

ESRI Discussion Paper Series No.209

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Were There Any Changes in the 1990s?**

by

Yasuyuki Iida and Tatsuyoshi Matsumae

March 2009



Economic and Social Research Institute
Cabinet Office
Tokyo, Japan

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Were There Any Changes in the 1990s? [†]**

Yasuyuki Iida ^{*}

Tatsuyoshi Matsumae ^{**}

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[†] We would like to thank the anonymous referee's suggestions but are solely responsible for remaining errors. We also acknowledge Pawel Mlodkowski, Bienvenido Cortes, Muliadi Widjaja, Kengo Nutahara, and members of the DSGE team at Economic and Social Research Institutes, Cabinet Office, Government of Japan for helpful comments.

^{*} Komazawa University, 1-23-1 Komazawa, Setagaya-ku, Tokyo, E-mail: iiday@komazawa-u.ac.jp

^{**} Tokyo Institute of Technology, 2-12-1 Ookayama, Meguro-ku, Tokyo, E-mail: tatsu-m@yg8.so-net.ne.jp

ABSTRACT

This study investigates changes in the contemporary Japanese economics and the effects of macroeconomic policies in the 1990s. We estimate several vector autoregression (VAR) models employing data detrended by different methods. This paper presents three major findings: First, there is a gradual decline in the influences of fiscal policy. Second, there is no decline in the impact of changes in the interest rate. Third, there has been a collapse in the linkage of monetary aggregates and real economy. These findings force us to reconsider the planning and designing of macroeconomic policies. Additionally, in each estimation we find strong tendency of so-called “price puzzle,” which require us more investigation to theoretical model we rely.

Keywords: *Japanese Economy, Fiscal Policy, Monetary Policy, Time Series Analysis.*

JEL Classification: E62, E52, C32

1. Introduction

In the past twenty years, the Japanese economy has experienced a historic economic boom, the so-called “asset price bubble,” and prolonged economic stagnation, the so-called “lost decade” or “great stagnation.”

Because of these experiences, policy makers have cast standard economic policies in doubt. After the bubble burst, the government introduced several large fiscal stimulation packages. However, these policies seem to have been ineffective; even with fiscal stimulation, the Japanese economy has remained stagnant.

The monetary policy has also been changed several times from the mid-1980s to the present. It often is said that the low interest rate policy in the mid-1980s caused a high-speed increase in asset prices and the Japanese economy experienced an economic boom around 1990. After the bubble burst, the Bank of Japan (BOJ) gradually cut interest rates, but the country still faces deflation.

Through these experiences, there has been considerable debate on the effectiveness of Japan’s economic policies. One hypothesis is that the economic systems of Japan changed completely after 1990 and traditional economic policies lost their power to affect the real economy. Another is that, the size of packages in the fiscal policy was too small to sustain economic growth, and the speed of interest rate cutting in the monetary policy was too slow to stabilize the real economy. Many studies have been conducted on Japanese economic stagnation, employing time series estimation (Bayoumi 2001, Kuttner and Posen 2001).

Kato (2003) estimated a structural vector autoregression (VAR) model using institutional information about the tax system as a restriction to identify the government spending shock; it showed that the effect of fiscal policy is positive but not statistically significant. Using similar VAR models, Watanabe et al. (2008) conclude that the influences of the fiscal stimulation declined after the mid-1980s relative to the 1960s and the 1970s.

Harada and Iida (2003) estimated recursive and structural VAR models to identify the monetary policy shock and determined that the effectiveness of the monetary policy was still alive around 2000. However, most economists think there were structural changes in monetary policy during the 1990s.¹ By estimating a recursive VAR model, Miyao (2002) concluded that there were structural changes around 1997. Kamata and Sugo (2006) employed Markov Chain Monte Carlo (MCMC) methods and showed that there was a structural break in 1991 or 1992.

Most studies analyzing the Japanese economy via time series analysis have concentrated on evaluating either the fiscal or the monetary policies because of the problem of sample size. When we

¹ In this paper, the term of structural changes means the changes of a central banker’s monetary policy rule or the changes of the propagation mechanism of the monetary policy shock.

accept the structural break, as Miyao (2002) and Kamata and Sugo (2006) did, this problem becomes more serious. We simplify the VAR model drastically to investigate the effects of the fiscal and the monetary policies simultaneously and pay attention to the possibility of structural changes.

Another interest of this paper is the connection between the business cycle theories and the statistical inferences of time series models. Most economic theories, from Neoclassical Synthesis in the 1960s to the Real Business Cycle models and contemporary New Keynesian models, implicitly assume the dichotomy of the trend component and the cycle component. After the seminal work of Kydland and Prescott (1982), business cycle studies started using the numerical simulation method. Recently, Smets and Wouters (2003) and Fernandez-Villaverde and Rubio-Ramirez (2005) applied a Bayesian method to estimate such types of models.

Despite these theoretical tendencies, most empirical studies pay greatest attention to the statistical inference of time series data. They estimate their models using logged level data (Christiano et al. 1999, 2005) or the logged difference data (Miyao 2002, Harada and Iida 2003) to accompany a unit root or cointegration relationship. However, these types of data handling are not consistent with standard business cycle theories. We employ detrended data to maintain the linkage between the theories and the empirics. Such data handling make the conclusions of these studies detrend method dependent. To obtain robust conclusions, we need to find common findings across the detrend method.

This paper is organized as follows: Section 2 explains the relationship between the trend and the cycles; Section 3 describes the data we use; Section 4 shows the structure of the VAR model we estimated; Section 5 analyzes the influences of macroeconomic policies to real economy; and Section 6 concludes the paper.

2. Trends and Cycles

One of the standard methods used in investigating the time cycle properties of economic data is to estimate the VAR model. We can observe the influences and propagations of policy shocks for endogenous variables from their impulse response functions.

In estimating the VAR model, the usual preparation had been to check the existence of unit roots and transform data into stationary variables with some order differences. Next, one chooses the lag length of VAR models according to information criteria such as Akaike Information Criteria (AIC) or Schwartz Bayesian Information Criteria (SIC) (Pantula et al. 1994). Many articles have been written in compliance with such traditional data handling methods. Miyao (2002) is one of the most famous studies applying these methods to the Japanese economy.

Accompanying the popularization of the seminal work of Sims et al. (1990),² many authors estimate VAR models using logged level data. For example, Christiano, Eichenbaum, and Evans (1999) inquire into the characteristics of U.S. business cycles.

On the other hand, most of us rely on the dynamic stochastic general equilibrium (DSGE) models to understand business cycles. In the DSGE models, the business cycle refers to deviations from the long-run steady state. In the balanced growth theory, one of the first DSGE models, consumption and capital stock grow at the same rate as efficient labor; thus, the variable per efficient labor remains in a long-run steady state. The deviations from the long-run steady state are caused by unanticipated exogenous shocks, such as technology shocks, preference shocks, and policy shocks.

Both the traditional method using stationary variables and the contemporary method care only about the statistical properties, and they are sometimes difficult to justify in the context of economic theory. Data handling consistent with the DSGE model would involve the extraction of the variation of variables around the steady state, i.e., to exclude the trend components from the data.

One way to exclude the long-run trend from the data is simply to assume that the data has a linear trend. However, because the Japanese economy experienced some structural changes during the postwar period, it is not appropriate to assume such a linear trend. To avoid the flaws of linear trend removing, we employ quadratic trend removing, in which the growth rate of the data is assumed to decline at a constant rate.

Quadratic trend removing enables us to deal with the diminishing of long-run growth; however, this is a restrictive assumption because there is a possibility that the declining speed of potential economic growth rate may not be constant. Therefore, we allow for the possibility that the data have a time-varying trend. We extract the business cycle components from the data by excluding the long-run trend using two filtering methods: the Hodrick–Prescott filter (Hodrick and Prescott 1997) and the Baxter–King filter (Baxter and King 1999).

