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Table of Contents

Preface

Overview of the Thesis

The purpose of this thesis is to examine the effectiveness of fiscal expansion in Japan. After the bubble burst in the early 1990s, many fiscal countermeasures have been implemented to revive the sluggish Japanese economy. However, the results of these policies are apparently not successful, which then have aroused some criticisms on the effectiveness of the fiscal expansion. Moreover, the resulting public debt of more than 200% of Japan's GDP has become a new problem and is regarded as a restriction for the effectiveness of the expansion.

However, as discussed in the text, these arguments were not always accompanied with rigorous empirical analyses. In this thesis, we investigate three topics that have not been sufficiently analyzed so far.

Chapter 1[1] examines the relationship between budget deficits, government debt, and interest rates. Traditionally, an increase in budget deficits or government debt is said to raise interest rates. Nevertheless, the 10-year Japanese Government Bond (JGB, hereafter) yields have remained steady at 2% or less since 1997, even though the long-term debt at the central and local government levels increased from ¥492 trillion at the end of FY 1997 to about ¥819 trillion at the end of FY 2009; that is, from 96% to 172% of Japan's GDP.

Do budget deficits and government debt have any effect on real interest rates in Japan? Contrary to expectations, few studies have investigated this issue with reference to Japan. Therefore, this study analyzes the relationship between budget deficits, government debt, and interest rates using two methods. First, employing the event study method, we find that the market participants consider the Japanese prime ministers' directions, declarations, and implicit suggestions regarding economic countermeasures as signals for future fiscal expansion. In addition, the probability that the JGB yields increase by these statements correlates with the monthly increments in the leading index of business conditions and the number of newly issued bonds in the relevant supplementary budgets. Secondly, by estimating the reduced form equations for the long-term interest rates, we find that a percentage point increase in both the projected/current deficit-to-GDP ratio and projected/current

[1] *Journal of the Japanese and International Economies*, 32, pp105-124. 2014.

primary-deficit-to-GDP ratio raises real 10-year interest rates by 26–34 basis points. However, the increases in the projected deficit are found to be more significant than the current deficit. In addition, we find that the current government debt to GDP ratio raises the rates by only 1.2 basis points at the most. These results suggest that the projected deficit is important than the current deficit and that budget deficits have larger effects than government debt, which are consistent with Feldstein (1986). Moreover, using factorial decomposition based on estimation result in the current deficit case, we estimate that the real budget deficit in 2008 causes an approximately 2 to 3% increase in the JGB yields, which reduces the real GDP by 0.39 to 0.63 percentage points in 2008.

Chapter 2[2] explores the possibility of the existence of non-Keynesian effects in Japan. The effectiveness of fiscal stimulus has received significant research attention since the collapse of the global financial services firm Lehman Brothers. Although most studies agree on the existence of Keynesian multiplier effects, several studies also demonstrate the existence of non-Keynesian effects. What explains the lack of consensus in the current body of literature? In this thesis, we aim to bridge the two views by estimating a near-vector autoregressive (near-VAR) system that includes the interaction terms of fiscal instruments with the debt-to-GDP or the primary-deficit-to-GDP ratios. Moreover, to embed the dynamics of the debt-to-GDP ratio in the analysis, we follow Favero and Giavazzi (2007) and explicitly incorporate the government budget constraint.

Our results are as follows: First, we find that the impulse response functions (IRFs, hereafter) of the government expenditure shock show the Keynesian features in general; however, the effects of tax increases on the GDP are Ricardian. This is not rare in fiscal VARs, however, as shown in Hebous (2011). Second, the primary-deficit-to-GDP ratios are statistically effective as the signal of fiscal condition, but the debt-to-GDP ratios are not. Finally, when we derive the IRFs for GDP by changing the initial values of the quarterly primary-deficit-to-GDP ratio from 0.000 to 0.015 and 0.03, the non-Keynesian features emerge in both the government expenditure case and the tax revenue case. In short, we conclude that an increasing primary-deficit-to-GDP ratio gives rise to non-Keynesian effects.

Chapter 3[3] investigates the causes of changes in the effectiveness of fiscal stimuli in Japan. Numerous studies have pointed out that the effects of these expenditures have diminished since around the 1990s. However, none of these studies has statistically explored the reasons for this diminution. The purpose of this study is to statistically investigate these reasons, using a threshold vector autoregression (VAR), in which the causes pointed out in the literature are adopted as the threshold. If the null hypothesis that the estimated parameters are equal under each regime is rejected,

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[2] *Asian Economic and Policy Review*, 7, pp227-243. 2012. The definitive version is available at http://onlinelibrary.wiley.com/doi/10.1111/j.1748-3131.2012.01238.x/

[3] *Japan and the World Economy,* DOI: 10.1016/j.japwor.2014.04.003, forthcoming.

we can conclude that a given cause does affect the macroeconomic structure and, in turn, affect the fiscal policy effects. We then estimate the IRFs in both sample periods, as constructed on the basis of threshold estimates, and compare the effects of fiscal policy in each period.

Based on our results, we find that the diffusion index of the financial institutions' lending attitudes and the yearly change in the annual average of the quarterly ratios of the structural primary budget balance to potential GDP significantly reject the null hypothesis. Therefore, we conclude that these variables have a definite impact on the effectiveness of fiscal expansion. Second, the IRFs show that the effects are traditional, although there are some notable differences. In particular, when banks' lending attitude is tight and the government's financial condition is bad, the demand-enhancing effects of government expenditure should be considered weak. In this regard, the traditional accelerator effects of private investment, the existence of liquidity-constrained households, and non-Keynesian effects are key operative concepts.

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To write this thesis, I have received assistance and encouragement from many people. First of all, Naoyuki Yoshino gave me the basic principles of academic thoughts and the importance of research ideas. Moreover, he understood me well and made me realize not to compromise on the quality of my research. Sahoko Kaji, my undergraduate supervisor, showed me the significance of economics. Michihiro Ohyama, my graduate supervisor, taught me the importance of logic. I owe my sincere thanks to these three supervisors.

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Chapter 1

Budget Deficits, Government Debt, and Long-Term Interest Rates in Japan*

1. Introduction

Traditionally, an increase in budget deficits or government debt is said to raise interest rates. Nevertheless, the 10-year Japanese Government Bond (JGB, hereafter) yields have remained steady at 2% or less since 1997, even though long-term debt at the central and local government levels increased from ¥492 trillion at the end of FY 1997 to about ¥819 trillion at the end of FY 2009; that is, from 96% to 172% of Japan's GDP.[1,2]

Do budget deficits and government debt have any effect on real interest rates in Japan? Contrary to expectations, few studies have investigated this issue in reference to Japan. Moreover, these studies are not based on the vast body of pre-existing literature that challenged this traditional proposition empirically for developed countries, particularly the US. Recently, Doi and Ihori (2009) pointed out the possibility of future tax hikes as the cause of low interest rates. However, this study does not analyze the point statistically.

The purpose of this study is to re-analyze the effect of budget deficits and government debt on real long-term interest rates in Japan using academic wisdom accumulated from previous studies. Looking at the huge body of previous literature followed by the seminal study of Plosser (1982), we classify these studies into two categories based on their conclusions. The first category of literature concludes that no significantly positive relationship exists between budget deficits or government debt and interest rates, and attributes the discussion to the Ricardian equivalence proposition. For example, Plosser (1982, 1987) and Evans (1987) revealed that fiscal variables do not significantly affect long-term interest rates, following an analysis based on a vector autoregression (VAR) macroeconometric model embedded with a rational expectations model of the term structure of interest rates. However, Elmendorf and Mankiw (1999) pointed out the poor fitness and robustness

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[1] Incidentally, the gross debt-to-GDP ratio is stated as 194.1% in the *OECD Economic Outlook 89*.

[2] According to the Nikkei NEEDS Financial QUEST database, the 10-year JGB yields exceeded two percentage points for only 13 days (12/30/98, from 2/2/99 to 2/15/99, except 2/9/99 (nine business days in total), 8/30/99, 5/10/06, and 5/15/06).

in these studies, and Feldstein (1986) and Gale and Orszag (2002) suspected that the VAR projection fails to incorporate information regarding, for example, scheduled and legislated future tax reduction. Thus, recently, the VAR method has rarely been employed in this field, although some improvement has been made in this methodology.[3]

The second category of literature emphasizes that it is not the current, but rather the expected budget deficit or government debt that affects current real long-term interest rates. This stream of studies can be further classified into two divisions: (1) those that conduct event analyses of news reports or announcements regarding budget projections (e.g., Wachtel and Young (1987), Thorbecke (1993), and Quigley and Porter-Hudak (1994)) and (2) those that use published forecasts of budget deficits as a proxy for market expectations (e.g., Feldstein (1986), Laubach (2003), and Engen and Hubbard (2004)). Both divisions of studies show that there exists a significantly positive relationship between projected budget deficits or government debt and current real long-term interest rates.[4]

As mentioned previously, the preceding Japanese case studies did not refer to or draw upon the previous literature. Nakazawa (2002) estimates how significantly long-term interest rates respond to increases in government debt by employing the VAR methodology, which has rarely been used in recent years. Nakazato et al. (2003) estimate various types of reduced form equations, but do not pay attention to expectations of market participants. Although Fukuda and Ji (2002) conducted event studies on Japanese financial markets, their main focus was on stock markets. To the best of my knowledge, these are the only studies in the literature that aim to explicitly analyze the relationship between interest rates and fiscal variables in Japan.[5] In this study, we investigate the effects of budget deficits and government debt on 10-year JGB yields in Japan after a careful consideration of the second-category literature.

The remainder of this paper is organized as follows. In Section 2, we present our event analyses results. In Section 3, we illustrate our published forecast approach results. In Section 4, we offer our conclusions.

2 Event Studies

2-1 Main Analysis

Wachtel and Young (1987) provided the seminal contribution of event studies on the relationship

[3] Millar and Russek (1996) tried to overcome the defects using variance decomposition.
[4] See Cohen and Garnier (1991), Elmendorf (1993), Kitchen (2002), as well as Canzoneri, Cumby, and Diba (2002) for the published forecast approach, and Elmendorf (1996) and Kitchen (1996) for event studies. See Barth et al. (1991) and Gale and Orszag (2002) for excellent surveys of both category studies.
[5] Another study written in Japanese is Isogai (2000), which treated the Japanese economy as one of the individuals in the G7 panel data. Many other studies, including Kamae (2005), investigated the JGB market without considering fiscal conditions.

between fiscal variables and long-term interest rates, which regressed unexpected changes in the budget deficit projection by the Office of Management and Budget (OMB) and Congressional Budget Office (CBO) on daily changes in interest rates. Under the assumption of market efficiency, the relationship can be confirmed if the unexpected changes are statistically significant. On the other hand, Quigley and Porter-Hudak (1994) exploited the intervention analyses of Box and Tiao (1975), which simply connects an ARMA (Autoregressive Moving Average) model with dummy variables regarding the release of budget projections. In this manner, the relationship can be confirmed if the dummy variables are statistically significant.

Although different statistical methodologies were employed in the abovementioned studies, both assessed how announcements affect interest rates. Therefore, using official Japanese budget projections, such as those included in the report entitled *Projection of the Budget's Effects on Outlays and Revenues* (predecessor: *Medium-Term Fiscal Perspectives*) issued by the Ministry of Finance (MOF), may be a suitable approach for performing a case study in Japan. However, these projections cannot be used for an event study, because, in general, market participants are considered to successfully forecast the contents of the *Projection* before its release, that is, it is not "surprise." Thus, we instead use the announcements of economic countermeasures to overcome a recession that are accompanied by supplementary budgets during the sample period of February 1, 1982, to September 7, 2009.[6] The economic countermeasures were implemented depending on the contemporary economic environment. Hence, the contents of the announcements and their release would be difficult to anticipate, at least more difficult than those of the *Projection*. For the sample period, we find 18 economic countermeasures with supplementary budgets (Table 1).[7]

As mentioned previously, we find two basic methodologies in the literature; Wachtel and Young (1987) and Quigley and Porter-Hudak (1994). However, the Wachtel and Young (1987) technique cannot be applied for the Japanese economy, because expected budget deficits caused by the countermeasures were not made public on the announcement days of the countermeasures. As will be mentioned subsequently, the supplementary budget followed by the countermeasures is released to the public, but only after a few months and not on the announcement day. Thus, we apply the Quigley and Porter-Hudak (1994) technique hereafter, because we only require dummy variables on the announcement days in this approach.

We designate the day the Prime Minister declares formulating an economic package as the event day. To specify a suitable day for this, we search articles on the first page of the *Nikkei* by using *Nikkei's* database—named the Nikkei Telecon 21—for the key words ["keizai" (economic) or "keiki" (boom or recession)] and ["shiji" (direct) or "hyomei" (declare) or "shisa" (implicit suggestion)] and

[6] The sample period used in this study is the longest in the Nikkei Financial Quest Database at the beginning of this study.

[7] Countermeasures without budgets are not investigated in the present study, because their impacts on the financial market are limited.

["taisaku" (countermeasure)] and ["shusho" (Prime Minister)], within the three months prior to the formal decision taken by the committee of the relevant economic ministers. Then, we choose articles containing the Prime Minister's intentions to perform economic countermeasures from the database output and select the oldest one to employ its published day as the event day. Needless to say, the reason why we adopt the oldest is that any information on the determinants of interest rates should be quickly incorporated into the observed rates under market efficiency, which is assumed here and in the literature.[8] Considering the possibility that the Prime Minister could have changed as a result of election within the three months, we searched for articles published only after the elections of the House of Representatives, that of the Councilors, and that of the President of the Liberal Democratic Party, which was the ruling party for most of our sample period, in the case that we had these elections.[9]

We employ the intervention analysis—a derivative of time series analyses—to examine the effects of an event by testing the null hypothesis that the coefficient of intervention variables is less than or equal to zero, $C(1) \leq 0$, in the following equation:

$$i_t = a_0 + A(L)i_{t-1} + C(L)z_t + B(L)\varepsilon_t \qquad (1)$$

where i_t is the closing yield of the 10-year JGB yields, $A(L)$, $B(L)$, and $C(L)$ are polynomials in the lag operator L, z_t is the intervention variable which takes several forms of dummy variables, such as the level-shift dummy taking the value of zero prior to the event day and unity thereafter, and ε_t is a white noise disturbance. As mentioned previously, this equation is

[8] In most cases, adopted articles are the first in the output article list after excluding editorial columns and articles on foreign countries.

