

Evaluation of Monetary Aggregate via Time Series Analysis

Monetary demand model based on the quadratic function

Masaaki Tokuda*

Contents

- 1 Introduction
- 2 Quantification of financial uneasiness
 - 2.1 Quantification using the Bank of Japan DI
 - 2.2 Quantification using the degree of uneasiness regarding livelihood
- 3 Derivation of the demand function for money
- 4 Estimation and results
- 5 Implications

1 Introduction

The purpose of this paper is to elucidate whether an appropriate quantity of money supply needed for efficiently managing the economy has been supplied in the past and present. In addition, it also searches out what level this supply should be, mainly by using an econometrics-technique. The “appropriate quantity” the author is referring to here is the level which is induced by the supply side and determined by the demand side. Although policy authorities passively supply a quantity which balances demand in the short term, we believe that the level can be guided on a mid- and long-term basis. In the past, “excess liquidity,” in which the amount of supply is very large compared to demand, occurred during the oil shock and the bubble period. On the contrary, “under liquidity,” in which liquidity does not adequately spread around to all areas industry-wide, has also occurred. It must be said that the public welfare losses exerted on the economy in such cases are large.

Supposing that the amount of money supply generally released is that according to published statistics, what would be the best way for us to compute the amount of demand? Although it is generally said that “demand for money is the function of income (volume of transactions) and the rate of interest,” a concrete function form has not necessarily been specified. Furthermore, there is a

* Waseda University Graduate School Economics Graduate Course, MORI seminar D3 E-mail : tkd@ruri.waseda.jp

shortcoming in that the “preliminary motive” which Keynes talks about has not been specified. In such a traditional type of demand function for money, the exact quantity of demand cannot be presumed, and therefore the deviation width of exact supply and demand cannot be specified either. What is more, even if the direction of the qualitative amount of supply-operation is known, you will face the quantitative problem of “what quantity to supply” as a practical issue. A current and up-to-date estimation of exact monetary demand is a necessary requirement in the sense of preventing disturbances that may result from unforeseen financial contingencies.

Particularly in the area of policy management in recent years, it is becoming indispensable for policy makers to take into consideration situations such as financial uneasiness and financial system shocks. Based on the above argument, the purpose of this paper is to come up with a derivation of the proxy variable of financial uneasiness, and an estimation of the demand function for money which uses it.

Hereafter, the degree of various types of financial uneasiness is quantified using the Bank of Japan’s TANKAN business confidence survey DI and the variables which represent consumers’ mental factor. Next, the demand function for money is derived based on findings by Kannianen and Tarkka (1986), and positive analysis is conducted regarding the bubble era and subsequent financial periods in Japan. Finally, an estimation is conducted which incorporates the previously mentioned financial-uneasiness terms into the demand function for money, and the connotations of such are considered.

2 Quantification of financial uneasiness

2.1 Quantification using the Bank of Japan DI

Financial uneasiness felt by companies is quantified using the Bank of Japan’s TANKAN business confidence survey DI (Diffusion Index). Each of the economic units in Japan have been taking action to more solidly secure high-liquidity assets in response to the financial uneasiness which stems from the continuing collapse of financial institutions like banks which have inter-mediacy, credit-creation, and account-settlement functions. It is believed that this is increasing the amount of unused money (idle money) which has no connection with real economic activity. One can verify how the correlation of diffusion indexes has collapsed by the financial uneasiness that is being generated. In this case, we can allow the conditional distribution of the TARCh (Threshold AutoRegressive Conditional Heteroscedasticity) model — which assumes asymmetric heteroscedasticity of the error term — to be the degree of financial uneasiness.

When creating a financial-uneasiness substitute variable, the TARCh model proposed by Glosten, Jaganathan, and Runkle (1993) and Zakoian (1994) has been used. The model assumes the asymmetry of an error term in deriving conditional variance. Following this model which was used by Kimura and Fujita (1999), we assumed that a precautionary demand for money is generated from uncertainty of the future (i.e. financial uneasiness) regarding cash flow that private sector units face, which stems from

unreliable payment of required amounts. And the degree of financial uneasiness was extrapolated from changes in the DI of the Bank of Japan's TANKAN business confidence survey. Speaking more concretely, we assumed that the gap between the conventional pattern of interest rates on loans and cash flow judgment of companies was a major cause of mental agitation due to financial uneasiness, and we defined the error distribution of the expression of relations as financial uneasiness (or financial system shock). The quantified figures were then examined. Henceforth, when quantifying, one trial which set material to DI is shown.

As shown in Fig. 1., from a motion of two variables of the beginning of the 80s or the last stage, it is imagined strongly that the DI of change in interest rates is ahead of the DI of financial position. In addition, trends of financial position have strongly been influenced by changes in interest rates on loans up until at least the first half of the 1990s.¹ It is shown from this that when the DI of change in interest rates (RR_t) is low; the more a company feels that interest rates are low, the higher the DI of financial position (FP_t) becomes. That is, in such a case a company will judge that it is in an easy financial position.

Based on this viewpoint, we have assumed that the DI of financial position judgment at arbitrary times is dependent on the accumulated values of the DI of change in interest rates in the present business period and the previous period. That is, if other conditions are fixed, the rise in the borrowing rate will be considered to be an aggravating factor for financial position and it means a rise in costs for a company. Then, the relationship of both can be simply expressed as follows.

