A FINANCIAL MACROECONOMETRIC MODEL OF THE UNITED STATES 1977-2002[1]

By

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Abstract

L. R. Klein presented a flow-of-funds model that has similarity to input-output model of the Leontief. The purpose of this paper is, first, to present a financial macroeconometric model for the United States, which is based on a flow-of-funds model that is formulated by making some modification to the above Klein model. In this financial macroeconometric model, the modified Klein model is a core of the whole system and asset-holding-coefficients are estimated as functions of interest rates etc. and the interest rates are also estimated as functions of the discount rate of FRB or other interest rates. In our simulations, all the financial assets in the whole economy and total liabilities of all the economic sectors expand owing to the increase in net worth of households and nonprofit organizations. And many of the financial assets in the U.S. financial system and many of the total liabilities of the individual economic sectors also increase due to the decline in the discount rate.

1 Introduction

In his *Lectures in Econometrics* (1983, pp. 1-46), L. R. Klein advanced a flow-of-funds model that has similarity to input-output model of the Leontief. Even if there are a great number of economic sectors, and assets and liabilities, this model can analyzes interdependence among them by a simple linear model, although Klein did not present any empirical study on the basis of his model.

The purpose of this paper is, first, to present a financial macroeconometric model for the United States, which is based on a flow-of-funds model that is formulated by making some modification to the above Klein model. In this financial macroeconometric model, the modified Klein model is a core of the whole system and asset-holding-coefficients are estimated as functions of interest rates etc. and the interest rates are

[1] The former version of this paper was reported at the 18th conference of Pan Pacific Association of Input-Output Studies, Chukyo University, November 10-11, 2007. Professor Kazusuke Tsujimura (Keio University), Professor Masako Tsujimura(Keio University) and Professor Kazuo Ogawa (Osaka University) gave me very helpful comments on my report at the conference. And anonymous referee and the editor of the journal gave me useful comments. I would like to thank them. Of course any remaining errors in this paper are mine.

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also estimated as functions of the discount rate of FRB or other interest rates.

Let us explain the outline of the modified Klein model which is the core of our system. First, we define the sum of all the financial liabilities and net worth held by each economic sector as 'total liability'. We assume that each economic sector determines the ratio of the level of holdings of each asset to the level of its total liability and we call this ratio, the asset-holding-coefficient. The ratio represents the incentive of each economic sector to holding the assets. On the other hand the total of each financial asset in the whole economy must be allocated as liabilities among individual economic sectors. Then we define the ratio in which the total of each financial asset of the whole economy is allocated among economic sectors as the liability-distribution-coefficient. The ratio may represent the institutional aspect or traditional practice of the financial system of the country. Now in the model, the basic exogenous variables are net worth held by the individual economic sectors. If all the above asset-holding-coefficients and liability-distribution-coefficients are given, the total liability held by each economic sector and the total of each financial asset in the whole economy are determined corresponding to the level of net worth held by all economic sectors; therefore all the entries in the flow-of-funds table are endogenously determined.

The feature of our model is that the modified Klein model is the foundation of the whole system. Some asset-holding-coefficients are endogenously determined in households and nonprofit organizations, nonfinancial business, commercial banking and private nonbank financial institutions and the asset-holding-coefficients are exogenous variables in the other public sectors, monetary authority and rest of the world. The liability-distribution-coefficients are exogenous variables.

The paper is organized as follows. The modified Klein model, which is the core of the whole system, is explained in section 2 in detail. This model is also explained and the empirical study of the Japanese economy by this model was made in Nishiyama (1992). The structure of our system is explained in section 3. Portfolio equations representing asset-holding-coefficients are estimated as functions of rates of interest and other economic variables. The sample period is 1977-2002. Section 4 is devoted to the explanation of the simulation analyses by our financial model. The final test was executed during 1977-2002. The solutions of a dynamic simulation of the model are compared with actual sample observations.

Let us compare our system with other research. In our model, asset-holding-coefficients and liability-distribution-coefficients play a very important role and some of the elements in the asset-holding-coefficient matrix are functions of rates of interest and other variables. A comparison of our model with other research is as follows. In Multi-sectoral Econometric Model by Economic Planning Agency (1996), some of the assets and liabilities in the flow-of-funds accounts are determined by multiplying total assets or total liabilities by constant ratios which indicate portfolio behavior and other assets and liabilities are estimated as functions of interest rates and other economic variables. In this respect, our model may be similar to financial sector of EPA model. In Yoshino and Furukawa (1991), some portfolio equations are estimated, however, many assets and liabilities are exogenous variables. Yoshino-Furukawa model is different from our model in many respects. On the other hand, our system is based on the modified Klein model in which all the entries in the flow-of-funds table are determined corresponding to the level of net worth if all the asset-holding-coefficients and liability-

distribution-coefficients are given.

Recently Tsujimura and Mizoshita (2002), (2003) used the approach of the original Klein model and the modified Klein model to transform the flow-of-funds table into the asset-liability-matrix and analyzed flow of funds of Japan from the demand side and the supply side. It must be remarked that a method for constructing the asset-liability-matrix was established by Tsujimura-Mizoshita (2002). Tsujimura-Mizoshita (2003) analyzed the recent monetary policy by the Bank of Japan using the asset-liability-matrix.

A comparison of our model with other research on the U.S. economy is as follows.

Backus-Brainard-Smith-Tobin (1980) is the pioneer work on an empirical study of the general equilibrium approach to financial asset markets. The basic idea of the asset demand functions in our financial model is based on their pioneer work. In Saito (1977), portfolio equations of households are formulated and estimated as linear expenditure system (LES).

2 The explanation of the basic model (The modified Klein model)

2.1 The basic model (The modified Klein model)

First, we explain the basic model. Table 1 represents the accounting scheme of the model (stock table) with symbols.

Table 1

The first economic sector		·····	The n th economic sector		Total	
Assets	Liabilities		Assets	Liabilities	Assets	Liabilities
$A_{1,1}$	$L_{1,1}$		$A_{1,n}$	$L_{n,1}$	A_1^*	L_1
⋮	⋮	·····	⋮	⋮	⋮	⋮
⋮	⋮	·····	⋮	⋮	⋮	⋮
⋮	⋮		⋮	⋮	⋮	⋮
$A_{m,1}$	$L_{1,m}$		$A_{m,n}$	$L_{n,m}$	A_m^*	L_m
	NW_1			NW_n		
K_1			K_n		K_T	NW_T
W_1	L_1^S	·····	W_n	L_n^S		

Notation of variables and the meanings of the symbols are as follows.
i: A subscript which denotes economic agents (i=1, ·····, n).
j: A subscript which denotes financial assets and liabilities (j=1, ……, m).
A_{ji}: The j th asset held by the i th sector.
L_{ij}: The j th liability held by the i th sector.
L_j: The j th liability in the whole economy.
W_i: Total wealth held by the i th sector (which includes real assets (K_i)).
A_j^*: The j th asset in the whole economy.

L_i^S: Total liability held by the i th sector (which includes net worth (NW_i)).
NW_i: Net worth held by the i th sector.
K_i: Real assets held by the i th sector.
K_T: Real assets in the whole economy.
NW_T: Net worth in the whole economy.

The following relationships hold in table 1.

(1) $$A_j^* = \sum_{i=1}^{n} A_{ji}$$

(1)' $$L_j = \sum_{i=1}^{n} L_{ij}$$

(1)'' $$A_j^* = L_j$$

$$(j = 1, \cdots\cdots\cdots, m)$$

(2) $$L_i^S = \sum_{j=1}^{m} L_{ij} + NW_i$$

(2)' $$W_i = \sum_{j=1}^{m} A_{ji} + K_i$$

(2)'' $$W_i = L_i^S$$

$$(i = 1, \cdots\cdots\cdots, n)$$

$$K_T = \sum_{i=1}^{n} K_i \qquad\qquad NW_T = \sum_{i=1}^{n} NW_i$$

Therefore, the following equation holds.

$$K_T \equiv NW_T$$

We define the following asset-holding-coefficient, which may correspond to an input coefficient in the input-output analysis.

(3) $$e_{ji} = \frac{A_{ji}}{L_i^S}$$

e_{ji} is the coefficient that represents the ratio of holdings of each asset held by sector to its total liability (which includes net worth). It expresses the portfolio behavior of economic agent. Also, we define the following liability-distribution-coefficient:

(4) $$f_{ij} = \frac{L_{ij}}{A_j^*}$$

The coefficient f_{ij} is frequently considered to be a ratio which has an institutional property (for example credit-rationing by banks to enterprises). It tends to be affected by institutional or customary factors. We can rewrite equations (1), (2) in matrix form by using the above coefficients, e_{ji}'s, f_{ij}'s.

(5) $$A^* = EL^S$$

(6) $$L^S = FA^* + NW$$

, where matrices E and F are defined as:

$$E = \begin{pmatrix} e_{11} & \cdots & e_{1n} \\ \vdots & & \vdots \\ e_{m1} & \cdots & e_{mn} \end{pmatrix}$$

$$F = \begin{pmatrix} f_{11} & \cdots & f_{1m} \\ \vdots & & \vdots \\ f_{n1} & \cdots & f_{nm} \end{pmatrix}$$

And vectors A^*, L^S and NW are defined as:

$$A^* = \begin{pmatrix} A_1^* \\ \vdots \\ A_m^* \end{pmatrix} \qquad L^S = \begin{pmatrix} L_1^S \\ \vdots \\ L_n^S \end{pmatrix} \qquad NW = \begin{pmatrix} NW_1 \\ \vdots \\ NW_n \end{pmatrix}$$

Then we can rewrite equation (2), using equation (5), (6).

