Macroeconomic Effects of Government Spending in Japan

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Abstract

It is often recognized that government spending shocks are well anticipated before they actually materialize. This paper uses a new approach that is possible to identify a government spending shock as both an unanticipated and an anticipated (i.e. news) shock to study the macroeconomic effects of government spending in Japan. We find that, in the whole sample 1968Q1-2010Q1, there is a clear difference between an unanticipated government spending shock and an anticipated one: the former significantly increases both GDP and consumption while the latter does not. We also find that government spending is effective in terms of simulating the economy in the pre-bubble period, but in the post-bubble period it is not and even aggravates the business cycle fluctuations at some horizons.

Keywords: Government spending, Japanese economy, News shock, VAR, Sign restriction.

JEL codes: E32, F33, F41.

1. Introduction

At least since the proposal of Keynes to increase government spending to save the economy from the Great Depression in the 1930s, fiscal policy, a policy that involves changes in government spending or taxes, has actively been used by governments in modern capitalist countries to control macroeconomic fluctuations. The recent worldwide financial and economic crisis presents a good example of this: governments in the U.S., Europe, Japan, China, and many other countries announced and implemented large scale fiscal stimulus

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[2] I benefited from the discussion with Etsuro Shioji and members of the Shioji seminar (Hitotsubashi University), especially the discussion on fiscal policy. Much of what I learned there goes into this paper. Some of the ideas here were developed during a joint work on news shocks with Jun-Hyung Ko. Hiroshi Morita helped me to collect part of the data used in the paper. I am solely responsible for any remaining errors in the paper.

packages in an attempt to first prevent their economies from falling into a deeper crisis, and next hopefully to bring them back to the normal condition.

Given this importance of fiscal policy, economists have long been interested in understanding its effects on the macroeconomy both empirically and theoretically. Regarding government spending, which is the focus of this paper, so far the literature is divided on several issues. On the theoretical front, traditional Keynesian models, for example the IS-LM model, predict that in response to an increase in government spending, output and consumption increase, and investment falls due to the rise in the interest rate caused by the upward shift of the IS curve. In contrast, a standard neoclassical model predicts that the increase in government spending will sooner or later require an increase in tax on the households, reducing their permanent income, and thus reducing their consumption. Households wishing to smooth their consumption will reduce their leisure and increase their labor supply. This causes output to increase, and also raises the marginal product of capital.[3] The latter effect induces firms to invest more and thus investment increases. New Keynesian models, which add distortions and frictions such as price stickiness, myopia of agents, adjustment cost of investment etc to the neoclassical framework, could produce results consistent with both of the types of models noted above depending on the parameter values or the functional forms assumed. Conflicting implications are also observed for other variables such as real wage, hours worked and so on.[4] On the empirical front, existing evidence seems to be mixed too, depending on the data and the methodology adopted. Using a structural vector autoregression (SVAR), Blanchard and Perotti (2002), Perotti (2005), and Gali et al. (2007), among others, find that consumption increases after a positive government spending shock. In contrast, using the event study approach, Ramey and Shapiro (1998), Edelberg et al. (1999), and Burnside et al. (2004), among others, find the opposite: consumption falls in response to the government spending shock. Different findings also exist for other variables such as investment, real wage, and hours worked.

One important problem facing the researcher when identifying government spending shocks (and fiscal policy shocks in general) is that these shocks often possess the property of news shocks,[5] i.e. these shocks are anticipated by the time they actually materialize. Take the case of an increase in government spending. This policy must follow a series of

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[3] These are known as the *wealth effects* of government spending.

[4] See for example Gali et al. (2007) and Perotti (2008) for details.

legislative procedure such as debates and approval in the Parliament, and even after it is approved and announced there usually is administrative procedure needed to be done before it is implemented, thus giving rise to the time lag between the announcement and the implementation. During these processes, there is no reason why the private sector cannot anticipate the policy and incorporate that information into their decision making. Given this news shock property of government spending shocks, if one fails to identify them, one might come up with misleading results. Although has been recognized, many studies, the above mentioned ones included, fail to develop a useful method to deal with this problem. Fortunately, there are some developments along this line recently. Extending the method of Ramey and Shapiro (1998), Ramey (2011) shows that the timing of shocks to be identified is indeed crucial, and constructs a news series to control for the problem. In a different paper, Mountford and Uhlig (2009) propose a different approach using SVAR identified by sign restrictions. While the method of Ramey (2011) has the strength of being able to incorporate into the VAR additional information other than that contained in the macro data, the method of Mountford and Uhlig (2009) is more systematic and more applicable when it is not easy to collect information on news. Both studies are conducted using the U.S. data.

