The International Journal of Economic Policy Studies

Volume 4 | 2009 | Article 5

A STRUCTURAL VAR ANALYSIS OF THE MONETARY POLICY STANCE IN JAPAN

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ABSTRACT

This paper empirically investigates the validity of the Bank of Japan's policy stance after the collapse of the "Bubble Economy" by utilizing structural vector autoregression analysis. Specifically, examination of the validity of the "interest rate targeting policy" and the "reserve targeting policy" are conducted with two different identifying restrictions constructed for each policy scheme. Impulse response and forecast error variance decomposition analyses provide affirmative results for the interest rate targeting policy in the sample period of "zero interest rate policy", while they provide positive findings for the reserve targeting policy in the period of "quantitative easing policy". On the whole, it can be concluded that the policy stances by the Bank of Japan in the period of concern are valid.

Keywords: policy stance, operating procedure, operating variable, monetary policy, structural vector autoregression

JEL classification : E52, E58, C32

A STRUCTURAL VAR ANALYSIS OF THE MONETARY POLICY STANCE IN JAPAN

1. Introduction

As is well known, since the pioneering work of Sims (1980) structural VAR (structural vector autoregression: SVAR) methodology has been widely applied to measure the effect of monetary policy. For instance, Bernake and Blinder (1992) and Sims (1992) emphasize the role of short-term market rate as the significant factor of monetary policy with recursive identification frameworks for SVAR. Blanchard and Watson (1986), Gali (1992), Gordon and Leeper (1994), and Lastrapes and Selgin (1995) all apply a non-recursive approach to impose contemporaneous restrictions for identification. In addition, Bernanke and Mihov (1998a) adopt the block-recursive approach to identify the shocks to monetary policy.

Some studies have used the SVAR model to investigate the characteristics of Japanese monetary policy. Kim (1999) deals with the G-7 countries including Japan with a non-recursive identification strategy. Chinn and Dooley (1998), Shioji (2000), and Bayoumi (2001) examine the features of monetary policy in Japan by utilizing their particular identification frameworks. Kasa and Popper (1997) focus on the validity of the Bank of Japan's four possible operating targets, and find some support for the operating target as a kind of weighted average constructed from the short-term interest rate and non-borrowed reserves targets. Mihira and Sugihara (2000) insist that monetary policy in Japan was more expansionary than usual in the late 1980s and tighter throughout most of the 1990s. Miyao (2002) finds a persistent effect of monetary policy on real output by the recursive identification approach, and Nakashima (2006) identifies the exogenous components of monetary policy using two kinds of equilibrium model for the reserve market. In particular, among these works, those of Kasa and Popper (1997), Mihira and Sugihara (2000), Miyao (2002), and Nakashima (2006) are valuable for introducing the institutional characteristics of the Bank of Japan's operating procedure into their identifying restrictions for the monetary policy stance. In the debates over the operating target and the policy stance of the central banks, these studies can be seen helping to lead monetary policy study in the right direction.

Following the collapse of the "Bubble Economy" in the early 1990s, the Japanese economy was confronted with prolonged recession due to the downward revision of expected economic growth, balance sheet adjustment, and malfunction of the intermediary system stemming from the non-performing asset problem. In the face of this difficulty, the Bank of Japan implemented two kinds of very untraditional monetary policies. One was the so-called "zero interest rate policy" (February 1999 to August 2000) and the other the so-called "quantitative easing policy"

(March 2001 to March 2006). The Bank of Japan conducted the zero interest rate policy by guiding the uncollateralized overnight call rate (short-term interbank market rate) to very close to zero percent, while it implemented the quantitative easing policy by guiding the outstanding balance of the private financial institutions' current reserve account (held at the Bank of Japan) to reach an extremely large amount. In the former case, the operating variable (operating target) of the Bank of Japan was the uncollateralized overnight call rate, and this was in keeping with traditional operating procedure except in that the level of market rate was kept extremely low. In the latter case, however, the operating variable was temporarily the outstanding balance of the current reserve account. To put it another way, the Bank of Japan tentatively replaced its operating variable with the bank reserves, but it restored the call rate to the operating variable at the termination of the quantitative easing policy. It is a common view to regard the call rate as the central policy instrument of the Bank of Japan (except in special cases). For example, in their overviews of the operating procedure implemented by the Bank of Japan, both Okina (1993) and Ueda (1993) acknowledge that the operating target is the call rate. Considering these arguments, the traditional, or typical, policy stance of the Bank of Japan can be regarded as a kind of "interest rate targeting policy" and the quantitative easing policy as a kind of "reserve targeting policy".

In this paper, the validity of the Bank of Japan's two policy stances after the collapse of the Bubble Economy – the interest rate targeting policy and the reserve targeting policy – are examined by applying structural VAR methodology.

The remainder of this paper is organized as follows. Section 2 highlights the characteristics of the structural VAR model. Section 3 describes the empirical study utilizing the structural VAR, and Section 4 presents concluding remarks.

2. Structural VAR Specification

The basic framework of the structural VAR (SVAR) model is as follows. Let y_t be a K-dimensional time series $(K \times 1)$ vector of endogenous variables, $y_t = (y_{1t}, \cdots, y_{Kt})'$, and ε_t be a $(K \times 1)$ vector of structural innovation with zero mean. The pth-order VAR (vector autoregression) model is described as:

$$\begin{aligned} Ay_t &= A_1^* y_{t-1} + A_2^* y_{t-2} + \cdots + A_p^* y_{t-p} + B\varepsilon_t \\ &= \sum_{i=1}^{p} A_i^* y_{t-i} + B\varepsilon_t. \end{aligned} \tag{1}$$

For simplicity, constant terms, deterministic terms, and exogenous variables are ignored. Matrix A $(K \times K)$ is invertible, and it summarizes the contemporaneous (instantaneous) relationship among the variables. The A_i^*'s $(i = 1, \cdots, p)$ are $(K \times K)$ coefficient matrices. Structural shocks are properly identified from the error terms of the estimated reduced form with the appropriate identifying restrictions. Non-zero off-diagonal elements of matrix B $(K \times K)$ allow some shocks to affect more than one endogenous variable in the system directly. ε_t is a vector of structural disturbance postulated to follow a white-noise process. Their linear combinations are assumed to be white-noise processes with zero means and constant variances, and are serially uncorrelated individually. The variance-covariance matrix of ε_t's is usually restricted to be diagonal.

The reduced form (corresponding to the structural form) is obtained by premultiplying with A^{-1}, provided that A is non-singular:

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + u_t \text{ ,} \tag{2}$$

where $A_j = A^{-1} A_j^* \ (j = 1, \cdots, p)$. $u_t = A^{-1} B \varepsilon_t$ describes the relation between the reduced form disturbances (u_t) and the underlying structural shocks (ε_t). Thus, we obtain

$$E(u_t u_t^{'}) = A^{-1} B E(\varepsilon_t \varepsilon_t^{'}) B^{'} A^{-1} . \tag{3}$$

Moreover, assuming that the variance of each disturbance is standardized, and substituting population moments with the sample moments, we have

$$\hat{\Sigma}_u = \hat{A}^{-1} B I \hat{B}' \hat{A}^{-1} . \tag{4}$$

$\hat{\Sigma}_u$ contains $\frac{K(K+1)}{2}$ different elements, so $\frac{K(K+1)}{2}$ is the maximum number of identifiable parameters in matrices A and B. Therefore, a necessary condition for identification is that the maximum number of parameters of A and B should be equal to $\frac{K(K+1)}{2}$. In other words, the number of equations should equal the number of unknowns in equation (4). Here, the total number of elements of the structural form matrices A and B is $2K^2$. Thus,

$$2K^2 - \frac{K(K+1)}{2} = K^2 + \frac{K(K-1)}{2} \tag{5}$$

restrictions should be imposed for identification. If one of the matrices A or B is an identity matrix, then $\frac{K(K-1)}{2}$ restrictions are left to be imposed. Hence, identification necessitates the imposition of some identifying restrictions on the parameters of A and B, and we have three cases: under-identification, just-identification, and over-identification. The validity of an over-identified case is examined by the statistic distributed as a χ^2 (chi-square) with a number of degrees of freedom equal to the numbers of over-identifying restrictions.

