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Expansionary Effect of an Anticipated Fiscal Policy on Consumption in Japan

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Expansionary Effect of an Anticipated Fiscal Policy on Consumption in Japan*

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Abstract

This paper investigates the effect of an anticipated fiscal policy on consumption in Japan. I identify an anticipated increment in public investment by using the excess stock returns on the construction industry and by applying the sign restriction VAR. The result shows that GDP and consumption respond to a public investment shock positively. Further, I demonstrate that the empirical facts are consistent with the New Keynesian model that has a high elasticity of labor supply and a large share of Non-Ricardians.

Keywords: Fiscal policy, fiscal foresight, sign restriction VAR

JEL codes: E62, H30

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1 Introduction

Does a fiscal policy stimulate an economic activity? This question is one of the biggest concerns in Japan that suffers from a long depression after the collapse of the "bubble" economy. The rich literature (e.g., Bayoumi (2001), Kuttner and Posen (2002), Kato (2003), Ihori and Nakamoto (2005), and Watanabe et al. (2010)) has investigated the effect of the fiscal policy in Japan by using VAR analysis.[1] Most authors mention that the expansionary effect of the fiscal policy on consumption and GDP has been reducing in the recent years. Furthermore, there is a consensus on this result.

However, the previous work by scholars misses the fact that changes in fiscal policy are anticipated. As noted in Blanchard and Perotti (2002) and Ramey (2011), the fiscal policy entails two lags: the decision lag and implementation lag. The former indicates a period between the time when a regulation is submitted and the time when it is enacted, while the latter refers to the period from the enactment of the regulation to the actual enforcement. Owing to the existence of the implementation lag, although the actual adjustment on the fiscal policy has not been done yet, there is a possibility that agents know about the change in the fiscal policy and react to it immediately. Therefore, the empirical literature in which the increase in government spending is identified as a surprise shock may fail to lead to correct results. In the context of this point of view, in this paper, I examine the effect of the fiscal policy to take into account the possibility that the fiscal policy is anticipated, which is called fiscal foresight. After Ramey (2011) pointed out that the standard VAR analysis without fiscal foresight fails to capture the true effect of the fiscal policy, several papers has attempted to estimate the effect of an anticipated fiscal policy in the U.S. (e.g., Fisher and Peters (2010), Mertens and Ravn (2010), and Tenhofen and Wolff (2011)). As per my knowledge, this is the first paper that estimates

[1] Fiscal policy includes some types of policies. For example, it refers to the tax cut, or the increment in government spending. In this paper, I define fiscal policy as an increase in public investment.

the effect of an anticipated fiscal policy in Japan.

Precisely, this paper adopts the approach of Fisher and Peters (2010). Their idea is as follows. If the financial market is effective and agents are forward looking, the asset prices reflect the information that is available at present. Hence, the news about fiscal policy fluctuates the stock price of the company related to the fiscal policy. On the basis of this idea, they identify government (military) spending shock as innovations on the excess stock returns of the large U.S. military contractors. In this paper, I apply this identification strategy to a relationship between public investment and the construction industry in Japan.

However, there is a problem with this method. As Fisher and Peters (2010) also states, all variations in stock returns are not owing to the news about the fiscal policy. Hence, all innovations in stock returns as an anticipated fiscal policy shock lead to wrong results. In order to overcome this problem, I employ the sign restriction VAR developed by Uhlig (2005). By using this method, it is possible to identify the stock returns shock that induces fluctuations in public investment.

The main findings in this paper are as follows. First, as a result of Granger causality test, the excess stock returns Granger-cause public investment. This implies that it is plausible to regard the variations in the excess stock returns as the leading indicator of public investment. Second, in the full-sample estimation, it is found that an anticipated public investment shock rises consumption and GDP. In return, labor, the real wage, and investment do not indicate a significant response to the public investment shock. Third, in a subsample analysis, the results show that the expansionary effect of the fiscal policy on GDP and consumption has been reducing recently, as reported in the previous studies. However, the effect is still positive. Therefore, the previous studies might underestimate the effect of the fiscal policy. Finally, it turns out that the results of the empirical analysis can be replicated in the New Keynesian model with a high labor supply elasticity and a large share of Non-Ricardians.

The remainder of this paper is organized as follows. In the subsequent section, I present the fact that excess stock returns of a construction industry can be regarded as the leading indicator of public investment. In Section 3, the theoretical model is built to find out the feasible sign restrictions imposing VAR model. Section 4 explains the estimation method of sign restriction VAR. In Section 5, I describe the data and specifications of VAR model. Thereafter, the empirical analysis is carried out in Section 6. In Section 7, the feasible parameter values to match the empirical results are considered in the discussion. The final section presents conclusion.

2 Preliminary Analysis

This section presents several facts to support that the excess stock returns on the construction industry is a good leading indicator of public investment. I estimate two variables VAR including excess stock returns and public investment and perform Granger causality test.[2] The VAR model in this section is simply identified by using Cholesky decomposition, where the excess stock returns is assumed to be order first. Additionally, the lag length is set to be four.

Figure 1 displays the impulse response functions (IRFs) of both variables to the excess stock returns shock. The IRFs are normalized so that the response of public investment at period 4 becomes one. On the basis of the results, it is observed that public investment rises gradually, although it once falls at period 2, after the excess stock returns shock. In particular, it increases rapidly from period 2 to period 4. Therefore, it can be considered that the excess stock returns is a variable that changes before the change in public investment.

[2]The data is explained in Section 5 and Appendix A.

Moreover, Table 1 shows the result of Granger causality test based on the same VAR model. I conducted the test for different lag lengths and specifications. The null hypothesis that the excess stock returns does not Granger-cause public investment is rejected in all cases.

Based on the results in this section, I regard the excess stock returns as the leading indicator of public investment. Thus, by applying this approach, it is possible to analyze the effect of an anticipated fiscal policy.

3 Theoretical Model

In this section, I build a Gali et al. (2007) type New Keynesian (NK) model to find out sign restrictions. In order to replicate a positive consumption response to a surprise government spending shock as seen in VAR analysis, Gali et al. type (2007) model has the four prominent characteristics: price stickiness, a rule of thumb consumer, debt financing, and wage union. In addition to these features, this paper incorporates wage stickiness, ΔI type investment adjustment cost and news process of government spending shock into the model.[3] [4] The following are the details about the model.

3.1 Households

Households are divided into two types: optimizing or Ricardian households that are denoted by R and have access to capital markets, and the rule of thumb or Non-Ricardian households that are denoted by N and do not own any assets and just consume their current disposal income in each period. A fraction $\mu \in [0, 1]$ of the population is Non-Ricardians, and the remaining population, $1 - \mu$, is Ricardians.

[3]Since several studies that estimate structural parameters on the basis of DSGE model adopt ΔI type investment adjustment cost, I employ it in order to operate calibration easily.

[4]Colciago (2011) has already introduced wage stickiness into the Gali et al. (2007) type model.

Let $c_t^R(i)$ and $n_t^R(i)$ represent the real consumption of and hours worked by Ricardians who belong to type i labor union. Following Colciago (2011), each household provides a differentiated labor input $n_t(i)$ and obtains a nominal wage $W_t(i)$. Ricardians maximize a lifetime utility

$$U = E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{(c_t^R(i))^{1-\gamma} - 1}{1-\gamma} - \frac{(n_t^R(i))^{1+\lambda}}{1+\lambda} \right], \tag{1}$$

subject to the budget constraint

$$P_t c_t^R(i) + P_t i_t^R(i) + B_t^R(i) = W_t(i) n_t^R(i) + P_t r_t^k k_{t-1}^R(i) + R_{t-1} B_{t-1}^R(i) + D_t^R(i) - P_t \tau_t^R(i), \tag{2}$$

and the capital accumulation equation

$$k_t^R(i) = (1-\delta) k_{t-1}^R(i) + \left\{ 1 - S\left(\frac{i_t^R(i)}{i_{t-1}^R(i)} \right) \right\} i_t^R(i), \tag{3}$$

where capital letters denote a nominal variable. P_t is the aggregate price level, B_t is a riskless one-period bond, and R_t is the gross nominal return on bond. Since the intermediate goods firms face a monopolistic competition and make excess profits, Ricardians receive dividends $D_t^R(i)$. $\tau_t^R(i)$ denotes lump-sum taxes paid by Ricardians. $i_t^R(i)$ and $k_t^R(i)$ respectively denote the real investment and real capital stock. r_t^k is the real rental rate on the physical capital. Contrary to Gali et al. (2007), I assume that the adjustment costs are proportional to the rate of change in investment, where $S(1) = S'(1) = 0$, and $S''(1) > 0$.[5] This type of adjustment cost is called ΔI adjustment cost in Monacelli and Perotti (2008).[6]

Conversely, Non-Ricadians simply consume all of their current disposable income. By denoting the consumption of and hours worked by type i Non-Ricardians as $c_t^N(i)$ and

[5] In this paper, I define a parameter of investment adjustment cost as $\kappa \equiv 1/S''(1)$.