The Hodrick–Prescott filter assumes that logarithms of the original series are additive separable between a trend component and a cyclical component. To isolate a cyclical component, the Hodrick–Prescott filter proposes to minimize the squared sum of the lack of smoothness in the cyclical component with a penalty parameter plus the squared sum of the cyclical component. In this paper, we set the penalty parameter to 1600, because it is a standard value for the quarterly data.

The Baxter–King filter is one of the bandpass filters that isolate a cyclical component of the original series from very low and very high frequency data. There are some characteristics in the Baxter–King filter relative to the Hodrick–Prescott filter.

² Sims et al. (1990) proves that the impulse response functions are estimated consistently even when using the level data with the unit root and without a cointegration relationship.

One is an advantage that the Baxter–King filter considers that very high frequency data are not cyclical components. It is consistent in business cycle studies for the movements that end up within a year to not be considered as business cycle movements. The second one is the disadvantage that one has to decide the longest range of business cycle on an ad hoc basis when removing low-frequency data. In addition, we lose some data to distinguish between cyclical components and trend components in the Baxter–King filter.³ Urasawa (2008) calculates the correlations between more than 50 Japanese macroeconomic variables detrended by the Baxter–King filter; however, there are few papers adopting this type of detrending when one estimates VAR models.

In the Baxter–King filter, we choose five quarters for the minimum period of oscillation of a desired component and 40 quarters (10 years) for the maximum period. In practice, many applications of the Baxter–King filter choose 32 quarters (8 years) for the maximum period of oscillation. The “lost decade,” the Japanese 1990s recession, suggests that the cyclical component has a maximum period of oscillation greater than 32 quarters.

The business cycle component of the real GDP is depicted in Figure 1. The data, excluding the quadratic trend, have relatively large variations because the quadratic trend is assumed to have a constant deterministic trend despite the fact that the Japanese economy experienced a long boom (the so-called “asset price bubble” during 1986–1991) followed by a serious recession (the so-called “lost-decade,” which occurred after 1994). These two major variations may suggest a time-varying trend. In other words, there is a possibility that the long-run steady state is time-varying.

3. Data Description

In the following sections, we treat six variables: real consumption, real investment, real government expenditure, inflation rate, nominal interest rate, and the growth rate of money supply. We use logarithms for all variables except the nominal interest rate.

The sampling periods range from 1980:Q1 to 2006:Q1. The source of GDP data is SNA. In order to expand the time series data up to the present, we connect the 1990-based SNA data (68SNA) and the 2000-based data (93SNA) with the benchmark 1990:Q1. Therefore, real data (real output, real consumption, and real investment) are based on the prices in 1990:Q1. Both SNA data employ the

³ This is the reason why there are differences in the sample period between the data detrended via the Baxter–King and the other filters mentioned in section 4. To avoid this problem, several authors employ the Christiano–Fitzgerald filter (Christiano and Fitzgerald 2003); however, on detrending the Japanese macroeconomic time series, we faced uninterpretable outcomes about interest rate data. Hence, we gave up trying to adopt the Christiano–Fitzgerald filter.

fixed benchmark year approach (not the chain approach) and quarterly data, which are seasonally adjusted by X12ARIMA.

In this paper, the monetary authority has two policy instruments: nominal interest rate and money supply. The nominal interest rate is the collateralized call rate.⁴ Following Christiano, Eichenbaum, and Evans (2005), we choose the growth rate of M2 + CD as the money supply. The inflation rate is the logarithmic first difference of the GDP deflator, which is based on the prices in 1990:Q1. We calculate the GDP deflator by dividing the nominal GDP by the real GDP. The inflation rate (GDP deflator) and the nominal interest rate (collateralized call rate) are annual rates.

We remove the long-run trend components from the data by (i) excluding the quadratic trend for the data and (ii) removing the time-varying trend through the Hodrick–Prescott filter (the smoothness penalty parameter is 1600) or the Baxter–King filter (the minimum period of oscillation of the desired component is 4 and the maximum period of oscillation is 40). Thus, we construct four kinds of time series datasets.

4. VAR Models

4.1. Selection of Variables

Although a VAR model can statistically identify the importance of various factors to economic fluctuations, the lack of samples is an obstacle. We choose five key variables: real consumption, real investment, real government spending, inflation rate, and monetary policy variable.

We exclude real GDP itself because consumption, investment, and government spending constitute more than 90 percent of GDP. Moreover, when we include GDP itself, the estimated effect of government spending on GDP may misguide readers to overvalue the effectiveness of fiscal policy, as pointed out by Ono (2006).

We use call rate and monetary aggregates (M2 + CD) as the proxies of monetary policy. Because, the Japanese economy has faced a zero lower bound of nominal interest rate since the mid-1990s, the BOJ has not been able to use interest rate as a policy instrument.

When we estimate a VAR model, we also have to choose the number of lags and the structure. Following previous studies, we calculate SIC, which suggests four lags in most of our VAR

⁴ Several studies use the uncollateralized call rate by connecting the collateralized one and the uncollateralized one, with some data adjustments. If we connect two sets of data based on the average value of two sets of data in the overlapped periods, we implicitly impose a strong assumption that the previous periods (1970:Q1–1985:Q1) always have the same spread, since the uncollateralized call rate contains the risk premium. In our estimation, we use the collateralized call rate because we can use the uncollateralized call rate only after 1985:Q2, and we cannot appreciate way to connect between the collateralized and uncollateralized ones.

models. This choice of the number of lags is the same as that of Christiano, Eichenbaum, and Evans (1999, 2005) about the U.S. economy. Thus, our estimations assume four lags. We present estimates of the five-variable VAR(4) models in Section 5.

With regard to structure, there are three popular assumptions: unstructured VAR, full recursive VAR, and structured VAR. We adopt full recursive VAR in this paper.⁵

4.2. Recursive VAR model

A full recursive formulation is a popular method to introduce an interperiod structure (short-run restrictions) into a reduced VAR. We have to impose restrictions on interperiod correlation to identify the shocks to each variable.

When we estimate five-variable VAR, we need ten restrictions to identify them. The expression of our model emerges as follows. The simplest method to impose restrictions is by assuming a determinant order of variables.

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ \alpha_1 & 1 & 0 & 0 & 0 \\ \alpha_2 & \alpha_3 & 1 & 0 & 0 \\ \alpha_4 & \alpha_5 & \alpha_6 & 1 & 0 \\ \alpha_7 & \alpha_8 & \alpha_9 & \alpha_{10} & 1 \end{pmatrix} \begin{pmatrix} G \\ mp \\ C \\ I \\ \pi \end{pmatrix} = const. + A(L) \begin{pmatrix} G \\ mp \\ C \\ I \\ \pi \end{pmatrix} + \begin{pmatrix} \varepsilon_t^G \\ \varepsilon_t^{mp} \\ \varepsilon_t^C \\ \varepsilon_t^I \\ \varepsilon_t^\pi \end{pmatrix}$$

where G is government spending; mp is proxies of the monetary policy; C , I , and π are real consumption and investment and inflation rate, respectively; $A(L)$ and $const.$ are lag operator and constant; and ε^X is the innovation of each parameter. None of these variables are serially correlated.

We assume that the fiscal and monetary policy affects real variables during the same period, but real block affects policy parameters only with lags. In addition, we assume that government spending is more exogenous than the monetary policy due to the policy-making process. We also assume that inflation is the most endogenous factor.

Because there are many alternative Cholesky orders, we have to estimate the other order VAR to check the robustness whenever we estimate recursive VAR. The implications of the estimation of alternative orders are similar to that of our assumptions.