[9] The principle to adopt the announcement day is as in the text. However, we fine-tune some announcement days depending on the situation of each countermeasure. First, we chose periods of more than three months before the implementation of the *Emergent Economic Countermeasures* in May 1987, since the announcement by the Prime Minister was made very early. Second, as for the *Comprehensive Economic Measures* in February 1994, we chose the day when government parties agreed to undertake these measures, not the day when directions were provided by the Prime Minister, since the coalition government consisted of eight political parties and agreements among them were key to execute any policy. Third, the *Emergent Economic Packages* implemented in November 1998 was announced on August 5, but we chose September 29 due to the rescheduling of the program. Fourth, under the Koizumi administration, we select the first day when the PM presented the supplementary budgets as the event day, since he strictly divided economic countermeasures with and without supplementary budgets from the view of fiscal consolidation. Finally, we did not adopt the *Immediate Policy Package to Safeguard People's Daily Lives* implemented in December 2008, since part of the countermeasures overlapped the previous program.

simply formed by adding dummy variables to an ARMA model, but allows for a formal test of change in the mean of the time series. In the following paragraphs, we consider two types of intervention terms, the above-mentioned level-shift dummy and the one-shot dummy, which takes the value of 1 only on the announcement day, as shown in Quigley and Poter-Hudak (1994). Needless to say, if the null hypothesis $C(1) \leq 0$ regarding the level-shift dummy is rejected significantly, we can say the announcement of the economic countermeasures increases JGB yields. Although we employ variables to investigate the cause of the rise in yields in Section 2.3, we concentrate first on the univariate analysis in order to answer the simple question of whether the yield rises or not.[10]

The estimation procedure is as follows. First, we set the sample period to 121 days, including 60 days before and 60 days after the event day for each countermeasure. The reason why we set it to 60 days is that the minimum time difference between the announcements is 60 days (from the 16th countermeasure to the 17th, as shown in Table 1). Then, we perform unit root tests on the 10-year JGB yields and adopted their first difference, because no rejections are found at the 1% level by all three types of augmented Dickey-Fuller unit root tests: the pure random, with drift, and with drift and time trend. We set the maximum lag length of the AR and MA parts as four and then decide the lag length for a simple ARMA model used in the estimation by the Akaike Information Criteria (AIC). Using these lag lengths, we estimate Equation (1) for each countermeasure, prolonging the lag length of $C(L)$ with regard to the one-shot dummy from 0 to 10 to exclude the temporal effects of the countermeasures, and moving the event day itself by 1–10 days after (11 days in total) to take care of the possibility that the market participants did not regard these articles as indicative of new countermeasures as soon as they heard the announcement regarding the implementation of the countermeasures.

It should be noted that the other shocks considered (e.g., change in monetary policy, release of the original budget proposals by the MOF, release of the Guidelines for Budget Requests, determination of economic package) are all controlled here by level-shift dummies.[11] Finally, we select the output

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[10] Some readers might also consider short-term interest rates such as call rates to be included in the explanatory variables. However, the preceding literature on Japanese financial markets shows that these rates have no effect on long-term yields. See Sugihara et al. (2000) and Ito (2005).

[11] The relevant dates for all sample periods are as follows:

Changes in the official discount rate: 3/7/86, 4/19/86, 10/31/86, 2/20/87, 5/30/89, 10/11/89, 12/25/89, 3/20/90, 8/30/90, 7/1/91, 11/14/91, 12/30/91, 4/1/92, 7/27/92, 2/4/93, 9/21/93, 4/14/95, 9/8/95, and 2/9/01.

Changes in the reserve requirement ratio: 10/1/91.

Changes in the operating target of the current uncollateralized overnight call rate: 3/31/95, 7/7/95, 9/9/98, 2/12/99, and 8/11/00.

Changes in the operating target of the current account balances with the Bank of Japan and changes in the target of this outstanding balance, and/or changes in the outright purchase of long-term government bonds: 3/19/01, 8/14/01, 12/19/01, 2/28/02, 10/30/02, 3/25/03, 4/30/03, 5/20/03, 10/10/03, 1/20/04, 5/20/05, and 3/9/06.

Simultaneous changes in the target of the current uncollateralized overnight call rate and the official

with the lowest value of the AIC from all 121 outputs for each countermeasure. Then we test the null hypothesis $C(1) \leq 0$ for both intervention dummies and consider the effects of the countermeasures on the JGB yields.

The regression results are summarized in Table 1. Of the eighteen economic countermeasures, we found fifteen significant temporary effects and six permanent significant effects on 10-year JGB yields[12]. Therefore, the directions, declarations, and implicit suggestions of Prime Ministers regarding economic countermeasures are possibly regarded as signals for future fiscal expansion by market participants and raise JGB yields, although this is not always possible.

2-2 Conditions to Raise Yields

The next question would be when the yields respond to the announcements. The expected answer to this question would be the time when good business environments are approaching and/or when the countermeasures are followed by large new bond issues. Table 2 summarizes the differences of the leading indices in the *Indexes in Business Conditions* published by the Cabinet Office of Japan between the current and previous month, a new-bond-issue-to-GDP ratio of the supplementary budgets followed by each countermeasure, and the t-values of each permanent shock presented in Table 1. Comparing t-values and leading index differences, we find that high t-values are accompanied with large differences in the leading index. For example, four of the five cases in which the leading index difference is greater than unity (shaded) are significant at 5% or less. The only exemption is the *Emergency Economic Package* in 1998, implemented under Prime Minister Obuchi.

This exemption may make readers suspect our results, since it was followed by the well-known

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discount rate: 2/28/01.

Simultaneous changes in the target of the current uncollateralized overnight call rate and the basic loan rate: 7/14/06, 2/21/07, 10/31/08, and 12/19/08.

Release of the Guidelines for Budget Requests (date reported in the Nikkei or in the case it was not a business day, the next day): 7/26/85, 7/21/86, 7/31/87, 7/15/88, 7/11/89, 7/27/90, 7/5/91, 6/23/92, 8/13/93, 7/29/94, 8/4/95, 7/31/96, 7/8/97, 8/13/98, 7/30/99, 8/2/00, 8/13/01, 8/7/02, 8/1/03, 7/30/04, 8/11/05, 7/21/06, 8/10/07, and 7/29/08.

Release of the original budget proposal by the Ministry of Finance (date reported in the Nikkei or, in the case it was not a business day or are reported in the evening edition, the next day): 12/24/85, 12/26/86, 12/24/87, 1/20/88, 12/25/89, 12/25/90, 12/24/91, 12/22/92, 12/22/93, 12/21/94, 12/21/95, 12/24/96, 12/22/97, 12/22/98, 12/21/99, 12/21/00, 12/21/01, 12/24/02, 12/22/03, 12/21/04, 12/21/05, 12/21/06, 12/21/07, and 12/22/08.

Determination of the economic package: date of announcement by the Prime Minister, as shown in Table 3.

[12] By the time the Prime Minister announces an economic package, markets may have formed an expectation about its execution to some extent. Thus, the announced effect measured in this paper might be the size of "surprise" only relative to this market expectation. As written in the text, we incorporate 0 to 10-days temporary dummies as independent variables, but 10 days might not be enough to exclude this effect. In such a case, the estimate may be underestimating the true announcement impact of a fiscal package on yields. The author owes this point to the anonymous referee.

Trust Bureau Shock on December 22, 1998, where announcements by the Finance Minister and the Governor of the Bank of Japan caused tremendous increases in the JGB yields for two or three months followed by this statement. The reason why this countermeasure was not significant in Table 1 is simply attributed to the existence of control dummies for the release of the original budget proposal by the MOF on the same day of the shock. As a matter of fact, the t-value of this control dummy is 5.982, which implies that the JGB market responds to this shock quite significantly. Needless to say, it would be interesting to consider whether this shock is relevant to this countermeasure. However, we do not consider this point in our study, since we already have a remarkable literature on this point, such as Tomita (2001) and Onji et al. (2012).

Next, comparing the t-values with the new-bond-issue-to-GDP ratios, we find that of the eight cases in which the ratio is above 0.7 (shaded), only four are significant at 10% or less. However, as expressed clearly in the 17th countermeasure, the leading indices fell sharply in the insignificant cases. To take care of this effect, we regressed the t-values on both measures of the leading indices and the new-bond-issue-to-GDP ratios. The result is illustrated in Column 1 of Table 3 and gives us the impression that these two measures correlate with the t-values regarding the permanent dummies of countermeasures, although not significantly. However, its significance emerges clearly if we exchange the t-value of the 10th countermeasure in Table 2 with that of the aforementioned dummy reflecting "Trust Bureau shock." The result is shown in Column 2, where we find the leading indices are significant at 5% and the new-bond-issue-to-GDP ratios are significant at 1%. In addition, we re-estimate this equation without this observation to take care of the possibility that this exchange affects the results strongly. We then obtain the same results in the sense that the two variables are significant (Column 3).

It is difficult to know the reason why the t-values are correlated with the new-bond-issue-to-GDP ratio, which cannot be observed when the announcements are released. However, if market participants are forward-looking and if they can project the amount of newly issued bonds, they will forecast the resulting changes in JGB yields, and the yields will self-fulfillingly increase in the efficient market by the amount depending on the number of newly issued bonds. Reflecting this relation, coefficients of the intervention dummies become large, which in turn makes t-values large.

We summarize our analysis above as follows. First, we showed that the directions, declarations, and implicit suggestions of the Prime Ministers regarding the economic countermeasures are possibly considered as signals for future fiscal expansion by market participants. Second, we showed the probability that an increase in JGB yields is correlated with the improvement in expected future business conditions and the amount of newly issued bonds in the supplementary budgets followed by the countermeasures. Thus, we say that the long-term interest rates, represented by JGB yields generally, are affected by market expectations regarding newly issued bonds, that is, expected budget deficits.

2-3 Good Rise or Bad Rise?

Given the recent fiscal situation in Japan, it is also important to consider whether these rises in JGB yields reflect their sovereign risks or improvements in the economic outlook. For this purpose, we perform two additional analyses. First, we include in Equation (1) a variable that controls for changes in the economic outlook—the Nikkei 225 index is adopted for this purpose. In this estimation, we keep the same lags of $A(L)$, $B(L)$ and the event dummy presented in Table 1. As shown in Column (1) in Table 4, this offsets the significant increases in the yields before the mid-1990s; however, the event dummies of the two countermeasures after the late 1990s are still significant.

Second, we examine foreign exchange movements in line with previous studies that have analyzed multiple asset prices to assess competing hypotheses (see Engel and Frankel, 1984; Cornell, 1983; Thorbecke, 1993). Cornell (1983) showed that even if an event reduces the price of a financial asset because of the risk premium required by investors, the exchange rate should not be affected. This is because a rise in yields does not cause an incipient capital inflow if the higher real interest rate is fair compensation for holding that asset. Inversely, if the interest rate increased because of an improvement in the economic outlook, exchange rates should be appreciated. Therefore, concurrent movements in exchange rates would provide supporting evidence of the risk premium.

Column 2 in Table 4 shows the estimation results of Eq. (1) employing the closing spot USD/JPY rates instead of the yields. These estimation results are shown in Column (2) in Table 4. As shown in the table, because none of the level dummies is significant, all increases in yields can be interpreted as those in the risk premium.

Although the two analyses performed above show some inconsistencies, they both suggest that rises in JGB yields reflect their sovereign risks at least since the late 1990s. We should thus consider this finding to be evidence that the recent positive responses of yields to the countermeasures reflect their sovereign risks.

3 Regression Methods Using Published Forecasts

As shown in the previous section, market participants contemplate the future fiscal situation, although interest rates are seemingly very low in the JGB market. However, we cannot determine JGB yield increments from the deteriorating fiscal position by the previous analysis, since the intervention analysis uses 0–1 dummies. In this section, we estimate the effects of budget deficits and government debt on JGB yields, using published forecasts as proxies for the expected future budget conditions of market participants.

3-1 Estimation equation

Researchers have analyzed the relationship between long-term interest rates and fiscal variables based on published forecasts.[13] In these studies, long-term interest rates were regressed on the ratio of forecasted budget deficits or government debt to nominal trend GDP; the null hypothesis is that the coefficient of fiscal variables is equal to zero. Therefore, the selection of control variables is quite important. Authors of the preceding literature clearly indicate the theoretical framework of their study—neoclassical or Keynesian—and derive their estimation equations accordingly.

In the following paragraphs, we summarize the basic neoclassical model, usually regarded as the long-run model, and the IS-LM model, generally considered the short-run model. We assume that domestic and foreign bonds are imperfect substitutes in this discussion, following Feldstein and Horioka (1980), Feldstein (1986) and Engen and Hubbard (2004); therefore, capital flow from overseas cannot offset the increase in domestic interest rates due to deteriorating fiscal conditions.

We review the neoclassical framework first. In the very basic framework, such as the Ramsey model, tax reduction increases private savings to the same extent as that shown in the Ricardian equivalence proposition. Therefore, the resulting budget deficits do not affect long-term interest rates. As is well known, a persistent increase in fiscal expenditures has the same effect as tax reductions in the infinite horizon. However, in the case that fiscal expansion is temporary, long-term rates rise until the level of the fiscal expenditure returns to its initial level and then decreases to a steady-state level. In addition, tax reduction and persistent increase in fiscal expenditures affect interest rates, both in the short run and long run under some plausible conditions, such as a finite horizon and/or the positive productivity of public capital.

Next, we review the IS-LM framework in a textbook fashion. Keeping public spending constant, a decrease in taxes increases the government deficit and enhances private consumption and saving. However, the increase in government deficit exceeds the increase in private saving. Thus, lower taxes lead to lower national savings and lower interest rates. On the other hands, keeping tax hikes constant, an increase in public spending enhances the output, which in turn raises the demand for liquidity. Thus, higher spending results in higher interest rates.

Although it is not certain whether these mean short-run or long-run interest rates in the framework, both rates eventually increase if the term structure of interest rates is satisfied and the current budget deficit leads to future budget deficit expectations. In addition, government debt also raises interest rates through wealth effects on private consumption and the demand for liquidity.

In short, economic theories show that fiscal variables have positive effects on long-term interest rates. However, these discussion show that the resulting estimation equations are different from each

13 See Footnote 5.

other. Needless to say, it is impossible to decide in advance which framework is more suitable. However, it would be better to employ the neoclassical model, since the dependent variable is the long-term interest rate and we use annual data in this analysis because of the data availability. Thus, we derive the estimation equation based on the steady-state condition, $r = \sigma g + \theta$, in the Ramsey model with the CES utility function, as shown in Laubach (2003):[14]

$$i_t = \beta_0 + \beta_1 f_t + \beta_2 g_t + \beta_3 e_t + \beta_4 Z_t + \varepsilon_t \qquad (2)$$

where i_t is the nominal interest rate, f_t the fiscal variable (e.g., the projected deficit-to-GDP ratio), g_t is a measure of trend GDP growth, e_t is a measure of the equity premium discussed below,[15] π_t^e is the expected inflation rate, and Z_t is a vector of control variables used to capture the effects outside the model. As is evident, a positive significance β_1 implies that an increase in the budget deficit or government debt positively affects long-term interest rates.