[6] Gali et al. (2007) adopts convex adjustment cost in which the costs of adjusting capital are proportional to the investment-capital ratio.

$n_t^N(i)$, they face the following budget constraint in each period:

$$P_t c_t^N(i) = W_t(i) n_t^N(i) - P_t \tau_t^N(i), \tag{4}$$

where $\tau_t^N(i)$ denotes lump-sum taxes paid by Non-Ricardians.

3.2 Wage setting

As discussed above, each household provides a differentiated labor input indexed in $i \in [0,1]$ and belongs to the labor union i. A perfectly competitive labor bundling firm bundles a differentiated labor input $n_t(i)$ into the effective labor n_t by using the following technology:

$$n_t = \left[\int_0^1 n_t(i)^{\frac{\varepsilon_w - 1}{\varepsilon_w}} di \right]^{\frac{\varepsilon_w}{\varepsilon_w - 1}}, \tag{5}$$

where ε_w is the elasticity of substitution across the different types of labor input. As a result of the labor bundler problem, the demand function for each differentiated labor input is expressed as

$$n_t(i) = \left(\frac{W_t(i)}{W_t} \right)^{-\varepsilon_w} n_t, \quad \text{for all } i, \tag{6}$$

and the aggregate nominal wage, W_t, is equal to

$$W_t = \left[\int_0^1 W_t(i)^{1-\varepsilon_w} di \right]^{\frac{1}{1-\varepsilon_w}}. \tag{7}$$

As in Gali et al. (2007) and Colciago (2011), I assume that households are distributed uniformly across unions. Hence, in each union i, a fraction μ is Non-Ricardians, and $1-\mu$ is Ricardians.

In each period, a labor union i sets its nominal wage $W_t(i)$ under the Calvo (1983) type staggered wage setting. A $1-\rho_w$ of a labor union resets the optimal nominal wage $W_t^*(i)$. Thus, the problem for a labor union is

$$\max E_t \sum_{s=0}^{\infty} (\beta \rho_w)^s \left[(1-\mu) \frac{c_{t+s}^R(i)^{1-\gamma} - 1}{1-\gamma} + \mu \frac{c_{t+s}^N(i)^{1-\gamma} - 1}{1-\gamma} - \frac{n_{t+s}(i)^{1+\lambda}}{1+\lambda} \right], \tag{8}$$

subject to (2), (4), and (6).

In the symmetric equilibrium, the first order conditions can be written as

$$W_t^* = \frac{\varepsilon_w}{\varepsilon_w - 1} \frac{E_t \sum_{s=0}^{\infty} (\beta\rho_w)^s n_{t+s}^{1+\lambda}}{E_t \sum_{s=0}^{\infty} (\beta\rho_w)^s \left[(1-\mu) \frac{n_{t+s}}{P_{t+s} {c_{t+s}^R}^{\gamma}} + \mu \frac{n_{t+s}}{P_{t+s} {c_{t+s}^N}^{\gamma}} \right]}, \tag{9}$$

and combining this and (7), the aggregate nominal wage at period t is given by

$$W_t = \left[(1-\rho_w) {W_t^*}^{1-\varepsilon_w} + \rho_w W_{t-1}^{1-\varepsilon_w} \right]^{\frac{1}{1-\varepsilon_w}}. \tag{10}$$

Then, log-linearization of (9) and (10) around the steady state yields the dynamic equation of the real wage as

$$\hat{w}_t = \Gamma \hat{w}_{t-1} + \Gamma \beta E_t \hat{w}_{t+1} + \Gamma \beta E_t \hat{\pi}_{t+1} - \hat{\pi}_t + \kappa_w \Gamma \gamma \hat{c}_t + \kappa_w \Gamma \lambda \hat{n}_t, \tag{11}$$

where a hat denotes the deviation from the steady state, and $\Gamma = \rho_w/(1+\beta\rho_w^2)$, and $\kappa_w = (1-\beta\rho_w)(1-\rho_w)/\rho_w$.

3.3 Firms

The production sector consists of two types of firms: the monopolistically competitive intermediate goods firms that produce differentiated intermediate goods and perfectly competitive final goods firms that produce single final goods by using intermediate goods as the input. Each intermediate goods firm $j \in [0, 1]$ produces an intermediate good $y_t(j)$, and the production function is given by

$$y_t(j) = k_{t-1}(j)^{\alpha} n_t(j)^{1-\alpha}, \tag{12}$$

where $k_{t-1}(j)$ and $n_t(j)$ respectively denote the capital stock and labor input used by the firm j.

The final goods firm has the following CES technology to produce final goods y_t:

$$y_t = \left[\int_0^1 y_t(j)^{\frac{\varepsilon_p - 1}{\varepsilon_p}} dj \right]^{\frac{\varepsilon_p}{\varepsilon_p - 1}}. \tag{13}$$

By solving a profit maximization problem of the final goods firm, the demand function for the intermediate goods is represented as

$$y_t(j) = \left(\frac{P_t(j)}{P_t}\right)^{-\varepsilon_p} y_t, \tag{14}$$

and the final goods pricing rule is written as

$$P_t = \left[\int_0^1 P_t(j)^{1-\varepsilon_p} dj\right]^{\frac{1}{1-\varepsilon_p}}. \tag{15}$$

3.4 Price setting

Similar to wage unions, the intermediate goods firms set prices according to the Calvo (1983) mechanism. An intermediate goods firm j can change its price with the probability $1-\rho_p$. The optimal price $P_t^*(j)$ is determined by solving the problem:

$$\max E_t \sum_{s=0}^{\infty} (\beta\rho_p)^s \left[P_t^*(j) y_{t+s}(j) - P_{t+s} y_{t+s}(j) mc_{t+s}\right], \tag{16}$$

subject to the demand function (14), and where mc_{t+s} denotes the real marginal cost in the period $t+s$.

The optimal price P_t^* and aggregate price law of motion are written in a similar way as in the case of wage:

$$P_t^* = \frac{\varepsilon_p}{\varepsilon_p - 1} \frac{E_t \sum_{s=0}^{\infty} (\beta\rho_w)^s P_{t+s} y_{t+s}(j) mc_{t+s}}{E_t \sum_{s=0}^{\infty} (\beta\rho_w)^s y_{t+s}(j)}, \tag{17}$$

and

$$P_t = \left[(1-\rho_p) P_t^{*1-\varepsilon_p} + \rho_p P_{t-1}^{1-\varepsilon_p}\right]^{\frac{1}{1-\varepsilon_p}}. \tag{18}$$

The New Keynesian Phillips Curve is obtained by log-linearization of (17) and (18) as follows:

$$\hat{\pi}_t = \beta E_t \hat{\pi}_{t+1} + \kappa_p \hat{mc}_t, \tag{19}$$

where $\kappa_p = (1-\beta\rho_p)(1-\rho_p)/\rho_p$.

3.5 Fiscal policy and Monetary policy

The government budget constraint is

$$P_t \tau_t + B_t = P_t g_t + R_{t-1} B_{t-1}, \tag{20}$$

where g_t denotes the real government spending. I assume a fiscal rule of the form

$$\hat{\tau}_t = \phi_b \hat{b}_{t-1} + \phi_g \hat{g}_t, \tag{21}$$

where $\hat{\tau}_t \equiv \frac{\tau_t - \tau}{y}$, $\hat{b}_t \equiv \frac{\frac{B_t}{P_t} - \frac{B}{P}}{y}$, and $\hat{g}_t \equiv \frac{g_t - g}{y}$.

In return, the monetary authority is assumed to set the nominal interest rate r_t according to a simple Taylor rule

$$\hat{r}_t = \phi_\pi \pi_t, \tag{22}$$

where a hat denotes the log deviation from the steady state value.