4.3. Sample Periods

⁵ We also estimate some structured VAR models; however, there is little dissimilarity between its implication and that of full recursive VAR models presented in the next section.

Taking the structural change into consideration, we divide samples into four sub-periods. Using MCMC methods, Kamata and Sugo (2006) conclude that there was a structural change of policy rules around 1991. Miyao (2002) reports the possibility of a structural change around 1997. Therefore, we choose the following four sub-sample periods: (a) 1980:Q1–1991:Q4, (b) 1980:Q1–1996Q4, (c) 1992:Q1–2006:Q1, and (d) 1997Q1–2006:Q4.

As noted above, we have some difficulties in deciding the number of samples. As using the Baxter–King filter reduces the sample range, we perform type (c) estimation using the samples of 1992:Q1–2003:Q1, and do not estimate type (d). Furthermore, it is difficult to rationalize using call rate as the proxy of the monetary policy, since the short-term nominal interest rate in Japan has been changed by a small amount after 1997. Therefore, we do not estimate type (d) with call rate. Finally, we estimate 27 VAR models of our interest.

5. Estimation Results

In this section, we compare the impulse response functions (IRF) of VAR models, which we explained in the previous section. We concentrate on the responses of the consumption, the investment and the inflation rate from policy variables and try to find the commonalities across several alternative estimation strategies.

Figure 2 through 13⁶ report the responses of each variable from one S.D. innovation of policy variables. In each figure, (a) the blue lines are the IRFs of 1980:Q1–1991:Q4; (b) the pink lines are those of 1980:Q1–1996Q4; (c) the orange lines are those of 1992:Q1–2006:Q1; and (d) the green lines are those of 1997Q1–2006:Q4.

5.1. Fiscal Policy

Figure 2 shows the IRFs of real consumption from the government spending shock with the short-term nominal interest rate as the proxy of the monetary policy. In the results of 80–91 sub-period (a) estimations, the government expenditure stimulated the consumption in three of four detrend methods. In sub-period (a), we find that the real consumption reacts positively to the positive government spending shock; however, in the responses of sub-period (b), only two of four detrending methods report a positive effect from the fiscal policy. The outstanding commonality of these IRFs is that the effect of the fiscal policy diminishes in the (c) and (d) sub-periods relative to (a) or (b).

Figure 3 depicts the IRFs of real consumption from the government spending shock with the

⁶ We also report the error bands of each IRFs in Table 1 through 12.

growth of the monetary aggregate as the proxy of the monetary policy. Whether the fiscal policy brings positive or negative reactions depends on the detrending methods; however, their quantitative effects decline and sometimes fall into negative in the (c) and (d) sub-periods.

Figure 4 reports the IRFs of real investment from the government spending shock with the short-term nominal interest rate as the proxy of the monetary policy. Same as the responses to the consumption depicted in figure 2, the effects of fiscal policies are gradually reduced and turn to negative as time goes by. In the detrended data via the Baxter–King filter, we find a positive reaction to the government spending shock in a previous half of 1990s, but this also drops into negative in a sub-period (c) estimation result. These tendencies are very similar to those in figure 5, which reports the IRFs with the growth rate of the monetary aggregate of the proxy of the monetary policy.

From these IRFs, we find that the robust inclination is the decline of the dynamic effects of the government expenditure policy shock. This is also pointed out by Kato (2003) and Watanabe et al. (2008). There are two possible explanations for this tendency. One is the Mundell–Fleming effect due to the reduction of the Japanese economy’s presence in the world economy. The other is the increase of the ratio of the so-called Ricardian household.

The Mundell–Fleming model, the textbook model for an open economy, suggests that fiscal policy never causes any reactions of real variables because of the appreciation of the exchange rate in the small open economy.⁷ The Japanese economy became smaller and more open during the “lost decade” because of its low growth rate and the emergence of the developing countries and communist countries like China and Russia.

According to Gali et al. (2004, 2007), myopic or liquidity constrained consumers have gradually become a key assumption in the DSGE models. If the proportion of such consumers is high, the economy has more traditional Keynesian model-like features rather than the Neoclassical or the New Keynesian ones. However, our results suggest that the Japanese economy has Neoclassical or New Keynesian features with regard to the effects of fiscal stimulation. The deficits of the Japanese central and local governments have become 1.6 times as much as the GDP. This fact reminds many agents of the linkage between contemporary fiscal stimulation and future tax increases.

5.2. Monetary Policy

As noted above, there are some severe difficulties in investigating the effect of monetary policy on the Japanese economy in recent years. The most striking problem is selecting the proxy for the monetary

⁷ We also estimate the VAR models including the nominal exchange rate, but we could not find the appreciation of the exchange rate for the positive fiscal shock. However, it can come from the flexibilities of foreign exchange market.

policy. Typical contemporary macroeconomic models assume that the central bank tries to stabilize the economy by using the short-term nominal interest rate as a policy instrument. In Japan, however, the nominal interest rate hit its lowest level after the mid-1990s. Therefore, there have been several changes of monetary policy instruments. To overcome these problems, we use two different variables as the proxy for the monetary policy instruments: the short-term nominal interest rate and the monetary aggregate (M2 + CD).⁸

Figure 6 depicts the IRFs of real consumption from an increase of the nominal rate as the proxy of the monetary policy. There are some common features among the detrended data. One is that the influence of the monetary policy on consumption became earlier and shorter in the data period. For instance, the peaks of responses from the monetary policy are after quarter 7 in the (a) and (b) sub-periods and after quarter 2 in the (c) sub-period in the logged and quadratic detrended data. It is sometimes said that the influence of interest rate over real variables is weakened; however, we cannot find this tendency from these estimation results.

Figure 7 reports the IRFs of real consumption from an increase in the monetary aggregate as the proxy of the monetary policy. In the 1980s and the early 1990s, the additional money supply stimulates the consumption, as shown in textbook-style economics. However, these relationships disappear in the IRFs in the samples from the latter half of the 1990s and the 2000s. This might be a fine example of a liquidity trap a la Krugman (1998).

Figure 8 shows the IRFs of real investment from the tightening monetary policy shock with the short-term nominal interest rate as the proxy of the monetary policy. Three series except the logged one show the same tendencies as the consumption depicted in Figure 6.⁹ Figure 9 presents the IRFs of real investment from the monetary policy shock with the monetary aggregate, and also expresses the shifting of the influence from money to real variables, as noted above.

The rationalizations of these findings are as follows: The changes of the nominal interest rate still influence real variables, but the zero lower bound of the nominal interest rate keeps us away from stimulation by cutting the interest rate. In other words, even in the latter half of the 1990s and the early 2000s, the increase of the interest rate fairly worsens the real economy.

5.3. Price Puzzle

Figure 10 depicts the IRFs of the inflation rate from the government spending shock with the short-term nominal interest rate as the proxy of the monetary policy, and figure

⁸ Harada and Iida (2004) use the base money as the proxy and Kamata and Sugo (2006) compile an index of monetary policies from survey data.

⁹ We cannot find a reasonable interpretation of the IRF using logarithmic 1990s data.

11 shows the IRFs with the growth of the monetary aggregate as the proxy of the monetary policy.

Most estimated results suggest that the government spending shock accelerate inflation up through only 1 to 3 period. After that, government expenditure lowers the inflation rate, which is consistent with the traditional AD-AS model, where the expansion of the government spending causes upward shift of the AD curve and causes the inflation. Therefore, our results are completely different from traditional Keynesian models.

These results stem from the negative reactions of real variables as noted above. The positive fiscal stimulation causes the negative reactions of the real consumption and the real investment. It means that the fiscal policy do not cause the upward shifts of the AD curve, but the downward shifts. From these reasons, “the price puzzle” from the government spending shocks are not puzzle, but the ineffectiveness of the fiscal policy.