The purpose of this paper is to apply the method of Mountford and Uhlig (2009) to the case of Japan. The reasons for choosing Japan are as follows. First, macro data for Japan is rich and available for a long period of time, and with this data we can provide some new findings using the new method noted above and contribute to the long and active debate on the effects of government spending. Second, and more importantly, there has been a wide debate on the role of fiscal policy in Japan, given the fact that the Japanese government actively used fiscal policy to stimulate the economy during the so called "lost decade" which started from the collapse of the asset bubble at the beginning of the 1990s. This active policy notwithstanding, the economy was not brought out of the long stagnation, and thus fiscal policy is often criticized for being ineffective to bring the economy out of the long stagnation.[6] Although there is already a large literature on the role of fiscal policy in Japan,[7] I wish to provide some new evidence and shed some new light on this issue by using a new method and a sample long enough to include the lost decade period and the

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[5] Recently understanding the role news shocks has emerged as one of the newest issues in macroeconomics. See the original contribution of Beaudry and Portier (2006).

[6] Another criticism is the accumulated of government debt, with the debt GDP ratio being now about 2.

period prior to that. My main focus is on the effects of government spending on output, consumption, investment, the price level, and stock prices, but I also present some results on employment, work hours, and the unemployment rate.

The rest of the paper is organized as follows. Section 2 explains the empirical methodology. Section 3 describes the data and estimation. Results and analysis are provided in section 4. Section 5 concludes the paper.

2. The Empirical Methodology

In order to study the effects of a government spending shock, we need to identify it. To do this task, we adopt the SVAR approach of Mountford and Uhlig (2009) in which shocks are identified by sign restrictions. A government spending shock is defined as an exogenous change in government spending. Note that in reality some part of the change in government spending is endogenous in the sense that it responds to fluctuations of the business cycles. Thus we need to control for this part, and to do that we introduce one more shock, namely a business cycle shock. We require the government spending shock to be orthogonal to the business cycle shock. The method used here is different from the conventional SVAR in that we do not need to identify all shocks (whose number is the same as the number of endogenous variables in the VAR) but instead we are able to identify only a subset of them, which in this case consists of the above two shocks.

We identify these shocks by imposing sign restrictions on the impulse response functions (IRFs) of macroeconomic variables to them. The sign restrictions are described in Table 1. A business cycle shock is defined as a shock that raises output, consumption, investment, and tax revenue of the government for some period (defined below as the first six quarters after the shock). Theoretically, we can think of this shock as a TFP shock, a monetary shock, or a demand shock that increases both consumption and investment. On the other hand, a government spending shock is defined as a shock that is orthogonal to the business cycle shock noted above and that raises government spending for some period. To allow the government spending shock to be a news shock, we impose the restrictions such that government spending remains unchanged for the first several quarters (denote this number of quarters by s), and then increases for the next some quarters. If s=0, the shock is an un-

[7] See for example Bayoumi (2001), Watanabe et al. (2001), Ihori et al. (2003), and Ihori and Nakamoto (2005), Fukuda (2002), Fukuda and Kei (2002), Nakazato (2002), Kobayashi and Komaki (2003), Miyazaki (2009, 2010), and Takeuchi (2011).

anticipated one and we are back to the conventional SVAR used in many existing studies. If instead $s>0$, the shock is an anticipated one (or a news shock) and we have a new identification scheme. Thus this is a crucial point to distinguish the new approach here with the ones used so far in the literature.

Table 1: The list of variables in the VAR and sign restrictions imposed

Endogenous variables in the VAR	Business cycle shock	Government spending shock
Government spending		0 & +
GDP	+	
Consumption	+	
Investment	+	
Tax revenue	+	
Stock price		
Price level (CPI)		
Total Employment		
Work hours per workers		
Unemployment		

Notes: A "+" means that the variable must increase for several periods right after the shock. A cell with a blank indicates that no sign restriction is imposed and the corresponding IRF is left agnostic. A government spending shock is identified as a news shock such that, in response to this shock, government spending remains unchanged for the first few periods, and then increases for several periods after that.

Details of the methodology are described by the following steps, which are based on Mountford and Uhlig (2009) and Uhlig (2005).[8]

Step 1: Estimate the following reduced-form VAR,

$$x_t = B_0 + B_1 x_{t-1} + B_2 x_{t-2} + ... + B_p x_{t-p} + u_t \qquad (1),$$

where x_t is a vector of endogenous (macroeconomic) variables of size $n\times1$, t denotes quarter t, $B_j (j=1,\cdots,p)$ are coefficient matrices of size $n\times n$, p is the lag length, and u_t is a $n\times1$ vector of residuals. Let Σ of size $n\times n$ be the residual variance-covariance matrix, and A of size $n\times n$ be the matrix that relates the residuals vector and the structural shocks vector ε_t, that is, $u_t=A\varepsilon_t$.

[8] See also Vu (2009) for details of the procedure and an application of a SVAR with sign restrictions.