3.6 Aggregation and Market clearing

Aggregate consumption, lump-sum taxes, capital, investment, bond, and dividends are given by

$$\begin{aligned} c_t &= (1-\mu) c_t^R + \mu c_t^N; \quad k_t = (1-\mu) k_t^R; \quad b_t = (1-\mu) b_t^R; \\ \tau_t &= (1-\mu) \tau_t^R + \mu \tau_t^N; \quad i_t = (1-\mu) i_t^R; \quad d_t = (1-\mu) d_t^R. \end{aligned}$$

The clearing conditions of factor and goods market are expressed as

$$\begin{aligned} n_t &= \int_0^1 n_t(j) dj; \quad k_t = \int_0^1 k_t(j) dj; \\ y_t &= c_t + i_t + g_t. \end{aligned}$$

3.7 News process

I assume that the dynamics of government spending is expressed as

$$\hat{g}_t = \rho_g \hat{g}_{t-1} + \epsilon_t^g + \xi_{t-p}^g, \tag{23}$$

where ϵ_t^g denotes a surprise government spending shock at the period t, and ξ_{t-p}^g denotes an anticipated fiscal shock that realizes at period t but is announced in the period $t-p$. In benchmark calibration, the foresight period p is set to be 3. This is on the basis of the results in Section 2.

3.8 Calibration results and Sign restrictions

A period is assumed to be a quarter. I set the baseline parameters based on previous works. The degree of risk aversion γ and an inverse of labor supply substitution λ are estimated from 1.249 (Sugo and Ueda (2008)) to 1.912 (Iiboshi et al. (2008)) and from 2.077 (Iiboshi et al. (2008)) to 2.149 (Sugo and Ueda (2008)), respectively. Thus, these parameters are set to be 1.5 and 2, respectively. In the baseline setting, the share of Non-Ricadrian households μ equals to 0.3 as suggested by the estimates in Hatano (2004) and Iwata (2008).[7] I take $\rho_p = 0.70$ and $\rho_w = 0.55$, which are average values of the estimated results in the literature. The baseline policy parameters are based on Gali et al. (2007). The remaining parameters are displayed in Table 2.

In this paper, the impulse response functions (IRFs) are calculated under two parameterizations: a baseline NK model and a frictionless RBC model.[8] As noted in Perotti

[7]Kohara and Horioka (2006) also estimates the share of Non-Ricardian households by limiting to young married households in Japan. Their results indicate that 8 - 15 percent of young married households are faced with a borrowing constraint.

[8]In a frictionless case, I set $\rho_p = 0.01$, $\rho_w = 0.01$, $\mu = 0.01$, and $\kappa = 100$. Under these parameters, price and wage are almost flexible, and the large part of households are Ricardians. Moreover, an investment adjustment cost is ignorable.

(2008), there is no consensus on the theoretical effect of the fiscal policy. Therefore, on the basis of two polar models, I attempt to find out sign restrictions that can be accepted widely.

Figure 2 shows IRFs of some key variables to an anticipated government spending shock ξ^g_{t-p}. As noted above, I assume a three-period foresight ($p = 3$); that is, at period 1, everyone knows that the government spending increases at period 4. The solid lines refer to the IRFs of RBC model, and the dash lines refer to that of NK model.

The IRFs under the RBC model are easy to understand. Even in the period when the government spending does not change, an anticipated government spending shock generates the negative wealth effect. Hence, on the impact of news shock, the optimizing households decrease their consumption and increase their labor supply. As a result, the output rises, and the real wage lowers. Investment soar up in the foresight period because the households attempt to accumulate a capital stock before increasing tax on the basis of the consumption-smoothing motivation.

Conversely, IRFs under the NK model are difficult to interpret. Similar to the RBC setting, the response of consumption is negative on the impact because of the negative wealth effect. This effect also increases the labor supply. However, under the staggered pricing model, a negative response of consumption lowers the aggregate demand and shifts the labor demand curve to leftward. Therefore, labor and the real wage decline on the impact. When the government spending shock realizes, an increasing aggregate demand rises the labor demand. Therefore, labor and the real wage show positive responses at period 4. The path of output is the same as the one for labor. Since there exists an adjustment cost on investment, a positive response of investment seen in the RBC model is not observed in the baseline case.

Based on the calibration results and discussions in Section 2, I impose sign restrictions to the path of excess stock returns and public investment and GDP. Table 3 summarizes sign restrictions that are adopted in VAR analysis. The period of news shock denotes $t = 1$, while the period of the real shock denotes $t = 3, 4, 5$.[9] The sign restrictions in Table 3 indicate that an anticipated government spending shock affects excess stock returns positively, but it hardly affects public investment on an impact. Additionally, following the results in Section 2, the restriction that the public investment reaches a peak at the timing of the real shock is also imposed. In addition to the excess stock returns and public investment, a sign restriction is also imposed on GDP. Because GDP responds positively in both models when the shock is realized, I adopt this restriction to identify an anticipated government spending shock.

4 Estimation Methodology

Based on Uhlig (2005), I employ the sign restriction VAR to identify an anticipated government spending shock. The estimation processes are as follows.

First, I estimate the reduced form VAR model by OLS.

$$Y_t = C(L)Y_{t-1} + u_t, \tag{24}$$

where Y_t is a vector of endogenous variables, $C(L) = \boldsymbol{C} \equiv [C_0, C_1, \cdots, C_p]$ is a vector polynomial in the lag operator, and u_t is a vector of reduced form residuals with the variance-covariance matrix denoted by Σ. I define v_t as a vector of structural shocks that are mutually independent and normalized to be of variance 1, that is, $E(v_t v_t') = I$. In order to identify the shock, I have to specify a matrix A such as $u_t = Av_t$. A must be satisfied

$$\Sigma = E[u_t u_t'] = AE[v_t v_t]A' = AA'. \tag{25}$$

[9] In the theoretical model, I assume that the government spending shock is realized after three quarters when the news was announced. In reality, the implementation lags vary with each fiscal package. Thus, the period of the real shock is assumed to be $t = 3, 4, 5$.

Second, by using the estimated $\hat{\boldsymbol{C}}$ and $\hat{\Sigma}$, I take random draws $\boldsymbol{C}$ and Σ from a Normal-Wishart family. According to Uhlig (2005), Σ^{-1} follows a Wishart distribution $W(\hat{\Sigma}^{-1}/T, T)$, with T being the sample size. Further, conditioned on Σ, the coefficient matrix in its column-wise vectorized form, $vec(\boldsymbol{C})$, follows a Normal distribution, $N(vec(\boldsymbol{C}), \Sigma \otimes (X'X)^{-1})$, where X is the data matrix.

Third, in the context of each draw $(\boldsymbol{C}, \Sigma)$ obtained in the second step, I randomly generate matrix A such as $A = A_0 Q$, where A_0 is a lower triangular matrix that is given by the Cholesky decomposition of Σ, and Q is an orthogonal matrix obtained by Q-R decomposing a randomly generated matrix $B \sim N(0, 1)$.

Finally, the impulse response functions (IRFs) are calculated on the basis of each draw $(\boldsymbol{C}, \Sigma, A)$. If IRFs satisfy sign restrictions in Table 3, they are candidates for valid IRFs, and are reserved; otherwise they are discarded. By repeating the above processes, the range of IRFs that is consistent with the sign restrictions imposed in Table 3 is obtained. In this paper, the numbers of random draws are 500 for generating $\boldsymbol{C}$ and Σ, and 700 for generating A.

5 Data and Specification

I use quarterly data of the real GDP, private consumption, non-residential investment, public investment, tax revenue, the real wage, hours worked, and the excess stock returns on the construction industry for the period 1968Q1-2009Q4. The series, except for excess stock returns, are seasonally adjusted in per capita, and logarithmized. The first five variables are downloaded from the SNA database. Further, the series of the real wage and hours worked are obtained from the Monthly Labor Survey and the Labor Force Survey, respectively. The data on stock returns is used from *Kabushiki Toushi Syuueki Ritsu 2009* (Rate of Stock Returns 2009). By following Fisher and Peters (2010), I construct excess stock returns by subtracting the returns of the construction industry from the overall market returns. Moreover, similar to Fisher and Peters (2010), in order to discern noise and low frequency movements, the accumulated excess stock returns is used in the analysis below. The details of data descriptions are in Appendix A.

The estimated system is five-variables VAR that includes the excess stock returns, public investment, tax revenue, and GDP, and an additional variable. Further, it contains a constant term and a oil shock dummy (1973Q4). The numbers of lags is chosen to be four as suggested by the Akaike information criterion. The benchmark estimation is carried out in levels. Additionally, the system is estimated in the first differences for robustness checks.

In addition to the full-sample analysis, I also estimate the VAR model in two subsample. This is because several previous researches (e.g., Watanabe et al. (2010), and Ihori and Nakamoto (2005)) point out that the effect of the fiscal policy in Japan has changed recently. By following Watanabe et al. (2010), the sample period is divided into pre- and post-bubble period in this paper. The first subsample is 1968Q1-1986Q4, and the second subsample is 1987Q1-2009Q4.