In practice, the four most common patterns for identifying restriction are (a) $B = I_K$, (b) $A = I_K$, (c) $Au_t = B\varepsilon_t$ (AB-model of Amisano and Giannini (1997)), and (d) the pattern with prior information on the long-run effects of some shocks, like that of Blanchard and Quah (1989).

The properties of SVAR analysis are described via impulse response function after the identification of structural shocks. The effects of shocks on the variables of a given system are seen in its Wold MA (moving average) representation if the process y_t is I(0):

$$y_t = \Phi_0 u_t + \Phi_1 u_{t-1} + \Phi_2 u_{t-2} + \cdots, \tag{6}$$

where $\Phi_0 = I_K$, and

$$\Phi_s = \sum_{j=1}^{s} \Phi_{s-j} A_j \text{ , } s = 1,2,\cdots . \tag{7}$$

It can be recursively calculated from the reduced-form coefficients of the VAR specified in equation (2). The coefficients of the above representation are interpreted as reflections of the responses to impulses hitting the system. The i,jth elements of the matrices Φ_s trace out the expected response of $y_{i,t+s}$ to a unit change in y_{it}, setting all past values of y_t as constant. The change in y_{it} is measured by the innovation u_{it}, so the elements of Φ_s represent the impulse response of the components of y_t to the innovations of u_t. The cumulative responses over all periods are described by

$$\Phi = \sum_{s=0}^{\infty} \Phi_s = (I_K - A_1 - A_2 - \cdots - A_p)^{-1} . \tag{8}$$

This matrix is obtained with a stable VAR process. If the components of u_t are instantaneously correlated, the underlying shocks do not occur individually. Hence, orthogonalized impulse responses are preferred, and there are some ways to derive them. In the case of Choleski decomposition, matrix A should be lower triangular such that the variance-covariance matrix $\Sigma_u = BB^{'}$, and the orthogonalized shocks are obtained by $\varepsilon_t = B^{-1}u_t$. Therefore, we obtain the following form of equation (6):

$$y_t = \Psi_0 \varepsilon_t + \Psi_1 \varepsilon_{t-1} + \cdots, \tag{9}$$

where $\Psi_i = \Phi_i B$, $(i = 0,1,2,\cdots)$. On the other hand, in the AB-model mentioned above, the relation to the reduced-form residuals is expressed as $Au_t = B\varepsilon_t$. In this case, the impulse responses in a SVAR may be given by equation (9) with $\Psi_j = \Phi_j A^{-1}B$. In the case of a long-run restriction, they may be set as $\Psi = \Phi A^{-1}B$ where Φ is the matrix specified in equation (8). On the whole, the appropriate model with the particular identifying restrictions should be appropriately selected.

The properties of SVAR analysis are also described by forecast error variance decomposition (variance decomposition of forecast errors). Based on the K-dimensional time series vector $y_t = (y_{1t}, \cdots, y_{Kt})'$, the pth-order VAR is described by $y_t = A_1 y_{t-1} + \cdots + A_p y_{t-p} + u_t$, where the $A_i{}'s$ are $(K \times K)$ coefficient matrices. $u_t = (u_{1t}, \cdots, u_{Kt})'$ is an unobservable error term. It is generally assumed to be a white noise process with a zero-mean, time-invariant, and positive definite covariance matrix $E(u_t u'_t) = \sum_u$. Thus, the $u_t{}'s$ are independent stochastic vectors with $u_t \sim (0, \sum_u)$. For simplicity, we ignore deterministic terms and exogenous variables, and assume that process parameters are known. With these conditions, minimum MSE (mean-squared error) forecast is a conditional expectation. For instance, an h-step ahead forecast is recursively obtained as

$$y_{T+h|T} = A_1 y_{T+h-1|T} + \cdots + A_p y_{T+h-p|T} , \tag{10}$$

where $y_{T+j|T} = y_{T+j}$ for $j \le 0$ at forecast origin T. The corresponding forecast error is

$$y_{T+h} - y_{T+h|T} = u_{T+h} + \Phi_1 u_{T+h-1} + \cdots + \Phi_{h-1} u_{T+1} , \tag{11}$$

where it can be shown by successive substitution that $\Phi_s = \sum_{j=1}^{s} \Phi_{s-j} A_j$, $s = 1,2,...,$ with $\Phi_0 = I_K$ and $A_j = 0$ for $j > p$. Expressing (11) with the structural innovations $\varepsilon_t = (\varepsilon_{1t}, \cdots, \varepsilon_{Kt})' = B^{-1} A u_t$, we have

$$y_{T+h} - y_{T+h|T} = \Psi_0 \varepsilon_{T+h} + \Psi_1 \varepsilon_{T+h-1} + \cdots + \Psi_{h-1} \varepsilon_{T+1} , \tag{12}$$

where $\Psi_j = \Phi_j A^{-1} B$. The *k*th element of the forecast error vector becomes

$$y_{k,T+h} - y_{k,T+h|T} = \sum_{n=0}^{h-1} (\Psi_{k1,n} \varepsilon_{1,T+h-n} + \cdots + \Psi_{kK,n} \varepsilon_{K,T+h-n}) \tag{13}$$

if we denote the i,jth element of Ψ_n by $\Psi_{ij,n}$. Assuming that the ε_{kt} s are contemporaneously and serially uncorrelated, and have unit variances by construction, the corresponding forecast error variance becomes

$$\sigma_k^2(h) = \sum_{n=0}^{h-1} (\Psi_{k1,n}^2 + \cdots + \Psi_{kK,n}^2) = \sum_{j=1}^{K} (\Psi_{kj,0}^2 + \cdots + \Psi_{kj,h-1}^2) . \tag{14}$$

The term $\Psi_{kj,0}^2 + \cdots + \Psi_{kj,h-1}^2$ is the contribution of variable *j* to the h-step forecast error variance of variable *k* if the ε_{it} s can be regarded as shocks in variable *i*. Dividing $\Psi_{kj,0}^2 + \cdots + \Psi_{kj,h-1}^2$ by $\sigma_k^2(h)$, the contribution of variable *j* to the h-step forecast error variance of variable *k* ($\omega_{kj}(h)$) is described in percentage terms by

$$\omega_{kj}(h) = \frac{1}{\sigma_k^2(h)} (\Psi_{kj,0}^2 + \cdots + \Psi_{kj,h-1}^2) . \tag{15}$$

3. Empirical Study

3.1. Model Structure

Consider the simple AD-AS type model as follows:

$$Y = Y^d(R) + \varepsilon_{IS,Y}$$

$$P = P^s(Y) + \varepsilon_{AS,P} \text{ (or } Y = Y^s(P) + \varepsilon_{AS,Y}\text{)}$$

$$R = R^p(Y,P) + \varepsilon_{MP,R}$$

$$M = M^d(Y,R,P) + \varepsilon_{LM,M}$$

where Y: production, M: money stock, P: price level, R: interest rate.

We have the basic Structural VAR (SVAR) specification (as a dynamic model) based on the structure of this AD-AS model (as a static model). This system of equations can be expressed in the following matrix form:

$$\begin{bmatrix} 1 & 0 & a_{YR} & 0 \\ -a_{PY} & 1 & 0 & 0 \\ -a_{RY} & -a_{RP} & 1 & 0 \\ -a_{MY} & -a_{MP} & a_{MR} & 1 \end{bmatrix} \begin{bmatrix} Y_t \\ P_t \\ R_t \\ M_t \end{bmatrix} = c + A(L) \begin{bmatrix} Y_t \\ P_t \\ R_t \\ M_t \end{bmatrix} + \begin{bmatrix} \varepsilon_{IS,Yt} \\ \varepsilon_{LM,Mt} \\ \varepsilon_{AS,Pt} \\ \varepsilon_{MP,Rt} \end{bmatrix}.$$

The contemporaneous relationship among the variables is reflected in the coefficient matrix in the left-hand side (contemporaneous impact matrix) which is described as “matrix A” in Section 2. The *c* in the right-hand side is a constant term. A shock to each variable is described by ε. (For instance, $\varepsilon_{MP,Rt}$ is defined as a “monetary shock”.)