(7) $$L^S = FEL^S + NW$$

Solving equation (7) with respect to L^S gives:

(8) $$L^S = (I - FE)^{-1} NW$$

Similarly, we can obtain the following equation system which determines A^*.

Table 2: Assets and liabilities

1. Depository institution reserves
2. Vault cash of commercial banking
3. Checkable deposits and currency
4. Time and savings deposits
5. Money market mutual fund shares
6. Federal funds and security repurchase agreements
7. Open market paper
8. Treasury securities
9. Agency- and GSE- backed securities
10. Municipal securities and loans
11. Corporate and foreign bonds
12. Corporate equities
13. Mutual fund shares
14. Bank loans not elsewhere classified
15. Other loans and advances
16. Total mortgages
17. Consumer credit
18. Trade credit
19. Security credit
20. Life insurance and pension fund reserves
21. Taxes payable by business
22. Other assets or liabilities

The numbers 1~22 on the left of the above assets and liabilities in table 2 denote the items of the financial instruments and correspond to a subscript j of symbols used in our model.

Table 3: Economic agents

1. Households and nonprofit organizations
2. Nonfinancial business
3. State and local governments
4. Federal government
5. Rest of the world
6. Monetary authority
7. Commercial banking
8. Private nonbank financial institutions

The numbers 1~8 on the left of the economic agents in table 3 denote the kind of the economic agents relevant to the analysis in this paper and correspond to the subscript i of the symbols used in our model.

$$A^* = EFA^* + E\{NW\} \tag{9}$$

or

$$A^* = (I - EF)^{-1} E\{NW\} \tag{10}$$

Equations (8) and (10) are reduced form equations which express L^S and A^* as functions of exogenous variables NW and coefficients E and F. Thus if coefficients, e_{ji}'s and f_{ij}'s are given in the form of (3) or (4) by using actual values, the actual values of endogenous and exogenous variables in each calendar year satisfy both equations (8) and (10).

Our financial macroeconometric model is based on the flow-of-funds accounts of the United States with 8 economic agents and 22 instruments. In our model, n=8 and m=22. The details on the flow-of-funds data are shown in table 2 and 3.

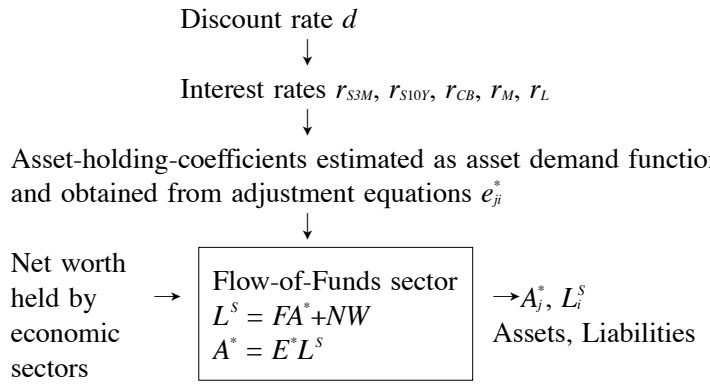
3 The outline of the financial macroeconometric model[2]

In basic system, net worth of the individual sectors determines the level of financial assets and liabilities in the flow-of-funds accounts. The whole system is composed of the four blocks: Interest rates, asset demand functions, adjustment equations, flow-of-funds sector. The outline of the whole system is summarized in figure 1. Various rates of interest determined by the discount rate affect the asset-holding-coefficients formulated as asset demand equations. And the asset-holding-coefficients affect the level of the financial assets in the whole economy and total liabilities held by the individual sectors in the flow-of-funds sector. And total liabilities held by commercial banking determined in the flow-of-funds sector affect the depository institution reserves held by commercial banking. The rate of change of depository institution reserves of commercial banking represents the state of supply of funds in the financial markets and the increase in supply of funds causes the short-term interest rates to decline and demand and supply of

[2] Full model list is available from the author on request.

funds in the financial markets have a feedback effect on the rates of interest.

Figure 1: The structure of the whole system



E^* matrix is obtained by replacing e_{j1}, e_{j2}, e_{j7} and e_{j8} ($j = 1, 2, \cdots\cdots, 22$) in E matrix with e_{j1}^*, e_{j2}^*, e_{j7}^* and e_{j8}^* ($j = 1, 2, \cdots\cdots, 22$).

3.1 Interest rates

Interest rates are determined by the discount rate of FRB and supply of funds. The interest rate on short-term government securities is determined by the discount rate and the rate of change of depository institution reserves. And other interest rates are determined by the interest rate on short-term government securities. A rise in the discount rate leads to the rise in the market interest rates. The following equations which determine the level of the interest rates are estimated by OLS.

Nominal interest rate on short-term government securities

$$r_{S3M} = \alpha_1 + \alpha_2 \left\{ \frac{A_{1,7} - A_{1,7}(-1)}{A_{1,7}(-1)} \right\} + \alpha_3 d$$

$\alpha_2 < 0 \qquad \alpha_3 > 0$

Nominal interest rate on long-term government securities

$$r_{S10Y} = \beta_1 + \beta_2 r_{S3M} + \beta_3 r_{S10Y}(-1)$$

$\beta_2 > 0 \qquad \beta_3 > 0$

Nominal interest rate on corporate bonds

$$r_{CB} = \gamma_1 + \gamma_2 r_{S3M} + \gamma_3 r_{S3M}(-1) + \gamma_4 r_{CB}(-1)$$

$\gamma_2 > 0 \qquad \gamma_3 > 0 \qquad \gamma_4 > 0$

Nominal interest rate on total mortgages.

$$r_M = \delta_1 + \delta_2 r_{S3M} + \delta_3 r_M(-1)$$

$\delta_2>0 \qquad \delta_3>0$

Nominal interest rate on bank loans.

$$r_L = \lambda_1 + \lambda_2 r_{S3M}$$

$$\lambda_2>0$$

r_{S3M}: Nominal interest rate on short-term government securities.
$A_{1,7}$: Depository institution reserves held by commercial banking (assets).
d: Discount rate. r_{S10Y}: Nominal interest rate on long-term government securities.
r_{CB}: Nominal interest rate on corporate bonds. r_M: Nominal interest rate on total mortgages.
r_L: Nominal interest rate on bank loans.

3.2 The asset demand function

In our financial macroeconometric model, the following set of portfolio equations is included and the levels of asset-holding-coefficients, e^*_{ji}'s, are determined. e^*_{ji} is the estimated value of the asset-holding-coefficient computed from the asset demand function. e_{ji} is the actual value of the asset-holding-coefficient. The sample period for estimation is calendar year of 1977-2002. The subscript j of e_{ji}, e^*_{ji} A_{ji}, L^S_i denotes the numbers of financial instruments in table 2 and the subscript i of e_{ji}, e^*_{ji}, A_{ji}, L^S_i denotes the numbers of economic sectors in table 3.

The following types of equations are employed as basic forms of asset demand functions. The following portfolio equations are based on the partial adjustment principle. All the equations are estimated by the ordinary least squares method.

$$A_{ji} = e^*_{ji} * L^S_i$$

$$e^*_{ji} = \alpha_0 + \alpha_1 r_{OWN} + \alpha_2 r_{SUB} + \alpha_3 \left[\frac{A_{ji}(-1)}{L^S_i} \right] + \alpha_4 X_1 + \alpha_5 \left[\frac{X_2}{L^S_i} \right] + \alpha_6 \left[\frac{10^3}{L^S_i} \right]$$

$$e^*_{ji} = \alpha_0 + \alpha_1 r_{OWN} + \alpha_2 r_{SUB} + \alpha_3 e^*_{ji}(-1) + \alpha_4 X_1 + \alpha_5 \left[\frac{X_2}{L^S_i} \right]$$

X_1 and X_2 denote nominal GDP and rate of growth of nominal GDP, etc. excluding interest rates and lagged variable of the j th asset. L^S_i is the total liability of the i th sector. A_{ji} is the j th asset held by the i th sector. A_{ji} is determined by multiplying L^S_i by e^*_{ji}. r_{OWN} is the own rate of interest on the j th asset and r_{SUB} denotes the interest rates of alternative assets or substitute assets. α_1 should be positive and α_2 should be negative from the viewpoint of portfolio selection. α_1 is the own effect of the own interest rate and α_2 is the cross effect of the substitute interest rates.

The functional form of e^*_{ji} is similar to Brainard-Tobin type portfolio equation. The Brainard-Tobin type equation is presented by Brainard-Tobin (1968) and Tobin (1969). Saito (1983) and Ogawa-Saito-Tokutsu (1992) are prototypes of empirical studies on the Brainard-Tobin type portfolio equations in Japan.