6 Empirical Results

Figure 3 displays the response of variables to an anticipated public investment shock in the full sample. The IRFs are normalized so that the responses of public investment are 1% at the peak. The solid lines and shaded areas indicate IRFs and one-standard error bands, respectively. One can see that the evolutions of the excess stock returns, public investment, and GDP are as sign restrictions. Here, I focus on the variables and the periods in which any restriction is not imposed.

As it can be seen in the third row, an anticipated public investment shock has a persistent positive effect on consumption significantly. Furthermore, the peak of consumption occurs at the same time as the peak of public investment. The response of GDP on impact is also positive in spite of imposing no restrictions. With respect to the labor variables, the real wage, and hours worked do not respond significantly in the short run, and only the real wage shows a positive significant response in the long run. The large response of investment as seen in the RBC model is not observed, although it is not significant.

Overall, the estimated results in the full sample indicate that an anticipated public investment shock increases consumption and GDP significantly, while the responses of the other variables are almost insignificant.

Figure 4 shows IRFs in the first subsample. As seen in the results of the full sample, GDP exhibits a positive response during all horizons. Moreover, this positive response of GDP leads to an increase in the tax revenue in the long run, and it is slightly significant. Consumption also responds positively and persistently although it is not significant at the moment of news shock. In the context of the labor market variables, it seems that the path of the real wage is similar to the full-sample estimation. In contrast, the IRFs of hours worked change dramatically. The hours worked rises significantly after the public investment shock realizes, and it shows a hump-shaped response that is observed in the theoretical analysis. Unfortunately, the response of investment is also insignificant in the first subsample. However, its point estimator displays a positive response to the news shock, which is different from the full-sample result.

Subsequently, I discuss about the second subsample reported in Figure 5. In many empirical studies, it is said that the effect of the fiscal policy in Japan is diminishing during the Lost Decade or the Lost Two Decades. This fact can be also seen in my analysis. The response of GDP is no longer significant in the whole horizon. The confidence intervals of GDP contain zero in the first two periods and after the eleventh period. Further, the path of consumption returns to zero more rapidly as compared to the one in the first subsample. However, it observed that the public investment shock still has a positive effect on consumption even in the second subsample. The evolutions of the real wage and hours worked are also different from the ones in the first subsample. The real wage indicates positive responses to the news shock although it is insignificant, and it reaches a peak when the news shock realizes. With regard to hours worked, we cannot say anything because of the wide confidence intervals in the short run, while in the long run, the response is slightly negative. In return, the investment shows the same dynamics as seen in the full sample.

These results can be confirmed in robustness checks. Figure 6–8 display IRFs under the first differences estimations. In this specification, an anticipated fiscal policy increases GDP and consumption. The path of investment is also similar to the levels estimation except being significant in the second subsample. However, significant responses of the labor variable are no longer observed.

The above results imply the following facts. As noted in several studies, the effect of the fiscal policy becomes weaker after the collapse of the bubble economy even if the fiscal foresight is taken into account. However, in the post-bubble period, the expansion of the public investment still stimulates consumption and GDP. Therefore, it can be concluded that the results in the literature without fiscal foresight may underestimate the effect of the fiscal policy.

7 Discussion

As reported in the preceding sections, the empirical results show that an anticipated public investment shock leads to an expansion in consumption. However, the theoretical model in Section 3 does not produce a positive response on consumption. In addition to consumption, the evolutions of the other variables are also different between theory and empirics. The aim of this section is to find out the feasible parameters that are consistent with the empirical results.

In order to perform the above-mentioned task, I focus on two parameters: the inverse of labor supply elasticity λ and the share of Non-Ricardians μ. The former determines the slope of the labor supply curve (refer to (11) in Section 3); it becomes looser as the value of λ becomes smaller. Thus, in the case of λ taking a small value, it can be predicted that the decline of the real wage becomes small when the negative wealth effect shifts the labor supply curve rightward. In return, the share of Non-Ricardians affects the dynamics of the aggregate consumption through the behavior of Non-Ricardians. Since they only consume their current labor income, the fluctuations in disposable income are reflected in the path of their consumption.

Figure 9 depicts IRFs under three parameterizations: a benchmark (solid lines), $\lambda = 0.5$ (dashed lines), and $\lambda = 0.5, \mu = 0.5$ (chain lines). The value of λ is calculated by combining the elasticity of wage with respect to an output of 0.7 that is estimated in Nishizaki and Nakagawa (2000) with an elasticity of output with respect to hours of 0.3. The large value of μ is referred to in Campbell and Mankiw (1989).

Consider the case that only λ is low. In this situation, agents change their labor supply flexibly since the labor elasticity is high. As explained above, the low value of λ reduces the negative response of the real wage on the impact. At the same time, it is observed that labor increases more than the benchmark case when the shock realizes. This is because a loose inclination of the labor supply curve amplifies the expansionary effect that is brought by the rightward shift on the labor demand curve at the moment of realizing the shock. GDP also responds greatly compared to the benchmark case. The expansion of GDP dampens the negative effect on consumption, although the path of aggregate is still negative. This implies that in the case where most households are Ricardians, the negative wealth effect for Ricardians dominates a dynamic path of aggregate consumption. Consequently, it is found that only a low value of λ does not replicate empirical results adequately.

Furthermore, I consider the other case where a fraction of Non-Ricardians is also high. At a glance, the IRFs seem to be matching the empirical results, at least qualitatively. The aggregate consumption and real wage respond positively as observed in the empirical analysis. Furthermore, labor shows a hump-shape response as seen in the first subsample estimation. The intuition of these responses is as follows. At the moment of news shock, the mechanism working on the variables is similar to the case $\lambda = 0.5$. Thus, on the impact, the variables respond in the same manner as the previous case. However, consumption and the real wage show a large positive response when the shock realizes. The existence of Non-Ricardian plays key roles in this result. In addition, in this case, the increment in public investment rises the aggregate demand and subsequently, it induces the rightward shift on the labor demand curve. This increases the consumption of Non-Ricardians through a rise in the real wage and labor. Moreover, in order that this increment in consumption rises the aggregate demand and subsequently rises the labor demand, consumption and the real wage need to grow further. In contrast to the first case, this effect dominates the path of the aggregate consumption and leads to a positive response on consumption since the share of Non-Ricardians is high.

On the basis of the exercise in this section, it is found that the combination of a high elasticity of labor supply and a large fraction of Non-Ricardians produces IRFs that is consistent with the empirical results.

8 Concluding Remarks

This paper has analyzed the effect of an anticipated fiscal policy to regard the excess stock returns on the construction industry as the leading indicator of public investment. Additionally, in the estimations, I apply sign restriction VARs, in which signs are drawn from the Gali et al. (2007) type New Keynesian model.

The main findings are as follows. First, in the full-sample estimation, an anticipated fiscal policy shock that is captured as an increment in the excess stock returns increases GDP and consumption persistently. Conversely, labor, the real wage, and investment hardly show significant responses. Second, it is observed that the expansionary effect of the fiscal policy on GDP and consumption has reduced recently, as pointed out in many literatures. However, the results in this paper still show a positive effect on these variables. This implies that the previous works may underestimate the effect of the fiscal policy owing to the ignorance of fiscal foresight. Finally, IRFs obtained in the empirical analysis can replicate in the NK model with a high elasticity of labor supply and a large share of Non-Ricardians. In other words, in the economy where most agents face borrowing constraints and change their labor supply flexibly, the fiscal policy stimulates GDP and consumption greatly. This consideration might be a clue to solve the question why the effect of the fiscal policy continues to decline in recent years. I shall address this concern in further research.

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Appendix A Data Source

Appendix A.1 GDP, private consumption, non-residential investment, and public investment

With respect to these data, the seasonal adjustment and real value series are downloaded from the SNA database. 68SNA is used as the data for 1968–1979, while 93SNA is used after 1980. I extend the data of 93SNA using the growth rate of 68SNA and construct the data of the whole period. Moreover, by dividing them by total population obtained from Population Census (Ministry of Internal Affair and Communications), I obtain the per capita data.