As mentioned in Section 1, there are two possible operating variables (operating targets) for the operating procedure of the Bank of Japan: call rate and bank reserves. Two types of model for estimation – Type I and Type II – are proposed below with different identifying restrictions based on the following considerations.

It is commonly accepted that the operating variable of the Bank of Japan is uncollateralized overnight call rate (short-term interbank market rate) except in the period of quantitative easing policy. However, this does not mean that the Bank of Japan ignores the other variables related to the policy decision when conducting the operating procedure. Although appropriate guidance of the short-term money market rate through market operations is the main concern of the central bank in the short run, close observation of the information variable (e.g. money stock (money supply)) is also an important factor in achieving the goal of monetary policy, namely, price-level stabilization. Further, as Shioji (2000) suggested, if the monetary authority does not fully accommodate demand for reserve or monetary base immediately, the policy reaction curve is not always horizontal. In such a case, the central bank may not perfectly adjust the short-term interest rate to the target level all at once because of the need to avoid abrupt fluctuation in bank reserves and monetary base. This consideration implies that the slope of the supply curve of the monetary base could be positive in the M-R plane. To put it another way, the slope of the supply curve might be a reflection of the relative weight between interest rate and money if we consider the policy reaction function of the Bank of Japan. This issue lies behind the discussions over the operating procedure of central banks, and is reflected in our model for estimation. Furthermore, our model contains the stock price as the indicator of asset price since it can be the important factor of asset route in the transmission of monetary policy. Taking these discussions and the basic structure of Mihira and Sugihara (2000)'s model into account, a Type I model (which is for the evaluation of interest rate targeting policy) is proposed as follows.

Type I model (interest rate targeting model)

$$Y = Y^d(R) + \varepsilon_{IS,Y} \qquad \text{[Y:IS]}$$

$$P = P^s(Y) + \varepsilon_{AS,P} \ \ (\text{or } Y = Y^S(P) + \varepsilon_{AS,Y}) \qquad \text{[P:AS]}$$

$$R = R^p(Y,P,V) + \varepsilon_{MP,R} \qquad \text{[R:MP]}$$

$$M = M^d(Y,P,R) + \varepsilon_{LM,M} \qquad \text{[M:LM]}$$

$$V = V^d(R,M) + \varepsilon_{RD,V} \qquad \text{[V:RD]}$$

$$S = S(Y,P,R,M,V) + \varepsilon_{AP,S} \qquad \text{[S:AP]}$$

where Y: production, P: price level, R: interest rate, M: money stock,
V: bank reserves, S: stock price, RD: demand for bank reserves,
MP: monetary policy (or policy reaction), AP: asset price.

This system of equations can be represented in the following matrix form:

$$\begin{bmatrix} 1 & 0 & a_{YR} & 0 & 0 & 0 \\ -a_{PY} & 1 & 0 & 0 & 0 & 0 \\ -a_{RY} & -a_{RP} & 1 & 0 & -a_{RV} & 0 \\ -a_{MY} & -a_{MP} & a_{MR} & 1 & 0 & 0 \\ 0 & 0 & a_{VR} & -a_{VM} & 1 & 0 \\ a_{SY} & -a_{SP} & -a_{SR} & a_{SM} & a_{SV} & 1 \end{bmatrix} \begin{bmatrix} Y_t \\ P_t \\ R_t \\ M_t \\ V_t \\ S_t \end{bmatrix} = c + A(L) \begin{bmatrix} Y_t \\ P_t \\ R_t \\ M_t \\ V_t \\ S_t \end{bmatrix} + \begin{bmatrix} \varepsilon_{IS,Yt} \\ \varepsilon_{AS,Pt} \\ \varepsilon_{MP,Rt} \\ \varepsilon_{LM,Mt} \\ \varepsilon_{RD,Vt} \\ \varepsilon_{AP,St} \end{bmatrix}.$$

This is the case of just-identification restriction. The coefficient matrix on the left-hand side of the above equation summarizes the contemporaneous relationship among the variables or the identifying restriction. In this case, shocks to R are regarded as the indicator of exogenous monetary policy shocks, and the third row of the matrix expresses the assumption that coefficient a_{RV} is set as the weight for the reduced form innovations in interest rate (u_{Rt}) and in bank reserves (u_{Vt}) for the structural shocks to monetary policy ($\varepsilon_{MP,Rt}$). The fifth row indicates that the structural shock to V ($\varepsilon_{RD,Vt}$) is assumed to be related to the reduced form innovations in interest rate (u_{Rt}) and in monetary base (u_{Mt}). This specification can be regarded as a kind of nested model since we are able to indirectly evaluate the propriety of interest rate targeting policy by examining the estimated coefficient of $a_{RV.}$ Y and P are ordered before the monetary instrument in our model because of the assumptions that the monetary authority acknowledges current Y and P when it decides the level of the monetary instrument, and that Y and P respond to a policy shock with a lag. Since financial markets are postulated to respond to a policy shock without any lag, S is ordered at the end of the line.

On the other hand, during the period of the quantitative easing policy in the early 2000s, the operating variable of the bank of Japan was tentatively the quantity of current account balances of the bank reserves, as explained in Section 1. Taking this factor and the basic structure of Mihira and Sugihara (2000)'s model into account, a Type II model (which is for the evaluation of reserve targeting policy) is proposed as follows.

Type II model (reserve targeting model)

$$Y = Y^d(R) + \varepsilon_{IS,Y} \qquad \text{[Y:IS]}$$

$$P = P^s(Y) + \varepsilon_{AS,P} \,(\text{or}\, Y = Y^S(P) + \varepsilon_{AS,Y}) \qquad \text{[P:AS]}$$

$$R = R^d(M,V) + \varepsilon_{RD,R} \qquad \text{[R:RD]}$$

$$M = M^d(Y,P,R) + \varepsilon_{LM,M} \qquad \text{[M:LM]}$$

$$V = V^P(Y,P) + \varepsilon_{MP,V} \qquad \text{[V:MP]}$$

$$S = S(Y,P,R,M,V) + \varepsilon_{AP,S} \qquad \text{[S:AP]}$$

This system of equations can be written in the following matrix form:

$$\begin{bmatrix} 1 & 0 & a_{YR} & 0 & 0 & 0 \\ -a_{PY} & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & -a_{RM} & a_{RV} & 0 \\ -a_{MY} & -a_{MP} & a_{MR} & 1 & 0 & 0 \\ a_{VY} & a_{VP} & 0 & 0 & 1 & 0 \\ a_{SY} & -a_{SP} & -a_{SR} & a_{SM} & a_{SV} & 1 \end{bmatrix} \begin{bmatrix} Y_t \\ P_t \\ R_t \\ M_t \\ V_t \\ S_t \end{bmatrix} = c + A(L) \begin{bmatrix} Y_t \\ P_t \\ R_t \\ M_t \\ V_t \\ S_t \end{bmatrix} + \begin{bmatrix} \varepsilon_{IS,Yt} \\ \varepsilon_{AS,Yt} \\ \varepsilon_{RD,Rt} \\ \varepsilon_{LM,Mt} \\ \varepsilon_{MP,Vt} \\ \varepsilon_{AP,St} \end{bmatrix}.$$

This is the case of over-identification restriction. In this model, shocks to V are regarded as the indicator of exogenous monetary policy shocks. The third row of the coefficient matrix on the left-hand side expresses the assumption that the structural shock to R ($\varepsilon_{RD,Rt}$) is related to the reduced form innovations in monetary base (u_{Mt}) and in bank reserves (u_{Vt}), while the fifth row indicates that the structural shock in V ($\varepsilon_{MP,Vt}$) is assumed to be related to the reduced form innovations in output (u_{Yt}) and in price level (u_{Pt}).