Figure 12 reports the IRFs of the inflation rate from a rise of the nominal rate as the proxy of the monetary policy and figure 13 describes the IRFs with the growth of the monetary aggregate as the proxy of the monetary policy.

Tightening monetary policy accelerate the inflation within 6 to 8 quarters. There are typical examples of “the price puzzle”. The possible explanation of these results is from the forward looking behavior of the monetary authority. When the central bank faces the future acceleration of the inflation rate, she tightens the monetary instruments. After that, the anxiousness of her becomes true but the effect of tightening monetary policy appears after 8 to 12 quarters because of the policy lags. These situations cause the price puzzle of earlier period. Therefore, the price puzzle of the monetary policy stems from the omitted variables which we didn't includes the theoretical and empirical models.

6. Concluding Remarks

We investigate the robust tendencies of contemporary Japanese economics and its macroeconomic policies by employing different detrending methods. We find three common features from the estimation results: First, we find a gradual decline in the influence of fiscal policy. Second, the impact of interest rate changes is not declining in the manner many economists believe. And, third, there has been a collapse of the linkage of monetary aggregates and real economy.

The first result suggests that the role of fiscal policy in stabilization must be reconsidered. It is difficult to use government funds to stimulate the economy when the government has a large deficit or the economy is facing global competition.

The second and third results as well as the existence of the lower bound of the nominal interest rate indicate that traditional monetary policy has lost its power in the deflation and stagnation era. We have to try and find other types of policies with the help of dynamic models.

References

- Bayoumi, Tamin (2001), "The Morning After: Explaining the Slowdown in Japanese Growth in the 1990s," *Journal of International Economics*, No. 53, pp.241-259.
- Baxter, Marianne and Robert G. King (1999), "Measuring business cycles: Approximate bandpass filters," *Review of Economics and Statistics*, 81(4): 575-93.
- Christiano, Lawrence J., Martin Eichenbaum and Charles L. Evans (1999), "Monetary policy shocks: what have we learned and to what end?" in *Handbook of Macroeconomics*, vol. 1, chapter 2.
- Christiano, Lawrence J., Martin Eichenbaum and Charles L. Evans (2005), "Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy," *Journal of Political Economy*, 113(1), pp.1-45.
- Christiano, Lawrence and Terry J. Fitzgerald (2003), "The bandpass filter," *International Economic Review*, 44(2): 435-65.
- Fernandez-Villaverde, J. and J. F. Rubio-Ramirez (2005), "Estimating Dynamic Equilibrium Economics: Linear versus Nonlinear Likelihood," *Journal of Applied Econometrics*, 20, pp.891-910.
- Gali, J., J. David Lopez-Salido and Javier Valles (2004), "Rule of Thumb Consumer and the Design of Interest Rate Rules," *Journal of Money, Credit and Banking*, 36(4).
- Gali, J., J. David Lopez-Salido and Javier Valles (2007), "Understanding the Effect of Government Spending on Consumption," *Journal of the European Economic Association*, 5(1).
- Harada, Yutaka and Yasuyuki Iida (2004), "Explaining Japan's Great Stagnation: An Inquiry using Vector Auto Regression Models," ESRI Discussion Paper No.123 (in Japanese).
- Hodrick, Robert J. and Edward C. Prescott (1997) "Postwar US business cycles: an empirical investigation," *Journal of Money, Credit, and Banking*, 29(1): 1-16.
- Kamata, Koichiro and Tomohiro Sugo (2006), "Seisaku kinri zero seiyaku-ka ni okeru Kinyu Seisaku Kouka no Cyusyutsu," Bank of Japan, Working Paper Series, No. 06-J-13 (in Japanese).
- Kato, Ryo (2003), "Zaisei Seisaku Jyousu no Nichi-Bei Hikaku," Bank of Japan, Working Paper Series, No. 03-J-4 (in Japanese).
- Kuttner, Ken and Adam Posen (2001), "The Great Recession: Lessons for Macroeconomic Policy from Japan," *Brookings Papers on Economic Activity*, No. 2, pp.93-185.
- Krugman, Paul R. (1998), "It's Baaack! Japan's Slump and the Return of the Liquidity Trap," *Brookings Papers on Economic Activity*, vol. 29, pp 137-206.
- Kydland, Fin, E. and Edward C. Prescott (1982), "Time to Build and Aggregate Fluctuations," *Econometrica*, 50, 1345-1370.

- Miyao, Ryuzou (2002), "The Effects of Monetary Policy in Japan," *Journal of Money, Credit and Banking*, Vol. 34, No. 2, May 2002.
- Ono, Yoshiyasu (2006) "Fallacy of the Multiplier Effect: Correcting the Income Analysis," ISER Discussion Paper No.673.
- Pantula, Sastry G., Graciela Gonzalez-Feris and Wayne A. E. Fuller (1994) "A Comparison of Unit-Root Test Criteria," *Journal of Business and Economic Statistics*, 461-471.
- Urasawa, Satoshi (2008) "Business Cycle Fluctuations in Japanese Macroeconomic Time Series," *Journal of the Asia Pacific Economy*, forthcoming.
- Sims, Christopher A., James H. Stock and Mark W. Watson (1990) "Inferences in Linear Time Series Models with Some Unit Roots," *Econometrica* 58: 113-144.
- Smets, Frank, and Raf Wouters (2003), "An Estimated Stochastic Dynamic General Equilibrium Model of the Euro Area," *Journal European Economic Association*, 1(5): 1123-1175.
- Watanabe, Tsutomu, Tomoyoshi Yabu and Arata Ito (2008), "Seidojyoho wo Mochiita Zaisei-Jyousu no Keisoku," Hitotsubashi University, Understanding Inflation Dynamics of the Japanese Economy Working Paper Series No.28.

Figure1: Cyclical Components of logged real GDP

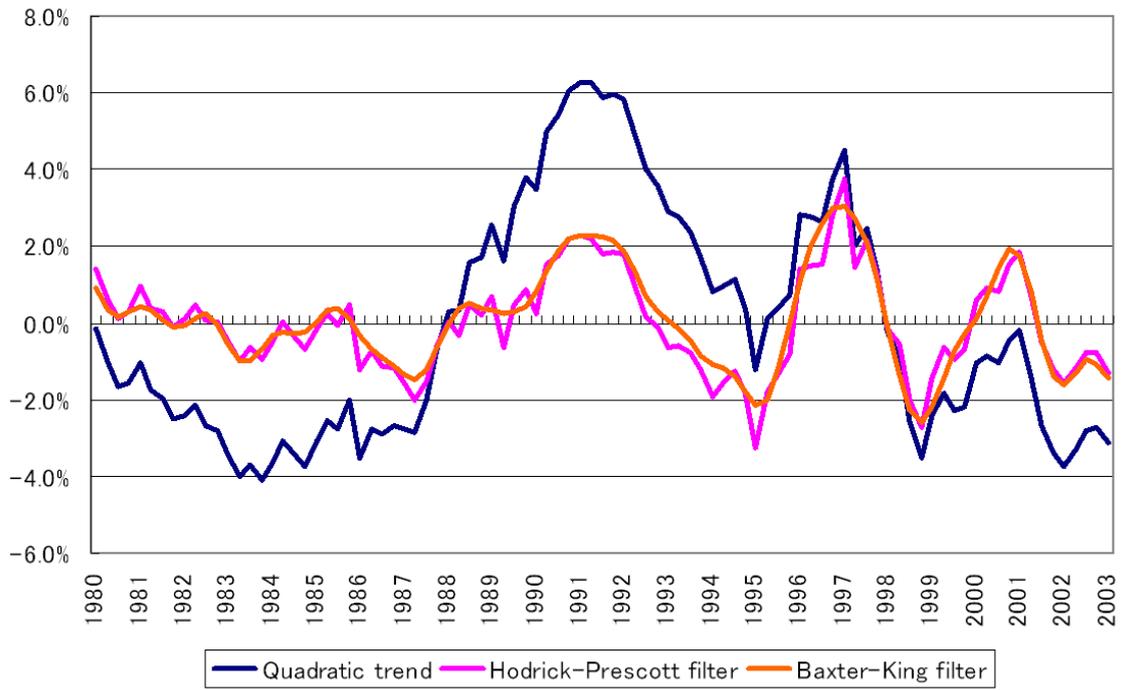


Figure 2: Responses of the consumption from the government spending (call rate)