The estimated results of the asset demand equations of households and nonprofit organizations by the ordinary least square method are presented in tables 4-1 and 4-2. All the own effects of nominal interest rates are positive in tables 4-1 and 4-2. As to

Table 4-1: Households and nonprofit organizations

Dependent variable	Constant term	r_{S3M}: Nominal interest rate on short-term government securities	gr_{S3M}: Growth rate of nominal rate on short-term government securities	r_{S10Y}: Nominal interest rate on long-term government securities	r_{CB}: Nominal interest rate on corporate bonds	r_M: Nominal interest rate on total mortgages	gr_M: Rate of change of nominal interest rate on total mortgages	r_E: Rate of return on corporate equities	$e^*_{j1}(-1)$: Own lagged variable	$A_{j1}(-1)/L^S_1$: Own lagged variable	$10^3/L^S_1$
$e^*_{3,1}$: Checkable deposits and currency	-0.0002713 (-0.20)	-0.00001013 (-0.06)							0.98335 (11.94)		
$e^*_{4,1}$: Time and savings deposits	0.001049 (0.25)		-0.002813 (-0.71)						0.9682 (22.93)		
$e^*_{7,1}$:Open market paper	0.0091 (2.49)			-0.0000895 (-1.55)						0.4749 (2.78)	0.020024 (4.75)
$e^*_{8,1}$: Treasury securities	-0.00176921 (-0.55)			0.0002733 (1.26)					0.9588 (7.77)		
$e^*_{10,1}$: Municipal securities and loans	0.001435 (1.37)							-0.002379 (-0.99)	0.9363 (14.02)		

The figures in parentheses under the coefficients represent the t–ratio.

$$gr_{S3M} = \frac{r_{S3M} - r_{S3M}(-1)}{r_{S3M}(-1)} \qquad gr_M = \frac{r_M - r_M(-1)}{r_M(-1)}$$

Table 4-2: Households and nonprofit organizations

Dependent variable	Constant term	r_{S3M}: Nominal interest rate on short-term government securities	gr_{S3M}: Growth rate of nominal rate on short-term government securities	r_{S10Y}: Nominal interest rate on long-term government securities	r_{CB}: Nominal interest rate on corporate bonds	r_M: Nominal interest rate on total mortgages	gr_M: Rate of change of nominal interest rate on total mortgages	r_E: Rate of return on corporate equities	$e^*_{j1}(-1)$: Own lagged variable	$A_{j1}(-1)/L^S_1$: Own lagged variable	$10^3/L^S_1$
$e^*_{11,1}$:Corporate and foreign bonds	0.0050795 (1.15)				0.0011077 (0.80)	-0.0012862 (-1.24)			0.7195 (4.79)		
$e^*_{12,1}$:Corporate equities	-0.0003803 (-0.05)	-0.001174 (-1.99)						0.088022 (10.04)	0.96496 (20.94)		
$e^*_{16,1}$:Total mortgages	-0.0006679 (-2.26)					0.0001357 (2.78)			0.8426 (13.32)		
$e^*_{20,1}$:Life insurance and pension fund reserves	0.0110098 (2.38)						-0.01632 (-1.73)		0.94594 (31.82)		

The figures in parentheses under the coefficients represent the t–ratio.

Table 5: Nonfinancial business

Dependent variable	Constant term	r_{S10Y}:Nominal interest rate on long-term government securities	r_M:Nominal interest rate on total mortgages	gr_{CB}:Rate of change of nominal interest rate on corporate bonds	$\frac{Y}{L_2^S}$:Ratio of nominal GDP to total liability of nonfinancial business	$e^*_{j2}(-1)$:Own lagged variable
$e^*_{3,2}$:Checkable deposits and currency	0.01488 (3.81)	-0.0006359 (-3.65)				0.5089 (3.80)
$e^*_{7,2}$:Open market paper	0.0009612 (3.67)		-0.00005404 (-3.33)			0.7130 (7.57)
$e^*_{8,2}$:Treasury securities	0.0009429 (1.14)	0.0000334 (0.57)				0.64839 (4.32)
$e^*_{10,2}$:Municipal securities and loans	0.0004669 (1.78)			-0.0009134 (-0.80)		0.76103 (5.98)
$e^*_{16,2}$:Total mortgages	-0.0009245 (-1.51)		0.0002296 (3.76)			0.7635 (9.01)
$e^*_{17,2}$:Consumer credit	0.0007754 (1.33)		-0.00001086 (-0.42)			0.82970 (8.32)
$e^*_{18,2}$:Trade credit	0.007099 (0.68)				0.03878 (2.46)	0.7075 (6.03)

The figures in parentheses under the coefficients represent the t–ratio.

$gr_{CB} = \frac{r_{CB} - r_{CB}(-1)}{r_{CB}(-1)}$ Y:Nominal GDP.

the own effects of nominal interest rates, the effect of the interest rate of total mortgages, r_M, on total mortgages, $e^*_{16,1}$ and that of the rate of return on corporate equities, r_E, on corporate equities, $e^*_{12,1}$, are statistically significant. Especially the t-value of the coefficient representing the effect of r_E on $e^*_{12,1}$ shows high value and is 10.04. The effect of the interest rate of government securities, r_{S10Y}, on treasury securities, $e^*_{8,1}$, and that of the interest rate of corporate bonds, r_{CB}, on corporate and foreign bond, $e^*_{11,1}$, are positive and their t-values are low in absolute value. The cross effects of nominal interest rates imply the opportunity cost of asset holding. All the cross effects of nominal interest rates are negative and the t-values of the coefficients representing the cross effects are low in absolute value in tables 4-1 and 4-2. The estimated coefficients of own lagged variables, $e^*_{j1}(-1)$'s, are 0.7~0.9. and imply slow adjustment.

The estimated results of the asset demand equations of nonfinancial business by the ordinary least square method are presented in table 5.

All the own effects of nominal interest rates are positive in table 5. As to the own effects of nominal interest rates, the effect of the interest rate on total mortgages, r_M, on total mortgages, $e^*_{16,2}$, is statistically significant. However, the effect of the interest rate on long-term government securities, r_{S10Y}, on treasury securities, $e^*_{8,2}$ is statistically insignificant and its t-value is 0.57. All the cross effects are negative in table 5. The effect of the interest rate of long-term government securities, r_{S10Y}, on checkable deposits and currency, $e^*_{3,2}$, and that of the interest rate of total mortgages, r_M, on open market paper, $e^*_{7,2}$ are statistically significant. The t-values of the coefficients of other cross effects are low in absolute value. The effect of Y/L_2^S on $e^*_{18,2}$ is positive and its t-value is 2.46. Nominal GDP has a positive effect on trade credit, because the increase in GDP implies the expansion of the transaction among enterprises. The estimated coefficients of own lagged variables, $e^*_{j2}(-1)$'s, are 0.52~0.83.

The estimated results of the demand asset equations of commercial banking by the ordinary least square method are presented in tables 6-1 and 6-2.

All the own effects of interest rates are positive in tables 6-1 and 6-2. As to the own effects of nominal interest rates, the effect of the interest rate of long-term government securities, r_{S10Y}, on treasury securities, $e^*_{8,7}$, and that of the interest rate of bank loans, r_L, on bank loans not elsewhere classified, $e^*_{14,7}$, are statistically significant. The effect of the lagged variable of the interest rate of corporate bonds, $r_{CB}(-1)$, on corporate and foreign bonds, $e^*_{11,7}$, and that of the rate of change of the interest rate on total mortgages, gr_M, on total mortgages, $e^*_{16,7}$, are positive and their t-values are low in absolute value. All the cross effects are negative in tables 6-1 and 6-2. The effect of the interest rate of bank loans, r_L, on treasury securities, $e^*_{8,7}$, and that of the interest rate of bank loans, r_L, on total mortgages, $e^*_{16,7}$, are statistically significant. The t-values of the coefficients of other cross effects are low and less than 2.0 in absolute value. The coefficients of own lagged variables, $e^*_{j7}(-1)$'s, are 0.65~0.96. And the coefficients of own lagged variables, $A_{j7}(-1)/L_7^S$'s, are 0.11~0.92. The effect of $A_{j7}(-1)/L_7^S$ on vault cash of commercial banking, $e^*_{2,7}$, is 0.11 and small.

The estimated results of the asset demand equations of private nonbank financial institutions by the ordinary least square method are presented in tables 7-1, 7-2 and 7-3.

Table 6-1: Commercial banking

Dependent variable	Constant term	d : Discount rate	r_{S10Y} : Nominal interest rate on long–term government securities	r_L:Nominal interest rate on bank loans	$r_{CB}(-1)$: Nominal interest rate on corporate bonds (Lagged variable)	r_M:Nominal interest rate on total mortgages	gr_M:Rate of change of nominal interest rate on total mortgages	$e^*_{j7}(-1)$:Own lagged variable	$A_{j7}(-1)/L^S_j$: Own lagged variable	$10^3/L^S_j$
$e^*_{1,7}$: Depository institution reserves	0.000817 (0.86)	-0.00016 (-0.89)						0.938 (13.09)		
$e^*_{2,7}$: Vault cash of commercial banks	0.006163 (3.82)								0.11152 (0.50)	0.007081 (4.36)
$e^*_{8,7}$:Treasury securities	0.0059581 (0.95)		0.0053776 (3.44)	-0.003134 (-2.81)				0.6522 (6.60)		
$e^*_{9,7}$:Agency- and GSE-backed securities	0.017822 (1.83)		-0.00119 (-1.60)					0.9351 (16.47)		
$e^*_{10,7}$:Municipal securities and loans	-0.001373 (-0.60)							0.9607 (27.99)		

The figures in parentheses under the coefficients represent the t–ratio.

$$gr_M = \frac{r_M - r_M(-1)}{r_M(-1)}$$

Table 6-2: Commercial banking

Dependent variable	Constant term	d : Discount rate	r_{S10Y} : Nominal interest rate on long–term government securities	r_L:Nominal interest rate on bank loans	$r_{CB}(-1)$: Nominal interest rate on corporate bonds (Lagged variable)	r_M:Nominal interest rate on total mortgages	gr_M:Rate of change of nominal interest rate on total mortgages	$e^*_{j7}(-1)$:Own lagged variable	$A_{j7}(-1)/L^S_j$: Own lagged variable	$10^3/L^S_j$
$e^*_{11,7}$: Corporate and foreign bonds	0.0096780 (1.27)		-0.0008446 (-1.25)		0.0005184 (0.76)				0.9162 (6.89)	-0.0071682 (-1.23)
$e^*_{14,7}$:Bank loans not elsewhere classified	0.040802 (1.73)			0.004034 (2.72)		-0.001947 (-0.81)			0.72025 (4.47)	0.05821 (4.31)
$e^*_{16,7}$:Total mortgages	0.034851 (2.20)			-0.001415 (-2.06)			0.01531 (0.93)	0.9231 (17.72)		
$e^*_{17,7}$: Consumer credit	0.01787 (1.57)			-0.0008565 (-1.77)					0.8647 (6.63)	0.029207 (3.76)
$e^*_{19,7}$:Security credit	0.008849 (1.56)		-0.0002164 (-0.51)						0.741 (3.98)	-0.002873 (-0.77)

The figures in parentheses under the coefficients represent the t–ratio.