$$FP = FP(RR) \quad FP' < 0$$

Furthermore, in order to make econometric analysis easy to carry out, it formulizes as follows as the first approach.²

$$FP_t = \alpha_0 + \alpha_1 RR_t + \alpha_2 RR_{t-1} + \mu_t \quad (1)$$

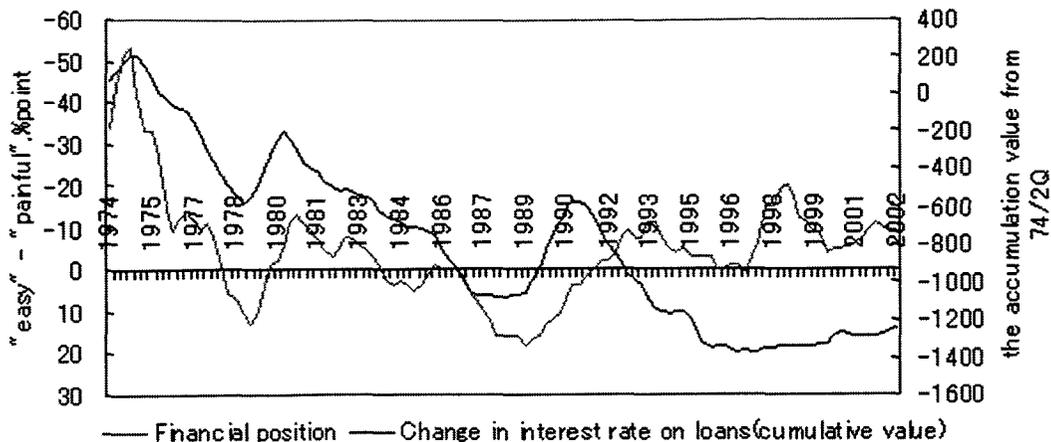
Here, it is expressed that FP_t is the DI of financial position judgment, RR_t denotes the DI of change in interest rates on loans (cumulative value³), μ_t is the error term, α_0 denotes the constant term, and α_1 , α_2 are adjustment factors.

μ_t expresses the disturbance and irregularity factor written for items other than interest rate, and the

1 The correlation coefficient of both the variables from the 1st quarter of 1974 to the 4th quarter of 1994 is comparatively as high as -0.7217. However, the correlation coefficient from the 1st quarter of 1995 to the 3rd quarter of 2002 is diluted at 0.0679.

2 As for the formulization about the variable treating such a mental factor, behavioral finance, prospect theory, etc. are studied actively in recent years. However, since it is a exploratory estimation here, stricter model construction is taken as subsequent subjects.

3 The DI of change in interest rates on loans expresses the direction of interest rates (rise and fall), and in order to change this into the concept of interest rate level, we adopted accumulation values.



(Source) Bank of Japan [Short-Term Economic Survey]

Figure 1 DI of financial position (left) and DI of change in interest rates on loans (right) [Actual values]

variance shows the uncertainty regarding financial position.⁴ That is, expansion of variance of the error term means that financial position becomes greatly influenced by the sudden factor which cannot be explained by interest rates, and shows expansion of uncertainty at such.

We believe that variance of this error term is not fixed through time. Moreover, when a large one-time shock is added such as a financial system shock, there is a tendency to expand distribution.⁵

Also, when a large negative shock is added such as financial uneasiness, heightened uncertainty occurs and precautionary demand stemming from unreliable payment of required amounts increases. It is necessary to provide a means for modeling such a situation.⁶ In light of this, as the heteroscedasticity and asymmetry of the error term are modeled this time, the following TARCH (1, 1) models are used.

$$\mu_t | I_{t-1} \sim N(0, \sigma_t^2)$$

$$\sigma_t^2 = \omega + \alpha \sigma_{t-1}^2 + \beta \mu_{t-1}^2 + \gamma D_{t-1}^- \mu_{t-1}^2 \quad (2)$$

Here, $\omega > 0$, $\gamma \geq 0$, μ is the prediction error at a previous period, I_{t-1} is that it sets at t-1 term and is the information set which can be used.

4 In the econometric model, the uncertainty of the economical relation is taken by the (conditional) variance σ^2 of the error term μ . It is important to model this error term because the error term is believed to express the action of an economic agent.

5 For example, due to a financial system shock, if a company expects that banks will be reluctant to extend new loans, in order to prepare for the uncertainty over the future (the risk of banks refusing loans etc.) and to secure funds more solidly (increase in monetary precautionary demand), the amount of funds that can be turned into real transactions will run short, and the ability to raise funds will worsen (even if there is no change in interest rates). Consequently, the DI of financial position judgment will also change sharply, i. e. variance will be expanded.

6 Even if positive financial shocks which greatly increase companies' financial position are added, monetary precautionary demand should not increase.

Furthermore, D_t^- is a conditional dummy variable, and if it is $\mu_{t-1} < 0$, it will be taken as $D_{t-1}^- = 1$. Then, it is as follows.

$$\begin{aligned}\sigma_t^2 &= \omega + \alpha\sigma_{t-1}^2 + \beta\mu_{t-1}^2 + \gamma\mu_{t-1}^2 \\ &= \omega + \alpha\sigma_{t-1}^2 + (\beta + \gamma)\mu_{t-1}^2\end{aligned}\quad (3)$$

Leverage effect by the dummy clause having been added occurs.

It will be referred to as $D_{t-1}^- = 0$ if it is $\mu_{t-1} \geq 0$. Then, it is as follows.

$$\sigma_t^2 = \omega + \alpha\sigma_{t-1}^2 + \beta\mu_{t-1}^2 \quad (4)$$

Then, under the condition of $\gamma > 0$, if the error of the previous period is $\mu_{t-1} < 0$, the variance of the current period will further increase.

Normality is assumed for the conditional distribution of μ_t , and (conditional) variance σ_t^2 is assumed for heteroscedasticity that is dependant on μ_{t-1} , σ_{t-1}^2 which is the past shock. Furthermore, when a negative shock enters the cash flow of the previous period ($\mu_{t-1} < 0$), compared to the case of positive shocks ($\mu_{t-1} \geq 0$), asymmetry where distribution of the current period becomes large is incorporated by the dummy variable. The estimation results of the degree of financial uneasiness are as follows.