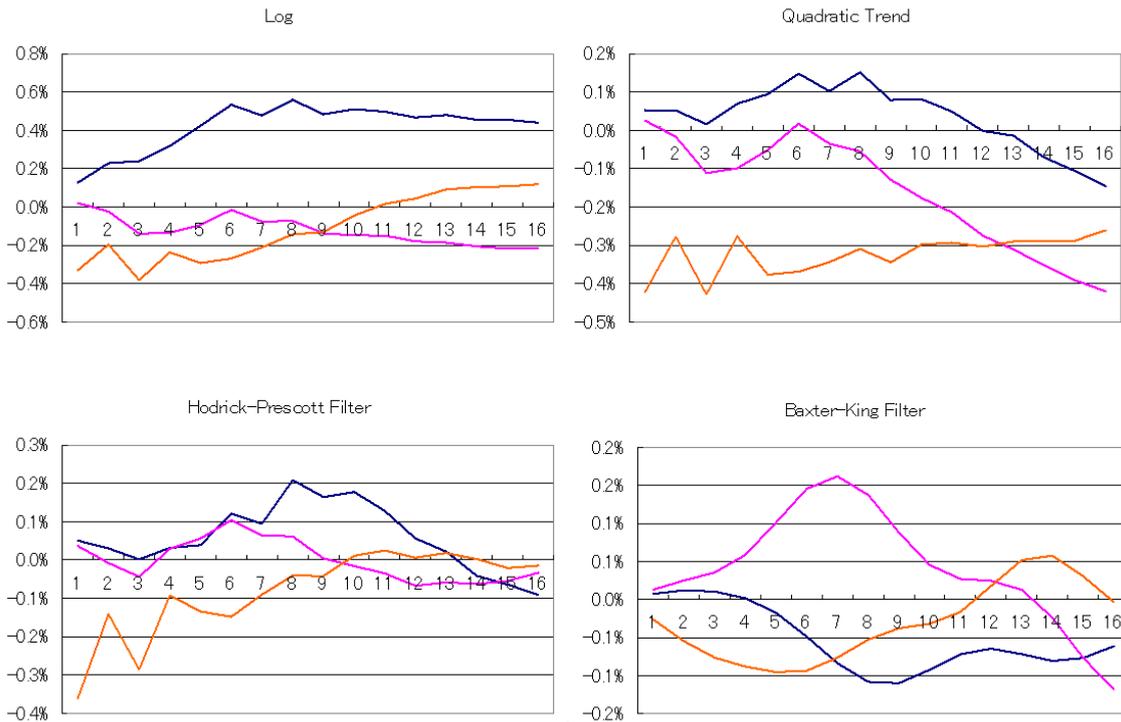


Figure 3: Responses of the consumption from the government spending (M2+CD)

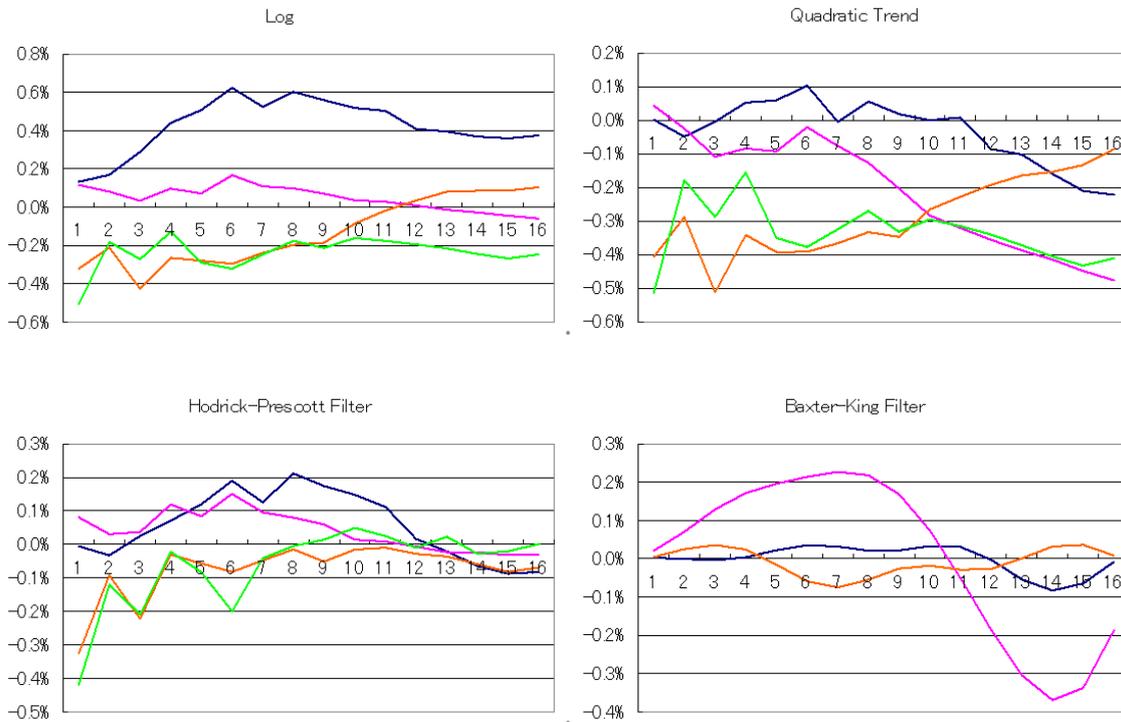


Figure 4: Responses of the Investment from the government spending (call rate)

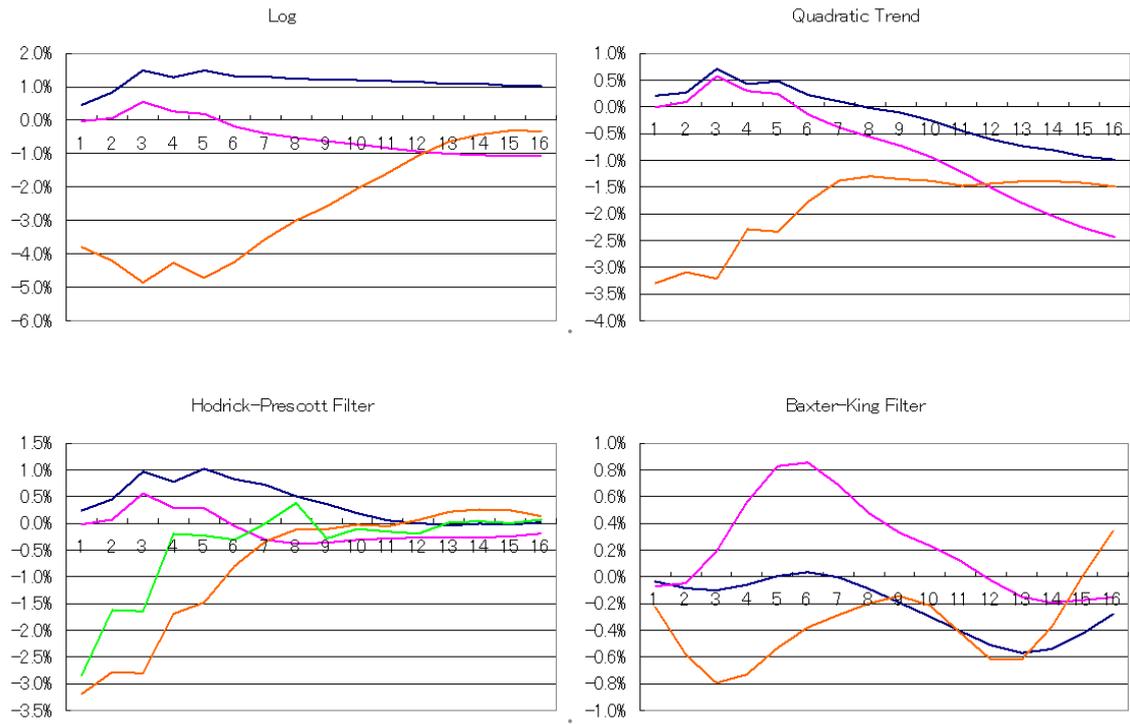


Figure 5: Responses of the Investment from the government spending (M2+CD)