3.2. Estimation Results

This section describes an empirical study utilizing SVAR with the two types of identifying restrictions described in Section 3.1. The AB-model of Amisano and Giannini (1997) is applied (see Section 2). Matrix A (contemporaneous impact matrix) represents the contemporaneous relationship among the variables and Matrix B is assumed to be diagonal. Monthly data are adopted to ensure a sufficient number of observations. Specifically, our estimation contains the following variables.[1]

Y: industrial production (connected indices, value added, mining and manufacturing, seasonally adjusted; base year: 2005)

P: consumer price index (all Japan, general, excluding fresh food; base year: 2005)

R: uncollateralized overnight call rate (monthly average, percent)

M: monetary base (reserve requirement rate change adjusted, 100 million yen, seasonally adjusted)

V: current account balances of the private financial institutions (average outstanding, 100 million yen)

S: Nikkei Stock Average (TSE 225 Issues, yen)

[1] Industrial production is obtained from the Ministry of Economy, Trade and Industry's website (http://www.meti.go.jp/english/). The consumer price index is retrieved from the website of the Ministry of Internal Affairs and Communications, Statistics Bureau, Director-General for Policy Planning (Statistical Standards) & Statistical Research and Training Institute (http://www.stat.go.jp/english/index.htm). The call rate, the monetary base, the current account balances, and the Nikkei Stock Average are retrieved from the Bank of Japan's website (http://www.boj.or.jp/en/index.htm).

In the dataset for estimation, P is seasonally adjusted by Eviews (Ver. 6.1) based on X-12-ARIMA,[2] and all variables except interest rate are in logarithms. Two sets of sample period are used for the Type I model: I(a), the period from March 1991 to January 1999; and I(b), the period from March 1991 to August 2000. I(a) is used for the investigation into the period from the end of the Bubble Economy to the month just before the introduction of the zero interest rate policy. I(b) is for the period from the end of the Bubble Economy to the termination of the zero interest rate policy. For the Type II model, a sample period from March 2001 to March 2006 is used in order to examine the suitability of the quantitative easing policy. Monetary base is adopted as the narrower money stock rather than the broad monetary aggregates. As Favero (2001) suggested, it becomes easier to identify shocks which are mainly driven by the behavior of the monetary policy authority if we utilize the narrower monetary aggregates rather than the broad ones. In other words, monetary shock measured by broad aggregates could be a complicated mixture of various shocks in the market. Therefore, monetary base is contained in our model as the narrower monetary aggregates.

It is not easy to define precisely the end of Japan's Bubble Economy in the early 1990s. However, the peak of the 11th business cycle determined by the Working Group of Indexes of Business Conditions at the Economic and Social Research Institute, Cabinet Office (Government of Japan) is February 1991. Taking this definition into account, February 1991 is regarded as the end of the Bubble Economy and March 1991 is set as the start date of the period "after the bubble collapse" for the sake of convenience in this study.

Our estimation utilizes the variables in levels, rather than in first differences following recent convention. This issue is a controversial matter, but as Bernanke and Mihov (1997) suggested, the specification of the VAR model with the variables in levels derives consistent estimates irrespective of whether cointegration exists or not, although the specification in first differences yields inconsistent estimates if it has some cointegrated variables. Therefore, the levels specification is adopted here. Moreover, estimations of the structural forms are implemented using the maximum likelihood method to avoid simultaneous equations bias.[3] Time trend is not included. Lag lengths are selected as 3 for Type I(a) and Type I(b) and as 5 for

[2] Seasonally adjusted series of the consumer price index for the period before 2001:1 could not be obtained from the website, but a seasonally non-adjusted series was available. Therefore, the seasonally non-adjusted series was converted into a seasonally adjusted series with Eviews (Ver. 6.1) applying X-12-ARIMA. The spec file for X-12-ARIMA was adjusted as close as possible to those applied to the indices of industrial production by the Ministry of Economy, Trade and Industry. See the interpretive article at (http://www.meti.go.jp/english/statistics/tyo/syoudou/pdf/h2snotee.pdf).

[3] The options for controlling the optimization process are as follows: starting values = 0.1, maximum number of iterations = 3000, convergence criterion = 0.001.

Type II, based on sequential modified LR test statistics (5% level) setting maximum length at 12.

Tables 1 and 2 show the estimated contemporaneous impact matrices for the sample periods I(a) and I(b), respectively, with the Type I identifying restriction. As described in Section 3.1, Type I is constructed as a nested model. Thus, the estimated coefficient of a_{RV} should be examined. The estimated coefficients of a_{RV} are 15101.38 in Table 1 and 38374.27 in Table 2, respectively. They are not significant, their values are not close to zero, and they have the wrong sign. Therefore, we are not able to have an affirmative conclusion for the interest rate targeting policy through verification of the nested model. Nevertheless, there is one point of reservation when considering this kind of issue. As Iwabuchi (1990) points out, it is not always appropriate to regard the contemporaneous relation among the variables as worthless simply because of the wrong sign and the insignificance of the estimated coefficients. Since the interdependence of the variables depends not only on contemporaneous factors but also on various other underlying elements, the sign and significance of the coefficients could possibly be incorrectly estimated in this kind of dynamic analysis. In this sense, it is often said that innovation accounting, including impulse response and forecast error variance decomposition analyses, has more instructive meaning in this line of research.

Table 3 indicates the estimated contemporaneous impact matrix for the period of the quantitative easing policy based on the Type II identifying restriction. The null hypothesis of over-identification cannot be rejected at the conventional levels of significance. (See Table 3 notes for test statistics.)

Table 1: Estimated Contemporaneous Impact Matrix for Type I(a)

Y	P	R	M	V	S
1	0	1.433887	0	0	0
		(0.250265)			
−0.063049	1	0	0	0	0
(−0.616727)					
−237250.6	−936285.8	1	0	15101.38	0
(−0.000278)	(−0.000278)			(0.000278)	
0.081384	0.725808	0.001136	1	0	0
(1.767367)	(2.300672*)	(0.374814)			
0	0	−0.083941	−2.878665	1	0
		(−3.111967**)	(−3.120786**)		
0.299393	−3.883899	−0.030599	0.198959	0.116457	1
(0.636334)	(−1.184257)	(−0.885763)	(0.168591)	(0.863824)	

Notes: SVAR is just-identified. Included observations = 95. Lag length = 3. Convergence achieved after 401 iterations. Log likelihood = 1449.080. z-statistics are in parentheses. ** and * denote significance at 1% and 5% levels, respectively.

Table 2: Estimated Contemporaneous Impact Matrix for Type I(b)

Y	P	R	M	V	S
1	0	19.96866	0	0	0
		(0.029473)			
−0.131043	1	0	0	0	0
(−0.793452)					
−571242.7	−3690705	1	0	38374.27	0
(−0.000139)	(−0.000139)			(0.000139)	
0.400918	3.460359	0.002717	1	0	0
(1.180202)	(1.372695)	(0.297036)			
0	0	−0.075675	−6.442308	1	0
		(−2.699068**)	(−13.13562**)		
0.125963	−4.917878	−0.031023	−1.137549	0.057576	1
(0.287648)	(−1.568692)	(−0.936736)	(−1.453942)	(0.51931)	

Notes: Structural VAR is just-identified. Included observations = 114. Lag length = 3. Convergence achieved after 2541 iterations. Log likelihood = 1641.009. z-statistics are in parentheses. **, *, denote significance at 1% and 5% levels, respectively.

Table 3: Estimated Contemporaneous Impact Matrix for Type II

Y	P	R	M	V	S
1	0	9.421633 (0.500027)	0	0	0
0.012861 (0.713333)	1	0	0	0	0
0	0	1	−0.442356 (−2.590267**)	0.093472 (2.650129**)	0
−1.71188 (−1.681876)	−10.41348 (−1.55668)	27.5588 (0.76171)	1	0	0
4.353397 (0.96743)	−21.50572 (−1.36269)	0	0	1	0
1.433992 (2.676532**)	13.43595 (2.042957*)	−19.96014 (−3.434603**)	0.768382 (0.865819)	−0.359805 (−1.840246)	1

Notes: Structural VAR is over-identified. Included observations = 61. Lag length = 5. LR test for over identification: Chi-square(1) = 3.6375, Prob. = 0.0565. Convergence achieved after 44 iterations. Log likelihood = 1360.898. z-statistics are in parentheses. **, *, denote significance at 1% and 5% levels, respectively.