The degree of financial uneasiness estimated by time series model (TARCH): [fuan A]

$$FP_t = \underset{(-2.188)}{-3.349} + \underset{(5.580)}{0.090} RR_t - \underset{(-3.691)}{0.092} RR_{t-1} + \mu_t \quad (5)$$

$$\sigma_t^2 = \underset{(2.164)}{30.366} - \underset{(-2.948)}{0.472} \sigma_{t-1}^2 + \underset{(1.406)}{1.058} \mu_{t-1}^2 + \underset{(2.116)}{0.098} D_{t-1}^- \mu_{t-1}^2 \quad (6)$$

The sample period is 1974/3rd quarter to 2001/2nd quarter, and the numbers in parentheses are t-values.

According to the estimation results, the leverage is 0.098 and is positive and significant. Moreover, except for μ_{t-1}^2 , every parameter is significant and also the sign conditions of the parameters are satisfied. (As for FP_t , the rise signifies the easing of financial position, while the rise of RR_t means a continued rise in interest rates. Therefore, when the sum total of the parameter (total of the coefficient of RR_t and RR_{t-1}) are judged in, it is theoretically correct that the sign condition of the item corresponding to DI of change in interest rates in formula (5) is negative.)

2.2 Quantification using the degree of uneasiness regarding livelihood

The foregoing section analyzed using variables related to companies. In this section the same analysis is further performed using variables on the consumer side, and it examines the differences

among both.

The rate of high-liquidity assets is considered to be positively dependent on the degree of uneasiness regarding livelihood, as seen from Figs. 2, 3. Similar to the analysis methods employed in the preceding section, we formulize that the rate of high-liquidity assets may be dependent on the degree of uneasiness regarding livelihood in the current period and the previous period, as shown in the following formulas.

That is,

$$LIQ_t = \alpha_0 + \alpha_1 LU_t + \alpha_2 LU_{t-1} + \mu_t \quad (7)$$

Here, LIQ_t expresses the rate of high-liquidity assets ($\frac{M_1 + \text{postal deposit}}{M_2 + CD + \text{postal deposit}}$), and LU_t (livelihood uneasiness) is the degree of uneasiness regarding livelihood.⁷

The degree of financial uneasiness estimated by time series model (TARCH): [fuan B]

$$LIQ_t = 0.70339 + 0.00064 LU_t + 0.00047 LU_{t-1} + \mu_t \quad (8)$$

(79.288) (6.783) (6.030)

$$\sigma_t^2 = (1.05E-05) - 0.108 \sigma_{t-1}^2 + 1.16266 \mu_{t-1}^2 + 0.22169 D_{t-1}^- \mu_{t-1}^2 \quad (9)$$

(1.835) (-1.028) (2.376) (0.297)

The sample period is 1977/3rd quarter to 2002/1st quarter, and the numbers in parentheses are t-values.

According to the estimation results, the leverage is positive at 0.22169 and the sign conditions are in agreement, however since the t value is low, questions remain regarding its explainability. Moreover, except for σ_{t-1}^2 , every parameter is significant and also the sign conditions of the parameters are satisfied. That is, the degree of uneasiness regarding livelihood is linked with the shift in high-liquidity assets, though it follows a lag.⁸

As mentioned above, the substitute variable of the degree of financial uneasiness has been estimated via two kinds of methods. Looking at the conditional variance (the substitute variable of financial uneasiness [fuan A] σ_t^2 , (Fig. 4)), one can see that financial uneasiness increased by about 10-fold (compared to normal times) during the second oil shock, the bubble economy period, and during periods of financial system shock since 1997.

Moreover, as shown by the conditional variance σ_t^2 (the substitute variable of financial uneasiness

7 Data released by the Nippon Research Institute (<http://www.research-soken.or.jp/>) in two-month intervals was converted into data for 4 half-year periods and the values from such were used.

8 Here, although the ordinary way of measurement which specifies a function by the linear model was followed for the explanatory variables that were understood, further specification of the functional form and verification are necessary in order to improve the significance of the leverage terms.

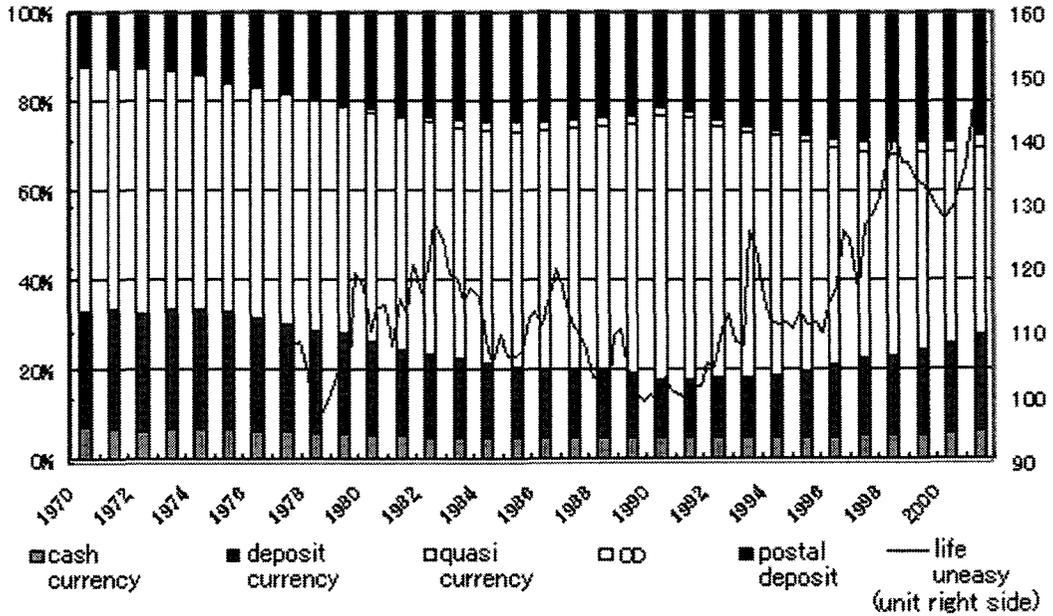


Figure 2 The liquidity components and the degree of uneasiness regarding livelihood

