bank of Japan is, in principle, supposed to be dependent on the sum of demands for money by all sectors, but as an alternative the case is also examined where supply of cash currency by the Bank of Japan is controlled trhough monetrary policies such as operation (not in open market), discount-business, the direct guidance to city banks, and so forth.

Supply of postal transfer savings and deposit currency may almost be dependent on demand for them and, consequently, on the economic activities of individuals, incorporated businesses and general government. Thus, total effective supply of money (M^s) can be defined as below:

$$(12)\quad M^s = (CAS_n^- + CAS_g^- - CAS_b^+) + (CDG_n^- + CSD_b^- + PTS_g^-)$$

where CAS_n^-, CAS_g^- and CAS_b^- are cash currency issued by the Bank of Japan and the government and cash holdings of private financial intermediaries respectively, and CDG_n^-, CSD_g^- and PTS_b^- are the government's deposit currency held in the Bank of Japan, deposit currency of individuals, incorporated businesses and the government held in the private financial intermediaries, and postal transfer savings respectively.(4)

Demand for money is the sum of sectors' demands for it. Demand for money by individuals is a function of price for consumer goods, disposable income and trade-credit received.(5) Demand for money by incorporated businesses depends on the level of real business activity, but as alrady mentioned they are supposed to have excess or undesired money which would, other things being unchanged, be swept away during the next few periods. Demand for money by the government is assumed to be exogenous. Thus the sum of sectors' demands for money (M^d) can be written as below:

$$(13)\quad M^d = MON_h^+ + MON_c^+ + MON_g^+ ,$$

where MON_h^+, MON_c^+ and MON_g^+ are money holdings of individuals, incorporated businesses and the bovernment.

From equations (12) and (13), the equality between supply of and demand for money or the equilibrium condition for the market for money is:

$$M^s = M^d, \text{ or}$$

$$(14)\quad (CAS_n^- + CAS_g^- - CAS_b^+) + (CDG_n^- + CSD_b^- + PTS_g^-) = MON_h^+ + MON_c^+ + MON_g^+ .$$

(4) Since cash currency can be issued by the Bank of Japan through changes in loans to city banks, acceptance of newly issued government bonds, operation orented to particular main city banks—in this sense, this situation is not open-market—and the purchasing of foreign exchange, various types of selection may be possible in estimating the impact multipliers, which will show significantly different results for each selection.

(5) After considerable attempts to introduce interest rates into the equation for demand for money, no satisfactory result could be obtained, but in the equation for demand for deposit currency, the large part of which is held by unincorporated businesses, a barely significant coefficient-estimate on stock price could be obtained.

In equation (14), since all the terms except for MON_g^+ on the right-hand side are determined by the corresponding demand behavior for each, and since CSD_b^- and PTS_g^- are determined elsewhere and CAS_g^-, CDG_n^- and MON_g^+ are assumed to be exogenous, this equation is supposed to determined cash currency issued by the Bank of Japan or, alternatively, cash holdings of private financial intermediaries with supply of cash currency as an exogenous variable.(6) In the latter case, an increase in supply of cash currency leads to an increase in cash holdings of private financial intermediaries, loans to individuals by private financial intermediaries, in trade-credit received by individuals and in consumption expenditures, investment in dwellings, investment of unincorporated businesses in plants and equipment, and so on. On the other hand. The adjustment of private financial intermediaries to changes in their assets-debts structure will lead to changes in demand for securities, which also give rise to changes in securities' holdings of individuals through changes in stock prices.

C) Market for Securities

In the postwar Japanese economy, the market for securities seems to be imperfectly competitive, particularly in their circulation market. Even in thestock market, the large portion of 'change-hands' appeared to be covered by the 'securities investment trust', particularly during the period 1960–61. Moreover, as interest rates on loans and discounts are strongly controlled by the monetary authorities, they do not serve as equilibrators in the markets for money and securities. Because of the factors mentioned above, stock price is chosen sa an equilibrator of demand for and supply of securities and consequently money.(7)

Demand for securities is the sum of those for government bonds, local government securities and public corporation bonds; industrial bonds and stocks; bank debentures; stocks issued by private financial intermediaries; and securities investment trusts, so that demand for a bundle of these various types of securities is dealt with by sector. Thus, total demand for securities SEC^d is:

$$SEC^d = SEC_h^+ + SEC_c^+ + SEC_b^+ + SEC_n^+ + SEC_g^+ , \tag{15}$$

where the subscripts h, c, b, n and g indicate the sectors of individuals, incorporated businesses, private financial intermediaries, the Bank of Japan and government respectively, and the superscripts (+) express the debit-side. All the terms no

(6) In the case where cash currency is assumed to be exogenous, equation (14) is supposed to determine cash holdings of private financial intermediaries at first, so that the equation for cash holdings of private financial intermediaries is to be dropped from the model. This was done by estimating the impact multipliers on an increase of supply of cash currency by the Bank of Japan through a change in loans or operations oriented to particular main city banks.

(7) In an earlier paper (12), stock price had been assigned as an exogenous variable, and this seemed to have made the model rather rigid so that an endogenous stock price has been introduced as an equilibrator in the market for securities and also for money to make the model itself more flexible. Otherwise, the gap between demand for and supply of securities should have been adjusted quantitatively as in the earlier paper.

the right-hand side except for the last two are assumed to be endogenously determined.

Supply of securities consists of those listed above, among which the first two (government bonds, local government securities and public corporation bonds, and industrial bonds and stocks) are assumed to be endogenous. Thus, the equality between demand for and supply of securities or equilibrium condition of the market for securities can be written as below:

$$SEC^d = SEC^s \tag{16}$$

As already mentioned above, the endogenous stock price, as an equilibrator between demand for and supply of securities, has a very important role in its relation to the workability of the model as a whole. For instance, the buying operations of the Bank of Japan, which are not open-market but oriented particularly to the main city banks, are supposed to reduce the securities holdings of private financial intermediaries and to lead to an increase of cash holdings by that sector, which will give rise to increases in deposit currency, stock prices and consequently in the supply of industrial bonds and stocks, which in turn lead to increases in the excess money of incorporated businesses, trade-credit granted to individuals, consumption expenditures, investment in dwellings, and so forth.

D) Market for Labor

In order to avoid complexity in wage determination, the money wage rate is assumed to be exogenously determined out side of this model. As a matter of fact, labor employment is supposed to be determined by the actual output level, which is the sum of final demands ($D^* + U$), with gross stock in fixed capital at the beginning-of-period as given. This implies that though the curve of demand for labor is coincident with that of the marginal productivity of labor, real wage rate is not necessarily equal to the actual marginal productivity of labor for the current period. It is also assumed that supply of labor always fulfills demand for it instantaneously.

III. EMPIRICAL RESULTS

The observation period is from the first half of 1955 through the latter half of 1965. Unit time period is a half year, so that the sample size is only 24. The reasons, as will be shown in the Appendix on data, are that i) this observation period is rather normal in the postwar Japanese economy, ii) comparatively reliable data on flow-of-funds is available during these years, and iii) quarterly data on flow-of-funds does not cover all the finnacial transactions, particularly of private financial intermediaries, except after 1963.

For this reason, the simple, least squares method was used in estimating all the equations. Since the production function is of *CES*-type, a sort of 'steepest

ascending' method of nonlinear parameters was used.[8] Seasonal adjustment has not been applied for all data, and instead a seasonal dummy variable was introduced. In principle, final selection of the estimated equations is due to 10 per cent significance-level with respect to estimates for the structural parameters and 5 per cent significance-level for serial correlation of the distrubances.

Needless to say, however, this criterion is not automatically applied for the final selection. In the notation below, a small circle after variables indicates that they are exogenous and an asterisk (*) indicates endogenous variables, which were eventaually assumed to be exogenous in estimating the impact multipliers. The first of the three figures in front of each equation indicates a sector; the second, debit-side (–1–) and credit-side (–2–) on the accounts for each sector and the third, the number of the equation in numerical order by sector. Figures in parentheses under the estimated coefficients are standard deviations of the estimates; $\bar{R}^2$ is the coefficient of determination; $\bar{S}$, the standard error of the regression estimates; and d, the Durbin-Watson statistic.

III.1. Empirical Results

(1) *Individuals and Unincorporated Businesses*

(1–1–1) Consumption Expenditures

$$\frac{C}{p_c} = \underset{}{745.48} + \underset{(0.0228)}{0.7424}\left(\frac{Y_d}{p_c}\right) + \underset{(0.1752)}{0.2573}\left(\frac{\Delta TCR_h^- + \Delta LO_h^-}{p_c}\right)_{-1} + \underset{(61.77)}{701.44}Q$$

$$\bar{R}^2 = 0.990 \qquad \bar{S} = 122.63 \qquad d = 2.955$$

(1–1–2) Direct Taxes and Charges

$$TAX_h + TAX_h^* = \underset{}{-170.26} + \underset{(0.0451)}{0.0896}\,(Y_w)_{-1} + \underset{(0.0408)}{0.1352}\sum_0^1 (Y_p + Y_r)_{-j} + \underset{(29.90)}{40.84}Q$$

$$\bar{R}^2 = 0.991 \qquad \bar{S} = 35.32 \qquad d = 0.840$$

(1–1–3) Investment of Unincorporated Businesses in Plant and Equipment

$$\frac{I_h}{p_i} = \underset{}{-62.02} + \underset{(0.0031)}{0.0397}\left(\frac{Y_d}{p_i}\right)_{-1} + \underset{(0.0246)}{0.0770}\frac{\Delta TCR_h^- + \Delta LO_h^- + \Delta LOG_h^-}{p_i} + \underset{(8.94)}{81.73}Q$$

$$\bar{R}^2 = 0.965 \qquad \bar{S} = 19.04 \qquad d = 2.586$$

(1–1–4) Investment in Dwellings

$$\frac{IH_h}{p_h} = \underset{}{-197.05} + \underset{(0.0043)}{0.0997}\left(\frac{Y_d}{p_h}\right) + \underset{(0.0282)}{0.0309}\left(\frac{\Delta TCR_h^- + \Delta LO_h^- + \Delta LOG_h^-}{p_h}\right)_{-1} \underset{(10.44)}{-118.15}Q$$

$$\bar{R}^2 = 0.981 \qquad \bar{S} = 19.41 \qquad d = 1.079$$

(8) The computation program for "Least Squares Estimation of Nonlinear Parameters" is avaialble at the Yale Computer Center. Charles W. Bischoff kindly asisted me in using and making the proper revision of the program. Suggestions on the device of the program by Roger Klein were also helpful.

(1–1–5) Money Holdings

$$\frac{MON_h^+}{p_c} = -120.75 + \underset{(0.0637)}{0.4289}\left(\frac{Y_d}{p_h}\right) + \underset{(0.1196)}{0.3057}\left(\frac{TCR_h^-}{p_c}\right)_{-1} - \underset{(96.15)}{349.87}Q$$

$$\bar{R}^2 = 0.991 \qquad \bar{S} = 97.07 \qquad d = 1.750$$

(1–1–6) Cash Currency Holdings

$$CAS_h^+ = 52.40 + \underset{(0.0055)}{0.3092}\, MON_h^+ + \underset{(15.00)}{62.65}Q$$

$$\bar{R}^2 = 0.994 \qquad \bar{S} = 34.50 \qquad d = 1.262$$

(1–1–7) Deposit Currency Holdings

$$\frac{CSD_h^+}{p_c} = 347.31 + \underset{(0.1220)}{0.2556}\left(\frac{Y_d - C}{p_c}\right) + \underset{(0.0577)}{0.6724}\left(\frac{TCR_h^-}{p_c}\right)_{-1}$$

$$- \underset{(0.0821)}{0.0920}\left(\frac{p_s}{p_c}\right) - \underset{(141.50)}{68.99}Q$$

$$R^2 = 0.984 \qquad \bar{S} = 94.97 \qquad d = 1.1617$$

(1–1–8) Postal Transfer Savings

$$\Delta PTS_h^+ = \Delta MON_h^+ - (CAS_h^+ + \Delta CSD_h^+)$$

(1–1–9) Time & Savings Deposit (incl. Trust & Life-Insurance)

$$\Delta DT_h^+ = 95.73 + \underset{(0.0668)}{0.3560}(Y_d - C) - \underset{(0.2095)}{0.2900}(\Delta p_s) + \underset{(0.1245)}{0.4230}(\Delta DT_h^+)_{-1} - \underset{(104.11)}{184.96}Q$$

$$R^2 = 0.925 \qquad \bar{S} = 107.67 \qquad d = 2.381$$

(1–1–10) Postal Savings and Post-Office Life-Insurance & Postal Annuity

$$\Delta PS_h^+ = 14.34 + \underset{(0.0043)}{0.0578}(Y_d - C) + \underset{(0.0645)}{0.5365}(\Delta PS_h^+)_{-1}$$

$$R^2 = 0.942 \qquad \bar{S} = 16.09 \qquad d = 2.942$$

(1–1–11) Securities Holdings

$$\frac{SEC_h^+}{p_c} = 205.77 + \underset{(0.3330)}{0.7237}\left(\frac{Y_d - C}{p_c}\right) + \underset{(0.2612)}{0.3735}\left(\frac{p_s}{p_c}\right) + \underset{(0.1398)}{0.5792}\left(\frac{SEC_h^+}{p_c}\right)_{-1}$$

$$- \underset{(395.34)}{617.52}Q$$

$$R^2 = 0.918 \qquad \bar{S} = 303.45 \qquad d = 2.474$$

$$\frac{\Delta SEC_h^+}{p_c} = 205.77 + 0.7237\left(\frac{Y_d - C}{p_c}\right) + 0.3735\frac{p_s}{p_c} - 0.4208\left(\frac{SEC_h^+}{p_c}\right)_{-1}$$