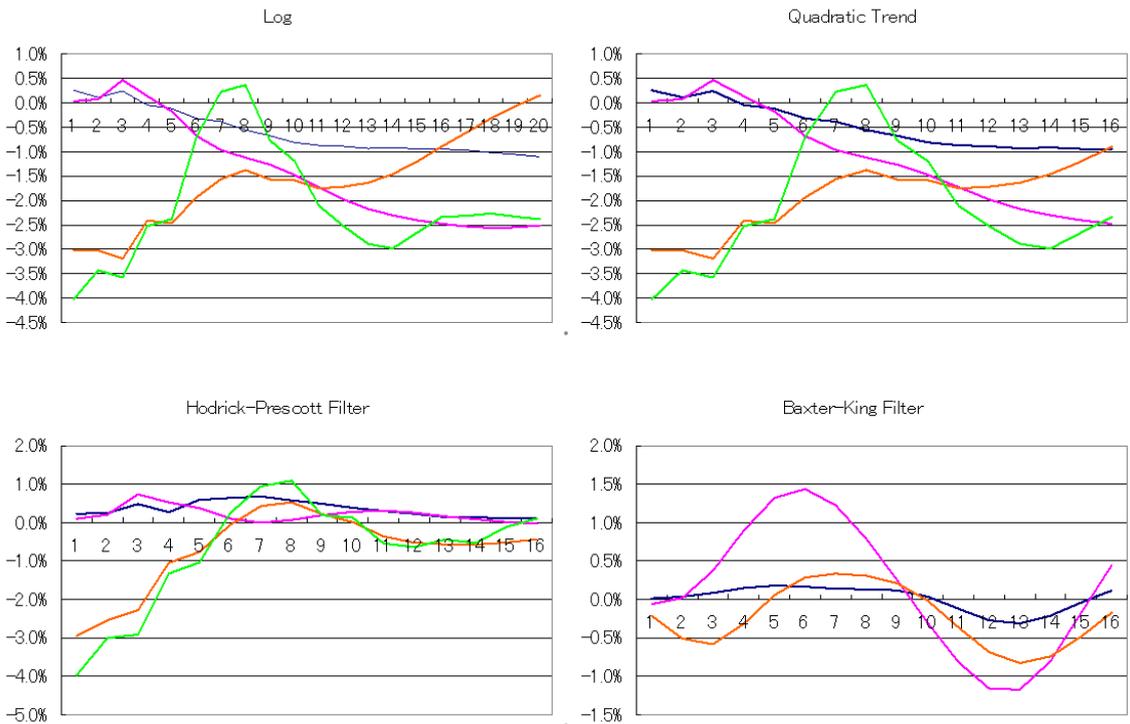


Figure 6: Responses of the consumption from the monetary tightening (call rate)

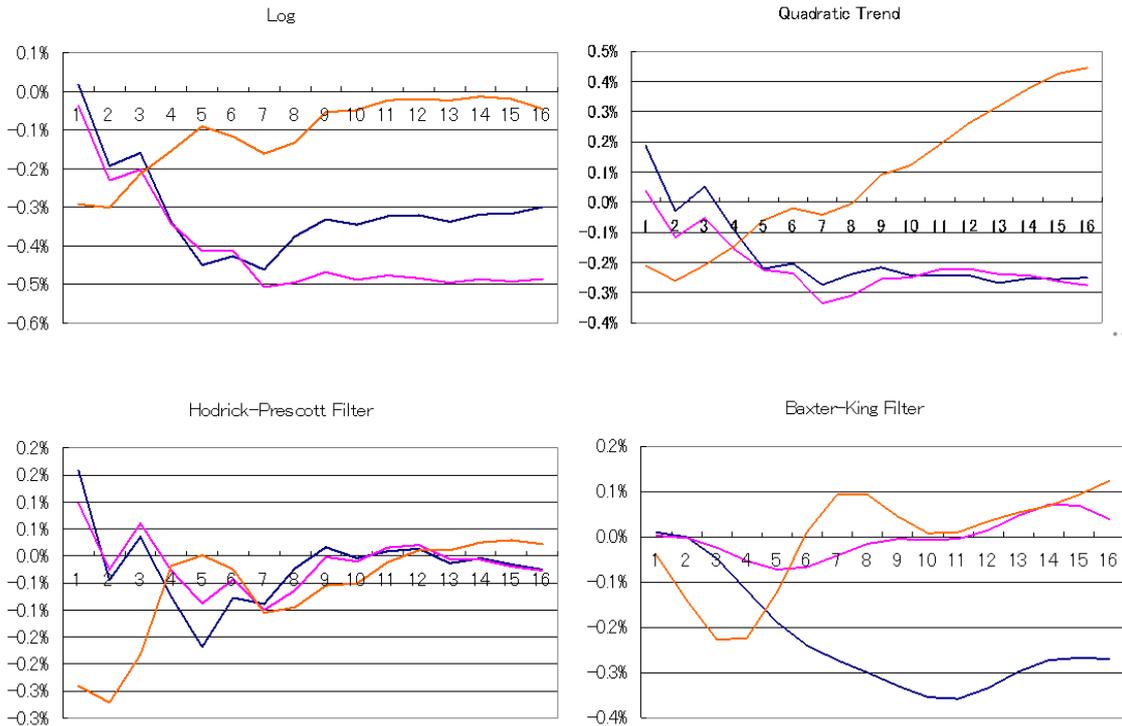


Figure 7: Responses of the consumption from the monetary easing (M2+CD)