Table 7-1: Private nonbank financial institutions

Dependent variable	Constant term	r_{S10Y}:Nominal interest rate on long-term government securities	r_{CB}:Nominal interest rate on corporate bonds	r_E:Rate of return on corporate equities	$r_{CB}(-1)$: Nominal interest rate on corporate bonds (Lagged variable)	gr_M:Rate of change of nominal interest rate on total mortgages	$e^*_{j8}(-1)$:Own lagged variable	$A_{j8}(-1)/L^{\S}_8$: Own lagged variable	$10^3/L^{\S}_8$
$e^*_{3,8}$:Checkable deposits and currency	0.0008431 (1.06)	-0.00004285 (-0.34)					0.9124 (18.24)		
$e^*_{4,8}$:Time and savings deposits	0.000671707 (0.42)							0.9654 (10.30)	0.01123 (2.71)
$e^*_{5,8}$:Money market mutual fund shares	0.0052113 (2.36)		-0.00012921 (-0.77)					0.88 (11.70)	-0.008378 (-2.31)
$e^*_{6,8}$:Federal funds and security repurchase agreement	0.004346 (1.32)	-0.0001216 (-0.42)					0.88 (6.28)		
$e^*_{7,8}$:Open market paper	0.008514 (1.39)							0.867 (6.44)	0.003943 (0.37)

The figures in parentheses under the coefficients represent the t–ratio.

$$gr_M = \frac{r_M - r_M(-1)}{r_M(-1)}$$

Table 7-2: Private nonbank financial institutions

Dependent variable	Constant term	r_{S10Y}:Nominal interest rate on long-term government securities	r_{CB}:Nominal interest rate on corporate bonds	r_E:Rate of return on corporate equities	$r_{CB}(-1)$: Nominal interest rate on corporate bonds (Lagged variable)	gr_M:Rate of change of nominal interest rate on total mortgages	$e^*_{j8}(-1)$:Own lagged variable	$A_{j8}(-1)/L^S_8$: Own lagged variable	$10^3/L^S_8$
$e^*_{8,8}$:Treasury securities	-0.012 (-3.05)	0.001775 (4.92)					0.944 (18.69)		
$e^*_{9,8}$:Agency– and GSE – backed securities	0.01032 (1.19)							0.9697 (9.44)	0.001424 (0.09)
$e^*_{10,8}$: Municipal securities	0.002271 (0.54)			-0.008527 (-2.61)			0.9727 (9.70)		
$e^*_{11,8}$:Corporate and foreign bonds	0.02283 (2.15)	-0.0007513 (-1.02)		-0.02085 (-4.16)	0.0001398 (0.17)		0.874 (11.24)		
$e^*_{12,8}$:Corporate equities	0.002701 (0.15)	-0.00141 (-1.32)		0.12581 (10.25)			0.9675 (20.15)		

The figures in parentheses under the coefficients represent the t–ratio.

Table 7-3: Private nonbank financial institutions

Dependent variable	Constant term	r_{S10Y}:Nominal interest rate on long-term government securities	r_{CB}:Nominal interest rate on corporate bonds	r_E:Rate of return on corporate equities	$r_{CB}(-1)$: Nominal interest rate on corporate bonds (Lagged variable)	gr_M:Rate of change of nominal interest rate on total mortgages	$e^*_{j8}(-1)$:Own lagged variable	$A_{j8}(-1)/L^S_8$: Own lagged variable	$10^3/L^S_8$
$e^*_{15,8}$: Other loans and advances	0.003012 (1.40)							0.9269 (11.79)	0.01488 (3.99)
$e^*_{16,8}$:Total mortgages	0.010727 (1.81)	-0.00042 (-0.38)		-0.00089 (-0.10)		0.000998 (0.07)		0.88 (7.88)	0.11758 (2.53)
$e^*_{17,8}$: Consumer credit	0.008573 (2.22)	-0.00006157 (-0.31)						0.8259 (6.66)	0.0134 (2.89)
$e^*_{21,8}$:Taxes payable by business	0.0009532 (1.57)	-0.000105 (-1.17)		-0.001293 (-1.17)			0.983 (11.82)		

The figures in parentheses under the coefficients represent the t–ratio.

All the own effects of interest rates are positive in the tables 7-1, 7-2, and 7-3. As to the own effects of nominal interest rates, the effect of the interest rate of long-term government securities, r_{S10Y}, on treasury securities, $e^*_{8,8}$, and that of the rate of return on corporate equities, r_E, on corporate equities, $e^*_{12,8}$, are statistically significant. The effect of the lagged variable of the interest rate of corporate bonds, $r_{CB}(-1)$, on corporate and foreign bonds, $e^*_{11,8}$ and that of the rate of change of the interest rate on total mortgages, gr_M, on total mortgages, $e^*_{16,8}$, are positive and their t-values are low in absolute value. All the cross effects are negative in tables 7-1, 7-2 and 7-3. As to the cross effects of nominal interest rates, the effects of the rate of return on corporate equities, r_E, on municipal securities and loans, $e^*_{10,8}$, and foreign bonds, $e^*_{11,8}$, are statistically significant. However the t-values of the coefficients of other cross effects are low and less than 2.0 in absolute value. The estimated coefficients of own lagged variables, $e^*_{j8}(-1)$'s, are 0.87~0.98 and the estimated coefficients of lagged variables, $A_{j8}(-1)\big/L^S_8$'s, are 0.82~0.97.

Similar results are obtained in Ogawa-Saito-Tokutsu(1992) and Saito-Ogawa-Tokutsu (1995) in the case of Japan.

3.3 Adjustment equation and budget constraint

In our model, the difference between the sum of estimated values of the asset-holding-coefficients, e^*_{ji}'s, obtained from the asset demand functions and the sum of actual values of the asset-holding-coefficients, e_{ji}'s, is adjusted in the residual asset-holding-coefficients in order to maintain accounting constraint in each economic sector. The following adjustment equations are used in our model and as a result the accounting constraints hold in the individual economic sectors.

Adjustment equation of households and nonprofit organizations

$$w_{j1} = \frac{e_{j1}}{1-e_{3,1}-e_{4,1}-e_{7,1}-e_{8,1}-e_{10,1}-e_{11,1}-e_{12,1}-e_{16,1}-e_{20,1}}$$
$$(j \neq 3, 4, 7, 8, 10, 11, 12, 16, 20)$$

$$\Delta ec_1 = e^*_{3,1}+e^*_{4,1}+e^*_{7,1}+e^*_{8,1}+e^*_{10,1}+e^*_{11,1}+e^*_{12,1}+e^*_{16,1}+e^*_{20,1} - (e_{3,1}+e_{4,1}+e_{7,1}+e_{8,1}+e_{10,1}+e_{11,1}+e_{12,1}+e_{16,1}+e_{20,1})$$

$$e^*_{j1} = e_{j1}-w_{j1} * \Delta ec_1$$
$$(j \neq 3, 4, 7, 8, 10, 11, 12, 16, 20)$$

Adjustment equation of nonfinancial business

$$w_{j2} = \frac{e_{j2}}{1-e_{3,2}-e_{7,2}-e_{8,2}-e_{10,2}-e_{16,2}-e_{17,2}-e_{18,2}}$$
$$(j \neq 3, 7, 8, 10, 16, 17, 18)$$

$$\Delta ec_2 = e^*_{3,2}+e^*_{7,2}+e^*_{8,2}+e^*_{10,2}+e^*_{16,2}+e^*_{17,2}+e^*_{18,2} - (e_{3,2}+e_{7,2}+e_{8,2}+e_{10,2}+e_{16,2}+e_{17,2}+e_{18,2})$$

$$e^*_{j2} = e_{j2} - w_{j2} * \Delta ec_2$$
$$(j \neq 3, 7, 8, 10, 16, 17, 18)$$

Adjustment equation of commercial banking

$$w_{j7} = \frac{e_{j7}}{1 - e_{1,7} - e_{2,7} - e_{8,7} - e_{9,7} - e_{10,7} - e_{11,7} - e_{14,7} - e_{16,7} - e_{17,7} - e_{19,7}}$$
$$(j \neq 1, 2, 8, 9, 10, 11, 14, 16, 17, 19)$$

$$\Delta ec_7 = e^*_{1,7} + e^*_{2,7} + e^*_{8,7} + e^*_{9,7} + e^*_{10,7} + e^*_{11,7} + e^*_{14,7} + e^*_{16,7} + e^*_{17,7} + e^*_{19,7} - (e_{1,7} + e_{2,7} + e_{8,7} + e_{9,7} + e_{10,7} + e_{11,7} + e_{14,7} + e_{16,7} + e_{17,7} + e_{19,7})$$

$$e^*_{j7} = e_{j7} - w_{j7} * \Delta ec_7$$
$$(j \neq 1, 2, 8, 9, 10, 11, 14, 16, 17, 19)$$