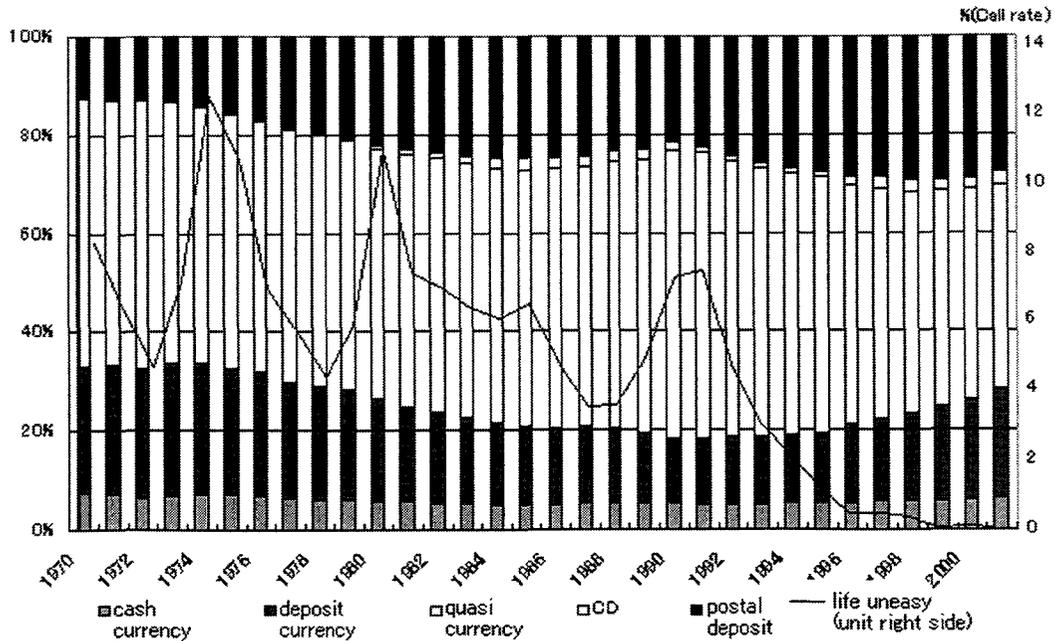


Figure 3 The liquidity components and the rate of interest

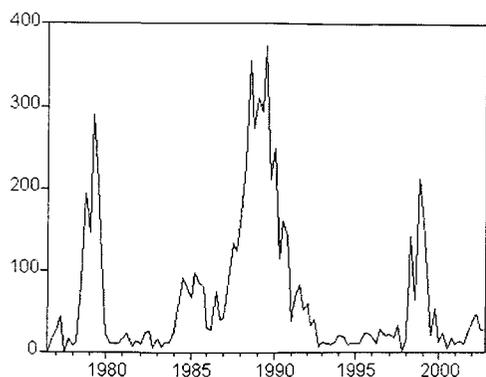


Figure 4 The substitute variable of financial uneasiness
[fuan A]

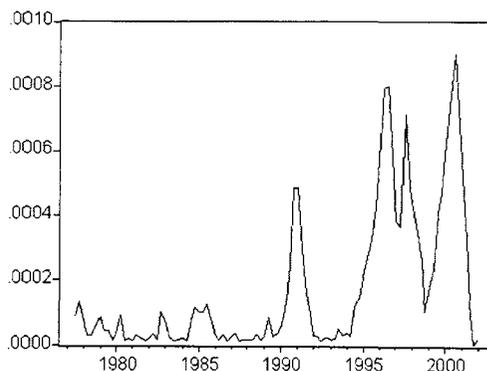


Figure 5 The substitute variable of financial uneasiness
[fuan B]

[fuan B], σ_t^2 (Fig. 5)), the degree of financial uneasiness remained very stable prior to 1990 — including during the second oil shock and the bubble economy. However it increased notably at the time of the collapse of Japan's bubble economy in the early 90's, during periods of financial system shock since 1997, during the 1998 failures of the Long-Term Credit Bank of Japan and the Nippon Credit Bank, and in 2001.⁹

Fig. 4 features three major spikes while Fig. 5 shows large shocks that occurred following the collapse of the bubble economy, especially 1997 and afterwards. The reason for the difference between the two figures lies in the fact that the informational source of the former is companies and that of the latter is consumers. However, considering that the purpose of this paper is to investigate the influence of continued financial collapses of large-sized financial institutions, we believe that the latter more closely resembles the actual situation.

3 Derivation of the demand function for money

Based on the findings of Kanninen and Tarkka (1986), a short-term demand function for money is derived from the following minimization problem of discount current expense. That is, in consideration of the cost adding the gap of requested money and the actual money balance and spontaneous adjustment cost of the balance, the economic agent who is going to make present discounted cost of infinite period minimum is assumed. Since \bar{m} based on long-term observation is contained in each period, the style of a kind of ECM (Error Correction Model) is made.

$$L_t = E_t \sum_{j=0}^{\infty} h^j \left\{ \omega_1 (m_{t+j} - \bar{m}_{t+j})^2 + \omega_2 a_{t+j}^2 \right\} \quad (10)$$

⁹ The financial uneasiness estimated in this paper is merely one substitute variable, and does not deny the possibility that other desirable substitute variables may exist which have been produced by others.