We will identify only the business cycle and government spending shocks which are the first and second elements of ε. Note that the ordering here is important in controlling for the endogenous part of government spending that reacts to business cycle fluctuations. To identify the two shocks we need to identify the first and second columns of A.

Step 2: Based on the estimated matrices $\hat{\Sigma}$ and $\hat{B}$ obtained in step 1, randomly generate Σ and B from the inverse Wishart and Normal distributions, respectively.

Step 3: For each pair B, Σ randomly generate a vector q_1 of size $n\times1$ with length equal to unity, and calculate the impulse response vector to the first shock at some horizion k as follows,

$$r_1(k) = \sum_{j=1}^{n} q_{1,j} c_j(k),$$

where $q_{1,j}$ is the j-th element of q_1, and c_j is the j-th impulse response vector obtained using Cholesky decomposition at horizon k. The impulse response vector to the second shock at horizion k, $r_2(k)$, is calculated similarly, except that now we add two types of restrictions on the vector q_2:(i) q_2 must be orthogonal to q_1; and (ii) $Cq_2=0$ (the 'news shock' restriction) where C is a matrix of size $(n-s-1)\times n$ and

$$C = \begin{bmatrix} c_{i,1}(0) & \cdots & c_{i,n}(0) \\ \vdots & \cdots & \vdots \\ c_{i,1}(s) & \cdots & c_{i,n}(s) \\ q_{1,1} & \cdots & q_{1,n} \end{bmatrix},$$

where s is number of horizons required for the shock to materialize since its news is revealed, and $c_{i,j}(k)$ is the response of the i-th variable (which is government spending) to the j-th impulse response vector obtained using Cholesky decomposition at horizon k ($k=0,\ldots,s$). With these restrictions, we need to randomly generate only $n-s-1$ elements of q_2.

Step 4: Check if the signs of the elements of $r_1(k)$ and $r_2(k)$ which are subject to the sign restrictions described in Table 1 satisfy the restrictions or not. If they are, call this a valid case and store $r_1(k)$ and $r_2(k)$, otherwise discard the pair (q_1, q_2). Perform this task for a certain number of times (say 100).

Step 5: Repeat steps 2 through 4 until obtaining a certain number of valid cases (say 500). Finally, use the set of $r_1(k)$ and $r_2(k)$ obtained to calculate and report the 16th, 50th, and 84thquantiles of these impulse responses.

3. Data and Estimation

Quarterly data of the following ten variables are used in the VAR model: GDP, private consumption, private investment, government spending, tax revenue, employment, work hours per worker, the unemployment rate, CPI, and stock prices. The sample period is 1968Q1-2010Q1, which is long enough to allow us to divide the sample into the sub-samples of the lost decade and the period prior to that. The first five series are in real terms and are from the SNA database, they are created by merging 68SNA and 93SNA data. Private investment is the sum of residential and nonresidential investment. Government spending is the sum of government consumption and public investment. Tax revenue is the sum of nominal direct and indirect tax revenue and then is divided by the GDP deflator (also available from the SNA database) to transform to the real series. The next three series are taken from the Labor Force Survey which can be downloaded from the homepage of the Ministry of Health, Labor, and Welfare. The last two series are from the OECD database with stock prices being the Nikkei average index. The inclusion of stock prices is to see whether the news on government spending be reflected in this forward-looking variable. All series are seasonal adjusted, and are in logarithms, except the unemployment rate which is in percentage. Following the conventional way in the literature, the first seven series are divided by population to transform to per capita terms before taking logarithms. The data of population is downloaded from the homepage of the Statistics Bureau, Ministry of Internal Affairs and Communications.