Adjustment equation of private nonbank financial institutions

$$w_{j8} = \frac{e_{j8}}{1 - e_{3,8} - e_{4,8} - e_{5,8} - e_{6,8} - e_{7,8} - e_{8,8} - e_{9,8} - e_{10,8} - e_{11,8} - e_{12,8} - e_{15,8} - e_{16,8} - e_{17,8} - e_{21,8}}$$
$$(j \neq 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16, 17, 21)$$

$$\Delta ec_8 = e^*_{3,8} + e^*_{4,8} + e^*_{5,8} + e^*_{6,8} + e^*_{7,8} + e^*_{8,8} + e^*_{9,8} + e^*_{10,8} + e^*_{11,8} + e^*_{12,8} + e^*_{15,8} + e^*_{16,8} + e^*_{17,8} + e^*_{21,8} - (e_{3,8} + e_{4,8} + e_{5,8} + e_{6,8} + e_{7,8} + e_{8,8} + e_{9,8} + e_{10,8} + e_{11,8} + e_{12,8} + e_{15,8} + e_{16,8} + e_{17,8} + e_{21,8})$$

$$e^*_{j8} = e_{j8} - w_{j8} * \Delta ec_8$$
$$(j \neq 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16, 17, 21)$$

3.4 Flow-of-Funds sector

The flow-of-funds sector of our model is the modified Klein model. The estimated values of asset-holding-coefficients, e^*_{j1}'s, e^*_{j2}'s, e^*_{j7}'s and e^*_{j8}'s are obtained from the above portfolio equations and the above adjustment equations. The estimated values of asset-holding-coefficients, e^*_{j1}'s, e^*_{j2}'s, e^*_{j7}'s and e^*_{j8}'s enter into the 1st column, the 2nd column, the 7th column and the 8th column of the asset-holding-coefficient matrix respectively. The following matrix equations are the core of the whole system as explained above.

$$\begin{bmatrix} L^S_1 \\ L^S_2 \\ L^S_3 \\ L^S_4 \\ L^S_5 \\ L^S_6 \\ L^S_7 \\ L^S_8 \end{bmatrix} = \begin{bmatrix} f_{1,1} & f_{1,2} & \cdots & \cdots & f_{1,22} \\ f_{2,1} & f_{2,2} & \cdots & \cdots & f_{2,22} \\ f_{3,1} & f_{3,2} & \cdots & \cdots & f_{3,22} \\ f_{4,1} & f_{4,2} & \cdots & \cdots & f_{4,22} \\ f_{5,1} & f_{5,2} & \cdots & \cdots & f_{5,22} \\ f_{6,1} & f_{6,2} & \cdots & \cdots & f_{6,22} \\ f_{7,1} & f_{7,2} & \cdots & \cdots & f_{7,22} \\ f_{8,1} & f_{8,2} & \cdots & \cdots & f_{8,22} \end{bmatrix} \begin{bmatrix} A^*_1 \\ A^*_2 \\ \vdots \\ \vdots \\ A^*_{22} \end{bmatrix} + \begin{bmatrix} NW_1 \\ NW_2 \\ NW_3 \\ NW_4 \\ NW_5 \\ NW_6 \\ NW_7 \\ NW_8 \end{bmatrix}$$

L^S_i: Total liability held by the i th sector. i=1, 2, ·····, 8
A^*_j: The j th asset in the whole economy. j=1, 2, ·····, 22
NW_i: Net worth held by the i th sector. i=1, 2, ·····, 8
f_{ij}: Liability-distribution-coefficients. i=1, 2, ·····, 8 j=1, 2, ·····, 22

$$\begin{bmatrix} A_1^* \\ A_2^* \\ \vdots \\ \vdots \\ A_{22}^* \end{bmatrix} = \begin{bmatrix} e_{1,1}^* & e_{1,2}^* & e_{1,3} & e_{1,4} & e_{1,5} & e_{1,6} & e_{1,7}^* & e_{1,8}^* \\ e_{2,1}^* & e_{2,2}^* & e_{2,3} & e_{2,4} & e_{2,5} & e_{2,6} & e_{2,7}^* & e_{2,8}^* \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ e_{22,1}^* & e_{22,2}^* & e_{22,3} & e_{22,4} & e_{22,5} & e_{22,6} & e_{22,7}^* & e_{22,8}^* \end{bmatrix} \begin{bmatrix} L_1^S \\ L_2^S \\ L_3^S \\ L_4^S \\ L_5^S \\ L_6^S \\ L_7^S \\ L_8^S \end{bmatrix}$$

A_j^*: The j th asset in the whole economy. j=1, 2, ·····, 22
L_i^S: Total liability held by the i th sector. i=1, 2, ·····, 8
e_{ji}: Asset-holding-coefficients. j=1, 2, ·····, 22 i=1, 2, ·····, 8
e_{ji}^*: The estimated values of e_{ji}'s obtained from the above portfolio equations or the above adjustment equations.

【Data source】
Many of the financial data are available from the website of Board of Governors of the Federal Reserve System.

Flow-of-funds data are obtained from Flow of Funds Accounts of the United States, 1975-1984, 1985-1994, 1995-2003 (compiled by Board of Governors of the Federal Reserve System).

Data on tangible assets and net worth are obtained from Flow of Funds Accounts of the United States, 1975-1984, 1985-1994, 1995-2003 (compiled by Board of Governors of the Federal Reserve System), National Economic Accounts, Current-Cost Net Stock of Fixed Assets and Consumer Durable Goods (compiled by U.S. Department of Commerce, Bureau of Economic Analysis), Survey of Current Business September 2004 (compiled by U.S. Department of Commerce) and Survey of Current Business January 1992 (compiled by U.S.Department of Commerce).
Y: Nominal gross domestic product.
Survey of Current Business July 2005 (compiled by U.S. Department of Commerce).
National Economic Accounts, Current-Dollar and "Real" Gross Domestic Product (compiled by U.S. Department of Commerce, Bureau of Economic Analysis).
Data source of interest rates is as follows.
Board of Governors of Federal Reserve System: Federal Reserve Statistical Release H. 15-Historcal Data. Selected Interest Rates.
d: Discount rate.
Discount rate, Federal Reserve District, New York.
r_M: Rate of return on total mortgages.
Mortgage interest rate, Federal home loan mortgage corporation, 30-year conventional mortgages. Fixed-rate, Contact rate.
r_{CB}: Rate of return on corporate bonds.
Corporate bonds, Moody's investor service, Private, all industries, Aaa rating.
r_{S3M}: Rate of interest on short-term government securities.
Government securities, Federal, Secondary, Three-month.
r_{S10Y}: Rate of return on long-term government securities.
Government securities, Federal, Constant maturity, Ten-year.

r_L: Rate of interest on bank loans not elsewhere classified.
Bank loans to business, Prime rate.
Data source of rate of return on corporate equities is as follows.
r_E: Rate of return on corporate equities. Large company stocks: Total returns.
Total return = income return + capital appreciation return.
Stocks, Bonds, Bills, and Inflation Valuation Edition 2003 Yearbook
(compiled by Ibbotson Associates) (WILY).

4 The structure of our model and the results of the dynamic simulation

The final test and the simulations in the case of an increase in net worth of households and nonprofit organizations and in the case of a decline in the discount rate are executed. Our model used for the simulations is summarized in figure 1.

4.1 The final test

The results of the final test are summarized in table 8.
Most of the endogenous variables show low RMS proportional errors.
RMS proportional error is defined as follows.

$$\text{RMS proportional error} = \sqrt{\frac{1}{N}\sum_{t=1}^{N}\left(\frac{P_t - A_t}{A_t}\right)^2}$$

Table 8. The results of the final test

Endogenous variables	RMS proportional error	Endogenous variables	RMS proportional error	Endogenous variables	RMS proportional error
A_1^*	0.277	A_{17}^*	0.061	$e_{7,1}^*$	0.259
A_2^*	0.109	A_{18}^*	0.034	$e_{8,1}^*$	0.251
A_3^*	0.086	A_{19}^*	0.076	$e_{11,1}^*$	0.515
A_4^*	0.126	A_{20}^*	0.071	$e_{3,2}^*$	0.086
A_5^*	0.049	A_{21}^*	0.132	$e_{7,2}^*$	0.206
A_6^*	0.139	A_{22}^*	0.017	$e_{8,2}^*$	0.311
A_7^*	0.146	L_1^S	0.008	$e_{10,2}^*$	0.383
A_8^*	0.097	L_2^S	0.027	$e_{16,2}^*$	0.195
A_9^*	0.109	L_3^S	0.048	$e_{1,7}^*$	0.294
A_{10}^*	0.192	L_4^S	0.108	$e_{2,7}^*$	0.103
A_{11}^*	0.056	L_5^S	0.018	$e_{8,7}^*$	0.325
A_{12}^*	0.095	L_6^S	0.088	$e_{9,7}^*$	0.234
A_{13}^*	0.020	L_7^S	0.065	$e_{3,8}^*$	0.223
A_{14}^*	0.065	L_8^S	0.030	$e_{4,8}^*$	0.178
A_{15}^*	0.046	$e_{3,1}^*$	0.278	$e_{5,8}^*$	0.238
A_{16}^*	0.061	$e_{4,1}^*$	0.145	$e_{6,8}^*$	0.355

N: number of sample observations. P_i: predicted value. A_i: actual value.
Solutions obtained in the final test are control solutions and compared with hypothetical solutions computed in the following simulations. The procedure of simulation is explained in Saito (2000, pp. 123-168) in detail. The control solutions mean the reproduction of the actual economic path estimated by our macroeconometric model. These control solutions will be used as baseline solutions in the following simulation analysis.