Next, we examine the estimated impulse response functions taking into consideration the significance of innovation accounting. Figure 1 shows the estimated cumulative impulse responses for the Type I model with regard to the sample period I(a). The solid line indicates the estimated impulse response of each variable up to 48 months. The dotted lines represent ± two standard error bands. (In the figure, shock 1 means shock to Y, shock 2 is for shock to P, shock 3 is for shock to R, shock 4 is for shock to M, shock 5 is for shock to V, and shock 6 is for shock to S.) With respect to the shock to R (interest rate), it can be seen that the response of Y (production) to a positive shock to R is consistent with the usual assumption, that is, a rise in R is followed by a decline in Y. This result suggests that call market rate guidance by the Bank of Japan had a persistent negative effect on output. P (price level) declines with a shock to R, indicating that the so-called "price puzzle"[4] is not apparent. In addition, M (monetary base) gradually declines when it is faced with a positive shock to R. Therefore, our estimation does not suffer from the "liquidity puzzle".[5] The responses of V (bank reserves) and S (stock price) are positive, and these responses are not consistent with the standard supposition. Concerning the shock to bank reserves, shocks to V are followed by cumulative positive responses of Y and S. These responses are consistent with the conventional belief. However, the negative response

[4] See Sims (1992), Strongin (1995), and Christiano et al. (1999).

[5] See Strongin (1995).

of P and the positive response of R are not. Overall, the shocks to R derived more reasonable responses compared with the ones to V.

Figure 2 reports the impulse responses based on the Type I model in the case of sample period I(b). Responses basically show the same patterns of behavior as we saw in the case of I(a) except for the following. A positive shock to R is followed by a small positive response of M, and a positive shock to V is followed by a negative cumulative response of M. Moreover, the price puzzle is not observed, but the liquidity puzzle appears. The source of these differences between I(a) and I(b) could be the fact that the latter contains the term of the zero interest rate policy while the former does not. As mentioned in Section 1, the level of call rate was artificially kept extremely low, and hence the relation among the variables could not be usual in the term of the zero interest rate policy. Moreover, in this period, the economy was faced with unsettled market conditions and the Bank of Japan experienced difficulties in conducting the operating procedure.[6] The result of estimation might be affected by these factors. Overall, given the result of the estimations described above, the shocks to the interest rate can be regarded as having relatively more reasonable effects on the variables compared with the shocks to the bank reserves. This implies that the Bank of Japan's interest rate targeting policy where it chose call rate as the operating variable was comparatively valid in the period of concern, although we found some unclear issues.

Figure 3 displays the impulse responses for the sample period of the quantitative easing policy derived by the estimations with Type II specification. Shocks to V are followed by persistent positive responses of Y, M, and S. The response of P to a rise in V is positive in the short run and negative in the long run. This pattern of response might be a reflection of the deflationary pressure in the early 2000s. The response of R is consistent with the usual assumption. On the other hand, the shock to R is narrowly accompanied by a reasonable response of Y. In addition, responses of P, M, and V in the short run are very ambiguous and the responses of M and V in the long run are unreasonable. Considering these results, shocks to V have more reasonable responses than shocks to R, and this implies that the quantitative easing policy as a reserve targeting policy by the Bank of Japan had a certain valid effect in the early 2000s.

[6] For details, see Fujiki, Okina, and Shiratsuka (2001), Oda and Okina (2001), Kimura, Kobayashi, Muranaga, and Ugai (2003), Kimura and Small (2004), and Oda and Ueda (2005).

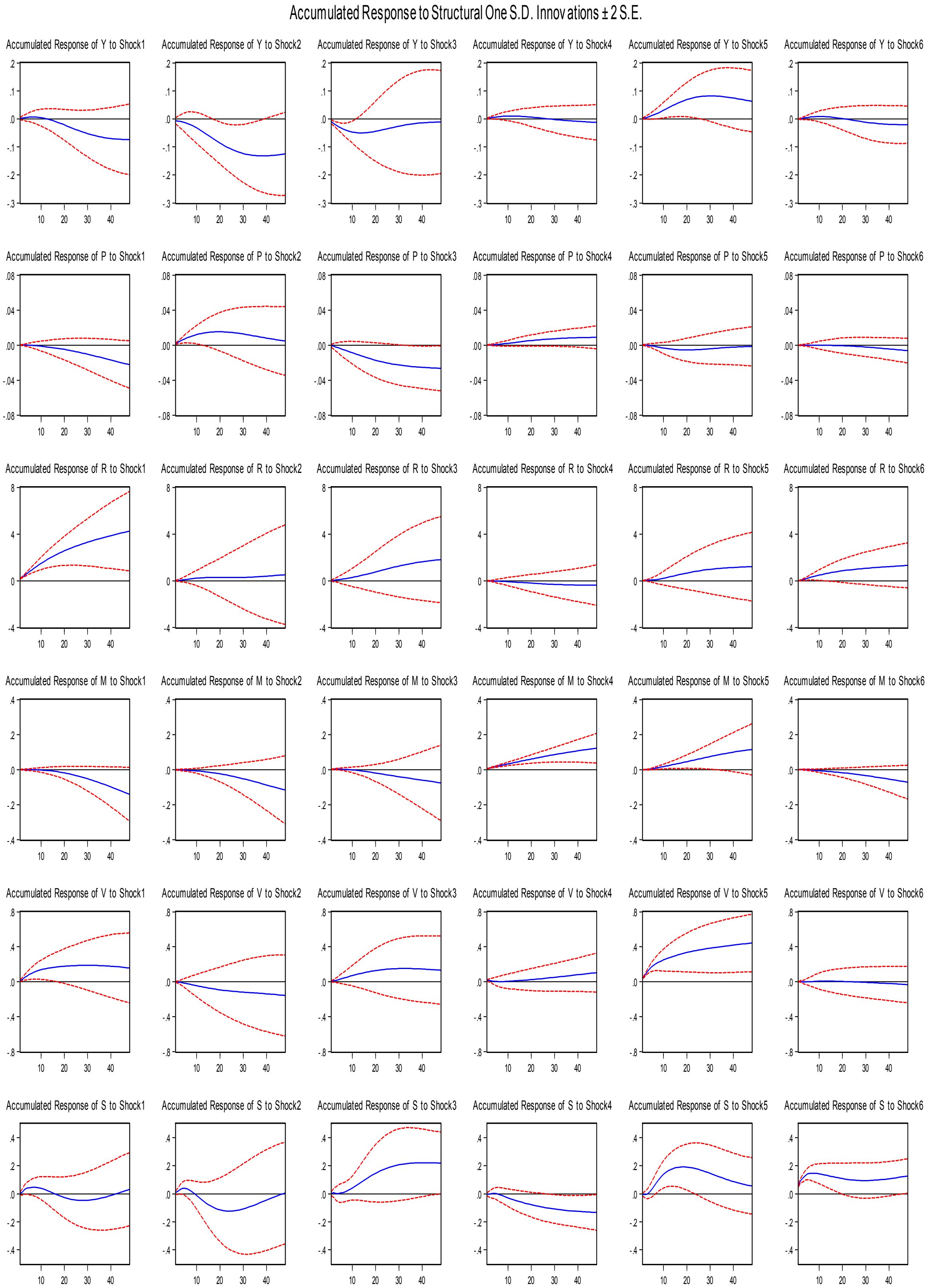

Figure 1: Cumulative Impulse Response for Type I(a)

Note: Shock 1 means shock to Y, shock 2 is for shock to P, shock 3 is for shock to R, shock 4 is for shock to M, shock 5 is for shock to V, and shock 6 is for shock to S.