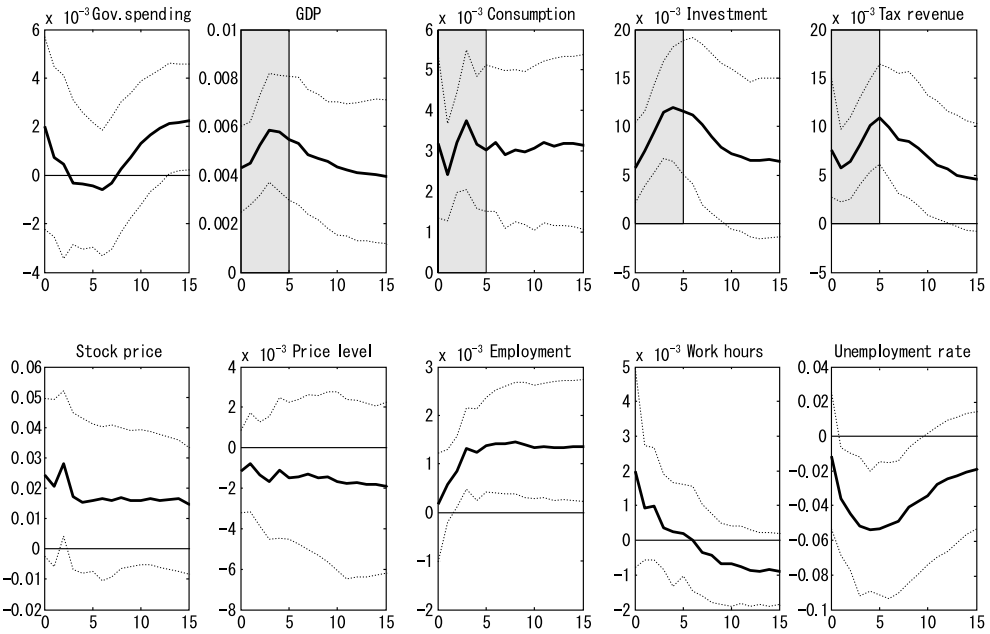
Using these data series, the reduced-form VAR model is estimated with all variables in levels. This is suggested by Hamilton (1994) to take into account the possibility that there might be some cointegration relationships between the variables. The lag length is chosen to be four, but a robustness check reveals that the results obtained when the lag length is six are very similar to those reported below.

4. Results and Analysis

Using the IRFs obtained from the estimated SVAR we can analyze the effects of shocks on the macroeconomic variables in the VAR. Figures 1-7 show the these effects corresponding to different shocks or different sample periods. In each box of a figure, numbers in the horizontal axis are quarters after the shock, and those in the vertical axis are percentage changes in the corresponding variables. Dashed lines are 16th and 84th quantiles, while solid lines are 50th quantiles. Shaded areas indicate the time intervals in which sign re-

strictions are imposed. With the shaded areas one can see graphically how the sign restrictions in Table 1 are imposed in the SVAR. We will look at the figures one by one with a focus on the IRFs that are left agnostic, i.e. without any restrictions imposed.

Figure 1:Effects of a business cycle shock when a government spending shock is identified as an unaticipated shock, estimated using the whole sample 1968Q1-2010Q1



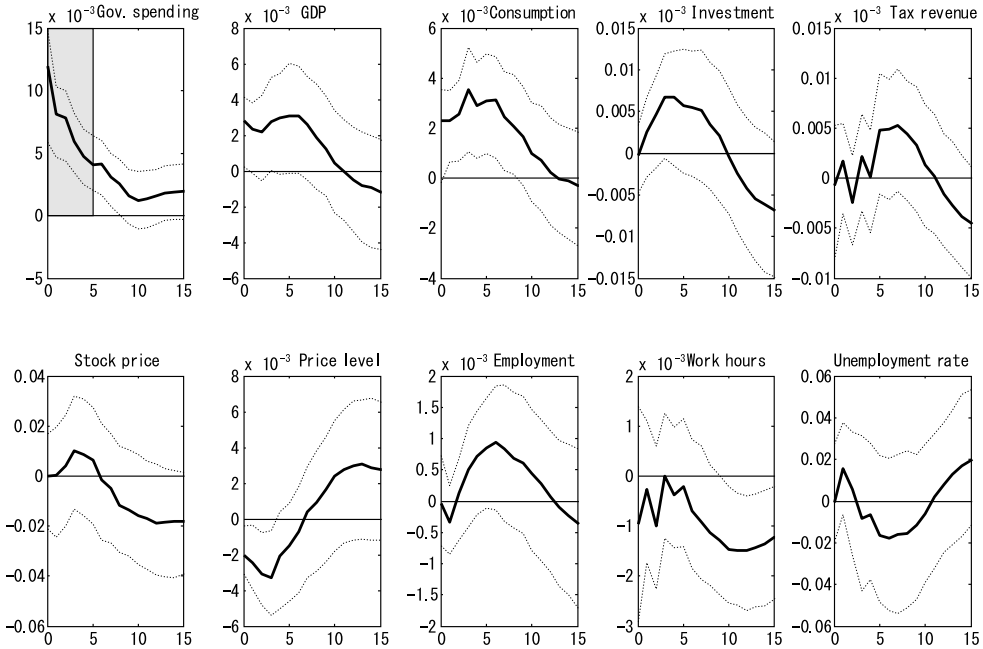
Notes: Numbers in the horizontal axis are quarters after the shock, while those in the vertical axis are percentage changes in the corresponding variables. Dashed lines are 16th and 84th quantiles, while solid lines are 50th quantiles. Shaded areas indicate the time intervals in which sign restrictions are imposed.