3-2 Recent topics to be considered for estimation

Before explaining the estimation methods and results, we review two concepts that are still controversial: the "*Parable of the Debt Fairy"* and "*Deficit or Debt."*

The Parable of the Debt Fairy

As pointed out by Gale and Orszag (2002) as well as Engen and Hubbard (2004), the expected magnitude of the effects of fiscal variables on long-term interest rates differs vastly across studies. For example, Feldstein (1986) found that a percentage point increase in the expected deficit-to-GDP ratio raises the 5-year rates of government bonds by 0.85–1.44% in the US; however, the corresponding increase was only 0.18% in a study conducted by Engen and Hubbard (2004). In such a situation, *the Parable of the Debt Fairy* according to Ball and Mankiw (1995) is being considered the standard model.

Let us imagine that one night, a debt fairy replaces every government bond with a piece of private

[14] r = real interest rate, σ = the degree of relative risk aversion, g = growth rate of technology, and θ = rate of time preference.

[15] Regarding data construction, see Section 3.3.

capital of an equivalent value. If we presume a neoclassical framework and the Cobb-Douglas technology, $Y = AK^{\alpha}L^{1-\alpha}$, back-of-the-envelope calculations reveal that the marginal product of capital is equal to the real interest rate: $r = \alpha A(L/K)^{1-\alpha}$. Taking logs and differentiating it, we obtain the following:

$$d\log r = (\alpha - 1)d\log K - (1-\alpha)d\log L. \qquad (3)$$

To what extent does the interest rate rise in Japan under this condition? Assuming $d\log L = 0$, setting α = 0.2819, and K = ¥1210 trillion adjusted to the Japanese economy in 2008,[16] and considering that the debt fairy magically replaces debt with capital; i.e. $dK/dD = -1$. In this presumption, if government debt increases by 1% of GDP, i.e., ¥5.568 trillion, the capital stock reduces by 0.47%,[17] the real interest rate raises by 2.54 basis points in this model.[18]

Needless to say, some assumptions are required to discuss the real economy on the basis of this model, such as a constant amount of private savings, a closed economy, and a single determinant for the marginal product of capital associated with a real interest rate (Elmendorf and Mankiw, 1999). However, several previous studies have used *this Parable of the Debt Fairy* as a benchmark. For example, Engen and Hubbard (2004) referred to this calculation as a "standard benchmark" and used it as a guideline for their estimation.

Deficit or Debt?

From the previous interest rate equation and $dK/dD = -1$, we obtain the following equation:

$$\frac{\partial r}{\partial D} = \frac{\partial r}{\partial K}\frac{\partial K}{\partial D} = \alpha(1-\alpha)\frac{Y}{K^2} > 0. \qquad (4)$$

This model implies that it is debt and not deficits that affects real interest rates. On the bases of this equation, Engen and Hubbard (2004) emphasize that debt has a stronger effect on interest rates than

[16] For capital stock, we use the tangible fixed assets of all industries included in the *Preliminary Quarterly Estimates of Gross Capital Stock of Private Enterprises* (http://www.esri.cao.go.jp/en/sna/data.html).

[17] $d\log K \approx dK/K = 0.01Y/K = 0.0047$

[18] In this calculation, following Elmendorf and Mankiw (1999), we compute its ex-ante real interest rate as marginal productivity; i.e., the ratio of ((1 $-\alpha$) times GDP) to gross capital stock, minus the depreciation rate drawn from the previous materials of the Preliminary Quarterly Estimates of Gross Capital Stock of Private Enterprises (0.0756). α is calculated by 1 minus the ratio of the compensation of employees to GDP.

deficits.

Contrary to this opinion, Feldstein (1986) argued that deficits were more important for the following three reasons. First, budget deficits raise aggregate demand through the resulting increase in the demand for money. Second, budget deficits cause inflation uncertainty. A sustained budget deficit would pressurize the monetary authority to ease money supply, which in turn causes investors to anticipate future inflation. In contrast, the stock of debt is the accumulation of deficits that the monetary authority has already accepted; thus, debt provides less information about future monetary expansion. Finally, he pointed out the effects of deficits through the adjustment cost of investments. If the cost of installing investment $c(I)$, where $c'(I) > 0, c''(I) > 0$, is needed and the price of one unit of capital is unity, the optimal rate of investment satisfies $f'(K) = (1 + c'(I))r$, where $f'(K)$ is the marginal product of capital and r is the real interest rate. Thus, if an increase in the budget deficit crowds out private investments, the interest rate would rise.[19]

It should be noted that the resulting decrease in private investment would decrease the capital stock and raise the interest rate through the decreasing marginal product of capital; government debt also affects interest rates. However, Feldstein (1986) concluded that the former effects were greater than the latter because of the slow adjustment of capital, as shown in Abel (1980) and Hayashi (1982).

3-3 Data and statistical methodology

To estimate the previous regression equation (2), we employed the following data based on Laubach (2003). As for published forecasts of budget deficits, we employ the 4-year-ahead forecasts of budget deficits named by the *difference* in the report *Projection of the Budget's Effects on Outlays and Revenues*. In addition to this simple budget deficit, we use the 4-year-ahead forecasts of the primary budget deficit computed by deducting interest payments from the *difference*.[20] The reason why we use 4-year-ahead forecasts here is to avoid the effects of the business cycle as much as possible.[21] In comparison, we also employ current values of both budget deficits. As for government debt, we constructed its annual data from quarterly data from the *Monthly Financial Review*

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[19] Under $dI = -\theta dG$ and $dK = 0$, where $\theta > 0$, $dr / dG = \theta r c'' / (1 + c'') > 0$.

[20] Note that these forecasts cover only those of the central government. Although we have the general government forecasts that the Cabinet Office of Japan produces, it began publishing in 2002 and have an insufficient number of observations for the purpose of estimation. However, the correlation between these data is 0.9844 (0.9650 for primary budget deficits) and among the Cabinet Office data, the correlation between the central government's budget deficit and the general government's one is 0.9741 (0.9493). Thus, the significance of the following estimation would be invariant.

[21] "If automatic fiscal stabilizers raise deficits during recessions, while at the same time, long-term interest rates fall due to monetary easing, deficits and interest rates may be negatively correlated even if the partial effect of deficits on interest rates—controlling for all other influences—is positive" (Laubach, 2003, p.1).

published by the MOF. To capture the better timing in the data with regard to estimation, we employ each observation in the quarterly data just before the release date of the *Projection*, typically in January. To change these fiscal variables into the ratios to GDP, we divide them by the current or the projected nominal GDP, which will be explained later.

As for long-term interest rates, we use the 10-year JGB yields as of the day on which the Diet submits the *Projection* to the budget committee of the House of Representatives. For the trend growth data, we employ a weighted average of the GDP growth rate over two years, mentioned in various economic planning reports, such as the *Reform and Medium-Term Economic and Fiscal Perspectives* (used in the calculation of the *Projection*). The weights are two-thirds on the current year and one-third on the previous year. We use the same reports to build the projected nominal GDP data mentioned above. The expected inflation rate is estimated using Kanoh's (2006) method, which in turn is based on Carlson and Parkin (1975). Finally, the equity premium, used as a proxy for risk aversion, is calculated as the ratio of the dividend component of national income to the market value of stocks and other equities held by households, minus the 10-year real JGB yields, plus the trend growth rate.[22]

To avoid spurious regressions, we first perform a preliminary unit root and cointegration analysis. Table 5 shows the results of the generalized least squares version of the Dickey-Fuller (DF-GLS) test (Elliott et al., 1996). For all variables in levels, the DF-GLS tests show that each series has at least one unit root. On the contrary, for the first difference of all variables, the DF-GLS tests all reject the null hypothesis of unit roots. Thus, we conclude that each of the underlying variables can be treated as a single unit root process [i.e., integrated of order one, or I(1)]. Then, we examine whether any cointegrating relationship exists in the variable sets using Johansen's (1988, 1991) trace test using one lag.[23] Regardless of the types of budget deficit data and whether or not the constant term is restricted in the cointegrating relationship, the test rejects the null hypothesis of at most zero cointegrating vectors, but not the null hypothesis of at most one (Table 6). These results imply that there is one cointegrating relation in each set of variables. Therefore, to obtain consistent estimators of these cointegrating relations, we take two approaches, namely, fully modified OLS (FM-OLS) and ordinary least squares (OLS), although the OLS estimates are just for reference since their asymptotic distribution is non-standard.

3-4 Estimation results

As mentioned in Section 3.2, the relative importance of budget deficits and debt is still controversial. As mentioned in Section 1, the second category literature including Feldstein (1986)

[22] See Appendix for details.
[23] Out of the four budget deficits, one lag is suggested in three cases and two lags in one case, based on the Bayesian Information Criteria (BIC). We choose one lag for all four cases for mutual comparison.

emphasizes that it is not the current, but rather the expected fiscal variables that affect current real long-term interest rates. In Table 7, we test these points using Japanese data.

Columns 1 and 2 in Table 7 present the estimation results including the projected/current deficit-to-GDP and current debt-to-GDP ratios, similar to Feldstein (1986).[24] In these estimations, the constant term is not included since the null that the constant is restricted in the cointegrating relationship is rejected at 1% significance level.[25] In all cases, the fiscal variables are significant at 1%, although the ratios with current government debt are less significant. This finding is invariant even if we replace the deficit-to-GDP ratio by the primary deficit-to-GDP ratio, as shown in Columns 3 and 4.

Next, we compare the magnitudes of the effects of these ratios on 10-year JGB yields. Focusing on Columns 1 and 2, we observe that a percentage point increase in the projected deficit-to-GDP ratio raises the real 10-year interest rate by 26 basis points and that in the current deficit-to-GDP ratio by 27 basis points. As for the primary deficits, we find 34 and 33 basis points. By contrast, for current government debt, a percentage point increase in the debt-to-GDP ratio raises the rate by 1.2 basis points at the most.

In the next step, we focus on the relative importance of the projected and current deficits. By comparing the t-values in Columns 1 with 2, and 3 with 4 in the table, we note that the ratios affect real 10-year JGB yields with a greater probability when we use the projected deficit rather than the current deficit. Therefore, as mentioned earlier, it is not the current deficit but rather the expected budget deficit that strongly affects the current real long-term interest rates, similar to the findings of the second category of literature.

In brief, we conclude that similar results to those presented by Feldstein (1986) are found in the Japanese economy: Contrary to the findings of Engen and Hubbard (2004), an increase in the budget deficit affects real long-term interest rates greater than an increase in government debt. Further, the projected deficit raises real long-term interest rates with a greater probability compared with the current one.

Finally, we conclude that *the Parable of the Debt Fairy* is realized partially. The coefficients of the debt-to-GDP ratio seem to be small, in line with the Japanese economy, compared with the calculation presented in Section 3.2 (i.e., 2.54 basis points). However, as mentioned, we need certain assumptions for the realization of *the Parable.* Thus, it would thus be reasonable to conclude that *the Parable* is partially acceptable for the Japanese economy.

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[24] In contrast to Feldstein (1986), Laubach (2003) constructed and employed the projected debt as well, but it was a simple linear combination of the projected deficit and current debt, and hence we did not use it here, since it contains no more information than the two.

[25] We can test this restriction using the difference of test statistics between both cases in Table 6. The difference is chi-square distributed with n – r degrees of freedom (n: the number of variables in the system, r: the number of the cointegrating vectors). Incidentally, even if we restrict the constant, the results are almost the same and our conclusions are not affected.

3-5 Factorial decomposition

Figure 1 is a stacked bar chart whose bars simply show the effect of each factor calculated by each datum multiplied by the coefficient estimates in Column 3 (using the projected primary deficit) and in Column 4 (using the current primary deficit) in Table 7. Note that the following results are not affected significantly if we use the other estimates shown in Tables 7.

From these figures, we find that the effects of the budget deficit increases remarkably after 1999 and offsets the effects of deflation, a decline in potential growth, and an increase in risk premium in the stock markets. Although outstanding government bonds are essential to promote liquidity in financial markets, the fiscal variables caused an approximately 2 to 3% increase in JGB yields in 2008, compared to their lowest level in 1991, so should be regarded as a factor restricting economic growth in Japan.

According to the estimation of the investment function by Shimizutani and Terai (2003),[26] a 1% rise in the real user costs of capital decreases private investment by 1.3% to 1.4%,[27] which means a 0.195% to 0.21% decrease in real GDP in turn, under the assumption that the share of private investment in the GDP is 0.15. Including this calculation in the results of the previous subsection—an approximately 2 to 3% increase in JGB yields in 2008—the existence of budget deficits is considered to result in a decrease in GDP by 0.39 to 0.63 percentage points.[28]

Whether this decline would be problematic or not is a controversial issue. However, considering that the average growth rate of real GDP is about 2.4% and that of real private investment is about 3.5% in the sample period and about 1.9% and 3.9%, respectively, after 2000, it seems, at least to this author, that this amount should not be overlooked.

4 Concluding Remarks

In this study, we examine the relationship of the budget deficit and government debt with long-term interest rates using two established methodologies: (1) the event analyses of news reports or announcements about fiscal events and (2) reduced form regressions using the published forecasts of budget deficits as a proxy for market expectations. As is well known, Japan has large budget

[26] We have not cited a number of previous studies based on Tobin's q theory here, because the association with long-term interest rates cannot be treated explicitly in these studies. In addition, we do not cite studies such as Iwata, Suzuki, and Yoshida (1987), because their estimates are too old to be useful for our discussion here.

[27] Shimizutani and Terai (2003), p.198.

[28] Note that these results do not include the effects of private residential investment, durable consumption goods, net exports via the appreciation of exchange rates, and the propagation effects of the fiscal multiplier.

deficits and government debt, but only a few studies have been conducted in this area so far. Besides, even in these works, the extensive knowledge accumulated in the field after the seminal study of Plosser (1982) was not drawn upon, nor was previous research cited. This study would be the first of its kind in Japan based on the vast body of literature in the field.