Here, m_t is the amount of nominal monetary holding of the economic agent, m_t^* is the amount of monetary holding which is requested, $0 < h = (1+r)^{-1} < 1$, h is the discount item (r =the rate of subjective time preference), ω_1 ω_2 is the weight regarding deviation with requested money and the spontaneous adjustment (positive value), and E_t is the expected operator. Furthermore, the change factor of the money balance is set up as follows.

$$m_t - m_{t-1} = a_t + x_t \quad (11)$$

Here, a_t is the spontaneous adjustment of the money balance (active adjustment) which describes the way it will act according to the clear intention adjusted so that it may return to the target level if a threshold with money balance is exceeded, and x_t is the exogenous change of the money balance (passive adjustment). That is, when a fixed money stock is given to an economic agent at period t , he must set forth an optimal plan concerning the amount of monetary holding. Consequently, a_t will be adjusted spontaneously.

Inserting Equation (11) into Equation (10) and then differentiating with respect to m_{t+j} , one obtains the following Euler equations (first order conditions):

$$E_t m_{t+j+1} - q E_t m_{t+j} + (1+r) E_t m_{t+j-1} = -p E_{t+j}^* + E_t x_{t+j+1} - (1+r) E_t x_{t+j} \quad (12)$$

$$\text{with } q = \frac{\omega_1 + h + 1}{\omega_2 h}; p = \frac{\omega_1}{h \omega_2}.$$

It is $\lambda_1, \lambda_2 = \frac{q \pm \{q^2 - 4(1+r)\}^{\frac{1}{2}}}{2}$ when λ_1, λ_2 are set to the Euler equations roots. If the relation of two roots is used and λ_2 is deleted

$$E_t m_{t+j} = \lambda_1 m_t + \frac{\lambda_1 p}{1+r-\lambda_1} m_t^* - \sum_{i=1}^{\infty} \left(\frac{\lambda_1}{1+r} \right)^i \{ E_t x_{t+i-1} - (1+r) E_t x_{t+i} \}. \quad (13)$$

The next step needed is to insert this equation into the first Euler equation in Equation (12), which then has to be solved for m_t . This gives:

$$m_t = \lambda_1 m_{t-1} + \beta m_t^* + \lambda_1 x_t + z_t \quad (14)$$

$$\text{with } \beta = \frac{\lambda_1 (\omega_1) (1+r)}{1+r-\lambda_1}; z_t = -(1-\lambda_1) \sum_{j=1}^{\infty} \left(\frac{\lambda_1}{1+r} \right)^j E_t x_{t+j}.$$

Hence, subtract the lagged nominal money balances, m_{t-1} , from both sides of Equation (14) to arrive at

$$m_t - m_{t-1} = (1-\lambda_1) \left\{ \frac{\beta}{1-\lambda_1} m_t^* - m_{t-1} \right\} + \lambda_1 x_t + z_t. \quad (15)$$

Then deflate both sides of Equation (15) by m_{t-1} . Employing the approximation $\ln(1+n) \simeq n$ for small n gives

$$\ln m_t = \ln \left(\frac{\beta}{1-\lambda_1} \right)^{1-\lambda_1} + (1-\lambda_1) \ln m_t^* + \lambda_1 \ln m_{t-1} + \lambda_1 \frac{x_t}{m_{t-1}} + \frac{z_t}{m_{t-1}}. \quad (16)$$

Let p_t denote the price level during period t , and subtract p_t . Then add and subtract the term $\lambda_1 \ln p_{t-1}$. One obtains

$$\ln \frac{m_t}{p_t} = \mu + (1-\lambda_1) \ln \frac{m_t^*}{p_t} + \lambda_1 \ln \frac{m_{t-1}}{p_{t-1}} + \delta \ln \frac{p_t}{p_{t-1}} + \lambda_1 \frac{x_t}{m_{t-1}} + \frac{z_t}{m_{t-1}} \quad (17)$$

$$\text{with } \mu = \ln \left(\frac{\beta}{1-\lambda_1} \right)^{1-\lambda_1}.$$

Next, the actual value of the balance of requested money m_t^* is assumed to be determined from the actual quantity of output y_t and the rate r_t of interest. The following Cobb-Douglas type functions are assumed as the function form.

$$m_t^* = \gamma y_t^\alpha r_t^\eta p_t \quad \gamma > 0, 0 < \alpha, \eta < 0 \quad (18)$$

Next exogenous injection x_t is defined

$$x_t = \Delta L_t + \Delta L_t^f + X_t. \quad (19)$$

Where ΔL_t is domestic credit expansion, ΔL_t^f is government net borrowing from abroad and X_t is current account balance of payments.¹⁰

Subsequently, we assumed the following simple model that exogenous change in the money balance which people expect is a fixed rate θ in each period.

$$E_t x_{t+j} = x_t (1+\theta)^j \quad \theta \neq 0 \quad (20)$$

Here, θ is the rate of exogenous money change which people infer. The following formulas may be drawn when this is substituted for the formula of the discount current value of z_t .

$$z_t = - \frac{(1-\lambda_1)\lambda_1(1+\theta)}{1+r-\lambda_1(1+\theta)} x_t = -\xi x_t \quad (21)$$

By these (17) becomes a form which it is suitable for econometric analysis as follows.

$$\ln \frac{m_t}{p_t} = \mu + (1-\lambda_1) \ln \frac{m_t^*}{p_t} + \lambda_1 \ln \frac{m_{t-1}}{p_{t-1}} + \delta \ln \frac{p_t}{p_{t-1}} + (\lambda_1 - \xi) \frac{x_t}{m_{t-1}} + u_t' \quad (22)$$

Here, u_t' is a random term showing the gap between the model and reality. Moreover, δ is a

¹⁰ Formulation of the amount of exogenous money injection in this paper applies to Kanninen and Tarkka (1984). However, Judd and Scadding (1981) considered only bank loans as a source of main money injection.

disturbance term of price level. If people believe there is a burden in the adjustment of price fluctuation, it will be $\delta = -\lambda_1$, and it will be $\delta = 0$ if they believe that no price shock will be received. Furthermore, we incorporated the notion that money injection expected in the future affects the demand for money. If (18) is substituted for (22), it will be set to

$$\ln \frac{m_t}{p_t} = \mu' + (1 - \lambda_1) \alpha \ln y_t + (1 - \lambda_1) \eta \ln r_t + \lambda_1 \ln \frac{m_{t-1}}{p_{t-1}} + \delta \ln \frac{p_t}{p_{t-1}} + (\lambda_1 - \xi) \frac{x_t}{m_{t-1}} + u'_t \quad (23)$$

with $\mu' = \mu + \ln \gamma$.