Appendix A.2 Tax revenue

The data source of tax revenue is also the SNA database. With regard to the data for 1980–2009, I sum up the data of "Taxes on production and imports, receivable" and "Current taxes on income, wealth ,etc., receivable" that are downloaded from the Income and Outlay Accounts classified by the Institutional Sectors on General Government in 93SNA. In the context of the data for 1968–1979, the tax revenue is defined as the sum of "Indirect taxes" and "Direct taxes" in 68SNA. Both of tax data are nominal and non-seasonal adjustment. Thus, I realize them using the GDP deflator that is constructed by the same way as the above variables. Thereafter, I combine the tax data in 68SNA and 93SNA using the growth rate of 68SNA. Finally, the seasonal adjustment is performed by X-12-ARIMA. The tax revenue is also obtained as the per capita data.

Appendix A.3 Real wage

The series of the real wage is obtained from the Monthly Labor Survey (Ministry of Health, Labor, and Welfare). Since the dataset that has already been seasonally adjusted is only from 1970, I download the non-seasonal adjusted series and perform a seasonal adjustment.

Appendix A.4 Hours worked

The data of hours worked is constructed as follows.

$$\begin{aligned}\text{Hours worked} = \;& \text{Aggregate weekly hours of work (Non-agricultural industries)}\\ & \div \text{Employed person in non-agricultural industries}\end{aligned}$$

These data are downloaded from the Labor Force Survey (Ministry of Internal Affairs and Communications).

Appendix A.5 Excess stock returns

Based on Fisher and Peters (2010), I define the excess stock returns of construction industry as

$$\begin{aligned}\text{Excess stock returns} = {} & \text{Stock returns on construction industry} \\ & - \text{Stock returns on whole market.}\end{aligned}$$

The data is used from *Kabushiki Tōshisyueki Ritsu 2009*. As noted, I employ the accumulated excess stock returns, which is the sum of the excess stock returns, in the analysis.

Appendix B Table and Figure

Table 1: Granger Causality

	lag length		
	4	6	8
levels	0.000	0.000	0.000
first deferences	0.011	0.006	0.012

Notes: H_0 : excess stock returns does not Granger cause public investment. The values denote p-value.

Table 2: Calibration Parameters

Parameter	Value	Description
β	0.99	Subjective discount rate
δ	0.06	Depreciation rate
α	0.3	Share of capital
γ	1.5	Risk aversion
λ	2	Inverse labor supply elasticity
μ	0.3	Share of Non-Ricardians
κ	0.15	Investment adjustment cost
ρ_p	0.70	Calvo parameters on prices
ρ_w	0.55	Calvo parameters on wages
ε_p	6	Elasticity of substitution in production
ε_w	6	Elasticity of substitution in labor input
s_g	0.2	Steady-state share of government spending
ϕ_g	0.1	Elasticity of tax to government spending
ϕ_b	0.33	Elasticity of tax to debt
ϕ_π	1.5	Monetary policy response of π
ρ_g	0.9	persistency of government spending shock

Notes: Calibration parameters are based on Iiboshi et al. (2008), Sugo and Ueda (2008), and Iwata (2009).

Table 3: Sign Restrictions

	Excess Stock Returns		Public Investment		GDP	
period	news shock	real shock	news shock	real shock	news shock	real shock
Anticipated Fiscal Policy Shock	$+$		$-0.001 \sim 0.001$	$+$ (max)		$+$

Notes: Sign restrictions imposing VAR analysis. Blank spaces mean that any sign restrictions are not imposed. The period of news shock denotes $t = 1$ and that of real shock denotes $t = 3, 4, 5$.

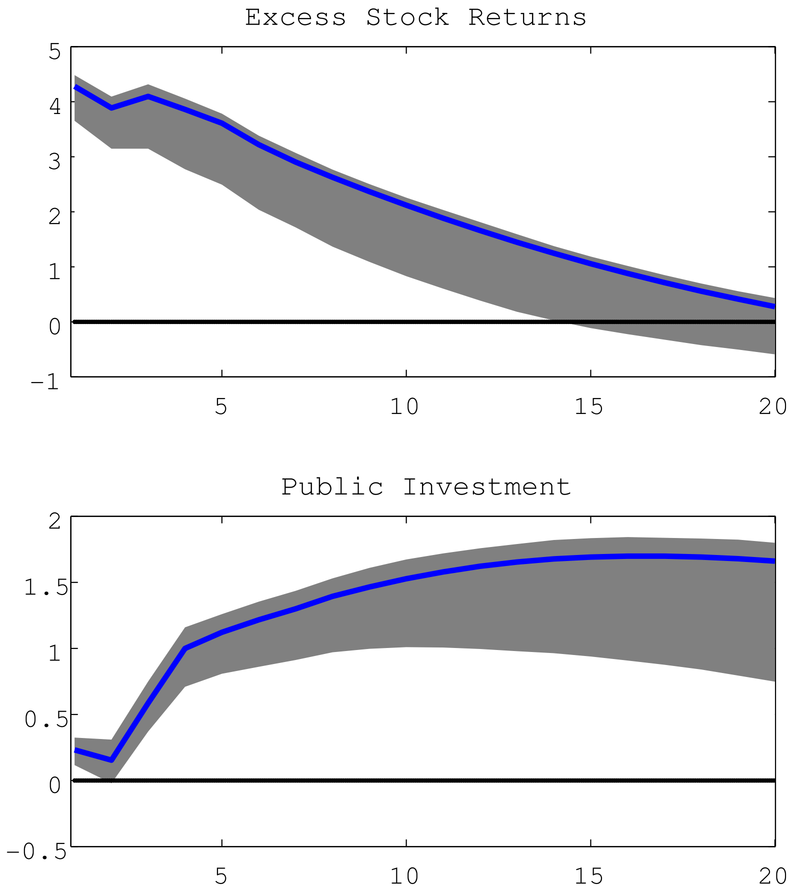

Figure 1: Impulse Response Function

Notes: Impulse response functions (IRFs) to an anticipated public investment shock. Solid lines and shaded areas indicate the estimated IRFs and one-standard error band bootstrapped confidence intervals, respectively.

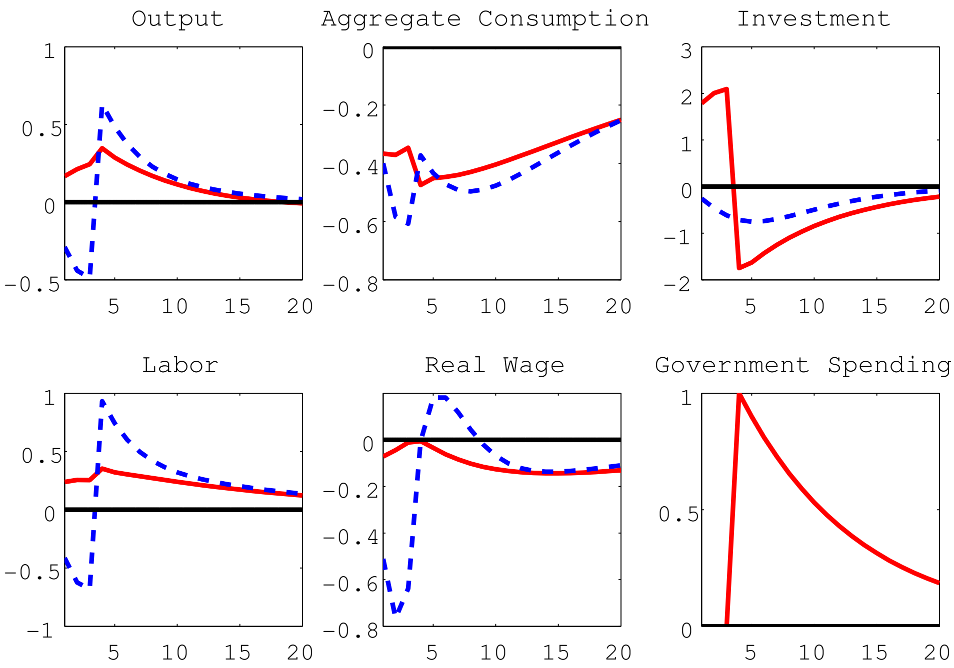

Figure 2: Impulse Response Function

Notes: Impulse response functions to an anticipated government spending shock in the theoretical model. Solid lines are IRFs under the frictionless parameterization; dash lines under the baseline parameterization.