Effects of a business cycle shock

Figure 1 displays the effects of a business cycle shock identified in the case in which a government spending shock is identified as an unanticipated shock and the whole sample (1968Q1-2010Q1) is used. We observed that the shock significantly increases the stock price and employment, while reducing the unemployment rate at a few quarters after it occurs. On the other hand, the effects on government spending, the price level and work hours are not significant. The effect on the price level is intuitive because the business cycle shocks here are a mix of supply and demand shocks which have opposite effects on the

price level. Since our main interest is in the government spending shocks, below we will focus on them.

Figure 2: Effects of an unanticipated government spending shock, estimated using the whole sample 1968Q1-2010Q1



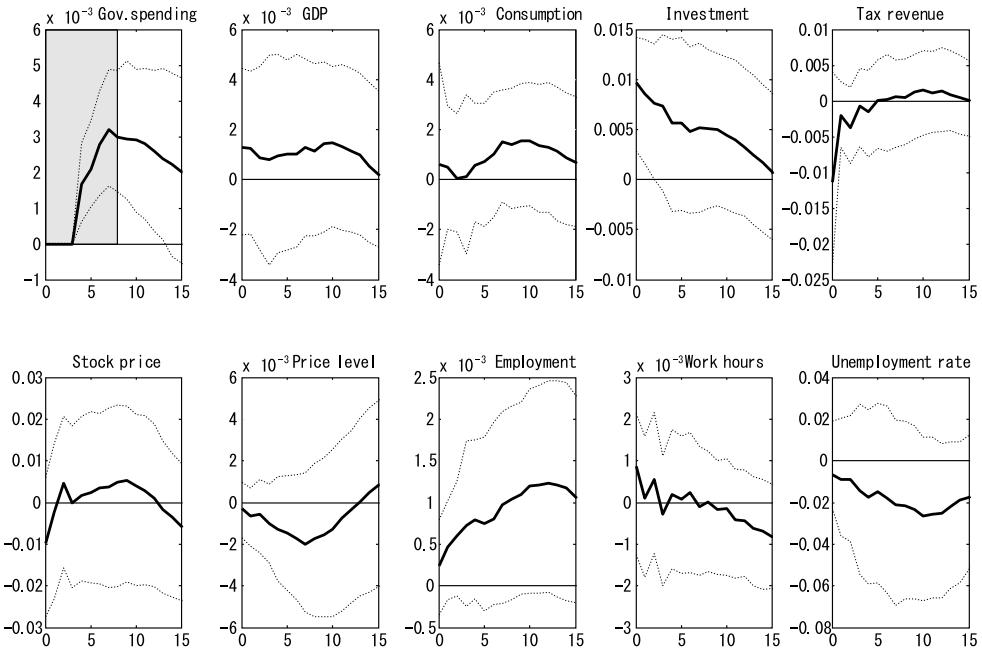
Notes: Numbers in the horizontal axis are quarters after the shock, while those in the vertical axis are percentage changes in the corresponding variables. Dashed lines are 16th and 84th quantiles, while solid lines are 50th quantiles. Shaded areas indicate the time intervals in which sign restrictions are imposed.

Effects of an unanticipated government spending shock

Figure 2 shows the effects of an unanticipated government spending shock estimated using the whole sample 1968Q1-2010Q1. One can see that the shock raises GDP (at the impact) and consumption. This result is similar to that of many existing studies using recursive SVAR, and is also consistent with the prediction of traditional Keynesian and some versions of New Keynesian models. The effect on investment, however, is not significant. The price level falls rather than rises. This is puzzling given that government spending shock is a demand shock, but it is similar to the finding of Mountford and Uhlig (2009) using data

of the U.S. The effect on the stock price is insignificant, which is consistent with the finding of Fukuda (2002). The government spending shock also has no significant effects on the labor market variables such as employment, work hours and the unemployment rate.

Figure 3: Effects of a 4-quarter-ahead anticipated government spending shock, estimated using the whole sample 1968Q1-2010Q1