(1–2–1) Compensation of Employees

$$Y_w = w^* \bar{h} L$$

(1–2–2) Income from Unincorporated Businesses

$$Y_p = \underset{}{217.92} + \underset{(0.0077)}{0.1469}GNP + \underset{(57.63)}{782.75}Q$$

$$R^2 = 0.975 \qquad \bar{S} = 130.56 \qquad d = 2.774$$

(1–2–3) Income from Property (excl. Dividends)

$$(Y_r - DIV) = \underset{}{17.40} + \underset{(0.0053)}{0.0170}\sum_0^1 (SEC_h^+)_{-j} + \underset{(0.0015)}{0.0291}\sum_0^1 (DT_h^+ + PS_h^+)_{-j}$$

$$R^2 = 0.999 \qquad \bar{S} = 10.44 \qquad d = 0.769$$

(1–2–4) Provisions for the Consumption of Fixed Capital in Unincorporated Businesses

$$DEP_h^1 = \underset{}{-923.14} + \underset{(0.0211)}{0.2205}(K_h)_{-1} - \underset{(57.87)}{131.10}i_L + \underset{(8.17)}{121.43}Q$$

$$R^2 = 0.968 \qquad \bar{S} = 18.83 \qquad d = 3.316$$

(1–2–5) Changes in Trade Credit Net-Received

$$\Delta TCR_h^- = TCR_c^+ - \Delta TCR_c^-$$

(1–2–6) Borrowings from Private Financial Instituttions

$$\Delta LO_h^- = \Delta LO_b^+ - \Delta LO_c^-$$

(1–2–7) Changes in Other Assets: Sector-Balancing Variable

$$\Delta OT_h^+ = (Y_d + DEP_h^1 + DEP_h^2 + \Delta TCR_h^- + \Delta LO_h^- + \Delta LOG_h^-) - C + I_h + IH_h + J_h + \Delta CAS_h^+ + \Delta CSD_h^+ + \Delta PTS_h^+ + \Delta DT_h^+ + \Delta PS_h^+ + \Delta SEC_h^+)$$

(1–2–8) Disposable Income of Persons

$$Y_d = (Y_w + Y_p + Y_r + TR_{ch} + RT_{gh} + TR_{fh} - R_h) - (TXA_h + SI_h + TR_{hg} + TR_{hf})$$

(2) *Corporate Businesses*

(2–1–1) Direct Taxes and Changes on Private Corporations

$$TAX_c = \underset{}{608.59} + \underset{(0.0340)}{0.2940}A\left(\sum_0^2 Y_{c-l} - d_1\sum_0^2 DIV_{-j}\right) + \underset{(0.1346)}{0.7386}B\sum_0^2 DIV_{-j}$$

$$- \underset{(73.74)}{246.65}i_L - \underset{(8.18)}{14.69}Q$$

$$R^2 = 0.990 \qquad \bar{S} = 19.01 \qquad d = 1.412$$

(2–1–2) Dividends to Persons

$$DIV = \underset{}{5.16} + \underset{(0.0087)}{0.0415}Y_c + \underset{(0.0530)}{0.7824}DIV_{-1} - \underset{(2.53)}{12.62}Q$$

$$R^2 = 0.994 \qquad \bar{S} = 5.53 \qquad d = 2.403$$

(2–1–3) Investment in Plant and Equipment

$$\frac{I_c}{p_i} = \underset{}{-10.62} + \underset{(0.1175)}{0.2156}\left(\frac{R_c^* + DEP_c^1}{p_i}\right)_{-1} + \underset{(0.0301)}{0.0992}\Delta\left(\frac{V_c}{p_w}\right) + \underset{(0.1046)}{0.6929}\left(\frac{I_c}{p_i}\right)_{-1}$$

$$+\underset{(48.79)}{222.99}Q$$

$$\bar{R}^2 = 0.970 \qquad \bar{S} = 113.08 \qquad d = 1.906$$

(2–1–4) Investment in Inventories

a) $\frac{J_c}{p_j^*} = \frac{J_c^*}{p_j^*} + U$, b) $\frac{J_c^*}{p_j^*} = \frac{H_c^*}{p_j} - \left(\frac{H_c}{p_j}\right)_{-1}$, c) $\frac{H_c}{p_j} = \frac{J_c}{p_j^*} + \left(\frac{H_c}{p_j}\right)_{-1}$

(2–1–5) Normal (or Desired) Level of Inventories

$$\frac{H_c^*}{p_j} = 0.30871e^{-0.0177t}\left(\frac{V_c}{p_w}\right)$$

(2–1–6) Holdings of Cash Currency

$$CAS_c^+ = MON_c^+ - CSD_c^+$$

(2–1–7) Deposit Currency Holdings

$$CSD_c^+ = \underset{}{-176.56} + \underset{(0.0054)}{0.9499}MON_c^+ + \underset{(2.7695)}{6.3657}\left(\frac{V_c}{Y_c}\right)$$

$$\bar{R}^2 = 0.999 \qquad \bar{S} = 32.44 \qquad d = 1.918$$

(2–1–8) Changes in Time and Savings Deposits

$$\Delta DT_c^+ = \underset{}{-15.60} + \underset{(0.0374)}{0.1334}\Delta MDT_c^+ + \underset{(0.0168)}{0.1282}\sum_0^1 \Delta LO_{c-j}^-$$

$$\bar{R}^2 = 0.922 \qquad \bar{S} = 58.28 \qquad d = 2.068$$

(2–1–9) Changes in Money Holdings

$$\Delta MON_c^+ = \Delta MDT_c^+ - \Delta DT_c^+$$

(2–1–10) Securities Holdings

$$SEC_c^+ = \underset{}{-20.15} + \underset{(0.0597)}{0.1372}(R_c^* + DEP_c^1 + DEP_c^2)_{-1} + \underset{(0.0369)}{0.0468}p_s$$

$$+ \underset{(0.0391)}{0.9667}(SEC_c^+)_{-1}$$

$$R^2 = 0.998 \qquad \bar{S} = 44.10 \qquad d = 2.043$$

(2-1-11) Trade Credit Granted

$$TCR_c^+ = 219.04 + 0.3355\Delta V_c + 1.0019(TCR_c^+)_{-1}$$
$$(0.1172) \quad (0.0224)$$
$$R^2 = 0.993 \quad \bar{S} = 482.84 \quad d = 1.851$$

(2-2-1) Income from Private Corporations

$$Y_c = (GNP - ITAX + SUB_g - DEP_h^1 - DEP_h^2 - DEP_c^1 - DEP_c^2 - SGAP) - (Y_w + Y_p + Y_r - DIV + Y_g - R_g - R_h)$$

(2-2-2) Net Savings

$$R_c = Y_c - (DIV + TAX_c + TR_{ch})$$

(2-2-3) Net Savings Available for Investment in Plant and Equipment

$$R_c^* = R_c - \frac{1}{2}(p_j + p_{j-1})U$$

(2-2-4) Provision for the Consumption of Fixed Capital

$$DEP_c^1 = -286.13 + 0.0748Y_c + 0.0483(K_c)_{-1} + 86.09d_2 + 22.92Q$$
$$(0.0302) \quad (0.0037) \quad (9.63) \quad (8.49)$$
$$R^2 = 0.998 \quad \bar{S} = 19.20 \quad d = 2.165$$

(2-2-5) Provision for the Consumption of Dwellings

$$DEP_c^2 = -2.04 + 0.0204[KH_c + (KH_c)_{-1}]$$
$$(0.0005)$$
$$R^2 = 0.989 \quad \bar{S} = 1.15 \quad d = 2.500$$

(2-2-6) Changes in Issue of Industrial Bonds and Stocks

$$\Delta BS_c^- = -87.97 + 0.3393(I_c\text{-}FINC\text{-}FING)$$
$$(0.0950)$$
$$- 0.1060(DT_c^+ + SEC_c^+ - 0.2563LO_c^-)_{-1} + 0.4544(p_s/i_L)$$
$$(0.0230) \quad (0.1781)$$
$$R^2 = 0.877 \quad \bar{S} = 67.89 \quad d = 2.569$$

(2-2-7) Changes in Trade Credit Received

$$\Delta TCR_c^- = 3425.37 + 1.3356J_c - 1216.90\Delta i_d - 0.0165(TCR_c^-)_{-1}$$
$$(0.4707) \quad (1265.87) \quad (0.0260)$$
$$- 0.6718(M_c^*)_{-1} - 1373.73id - 117.78Q$$
$$(0.2794) \quad (1044.90) \quad (142.29)$$
$$R^2 = 0.676 \quad \bar{S} = 313.79 \quad d = 1.355$$

(2-2-8) Changes in Borrowing from Private Financial Institutions

$$\Delta LO_c^- = -1574.88 + 0.3103I_c - 0.2558d_3(I_c + J_c) - 0.4482(LO_c^-)_{-1}$$
$$(0.1870) \quad (0.0680) \quad (0.1652)$$

$$+ \underset{(0.0688)}{0.2100}(TAS_c)_{-1} + \underset{(91.99)}{304.14}Q$$

$$R^2 = 0.928 \qquad \bar{S} = 199.54 \qquad d = 2.399$$

(2–2–9) New Supply of Industrial Funds from Private Financial Institutions

$$FINC = 1.5288 + \underset{(0.0185)}{0.1499}\Delta LO_c^- + \underset{(0.0638)}{0.5654}(FINC)_{-1}$$

$$R^2 = 0.972 \qquad \bar{S} = 34.59 \qquad d = 2.568$$

(2–2–10) Changes in Money and Time and Savings Deposits: Sector-Balancing Variable

$$\Delta MDT_c^+ = (Y_c + DEP_c^1 + DEP_c^2 + \Delta BS_c^- + TCR_c^- + \Delta LO_c^- + \Delta LOG_c^- + \Delta OT_c^-) - (TAX_c + DIV + TR_{ch} + I_c + IH_c + J_c + \Delta SEC_c^+ + TCR_c^+)$$

(2–2–11) Total Assets

$$TAS_c = K_c + KH_c + H_c + CSD_c^+ + CSD_c^+ + DT_c^+ + SEC_c^+ + TCR_c^+$$

(2–2–12) Excess Money Balance

$$M_c^* = MON_c^+ - \begin{bmatrix} 0.1114 \\ 0.1176 \end{bmatrix} V_c$$

(3) *Private Financial Institutions*

(3–1–1) Cash Currency Holdings

$$CAS_b^+ = \underset{(0.0006)}{-6.25 + 0.0165}(CSD_b^- + DT_b^-) + \underset{(9.69)}{22.80}Q$$

$$R^2 = 0.973 \qquad \bar{S} = 22.60 \qquad d = 1.621$$

(3–1–2) Changes in Short-Term Government Securities

$$\Delta SB_b^+ = \Delta SB_g^- - (\Delta SB_n^+ + \Delta SB_g^+)$$

(3–1–3) Changes in Loans

$$\Delta LO_b^+ = 712.33 + \underset{(0.1477)}{0.6159}\Delta LON_b^- + \underset{(0.0277)}{0.7609}\Delta(CSD_b^- + DT_b^- + BF_b^-) + \underset{(0.2768)}{1.0488}OPe - \underset{(42.06)}{104.66}(LO_b^+/SEC_b^+)_{-1}$$

$$R^2 = 0.989 \qquad \bar{S} = 94.42 \qquad d = 1.635$$

(3–1–4) Changes in Securities: Sector-Balancing Variable

$$\Delta SEC_b^+ = (\Delta CSD_b^- + \Delta DT_b^- + \Delta BF_b^- + \Delta ST_b^- + \Delta IB_b^- + \Delta LON_b^- + \Delta OT_b^-) - (\Delta CAS_b^+ + \Delta CND_b^+ + \Delta SB_b^+ + \Delta LO_b^+)$$

(3–2–1) Changes in Current Deposits

$$\Delta CSD_b^- = \Delta CSD_h^+ + \Delta CSD_c^+ + \Delta CSD_g^+$$

(3–2–2) Changes in Time and Savings Deposits

$$\Delta DT_b^- = \Delta DT_h^+ + \Delta DT_c^+ + \Delta DT_g^+$$

(4) *The Bank of Japan*

(4–1–1) Changes in Loans

$$\Delta LON_n^+ = \Delta LON_b^-$$

(4–2–1) Changes in Other Debts: Sector-Balancing Variable

$$\Delta OT_n^- = (\Delta SB_n^+ + \Delta SEC_n^+ + \Delta LON_n^+) - (\Delta CAS_n^- + \Delta CND_n^- + \Delta CDG_n^-)$$

(5) *General Government*

(5–1–1) Changes in Deposit Currency

$$\frac{CSD_g^+}{P_{cg}} = \underset{}{23.96} + \underset{(0.1519)}{0.4004}\left(\frac{Y_g}{P_{cg}}\right)_{-1} + \underset{(0.0401)}{0.1243}\left(\frac{C_g}{P_{cg}}\right)_{-1} - \underset{(9.13)}{61.98}Q$$

$$R^2 = 0.775 \qquad \bar{S} = 20.98 \qquad d = 2.152$$

(5–2–1) Indirect Taxes

$$ITAX = \underset{}{18.81} + \underset{(0.0172)}{0.0538}GNP_{-1} + \underset{(0.2241)}{0.3422}ITAX_{-1} + \underset{(29.35)}{78.05}Q$$

$$R^2 = 0.997 \qquad \bar{S} = 46.12 \qquad d = 2.134$$

(5–2–2) Changes in Postal Transfer Savings

$$\Delta PTS_g^- = \Delta PTS_h^+$$

(5–2–3) Changes in Postal Savings

$$\Delta PS_g^- = \nabla PS_h^+$$

(5–1–2) Changes in Government Bonds and Others: Sector-Balancing Variable

$$\begin{aligned}\Delta PB_g^- = {} & (C_g + SUB_g + TR_{gh} + TR_{gf} + I_g + J_g + \Delta CAS_g^+ \\ & + CSD_g^+ + \Delta CDG_g^+ + \Delta DT_g^+ + \Delta SB_g^+ + \Delta SEC_g^+ \\ & + \Delta LOG_g^+ + \Delta FCRE_g^+ + \Delta FM_g^+ + \Delta OT_g^+) - (TAX_h \\ & + TAX_c + ITAX + SI_h + TR_{hg} + Y_g + DEP_g - R_g \\ & + \Delta CAS_g^- + \Delta PTS_g^- + \Delta PS_g^- + \Delta SB_g^- + \Delta FDEB_g^-)\end{aligned}$$

(6) *The Rest of the World*

(6–2–1) Imports of Goods and Services and Factor Income Paid Abraod

$$\frac{IMP}{p_m} = \underset{}{-53.76} + \underset{0.0303)}{0.0826}\left(\frac{GNP}{p} - \frac{J_p}{p_j^*}\right) + \underset{(0.0638)}{0.3527}(J_p/p_j^*)$$

$$+ 0.4340(IMP/p_m)_{-1} - 41.80i_m - 250.80Q$$
$$(0.1897) \qquad (25.60) \quad (34.03)$$
$$R^2 = 0.991 \qquad \bar{S} = 43.92 \qquad d = 2.110$$

(6-2-2) Changes in Gold & Foreign Exchange Reserves: Sector-Balancing Variable

$$\Delta FM_f^- = (EXP + TR_{fh} + TR_{fh} + FDEB_f^+) - (IMP + TR_{hf} + TR_{gf}^- + \Delta FCRE_f^- + \Delta OT_f^-)$$