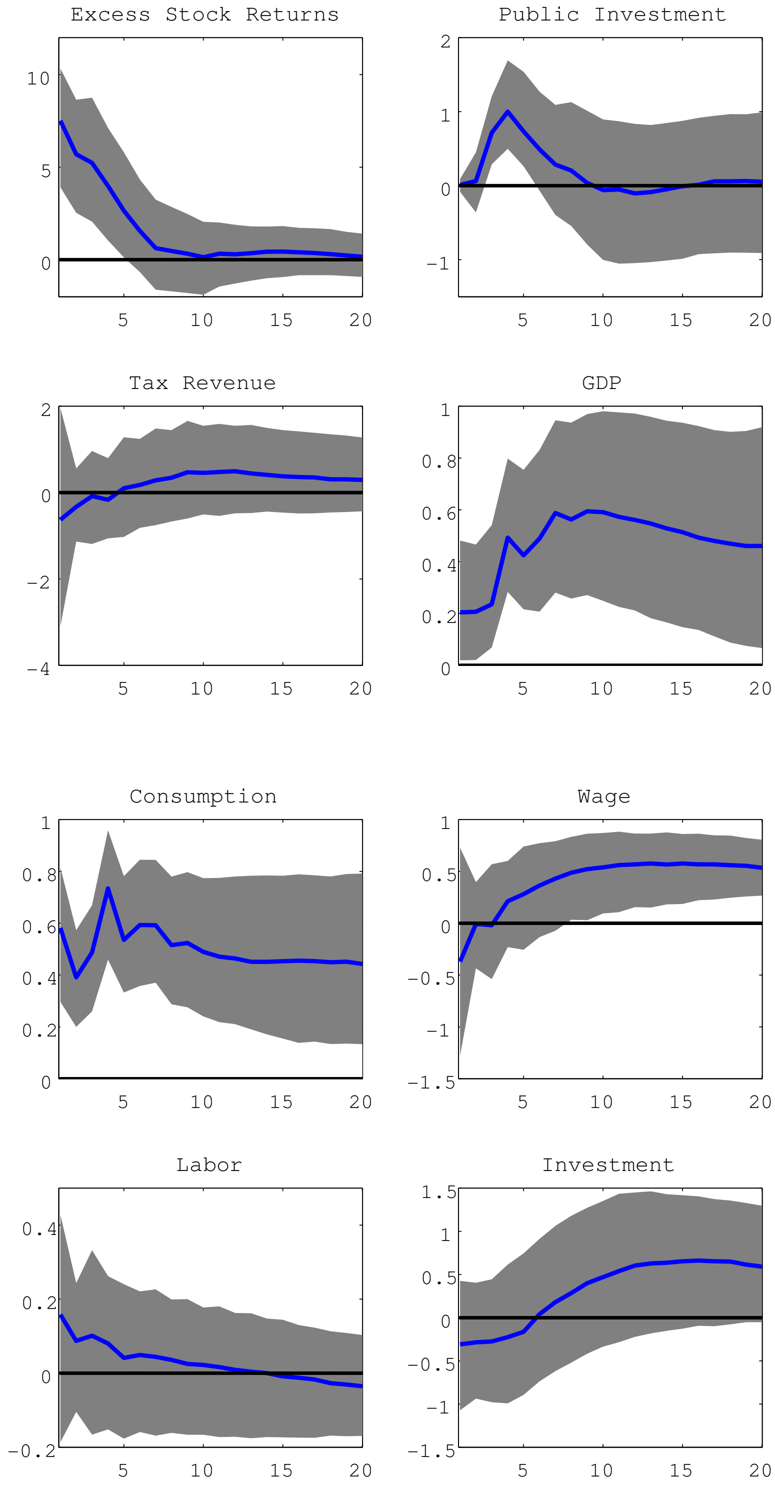

Figure 3: Impulse Response Functions (Levels) : 1968Q1-2009Q4

Notes: Solid lines are IRFs that are 50th quantiles of a valid draw and shaded areas are one-standard error band that are 16th and 84th quantiles.

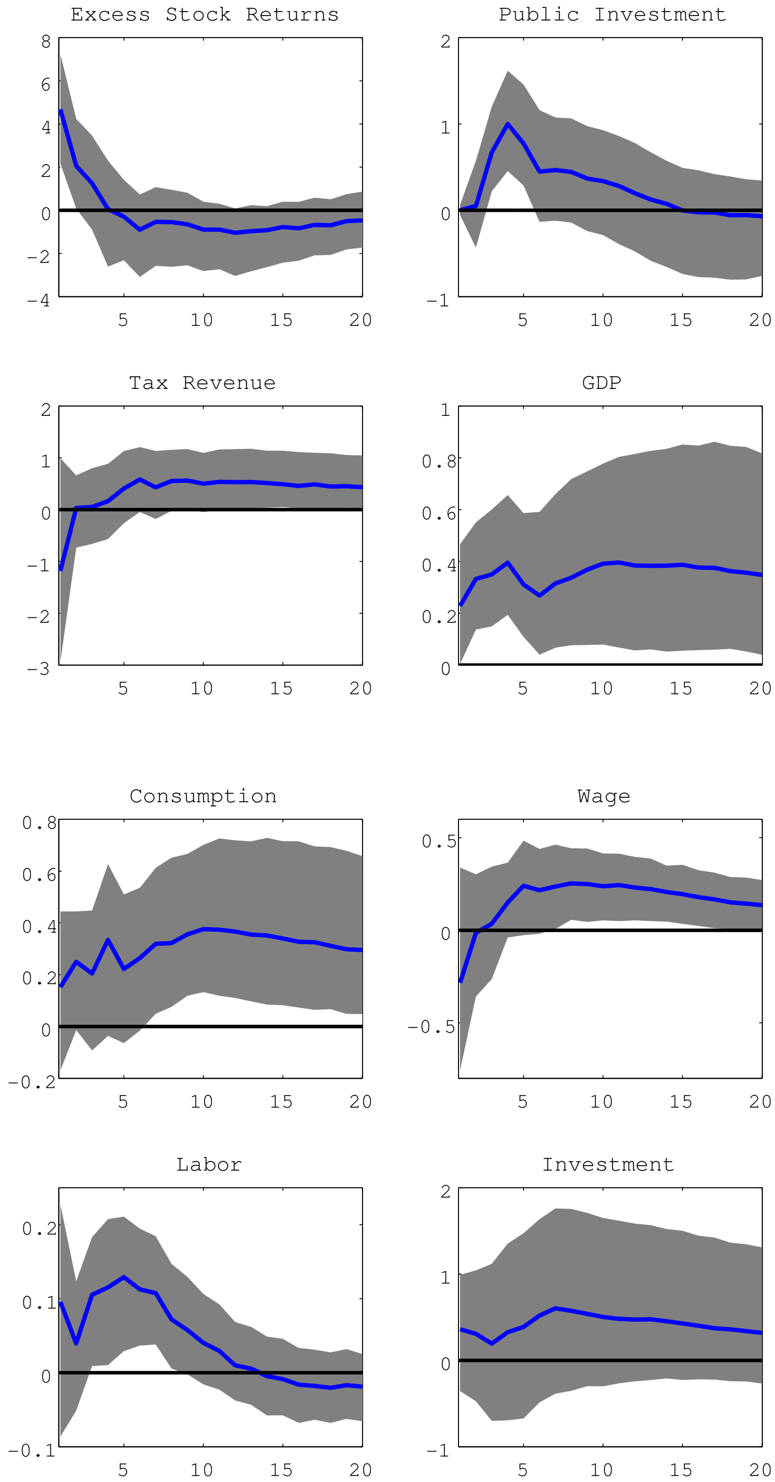

Figure 4: Impulse Response Functions (Levels) : 1968Q1-1986Q4

Notes: Solid lines are IRFs that are 50th quantiles of a valid draw and shaded areas are one-standard error band that are 16th and 84th quantiles.