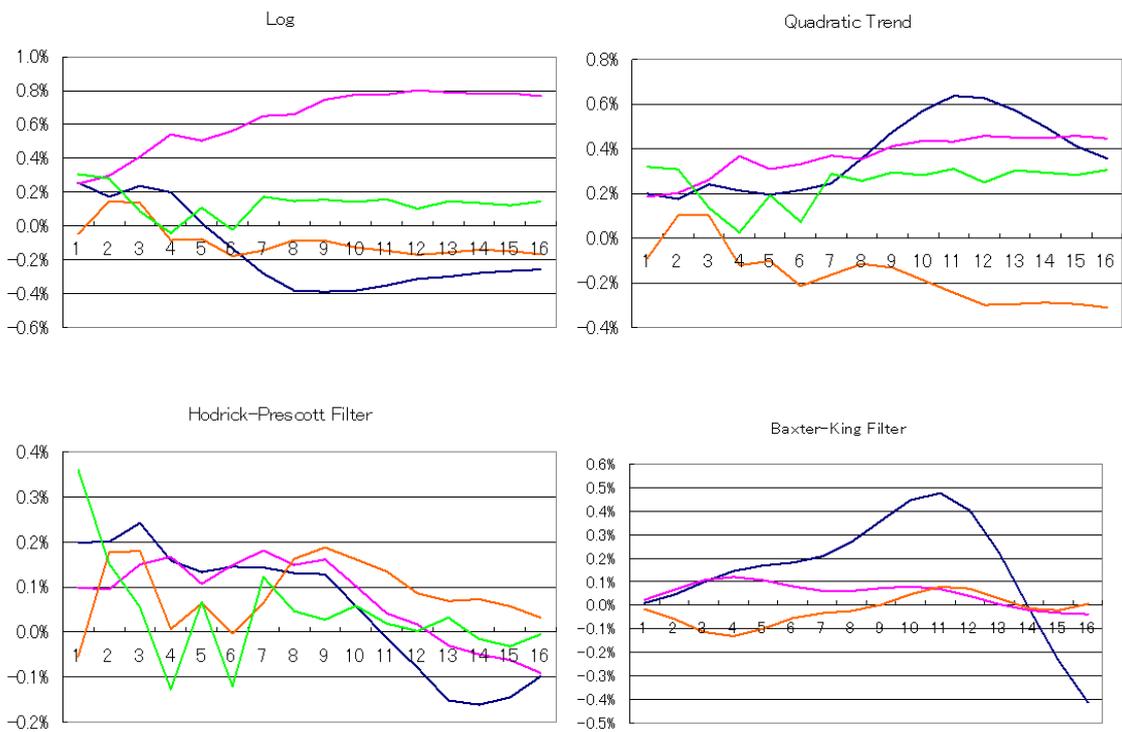


Figure 8: Responses of the Investment from the monetary tightening (call rate)

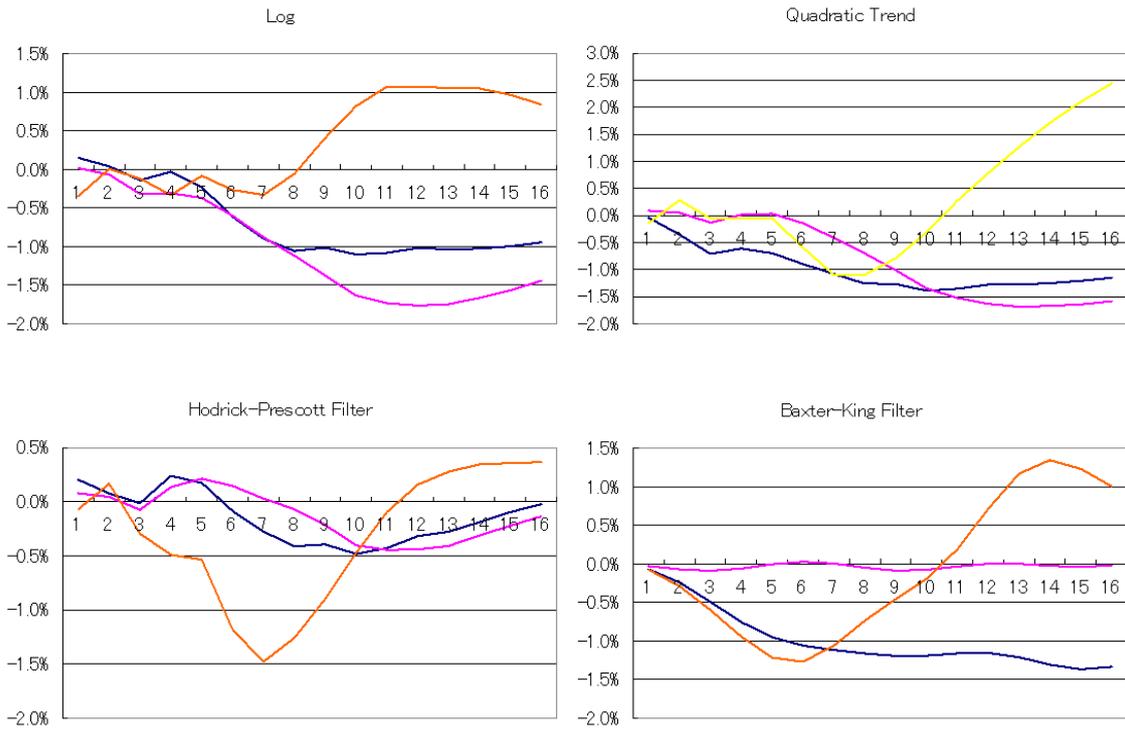


Figure 9: Responses of the Investment from the monetary easing (M2+CD)

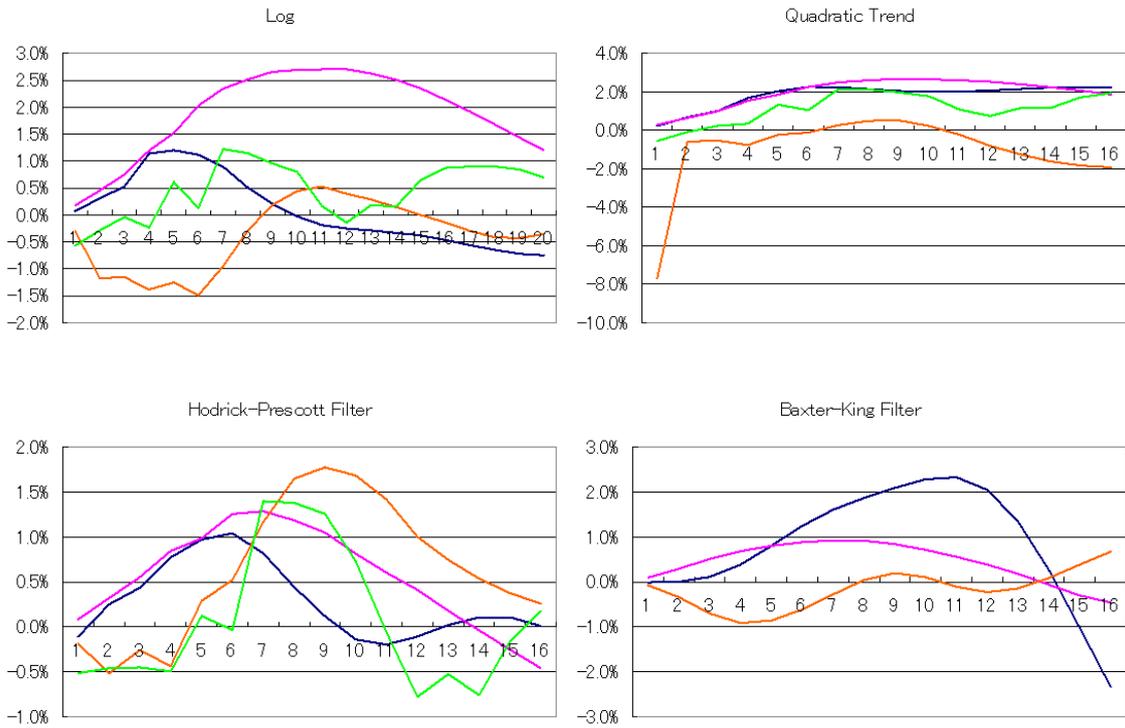


Figure 10: Responses of the inflation rate from the government spending (call rate)