(7) *The Unifying Sector*

(7-1) Potential Supply of Final Products

$$\frac{GNP^*}{p} = 3854.029\, e^{0.0024627t} GK_{-1} \left(\frac{w^*}{p}\right)^{0.8183092} \cdot \left[0.9122997 \left\{0.424569\, e^{0.013554t} \Big/ \left(\frac{w^*}{p}\right)\right\}^{0.1816908} - 1\right]^{4.5038553}$$

(7-2) Production Function (determining the number of employees)

$$\frac{GNP}{p} = 0.246616\, e^{0.013554t}[0.15006(GK_{-1})^{-0.222032} + 0.84994(hL)^{-0.222032}]^{-4.5038553}$$
$$\bar{S} = 324.63 \qquad F = 4.000$$

(7-3) Potential Demand for Final Products

$$GNE^* = C + I_h + J_h + JH_h + I_c + J_c^* + IH_c + C_g + I_g + J_g + EXP - IMP$$

(7-3′) Gross National Product

$$GNP = GNE^* + p_j^* U$$

(7-4) Passive (Unintended) Investment in Inventories

$$U = -2574.06 + \underset{(0.0683)}{0.140897}\left(\frac{GNP^* - GNE^*}{p}\right) + \underset{(0.1683)}{0.53756U_{-1}}$$
$$+ \underset{(827.60)}{2558.11p_w} - \underset{(45.691)}{29.4207Q}$$
$$\bar{R}^2 = 0.611 \qquad \bar{S} = 98.79 \qquad d = 1.939$$

(7-5) GNP Implicit Deflator

$$GNP = p\left[\frac{C}{p_c} + \frac{I_h}{p_i} + \frac{J_h}{p_f^*} + \frac{IH_h}{p_h} + \frac{I_c}{p_i} + \frac{J_c}{p_j^*} + \frac{IH_c}{p_h} + \frac{C_g}{p_{cg}} + \frac{I_g}{p_{ig}} + \frac{J_g}{p_{jg}} + \frac{EXP}{p_e} - \frac{IMP}{p_m}\right]$$

(7-6) Net Sales in Incorporated Businesses

$$\frac{V_c}{p_w} = -10335.70 + \underset{(0.1049)}{3.9101}\frac{GNP}{p} - \underset{(546.15)}{5016.80}Q$$

$$\bar{R}^2 = 0.987 \qquad \bar{S} = 1216.93 \qquad d = 1.707$$

(7–7) Gross Stock in Fixed Capital in Private Sector

$$GK = GK_{-1} + \left(\frac{I_c + I_h}{p_i}\right) - \left(\frac{REP}{p_i}\right)$$

(7–8) Implicit Deflator for Consumers' Goods

$$p_c = \underset{}{0.28507} - \underset{(0.000013)}{0.000012}\sum_{1}^{2} U_{-j} + \underset{(0.5884)}{1.3302}w^* + \underset{(0.2214)}{0.5868}p_{c-1} - \underset{(0.0117)}{0.0208}Q$$

$$\bar{R}^2 = 0.989 \qquad \bar{S} = 0.0142 \qquad d = 2.872$$

(7–9) Wholesale Price

$$p_w = \underset{}{0.2509} - \underset{(0.000015)}{0.000055}\sum_{1}^{2} U_{-j} - \underset{(0.0732)}{0.0918}\Delta i_d + \underset{(0.1906)}{0.7484}p_{w-1} + \underset{(0.0072)}{0.0044}Q$$

$$\bar{R}^2 = 0.656 \qquad \bar{S} = 0.0168 \qquad d = 1.560$$

(7–10) Implicit Deflator for Fixed Investment Goods

$$p_i = \underset{}{1.5998} + \underset{(0.2980)}{0.4488}p_w + \underset{(0.2452)}{0.3815}w^* - \underset{(0.1286)}{0.4944}i_L$$

$$\bar{R}^2 = 0.823 \qquad \bar{S} = 0.0314 \qquad d = 0.813$$

(7–11) Implicit Deflator for Inventories

$$p_j = \underset{}{0.0625} + \underset{(0.0961)}{0.4963}p_w + \underset{(0.1164)}{0.4397}p_{j-1} - \underset{(0.0044)}{0.0002}Q$$

$$\bar{R}^2 = 0.797 \qquad \bar{S} = 0.010 \qquad d = 0.660$$

(7–12) Implicit Deflator for Investment in Inventories

$$p_j^* = \frac{1}{2}(p_j + p_{j-1})$$

(7–13) Equality of Demand for and Supply of Money

$$(CAS_n^- + CAS_g^- - CAS_b^+) + CSD_b^- + PTS_g^- + CDG_n^-)$$
$$= MON_h^+ + MON_c^+ + MON_g^+$$

(7–14) Equality of Demand for and Supply of Securities (in terms of rate of stock turnover)

$$PB_g^- + IB_b^- + BF_b^- + ST_b^- + BS_c^-$$
$$= SEC_h^+ + SEC_c^+ + SEC_b^+ + SEC_n^+ + SEC_g^+$$

Other Identities

$$TCR_h^- = TCR_{h-1}^- + \Delta TCR_h^- \qquad \Delta SEC_c^+ = SEC_c^+ - SEC_{c-1}^+$$

$$\Delta MON_h^+ = MON_h^+ - MON_{h-1}^+ \qquad DT_c^+ = DT_{c-1}^+ + \Delta DT_c^+$$

$$\Delta CAS_h^+ = CAS_h^+ - CAS_{h-1}^+ \qquad LO_c^- = LO_{c-1}^- + \Delta LO_c^-$$

$$\Delta CSD_h^+ = CSD_h^+ - CSD_{h-1}^+ \qquad TCR_c^- = TCR_{c-1}^- + \Delta TCR_c^-$$

$$\Delta SEC_h^+ = SEC_h^+ - SEC_{h-1}^+ \qquad \Delta SCD_g^+ = SCD_g^+ - SCD_{g-1}^+$$

$$DT_h^+ = DT_{h-1}^+ + \Delta DT_h^+ \qquad K_c = K_{c-1} + I_c - DEP_c^1$$

$$PS_h^+ = PS_{h-1}^+ + \Delta PS_h^+ \qquad CSD_b^- = CSD_{b-1}^- + \Delta CSD_b^-$$

$$K_h = K_{h-1} + I_h - DEP_h^1 \qquad DT_b^- = DT_{b-1}^- + \Delta DT_b^-$$

$$\Delta TCR_c^+ = TCR_c^+ - TCR_{c-1}^+ \qquad LO_b^+ = LO_{b-1}^+ + \Delta LO_h^+$$

$$\Delta CSD_c^+ = CSD_c^+ - CSD_{c-1}^+ \qquad SEC_b^+ = SEC_{b-1}^+ + \Delta SEC_b^+$$

$$MON_c^+ = MON_{c-1}^+ + \Delta MON_c^+ \qquad \Delta CAS_b^+ = CAS_b^+ - CAS_{b-1}^+$$

III.2. Remarks on the Empirical Results

1) Individuals Sector

Demand for consumer goods, equation (1–1–1), is assumed to be dependent on changes both in trade-credit net received and in borrowing, deflated by rpice-index for consumer goods, as well as on real disposable income. This implies that the consumption function includes the main sources of funds available to consumers, except for the liquid assets balance. Changes in trade-credit net received are given an important role in propagating the impact of net trade-credit granted by the incorporated businesses sector on consumer behavior. The same type of impact is taken into account both in the equation for investment in dwellings (1–1–4) and in that for investment of unincorporated businesses in plants and equipment (1–1–3).

Needless to say, if data on consumer credit were available, it would be desirable to replace changes in trade-credit net received with it. However, we are unfortunately not able to decompose changes in tradecredit net received into those attributed to consumers and to unincorporated businesses, and this is the sole reason why changes in trade-credit net received were introduced into the consumption function, instead of those in consumer credit received. In principle, the consumption function is a simple Keynesian type, but during the observation period, it seems that this function estimated is comparatively stable.

The direct taxes and charges equation (1–1–2) is also very simple. Mitigation of taxes on income has so far been done by raising the level of basic exemption during the periods in question without any significant alteration of the tax rate system. To introduce a variable for the accumulated tax-exemption (TAX^*) into equation (1–1–2) is very convenient in calculating the effect of 'effective tax' rate on all the endogenous variables, which will be shown in Chapter IV. With-

holding income taxes are particularly concentrated in January and July, because of semi-annual bonuses paid to employees. Since in income tax by self-assessment and residence tax the preiod from income produced to actual tax payment appears to be considerably long, one-period lag for income from unincorporated businesses and income from property is assigned.

Real demand for money is based on the assumption of transaction motive; that is, real disposable income is a proxy variable for current expenditures including household consumption, expenditures on variable costs in the form of cash-payment by unincorporated businesses, and so forth, and trade-credit received also needs some reserves for its repayments. Although it is naturally desirable to introduce compensation of employees, income from unincorporated businesses and that from property separately, multicollinearity interfered with getting reasonable estimates for these variables. Estimated coefficients for real disposable income and trade-credit received seem to be permissibly stable.

Real demand for deposit currency, the greater part of which is considered to be held by unincorporated businesses, is assumed to be dependent on the ratio of stock price to the price for consumer goods in addition to those variables included in the equation for real demand for money. The estimate for the coefficient of the ratio of stock price to the price for consumer goods does not appear to be highly significant but seems to be consistent with the estimated results for the securities holdings equation (1–1–11). Postal transfer savings are determined as the difference between money holdings and cash plus deposit currency.

Demand for time and savings deposits, including trust and life insurance (1–1–9), depends on savings from income, change in stock price and is itself lagged by one period. Since a decline of interest rate on time and savings deposits happened only once (in 1961) and the reaction of time and savings deposit holders seemed to be quite gradual, it is almost impossible to take into account the effect of the interest rate on demand for time and savings deposits during the periods in question. Demand for postal savings and post-office life insurance and postal annuities (1–1–10) is a function of savings from income with distributed lag. The average period of adjustment is about 11 months for time and savings deposits and 14 months for postal savings and post-office life insurance and postal annuities. There was no significant difference between these two equations and those in which all the variables were deflated by the price for consumer goods, and the goodness of fit was rather unsatisfactory for the latter cases.

Securities holdings deflated by the price for consumer goods (1–1–11) is a function of real saving from income and the ratio of stock price to the price for consumer goods with distributed lags. The positive sign of the coefficient for this ratio could be interpreted to mean that stock price changes probably indicate their own future trend, so that people would buy securities expecting capital gains in the future. Indeed, since stock certificates are in principle issued and sold at face-value and not at market value by incorporated businesses, to buy newly issued stock certificates implies getting some capital gain immediately: the differece

is usually positive, between face and market value, and in this study stock prices are supposed to indicate the general trend of the market for securities. The average period of adjustment is about 15 months. Consequently, a conclusion could be that thre may be a separation of preference between money (including cash currency, deposit currency, postal transfer savings and postal savings including post-office life insurance and postal annuity) and time and savings deposits and securities, and therefore there probably exists a preference field specific to the latter group, in which stock price and the price for consumer goods are considerably influential.

Compensation of employees is a product of labor employment (man-hours) and nominal wage rate; the former is determined by equation (7–2). Income from property excluding dividens (1–2–3) is assumed to depend on financial assets holdings at the beginning and end-of-period. Change in trade-credit net received (1–2–5) is wholly dependent on the trade-credit business of the incorporated businesses sector, so that if liquidity availability becomes high in the this sector, tradecredit net received is supposed to rise more and more in the inceived is supposed to rise more and more in the individuals sector. Borrowings from private finanical intermediaries are treated almost in the same way as trade-credit net received.

It might appear that almost all the sources of funds of the individuals sector, whether real or financial, internal or external, are assumed to be determined from outside the sector, and therefore all the expenditures or uses of funds of this sector are regulated from outside. However, this does not necessarily imply that a large part of the uses of funds by this sector is exogenously determined within this model: for instance, demand for labor (7–2) and consequently compensation of employees (1–2–1) are simultaneously determined, depending on the effective demand for final products, of which one dominant component is consumption.

2) Incorporated Businesses Sector

Direct taxes and charges on private corporations (2–1–1) are dependent on corporate income. After April 1, 1961, the middle of our observation period, income which is the object of direct taxes has been divided into two parts dividends received and other income so that two different tax rates are applied. Moreover, corporate income includes income assigned to legal reserves and allowances which should be free from taxation. Since these parts are considered to fluctuate cyclically under the influence of the business cycle, the corporate income tax would vary, other things being unchanged, in the same direction as business benefits. The estimated result seems to satisfy the requirements stated above. Two estimates for the coefficients of products of income tax rates and incomes can be interpreted as realization rates for these two rates.[9] Dividends to persons (2–1–2)

(9) This specification is due to a project study paper on fiscal behavior headed by Y. Ichikawa, Economic Research Institute, Economic Planning Agency, the Japanese Government. See Y. Ichikawa and H. Ikeda, "Measurement of Tax Functions," Keizai-bunseki (*Economic Analysis*), Economic Research Institute, Economic Planning Agency, No. 19, September, 1966.

are supposed to be a distributed lag function of corporate income.[10]

Real gross investment in plants and equipment, as shown in many recent empirical results, seems to be highly correlated with profits, internal funds or real sales.[11] For the sake of simplicity, we could take the so-called "Accelerator-Residual Funds" hypothesis.[12] Thus gross, fixed investment (2–1–3) is supposed to be a function of real internal funds, changes in real sales and lagged gross fixed investment. The average period of adjustment is about 20 months.

As equation (2–1–4a) shows, actual investment in inventories is decomposed into desired and undesired or passive investments. The former is determined by equations (2–1–4b) and (2–1–5). During the observation period, the ratio of real inventories to real sales is exponentially declining, as seen in Fig. 2, reflecting probably the gradual relaxation of import quotas which have forced the enterprises to have extra inventories in raw materials and goods in process. As a matter of fact, data or estimates for passive investment in inventories can be obtained by subtracting desired investment in inventories from actual changes in inventories.

Securities holdings (2–1–10) are a function of lagged internal funds, net of passive investment in inventories, and stock price. It is assumed that some part of internal funds is held in the form of securities. The estimate for the coefficient of stock price is positive but not highly significant. It appears that the coefficient of securities holdings at the beginning-of-period is too high, and consequently the average period of adjustment is too long (about 180 mnonths). However, it should be noted that a part of securities holdings is holdings of stocks issued by other companies, most of the products of which are supplied to their stockholders, so that this kind of stock-holding may be considered to be just the same as investment in physical assets in another form, which could be done under the long-run projection.