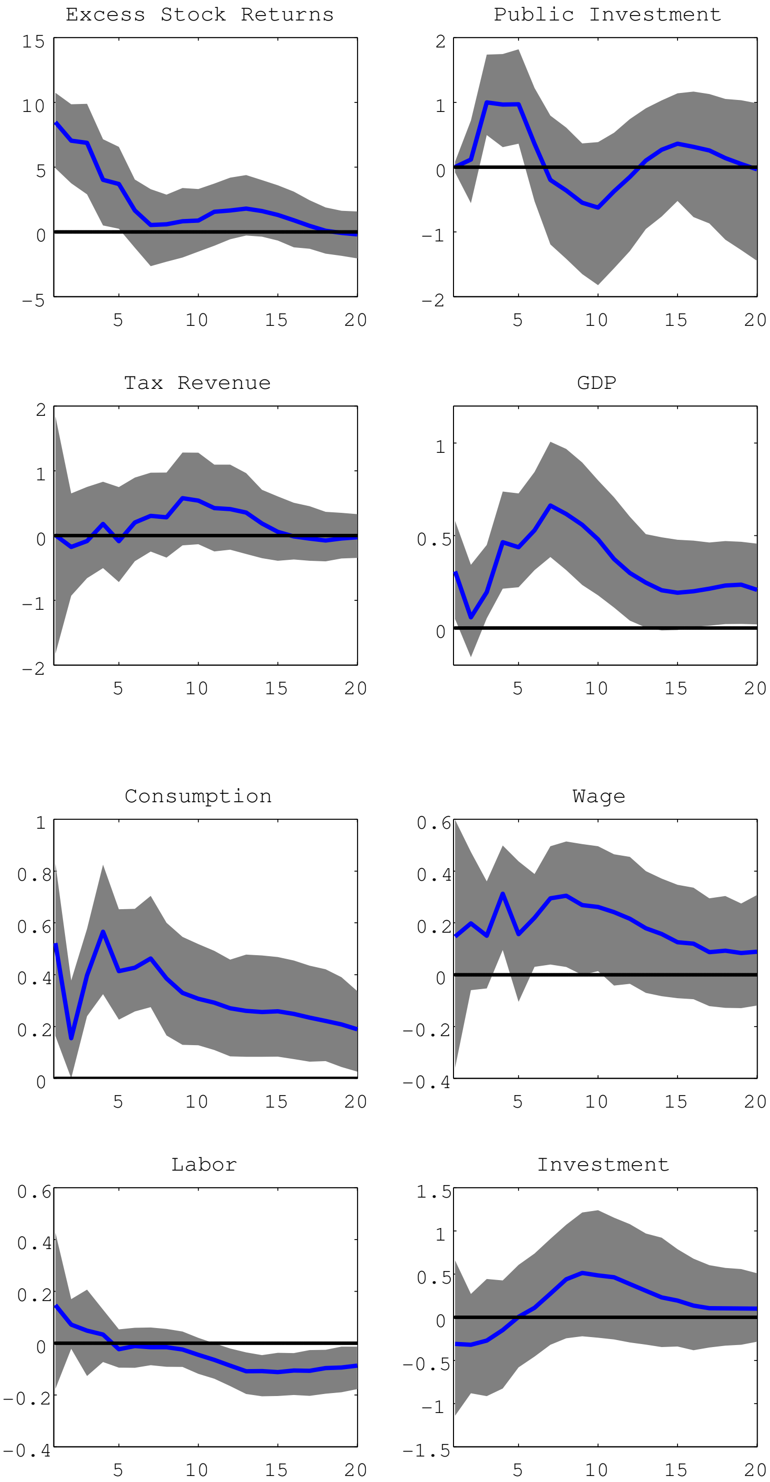

Figure 5: Impulse Response Functions (Levels) : 1987Q1-2009Q4

Notes: Solid lines are IRFs that are 50th quantiles of a valid draw and shaded areas are one-standard error band that are 16th and 84th quantiles.

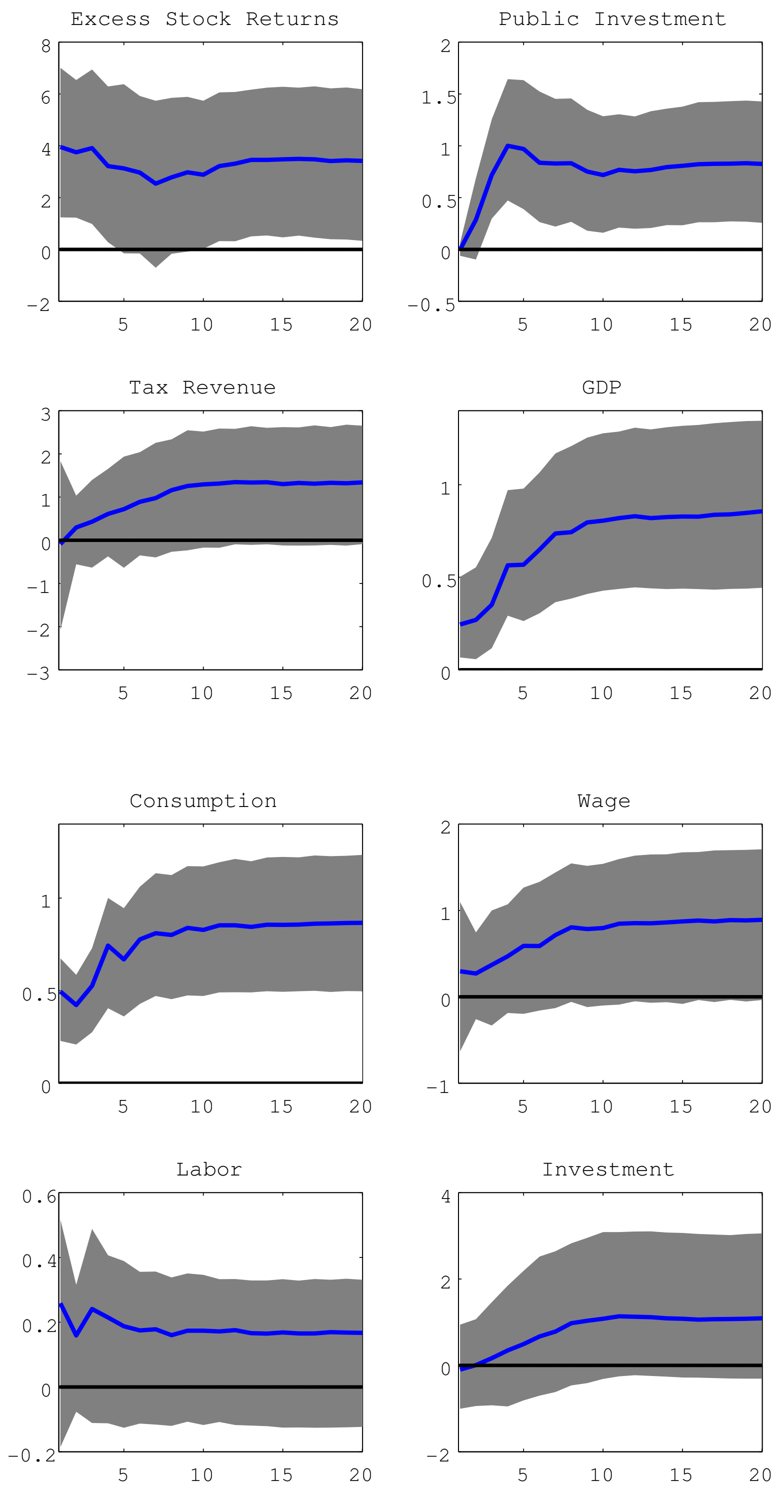

Figure 6: Impulse Response Functions (First differences) : 1968Q1-2009Q4

Notes: Solid lines are IRFs that are 50th quantiles of a valid draw and shaded areas are one-standard error band that are 16th and 84th quantiles.