The findings from the empirical analysis are as follows:

1. Directions, declarations, and implicit suggestions provided by Prime Ministers regarding economic countermeasures are regarded by market participants as signals for future fiscal expansion.
2. The probability that the JGB yields increase after the PM announcements regarding economic countermeasures is positively correlated with the improvement in expected future business conditions and the amount of newly issued bonds in the relevant supplementary budgets. Considering Point 1, long-term interest rates are affected by market expectation of newly issued bonds, that is, expected budget deficits.
3. At least since the late 1990s, the increase in JGB yields caused by economic countermeasures reflects their sovereign risks.
4. A percentage point increase in the projected deficit-to-GDP ratio raises 10-year real interest rates by 26 basis points, while a similar increase in the current deficit-to-GDP ratio raises the rate by 27 basis points. As for primary deficits, these increases are 34 and 33 basis points, respectively. However, a similar increase in the current debt-to-GDP ratio raises the rate by 1.2 basis points at most.
5. Similar to Feldstein (1986), it is not the current, but rather the expected budget deficit that affects current long-term interest rates more strongly in Japan.
6. Ball and Mankiw's (1995) *Parable of the Debt Fairy* is partially applicable to the Japanese economy; that is, government debt affects real long-term interest rates, but the magnitude is smaller than expected by *the Parable*.
7. Factorial decomposition based on regression results shows that both the budget deficit and the primary deficit caused an approximately 2 to 3% increase in JGB yields in 2008, compared to their lowest level in 1991. Based on the empirical literature on private investment, this result implies a decrease in real GDP by 0.39 to 0.63 percentage points annually in 2008.

Further, the average ratio of the coefficients of the permanent dummies in Table 1 to the expected new bond issue-to-GDP ratio (Table 2) is computed to be 0.347 (%) in the six significant countermeasures. Thus,

8. The significant response of JGB yields in the event study is almost consistent with that in the

reduced form regression, especially in the primary budget deficit cases (Point 4). Considering Point 2 above, this means that the JGB market tends to accomplish its long-run equilibrium rapidly when expected future business conditions are better and the amount of newly issued bonds in the relevant budgets is larger.

These empirical results are interesting academically. In particular, it is useful to statistically confirm that the positive relationship between budget deficits and real long-term interest rates in Japan, despite that this relationship is seemingly unobserved in the real economy. However, from an economic policy viewpoint, the effects of public debt should be more important.

As mentioned in Point 4, an increase in the public debt-to-GDP ratio raises the rate by 1.2 basis points at most. However, as stated in the introduction, we have a huge amount of public debt that is projected to grow consistently. As shown in Figure 1 this huge debt raises the real long-term interest by approximately 1% in 2008 compared with that in 1991 and reduces GDP by approximately 0.2% annually as mentioned in Section 3.5. This situation cannot be improved until the primary deficits start to be reduced; thus, the situation poses a severe restriction on the Japanese economy and policies for a long period. The Japanese government and its people should choose to fiscally consolidate even when the economy is in an unfavorable situation. Otherwise, accumulated debt gradually raises the long-term interest rates and worsens the country's long-term economic growth and fiscal status.

A couple of points remain to be considered, but are reserved for future studies. First, the difficulty of specifying the announcement day is an issue that needs attention. There is ambiguity regarding the time when the announcement occurs. In this study, we define the announcement day as the day when the Prime Minister announces economic countermeasures. However, it is well-known that, in some cases, someone in the ruling party started a debate on the measures prior to the Prime Minister. In addition, it is also known that these discussions do not always produce the actual implementation of the measures, as in the last days of Prime Minister Mori's term. Thus, it would be impossible to define the criteria perfectly to select announcement days, although efforts to do so should be commended. Second, as Thorbecke (1993) and Laubach (2003) point out, the relationship between budget deficits or debt and interest rates could be revealed more clearly and categorically if business cycle effects are eliminated effectively. Although using implied forward rates might be effective and the rates are available from data vendors such as Bloomberg, they are extremely expensive. This point is reserved aside for future studies due to budget constraints.

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Data Appendix

(1) Fiscal Variables

[Projected Budget Deficits]

For published forecasts of budget deficits, we employ the *differences* provided in the report *Projection of the Budget's Effects on Outlays and Revenues* (hereafter, referred to as the *Projection*) issued by the Japanese MOF. The *Projection* presents the general account budget expected to prevail in the next 4 years, and is submitted by the MOF to the budget committee of the House of Representatives along with the government's draft budget.[29] To avoid business cycle effects, we use 4-year-ahead forecasts similar to Lauback (2003).

This source is chosen in preference to other sources, such as the *OECD Economic Outlook,* for several reasons. First, the *Projection* dates back to FY 1981 and market participants are familiar with it. Second, the *Projection* provides 4-year-ahead projections, which are less affected by business cycles than OECD projections which forecast only 2 years ahead. Finally, as pointed out in Section 1 and 2, the literature also employs the government's projections.

It should be noted that the term *difference* does not mean what it did in the old edition of the *Projection*. Until FY 1996, *difference* implied "target" budget deficits, and not expected budget deficits, which suggests that a different accounting subject to equalize expected revenue to expected expenditure existed in the old *Projection*. In this study, we solved this problem by adding the *difference* and this subject through 1996. Furthermore, even in single annual editions, different projections are calculated for a given year. In such cases, we use the arithmetic average of these projections.

[Public Debt]

We employ the outstanding of government bonds obtained from various issues of the *Monthly Financial Review* published by the MOF. We ignore the outstanding of long-term borrowing here since this borrowing include the borrowing at *special account for distribution of local allocation and shared taxes*. If we include the borrowing in this special account, its estimated effects on the long-term interest rates—10-year central government bond yields—would be biased since some of this has to be repaid by local governments. Having said that, the qualitative results of this paper are not affected even if we construct using public debt data inclusive of this borrowing.

[Projected nominal GDP]

[29] The fact that we only use general account budget deficits and disregard special accounts, local government deficits and other deficits suggests an obvious omission. However, to the best of my knowledge, no forecast has been made for these accounts.

The projected nominal GDP data are built to be consistent with the *Projection*. First, we set as the benchmark, the actual nominal GDP as of the end of the fiscal year preceding the last one. To obtain the projected nominal GDP in the current fiscal year, this value is multiplied by the growth rates of the previous 2 years provided in the *Economic Outlook and Basic Stance for Economic and Fiscal Management* because the *Projection* is based on this guideline. Finally, to obtain the projected 4-year-ahead nominal GDP, the current GDP calculated previously is multiplied three times by the expected annual growth rate presumed in various economic planning reports such as the *Reform and Medium-Term Economic and Fiscal Perspectives*, also utilized in the calculations of the *Projection*.[30]

(2) Long-Term Interest Rates

For the nominal long-term interest rates, we use 10-year JGB yields as of the day on which the Diet submits the government draft budget to the budget committee of the House of Representatives.

(3) Others

[Trend growth]

We use a weighted average of the GDP growth rate over two years used in the calculations of the *Projection* and printed in various economic planning reports, such as the *Reform and Medium-Term Economic and Fiscal Perspectives.* The weights are two thirds on the current year and one third on the previous year.

[Expected inflation]

The expected inflation rate is estimated using Kanoh's (2006) method, which in turn is based on the Carlson-Parkin method (Carlson and Parkin, 1975). The survey data are obtained from the *Consumer Confidence Survey;* the deflator of household consumption provided in *National Accounts* is adopted as the price level.

Note that until a few years ago, the *Consumer Confidence Survey* published in the Cabinet Office of Japan was released on a quarterly basis and issued in March, June, September, and December. The *Projection,* on the other hand, is published on an annual basis, and is typically issued in January. Therefore, we use the data from the December issues of the *Consumer Confidence Survey* on the assumption that these provided the best available forecasts when the *Projection* was published. However, for the years 1994, in which the *Projection* was issued in May rather than in January, the

[30] We extract actual nominal GDP data until 2003 from the *Annual Report on National Accounts 2003* and those from 2003 to 2007 from its 2007 edition. We adjust the latter series by multiplying the latter with the ratio of the former to the latter in the first quarter in 2003 and then connect this with the former series.

data are taken from the March issue of the *Consumer Confidence Survey*.

[Equity premium]

The equity premium, used as a proxy for risk aversion, is calculated using Laubach's (2003) method. More specifically, it is computed as the ratio of the dividend component of national income, (a), to the sum of the market value of stocks and other equities held by household, (b), minus the 10-year real JGB yields, (r), plus the trend growth rate, (g); a/b-r+g. Similar to the case of expected inflation, we use each observation the equity premium just before the date of the release of the *Projection.*[31]

[31] Similar to the nominal GDP, we use growth rates of the relevant variables provided in the *Annual Report on National Accounts, 2003* and *2007*.

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Table 1: Results of the Intervention Analysis for Announcement Days of Economic Countermeasures by the Prime Minister.

Economic Packages	P.M.	Day of Direction	Final Determination	AR lags	MA lags	Level Dummy			One-Shot Dummy	
						Coefficients	t-value	lags	P-Value	lags
Comprehensive Economic Measures	Nakasone	1986/7/11	1986/9/19	0	0	0.029	0.232	10	0.995	0
Emergency Economic Package	Nakasone	1987/2/10	1987/5/29	4	1	0.787	1.873 *	8	0.000 ***	10
Comprehensive Economic Measures	Miyazawa	1992/7/27	1992/8/28	3	2	0.100	1.007	5	0.000 ***	3
Comprehensive Economic Measures	Miyazawa	1993/1/19	1993/4/13	0	0	-0.406	-1.507	8	0.000 ***	3
Emergency Economic Countermeasures	Hosokawa	1993/8/7 †	1993/9/16	2	2	0.080	1.754 *	6	0.000 ***	3
Comprehensive Economic Measures	Hosokawa	1994/1/7	1994/2/8	0	0	0.443	2.145 **	5	0.000 ***	10
Emergency measures for economy and appreciaiton of Yen	Murayama	1995/3/11	1994/4/14	2	4	-0.042	-0.771	0	0.000 ***	0
Economic Countermeasures	Murayama	1995/8/9	1995/9/20	4	4	0.211	2.244 **	4	0.002 ***	0
Comprehensive Economic Measures	Hashimoto	1998/2/2	1998/4/24	2	2	-0.052	-0.590	10	0.918	0
Emergency Economic Package	Obuchi	1998/9/29 †	1998/11/16	0	0	148.555	0.008	0	0.000 ***	2
measures for the rebirth of the Japanese economy	Obuchi	1999/9/22 †	1999/11/11	3	2	0.437	3.276 ***	8	0.000 ***	10
Policy Package for New Economic Development Measures for the Rebirth of Japan	Mori	2000/7/28	2000/10/19	3	3	0.229	0.701	0	0.000 ***	0
Front-Loaded Reform Program	Koizumi	2001/7/30 †	2001/10/26	2	2	-0.036	-0.836	5	0.000 ***	2
Immediate Economic Action Package	Koizumi	2001/11/19 †	2001/12/14	0	2	0.012	0.445	4	0.000 ***	1
Program to Accelerate Reforms	Koizumi	2002/10/8	2002/12/12	2	3	-0.049	-1.064	3	0.592	0
Comprehensive Immediate Policy Package –Easing Public Anxiety-	Fukuda	2008/8/2	2008/8/29	1	0	0.342	0.231	10	0.000 ***	0
Measures to Counter Difficulties in People's Daily Lives	Aso	2008/10/1 †	2008/10/30	2	1	0.109	1.527	1	0.000 ***	7
Countermeasures to Address the Economic Crisis	Aso	2009/3/15 †	2009/4/10	2	4	0.124	3.604 ***	5	0.000 ***	10

Note 1: *** means significant at the 0.01 level, ** implies significant at 0.05 level, and * implies significant at 0.10 level.

Note 2: One-shot dummies which take 1 only on the event day are use to exclude temporary changes and lags of them mean the number of days assigned one-shot dummy based on Akaike Information Criteria. P-value for one-shot dummies implies significant level for the null hypothesis that all coefficient od one-shot dummies are zeros.

Note 3: The days symbolized with † means the next business day of direction are adopted as the event day since the article of this topic appeared in newspaper on next day.

Table 2: Summary of Indices for Each Countermeasure: Leading Index of Business Conditions, Newly Issued Bonds, and t-values in Table 1.

	t-value in Table 1	change in leading index	ratio of new-bond to GDP
1	0.2315	-0.2	0.163
2	1.8734 *	0.9	0.400
3	1.0070	0.2	0.473
4	-1.5071	0.4	0.476
5	1.7544 *	0.5	0.763
6	2.1452 **	1.3	0.450
7	-0.7709	-1.7	0.575
8	2.2443 **	1.5	0.956
9	-0.5901	-1.1	1.210
10	0.0080	-0.1	2.250
11	3.2762 ***	1.2	1.412
12	0.7008	1.5	0.367
13	-0.8360	-1.1	0.319
14	0.4450	0.4	0.474
15	-1.0641	0	0.946
16	0.2308	-2	0.078
17	1.5267	-4.4	1.402
18	3.6035 ***	1.4	2.238

Note: Column 2 shows difference of leading indices in the Indexes in Business Conditions between current and previous month and the cases in which the number is more than unity are shaded. Column 3 means a new-bond-issue-to-GDP ratio of the supplementary budgets accompanied by each countermeasure and the cases in which the number is more than 0.7 are shaded.

Table 3: Regression Results of t-values on the Leading Index and the New-Bonds-to-GDP Ratio.

	(1)	(2)	(3)
change in leading index	0.3743	0.3655 **	0.3566 **
	(1.596)	(2.008)	(2.449)
ratio of new-bond to GDP	0.8263	1.4164 ***	2.0214 ***
	(1.565)	(3.749)	(3.980)
Num. of Observations	18	18	17

Note 1: The 10th observation is replaced in Column 2. Details are in the text.

Note 2: Observation 10 is omitted in Column 3. Details are in the text.

Note 3: Observation 10 is replaced in Column 2. Details are in the text. Heteroscedasticity-Consistent (Eicker-White) Standard Errors are reported in parenthesis.

*** Significant at the 0.10 level.

** Significant at the 0.05 level.

* Significant at the 0.01 level.

Table 4: Investigation into the Cause of the Increase in 10-year JGB Yields: Improvement in Economic Outlook vs. Sovereign Risks.