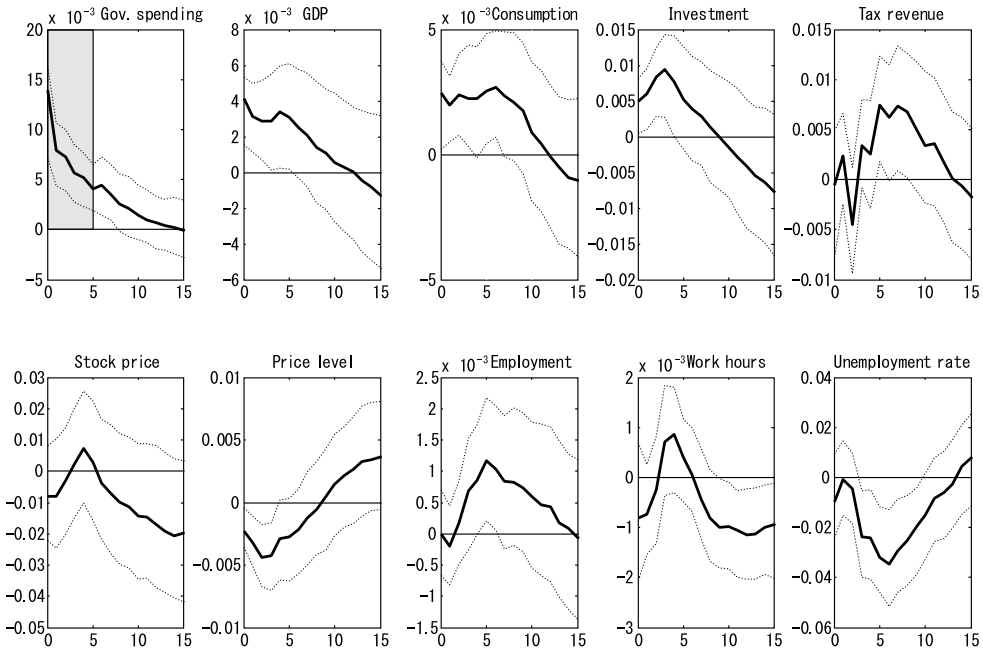
Notes: Numbers in the horizontal axis are quarters after the shock, while those in the vertical axis are percentage changes in the corresponding variables. Dashed lines are 16th and 84th quantiles, while solid lines are 50th quantiles. Shaded areas indicate the time intervals in which sign restrictions are imposed.

Effects of an anticipated government spending shock

The effects of a 4-quarter-ahead anticipated government spending shock (or a news shock) estimated using the whole sample 1968Q1-2010Q1 are presented in Figure 3. We can see from the response of government spending what is meant by a "news shock": government spending remains unchanged for the first four quarters and only starts rising in the 4th quarters, but this change is anticipated by the agents in the economy at quarter 0 and thus other variables respond before government spending actually rises. Turning to the effects of the shock, we observe that when the government spending shock is identified as

a news shock, the responses of GDP and consumptions turn insignificant. This is totally different from the case of an unanticipated shock analyzed above, and it implies that government spending is not effective in stimulating the economy in Japan, at least in terms of GDP. The shock, however, does have positive effects on employment and investment. Since theoretical implications regarding a news shock to government spending are not yet well established (at least to the best knowledge of the author), we can not say much about the likely underlying mechanism here.[9] The above results indicate that the timing of the government spending shock is crucial, and this is one more piece of evidence supporting the argument of Ramey (2011).

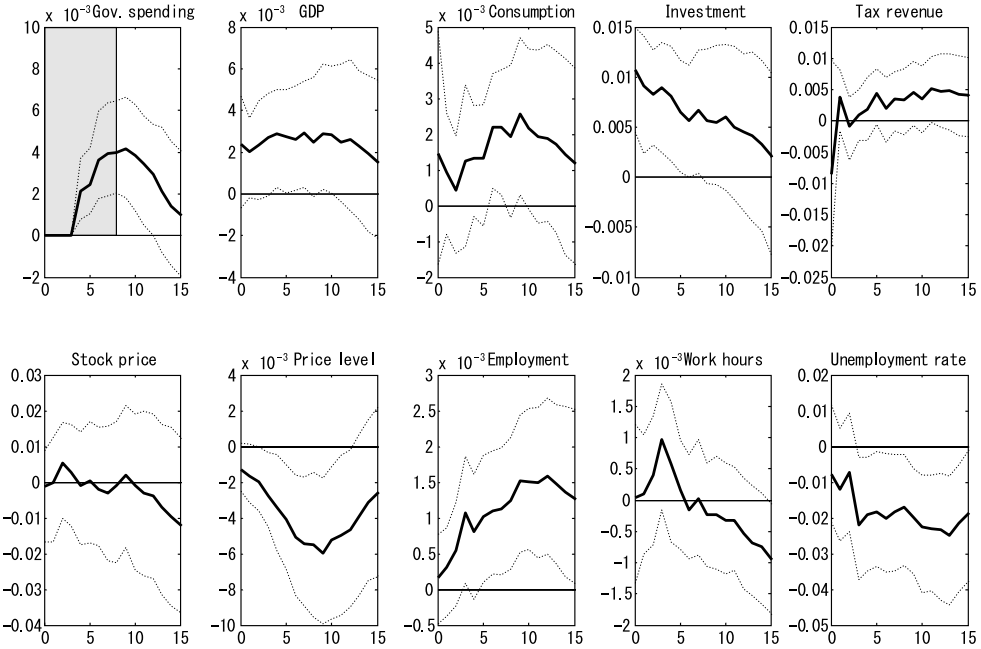
Figure 4: Effects of an unanticipated government spending shock, estimated using the sub-sample 1968Q1-1992Q4



Notes: Numbers in the horizontal axis are quarters after the shock, while those in the vertical axis are percentage changes in the corresponding variables. Dashed lines are 16th and 84th quantiles, while solid lines are 50th quantiles. Shaded areas indicate the time intervals in which sign restrictions are imposed.