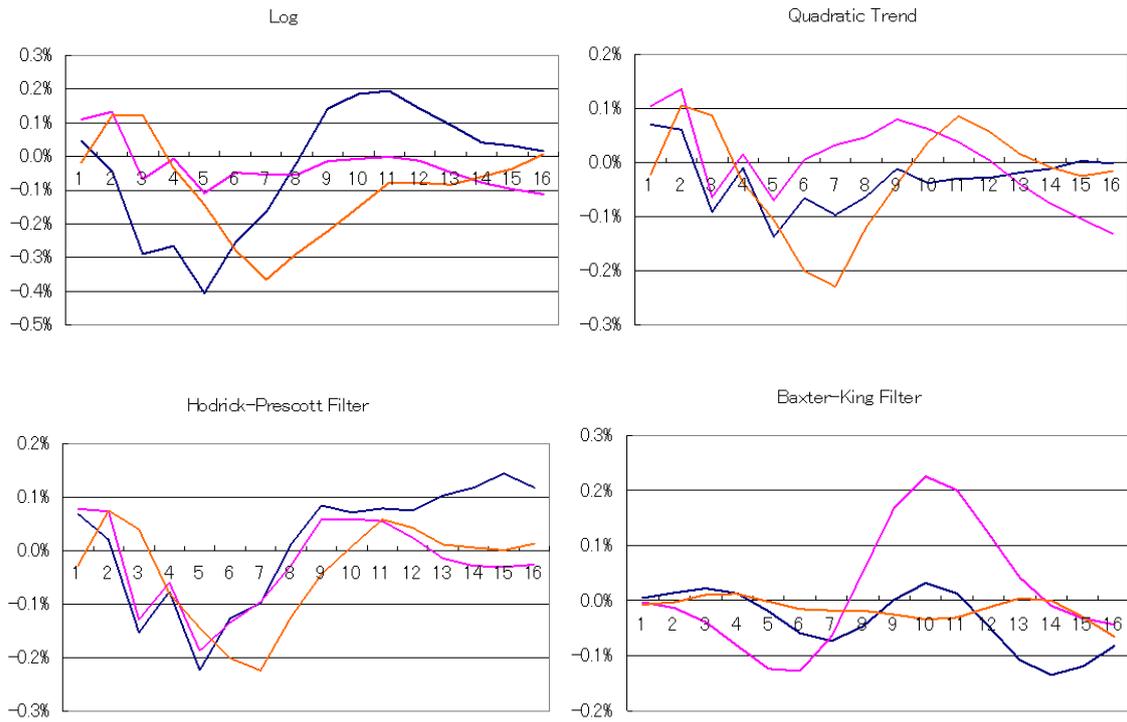


Figure 11: Responses of the inflation rate from the government spending (M2+CD)

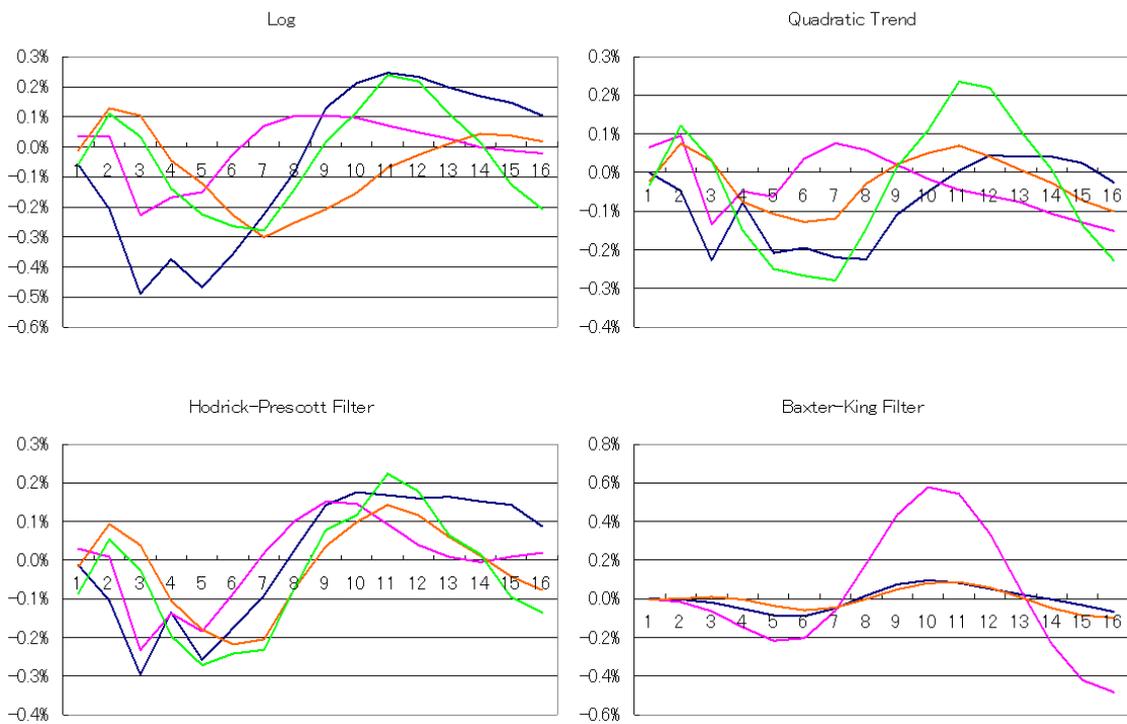


Figure 12: Responses of the inflation rate from the monetary tightening (call rate)

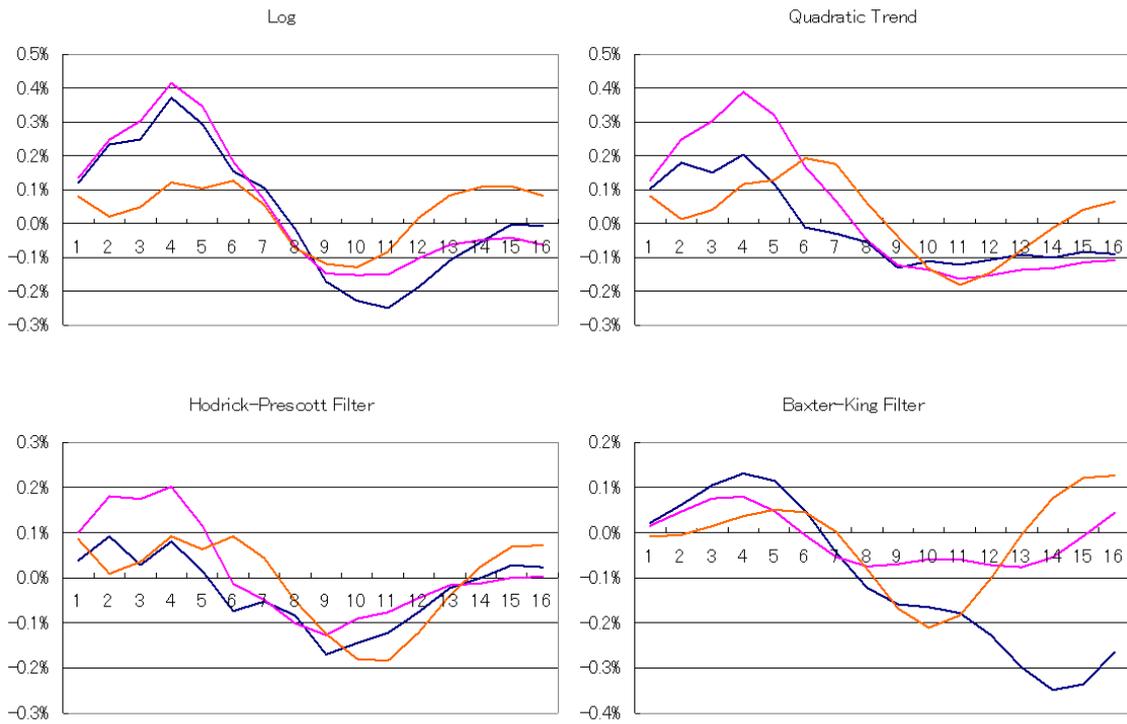


Figure 13: Responses of the inflation rate from the monetary easing (M2+CD)