Economic Packages	(1)			AR Lags	MA Lags	(2)			
	Level Dummy		One-Shot Dummy			Level Dummy		One-Shot Dummy	
	Coefficients	t-value	p-value			Coefficients	t-value	p-value	lags
Emergency Economic Package	0.770	1.839 *	0.000 ***	0	0	0.353	0.238	0.967	0
Emergency Economic Countermeasures	0.078	1.507	0.327	2	2	3.013	1.215	0.000 ***	8
Comprehensive Economic Measures	0.373	1.184	0.003 ***	0	0	-2.494	-1.016	0.480	8
Economic Countermeasures	0.094	1.173	0.000 ***	0	0	-1.328	-0.473	0.358	8
Measures for the Rebirth of the Japanese Economy	0.456	3.447 ***	0.000 ***	0	2	2.157	1.119	0.802	5
Countermeasures to Address the Economic Crisis	0.144	2.226 **	0.009 ***	0	0	-0.919	-0.213	0.930	0

Note 1: *** means significant at the 0.01 level, ** means significant at the 0.05 level, and * means significant at the 0.10 level.

Note 2: One-shot dummies that take one only on the event day are used to exclude temporary changes, while the lags of them represent the number of days assigned to the one-shot dummy based on AIC. The p-values of one-shot dummies provide the significance level for the null hypothesis that all coefficients of one-shot dummies are zeros. The lags of the level-shift dummies are the same as those presented in Table 1. See the text for details.

Note 3: Column (1) shows the result when the Nikkei 225 index is added into Equation (1). Column (2) shows the estimation results of Equation (1) with yields replaced by the closing spot JPN/USD exchange rate. See the text for details.

Table 5: Unit Root Test Statistics

Variables	In Level				In 1st Difference			
	Detrended		Demeaned		Detrended		Demeaned	
Long-Term Rate	-2.678	(1)	-0.534	(0)	-4.299 **	(0)	-4.214 **	(0)
Projected Deficit/GDP	-1.618	(0)	-1.263	(0)	-4.911 **	(0)	-4.487 **	(0)
Projected Primary Deficit/GDP	-1.582	(1)	-1.389	(1)	-4.624 **	(0)	-4.159 **	(0)
Current Deficit/GDP	-1.664	(0)	-1.248	(0)	-4.380 **	(0)	-4.084 **	(0)
Current Primary Deficit/GDP	-1.845	(0)	-1.414	(0)	-4.463 **	(0)	-4.090 **	(0)
Current Debt/GDP	-1.233	(4)	-1.957	(4)	-3.558 *	(4)	-3.517 *	(4)
Trend Growth	-2.482	(2)	1.053	(1)	-6.129 **	(1)	-6.269 **	(1)
Expected Inflation	-2.462	(0)	-1.671	(0)	-4.391 **	(0)	-3.387 *	(0)
Equity Premium	-2.887	(0)	-1.993	(0)	-5.029 **	(0)	-3.776 **	(0)

Notes: Results of Dickey-Fuller test based on GLS de-trended series, proposed by Elliott, Rothenberg and Stock (1996), are printed. The lag lengths, shown in the parentheses, are chosen based on BIC. Critical values, tabulated by Fuller (1976) and Elliott. Rothenberg, and Stock (1996), are as follows (Sample size =50).

	1%(**)	5%(*)
Detrended	-3.77	-3.19
Demeaned	-3.58	-2.93

Table 6: Cointegration Test Statistics

Null on the Rank (r) Condition	Type of Budget Deficit			
	Projected Deficit	Current Deficit	Projected Primary Deficit	Current Primary Deficit
	Unrestricted constants			
r ≦ 0	141.464 *	139.438 *	149.550 *	140.232 *
r ≦ 1	83.028	83.612	85.197	81.318
r ≦ 2	41.814	46.140	43.449	43.493
r ≦ 3	18.641	25.500	20.226	22.758
r ≦ 4	8.121	8.507	10.235	8.804
r ≦ 5	1.440	1.944	2.107	2.112
	Restricted constants			
r ≦ 0	164.394 *	161.081 *	172.405 *	161.675 *
r ≦ 1	89.501	90.025	90.714	86.448
r ≦ 2	47.724	50.196	48.603	46.714
r ≦ 3	23.706	29.491	24.626	25.978
r ≦ 4	13.166	12.212	14.625	11.993
r ≦ 5	4.219	4.158	5.147	4.091

Notes: * denotes statistical significance at the 5% level. The constant in the six-variant vector error correction model(VECM) is restricted or unrestricted in the cointegration vectors. 5% critical values of Johansen's rank test are presented below. Following the procedure proposed by Cheung and Lai (1993), Juselius (2006, Appendix: Case 2 and 3) critical values are corrected to account for possible size distortions in finite samples. Incidentally, we cannot present the 1% corrected critical values since Cheung and Lai (1993) did not compute parameters for them.

	Unrestricted	Restricted
r ≦ 0	118.782	128.942
r ≦ 1	86.571	95.525
r ≦ 2	59.335	67.083
r ≦ 3	37.061	43.615
r ≦ 4	19.165	25.072
r ≦ 5	4.776	11.367

Table 7 : Cointegrating Relations of Primary Deficit/GDP, Debt/GDP and 10-year JGB yield.

Normalized Variable	10-year JGB Yield							
Estimation Method	FMOLS				OLS			
Projected Deficit/GDP	0.264 **				0.201 **			
	(4.802)				(2.874)			
Current Deficit/GDP		0.269 **				0.236 **		
		(3.450)				(2.775)		
Projected Primary Deficit/GDP			0.337 **				0.246 **	
			(5.896)				(3.046)	
Current Primary Deficit/GDP				0.334 **				0.246 **
				(4.473)				(2.758)
Current Debt/GDP	0.001	0.006	0.007 **	0.012 **	0.005	0.008 *	0.010 **	0.014 **
	(0.324)	(1.699)	(3.081)	(4.441)	(1.210)	(2.105)	(3.169)	(4.272)
Trend Growth	1.060 **	1.046 **	1.263 **	1.243 **	1.166 **	1.133 **	1.307 **	1.293 **
	(18.478)	(13.981)	(31.444)	(24.937)	(16.408)	(14.256)	(22.281)	(21.647)
Expected Inflation	1.002 **	1.064 **	1.000 **	1.097 **	0.912 **	0.981 **	0.917 **	0.985 **
	(11.368)	(8.847)	(13.094)	(10.047)	(7.964)	(7.464)	(8.166)	(7.414)
Equity Premium	-0.455 **	-0.613 **	-0.503 **	-0.679 **	-0.576 **	-0.704 **	-0.618 **	-0.743 **
	(-5.046)	(-4.698)	(-6.337)	(-5.640)	(-5.544)	(-5.377)	(-5.742)	(-5.255)

Note 1: * and ** denote statistical significance at the 5% and 1% levels, respectively.

Note 2: Sample period is from fiscal years 1981 to 2008. t-values are shown below the coefficients.

Note 3: OLS estimates are just a reference, since the distributions of coefficient estimates are biased when the first difference of the explanatory variables are correlated with the disturbance term. See Hamilton (1994) for details.

Chapter 2

Estimating non-Keynesian Effects for Japan*

1 Introduction

Is a fiscal stimulus effective? This classical question has received significant research attention since the collapse of the global financial services firm Lehman Brothers (Barro, 2009; Feldstein, 2009; Krugman, 2008). The empirical literature does not provide a clear answer to this question because the studies have varied in regard to sample periods, sample countries, analytical frameworks such as the vector autoregressive (VAR) approach, and the methodologies for the identification of fiscal shocks in the VAR approach. However, all but a few agree on the existence of Keynesian multiplier effects (Hebous, 2011).

On the other hand, there are also some studies demonstrating the existence of non-Keynesian effects. The seminal study of Giavazzi and Pagano (1990) shows that a fiscal contraction enhanced economic growth in Denmark and Ireland through an increase in expected future permanent income due to a lower possibility of fiscal bankruptcy, especially in bad fiscal situations. Perotti (1999), Giavazzi, Jappelli, and Pagano (2000), and Giavazzi et al. (2005) followed up Giavazzi and Pagano's (1990) study and using multi-country panel data confirmed the effects of fiscal stimuli can be negative when fiscal conditions are bad. In addition, Alesina et al. (2002) and Ardagna (2004) show that a reduction of both taxes and public spending relevant to labor markets, such as government wages, enhanced private investment and gross domestic product (GDP) since the reductions benefit the business sector, which in turn invested more.

Do poor fiscal conditions depress the Keynesian effects? To answer this question, we construct a near-VAR that includes interaction terms of government expenditure or tax revenue and the debt-to-GDP or primary-deficit-to-GDP ratio. Following Favero and Giavazzi (2007), to embed the dynamics of the debt-to-GDP ratio in the analysis, we explicitly incorporate the government budget constraint. From the near-VAR, we then compute impulse response functions (IRFs, hereafter) changing artificially the initial level of debt-to-GDP or primary-deficit-to-GDP ratio, and examining how the demand enhancement effect changes with the changes in the initial level of these ratios.

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This paper is organized as follows. Section 2 reviews non-Keynesian studies. Section 3 explains the statistical methodology and the data to be used in the analysis in this paper. Section 4 presents estimates of the IRFs, as well as our finding that only the primary-deficit-to-GDP ratio influences the demand enhancement effects of government expenditure and tax revenues and that non-Keynesian effects are observed when the primary deficit is large. Finally, Section 5 discusses the policy implications of our results and presents our conclusions.

2 Literature on Non-Keynesian Effects

Giavazzi and Pagano (1990) estimate consumption functions for Denmark and Ireland following fiscal consolidation in the 1980s, and find that the observed forecast errors could not be explained by the Keynesian view. They attributed this consumption puzzle to the expected future tax reductions, calling these effects the "expectations view" of the transmission channels of fiscal policy, or simply the "non-Keynesian effect."

Following this seminal study, studies have mostly proceeded in two directions: one examining the theoretical foundations of the non-Keynesian effects, and the other exploring their generality, that is, whether these non-Keynesian effects can be found in countries other than Denmark and Ireland. First, we summarize the literature examining the theoretical foundations of non-Keynesian effects. Table 1 shows the theoretical predictions concerning the relationship between fiscal expansion and private consumption. The traditional Keynesian view suggests that an increase in government expenditure and/or tax reduction drives up consumption, while the very basic new classical framework, such as the Ramsey model, indicates that a persistent increase in fiscal expenditure crowds out private consumption to exactly the same extent, so that a tax reduction has no effect on private consumption, as in the Ricardian equivalence proposition.

However, it is important to note that a tax hike can possibly increase consumption when taxation is distortional (Blanchard, 1990). Moreover, it is also worthwhile mentioning that fiscal policy can be expansionary in an overlapping generations model, since in this model, the amount that consumption is crowded out is less, and tax reductions replaced by bonds issues can increase consumption by imposing a burden on future generations.

Although these stylized theories provide the theoretical foundations for both Keynesian and non-Keynesian effects, they cannot explain both effects simultaneously. To address this problem, Bertola and Drazen (1993) demonstrate that the effects of government expenditure effects vary according to the budget-deficit-to-GDP ratio by expanding the neoclassical model with a mechanism in which a household's subjective probability of a fiscal consolidation takes a certain positive value or zero, depending on its past experiences of consolidation. On the other hand, Sutherland (1997) shows the possibility that tax effect vary by expanding the overlapping generations model with a mechanism similar to that of Bertola and Drazen (1993) and replacing the budget-deficit-to-GDP ratio by the debt to GDP ratio. Perotti (1999) shows intertemporal maximizing households decrease their consumption when

the government implements fiscal stimuli and has budget deficits, if their expected path for distortional taxes is upward sloping. Household consumption decreases substantially when not only the budget deficit is large but also when the public debt is huge because public debt is the source of the upward-sloping expected path for taxes. If the decrease in their consumption overwhelms the increase in consumption by liquidity-constrained households, then total consumption decreases.

Second, we examine the literature exploring the generality of non-Keynesian effects. Panel A of Table 2 shows the empirical studies following Giavazzi and Pagano (1990). All of these studies employed multi-country annual data and sought to confirm the existence of the non-Keynesian effects by testing the significance of dummy variables representing fiscal contractions and fiscal expansions, which were usually measured by changes in budget deficits, in consumption or saving functions. All of these studies, except Hjelm (2002), confirmed the existence of non-Keynesian effects, which can be attributed to the size of the budgetary change.

In contrast to the studies cited above, all of which focus on private consumption, Alesina et al. (2002) used the stylized theories as a benchmark and statistically confirmed that a reduction of both income tax and public spending such as government wages enhances private investments since the reductions benefit business sectors, which in turn invest more. In addition, they found no significant difference in this effect between good and bad fiscal situations. This “labor market view” of non-Keynesian effects was also confirmed by Ardagna (2004), who examined the relative importance of these two views and found that GDP growth is affected negatively not only by government expenditure but also by taxes regardless of the fiscal situation (Panel B in Table 2).

Finally, we introduce the studies for the Japanese economy. Nakazato (2002) employs the Perotti (1999) scheme and concludes that Japan experienced non-Keynesian effects from 1980 to 1987, which is regarded as a period of fiscal consolidation. Ito and Watanabe (2004) estimate consumption functions using prefectural-level panel data and point out that the effect was probably one of the sources of the recession after the mid-1990s. Kameda (2009) surveys these case studies of Japan, as well as others not introduced in this paper, and concludes that the strong consolidation measures, such as those implemented by Prime Ministers Nakasone and Koizumi, could well have generated non-Keynesian effects in Japan.

3 Methodology and Data

To analyze the existence of non-Keynesian effects, we adopt a near-VAR that includes an interaction term of the debt-to-GDP or primary-deficit-to-GDP ratio and government expenditure or tax revenues. We consider the following two systems: one that uses the debt to GDP ratio (system 1) and the deficit to GDP ratio (system 2).