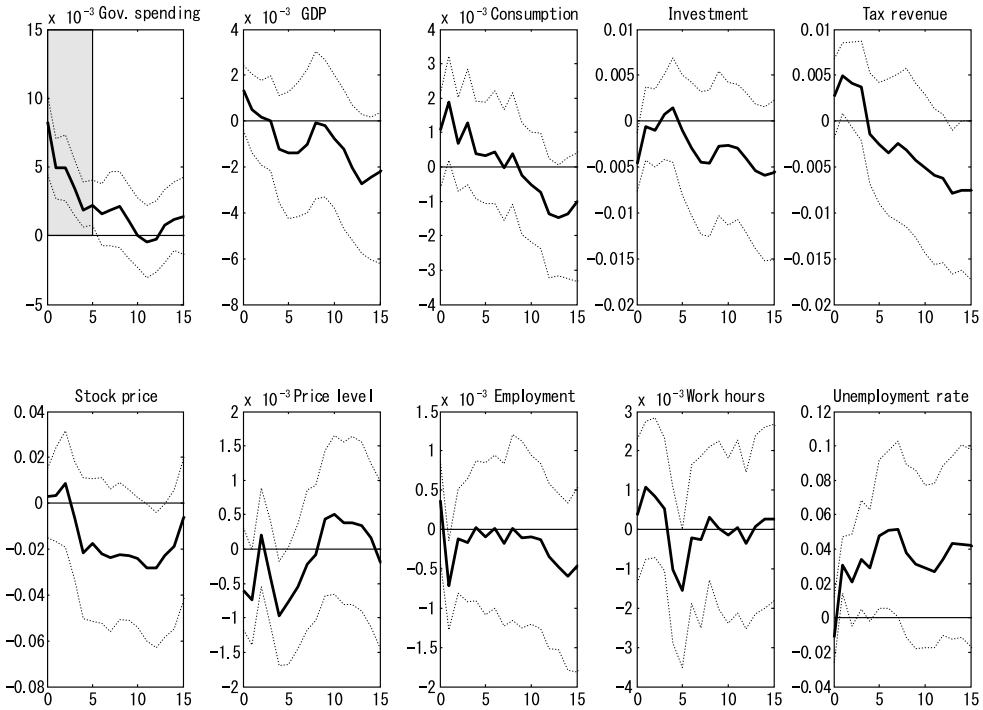
[9] Building a theoretical model (probably a DSGE one) to explain the effects of a news shock to government spending would be an interesting future task.

Figure 5: Effects of a 4-quarter-ahead anticipated government spending shock, estimated using the sub-sample 1968Q1-1992Q4



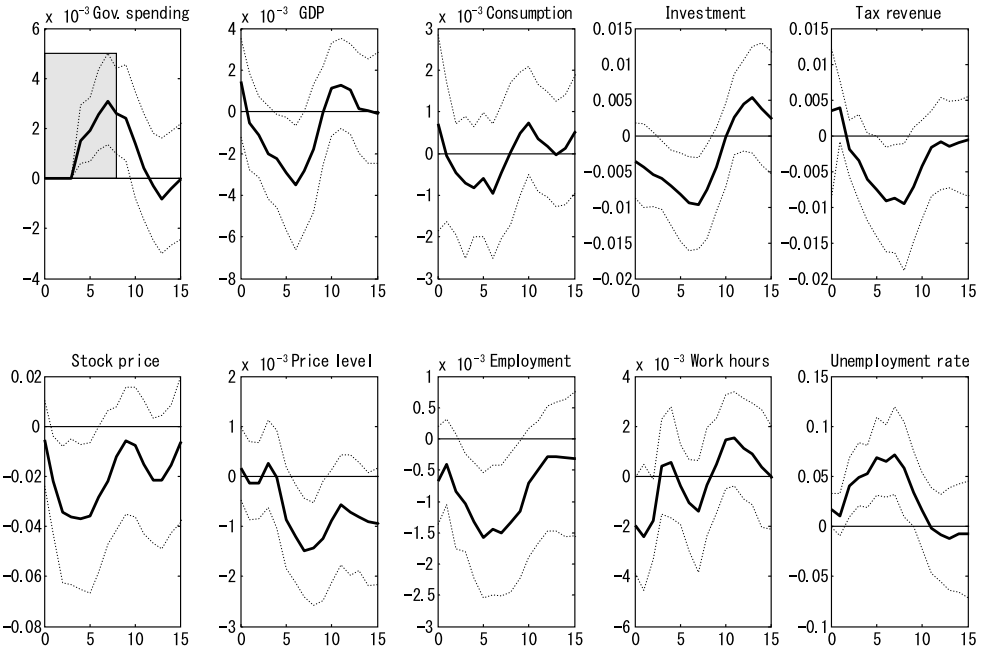
Notes: Numbers in the horizontal axis are quarters after the shock, while those in the vertical axis are percentage changes in the corresponding variables. Dashed lines are 16th and 84th quantiles, while solid lines are 50th quantiles. Shaded areas indicate the time intervals in which sign restrictions are imposed.