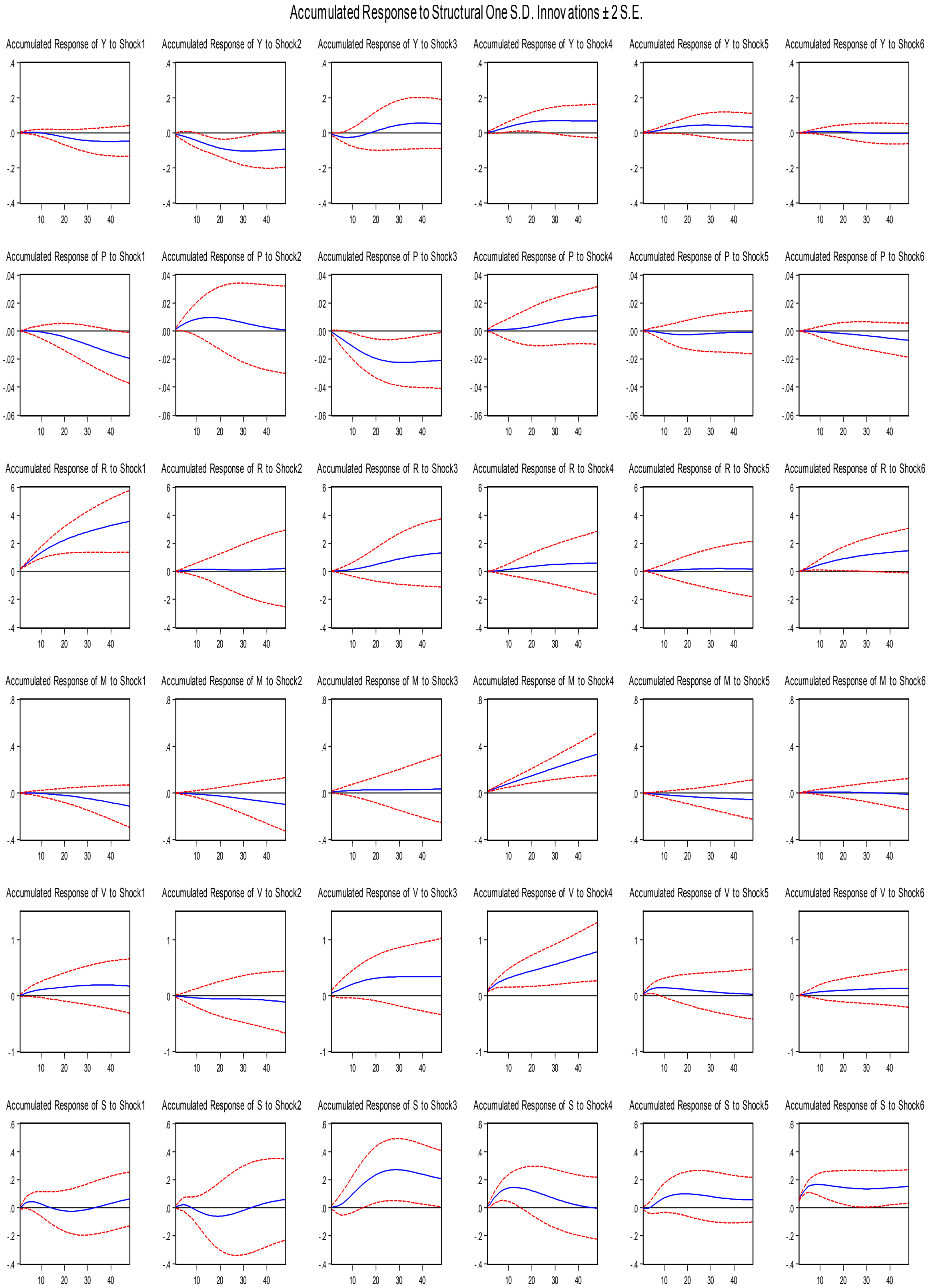

Figure 2: Cumulative Impulse Response for Type I(b)

Note: Shock 1 means shock to Y, shock 2 is for shock to P, shock 3 is for shock to R, shock 4 is for shock to M, shock 5 is for shock to V, and shock 6 is for shock to S.

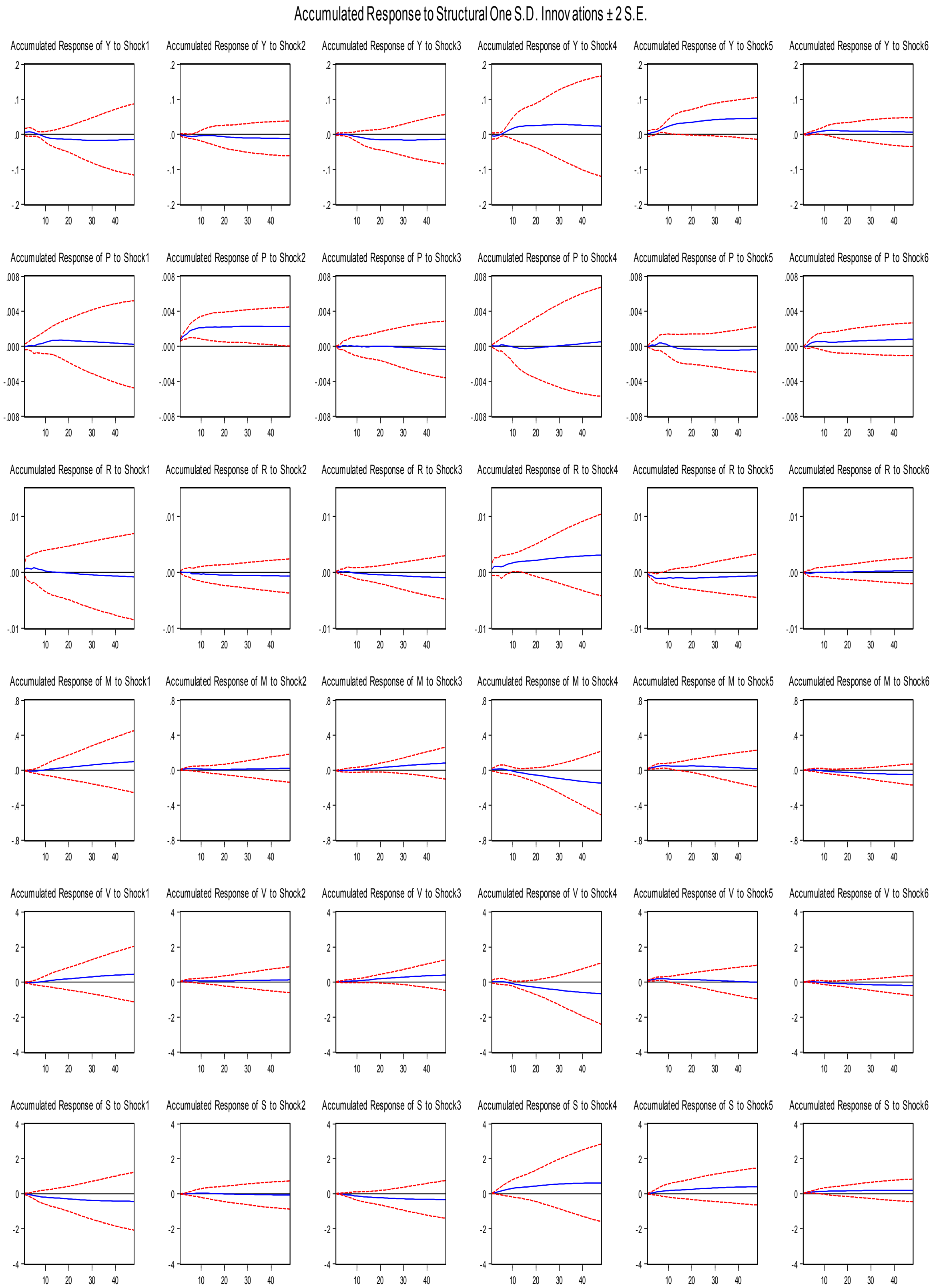

Figure 3: Cumulative Impulse Response for Type II

Note: Shock 1 means shock to Y, shock 2 is for shock to P, shock 3 is for shock to R, shock 4 is for shock to M, shock 5 is for shock to V, and shock 6 is for shock to S.