System 1: Debt to GDP

$$\mathbf{Y}_t = C_0 + \sum_{i=1}^{k} \mathbf{C}_i \mathbf{Y}_{t-i} + \gamma_G d_{t-1} g_{t-1} + \gamma_T d_{t-1} t_{t-1} + \mathbf{u}_t \qquad (1)$$

$$d_t = \frac{1 + r_t}{(1 + \Delta y_t)(1 + \Delta p_t)} d_{t-1} + \frac{\exp(g_t) - \exp(t_t)}{\exp(y_t)} \qquad (2)$$

System 2: Deficit to GDP

$$\mathbf{Y}_t = C_0 + \sum_{i=1}^{k} \mathbf{C}_i \mathbf{Y}_{t-i} + \gamma_G PB_{t-1} g_{t-1} + \gamma_T PB_{t-1} t_{t-1} + \mathbf{u}_t \qquad (3)$$

$$PB_t = \frac{\exp(g_t) - \exp(t_t)}{\exp(y_t)} \qquad (4)$$

where $Y_t^{'} = [g_t, t_t, y_t, p_t, r_t]$, t_t and g_t are the logs of government revenues and government expenditure net of interest, per capita, respectively, r_t is the nominal rate of interest (the average cost of debt financing), y_t is the log of real GDP per capita, p_t is the GDP deflator (these variables are the same as in Perotti, 2004, and Favero and Giavazzi, 2007), d_t is the debt-to-GDP ratio, and PB_t is the primary-deficit-to-GDP ratio. The parameters to be estimated in these models are the 5x5 matrices C_j (j=0,.1.,,k), and the 5x1 vectors γ_G and γ_T , and the 5x1 vector u_t is a disturbance term. Needless to say, in the regression of the log of real GDP per capita, y_t , $\gamma_G < 0$ and $\gamma_T > 0$ indicate the existence of non-Keynesian effects in both systems.[1]

To estimate these systems, we use quarterly data for the Japanese economy from 1980Q1 to 2008Q2.[2] Due to the data availability, debt data are constructed by multiplying central government debt (government bonds + borrowings) by the ratio of total (central + local) government debt to central government debt. For the primary government expenditure, g_t , we aggregate the amounts in accounting subjects payable, except interest payments, in the general government accounts. Then, to extract the effects of social security funds in the general government accounts, we multiplied them by 1 - θ , where θ is the ratio of social security funds provided by the general government to total social security outlays. For government revenue, we use the sum of personal income taxes, corporate income taxes, indirect taxes, and transfers. Needless to say, the primary deficits are constructed by subtracting government revenue from primary expenditure.

The average cost of servicing the public debt is obtained by dividing interest payments by the public debt at time t − 1 and then by 4 for conversion to a quarterly basis. For price data, we take the log of the GDP deflator. In equations (1) and (3), we employ the logs of primary government expenditure, revenues, and GDP (all on per capita basis). All data are seasonally adjusted using X-12-ARIMA with

[1] Appendix 1 contains details of the VAR identification method.
[2] Appendix 2 contain details of data construction.

additive outlier dummies for 1997Q1 and Q2 in view of the increase in the consumption tax rate in April 1997.

Finally, we checked the accuracy of the debt dynamics equation in (2) by simulating it forward from 1980Q1 (see Figure 1). The simulated series is virtually superimposed on the actual one, and is thus accurate enough for the derivation of the impulse response functions. It is also worthwhile showing the ternd of the primary-deficit-to-GDP ratio. As is shown in Figure 2, the ratio decreased in the 1980s, increased in the 1990s, and decreased again in the 2000s; however, it jumped up after the collapse of Lehman Brothers. To tackle this situation, the Japanese government plans a new consumption tax hike from 2014Q2 and 2015Q4, sparking off discussions on the effects of such a hike on the macroeconomy. This paper is a part of this ongoing debate.

3 Empirical Analysis

4-1 Preliminary Analysis

Before estimating the near-VAR, we report a preliminary unit-root and cointegration analysis.[3] No rejections are found from the augmented Dickey−Fuller (ADF) tests for all the variables in levels, which means that each series has at least one unit root. For the first difference of all variables the ADF tests all indicate strong rejection of the null hypothesis of unit roots in all cases. We further examine whether any cointegrating relationship exists in our five-variable system. Using a 5% significance level, the trace test rejects the null hypothesis of a rank of 0, but not the null hypothesis of a rank of 1 (see Johansen, 1991). This means that the system has one cointegration relationship, and we should estimate a vector error correction model (VECM).

Table 3 shows the estimates of the non-Keynesian terms based on a two-step estimation. As you may find at a glance, some of these effects are significant when the primary-deficit-to-GDP ratio is employed. In particular, it is worth noting that the government expenditure affects GDP negatively. In contrast, none of the coefficients are significant when we use the debt-to-GDP ratio. Therefore, we concentrate on the primary-deficit-to-GDP case hereafter.

4-2 Impulse Response Functions

Given the presence of the government budget constraint, computing the impulse response functions (IRFs)for this model differs from the standard VAR case. Following Favero and Giavazzi (2007), we calculate the IRFs as follows. First, we generate a baseline simulation for all variables by solving equations (3) and (4), including the error correction term, dynamically forward. Second, we generate an alternative simulation by imposing a 1% (0.01) deviation of the structural shock of government expenditure and tax revenue, and dynamically solving the model forward up to the same horizon (eight

[3] The results of ADF and cointegration tests can be obtained from the author upon request.

quarters). Third, we compute the IRFs to the structural shocks by subtracting the former simulation results from the latter. Finally, we compute one-standard-deviation confidence bands by Monte Carlo simulation based on 1000 replications.

The benchmark IRFs, which artificially assign zero to the initial primary-deficit-to-GDP ratio, are shown in Figure 3. All of the five responses in the government expenditure case show the Keynesian features in general; however, the effects of tax increases on the GDP are Ricardian. This is not rare in fiscal VARs, however, as shown in Hebous (2011).

More interesting analyses are shown in Figure 4. The IRFs for GDP in this figure are derived by changing the initial values of the quarterly primary-deficit-to-GDP ratio from 0.000 to 0.015 and 0.03.[4] As Figure 4 indicates, government expenditure increases the GDP steadily when the deficit is equal to zero; however, the effect becomes ambiguous when the ratio is 0.015. Then, when fiscal condition are far worse (a ratio of 0.03), the effect of an increase in government expenditure is negative when evaluated by the median of the Monte Carlo draws.

We can also have the non-Keynesian effects for tax revenue as well.. When the primary-deficit-to-GDP ratio is set equal to zero, a tax hike has an ambiguous effect. However, as this ratio is increased, the effect tends to become positive, almost significantly, especially when the ratio is 0.03. As a result, we conclude that an increasing primary-deficit-to-GDP ratio gives rise to non-Keynesian effects.

5 Discussion

In this concluding section, we summarize the policy implications of our estimates for the Japanese economy. First, regarding the ongoing debate on the consumption tax hike, it may be said that undue concerns about its negative effects on the economy are not warranted. On June 26, 2012, Japan's House of Representatives approved a bill to double the current 5% consumption tax to 10% by 2015. Some politicians and economists are concerned about the possible recessionary effects generated by this tax hike. However, the actual primary-deficit-to-GDP ratio at the central and local government level is −6.7% in fiscal year 2010. Considering this fact, in combination with our results, the effect of the consumption tax hike would be neutral since the Keynesian and non-Keynesian responses would offset each other. One point that would be worth of attention, but that is not captured in this study is the exchange rate channel. The sound budgetary situation resulting from the new tax might accelerate an exchange rate appreciation and dampen the economy. The government and the Bank of Japan should realize this channel, and prepare for this possibility.

The second implication is that increasing government expenditure as an economic countermeasure is not justified. If the government adopts a high-spending policy, the non-Keynesian effects might work and depress the Japanese economy. Although renewing public capital is an important issue to be debated,

[4] To obtain the impulse response functions in the simulation 0.015 or 0.03 is added to the right-hand side of equation (4).

this option should be deferred at least until a sound budget situation is restored.

Third, the Japanese government must push for fiscal consolidation regardless of the economic situation. The bill provided for the enforcement of the tax hike conditional on the economic environment. Supplement 18 calls for countermeasures to aim for annual growth rate (on average) over the period 2011-2020 of about 3% in nominal terms and about 2% in real terms,. In addition, the agreement between the government party and two opposition parties (the Liberal Democratic Party [LDP] and the Komei Party) for the approval of the bill in the House of Representatives defined these growth rates as those to be achieved. Responding to these initiatives, Seiji Maehara, policy chief of the government party, suggested funding an economic package in this autumn's supplementary budget, and the LDP insisted on a 45 trillion yen public works program in their law (roughly translated as the Basic Law to Strengthen the Homeland) submitted to the Diet.

However, as has already been mentioned, these fiscal stimuli will have little effect on the economy. Therefore, we must not expect demand enhancement effects from the fiscal expansion. Moreover, our estimates show that tax increases have no effect on real GDP growth. The present government must push for a consumption tax increase regardless of the economic situation, although a decision on the hike has been deferred in terms of the agreement with the opposition and the buck may eventually be passed on to a future government.

Finally, we should note that the debt-to-GDP ratio is insignificant, and does not contribute to the emergence of non-Keynesian effects. In fact, Ito and Watanabe (2004) also obtained the same results. Feldstein (1986) provides some insights on why outstanding debt is not a significant factor in generating non-Keynesian effects. On the relationship between the government budget and nominal long-term interest rates, he argues that the budget deficit exerts a stronger effect on these rates than does public debt. A sustained budget deficit would pressure the monetary authority to ease the money supply, which in turn increases the nominal interest rates. In contrast, the stock of debt is the accumulation of deficits that have already been accepted, so debt provides less information about the future.

This argument would also apply to the non-Keynesian effects. A sustained budget deficit tends to cause people to anticipate future deficits. In contrast, the stock of debt is the accumulation of deficits that people have already accepted; thus, the amount of outstanding debt provides less information about future budget conditions. This discussion not only provide insights into our results, but also reveal why the Japanese people are not unduly concerned about the incredible amount of debt outstanding.

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I am grateful to Kazumasa Iwata, Naoyuki Yoshino, and all the participants of the Asian Economic Policy Review Conference on Fiscal Policy and Sovereign Debt held on March 25, 2012, for their helpful comments. This study is supported by the Japan Society for the Promotion of Science (Grant-in-Aid for Scientific Research #19730234). The responsibility for any errors in the text is, of course, entirely the author's.

Appendix 1: Identification of Structural Shocks

To identify fiscal shocks, we employ the standard approach of Blanchard and Perotti (2002). This approach identifies fiscal shocks by imposing restrictions that allow two structural fiscal shocks for government expenditure and government revenue, ε_t^g and ε_t^t, respectively, to be recovered from the reduced-form residuals of equations (1) ad (2), $\mathbf{u}_t$. Blanchard and Perotti focus on the fact that it typically takes longer than a quarter for discretionary fiscal expansion to respond to macroeconomic movements. Based on this finding, they considered that, at least at a quarterly frequency, the contemporaneous discretional response of fiscal policy to the macroeconomy is limited and only automatic-stabilizer-components should be included as a response. To this end, they estimated the elasticities of tax revenues and government spending with respect to macroeconomic variables, using institutional information.

Then, they identified the structural shocks to government spending and tax revenues by imposing the following on $\mathbf{A}$ and $\mathbf{B}$ matrices in $\mathbf{A}\mathbf{u}_t = \mathbf{B}\boldsymbol{\varepsilon}_t$.

$$\begin{pmatrix} 1 & 0 & a_{gy} & a_{gp} & a_{gr} \\ 0 & 1 & a_{ty} & a_{tp} & a_{tr} \\ \gamma_{yg} & \gamma_{yt} & 1 & 0 & 0 \\ \gamma_{pg} & \gamma_{pt} & \gamma_{py} & 1 & 0 \\ \gamma_{rg} & \gamma_{rt} & \gamma_{ry} & \gamma_{r\pi} & 1 \end{pmatrix} \begin{pmatrix} u_t^g \\ u_t^t \\ u_t^y \\ u_t^p \\ u_t^r \end{pmatrix} = \begin{pmatrix} b_{11} & 0 & 0 & 0 & 0 \\ b_{21} & b_{11} & 0 & 0 & 0 \\ 0 & 0 & b_{11} & 0 & 0 \\ 0 & 0 & 0 & b_{11} & 0 \\ 0 & 0 & 0 & 0 & b_{11} \end{pmatrix} \begin{pmatrix} \varepsilon_t^g \\ \varepsilon_t^t \\ \varepsilon_t^y \\ \varepsilon_t^p \\ \varepsilon_t^r \end{pmatrix}$$

where u_t^j ($j = y, t, y, p, r$) are the individual components of the vector of reduced form residuals, $\mathbf{u}_t$, and $\boldsymbol{\varepsilon}_t^j$ ($j = y, p, r$) are non-fiscal shocks that do not need to be interpreted. Since we identify a_{gy}, a_{gp}, a_{gr}, a_{ty} a_{tp}, and a_{tp} using external information, there are only 15 parameters (γ's and β's) to be estimated, which means the VAR is indeed identified.[i]

We assign values to the a parameters as follows. Following Watanabe et al. (2009), we set $a_{gy} = 0$, because the automatic response of government expenditure to output fluctuations within a quarter is limited. Following Perotti (2004), we assign −0.5 to the price elasticity of government spending, a_{gp}.[ii] We assume that $a_{gr} = a_{tr} = 0$, because property income is excluded from both expenditure and revenue. From Kato (2003), we set a_{tp} equal to 1.87.

Following Blanchard and Perotti (2002) and Perotti (2004), to construct the elasticity of real per capita revenues with respect to real per capita GDP, we set a_{ty} equal to 0.9. First, we decompose the

[i] Here, we assume that the second structural shock does not have an impact on government spending: $b_{12} = 0$.

[ii] We have a similar result assuming $a_{gp} = -1$, following Kato (2003) and Ko and Morita (2011).

elasticity as follows:

$$a_{ty} = \sum_i \eta_{TiBi}\eta_{Biy}\frac{\widetilde{T}_i}{\widetilde{T}}$$

where $\eta_{Tt,Bt}$ is the tax elasticity with respect to its own base; $\eta_{Bt,y}$ is the elasticity of the tax base with respect to real per capita GDP (y_t); $\widetilde{T}_i$ refers to each category of revenue *level*, and $\widetilde{T} = \sum \widetilde{T}_i$. Thus $\widetilde{T}_i / \widetilde{T}$ is the share of each category of revenue in total revenue. We consider four categories of revenues: personal income taxes, corporate income taxes, indirect taxes, and transfers. In contrast to Blanchard and Perotti (2002), we use accrual base data from the *Annual Report on National Accounts 2010* (henceforth *National Accounts*). Thus, we do not mention the collection lags below. All data are seasonally adjusted using a process similar to that detailed in the text. The data names from the source are in parentheses below.

Personal Income Taxes (*Current Taxes on Income, Wealth, Etc., Payable; Household*)

Let $T^{PI} = S(W)W(E)E(y)$, where T^{PI} is revenue from personal income taxes, S is the tax rate, W is the wage, and E is employment. By taking logs and totally differentiating, we obtain

$$d\log T_t^{PI} = \left[\left(\frac{\partial \log S}{\partial \log W_t}+1\right)\frac{\partial \log W_t}{\partial \log E_t}+1\right]\frac{\partial \log E_t}{\partial \log y_t} d\log y_t$$

The coefficient on $d\log y_t$ on the right-hand side is equal to $\eta_{TiBi}\eta_{Biy}$. By regressing log man-hours (employment multiplied by working hours) on lags 4 to -1 of $\log y_t$, we find that the estimated coefficient on the zero lag variable which is employed as $\partial \log E_t / \partial \log Y_t$ is not significant. Thus, we set the output elasticity of personal income taxes as zero.