4.2 The effect of an increase in net worth of households and nonprofit organizations

Next, the model simulation is applied for the estimation of the effect of an increase in net worth held by households and nonprofit organizations. The accumulation of net

Table 9-1: The effect of an increase in net worth of households and nonprofit organizations by 100 billion dollars. (Hypothetical solution minus control solution)

Year	A_1^*	A_2^*	A_3^*	A_4^*	A_5^*	A_6^*	A_7^*	A_8^*	A_9^*	A_{10}^*
1977	0.3	0.1	4.9	14.0	0.2	0.7	1.3	7.7	1.3	3.7
1978	0.3	0.1	4.7	13.6	0.3	0.8	1.2	7.5	1.6	3.7
1979	0.3	0.1	4.6	13.2	0.8	0.9	1.4	7.0	2.0	3.7
1980	0.2	0.1	4.3	12.9	1.0	0.9	1.4	6.9	2.3	3.5
1981	0.2	0.1	4.1	12.7	1.9	0.9	1.4	7.4	2.5	3.6
1982	0.2	0.1	4.0	12.6	2.1	1.0	1.4	7.9	2.7	3.6
1983	0.2	0.1	3.9	12.5	1.8	1.0	1.5	8.4	3.0	3.6
1984	0.2	0.1	3.7	12.2	2.1	1.1	1.6	8.4	3.4	3.7
1985	0.2	0.1	3.8	12.1	2.1	1.3	1.7	8.8	3.8	3.8
1986	0.2	0.1	3.8	12.0	2.2	1.5	1.9	9.1	4.2	3.9
1987	0.2	0.1	3.6	11.8	2.4	1.4	2.0	9.1	4.6	4.0
1988	0.2	0.1	3.6	11.6	2.4	1.5	2.2	9.0	5.1	3.9
1989	0.1	0.1	3.5	11.4	2.7	1.7	2.3	8.9	5.7	3.9
1990	0.1	0.1	3.5	11.2	2.9	1.8	2.4	9.0	6.3	4.0
1991	0.1	0.1	3.7	11.3	3.0	1.9	2.6	9.4	6.8	4.0
1992	0.1	0.1	3.6	11.3	2.9	2.0	2.7	9.5	7.4	4.2
1993	0.1	0.1	3.9	11.4	2.9	2.1	2.9	9.6	8.0	4.4
1994	0.1	0.1	3.7	11.2	3.0	2.2	3.1	9.2	9.4	4.5
1995	0.1	0.1	3.7	10.9	3.4	2.5	3.3	9.3	9.9	4.5
1996	0.1	0.1	3.8	10.9	3.6	2.5	3.5	9.4	11.1	4.5
1997	0.1	0.1	3.8	10.9	3.8	2.6	3.6	9.5	12.0	4.5
1998	0.1	0.1	3.7	10.9	4.2	2.5	3.9	9.1	13.3	4.4
1999	0.1	0.1	4.1	10.9	4.4	2.9	3.8	8.7	14.5	4.4
2000	0.1	0.1	3.5	10.6	4.8	2.6	4.0	8.1	15.7	4.7
2001	0.1	0.1	3.6	10.7	5.5	2.8	4.0	7.9	16.7	5.0
2002	0.1	0.1	3.4	10.8	5.4	2.8	4.1	7.7	17.4	5.3

*) The unit of A_j^*, L_i^S, A_{ji} and L_{ij} is billions of dollars.

Table 9-2: The effect of an increase in net worth of households and nonprofit organizations by 100 billion dollars. (Hypothetical solution minus control solution)

Year	A^*_{11}	A^*_{12}	A^*_{13}	A^*_{14}	A^*_{15}	A^*_{16}	A^*_{17}	A^*_{18}	A^*_{19}	A^*_{20}
1977	6.4	14.3	1.1	0.8	3.3	5.5	0.6	4.7	1.2	11.8
1978	6.3	13.4	1.0	1.5	3.1	5.9	0.9	3.8	1.2	12.1
1979	6.0	13.8	0.9	2.0	3.2	6.3	1.1	3.5	1.1	12.3
1980	5.7	16.0	0.9	2.5	3.3	6.6	1.3	3.0	1.3	12.6
1981	5.6	12.7	0.8	2.8	3.7	6.9	1.4	2.6	1.1	12.9
1982	5.6	13.4	0.9	2.9	3.8	7.5	1.5	2.9	1.1	13.5
1983	5.8	15.0	1.2	2.9	3.9	8.2	1.7	1.9	1.2	14.2
1984	5.9	13.7	1.3	2.9	4.0	8.5	1.8	1.4	1.1	14.7
1985	6.3	17.1	1.9	2.8	4.0	9.4	2.0	1.9	1.3	15.4
1986	6.9	18.7	3.1	2.8	4.1	10.4	2.2	1.8	1.3	16.0
1987	7.3	17.9	3.2	2.8	4.1	11.2	2.3	1.8	1.0	16.6
1988	7.4	18.7	3.0	2.8	4.0	11.6	2.5	1.6	0.9	17.0
1989	7.3	21.9	3.1	2.9	3.8	12.3	2.6	1.8	0.9	17.4
1990	7.6	19.3	3.2	2.9	3.7	13.3	2.7	1.9	0.9	17.8
1991	7.9	23.1	3.7	2.9	3.3	14.3	2.9	2.4	1.1	18.4
1992	8.6	23.6	4.7	2.9	3.3	15.4	3.1	2.6	1.0	19.2
1993	9.5	24.8	6.3	2.9	3.3	16.3	3.3	2.7	1.3	19.9
1994	10.2	23.7	6.4	3.0	3.4	17.0	3.5	2.5	1.3	20.3
1995	10.4	29.2	7.1	3.2	3.4	17.4	3.7	2.4	1.3	20.4
1996	10.8	32.2	8.2	3.3	3.6	18.2	3.9	2.3	1.4	20.6
1997	11.1	37.3	9.1	3.4	3.8	19.0	4.1	2.2	1.5	20.9
1998	11.5	41.2	9.6	3.4	4.1	19.4	4.2	2.0	1.6	21.2
1999	12.0	43.8	10.5	3.5	4.4	19.7	4.4	2.1	1.7	21.4
2000	12.8	39.4	10.2	3.5	4.4	20.3	4.6	1.5	2.0	21.6
2001	13.8	35.2	9.7	3.5	4.4	21.0	4.7	1.5	2.0	22.1
2002	14.8	28.7	8.7	3.3	4.3	22.0	4.9	1.5	1.9	22.8

*) The unit of A^*_j, L^S_i, A_{ji} and L_{ij} is billions of dollars.

worth of households and nonprofit organizations is caused by savings in real economy and rise in asset prices. The expansion of net worth of the individual economic sectors is one of the most important factors of growth of the whole financial economy (see figure 1). We assume a hypothetical shift in net worth of households and nonprofit organizations in this simulation. Hypothetical solutions are obtained by solving our system under a hypothetical setting in the exogenous variable of our model i.e. net worth of households and nonprofit organizations. The effect of an increase in net worth of households and nonprofit organizations on financial assets and interest rates can be estimated by simulating the path which is traced by 100 billion dollars increase in net worth held by households and nonprofit organizations. Simulation is executed by raising net worth of households and nonprofit organizations every year by 100 billion dollars above the actual value over the period between 1977 and 2002.

Tables 9-1, 9-2, and 9-3 present the simulation results in terms of the divergence of the hypothetical solutions from the control solutions. The figures in tables 9-1, 9-2

Table 9-3: The effect of an increase in net worth of households and nonprofit organizations by 100 billion dollars. (Hypothetical solution minus control solution)

Year	A^*_{21}	A^*_{22}	L^S_1	L^S_2	L^S_3	L^S_4	L^S_5	L^S_6	L^S_7	L^S_8
1977	0.5	44.8	105.3	32.9	4.7	10.8	6.6	1.7	13.8	30.3
1978	0.5	45.2	106.0	32.1	4.4	10.9	6.9	1.6	13.9	30.4
1979	0.5	44.5	106.5	33.3	4.1	10.6	7.0	1.6	13.8	30.6
1980	0.4	43.0	107.0	35.4	3.8	10.8	6.9	1.5	13.1	30.7
1981	0.3	43.4	107.3	33.3	3.7	11.6	6.8	1.4	12.9	31.2
1982	0.3	42.2	107.8	34.7	3.7	12.4	6.8	1.4	12.7	32.1
1983	0.3	43.2	108.4	36.0	3.4	13.1	7.3	1.4	12.7	34.1
1984	0.3	42.1	108.4	34.8	3.3	13.7	6.6	1.3	12.5	35.2
1985	0.3	41.9	109.4	38.3	3.5	14.6	6.2	1.3	13.0	38.9
1986	0.4	41.5	110.3	38.9	3.7	15.4	6.3	1.2	13.2	41.8
1987	0.4	42.0	110.7	38.3	3.8	15.9	6.5	1.2	13.4	42.8
1988	0.4	41.8	111.2	39.0	3.7	16.3	6.6	1.2	13.3	43.1
1989	0.4	40.9	111.9	41.6	3.7	16.8	7.0	1.2	13.7	43.7
1990	0.4	41.8	112.9	40.1	3.9	17.7	7.4	1.2	13.8	44.0
1991	0.3	41.8	114.2	43.3	4.1	18.7	7.4	1.3	14.4	46.5
1992	0.3	42.5	115.5	44.5	4.4	19.6	7.5	1.2	15.3	49.5
1993	0.4	44.1	116.8	45.3	4.5	20.3	8.8	1.3	16.1	52.7
1994	0.4	44.7	117.7	44.1	4.5	21.2	9.3	1.4	16.9	53.5
1995	0.3	44.5	118.3	47.5	4.4	21.7	10.0	1.4	17.0	55.8
1996	0.4	45.0	119.2	49.5	4.3	23.0	11.0	1.5	17.0	58.4
1997	0.4	44.0	120.0	52.4	4.3	23.8	11.3	1.6	17.8	61.1
1998	0.3	44.4	120.2	56.5	4.2	24.7	11.5	1.6	17.7	62.8
1999	0.4	45.3	120.6	61.1	4.1	25.4	12.5	1.9	17.5	64.0
2000	0.5	47.4	121.0	56.6	4.1	25.9	12.3	1.6	17.6	65.3
2001	0.6	47.7	121.5	53.8	4.4	26.8	12.0	1.6	17.8	67.1
2002	0.6	47.5	122.4	48.0	4.7	27.3	12.0	1.6	18.2	66.7

*) The unit of A^*_j, L^S_i, A_{ji} and L_{ij} is billions of dollars.

and 9-3 mean the hypothetical solution minus the control solution. The effect of the increase in net worth of households and nonprofit organizations by 100 billion dollars on financial growth path is shown in terms of the difference between the control and hypothetical solutions in tables 9-1, 9-2 and 9-3.