4 Estimation and results

Variables used:

- m_t : the logarithmic value of the amount of seasonally adjusted nominal money
- y_t : the logarithmic value of the amount of seasonally adjusted real GDP
- r_t : call rate
- p_t : the logarithmic value of the amount of seasonally adjusted GDP deflator
- ΔL_t : the difference of [domestic bank account housing credit balance + domestic bank account consumer credit balance]
- ΔL^s : net overseas transfers to the government
- X_t : current account balance

The period used for the estimation was set as 1985/2nd quarter to 1999/1st quarter. The estimation results based on formula (22) are shown in OLS (1) of Table 1. Subsequently, estimation which added the financial uneasiness substitute variables $fuan A_t$, $fuan B_t$, respectively, which were quantified in Section 2, was also performed. Very exceptional phenomena, in view of conventional Japan, such as the continued financial collapse of large-sized financial institutions, were not assumed in the theoretical model. Moreover, we believe that the economic agent was not expectable in the model. That is, x_t is a variable generated as a result of the expected formation of the economic agent which can be foreseen. On the other hand, the financial uneasiness $fuan A_t$, $fuan B_t$ have an unexpected shock element. Based on this idea, therefore, the two variables are thought to be independent. Furthermore, since the serial correlation was seen from all estimations of the h statistics, we also combined the use of Cochrane-Orcutt estimation.

As a result of the estimation, although it was recognized that y_t has a significant, positive affect on money, r_t has a low explainability in general. A rising trend was recognized in $\frac{m_t}{p_t}$ from the parameters of $\frac{m_{t-1}}{p_{t-1}}$. Moreover, price fluctuation has significant negative influence from the parameters of $\frac{p_t}{p_{t-1}}$.

We understood that the exogenous factor significantly makes money increase.

About the financial uneasiness terms, it became clear from a viewpoint of a coefficient that the *fuan* A_t of explanation power is higher a little.¹¹ The mark is reversed by OLS(3) and CO(3), and *t* value of *fuan* B_t is also unstable. If it sees generally, it is thought that financial uneasiness has influence of plus on the demand for money. However, since it is thought that an uneasiness factor is also included in the $\frac{x_t}{m_{t-1}}$ term, we have to sort of discount this point when considering the increase of money.

Next, in order to consider the policy connotations of the present condition regarding aggregate money, the parameters of the OLS(2), (3), CO(2), (3) formulas are used, data from the second quarter of 2000 to the first quarter of 2002 is extrapolated, and residual (actual values — estimation values) transition during the entire period is examined.

According to Fig. 6, after the rapid upper deflection of 1989 age of the bubble last stage, the downturn occurred rapidly in 1992, and after that, till 1997, although changed by some rise trend, it took a downturn rapidly in the 1997 4th quarter of a large-sized financial institution breakdown. However, the big downturn has occurred in and after 2000 which performed extrapolation. As long as it sees by the diagram, this is equal to the size just behind the collapse of the 'bubble' economy. Then, although there is some deflection, it is thought that it has usually returned to the level in the 1st quarter in 2002.

The big downturn means that the actual amount of money was stopped at a level below the estimation value drawn from the estimation period (1985-00). From this, an inference can be made that either the factor of the considered explanatory variables y ; r ; p ; *fuan* B is effective, or that the simple expected formation considered in (20) stopped being conducted. The residual transition in 1999 and afterwards sways toward minus sharply. If we use the actual values to represent supply and the estimation values to represent demand, it could be seen that there is under-supply. Presuming that the formulization of the right-hand side of formula (22) is appropriate, it must be said that there was under-liquidity in those days. Since the risk of causing adverse effects of under-liquidity in such state emerges, it is desirable to raise the level of money supply to the optimal level.

11 Concerning the financial uneasiness terms [*fuan* A] and [*fuan* B], since the target of analysis is companies and consumers, respectively, it is normal to make a distinction between the money used for estimation of companies and that used for consumers. However, it should be pointed out that the data concerning flow-of-funds accounts are merely estimation values. And since a lag time of three months occurs in the official release of information (other variables are released about one month later), it is lacking in terms of up-to-date nature. Therefore, it is probably somewhat unsuitable for use by authorities because they are required to react immediately to demands for money requests of the market. Therefore in the report, aggregate money is used.

Evaluation of Monetary Aggregate via Time Series Analysis (Tokuda)