Equation (2–2–3) shows net savings or retained earnings, which are available for investment in plants and equipment. Since passive investment in inventories, if positive, does force businesses to invest funds equal to that amount for the current period, a portion of the sources of funds equal to this amount could not be available to this sector. In a case where passive investment is negative, net savings minus passive investment becomes greater than the actual retained earnings, and this would be a much more appropriate proxy variable for the future expec-

(10) See J. Lintner (23).

(11) Meyer and Kuh (26), Kuh (20) and Meyer and Glauber (27) showed a wide variety of empirical results, using cross section and time-series data. Another remarkable attempt has been made by Jorgenson, based on the assumption of the neoclassical theory of capital accumulation and a generalized distributed lag structure. See Jorgenson (13), (14) and (15). See also F. Hamada (10) and (11).

(12) See Meyer and Kuh (26) and Meyer and Glauber (27). Of course, it might be more plausible to apply the neoclassical theory of capital accumulation for empirical analysis of investment behavior, but specification of a fixed investment function in such a highly aggregative model (both of industries and over time), would not lead to a successful result without drastic simplification.

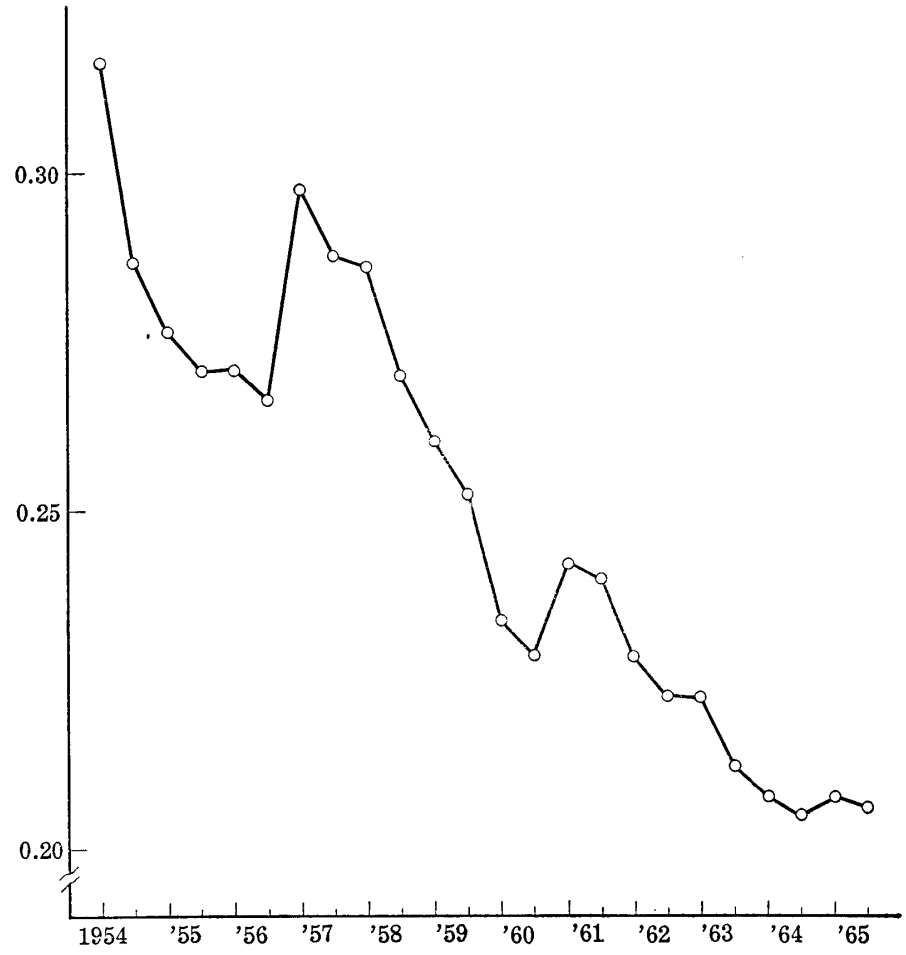

Figure 2 The Ratio of Real Inventories to Real Sales

tation asto market for products. This variable is introduced in the equation for investment in plants and equipment (2–1–3), showing satisfactory results.

Provision for the consumption of fixed capital (2–2–4) is a function of corporate income, lagged net stock in fixed capital and two dummy variables, one of which, d_2, is introduced to take into account the revision of tax regulations in the first-half of 1964 which allowed reduction in the lifetime of machines and apparatus by 15 per cent. The estimate for coefficient of d_2 seems to be significant.[13]

Change in issue of industrial bonds and stocks (2–2–6) is explained from the supply-side. It is assumed that the entrepreneur first uses the internal liquid assets available for investment in plants and equipment because the cost of using

(13) Before this revision of 1964, another big revision had been made in 1961, but preliminary estimation taking both of them into account was unsuccessful so that in the final result another dummy variable, corresponding to another revision of the regulation, has been dropped in this equation.

these funds is least.[14] In this model, they are a proportion of the sum of time and savings deposits and securities ninus savings forced by borrowings.[15] Thus, the internal funds available at first ore:

$$\alpha_2(DT_c^+ + SEC_c^+ - \alpha_3 LO_c^-),$$

where α_3 is the ratio of forced savings to borrowings from private financial intermediaries, and α_2 is the ratio of available liquid assets to the total, which might be dependent on the distribution of the dates of maturity of time and savings deposits and of securities. If it is still insufficient for investment expenditures to be covered in full, the next funds to be raised are obtained by borrowing, and the third source of funds is assumed to result from issuing industrial bonds and stocks; that is:

$$\Delta BS_c^- = \alpha_0 + \alpha_1[(I_c - FINC - FING) - \alpha_2(DT_c^+ + SEC_c^+ - \alpha_3 LO_c^-)],$$

where α_1 is the marginal ratio of industrial bonds and stocks to be issued to the deficit of funds, which may also be affected by the condition of the issue-market for bonds and stocks. To take this into account, the estimated equation includes ratio of stock price to average interest rate on loans of all banks. The estimated result seems to be quite successful.

Change in money and time and savings deposits (2–2–10) is determined as the difference between sources of funds and uses of funds (excluding change in cash currency, deposit currency and time and savings deposits of this sectors); in other words, this is a secotr-balancing variable. Change in time and savings deposits (2–1–8) is dependent on change in the amounts of money, time and savings deposits and on change in borrowings from private financial intermediaries for the current and previous periods. The latter was introduced taking into account forced savings out of borrowings from private financial intermediaries. Since an estimate for the coefficient of change in borrowings is 0.1282 for two periods, an estimate for the ratio of time and savings deposits forced by city banks to borrowings turns out to be about 26 per cent, which appears to be a little higher but not as unrealistic as an average ratio during the observation periods.

Thus, change in money holdings (2–1–9) is determined by subtracting time and savings deposits from the sum of change in money and time and savings deposits. The assumption regarding demand for money of this sector is somewhat different from the ordinary situation because of the specific circumstances of the Japanese economy, in which the indirect financing system and the downward rigidity of financial transactions between incorporated businesses and private

(14) Duesenberry (4) attempted to analyze the cost of raising funds and the behavior of corporate finance, but this analysis has not yet been made applicable to empirical study. However, in this study, the order of cost of raising funds is supposed to be implicitly reflected in the order of selection of funds.

(15) This forced savings will soon be explained in its relation to time and savings deposits (2–1–8).

financial intermediaries seem to be dominant. Moreover, the opportunities for investment in physical assets have been so abundant during the postwar period that the entrepreneur may not have dared to engage in speculative investment in securities. Thus the actual money balance, showing a rather smooth trend during the observation periods, is divided into two portions: active money and excess money. The former is simply assumed to be proportional to sales, and the latter is the rest. Let us define $MONA_c$ as active money balance, V_c as sales and δ as a constant, then:

$$MONA_c^+ = \delta V_c$$

and consequently, the excess money balance (2–2–12) is:

$$M_c^* = MON_c^+ - \delta V_c = 0\,,$$

where the value of δ is assumed to be approximately the average value of actual money-sales ratios in each sub-period ($\delta = 0.1114$ for the period of 1954–60 and $\delta = 0.1176$ for the period of 1961–65). The excess money is supposed to be used to reduce trade-credit received and not borrowings, if it is positive, and vice versa when negative.[16]

Fig. 3 shows the fluctuations of actual excess money balance during the periods in question. Clearly, the excess money turns out to be negative during the periods under tight money policy, particularly in the periods of the first-half of 1957 through that of 1958 and the latter-half of 1961 through that of 1962; but it begins to increase in the latter-half of 1964, which is also under tight money policy. However, at the same time it should be noted that after the first-half of 1965 investment in plants and equipment by this sector remains almost on the same level until the end of the observation period. Now in the light of preliminary research involving estimation of the effect of the excess money on change in bor-borwings, it could be rather plausibel to assume that sector does not private financial intermediaries, who are considered to be the main suppliers of funds to this sector. Thus, even if this sector had the excess money and at the same time were borrowing from city banks, it would not give money back to city banks but rather keep it on deposit in the banks or otherwise use it to reduce trade-credit

(16) Baumol (3) and Tobin (29) developed the theory of transactions demand for money, and Meltzer (24) and (25) applied it in empirical studies, using cross section and time series data, which appeared not to be successful. Moreover, Tobin (30) extended a sophisticated theory of liquidity preference, but no remarkable development has yet been achieved in the field of empirical studies. Kisselogff (16) and Klein (17) attempted to estimate an equation for demand for idle money. The author himself also tried to explain the excess money, the derivation of which is very similar to that of Kisselgoff's excepy that the author's excess money has positive, zero and negative value, with interest rate and rate of change of wholesale price, but the result was poor that is:

$$\frac{Mp}{p_j} = 3142.47 - 1385.28\, i_L + 4634.27\, p_w$$
$$\qquad\qquad\qquad\quad (1326.27) \qquad (4921.02)$$
$$\bar{R} = 0.120 \qquad \bar{S} = 527.85 \qquad d = 0.979$$

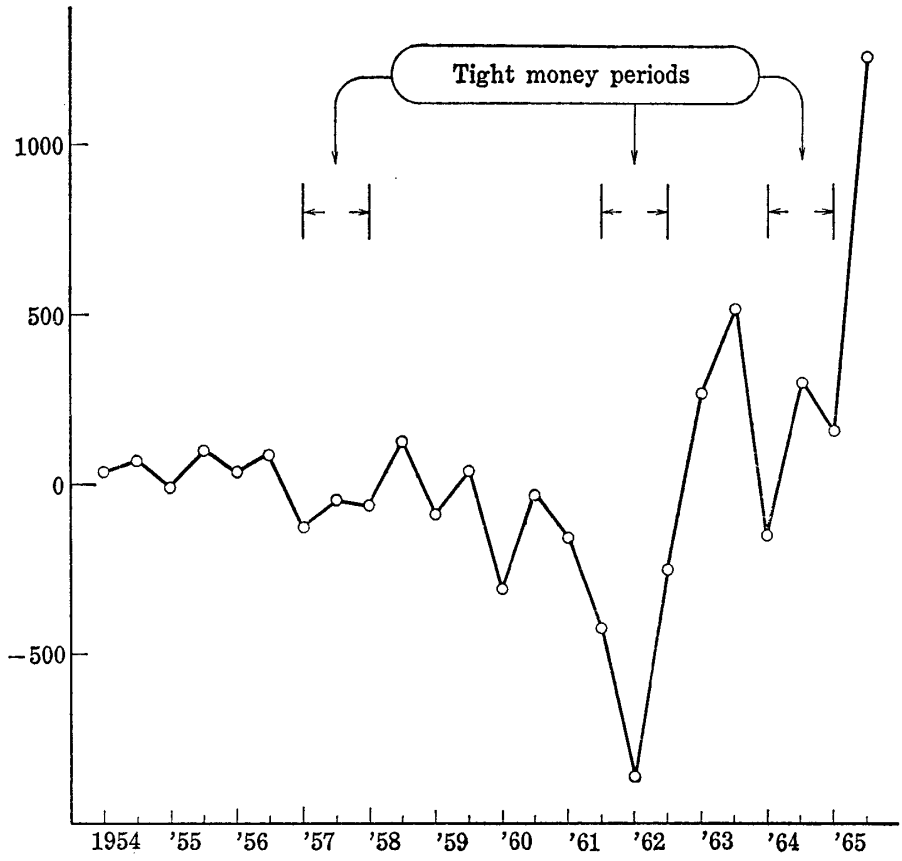

Figure 3 Estimates for Excess Money (in billions of Yen)

received. This is the reason why excess money is introduced in the equation for change in trade-credit received (2–2–7).[17]

In contrast with equation (2–2–7), the equation for change in borrowing from private financial intermediaries (2–2–8) is based on the assumption of debts-assets adjustment, which is strongly dueto Anderson (1); That is, change in borrowing may be adjusted to the limit of borrowing capacity in the long-run. Moreover, the entrepreneur's behavior in borrowing would change, depending on whether or not the economy as a whole is under tight money policy, which leads to introducting a dummy variable d_3 (= 1 for the periods under tight money policy and = 0 for others). According to Anderson, an estimate for coefficient of "debt-limt" ratio is, in this case, about 0.47 (=0.2100/0.4482), which seems very plausible during the observation period.

3) Private Financial Intermediaries Sector

Most important in this sector is the loan behavior or change in loans (3–1–3), which may considerably influence the activities of the economy as a whole, particularly in their relation to the indirect financing system dominating the Japanese

(17) Duesenberry has already pointed out almost the same thing for the United States economy as what is stated here. See Duesenberry (5, particularly p. 11).

economy. In general, changes in loans may be restricted by their main sources of funds, such as changes in demand deposit, time and savings deposits and bank debenture issues. But they may also be dependent on changes in borrowing from the Bank of Japan, which is controlled by the monetary authorities, on buying and selling operations of the Bank of Japan, and on the assets-structure of this sector at the beginning-of-period. If the portfolio were weighted in facor of loans compared with securities holdings, this bias would be gradually adjusted to the normal ratio.

Change in the securities holdings of this sector (3–1–4) is determined as the difference between the sum of sources of funds and that of uses of funds excluding change in securities, so that this variable has a role in balancing uses and sources of funds of this sector. Thus the government deficit policy, as well as selling or buying operations by the Bank of Japan, could be assumed to make city banks change their portfolios, and consequently to cause them to shift their loan behavior.