Corporate Income Taxes (*Current Taxes on Income, Wealth, Payable; Financial and Non-financial*)

We estimate $\eta_{Bt,y}$ as the estimated coefficient on the zero lag variable in a regression of the log corporate profits on lags 4 to -1 of $\log y_t$. For corporate profits, we employ the sum of the *net operating surplus* from the financial and non-financial sectors in the *National Accounts*. This gives an estimated coefficient of 4.47. We estimate $\eta_{Tt,Bt}$ from a regression of the log tax receipts on the corporate profit which gives a coefficient of 0.79.

Indirect Taxes (*Taxes on Production and Imports*)

Following Perotti (2004), the output elasticity of indirect taxes is assumed to be 1.

Transfer (*sum of other current transfers, capital transfers, and imputed social contribution*)

We assume the output elasticity of transfers is zero.

Appendix 2: Data

We constructed the debt data by multiplying central government debt data (government bonds + borrowings), obtained from various issues of the *Monthly Financial Review* published by the Ministry of Finance, by the ratio of total (central + local) government debt to central government debt. The ratio is calculated on the basis of Kawade, Ito, and Nakazato (2004), who estimate quarterly data by linear interpolation from the annual ratios published in *Trends of Long-Term Debt Outstanding*. Then, to adjust for the effects of the privatization of the Postal Savings System, we add 48.7374 trillion yen to this debt data series from 2003Q2 onward.

To obtain data on primary government expenditure, we aggregate the amounts in accounting subjects payable, except interest payments, in general government income and outlay accounts and capital finance accounts in the *Annual Report on National Accounts 2010*. For some subjects that are available only on an annual basis (capital transfers and land purchase), we simply divided them into four equal parts. In addition, for data changes caused by, for example, the privatization of Japan Highway Corporation, we reverse these discretionary changes.

These data are not yet consistent with the definition of public debt since general government accounts include social security funds. To subtract this amount, we calculate the annual ratio of outlays of social security funds to general government outlays, by subject, and then estimate the quarterly amounts by linear interpolation. Using this ratio, we constructed quarterly series of the central and local governments' primary expenditure.

To obtain data on government revenues, we use the sum of personal income taxes, corporate income taxes, indirect taxes, and transfers. The latter three are available only on a general government basis; therefore, we estimate their quarterly values using the procedures described for social security funds.

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Table 1: Predicted effects of a fiscal impulse on private consumption in various models

Keynesian (IS-LM)	＋	＋
Neo-classical (Infinite Horizon)	-	0
Neo-classical (Infinite Horizon+α (Distortional Tax)	-	-
Overlapping generation model (Blanchard (1985) ,Finite Horizon)	-	＋
Bertola and Drazen (1993)	Depends on gov't expenditure-to-GDP ratio （＋ (-) when the ratio is low (high)）	/
Sutherland (1997)	/	Depends on gov't debt-to-GDP ratio （＋ (-) when the ratio is low (high)）
Perotti (1999)	Dependd on gov't debt-to-GDP ratio or deficit-to-GDP ratio （- (+) when the ratio is low (high)）	Depends on gov't debt-to-GDP ratio or deficit-to-GDP ratio （＋ (-) when the ratio is low (high)）

Table 2 Review of studies on non-Keynesian effects

Panel A

	Sample	Estimation method(*5)	Estimation equation	Fiscal dummies: Definition of fiscal contractions and expansions	Fiscal dummies: No. of episodes (No. of years in total) (Share of all observations): Consolidation	Fiscal dummies: No. of episodes (No. of years in total) (Share of all observations): Expansion	Existence of non-Keynesian Effects						
								Tax vs. Gov't Outlay (*4)	Conditions that trigger the effects: Size	Com-position	Debt level	Growth rate of Debt	Ex-rate
Giavazzi and Pagano (1990)	1971-87 (D) 1961-87(I) (*1)	NLIV indiv. country	Consumption (Hayashi, 1982)	Unused (existence of effects are determined based on features on the residuals of out-of-sample simulation for fiscal consolidation period. See main text for details.)	–	–	Yes	–	–	–	–	–	–
Giavazzi and Pagano (1996)	1972-92 19 OECD countries (n = 367)	IV Panel	ECM consumption	The cumulative change in the structural deficit: (i) in 4 successive years including t exceeds 5% of potential GDP (ii) in 3 successive years including t exceeds 4% of potential GDP (iii) in 2 successive years including t exceeds 3% of potential GDP; or (iv) if change in structural deficit in year t exceeds 3	36 (114) (31.0%)	–	Yes	–	○	–	–	–	–
Giavazzi, Jappelli and Pagano (1998, 2000)	1970-96 18 OECD countries (n = 417)	IV Panel	Savings rate	Full employment surplus changes by at least 1.5% per year, on average, over a two-year period	38 (99) (23.7%)	65 (174) (41.7%)	Yes	T	○	×	×	×	×
	1970-94 101 countries incl. developing (n = 1770)	OLS Panel			270 (*2)	259 (*2)	Yes	T	○	×	×	○	–
Giavazzi, Jappelli, Pagano, and Benedetti (2005)	1964-03 18 OECD countries (n = 556)	IV Panel			51 (145) (26.1%)	69 (200) (36.0%)	Yes	T	○	○	–	×	–
Perotti (1999)	1965-94 19 OECD countries (n = 484)	OLS/ GMM Panel	Euler equation	Type 1 dummy: ratio of sum of cyclically adjusted government debt and PDV of future government expenditure to trend GDP in t-1 exceeds 90%	48 (9.9%)	–	Yes	G	○	×	×	×	×
				Type 2 dummy*: cyclically adjusted deficit, as a share of trend GDP, exceeds 4% in two previous years t - 1 and t - 2	53 (11.0%)	–	Yes	G	○	×	○	–	–
Hjelm (2002)	1974-97 19 OECD countries (n = 456)	IV Panel	Solved consumption	The cumulative decrease (increase) in the cyclically adjusted primary deficit as a percentage of potential GDP: (i) in four successive years including t exceeds 5%; (ii) in three successive years including t exceeds 4%; (iii) in two successive years including t exceeds 3%; (iv) in year t exceeds 3%	23 (82) (18.0%)	22 (65) (14.6%)	No	×	×	×	×	×	(○) (*3)

Panel B

Alesina, Ardagna, Perotti, and Schiantarelli (2002)	1960-96 18 OECD countries (n = unknown)	OLS/ IV Panel	q-type investment equation	The primary cyclically adjusted balance as share of trend GDP improves by at least 2% in one year or by 1.25% in two consecutive years and the average real GDP growth in each adjustment year and in the two years after is greater (lower) than the average real GDP growth in the two years before	Unknown	Unknown	Yes	G	○	○	–	–	–
Ardagna (2004)	1975-02 17 OECD countries (n=413)	OLS / Amemiya's GLS Panel	Prob. of successful stabilization (Probit) & GDP growth function	As successful stabilazation: the cyclically adjusted primary balance improves, and, 2 years after, the debt-to-GDP ratio is at least 3% lower than the year of the fiscal tightning. For GDP growth funvtion: None (Squared Values of fiscal variables are employed as independent variables.)	Unknown	–	Yes	G	○	○	–	–	–

*1: D and I denote Denmark and Ireland, respectively.

*2: The number of years in the episodes is unknown.

*3: We added the parentheses because, in Hjelm (2002), the success of fiscal consolidation is attributed to an expectation of a depreciation of exchange rates, and not to non-Keynesian effects.

Table 3: Coefficients of non-Keynesian terms

Debt-to-GDP System					
	DG	DT	DY	Dπ	Dr
DG*D/Y	0.172	0.124	-0.101	0.054	-1.575
	(0.444)	(0.299)	(-0.890)	(1.278)	(-1.117)
DT*D/Y	-0.159	-0.090	-0.009	-0.049	-0.470
	(-0.564)	(-0.301)	(-0.109)	(-1.609)	(-0.458)
Primary-Deficit-to-GDP System					
	DG	DT	DY	Dπ	Dr
DG*(G-T)/Y	21.582	-6.855	-7.754 *	1.129	-137.214 **
	(1.405)	(-0.413)	(-1.711)	(0.665)	(-2.463)
DT*(G-T)/Y	-30.771 **	-5.704	4.034	-2.904 *	66.055
	(-2.015)	(-0.346)	(0.896)	(-1.720)	(1.193)

Notes:
(1) t-values are in parentheses.
(2) ** and * denote the coefficient is significantly different from zero at the 0.05 and 0.10 level of significance, respectively.