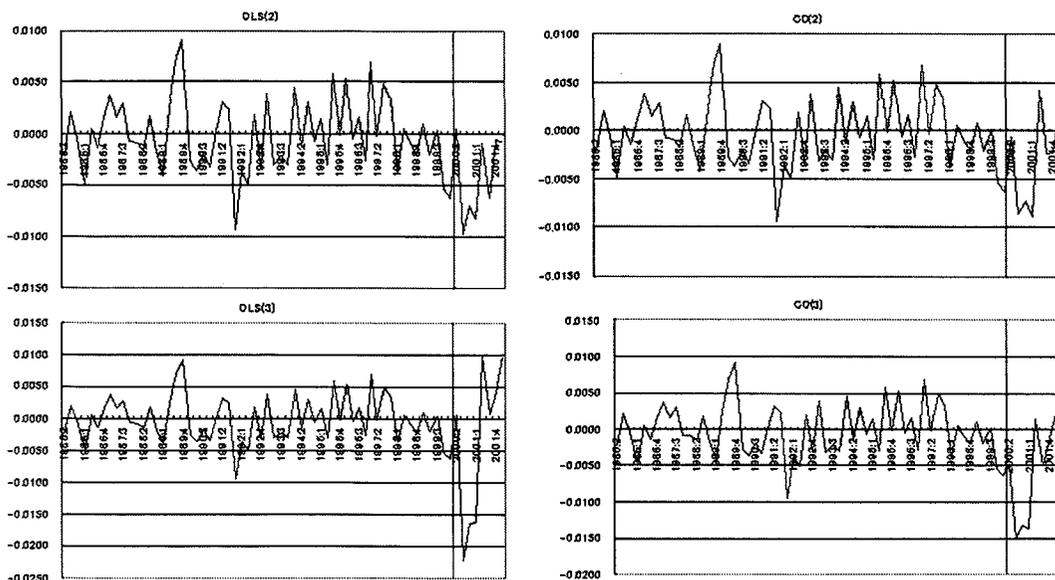


Figure 6 Residual transition

Table 1 Estimation results

	$\ln y_t$	$\ln r_t$	$\ln \frac{m_{t-1}}{p_{t-1}}$	$\ln \frac{p_t}{p_{t-1}}$	$\frac{x_t}{m_{t-1}}$	fuan A	fuan B	\bar{R}^2	DW	h	AC	see
OLS(1)	0.082 (2.22)	-0.002 (-2.08)	1.045 (45.05)	-1.006 (-6.88)	0.119 (3.38)			0.999	1.027	3.831		0.004
OLS(2)	0.029 (0.79)	-0.001 (-0.39)	1.006 (42.44)	-1.060 (-7.71)	0.077 (2.25)	0.001 (3.55)		0.999	1.193	3.180		0.004
OLS(3)	0.105 (3.77)	-0.003 (-2.78)	1.059 (44.77)	-1.000 (-6.99)	0.138 (3.88)		7.436 (2.00)	0.999	1.232	3.026		0.004
CO(1)	0.080 (1.74)	-0.001 (-0.88)	1.028 (33.55)	-1.003 (-8.72)	0.055 (1.75)			0.999	2.064		0.573	0.004
CO(2)	0.047 (1.08)	-0.000 (-0.30)	1.001 (34.56)	-0.966 (-8.37)	0.041 (1.28)	0.001 (2.57)		0.999	1.944		0.475	0.004
CO(3)	0.073 (1.53)	-0.001 (-0.59)	1.023 (32.30)	-1.012 (-8.51)	0.046 (1.41)		-3.176 (-0.61)	0.999	2.081		0.612	0.004

The estimation period is 1985/1st quarter to 2000/1st quarter.

The explained variable is $\ln \frac{m_t}{p_t}$.

OLS shows the least-squares method and CO indicates the Cochrane-Orcutt estimation method.

h shows the amount of h statistics and AC indicates a self-correlation coefficient.

5 Implications

In deriving and estimating the model this time, reference was made to the monetary view of Carr and Darby (1981). The theoretical background of such is as follows.

The amount of money (money balance) carries two roles. That is, there is a money stock side and a money flow side. The stock side is premised on the well known long-term money demand function. The flow side meanwhile can be further divided into two more factors. One is the exogenous factor of injecting money from the bond, trust, and money markets or other markets, and another is the endogenous factor of a buffer for unexpected situations and unexpected shocks. In this paper, we consider that the total monetary quantity is formed as the whole of all the economic agents.

When turning our attention to the measurement aspect, the demand function for money (which includes the conventionally used scale variable, rate of interest, and prices) was regarded in this paper as the long-term money demand function on the stock side. Furthermore, as a flow factor, the monetary view of Carr and Darby (1981) and that of Laidler (1983), which take into consideration the exogenous factor of injecting money from the market that the concerned individual is faced with, and endogenous factors, such as contingencies and a buffer to receive shocks, were considered. Reference was also made to Mizen (1986), Kannianen and Tarkka (1986), and Sargent (1987) and a model according to such monetary view was created. Furthermore, people's financial uneasiness (financial system shock) generated from events such as continued collapses of large-sized financial institutions in and after '97 which are events peculiar to Japan in recent years, was quantified by considering the findings of Kimura and Fujita (1999) and Glosten, and Jaganathan and Runkle (1993) as a reference. Such quantification was then introduced into the model produced by Kannianen.

Judging from the problems regarding the significance of the coefficient, and the independency between explanatory variables etc., the results were not necessarily satisfactory in terms of measurement. At present, we cannot definitively state that there is sufficient relevance regarding the 2-stage presumption concerning estimation of the demand function for money, which was made after separately searching for the substitute variable of financial uneasiness ($fuan A_i$, $fuan B_i$). However, as for monetary amount, there are values which adopt different amounts of money, such as Divisia money in which weight is given to the liquidity of each financial asset, and CE (Currency Equivalent) money in which weight attachment is conducted in certain periods, in addition to $M_2 + CD$ generally used in Japan now. Moreover, as for the TARARCH (p, q) model which incorporates the mental factor where negative phenomena have more impact than positive ones, further improvements will be achieved from models such as the Component GARCH (p, q) model which divides component elements into long periods of time and short periods of time, and from information sources such as the Bank of Japan's TANKAN business confidence survey DI and the degree of uneasiness regarding livelihood.

There is likely no dispute that the authorities have a certain grasp of at least the exact level of demand for money. In the current model, although the level of explainability is somewhat lacking, the state of excess money demand in recent years has appeared in the model. It is not desirable in the real economy for the money balance to remain below the optimal level for extended periods of time. As shown in the fixed money multiplier theory of Friedman and Schwartz (1963) and the variable money multiplier theory of Brunner and Meltzer (1964), if you assume the controllability of base money and the stability of the money multiplier, and then base this supposition on the exogenous money supply theory where money supply is determined exogenously by the central bank, the Bank of Japan will likely have to devise a measure to further increase the money supply.