4) The Band of Japan

Equation (4–2–1) determines cahnge in other debts, and the true purpose in presenting this equation explictly is to show that cash currency issued by the Bank of Japan should, in this model, be accompanied by an increase of securities holdings, including an increase through purchases or loans by this sector. Needless to say, ΔOT_n^- could be positive, zero and negative, the last of which situations would include the purchasing of foreign exchange, which is not dealt with explicitly here.

5) General Government Sector

Equations (5–1–2) is also an equation determining a sector-balancing variable: change in government bonds and others. In principle, the deficit of this sector is supposed to be adjusted by issuing bovernment bonds. In cases where this increase is purchased by the Bank of Japan, the supply of cash currency increases through equation (4–2–1), fixing ΔOT_n^- temporarily at a certain level, which should cause an increase in the securities holdings of this sector.

6) Foreign Trade Sector: The Rest of the World

This sector is too simply dealt with to require any remark.

7) Market Equations: The Unifying Sector

Equation (7–2) is a production function of *CES*-type, which was directly estimated, in which an estimate for the substitution parameter is 0.222032; that for the distribution parameter, 0.15006; that for the efficiency parameter, 0.246616 and 0.013554 (the latter is an estimate for neutral technical progress).[18] The reason why a *CES*-type was adopted is that during the observation periods there

(18) Estimation was done under the constraints as below:

$$\gamma_0, \gamma_1 \text{ and } \rho < 0; \quad 0 < \delta < 1 .$$

Many cases were attempted, varying the initial assumption for these parameters, and most of them showed that the estimates were very concentratedly distributed. Thus final selection was made so as to choose the set of parameters for which standard error of regression estimates turned out to be minimum.

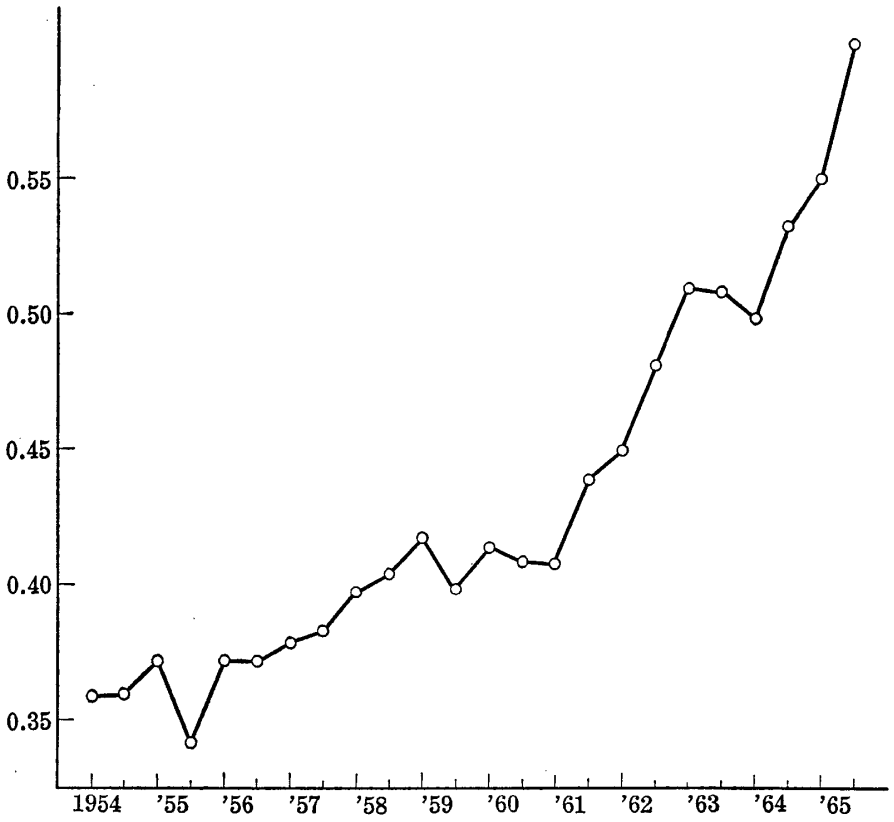

Figure 4 Fluctuation of Relative Labor-Income Share

exists a remarkable tendency to increase the relative labor-income share for the economy as a whole, as shown in Fig. 4. This and other recent empirical results indicate that it may be more desirable to introduce a *CES*-type of production function for Japan.[19]

Equation (7–1) can be deduced from equation (7–2) and the equality between real wage rate and marginal productivity of labor obtained by differntiating equation (7–2) with respect to labor input, hL.[20] Fig. 5 shows the estimates for the difference between potential supply, estimated using equation (7–1), and demand for final products, which is determined by equation (7–3). It is clear that in the early period under tight money policy—in particular, during the first-half of 1957 and the latter-half of 1961—the potential excess supply begins to increase. About one year later this excess turns positive, from a negative value for the earlier periods. The potential excess begins to increase in the latter-half of 1964,

(19) See Kuroda and Tsujimura (21), Hamada (10) and elsewhere.

(20) To make the estimates for potential supply of final products more plausible, a markup factor 2.002 was introduced, which was inversely derived from the average ratio of potential supply with this factor as unity to real GNP. In the case of the Cobb-Douglas type, which had been used in the earlier paper (12), the value of this factor was about 1.028, which might have been rather plausible compared with that derived from the CES-type as far as the value of this factor is concrned.

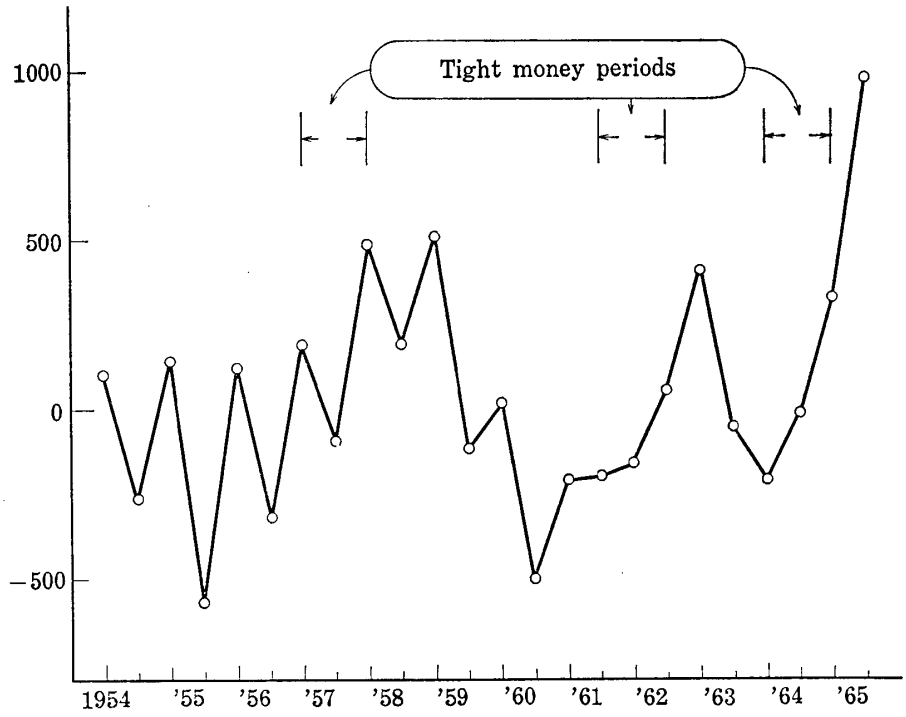

Figure 5 Estimates for Potential Excess Supply
(1960 constant prices in billion in Yen)

lagging one period behind the start of tight money policy, and this tendency goes on until the end of our observation period. As a matter of fact, the estimates for potential excess supply can be considered to be most plausible.

Equation (7–4) determines passive investment in inventories, using the estimates for the potential excess supply just mentioned above. The coefficient of determination is not very high, but an estimate for the coefficient of potential excess supply seems to be highly stalbe.

The estimated coefficient of passive investment in equation (7–8) is not significant, and this seems to suggest that the price-formation mechanism in the market for consumer goods is probably much more complicated, reflecting its multi-stage interim process through which consumer goods are distributed from producers to final purchasers. This might be closely connected with the fact that the estimate for the coefficient of the money wage rate is highly significant. In contrast with the price for consumer goods, the estimate for the coefficient of passive investment in inventories in the wholesale-price equation (7–9) seems to be significant, so that the existence of potential excess supply of final products would mostly be reflected in changes in wholesale price.

Finally, though it is not shown explicitly in the model, another equation determining change in "other debts" in the foreign trade sector is existent, which is taken as being dropped by the "Walras Law".[21] This equation can be wirtten explicitly as below:

(21) See Lange (22).

$$\Delta OT_f^- = \Delta OT_h^+ + \Delta OT_g^+ - \Delta OT_c^- - \Delta OT_b^- - \Delta OT_n^-$$

IV. MULTIPLIER ANALYSIS OF THE MODEL

IV.1. Procedures in Calculating Multipliers

As already seen above, this model is a system of simultaneous dynamic nonlinear equations, so that the procedures in calculating multipliers are not simple, compared with those for models of linear sysfems. Roughly, there are two types of method in calculating multipliers for a simultaneous nonlinear equations system—one is the direct calculation-of-convergence method and the other is Newton's approximate method of solution—but essentially, these two methods are akin to each other.[22] As a first approach, the latter is applied for this model. Goldberger (9) and Evans (8) have previously tried to estimate impact multipliers for the U.S. economy by this method. Needless to say, estimates by this method would bring about some biases for true values, particularly for the so-called "dynamic multipliers", because it is not the original equation's system but the system of "tangent-plane" equations that is actually used in calculating multipliers for each period. The following is a general description of procedures in calculating multipliers in this paper.

The original nonlinear equations system can be written in general form as below:

i) $$G_i[(y_1),\ldots,(y_p)_t, (y_1)_{t-1},\ldots,(y_p)_{t-\tau}. (z_1)_t,\ldots,(z_k)_{t-\theta}] = 0,$$
$$(i = 1, 2,\ldots, p)$$

where $(y_1)_t,\ldots,(y_p)_t$ are endogenous variables; $(y_1)_t,\ldots,(y_p)_{t-\tau}$ are lagged endogenous variables and $(z_1)_t,\ldots,(z_k)_{t-\theta}$ are exogenous variales. Let us further define vectors for these variables as follows:

$$\Delta Y_t = \begin{bmatrix} (\Delta y_1)_t \\ \vdots \\ (\Delta y_p)_t \end{bmatrix}; \quad \Delta GY_t' = (\Delta Y_t', \Delta Y_{t-1}', \ldots, \Delta Y_{t-\tau}')$$

$$\Delta GZ_t' = [(\Delta z_1)_t \ldots\ldots (\Delta z_k)_{t-\theta}]; \qquad \Delta Z^* = \begin{bmatrix} 1 \\ \vdots \\ 0 \\ 1 \\ 0 \\ \vdots \\ 1 \end{bmatrix}.$$

Then expand functions G_i $(i = 1,\ldots, p)$ linearly in a Taylor's series about a set of values of all *ys* and *zs* for the period t_0, and take the first difference with respect

(22) See Duesenberry, fromm, Klein and Kuh (6), particularly pp. 371–382.

to all *ys* and *zs*. Thus we can get the so-called "tangent plane" equations system; that is,

ii) $A_1(GY_{t_0}, GZ_{t_0})\Delta Y_t + A_2(GY_{t_0}, GZ_{t_0})\Delta GY_{t-1} + B(GY_{t_0}, GZ_{t_0})\,\Delta GZ_t = 0\,,$

where A_1, A_2 and B are the coefficient-matrix for the endogenous variables, lagged endogenous variables and exogenous variables respectively, which depend on the values of those variables for period t_0.

Suppose some of the components of vector ΔGZ_t had zero value and others had unity for period t_1 with all the lagged endogenous variables fixed at the level of the period t_0. Then the impact multipliers of these components for all the endogenous variables $\Delta Y^*_{t_1}$ can be written as below:

iii) $$\Delta Y^*_{t_1} = -\,[A_1(GY_{t_0}, GZ_{t_0})]^{-1}\cdot B(GY_{t_0}, GZ_{t_0})\,\Delta Z^*\,,$$

where the first factor on the right-hand side is the inverse matrix of A_1.[23] As already noted above, calculation of dynamic multipliers has not yet been done, at the present stage, except for those for prices during the second period.

IV.2. Imaact Multipliers for Fiscal and Monetary Policy

The impact (first period) multipliers based on the values of all variables for the latter-half of 1965 were calculated using equation (iii). The multiplicands were selected so as to include several important variables for fiscal and monetary policy.

The model has been reduced to a 50 equations system by substituting identities and even a part of the behavioral equations, eliminating the variables corresponding to those equations, and dropping equations for provisions for the consumption of dwellings, change in short-term government securities holdings of private financial intermediaries, provision for the consumption of fixed capital by unincorporated businesses and change in the deposit currency of the general government. Moreover, the indirect tax equation was excluded because all the effects on indirect taxes come out in the second and later periods.

Tables 1–7 show the estimates for impact multipliers for the principal GNP components, change in financial assets and debts in several sectors, changes in prices and real wage rate.

A) Impact Multipliers for Fiscal Policy

The first columns in Table 1 and 2 are the impact multipliers of current ex-

(23) Dynamic multipliers for the periods $t_1, t_2, \ldots$ can be expressed as follows:

$$\Delta Y^*_{t_2} = -\,[A_1(GY^*_{t_1}, GZ^*_{t_1})]^{-1}\cdot[A_2(GY^*_{t_1}, GZ_{t_1})\begin{bmatrix}\Delta Y^*_{t_1}\\ 0_1\end{bmatrix} + B(GY^*_{t_1}, GZ^*_{t_1})\Delta GZ^*_{t_2}]\,,$$

$$\Delta Y^*_{t_3} = -\,[A_1(GY^*_{t_2}, GZ^*_{t_2})]^{-1}\cdot[A(G_2Y^*_{t_2}, GZ^*_{t_2})\begin{bmatrix}\Delta Y^*_{t_2}\\ \Delta Y^*_{t_1}\\ 0_2\end{bmatrix} + B(GY^*_{t_2}, GZ^*_{t_2})\Delta GZ^*_{t_2}]\,,$$

where 0_1 is $(p \times \tau)$ zero vector and 0_2, $(p \times (\tau - 1))$ zero vector and

$$\Delta GZ^{*\prime}_{t_2} = [\Delta z^{*\prime}\,\Delta z^{*\prime}]\,;\quad \Delta GZ^{*\prime}_{t_3} = [\Delta z^{*\prime}\,\Delta z^{*\prime}\,\Delta z^{*\prime}]\,.$$

penditures of general government. An impact multiplier for GNP is 1.60429; that for potential of final prodcts is 3.65152,[24] and that for passive investment in inventories is 0.24364, which seems to be larger than that for intended investment in inventories J^*(0.13736). Thus in the next and later periods, prices will, other things being unchanged, begin to decline, though changes in prices for the next period appear to be negligible with negative signs.