Impulse response analysis examines the effects of a shock to each endogenous variable on the others, whereas forecast error variance decomposition investigates the separation of the variation in an endogenous variable into the component shock to the system. Tables 4 and 5 show the estimated variance decompositions of Y for the respective sample periods I(a) and I(b) with the Type I identifying restriction. These tables contain the percentage proportions of the movements in a sequence of Y due to its own shocks versus shocks to the others up to 48 periods. Table 4 shows that P has great influence on the evolution of Y compared with the other variables in the long run. With regard to the two operating variables, the ratio of R is consistently larger than that of V, and the large discrepancy between the shares of these two variables is particularly apparent for the first 12 periods. In other words, the impact of interest rate on the movement of production at short horizons dominates that of bank reserves. It indirectly shows that the choice of overnight call rate rather than bank reserves as the operating variable was valid in the 1990s. On the other hand, Table 5 indicates the variance decomposition of Y for the sample period I(b). P maintains the largest share for the variance of Y from the first to the last period. The ratio of R, however, gradually approaches that of P from around the 29th period. Moreover, the percentage ratio of R is continuously much greater than that of V. In particular, the proportion of R is approximately four times as large as that of V at longer horizons. This result clearly shows that interest rate has a greater effect on the evolution of output level in the long run. One difference between I(a) and I(b) related to the problem of R and V is that the share of V gradually approaches that of R at longer forecast horizons in the case of I(a), but the proportion of influence with respect to R is much larger than that of V for the entire period in the case of I(b). This distinction might be caused by a different characteristic of the sample periods – sample period I(b) includes the term of zero interest rate policy while I(a) does not – or by the fact that the variation of interest rate in the period of the zero interest rate policy is much smaller than in other periods.

Table 6 shows the variance decomposition of Y for the term of the quantitative easing policy based on the Type II specification. The ratio of S is approximately 4.5 percent and is the smallest factor among all variables, although its level is slightly larger than in the case of I(a) and I(b). Objectively, the forecast error of Y is largely explained by its own evolution in the short run, but the ratio of V becomes larger than that of Y from the 27th period. In addition, the share of V clearly exceeds that of R at all forecast horizons. This result implies that the choice of the reserve targeting policy in the early 2000s was appropriate. However, the fact that the estimated proportion of V is no more than 25 percent in the long run might be an indication of the vulnerability of the reserve targeting policy.

Table 4: Variance Decomposition of Y for Type I(a)

Period	S.E.	Y	P	R	M	V	S
1	0.012681	0.307898	28.663130	67.797030	0.335193	2.896752	0.000000
2	0.014439	3.738928	22.354800	68.053670	3.007627	2.766784	0.078191
3	0.016046	3.192954	19.010660	67.595010	3.740715	4.983037	1.477627
4	0.017324	3.059412	17.806560	67.437480	3.461158	6.087750	2.147639
5	0.018568	3.109882	17.000750	66.205900	3.323569	8.277844	2.082050
6	0.019605	2.815789	17.365320	63.995900	3.318624	10.249320	2.255052
7	0.020571	2.557524	18.431190	60.993460	3.134505	12.561780	2.321547
8	0.021532	2.361442	20.020290	57.671830	2.921472	14.810970	2.213995
9	0.022487	2.261943	21.924290	54.064630	2.721331	16.959490	2.068314
10	0.023463	2.324293	24.070010	50.290940	2.512814	18.887550	1.914381
11	0.024454	2.512192	26.278600	46.603090	2.314590	20.529080	1.762455
12	0.025459	2.819011	28.453160	43.122200	2.135640	21.837390	1.632607
13	0.026468	3.244478	30.500860	39.925800	1.979351	22.817850	1.531662
14	0.027473	3.766611	32.375840	37.058810	1.847453	23.488570	1.462712
15	0.028461	4.353536	34.049560	34.542870	1.739472	23.886790	1.427770
16	0.029421	4.989656	35.508200	32.369210	1.653242	24.056920	1.422770
17	0.030345	5.659402	36.753950	30.515630	1.586783	24.041590	1.442639
18	0.031225	6.344173	37.798480	28.953180	1.537866	23.882240	1.484062
19	0.032055	7.030699	38.656860	27.649780	1.503877	23.615880	1.542904
20	0.032829	7.709591	39.346610	26.573020	1.482543	23.273660	1.614573
21	0.033546	8.372235	39.886620	25.691920	1.471961	22.881760	1.695494
22	0.034202	9.011606	40.295420	24.978050	1.470318	22.461910	1.782690
23	0.034798	9.622767	40.590440	24.405900	1.475996	22.031580	1.873314
24	0.035335	10.201910	40.787960	23.952830	1.487647	21.604700	1.964956
25	0.035813	10.745970	40.902970	23.598950	1.504094	21.192310	2.055695
26	0.036236	11.252800	40.949080	23.326950	1.524284	20.802980	2.143909
27	0.036607	11.720930	40.938530	23.121830	1.547315	20.443150	2.228238
28	0.036929	12.149430	40.882390	22.970630	1.572403	20.117540	2.307614
29	0.037207	12.537850	40.790540	22.862200	1.598857	19.829330	2.381220
30	0.037444	12.886230	40.671810	22.786990	1.626074	19.580450	2.448444
31	0.037646	13.195030	40.534020	22.736880	1.653528	19.371670	2.508876
32	0.037816	13.465120	40.384070	22.704980	1.680764	19.202780	2.562291
33	0.037958	13.697750	40.227950	22.685540	1.707388	19.072750	2.608630
34	0.038078	13.894540	40.070800	22.673820	1.733069	18.979780	2.647985
35	0.038178	14.057460	39.916980	22.665970	1.757531	18.921480	2.680586
36	0.038262	14.188770	39.770030	22.658930	1.780551	18.894940	2.706781
37	0.038334	14.291000	39.632770	22.650380	1.801959	18.896870	2.727018
38	0.038396	14.366900	39.507310	22.638620	1.821635	18.923710	2.741829
39	0.038451	14.419350	39.395100	22.622500	1.839505	18.971730	2.751808
40	0.038500	14.451340	39.297020	22.601360	1.855535	19.037160	2.757590
41	0.038546	14.465870	39.213380	22.574930	1.869734	19.116260	2.759830
42	0.038590	14.465910	39.144040	22.543260	1.882142	19.205450	2.759186
43	0.038633	14.454350	39.088490	22.506660	1.892831	19.301370	2.756299
44	0.038676	14.433890	39.045850	22.465640	1.901894	19.400950	2.751779
45	0.038719	14.407060	39.015040	22.420830	1.909447	19.501430	2.746191
46	0.038763	14.376150	38.994800	22.372930	1.915617	19.600450	2.740045
47	0.038807	14.343210	38.983760	22.322690	1.920541	19.696010	2.733787
48	0.038853	14.309980	38.980490	22.270860	1.924361	19.786510	2.727801

Table 5: Variance Decomposition of Y for Type I(b)