Figure 6: Effects of an unanticipated government spending shock, estimated using the sub-sample 1993Q1-2010Q1



Notes: Numbers in the horizontal axis are quarters after the shock, while those in the vertical axis are percentage changes in the corresponding variables. Dashed lines are 16th and 84th quantiles, while solid lines are 50th quantiles. Shaded areas indicate the time intervals in which sign restrictions are imposed.

Figure 7: Effects of a 4-quarter-ahead anticipated government spending shock, estimated using the sub-sample 1993Q1-2010Q1



Notes: Numbers in the horizontal axis are quarters after the shock, while those in the vertical axis are percentage changes in the corresponding variables. Dashed lines are 16th and 84th quantiles, while solid lines are 50th quantiles. Shaded areas indicate the time intervals in which sign restrictions are imposed.

Effects of a government spending shock: does the sample period matter?

Many studies argue that fiscal policy in Japan has become less effective over the last two decades or so. Explanations for this are that there might have been some structural change in the economy in around the asset bubble period, or that the accumulated government debt could have played some role in affecting the effects of fiscal policy. Recently, using a Bayesian approach Takeuchi (2011) endogenously estimates the timing of structural change and finds that it is around the year 1992. Following her finding, we divide the sample into two sub-samples with the sample periods being 1968Q1-1992Q4 and 1993Q1-2010Q1, respectively, and reestimate the SVAR model to see if there is any difference in the effects of government spending between the two. The results are shown in Figures 4-7. Concerning the effects of an unanticipated government spending shock, it can be seen that government spending has stronger effects in the 1968Q1-1992Q4 sub-sample than in the

1993Q1-2010Q1 sub-sample: an increase in government spending raises GDP, consumption, investment, and employment and reduces the unemployment rate significantly in the former sub-sample (Figure 4), while it does not do so, but even raises the unemployment rate in the latter sub-sample (Figure 6). As for the effects of an anticipated government spending shock, we observe a more contrast picture: the news shock to government spending raises GDP, consumption, investment, and employment and reduces the unemployment rate in the first sub-sample (Figure 5), while it even reduces GDP and employment and raises the unemployment rate in the second (Figure 7). Given that government spending shocks are more likely anticipated shocks (than unanticipated ones), the above result implies that during the lost decade period, active government spending policy not only could not stimulate the Japanese economy but even worsened it.

Some additional observations can be made regarding the results using the 1968Q1-1992Q4 sub-sample. First, the difference between the effects of an unanticipated government spending shock and those of the anticipated one is less clear here, except the case of the effect on consumption. The effects of an unanticipated government spending shock on GDP, consumption and investment appear to be consistent with some New Keynesian models but not with the traditional Keynesian models: all the three variables increase in response to the shock. The response of the price level remains puzzling: it falls rather than rises.

5. Concluding Remarks

In this paper we have adopted a new approach that is possible to identify a government spending shock as both an unanticipated and an anticipated (i.e. news) shock to study the macroeconomic effects of government spending in Japan. We find that, in the whole sample, there is a clear difference between an unanticipated government spending shock and an anticipated one: the former significantly increases both GDP and consumption while the latter does not. The results using the whole sample lend support to traditional Keynesian models and some New Keynesian models. We also find that, the effects of government spending are very different between the two sub-samples of 1968Q1-1992Q4 and 1993Q1-2010Q1: in the first one government spending is very effective while in the second one it is not and even aggravates the business cycle fluctuations at some horizons. This suggests there might have been some structural change in the Japanese economy around the asset bubble period. Results using the 1968Q1-1992Q4 sub-sample are consistent with some

New Keynesian models but not with the traditional Keynesian and neoclassical models: GDP, consumption, and investment all increase in response to an unanticipated government spending shock.

Several important tasks are left untouched in the paper. We have not paid attention to the quantitative effects of government spending shocks, especially we have not calculated the government spending multiplier. We need a theoretical model to explain the channels through which news shocks to government spending affect the macroeconomy. In addition, not only government spending but tax policy is also actively used by the Japanese government, thus examining the effects of tax policy is also important. It is also interesting to consider the effects of accumulated government debt, a big issue in Japan and many other countries, on the effects of fiscal policy. Further research is required along these lines.

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