The multiplier for personal disposable income is 0.40538 and that for consumption, 0.30095. On the whole, it seems that multipliers for financial transactions are higher than those for non-financial transactions. This may be partly because investment by incorporated businesses in plants and equipment reacts very slowly, so that the excess money increases 1.15008, which will stimulate trade-credit granted to the individuals sector for the next period.

Multipliers for deposit currency and time and savings deposits are negative, which reflect an increase in stock price by 1.77871, which may contribute to increases in securities holdings of individuals and of the incorporated businesses sectors. The reason why the increase in incorporated profits Y_c is remarkably high (1.15240) is that the increase in GNP is greater than those of unincorporated businesses income and income from property. Unincorporated businesses income is simply dependent on GNP, the coefficient of which is 0.1469. Income from property is dependent on securities holdings and time and savings deposits, the coefficient for the former of which is not very high and its multiplier less than uity; moreover, multiplier for the latter is negative.[25] The increase in supply of cash currency by the Bank of Japan is, after all, 0.28847, which is the sum of increases in cash holdings of individuals 0.5376, that of incorporated businesses 0.22146 (=1.01664 − 0.49518) and that of private financial intermediaries 0.01325. Multipliers of government investment in gross fixed capital are shown in the second columns of Tables 1 and 2. The main difference from those of current expenditures depends on that of implicit price deflators for these two compoentnts used in calculating real final demands; that is, the deflator for current expenditures of general government is 1.695 for the latter half of 1965, and that for government's gross fixed investment is 1.284 for the same period.

The third and fourth columns in Tables 1 and 2 show multipliers of current transfers from government to households and nonprofit institutions and the accumulated sum of tax reduction in the past. These two are, as a matter of fact,

(24) The reason why the multiplier for potential supply of final products is positive may be that an increase in current expenditures lets the GNP implicit price deflator p increase, simply because of an increase in the relative weight of government expenditures, the price for which is relatively high, and this increase in$p$ causes a decline of real wage rate (−0.00002), because money wage rate is fixed at the same level. However, it is very interesting that potential supply of final products seems to be considerably sensitive to the various types of impacts. The same thing will be seen in other tables.

(25) The reaction of investment in inventories, as well as that of corporate profits, seems to be very rapid which seems plausible.

TABLE 1. THE IMPACT MULTIPLIERS

	C_g	I_g	TR_{gh}	TAX_h^*	A	B
C	0.30095	0.10593	0.80196	0.80196	−0.0352	−0.0181
TAX_h	0.00814	0.00713	0.00597	−0.99403	0.0023	0.0012
I_h	0.02152	0.02772	0.03133	0.03133	−0.5410	−0.2775
IH_h	0.04042	0.01423	0.10770	0.10770	−0.0047	−0.0024
MON_h^+	0.17387	0.06120	0.46332	0.46332	−0.0203	−0.0104
CAS_h^+	0.05376	0.01892	0.14326	0.14326	−0.0063	−0.0032
CSD_h^+	−0.13695	−0.17583	0.00541	0.00541	−0.6618	−0.3394
DT_h^+	−0.01441	−0.04530	0.07835	0.07835	−0.2120	−0.1087
PS_h^+	0.00604	0.00212	0.01608	0.01608	−0.0007	−0.0004
SEC_h^+	0.73993	0.77859	0.46819	0.46819	2.6650	1.3670
Y_d	0.40538	0.14269	1.08025	1.08025	−0.0474	−0.0243
TAX_c	0.12936	0.11014	0.09045	0.09045	9.6688	4.9596
DIV	0.04782	0.04072	0.03344	0.03344	−0.0223	−0.0114
I_c	0.06309	−0.03947	−0.04970	−0.04970	0.0143	0.0072
J_c	0.38710	0.17971	0.11992	0.11992	−0.1003	−0.0514
H_c	0.39124	0.18164	0.12120	0.12120	−0.1014	−0.0520
J_c^*	0.13736	−0.08595	−0.10822	−0.10822	0.0306	0.0157
CSD_c^+	0.79518	0.98078	0.71911	0.71911	−7.3816	−3.7864
DT_c^+	0.15939	0.18140	0.13432	0.13432	−1.2088	−0.6201
MON_c^+	1.01664	1.19018	0.88742	0.88742	−7.8570	−4.0302
SEC_c^+	0.08324	0.09423	0.03343	0.03343	0.3350	0.1719
TCR_c^+	0.20490	−0.12820	−0.16143	−0.16143	−0.0457	−0.0234
Y_c	1.15240	0.98112	0.80572	0.80572	−0.5378	−0.2759
R_c^*	0.72547	0.56460	0.45369	0.45369	−10.0534	−5.1569
DEP_c^1	0.08620	0.07339	0.06027	0.06027	−0.0402	−0.0206
BS_c^-	0.40256	0.41979	0.13739	0.13739	1.5426	0.7913
TCR_c^-	0.51701	0.24002	0.16016	0.16016	−0.1340	−0.0687
LO_c^-	0.01958	−0.01225	−0.01542	−0.01542	0.0044	0.0022

Note: Supply of money is assumed to be endogenously determined by equation (7–13). Multiplicands A and B are increased one per cent for each point.

identical with each other except that the latter causes a decline of tax revenue from personal income. It should be pointed out that though the multiplier for GNP is smaller than those of C_g and I_g (0.91876), those for consumption, investment in dwellings, and investment of unincorporated businesses in plants and equipment are larger than those of C_g and I_g. On the other hand, increases in corporate profits, excess money, potential supply of final products and so on are smaller than those of TR_{gh} and TAX_h^*. In this point, C_g and I_g are in contrast to TR_{gh} and TAX_h^* with regard to their multipliers. By multiplying the amount of 0.1 per cent reduction of unincorporated businesses income and income from property to the figures in the fourth column of Tables 1 and 2, we can get the effects of 0.1

TABLE 2. THE IMPACT MULTIPLIERS

	C_g	I_g	TR_{gh}	TAX_h^*	A	B
$FINC$	0.00293	−0.00184	−0.00231	−0.00231	0.0007	0.0003
MDT_c^+	1.17603	1.37157	1.02174	1.02174	−9.0658	−4.6503
TAS_c^+	1.42251	1.66278	1.22783	1.22783	−8.8235	−4.5260
M_c^*	1.15008	1.10668	0.78229	0.78229	−7.8272	−4.0150
CAS_b^+	0.01325	0.01553	0.01546	0.01546	−0.1562	−0.0801
LO_b^+	0.61117	0.71604	0.71312	0.71312	−7.2013	−3.6939
SEC_b^+	0.17880	0.20948	0.20862	0.20862	−2.1067	−1.0806
PB_g^-	0.59941	0.66250	0.57285	0.57285	−0.6493	−0.3330
IMP	0.20879	0.12451	0.09246	0.09246	−0.0663	−0.0340
GNP^*	3.65152	3.32548	2.77295	2.77295	−1.6671	−0.8551
hL	0.51617	−0.32374	−0.40745	−0.40755	−0.1154	0.0592
GNE^*	1.35455	0.98795	0.69062	0.69062	−0.4700	−0.2411
GNP	1.60429	1.16361	0.91876	0.91876	−0.6009	−0.3082
U	0.24364	0.25918	0.22258	0.22258	−0.1277	−0.0655
P	0.00011	0.00010	0.00008	0.00008	−0.0000	−0.0000
V_c	0.61072	−0.38213	−0.48116	−0.48116	0.1362	0.0698
GK	0.07944	−0.01103	−0.01725	−0.01725	−0.4948	−0.2538
P_c	———	———	———	———	———	———
P_w	———	———	———	———	———	———
P_i	———	———	———	———	———	———
P_j	———	———	———	———	———	———
P_s	1.77871	2.01336	0.71432	0.71432	7.1590	3.6722
TCR_h^-	−0.31211	−0.36822	−0.32159	−0.32159	0.1796	0.0921
LO_h^-	0.59159	0.72729	0.72854	0.72864	−7.2056	−3.6961
Y_w	0.11769	−0.07381	−0.09290	−0.09290	0.0263	0.0014
Y_p	0.23567	0.17093	0.13497	0.13497	−0.0883	−0.0453
Y_r	0.06016	0.05534	0.04415	0.04415	0.0168	0.0086
w^*/p	−0.00002	−0.00001	−0.00001	———	———	———

Note: Supply of money is assumed to be endogenously determined by equation (7–13).

per cent reduction of the tax-coefficient of Y_p and Y_r (about 5.5 billion Yen), which are shown in Table 3. Thus to realize the same increase in GNP as C_g does, tax reduction of personal income should be about 0.033 per cent of Y_p and Y_r of the latter-half of 1965, which will cause an increase in consumption of about 1.34 billion Yen. Supply of cash currency increases about 0.327, which is greater than the figures for C_g and I_g.

The last two columns of Tables 1 and 2 give the effects of increases in corporate income tax rate and tax rate on dividends (one per cent increase for each point), most of which are negative except for SEC_c^+, SEC_h^- and BS_c^+ which accompany an increase in stock price. Other exceptions are investment in plants and equipment, intended investment in inventories and sales of incorporated businesses and

TABLE 3. EFFECTS OF 0.1 PER CENT REDUCTION OF TAX-COEFFICIENT OF Y_p AND Y_r

C	4.02103	$FINC$	−0.01158
TAX_h	−4.98407	MDT_c^+	5.12300
I_h	0.15709	TAS_c^+	6.15634
JH_h	0.54001	M_c^*	3.92240
MON_h^+	2.32309	CAS_b^+	0.07752
CAS_h^+	0.71831	LO_b^+	3.57558
CSD_h^+	0.02713	SEC_b^+	1.04602
DT_h^+	0.39285	PB_g^-	2.87227
PS_h^+	0.08063	IMP	0.46359
SEC_h^+	2.34750	GNP^*	13.90357
Y_d	5.41637	hL	−2.04295
TAX_c	0.45352	GNE^*	3.46277
DIV	0.16767	GNP	4.60666
I_c	−0.24920	U	1.11602
J_c	0.60128	P	0.00040
H_c	0.60770	V_c	−2.41254
J_c^*	−0.54262	GK	−0.08649
CSD_c^+	3.60562	P_c	———
DT_c^+	0.67348	P_w	———
MON_c^+	4.44952	P_i	———
SEC_c^+	0.16762	P_j	———
TCR	−0.80941	P_s	3.58160
Y_c	4.03988	TCR_h^-	−1.61245
R_c^*	2.27480	Lo_h^-	3.65290
DEP_c^1	0.30219	Y_w	−0.46580
BS_c^-	0.68887	Y_p	0.67674
TCR_c^-	0.80304	Y_r	0.22137
LO_c^-	−0.07732	w^*/p	———

Note: Supply of money is assumed to be endogenously determined by equation (7–13).

labor employment, which are caused by a decrease in the GNP implicit price deflator (−0.00005) which raises real GNP, real sales and consequently labor employment.

B) Impact multipliers for Monetary Policy

The first three columns of Tables 4 and 5 give the effects of borrowing by individuals from government financial institutions, buying-operations oriented to particular main city banks by the Bank of Japan and borrowing of private financial intermediaries from the Bank of Japan. As is shown clearly in Tables 4 and 5, impact multipliers for GNP of these ghree multiplicands are about one fourth that of C_g. Borrowing by individuals from government financial institutions would seem to be effective on deposit currency and time and savings deposit hold-

TABLE 4. THE IMPACT MULTIPLIERS

	LOG_h^-	*Ope*	LON_n^+	i_L	i_d
C	0.15696	0.11325	0.14536	748.3	945.5
TAX_h	−0.00123	0.00341	0.00478	———	4.3
I_h	0.06593	0.08728	0.05661	−179.5	19.6
IH_h	0.02108	0.01521	0.01952	100.5	126.9
MON_h^+	0.09068	0.06543	0.08398	432.3	545.2
CAS_h^+	0.02804	0.02023	0.02597	133.7	168.9
CSD_h^+	0.33718	−0.28190	−0.44792	119.6	57.7
DT_h^+	0.12129	−0.07804	−0.12730	109.2	108.6
PS_h^+	0.00315	0.00227	0.00292	15.0	18.9
SEC_h^+	−1.27296	1.21367	1.90731	28.3	343.5
Y_d	0.21142	0.15255	0.19580	1007.9	1273.5
TAX_c	0.02422	0.01825	0.01750	−255.6	61.3
DIV	0.00895	0.00675	0.00647	−3.3	22.6
I_c	0.08335	0.04456	0.06008	−221.5	470.2
J_c	0.18314	0.11590	0.14164	733.9	548.3
H_c	0.18510	0.11714	0.14315	741.7	553.8
J_c^*	0.18149	0.09702	0.13082	1016.9	982.8
CSD_c^+	−0.56468	0.42772	0.63908	−971.3	−2289.8
DT_c^+	−0.08308	0.07497	0.10965	−173.3	−337.6
MON_c^+	−0.56457	0.47376	0.69439	−1059.4	−2333.6
SEC_c^+	−0.16444	0.14851	0.23441	−27.1	13.3
TCR_c^+	0.27071	0.14472	0.19513	1516.9	602.0
Y_c	0.21577	0.16216	0.15589	−80.0	545.7
R_c^*	0.18093	0.11873	0.12110	462.0	896.3
DEP_c^1	0.01614	0.01216	0.01166	−5.9	40.8
BS_c^-	−0.72794	0.69619	1.09557	−320.9	213.2
TCR_c^-	0.24461	0.15480	0.18917	980.1	−1858.4
LO_c^-	0.02586	0.01383	0.01864	−68.7	145.9

Note: Supply of money is assumed to be endogenously determined by equation (7–13).

ings of individuals but instead it causes a reduction in the general financial activities of incorporated businesses and private financial intermediaries and also a decline in stock price. On the contrary, buying-operations and loans of the Bank of Japan to city banks raise the level of financial activities of the private sectors, and the stock price rises about 3 to 5 points. However, it should be noted that the impact of these monetary policies seems not to be great compared with that of fiscal policies. Supply of cash currency caused by loasn of the Bank of Japan, for instance, increases only 0.08414 in all for the current period.