Period	S.E.	Y	P	R	M	V	S
1	0.012043	0.055039	55.883210	36.908820	5.741897	1.411029	0.000000
2	0.013593	2.535946	46.676730	43.263390	6.405885	1.114617	0.003439
3	0.015243	2.046090	41.939200	45.334420	7.322417	2.463034	0.894839
4	0.016502	1.759896	40.925650	42.295280	10.647700	2.973430	1.398042
5	0.017811	1.592469	40.232250	38.969400	14.102450	3.568458	1.534977
6	0.018911	1.418362	40.393530	35.645140	16.378430	4.408522	1.756019
7	0.019990	1.357605	40.860100	32.162060	18.343070	5.393312	1.883845
8	0.021082	1.386913	41.494580	28.921430	20.179670	6.171052	1.846346
9	0.022158	1.537009	42.105900	26.236990	21.490820	6.863107	1.766172
10	0.023224	1.852359	42.616910	24.163850	22.223910	7.474421	1.668558
11	0.024291	2.257889	42.950060	22.676570	22.630630	7.935537	1.549323
12	0.025348	2.725351	43.099520	21.732390	22.768830	8.244578	1.429332
13	0.026379	3.251101	43.076290	21.262320	22.644280	8.445288	1.320728
14	0.027378	3.805275	42.895090	21.183260	22.340150	8.549808	1.226418
15	0.028337	4.356044	42.581410	21.410300	21.934050	8.569118	1.149079
16	0.029245	4.894191	42.166660	21.865700	21.458510	8.526092	1.088848
17	0.030096	5.410876	41.678010	22.483960	20.943290	8.439324	1.044540
18	0.030884	5.894425	41.139560	23.209980	20.420280	8.320515	1.015244
19	0.031605	6.339586	40.573370	23.997720	19.909240	8.180939	0.999141
20	0.032258	6.745309	39.997900	24.810580	19.421530	8.030729	0.993950
21	0.032842	7.110127	39.427960	25.620230	18.966600	7.877168	0.997917
22	0.033358	7.433620	38.875660	26.404610	18.550870	7.725846	1.009400
23	0.033808	7.717228	38.350650	27.146920	18.177190	7.581398	1.026612
24	0.034196	7.962863	37.860240	27.835030	17.846560	7.447303	1.048010
25	0.034526	8.172547	37.409810	28.460570	17.558730	7.326023	1.072321
26	0.034803	8.348798	37.003060	29.018250	17.312240	7.219286	1.098361
27	0.035032	8.494450	36.642200	29.505450	17.104660	7.128168	1.125068
28	0.035218	8.612392	36.328060	29.921850	16.932980	7.053143	1.151578
29	0.035368	8.705577	36.060280	30.269070	16.793720	6.994182	1.177173
30	0.035486	8.777024	35.837450	30.550350	16.683100	6.950816	1.201256
31	0.035577	8.829717	35.657200	30.770350	16.597160	6.922191	1.223373
32	0.035648	8.866546	35.516400	30.934780	16.531930	6.907138	1.243204
33	0.035702	8.890276	35.411250	31.050190	16.483510	6.904234	1.260548
34	0.035743	8.903501	35.337490	31.123640	16.448190	6.911867	1.275314
35	0.035774	8.908592	35.290560	31.162470	16.422570	6.928307	1.287512
36	0.035800	8.907669	35.265750	31.173960	16.403610	6.951776	1.297240
37	0.035821	8.902572	35.258410	31.165150	16.388700	6.980510	1.304665
38	0.035841	8.894851	35.264070	31.142550	16.375700	7.012821	1.310010
39	0.035860	8.885756	35.278590	31.112020	16.362960	7.047147	1.313533
40	0.035879	8.876253	35.298250	31.078600	16.349290	7.082092	1.315515
41	0.035899	8.867036	35.319870	31.046430	16.333960	7.116458	1.316244
42	0.035921	8.858557	35.340820	31.018720	16.316640	7.149260	1.315998
43	0.035944	8.851062	35.359040	30.997780	16.297350	7.179731	1.315038
44	0.035968	8.844625	35.373030	30.985060	16.276370	7.207318	1.313600
45	0.035992	8.839187	35.381830	30.981200	16.254240	7.231666	1.311885
46	0.036017	8.834598	35.384950	30.986200	16.231590	7.252600	1.310060
47	0.036042	8.830651	35.382300	30.999510	16.209180	7.270097	1.308256
48	0.036067	8.827111	35.374140	31.020150	16.187770	7.284261	1.306569

Table 6: Variance Decomposition of Y for Type II

Period	S.E.	Y	P	R	M	V	S
1	0.008408	57.884960	0.680863	1.003062	32.142330	8.288784	0.000000
2	0.009033	50.245600	9.894169	4.600096	27.865560	7.253124	0.141445
3	0.009494	46.217120	9.012212	5.762947	25.537870	12.550010	0.919840
4	0.009990	42.325640	11.328230	5.283064	25.765300	11.962520	3.335248
5	0.010782	38.338480	10.128710	4.565385	27.657890	13.349500	5.960022
6	0.012095	35.756900	8.882932	4.077505	29.594860	16.432250	5.255563
7	0.013579	31.086560	7.726262	4.067178	30.820270	20.273630	6.026102
8	0.014626	29.520390	6.670840	5.145689	31.576250	21.682210	5.404633
9	0.015815	28.400130	6.129138	5.559076	32.580850	22.304640	5.026168
10	0.016455	27.998800	5.711811	5.479936	32.780910	23.147440	4.881110
11	0.017036	27.534510	5.466707	5.746480	33.147130	23.309640	4.795533
12	0.017398	26.909220	5.256599	6.442434	32.749410	24.043890	4.598451
13	0.017614	26.556570	5.140268	6.625666	32.640200	24.511920	4.525378
14	0.017720	26.358500	5.105509	6.933050	32.480560	24.635100	4.487286
15	0.017809	26.183340	5.072169	7.292074	32.326870	24.653810	4.471726
16	0.017846	26.079930	5.144963	7.385684	32.206030	24.711320	4.472070
17	0.017882	25.993560	5.289043	7.449827	32.104930	24.686250	4.476395
18	0.017922	25.884680	5.409893	7.536286	31.970490	24.690180	4.508472
19	0.017951	25.809240	5.527121	7.541405	31.876360	24.741400	4.504470
20	0.017982	25.739610	5.675286	7.529858	31.782350	24.773060	4.499845
21	0.018017	25.683180	5.779015	7.514636	31.694590	24.838040	4.490542
22	0.018051	25.629260	5.850837	7.486812	31.610940	24.948360	4.473786
23	0.018088	25.583760	5.915182	7.456754	31.533980	25.054670	4.455663
24	0.018124	25.538790	5.944862	7.429311	31.459290	25.190080	4.437667
25	0.018157	25.498930	5.957610	7.402749	31.390800	25.327620	4.422280
26	0.018185	25.468850	5.964676	7.381545	31.335300	25.440690	4.408930
27	0.018208	25.440130	5.964225	7.367074	31.283190	25.547010	4.398365
28	0.018225	25.414200	5.961349	7.354894	31.238690	25.640380	4.390492
29	0.018237	25.392300	5.960142	7.347332	31.201740	25.711950	4.386544
30	0.018247	25.370340	5.957604	7.343200	31.168840	25.773170	4.386853
31	0.018255	25.351330	5.956264	7.338243	31.144160	25.821350	4.388657
32	0.018260	25.335360	5.956558	7.333953	31.126580	25.854170	4.393380
33	0.018266	25.320310	5.956865	7.329563	31.114250	25.878450	4.400559
34	0.018271	25.307360	5.957713	7.325896	31.108520	25.894110	4.406395
35	0.018277	25.295690	5.959725	7.323175	31.107230	25.901140	4.413043
36	0.018283	25.284840	5.961301	7.321204	31.109280	25.903340	4.420034
37	0.018289	25.274920	5.962617	7.322013	31.114750	25.900430	4.425267
38	0.018295	25.265660	5.963992	7.324209	31.122050	25.893690	4.430399
39	0.018302	25.257080	5.964301	7.327087	31.130940	25.885140	4.435445
40	0.018308	25.249150	5.963630	7.332136	31.141200	25.874680	4.439212
41	0.018314	25.241850	5.962329	7.337634	31.152260	25.863010	4.442918
42	0.018320	25.235240	5.960079	7.343082	31.164200	25.850810	4.446593
43	0.018327	25.229210	5.957115	7.349649	31.177030	25.837490	4.449503
44	0.018333	25.223750	5.953789	7.356217	31.190550	25.823310	4.452384
45	0.018339	25.218920	5.950077	7.362538	31.204970	25.808260	4.455236
46	0.018345	25.214610	5.946071	7.369473	31.220340	25.791920	4.457596
47	0.018352	25.210820	5.941910	7.376300	31.236530	25.774520	4.459929
48	0.018358	25.207580	5.937578	7.382899	31.253620	25.756090	4.462228

4. Concluding Remarks

This study investigated the validity of the policy stances of the Bank of Japan after the collapse of the Bubble Economy. In particular, the suitability of the “interest rate targeting policy” and the “reserve targeting policy” were examined by applying SVAR methodology with two different identifying restrictions constructed for each policy scheme. First, estimated impulse response functions showed that the shock to the call rate was followed by more favorable responses compared with the shock to bank reserves in the sample period of the “zero interest rate policy”. In addition, forecast error variance decomposition derived the result that the short-term interest rate had a certain impact on the evolution of production. These results imply that the interest rate targeting policy was effective. Second, impulse response analysis for the sample period of the “quantitative easing policy” showed that the shock to bank reserves was followed by a persistent positive response of production, while the responses to the shock to call rate were not. In addition, forecast error variance decomposition showed positive findings for the impact of call rate. These outcomes imply that the interest rate targeting policy functioned properly in the period of concern.

Considering the results of these empirical studies, it can be concluded that the two kinds of monetary policy stances that the Bank of Japan conducted after the collapse of the Bubble Economy – the interest rate targeting policy (as the zero interest rate policy) and the reserve targeting policy (as the quantitative easing policy) – were each valid.

Since the empirical analyses in this study have some unclear elements, the absolute validities of the Bank of Japan’s policy stances cannot be examined. Therefore, a natural extension of this analysis is required.

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