The time when money balance swayed is in agreement with the time when the Bank of Japan presented the new package about financial market regulation. Specifically, the following three are contained. ① An operation target is shifted to the current account balances at the Bank of Japan from an unsecured call rate (Uncollateralized Overnight). In other words, monetary control shifts to the quantitative thing from interest rates. ② The policy continues until the ratio increasing rate of the previous year of the consumer price index (the whole country, Fresh food to remove) becomes zero % stably. ③ Purchase increase of a long-term government bond

How many influences did such the policy change have on the economic units or the financial institutions, and did money balance go stably as the result? Inquiring in detail becomes the next subject.

Including such implications, we believe that this model is meaningful as an alternative model of the demand function for money, since such models have been waning in explainability in recent years. Its significance is due to the addition of the flow factor and in particular the financial uneasiness factor.

References

- [1] Barth, Marvin J. and Valerie A. Ramey. (2001), The Cost Channel of Monetary Transmission. *NBER Macroeconomics Annual 2001*.
- [2] Bernanke, Ben S. and Ilian Mihov. (1998), Measuring Monetary Policy. *Quarterly Journal of Economics* 113, no. 3, pp. 869-902.
- [3] Blinder, A. S. and Maccini, L. (1991), Taking Stock: A Critical Assessment of Recent Research on Inventories, *Journal of Economic Perspectives* 5(1), pp. 73-96.
- [4] Boivin, Jean. and Marc Giannoni (2002), Has Monetary Policy Become Less Powerful? *Federal Reserve Bank of New York Staff Reports* No. 144, March.
- [5] Brunner, K. and Meltzer, A. H. (1964), Some Further Investigations of Demand and Supply Functions for Money, *Journal of finance* May 1964, pp. 240-283.
- [6] Carr, J. and Darby, M. R. (1981), The role of money supply shocks in the short-run demand for money, *Journal of Monetary Economics* 8, pp. 183-199.
- [7] Dickey, D. A., W. A. Fuller (1979), Distribution of Estimators for Autoregressive Time Series with a Unit

Table 2 The source of variables

(variable)	(unit)	(source)
Financial Position DI		BOJ "TANKAN: Short-term Economic Survey"
Change in Interest Rate on Loans DI		BOJ "TANKAN: Short-term Economic Survey"
M_1	billion yen	BOJ "Financial economic-statistics annual report"
Postal deposit balance	100 million yen	Postal services agency "Postal administration administration statistics data"
The degree of life uneasy		Nippon Research Institute "Consumer confidence investigation"
Seasonal-adjustment finishing nominal money ($M_2 + CD$)	billion yen	BOJ "Financial economic-statistics annual report"
Seasonal-adjustment finishing real GDP	1990=100	Cabinet Office "Annual Report on National Accounts"
Call rate	annual rate %	BOJ "Financial economic-statistics annual report"
Bank calculation housing credit balance	100 million yen	BOJ "Financial economic-statistics annual report"
Bank calculation consumer credit balance	100 million yen	BOJ "Financial economic-statistics annual report"
The net move for the government from overseas	100 million yen	Cabinet Office "Annual Report on National Accounts"
Current account	100 million yen	MOF "Monthly report of balance-of-payments-statistics"

Root. *Journal of the American Statistical Association* vol. 74, pp. 427-431.

- [8] Friedman, M. and Schwartz, A. (1963), *A Monetary History of the United States 1868-1960*, Princeton University Press.
- [9] Glosten, L. R., R. Jaganathan. and D. Runkle (1993), On the Relation between the Expected Value and the Volatility of Nominal Excess Returns on Stocks, *Journal of Finance* 48, pp. 1779-1801.
- [10] Goldberg, J. and R. V. Nitzsch (1999), *BEHAVIORAL FINANCE*, FinanzBuch Verlag GmbH. Akio Makabe translation (2002), behavioral finance, DIAMOND, inc.,
- [11] Judd, J. P. and Scadding, J. L. (1981), Liability management, bank loans, and deposit market disequilibrium, *Federal Reserve Bank of San Francisco Economic Review* Summer, pp. 21-44.
- [12] Kannianen, V. and Tarkka, J. (1984), The role of capital flows in the adjustment of money demand: the case of Finland, *Empirical Economics* 9, pp. 75-85.
- [13] Kannianen, V. and Tarkka, J. (1986), On the Shock-Absorption View of Money: International Evidence from the 1960s and 1970s, *Applied Economics* 18(10), pp. 1085-1101.
- [14] Laidler, D. (1983), The buffer stock notion in monetary economics, *Supplement to the Economic Journal* 94, pp. 17-34.
- [15] MacKinnon, J. G. (1991), Critical Values for Cointegration Test, chapter 13 in Engle, R. F. and C. W. J.

- Granger (eds.), *Long-run Economic Relationship: Readings in Cointegration*, Oxford University Press, Oxford.
- [16] Mizen, Paul. (1994), *Buffer Stock Models and the Demand for Money*, St. Martin's Press.
- [17] Pantula, S. G., L. Pinkowitz, G. Gonzalez-Farias and W. A. Fuller (1994), A Comparison of Unit-Root Test Criteria, *Journal of Business and Economic Statistics* 12, pp. 449-459.
- [18] Sargent, T. J. (1987), *Dynamic Macroeconomic Theory*, Cambridge, MA, Harvard University Press.
- [19] Rotemberg, Julio J. and Michael Woodford (1997), An optimization-Based Econometric Framework for the Evaluation of Monetary policy, *NBER Macroeconomics Annual 1997*, pp. 297-346.
- [20] Zakoian, J. M. (1994), Threshold Heteroskedastic Models, *Journal of Economic Dynamics and Control* 18, pp. 931-955.
- [21] Kimura, T. and Fujita, S. (1999), Kinyufuantomoney, jittaikeizai, bukka nokannkeinituite (About the relation of financial uneasiness, money, real economy, and prices), *Working Paper Series*, 1999-6, Research and Statistics Department.