The same is true of the effects of interest rates on loans and discounts, which are shown in the last two columns of Tables 4 and 5. Multiplicands i_L and i_d are increased by about 47 per cent, which corresponds to an increase of one sen (0.01

TABLE 5. THE IMPACT MULTIPLIERS

	LOG_h^-	*Ope*	LON_h^+	i_L	i_d
FINC	0.00388	0.00207	0.00279	−10.3	21.9
MDT_c^+	−0.64765	0.54873	0.80404	−1232.7	−2671.3
TAS_c^+	−0.83048	0.70206	1.03490	−2250.4	−2276.7
M_c^*	−0.38826	0.56801	0.82147	−71.6	−1941.6
CAS_b^+	−0.00312	0.00236	0.00286	−15.1	−40.6
LO_b^+	−0.14403	1.15742	0.74792	−696.7	−1872.7
SEC_b^+	−0.04214	−1.01702	−1.57728	−203.8	−547.9
PB_g^-	−0.75159	−0.35103	−0.53113	61.7	−404.2
IMP	0.07732	0.05222	0.06155	256.4	268.9
*GNP**	0.45910	0.48469	0.45892	−1314.9	619.1
hL	0.68257	0.36487	0.49199	3825.2	4276.9
*GNE**	0.43148	0.30511	0.35084	1208.3	2276.2
GNP	0.43314	0.32399	0.36166	925.2	1841.7
U	0.00162	0.01842	0.01056	−276.2	−420.8
P	0.00001	0.00001	0.00001	−0.0390	0.0184
V_c	0.80689	0.43135	0.58161	4521.2	1794.2
GK	0.14017	0.12379	0.10956	526.3	535.2
P_c	———	———	———	———	———
P_w	———	———	———	———	−0.0918
P_i	———	———	———	−0.4944	−0.0412
P_j	———	———	———	———	−0.0455
P_s	−3.51373	3.17329	5.00884	−578.9	284.1
TCR_h^-	0.02610	−0.01008	0.00870	536.7	2460.3
Lo_h^-	−0.16989	1.14359	0.72928	−628.0	−2018.6
Y_w	0.15563	0.08319	0.11217	872.1	975.1
Y_p	0.06363	0.04754	0.05313	135.9	270.5
Y_r	−0.00907	0.02518	0.03527	−0.1866	32.2
w^*/p	———	———	———	0.0055	0.0026

Note: Supply of money is assumed to be endogenously determined by equation (7–13).

yen) a day. Interest rates appear not to work well as a means of effecting monetary policy, at least for the current period. However, they do cause a reduction of the excess money of incorporated businesses, which will reduce trade-credit granted to individuals, and consequently consumption, investment in dwellings, investment of unincorporated businesses in plants and equipment, and so forth for the next and later periods.

The last two columns in Tables 6 and 7 give the effects of loans and buying-operation to city banks by the Bank of Japan, when supply of cash currency by the Bank of Japan is assumed to be exogenously determined or, in other words, cash holdings of private financial intermediaries are controlled by the Bank of Japan; this means dropping equation (3–1–1) from the model, and these figures

are considered as multipliers of the supply of money. The multiplier for GNP is 0.51204 of LON_n^+ and 0.47692 of Ope respectively, which is about one third of that of C_g, but these figures are greater than those in Tables 4 and 5, where supply of cash currency is unconstrained.

C) Effects of Money Wage Rate and Exports

The fitst two columns in Tables 6 and 7 give the effects of money wage rate and exports. The money wage rate is increased by one billion yen per one thousand persons per hour. This increase brings about an increase in GNP ff 4.3 billion yen (about 2.5 times the multiplier of C_g for GNP), in personal disposable income of 24.4 billion yen, and a decline in corporate profits of 19.3 billion yen, in invest-

TABLE 6. THE IMPACT MULTIPLIERS

	w^*	EXP	LON_n^+ (*)	Ope (*)
C	18.2792	0.47541	0.21454	0.18361
TAX_h	−0.1092	0.00667	0.00721	0.00589
I_h	0.9640	0.05661	0.06131	0.09476
IH_h	2.4305	0.06385	0.02881	0.02465
MON_h^+	11.0527	0.27466	0.12395	0.10607
CAS_h^+	3.4175	0.08492	0.03832	0.03279
CSD_h^+	7.7461	0.19594	−0.69568	−0.53385
DT_h^+	3.1567	0.10720	−0.19878	−0.15073
PS_h^+	0.3525	0.00954	0.00431	0.00369
SEC_h^+	−6.2740	−0.50489	2.95542	2.27954
Y_d	24.3777	0.64038	0.28899	0.24732
TAX_r	−2.1693	0.14756	0.02345	0.02431
DIV	−0.8020	0.05455	0.00867	0.00898
I_c	−4.6869	0.16239	0.08984	0.07482
J_c	−16.9073	0.58290	0.20620	0.18156
H_c	−17.0882	0.58914	0.20840	0.18349
J_c^*	−11.3621	0.35359	0.19561	0.16291
CSD_c^+	−4.6385	0.16621	0.97942	0.77383
DT_c^+	−1.3970	0.06519	0.16723	0.13353
MON_c^+	−7.6774	0.37504	1.05954	0.84510
SEC_c^+	−1.5905	−0.07822	0.36357	0.27985
TCR_c^+	−16.9479	0.52742	0.29177	0.24300
Y_c	−19.3246	1.31447	0.20888	0.21650
R_c^*	−10.8080	0.88305	0.16618	0.16457
DEP_c^1	−1.4455	0.09832	0.01563	0.01620
BS_c^-	−8.8180	−0.30656	1.69810	1.30893
TCR_c^-	−22.5814	0.77853	0.27539	0.24248
LO_c^-	−1.4544	0.05039	0.02786	0.02322

(*) Note: Supply of money is assumed to be exogenous, so equation (3-1-1) is dropped from the model.

TABLE 7. THE IMPACT MULTIPLIERS

	w^*	EXP	$\overset{(*)}{LON_n^+}$	$\overset{(*)}{Ope}$
$FINC$	−0.2180	0.00755	0.00418	0.00348
MDT_c^+	−9.0744	0.44023	1.22677	0.97862
TAS_c^+	−14.0467	0.48780	1.58118	1.25759
M_c^*	−18.7150	0.71853	1.24956	1.00335
CAS_b^+	0.0803	0.00882	0.88155	0.89594
LO_b^+	3.7035	0.40673	0.80779	1.21831
SEC_b^+	1.0835	0.11899	−2.43716	−1.89147
PB_g^-	2.0369	−0.15756	−0.81626	−0.64100
IMP	−4.2211	0.28736	0.08865	0.07977
GNP^*	−37.3526	3.90073	0.61183	0.64020
hL	−42.7439	1.32942	0.73566	0.61267
GNE^*	9.8457	1.77598	0.50146	0.45828
GNP	4.3004	2.00530	0.51204	0.47692
U	−5.4100	0.22372	0.01033	0.01819
P	0.0016	0.00012	0.00001	0.00000
V_c	−50.5154	1.57203	0.86966	0.72429
GK	−4.1924	0.16009	0.14193	0.15670
P_c	0.0013	———	———	———
P_w	———	———	———	———
P_i	0.0004	———	———	———
P_j	———	———	———	———
P_s	−33.9860	−1.67142	7.76854	5.97975
TCR_h^-	5.6335	0.25111	0.01638	0.00052
Lo_h^-	5.1579	0.35634	0.77992	1.19509
Y_w	24.4433	0.30311	0.07137	0.07396
Y_p	0.6317	0.29458	0.07522	0.07006
Y_r	−0.8065	0.04936	0.05326	0.04346
w^*/p	0.0006	−0.00002	———	———

(*) Note: Supply of money is assumed to be exogenous, so equation (3–1–1) is dropped from the model.

ment, and in inventories of 4.7 and 16.9 billion yen respectively. It might seem strange that despite a large increase in personal disposable income the increase in GNP is small, but this phenomenon should be considered as the resulting only from an increase of money wage rate, most of the benefits of which are given to the individuals sector, at least for the current period.

A decline of investment by incorporated businesses in plants and equipment (about 4.7 billion yen) will slow down the rate of growth in fixed capital, which will delay increase in technical productivity of labor and bar an immediate recovery of general price stability. Moreover, a decline of corporate profits and of excess money will strengthen this tendency or postpone the recovery of investment in

plants and equipment and in inventories. The counter-effects of a price increase on corporate profits and real wage rate should also be examined. Using equations (7–8)—(7–11), changes in prices can be estimated at least for the next period, which are shown in Table 8. These results clearly show that price increases are not

TABLE 8. EFFECTS OF MONEY WAGE RATE ON PRICES

P_c	0.001131
P_w	0.000297
P_i	0.000220
P_j	0.000147

negligibly small, so that a decline of corporate profits for the next period could partly be offset. The real wage rate from the viewpoint of employees as onsumers increases 0.000769 for the current period and 0.000766 for the next period. Similarly, it is also possible to calculate the effects of interest rates for loans and discounts on changes in prices for the next period. They are given in Table 9. These figures are calculated based on Tables 4 and 5 and equation (7–8)—(7–11).

TABLE 9. EFFECTS OF INTEREST RATES ON CHANGES IN PRICES FOR THE NEXT PERIOD

	i_L	i_d
P_c	−0.00331	−0.00505
P_w	−0.01519	−0.09184
P_i	−0.00682	−0.04122
P_j	−0.02755	−0.06559

Impact multipliers of exports are almost the same as those of current expenditures by the general government. The former does not give rise to government deficit or to an increase in government bond issues. The impact multiplier for GNP is 2.00530, which is a little higher than that of current expenditures of government, reflecting partly the difference of price-deflators between them which affects the level of real GNP. Another interesting fact is that an increase in exports leads to a decrease in government bonds issue, which reduces securities holdings of individuals and incorporated businesses, inducing a decline of stock price and of industrial bond and stock issues. Since these are reactions for the first period, it may not be quite certain, but it seems that exports probably make the financial structure of private sectors change differently than do government current expenditures.

V. APPENDIX: REMARKS ON DATA

1. General Characteristics

In order to observe the general interdependence among the conomic sectors in

their relations to financial and non-financial (physical) transactions, it is necessary at least to obtain data on transactions of final products, money and securities among those sectors. In our case, the time-series data, both on National Income Accounts reported by the Economic Planning Agency of the Japanese Government and on the Flow of Funds Table reported by the Bank of Japan, are available for the periods after 1954.

However, since these surveys were done by the different agencies independently of each other, according to their own purposes and consequently subject to their own criteria, the problem of consolidation or combination has turned out to be difficult from the viewpoint of internal consistency among some particular items. For instance, the difference between savings and investments in real assets by sector does not necessarily coincide, but is always at variance with the so-called "excess funds" of that sector, mainly because of the fact that the concepts assigned to those accounts are different from each other.

In National Income Accounts, investment does not include that in land (that is, purchases of land). Profits of financial intermediaries are included in those to the incorporated businesses sector, which seems to be difficult to split into two sectors. Also, personal or individual income includes imputed income, such as interests, rents and so forth.

On the other hand, in the Flow of Funds Table any transaction, whether financial or non-financial, might be recorded, though the in- or outflow of funds is reported in terms of net flow. However, stock transactions are treated differently from others, because though the stock issues are recorded at their issue price, the holdings of them in each sector are not evaluated at their current prices, but at their original (at time of purchase) price, and consequently the gaps between them are included in the item "Other Transactions".

As has already been made clear by the brief notes above, the author had to make the sector-balancing item include, in fact, the statistical discrepancy for each sector and for the economy as a whole, and this may be an unavoidable aspect of the first approach. Of course, it should be noted that this item is quite different from the sector-balancing variable specified by the identity in the Model, which has a clear economic meaning.

2. Division of Sectors

The Flow of Funds Table reported by the Bank of Japan is, in this study, reclassified into six sectors: individuals, including households and uninocorporated businesses; incorporated businesses; private financial intermediaries; the Bank of Japan; general government, including government financial institutions, local governments and public corporations; and the foreign trade sector. This division mainly depends on the simplicity of the model and on making easier the consolidation of this table with National Income Accounts.

Uninocorporated businesses have a twofold function, the first of which is virtually that of a consumer or household and the second, that of an entrepreneur. However, most of them are very small-scale and have not yet been greatly moderniz-

ed. Moreover, most agricultural and small-scale fishing enterprises are also included here.

In the incorporated businesses sector, the security corporations are included. The latter should properly be separated as an independent sector, but to do that we would need more detailed information which has not yet become available. sector covers all private incorporated businesses in all industries except for financial intermediaries.

Financial institutions are divided into three groups. The first is the Bank of Japan, the central bank, assigned to an independent sector having a role in executing various types of monetary policies, such as supply of cash currency, indirect creditcontrol, operations with particular city banks, official rate of interest, and so forth. The second group is the government financial institutions supplying long-term loans to particular enterprises according to the industrial policies of the government, and the third is the private financial intermediaries which also include the insurance and trust companies. For simplicity's sake, government financial institutions are, included in the general government sector.

It goes without saying that all the transactions of all domestic sectors with foreign countries are assigned to one quasi-sector, the foreign trade sector.

3. Consolidation and Rearrangement of Financial Items

For the sake of simplicity, some of the financial items listed in the Flow of Funds Table were eliminated or offset on a debit-side and a credit-side in each sector's accounts; "other assets," or "other debts" in each sector therefore include the residuals caused by these adjustments. The reason is that they were considered not to be very important from the viewpoint of economic theory and/or to be negligibly small compared with other tiems.

The neglected items are as follows: (i) government deposits, (ii) personal contributions or direct investments, (iii) foreign currency reserves, (iv) foreign exchanges and (v) foreign claims of all sectors except for those in the general government and foregin trade sectors.

Call Money was offset in the private financial intermediaries sector. Most call transactions have been within this sector and, as is well known, their role is in making smooth the short-term financial transactions between the demanders (main city banks) and the suppliers (local banks, creditassociations or agricultural cooperative associations).

Each financial item in the individuals sector is determined or computed as the residual or difference between total holdings of the asset and total issues of the debt in other sectors except for the foreign trade sector, in order to hold the expost equality between the sum of the asset and that of the debt issued.

The end-of-period balance or stock for each financial item in each sector and in the economy as a whole is obtained by adding cumulatively the net financial in- or outflow in each period to the initial (the latter half of 1954 calendar year) balance.

4. Consolidation of Flow of Funds Table and National Income Accounts.

As already stated above, it is most difficult to treat properly the gap between the difference of savings-investments and that of changes in debtsassets or, in other words, the net deficit or surplus of dunds in each sector. In this study, investment in land (purchases of land) is neglected, and therefore the gap in question in each sector also includes investment in land. Moreover, the fact that profits of financial institutions are included in the incorporated businesses sector will also cause this gap to swell further. Data on investment in land and on profits to financial institutions are not, in general, available.