The effect of the increase in net worth of households and nonprofit organizations on financial growth path is interpreted as follows.

The whole financial economy expands owing to the increase in net worth of households and nonprofit organizations. All the financial assets in the whole economy, A^*_j's, increase and total liabilities of the individual sectors, L^S_i's, also increase in parallel with the increase in net worth of households and nonprofit organizations.

The expansion of net worth of households and nonprofit organizations leads to the increase in total liability held by households and nonprofit organizations. This increase in total liability of households and nonprofit organizations causes the increase in checkable deposits and currency, time and savings deposits, money market mutual fund

shares, corporate and foreign bonds, mutual fund shares, life insurance and pension fund reserves, etc. held by households and nonprofit organizations. The increase in checkable deposits and currency, time and savings deposits, money market mutual fund shares, corporate and foreign bonds, mutual fund shares, life insurance and pension fund reserves, etc. held by households and nonprofit organizations leads to the increase in the total liabilities held by commercial banking and private nonbank financial institutions. These increases in the total liabilities held by commercial banking and private nonbank financial institutions cause the increases in money market mutual fund shares, federal funds and security repurchase agreement, open market paper, agency- and GSE-backed securities, municipal securities and loans, corporate and foreign bonds, corporate equities, mutual fund shares, bank loans not elsewhere classified, total mortgages, consumer credit, etc. held by commercial banking or private nonbank financial institutions. These increases in the asset holding of commercial banking or private nonbank financial institutions cause the increases in the total liabilities and various assets of all the economic sectors.

This process of financial assets expansion is repeated and the total liabilities of all the economic sectors and all the financial assets in the whole economy expand through this process. This iterative process of financial asset expansion is what we call the process of credit creation.

On the other hand, the increase in the assets held by households and nonprofit organizations also causes the increase in the total liability of nonfinancial business directly. Households and nonprofit organizations increase the total liability of nonfinancial business by increasing their holdings of corporate equities. In the like manner, households and nonprofit organizations increase the total liability of nonfinancial business by increasing their holdings of corporate and foreign bonds.

Eventually most financial assets in the whole economy and the total liabilities of all the economic sectors expand owing to the increase in net worth of households and nonprofit organizations. Especially the effects of net worth of households and nonprofit organizations on the following assets are large in tables 9-1, 9-2 and 9-3: time and savings deposits, A_4^*, Agency- and GSE- backed securities, A_9^*, corporate and foreign bonds, A_{11}^*, corporate equities, A_{12}^*, total mortgages, A_{16}^*, life insurance and pension fund reserves, A_{20}^*. The lag effects in the asset demand functions also accelerate the financial growth and expansion.

4.3 The effect of a decline in the discount rate

We can simulate an effect of a decline in the discount rate on various assets in the whole economy, A_j^*'s and total liabilities of the individual economic sectors, L_i^S's. We assume a hypothetical shift in the discount rate in this simulation. Hypothetical solutions are obtained by solving our system under a hypothetical setting in the exogenous variable of our model i.e. the discount rate. The discount rate is lowered by 1 percent point below the actual value. The discount rate is placed at a level 1 percentage lower than the actual value. Simulation is executed by lowering the discount rate by 1 percent every year below the actual one over the period between 1977 and 2002.

Tables 10-1, 10-2 and 10-3 present the simulation results in terms of the divergence of the hypothetical solution from the control solution. The figures in tables 10-1, 10-2

Table 10-1: The effect of 1 percent decline in the discount rate. (Hypothetical solution minus control solution)

Year	A_1^*	A_2^*	A_3^*	A_4^*	A_5^*	A_6^*	A_7^*	A_8^*	A_9^*	A_{10}^*
1977	0.3	0.0	2.5	4.6	0.2	0.4	0.9	–0.5	1.1	1.3
1978	0.6	0.1	5.0	3.6	0.4	0.8	1.6	–6.0	2.7	1.9
1979	0.8	0.1	7.4	2.7	0.5	1.1	2.3	–14.6	4.6	2.2
1980	1.1	0.1	9.8	2.6	0.6	1.5	2.9	–25.2	6.7	2.3
1981	1.4	0.1	11.6	2.5	0.2	1.8	3.3	–36.0	8.8	2.5
1982	1.6	0.1	12.9	3.3	0.1	2.1	3.7	–47.4	10.8	2.7
1983	1.9	0.2	14.7	4.6	0.4	2.7	4.2	–59.6	13.2	3.2
1984	2.2	0.2	16.5	4.8	0.2	3.0	4.8	–74.3	16.1	3.6
1985	2.7	0.2	18.7	6.2	0.4	3.9	5.6	–97.3	20.4	4.3
1986	3.2	0.3	21.2	8.2	0.3	5.3	6.4	–123.2	24.8	5.0
1987	3.6	0.3	24.3	9.6	0.3	5.8	6.9	–145.0	28.9	5.3
1988	4.1	0.3	26.9	9.2	0.4	6.6	7.8	–169.2	32.9	5.7
1989	4.7	0.3	30.3	8.3	–0.6	5.7	8.5	–197.6	37.9	5.6
1990	5.1	0.3	31.6	7.9	–0.6	6.1	8.5	–216.2	39.9	5.0
1991	5.7	0.3	32.5	11.0	–0.8	7.3	8.8	–248.0	44.3	5.6
1992	6.5	0.4	36.5	18.2	1.0	9.2	9.7	–276.7	51.4	7.6
1993	7.4	0.5	40.1	22.8	1.5	13.2	11.3	–310.2	61.7	9.1
1994	8.1	0.5	45.3	16.0	2.4	11.2	11.7	–336.7	60.8	8.9
1995	9.0	0.4	49.4	2.6	1.8	10.9	13.0	–391.7	63.5	7.4
1996	9.8	0.5	52.6	3.1	1.5	13.8	13.5	–440.6	62.1	7.0
1997	11.1	0.5	57.7	3.3	0.7	16.0	16.1	–518.0	61.3	6.9
1998	12.5	0.6	67.5	4.1	–0.2	19.2	15.1	–599.4	51.7	5.5
1999	13.8	0.6	68.2	5.6	–1.9	25.1	19.6	–718.5	37.2	2.1
2000	14.5	0.7	83.2	–4.2	–1.8	26.3	21.0	–738.9	34.6	6.3
2001	15.2	0.9	83.7	7.2	1.4	29.7	23.0	–771.8	34.8	10.1
2002	16.5	1.3	92.5	41.7	6.0	38.3	29.2	–776.4	60.6	19.8

*) The unit of A_j^*, L_i^S, A_{ji} and L_{ij} is billions of dollars.

and 10-3 mean the hypothetical solution minus the control solution. The tables 10-1, 10-2 and 10-3 present the effect of a decline in the discount rate by 1 percent on the financial system. The effect of a decline in the discount rate by 1 percent on the whole system is as follows.

The interest rates, r_{S3M}, r_{S10Y}, r_{CB}, r_M and r_L, fluctuate in parallel with the discount rate, d.

The interest rates, r_{S3M}, r_{S10Y}, r_{CB}, r_M and r_L, decline as the discount rate, d, declines. All the assets and liabilities in the flow-of-funds accounts respond to the fluctuations in these interest rates. The determination of the levels of the assets and liabilities within our system is affected by the fluctuations in the interest rates, r_{S3M}, r_{S10Y}, r_{CB}, r_M and r_L (see figure 1). Many of the financial assets in the U.S. financial system, A_j^*'s, increase and the total liabilities of the individual economic sectors, L_i^S's, excluding L_1^S and L_4^S, also increase due to the decline in the discount rate. These increases in the total liabilities lead to the increases in various assets, A_{ji}'s. The cross effects of interest rates or the

Table 10-2: The effect of 1 percent decline in the discount rate. (Hypothetical solution minus control solution)