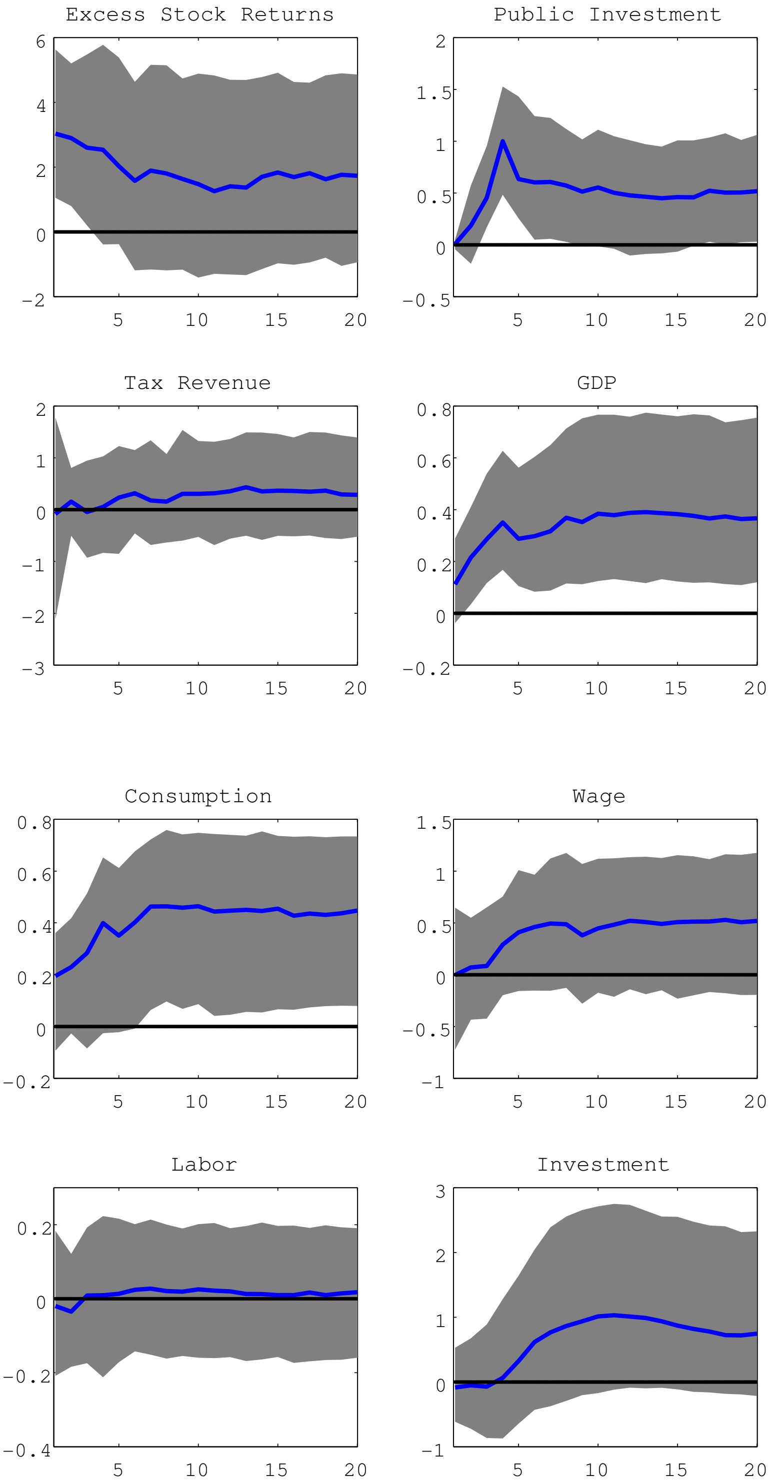

Figure 7: Impulse Response Functions (First differences) : 1968Q1-1986Q4

Notes: Solid lines are IRFs that are 50th quantiles of a valid draw and shaded areas are one-standard error band that are 16th and 84th quantiles.

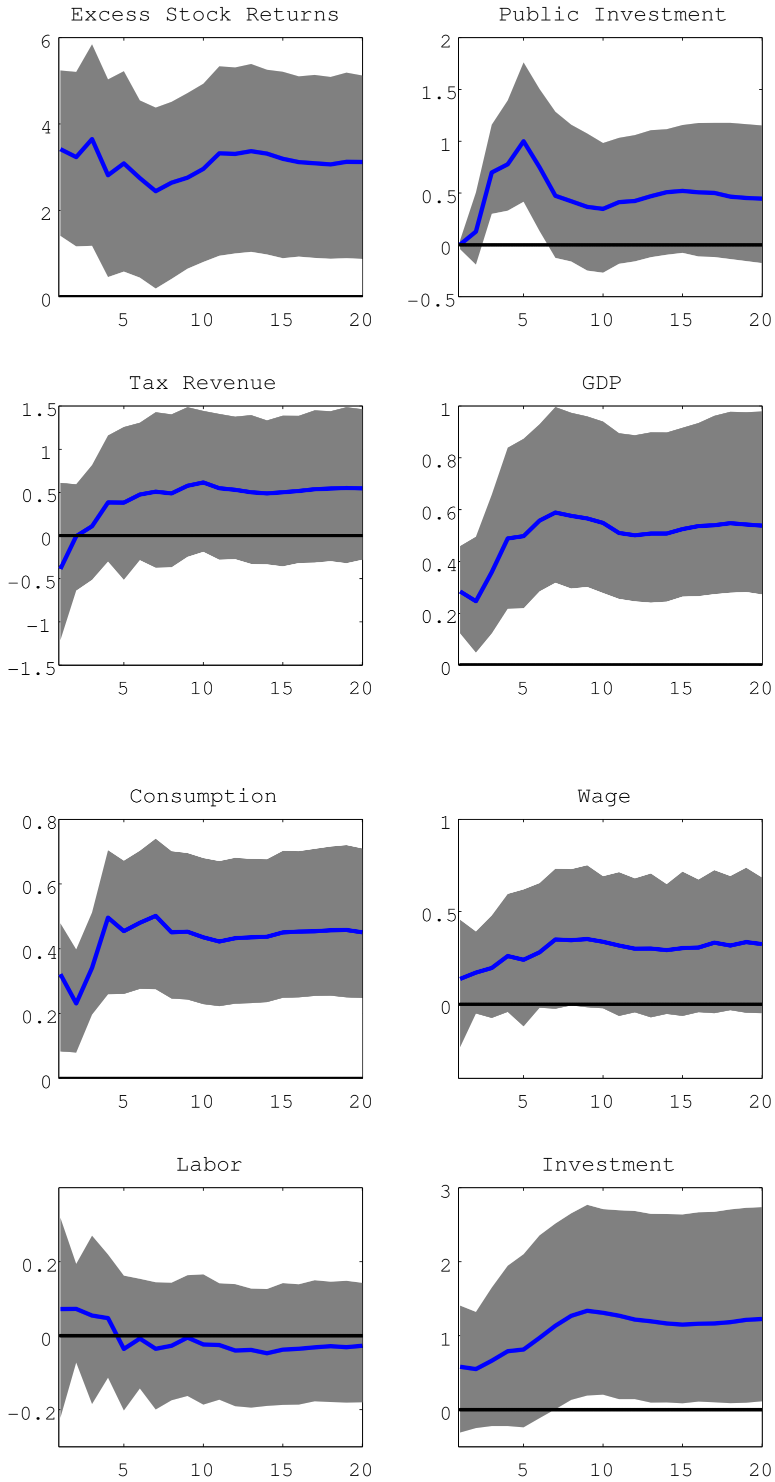

Figure 8: Impulse Response Functions (First differences) : 1987Q1-2009Q4

Notes: Solid lines are IRFs that are 50th quantiles of a valid draw and shaded areas are one-standard error band that are 16th and 84th quantiles.

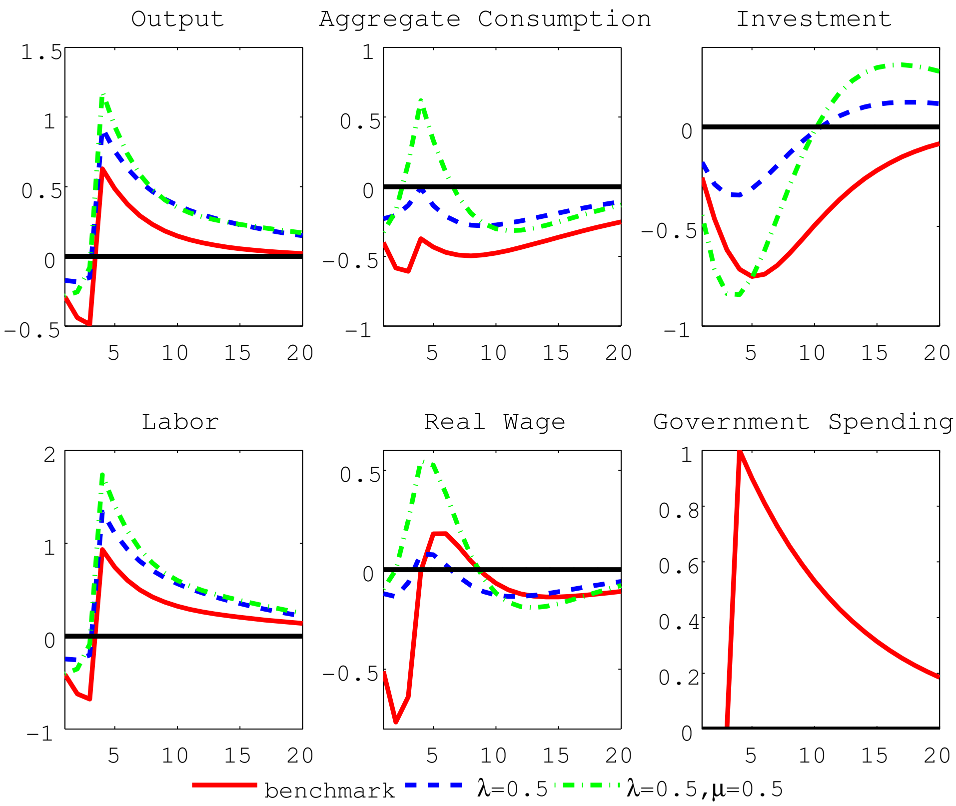

Figure 9: Impulse Response Functions