Consolidated flow accounts by sector in each half-calendar year are as follows:

1. Individuals (h)

C	Y_w
TAX_h	Y_p
SI_h	Y_r $(-DIV)$
TR_{hg}	DIV
TR_{hf}	TR_{ch}
	TR_{gh}
	TR_{fh}
	$-R_h$
I_h	DEP_h^1
IH_h	DEP_h^2
J_h	
ΔCAS_h^+	ΔTCR_h^-
ΔCSD_h^+	ΔLO_h^-
ΔPTS_h^+	ΔLOG_h^-
ΔDT_h^+	
ΔPS_h^+	
ΔSEC_h^+	
ΔOT_h^+	

2. Incorporated Businesses

TAX_c	Y_c
DIV	
TCR_{ch}	
I_c	DEP_c^1
J_c	DEP_c^2
IH_c	
ΔCAS_c^+	ΔBS_c^+
ΔCSD_c^+	ΔTCR_c^+
ΔDT_c^+	ΔLC_c^+
ΔSEC_c^+	ΔLOG_c^+
ΔTCR_c^+	ΔOT_c^+

3. Private Financial Intermediaries

ΔCAS_b^+	ΔCSD_b^-
ΔCND_b^+	ΔDT_b^-
ΔSB_b^+	ΔBF_b^-
ΔSEC_b^+	ΔST_b^-
ΔLO_b^+	ΔIB_b^-
	ΔLON_b^-
	ΔOT_b^-

4. The Bank of Japan

ΔSB_n^+	ΔCAS_n^-
ΔSEC_n^+	ΔCND_n^-
ΔLON_n^+	ΔCDG_n^-
	ΔOT_n^-

5. General Government

C_g	TAX_h
SUB_g	TAX_c
TR_{gh}	$ITAX$
TR_{gf}	SI_g
	TR_{hg}
	$-R_g$
	Y_g
I_g	DEPt
J_g	
ΔCAS_g^+	ΔCAS_g^-
ΔCSD_g^+	ΔPTS_g^-
ΔCDG_g^+	ΔPS_g^-
ΔDT_g^+	$\Delta FDEB_g^-$
ΔSB_g^+	
ΔSEC_g^+	
ΔLOG_g^+	
$\Delta FCRE_g^+$	
ΔFM_g^+	
ΔOT_g^+	

6. Foreign Trade	
EXP	IMP
TR_{fh}	TR_{hf}
TR_{fg}	TR_{gf}
$\Delta FDEB_f^+$	$\Delta FCRE_f^-$
ΔOT_f^-	ΔFM_f^-

7. Final Products	
Y	
Y	GNP
DEP_h^1	
DEP_h^2	
DEP_c^1	
DEP_c^2	
DEP_g	
$ITAX$	
$-SUB_g$	
$SGAP$	

8. Distribution and Expenditures	
C	Y_w
C_g	Y_p
$I(=I_h+I_c+I_g+IH_h+IH_c)$	$Y_r\ (-DIV)$
	DIV
	TR_{ch}
$J(=J_h+J_c+J_g)$	TAX_c
EXP	R_c
$-IMP$	Y_g
	$-R_g$
	$-R_h$
	$DEP_h^1+DEP_h^2+DEP_h^1+DEP_h^2+DEP_g$
	$ITAX$
	$-SUB_g$

5. Variables Other than Those for National Income Accounts and Flow of Funds Table

The model includes many other variables which do not appear in National Income Accounts and the Flow of Funds Table. They are listed in the table below:

Miscellaneous Variables

Variables	Sources:
L	*Labor-Forces Survey*; Statistical Department, the Prime Minister's Office.
h	*Monthyl Report of Labor Statistics*; the Ministry of Labor.
w^*	(Compensation of employees) divided by (the number of employees) times (average labor-hours per person for six months).
p	*Annual Report of National Income Statistics*; Economic Research Institute, Economic Planning Agency.
p_i	
p_j	
p_h	
p_e	
P_m	The same as p above.
p_c	
p_{ig}	
p_{cg}	
p_{jg}	

Miscellaneous Variables (Continued)

Variables	Sources:
p_w	*Monthly Report of Economic Statistics*; The Bank of Japan.
p_s	
i_L	The same as *po* above.
i_N	
Ope	
V_c	*Quarterly Report of Incorporated Business Survey*; the Ministry of Finance.
*TAX**	Main Tax Division, The Ministry of Finance.
A	*The Annual Report of Tax Statistics*, Tax Administration Agency.
B	The same as *A* above.

6. Aggregation and Dis-aggregation Over Time

Time-series data on National Income Accounts are available in each quarterly period, but to make those series correspond or coincide with those on Flow of Funds, they were summed up into half-calendar year series. As already noted above, data on the quarterly Flow of Funds do not seem to be sufficiently reliable, mainly because of the coversage of that survey. That is, the quarterly series do not include the financial flows of all insurance companies until 1963. Annual data on those of all sectors, on the other hand, are available throughout our observation perods, so data on half-calendar year Flow-of-Funds were obtained by dividing an annual figure into two portions for each half-calendar year, subject to the weights derived from the corresponding quarterly series.

Let A_t be the value of a certain variable at calendar year t; $Q_{t,i}$ ($i=$ 1,2,3 and 4), a value of the quarterly variable corresponding to A**i** at the ith quarter of the calender year t. Then the half-calender year value of the variable $F_{t,j}$ ($j=I$ and II) is:

$$F_{t,I}=\frac{\sum_{i=1}^{2} Q_{t,i}}{\sum_{i=1}^{4} Q_{t,i}}\cdot A_t\ ;\quad F_{t,II}=\frac{\sum_{i=3}^{4} Q_{t,i}}{\sum_{i=1}^{4} Q_{t,i}}\cdot A_t$$

respectively.

B. Notation

1) *Individuals* (incl. households and unincorporated businesses)

C		Consumption expenditures
TAX_h		Direct taxes and charges on households and nonprofit institutions
TAX_h^*	°	The accumulated sum of tax-reduction in the past
SI_h	°	Social insurance contributions
TR_{hg}	°	Current transfers to general government

TR_{hf} ° Transfers to the rest of the world
I_h Investment of unincorporated businesses in plants and equipments
IH_h Investment in dwellings
J_h ° Investment in inventories (changes in inventories)
ΔMON_h^+ Changes in money holdings (cash currency, current deposits, ordinary deposits, special deposits and checks & bills)
ΔCAS_h^+ Changes in cash currency
ΔCSD_h^+ Changes in deposit currency
ΔDT_h^+ Changes in time and savings deposits (incl. insurance and trust)
ΔPTS_h^+ Changes in post transfer savings
ΔPS_h^+ Changes in postal savings (incl. post-office life insurance and postal annuity)
ΔSEC_h^+ Changes in securities holdings
ΔOT_h^+ Changes in other assets
Y_w Compensation of employees
Y_p Income from unincorporated businesses
Y_r Income from property
DIV Dividends received
TR_{ch} ° Transfers from corporate businesses
TR_{gh} ° Transfers from general government
TR_{fh} ° Transfers from the rest of the world
R_h ° Interest on consumers' debt
DEP_h^1 * Provisions for the consumption of fixed capital in unincoporated businesses
DEP_h^2 ° Provisions for the consumption of dwellings
Y_d Disposable income of persons
ΔTCR_h^- Changes in trade credit net-received
ΔLO_h^- Changes in borrowings from private financial institutions
ΔLOG_h^- ° Changes in borrowings from general government

2) *Corporate Businesses*

TAX_c Direct taxes and charges on private corporations
TR_{ch} ° Transfers to households and private non-profit institutions
R_c Gross savings
I_c Investment in plants and equipments
J_c Investment in inventories (changes in inventories)
J_c^* Intended investment in inventories
U Uninted investment in inventories
H_c^* Inventories, desired at the end of the period
V_c Net sales
IH_c ° Investment in dwellings
ΔMON_c^+ Changes in money holdings (cash currency, current deposits, ordinary deposits, special deposits, and checks & bills)
ΔCAS_c^+ Changes in cash currency

ΔCSD_c^+ Changes in deposit currency
ΔDT_c^+ Changes in time and savings deposits (incl. trust)
ΔSEC_c^+ Changes in securities holdings
ΔTCR_c^+ Changes in trade credit granted
Y_c Income from private corporations
DEP_c^1 Provisions for the consumption of fixed capital
DEP_c^2 * Provisions for the consumption of dwellings
ΔBS_c^- Changes in issue amount of industrial bonds and stocks
ΔTCR_c^- Changes in trade credit received
ΔLO_c^- Changes in borrowings from private financial institutions
ΔLOG_c^- ° Changes in borrowings from general government
ΔOT_c^- ° Changes in other debts
ΔMDT_c^+ Changes in money and time and savings deposits: Sector-balancing variable
M^* Excess money balance
$FINC$ New supply of industrial funds from private financial insitutions
$FING$ ° New supply of industrial funds from government financial institutions
TAS_c Total assets holdings of corporate businesses

3) *Private Financial Institutions*

ΔCAS_b^+ Changes in cash currency
ΔCDN_b^+ ° Changes in current deposits to Bank of Japan
ΔSB_b^+ * Changes in short-term government securities
ΔSEC_b^+ Changes in securities (government bonds, local government securities, public corporation bonds, bank debentures, industrial bonds, stocks, and sccurities investment trust):
ΔLO_b^+ Changes in loans
ΔCSD_b^- Changes in deposit currency
ΔDT_b^- Changes in time and savings deposits (incl. insurance and trust)
ΔBF_b^- ° Changes in issue amount of bank debentures
ΔST_b^- ° Changes in issue amount of stocks
ΔIB_b^- ° Changes in issue amount of securities investment trust
ΔLON_b^- Changes in borrowings from Bank of Japan
ΔOT_b^- ° Changes in other debts

4) *The Bank of Japan*

ΔSB_n^+ ° Changes in short-term government securities
ΔSEC_n^+ ° Changes in government bonds, public corporation bonds, bank debentures, and industrial bonds
ΔCAS_n^- Changes in Bank Notes
ΔLON_n^+ ° Changes in loans
ΔCND_n^- ° Changes in current deposits
ΔCDG_n^- ° Changes in government current deposits
ΔOT_n^- Changes in other debts: Sector-balancing variable

5) *General Government*

C_g ° Current expenditures on goods and services
SUB_g ° Current subsidies
TR_{gf} ° Transfers to the rest of the world
I_g ° Gross fixed capital formation
J_g ° Changes in inventories
ΔMON_g^+ °Changes in money holdings
ΔCAS_g^+ ° Changes in cash currency
ΔCSD_g^+ * Changes in deposit currency
ΔCDG_g^+ ° Changes in government current deposits
ΔDT_g^+ ° Changes in time and savings deposits (incl. trust)
ΔSB_g^+ ° Changes in short-term government securities
ΔSEC_g^+ ° Changes in securities: Sector-balancing variable
ΔLOG_g^+ ° Changes in loans
$\Delta FCRE_g^+$ °Changes in foreign claims
ΔFM_g^+ ° Changes in gold & foreign exchange reserves
ΔOT_g^+ ° Changes in other assets
$ITAX$ Indirect taxes
R_g ° Interest on the public debt
Y_g ° Income from property and entrepreneurship
DEP_g ° Provisions for the consumption of fixes capital
ΔCAS_g^- ° Changes in issue amount of subsidiary coins
ΔPTS_g^- Changes in post transfer savings
ΔPS_g^- Changes in postal savings (incl. post-office life insurance and postal annuity)
ΔSB_g^- ° Changes in issue amount of short-term government serurities
ΔPB_g^- Changes in issue amount of government bonds, local government securities and public corporation bonds
$\Delta FEDB_g^-$ °Changes in foreign debts

6) *The Rest of the World*

EXP ° Exports of goods and services and factor income received from abroad
TR_{fg} ° Current transfers to government
$\Delta FDEB_f^-$ °Changes in foreign debts
IMP Imports of goods and services and factor income paid abroad
$\Delta FCRE_f^-$ °Changes in foreign claims
ΔFM_f^- Changes in gold & foreign exchange reserves: Sector-balancing variables
ΔOT_f^- Changes in Other Debts

7) *Miscellaneous Variables*

K_h The fixed capital stock in unincorporated businesses at the end of the period

K_c		The fixed capital stock in corporate businesses at the end of the period
GK		The gross stock in fixed capital of the private sectors at the end of the period (in constant prices)
REP	°	The replacement of gross stock in fixed capital
GNP		Gross national products
GNP^*		Potential supply of final products
GNE^*		Potential demand for final products
$SGAP$	°	Statistical discrepancy
L		Number of employees (million persons)
$\bar{h}$	°	The average labor-hour per person for six months
w^*	°	Wage rate for six months (billion Yen) (million persons)
p		GNP implicit price-defiator (1960 = 100)
p_i		Implicit price-deflator for investment in plants and equipments (1960 = 100)
p_j		Implicit price-deflator for inventories (1960 = 100)
p_j^*		Implicit price-deflator for investment in inventories $(= (1/2)(p_j + p_{j-1}))$
p_h	°	Implicit price-deflator for investment in dwellings (1960 = 100)
p_e	°	Implicit price-deflator for exports (1960 = 100)
p_m	°	Implicit price-deflator for imports (1960 = 100)
p_c		Implicit price-deflator for consumers' goods (1960 = 100)
p_{ig}	°	Implicit price-deflator for fixed investment by government (1960 = 100)
p_{cg}	°	Implicit price-deflator for current expenditures by government (1960 = 100)
p_{jg}	°	Implicit price-deflator for investment in inventories by government (1960 = 100)
p_w		Whole-sale price index (1960 = 100)
p_s		Index of Tokyo Stock Exchange's stock price average (incl. 225 issues listed on T.S.E. First Section)
i_L	°	Average interest rate on loans of all banks
i_d	°	Average interest rate on discounts of all banks
i_m	°	A dummy variable (=1 for the periods of high ratio of deposit for imports, and = 0 for the other periods)
O_{pe}	°	Operations (buy) by the Bank of Japan
A	°	The corporate tax-rate on Higher income from private corporations
B	°	Tax-rate on dividends
t	°	Time-trend variable
d_1	°	A dummy variable (=0 before the former half of 1961, and = 1 after the latter half of 1961)
d_2	°	A dummy variable (= 1 between the former half of 1961 and that of 1964, and = 0 for the other periods)

d_3 ° A dummy variable (= 1 for the period under the tight money policies, and = 0 for the others).

Q ° A seasonal dummy variable

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