Year	A^*_{11}	A^*_{12}	A^*_{13}	A^*_{14}	A^*_{15}	A^*_{16}	A^*_{17}	A^*_{18}	A^*_{19}	A^*_{20}
1977	5.2	12.4	0.1	–3.1	0.7	1.0	1.3	1.6	0.5	7.8
1978	10.5	26.6	0.0	–4.9	0.0	1.2	2.7	2.3	0.7	11.9
1979	15.9	44.4	–0.2	–6.0	–1.4	1.1	4.1	2.6	0.7	12.5
1980	21.5	66.0	–0.4	–6.7	–3.3	0.5	5.5	2.8	0.6	12.2
1981	26.6	86.9	–0.6	–7.0	–5.8	–0.1	6.7	2.9	0.6	10.9
1982	31.8	111.0	–0.8	–7.3	–7.8	–1.7	7.9	2.9	0.6	11.7
1983	37.4	138.6	–1.4	–7.6	–9.6	–3.8	9.3	4.0	0.5	13.8
1984	43.7	169.5	–1.8	–7.9	–12.2	–5.0	10.7	4.7	0.7	15.3
1985	53.0	216.2	–3.4	–8.4	–15.1	–7.9	12.4	5.2	0.4	17.9
1986	62.9	266.8	–6.7	–9.0	–17.8	–13.8	14.3	6.4	0.3	21.3
1987	70.8	310.9	–8.5	–9.8	–20.5	–19.1	16.2	6.7	0.8	24.5
1988	80.0	365.7	–9.4	–10.3	–21.8	–23.7	18.1	7.7	0.9	25.9
1989	89.1	428.7	–12.3	–11.2	–22.0	–30.3	20.1	7.8	0.7	25.0
1990	92.5	462.0	–14.1	–12.2	–20.0	–37.8	21.7	7.7	0.6	22.7
1991	103.4	533.2	–19.0	–13.4	–18.0	–47.0	23.7	8.4	–0.4	26.0
1992	115.7	599.3	–24.8	–14.4	–17.6	–50.3	26.1	10.4	0.3	35.1
1993	131.3	682.5	–35.4	–15.3	–17.4	–53.0	29.0	11.9	–0.6	43.9
1994	139.2	737.6	–38.7	–16.6	–18.4	–57.7	31.2	10.3	–0.6	44.1
1995	151.8	852.7	–52.4	–18.3	–22.1	–72.7	33.3	12.7	–1.5	32.4
1996	167.3	970.8	–69.3	–19.9	–26.5	–87.4	35.5	14.6	–3.1	28.1
1997	186.3	1133.2	–95.7	–21.8	–33.1	–110.3	37.9	17.4	–6.4	25.7
1998	205.0	1298.5	–122.8	–24.1	–44.6	–136.6	40.6	18.0	–9.7	23.7
1999	223.9	1496.2	–173.5	–27.3	–60.4	–183.4	41.7	22.7	–16.9	21.9
2000	248.1	1601.2	–149.0	–28.4	–61.9	–182.1	44.2	14.9	–16.3	12.2
2001	269.6	1672.1	–132.9	–28.9	–58.3	–183.1	48.5	15.3	–14.4	24.8
2002	303.9	1727.1	–104.4	–27.6	–50.4	–158.3	55.9	15.3	–8.5	57.1

*) The unit of A^*_j, L^S_i, A_{ji} and L_{ij} is billions of dollars.

effects of the interest rates of substitute assets cause the increase in the financial assets and total liabilities. The effect of the decline in the discount rate on corporate equities in the whole economy, A^*_{12}, is largest among all assets. And the effect of the decline in the discount rate on the total liability held by nonfinancial business, L^S_2, is larger than those on the total liabilities of other economic sectors.

However the decline in the discount rate has negative effects on some assets in the whole economy and some total liabilities.

Treasury securities in the whole economy, A^*_8, decrease over the whole period owing to the own effect of the rate of interest on long-term government securities, r_{S10Y}. And total liability held by federal government, L^S_4, decreases over the period between 1978 and 2002. The decrease in L^S_4 is caused by the decrease in treasury securities in the whole economy, A^*_8.

Other loans and advances in the whole economy, A^*_{15}, decrease over the period between 1979 and 2002. Other loans and advances held by federal government, $A_{15,4}$, de-

Table 10-3: The effect of 1 percent decline in the discount rate. (Hypothetical solution minus control solution)

Year	A^*_{21}	A^*_{22}	L^S_1	L^S_2	L^S_3	L^S_4	L^S_5	L^S_6	L^S_7	L^S_8
1977	0.3	–0.1	2.0	14.7	1.7	0.8	0.6	1.0	5.6	12.3
1978	0.5	–2.6	3.5	29.8	2.3	–3.2	0.5	1.9	8.3	17.7
1979	0.7	–8.0	4.6	47.4	2.5	–10.0	0.4	2.7	10.9	18.9
1980	1.0	–15.6	5.3	69.0	2.6	–18.8	–0.3	3.7	13.6	18.8
1981	1.6	–21.2	5.8	87.9	2.6	–27.6	–0.4	4.5	16.0	19.1
1982	2.1	–27.4	5.6	109.5	2.8	–37.4	–0.5	5.1	18.8	21.8
1983	2.7	–35.0	5.6	133.8	3.4	–47.4	–0.6	5.9	22.3	26.5
1984	3.2	–38.5	6.5	160.4	3.7	–59.4	0.0	6.7	25.7	33.1
1985	4.3	–45.2	6.1	197.8	4.1	–78.4	1.7	7.7	31.6	42.0
1986	5.4	–53.2	4.0	240.1	5.1	–100.2	3.7	8.3	37.4	51.8
1987	6.6	–62.9	2.6	279.1	5.6	–118.4	6.5	10.0	40.1	55.9
1988	7.6	–69.1	1.5	323.5	6.6	–138.7	10.9	11.3	43.9	65.3
1989	9.2	–85.4	–1.2	371.3	6.6	–163.1	16.3	13.1	45.3	67.7
1990	10.2	–102.5	–5.3	401.2	6.2	–180.8	18.8	14.3	42.9	60.5
1991	12.6	–112.6	–11.0	456.5	7.0	–209.1	24.4	15.3	47.5	73.3
1992	14.9	–108.8	–11.8	505.6	9.2	–230.7	30.4	16.9	61.9	103.6
1993	17.5	–101.7	–12.0	556.5	10.9	–253.3	60.0	19.0	73.3	128.2
1994	19.5	–118.6	–14.3	588.6	10.1	–281.4	71.6	22.2	69.8	130.7
1995	23.0	–141.1	–24.6	666.4	9.5	–334.5	76.8	25.0	63.7	128.6
1996	26.4	–154.3	–34.5	743.3	9.5	–385.5	92.7	27.6	70.8	134.1
1997	31.4	–189.1	–50.6	853.7	10.1	–465.3	98.4	31.4	79.2	140.7
1998	36.9	–191.0	–67.8	983.1	9.0	–556.2	118.9	37.3	85.1	130.1
1999	42.1	–198.0	–103.4	1168.6	7.2	–689.5	147.0	41.3	79.9	60.6
2000	45.7	–126.4	–97.9	1178.9	8.1	–709.1	173.5	47.8	103.7	186.4
2001	46.3	–96.7	–92.0	1226.9	11.6	–740.7	183.3	47.5	127.9	267.6
2002	52.5	–32.9	–64.0	1240.7	19.6	–716.6	212.1	53.9	189.2	435.9

*) The unit of A^*_j, L^S_i, A_{ji} and L_{ij} is billions of dollars.

crease due to a decline in the total liability of federal government, L^S_4, caused by the decline in the discount rate as stated above. This decrease in $A_{15,4}$ contributes to the decrease in A^*_{15}.

Bank loans not elsewhere classified in the whole economy, A^*_{14}, decrease over the whole period due to the own effect of the rate of interest on bank loans, r_L.

Total mortgages in the whole economy, A^*_{16}, decrease over the period between 1981 and 2002 due to the own effect of the rate of interest on total mortgages, r_M. And total liability held by households and nonprofit organizations, L^S_1, decreases over the period between 1989 and 2002. The decrease in L^S_1 is caused by the decrease in total mortgages in the whole economy, A^*_{16}.

5 Concluding remarks

Although some t-values of the estimated coefficients in the asset demand equations are low, most of the estimated coefficients in the asset demand functions indicate reasonable results from the viewpoint of economic theory. Most of the endogenous variables show low RMS proportional errors. The results of the final test of our model indicate that the model works well to some extent.

Two simulations were executed in the case of the increase in net worth of households and nonprofit organizations and in the case of the decline in the discount rate. The monetary authority expands the whole financial economy by lowering the discount rate and, on the whole, many financial assets and liabilities in the whole economy increase excluding some cases. The discount rate is an important policy instrument by monetary authority and it has an announcement effect on the financial markets. The accumulation of net worth of households and nonprofit organizations is caused by savings in real economy and rise in asset prices. The increase in net worth of households and nonprofit organizations causes the accumulation of the financial assets and liabilities. The accumulation of the financial assets means the expansion of the supply of funds in the whole economy. This point is explained clearly in Tsujimura and Mizoshita (2002) using an idea of the asset-liability-matrix. In other words the accumulation of various financial assets in the whole economy and the accumulation of the total liabilities of the individual economic sectors mean the financial growth of the whole economy.

Next problem is the simulation outside the sample period. The liability-distribution -coefficients, f_{ij}'s, are given as exogenous variables and actual values in the sample period are given to the liability-distribution-coefficients in the case of the final test.

However, the liability-distribution-coefficients, f_{ij}'s, must be forecasted outside the sample period. The asset-holding-coefficients, e_{ji}'s, indicate portfolio behavior and are endogenously determined as functions of economic variables. On the other hand, the economic implication of the liability-distribution-coefficients is ambiguous and it is difficult to specify the form of the functions explaining the fluctuations of the liability-distribution-coefficients from the viewpoint of economic theory. The remaining problem is to forecast the liability-distribution-coefficients outside the sample period.

In macroeconometric models of real sector, input-output model and input-output accounts are the core of the whole system. Similarly the modified Klein model is the core of the financial macroeconometric model, because all the assets and liabilities held by the individual economic sectors can be forecasted systematically and exhaustively corresponding to the level of net worth. Therefore the modified Klein model is expected to play an important role as a vehicle for macroeconometric modeling (see Klein, et al. (1999), pp. 50-51.). Our financial macroeconometric model is a preparation for building an overall macroeconometric model.

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