Figure 1: Actual and simulated debt-to-GDP ratio

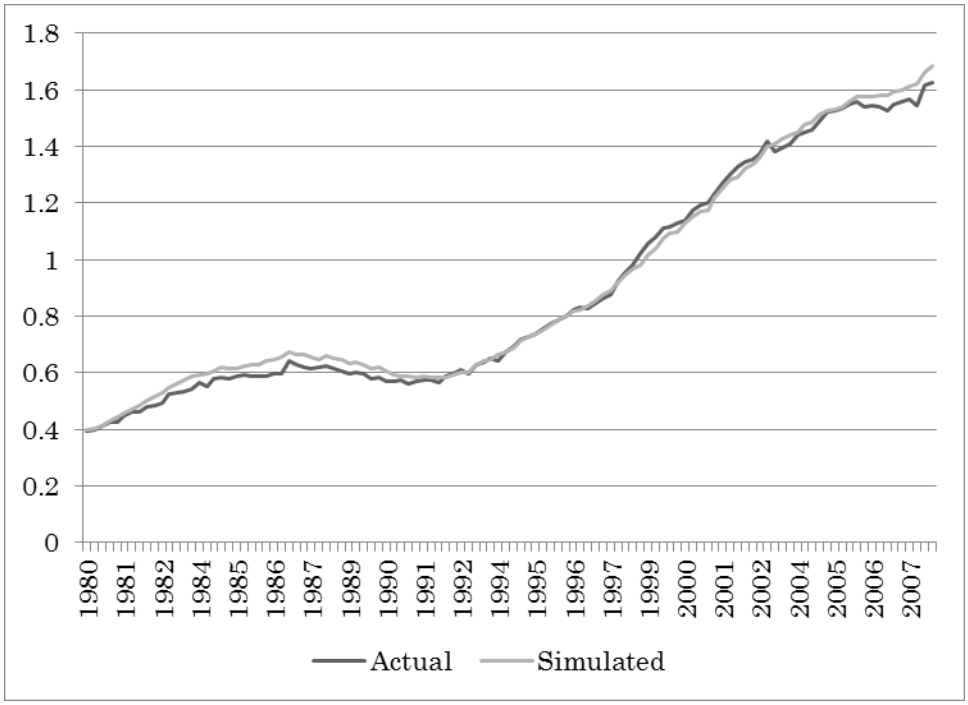


Figure 2: Quarterly primary-deficit-to-GDP ratio

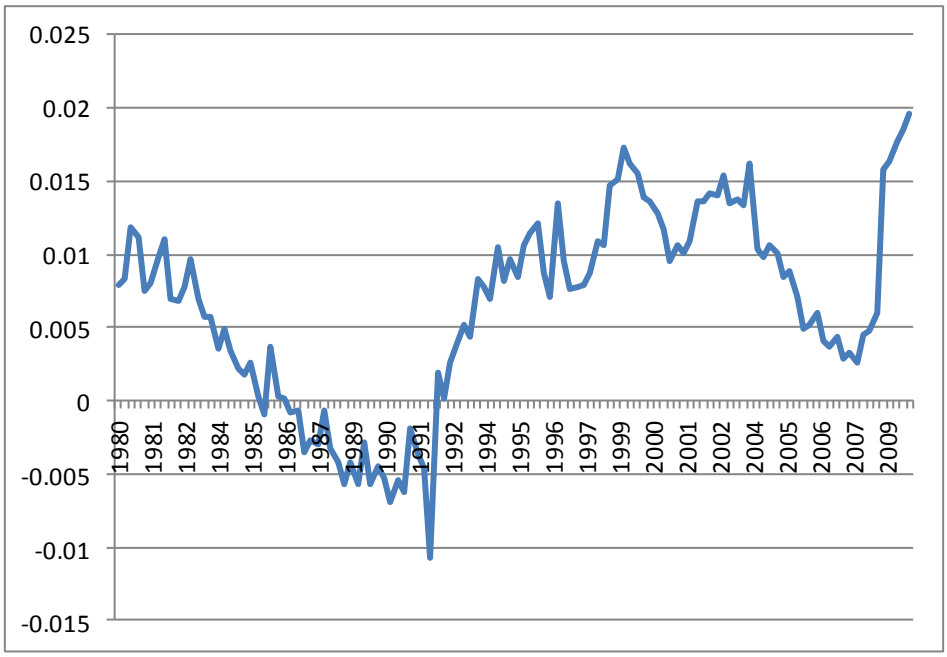
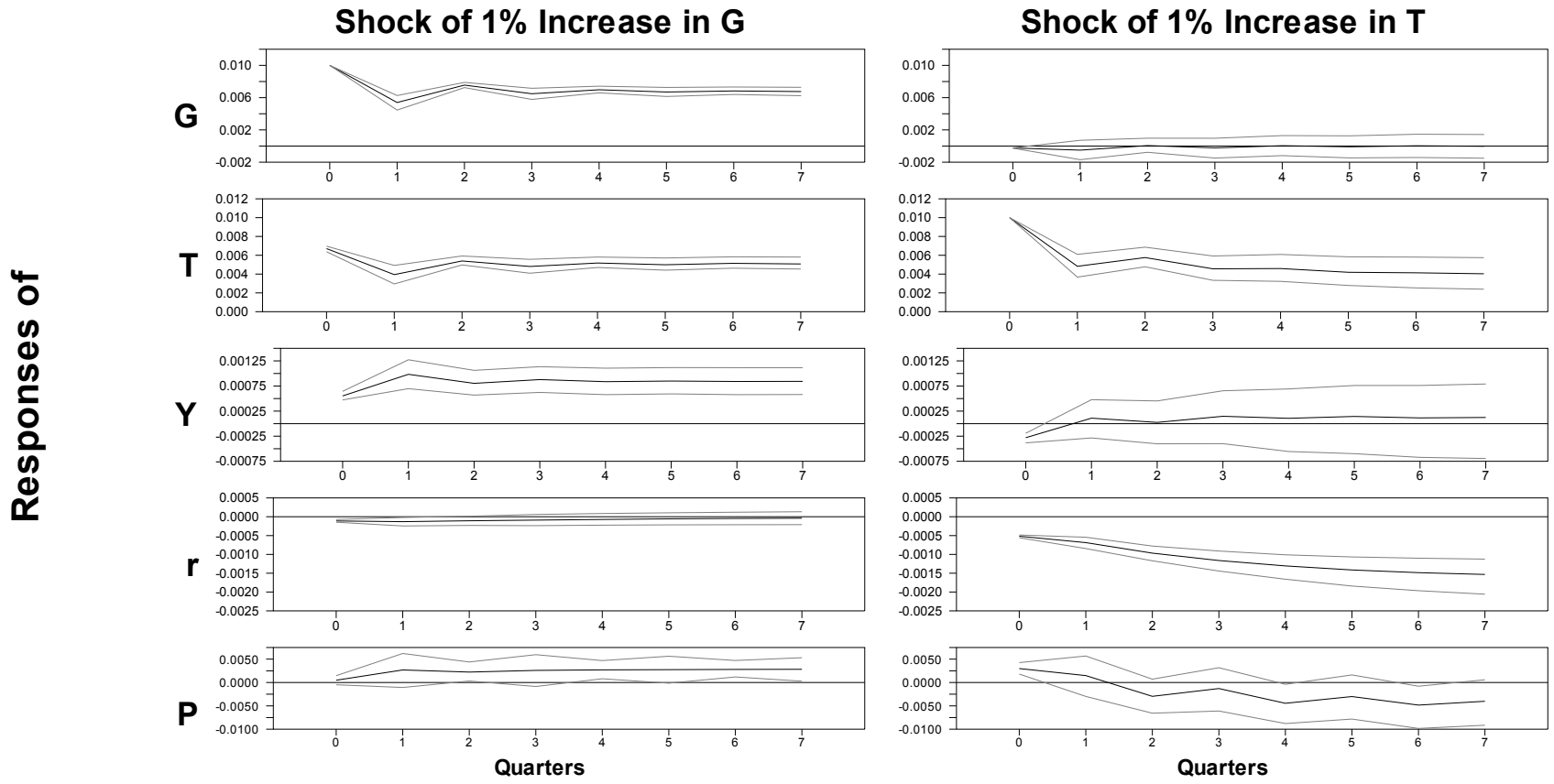
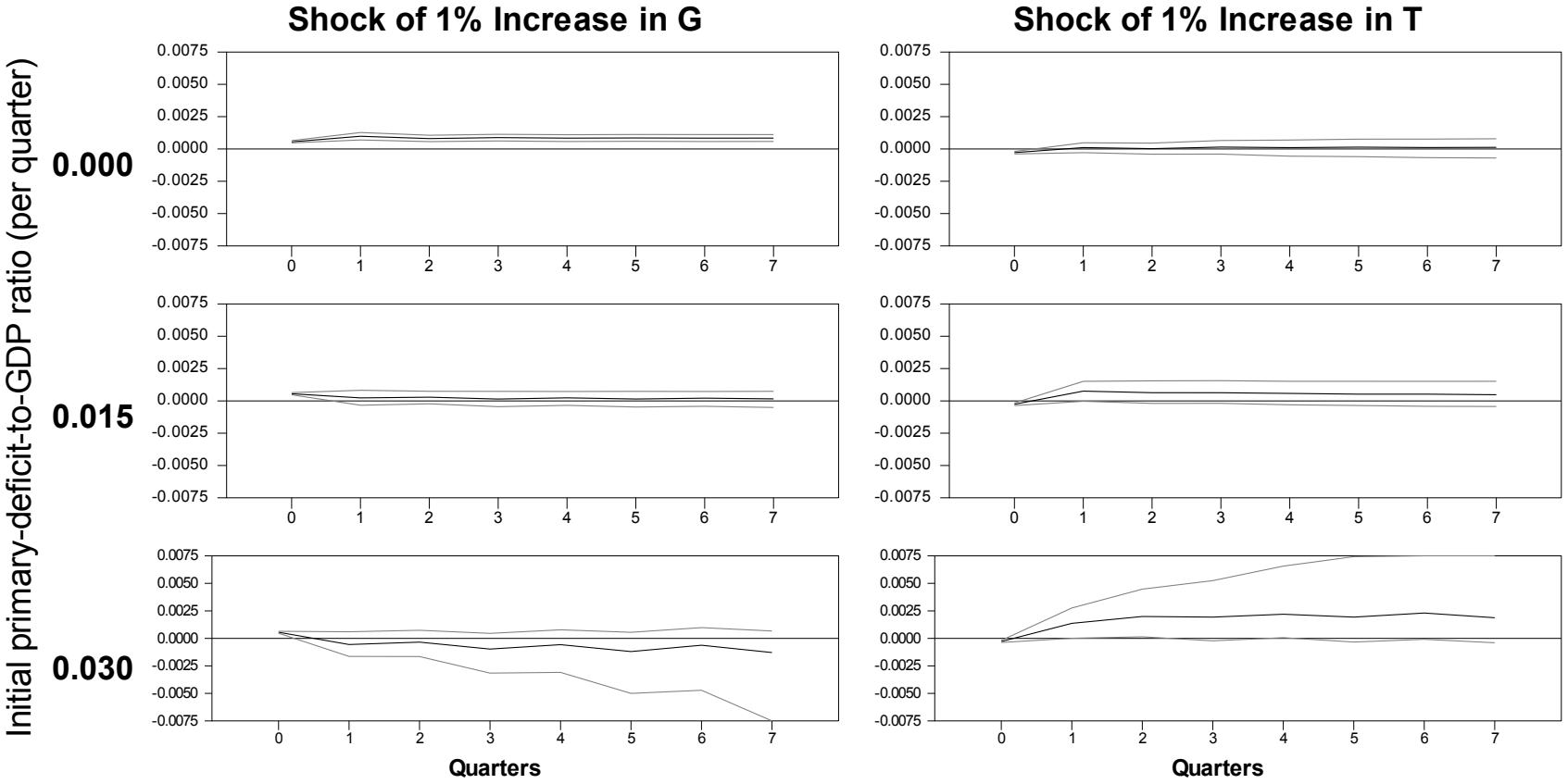


Figure 3: Impulse response functions



Note :
The dark line indicates the median of 1000 draws obtained by Monte Carlo simulation. The light lines which represent significance bands are computed from the 16th and 84th percentiles.

Figure 4: Impulse response functions for the log of GDP per capita under various initial values of the primary-deficit-to-GDP ratio



Note :
The dark line indicates the median of 1000 draws obtained by Monte Carlo simulation. The light lines which represent significance bands are computed from the 16th and 84th percentiles.

Chapter 3

What Causes Changes in the Effects of Fiscal Policy? A Case Study of Japan*

1 Introduction

In the past two decades, the Japanese government has spent a considerable amount of money to counteract the recurring and severe recessions that have occurred since the early 1990s, and there has been much discussion of the effects of this fiscal expansion. Although the resulting conclusions remain controversial, almost all studies have found that the effects of fiscal policy are weakening, and that the fiscal multiplier has decreased since the mid- to late 1990s. For example, EPA (1998) have identified several possible reasons for this weakening, which include the following: breaks in the feedback loop from existing production to expected production via investment and profits, adjustments to the excess physical stock, weakened effectiveness of capital stock, balance sheet adjustments, declining asset markets, and weak prospects for economic growth, among others. Studies have also focused on the non-Keynesian effects of huge budget deficits, which bring about a decrease in private consumption (Kawade et al., 2004) and in employment (Miyazaki, 2010). In addition, Kamoi and Tachibanaki (2001) showed that public investments directly replaced private investments after the mid-1980s.[1]

As mentioned above, numerous studies have pointed out that fiscal policy effects declined after the mid- to late 1990s; however, none of these studies have statistically tested the relationship between the effects and the causes that they implicitly or explicitly mention. The methodology of these studies is simply to divide the entire sample into two periods—before and after the mid-1990s—and then speculate upon the causes by comparing the shape of the impulse response functions (hereafter, IRFs) of VAR for these two periods.

By using a new methodology, this paper analyzes this relationship. We statistically test the relationship by using a threshold VAR in which the causes mentioned in the literature are adopted as

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[1]As in other studies, Kitaura et al. (2005) discussed the same effects of crowding-out of private investment; however, they also pointed out the possibility that these results simply reflect an adverse relationship in which fiscal expansion was undertaken in order to offset a decrease in private investment. For a study that insists that the multiplier effect does not decrease in a more apparent manner, see Hori and Ito (2002).

the threshold. If we reject the null hypothesis, defined by each of the selected threshold variables, that the estimated parameters in a VAR are equal under each regime, we can say that a given cause does affect the macroeconomic structure and, in turn, the fiscal policy effects. Next, we estimate the IRFs for both sample periods, as constructed according to the cause estimates, and compare the fiscal policy effects in each regime[2].

Our findings are as follows. The diffusion index of the attitudes of financial institutions toward lending and the yearly change in the annual average of the quarterly ratios of structural primary budget balance to potential GDP significantly reject the null hypothesis. Therefore, we concluded that these variables have a definite impact on fiscal expansion effects. Then, estimating the IRFs for both sample periods, we found the demand-enhancing effects of government expenditure and tax reduction to be weak when these two indices were in bad situation through the traditional accelerator effects of private investment, the effects of liquidity-constrained on households, and the non-Keynesian effects on private consumption.

This paper is organized in the following manner. In section 2, we review Japanese economic countermeasures after the asset price bubble burst in the early 1990s. Section 3 explains the statistical methodology and data, drawing comparisons with the previous literature, and Section 4 discusses the test results and derived IRFs. Finally, Section 5 summarizes our findings and concludes the paper.

2 A Brief History of Fiscal Stimuli after the Bubble Burst in the Early 1990s

The in-depth analyses conducted by Bayoumi and Collins (2000) and Ihori (2006) indicate that the asset price bubble in Japan burst in the early 1990s. In order to overcome this enormous setback, the Government of Japan initiated a process of fiscal expansion in the form of economic countermeasures (Table 1, Figure 1).

The first step involved the "Emergency Economic Countermeasures" under Prime Minister Kiichi Miyazawa, framed on March 31, 1992.[3] This countermeasure was not accompanied by a supplementary budget, but public works projects were front-loaded and the prime minister officially suggested the possibility of additional measures. In fact, the prime minister added two measures with supplementary budgets, which accounted for a total of ¥24.9 trillion. Although the government expected that these measures would be effective, the problems of the economy were further aggravated and three additional measures were required until 1995. These fiscal stimuli rapidly worsened the Japanese *budgetary* situation, and it became essential in 1996 to issue deficit-covering

[2] Although applying threshold VAR for studies on Japanese fiscal policy is relatively new, this method is becoming popular. Consider, for example, Choi and Devereux (2006), Afonso et al. (2011), and Auerbach and Gorodnichenko (2012).

[3] Since this measure was not accompanied by a supplementary budget, it is not presented in Table 1.

government bonds, which were not backed by any funds or measures for redemption, such as planned tax hikes in the future.

Although the economic strain was expected to be prolonged, the economy did begin to recover in 1996. With this improvement, Prime Minister Ryutaro Hashimoto, who took office on January 11, 1996, enforced a consumption tax hike in April 1997, aiming at fiscal consolidation. However, external and internal financial crises played a crucial role in taking the Japanese economy to a state of near-destruction. Externally, the so-called Asian financial crisis worsened the economic environment around Japan, and the internal crisis related to successive bankruptcies of domestic financial institutions caused by deflated stock markets and bad loans. In these difficult conditions, the prime minister had to put into place an economic package exceeding ¥16 trillion in April 1998, although he had already enforced "the Act on Special Measures Concerning Promotion of Fiscal Structural Reform" on December 5, 1997. However, despite these efforts, the economy slipped into a recession, and several more financial institutions went bankrupt.

In order to lift the economy out of depression, the next prime minister, Keizo Obuchi, promoted Keynesian policies on a large scale and enacted a law that laid down a procedure for handling bankruptcies of financial institutions. His two economic countermeasures cost an enormous ¥34 trillion in total, although these measures turned out to be worthwhile as the economic situation improved.

Unfortunately, no sooner had the IT bubble burst than the economy went back into a recession. In addition, as easily calculated from Table 1, at the end of FY2000, the total cost of economic countermeasures had already exceeded ¥127 trillion, and long-term debt at the central and local government levels amounted to ¥646 trillion, or 128% of Japan's GDP. Moreover, credibility of fiscal expansion as an effective strategy declined, as explained in the previous section. As shown in Figure 2, a steady growth could not be achieved in Japan in spite of large-scale and repeated fiscal countermeasures, as described above.

Prime Minister Junichiro Koizumi, who was appointed on April 26, 2001, amid enthusiastic expectations that he would take the Japanese economy out of stagnation, abolished the Keynesian demand-side policy and initiated "structural reform," which involved reconstruction of the supply-side of the economy with deregulation and resolution of the bad loan problem. These new policies were regarded as threats by some politicians who were used to Keynesian demand-side policies and occasionally used them for rent-seeking activities. However, Koizumi ended up heading an administration that had the third-longest duration after World War II. He implemented countermeasures thrice but reduced their cost and scope, and the original budgets decreased year after year. As a result, the primary balance improved consistently between FY2002 and FY2007 when Yasuo Fukuda, the second prime minister after Koizumi, assumed office.

On September 15, 2008, the Lehmann shock caused a drastic change in the fiscal stance. Prime

Minister Taro Aso introduced a huge expansion to counter the shock, and his three-step package of countermeasures cost ¥120.7 trillion in total. The three subsequent prime ministers, appointed after the historic change of government from the Liberal Democratic Party to the Democratic Party of Japan, adopted a socially liberal stance and expanded the budget to cope with the aftermath of a major world depression and the East Japan Earthquake that occurred on March 11, 2011.

On reviewing these past two decades it is evident that the Government of Japan introduced 21 economic countermeasures with supplementary budgets, which cost approximately ¥348 trillion yen in total, although this includes not only government expenditure but also land purchase and financial support to private companies, for example, credit guarantee assistance.[4] According to Feldstein (2009), it was the appropriate response when faced with a dysfunctional financial system. However, as shown in Figure 2, the annual average growth rate of Japan was much lower than those of other developed countries and Asian economies; therefore, it would be difficult to say those fiscal policies worked effectively and resulted in actual expansion. In general, fiscal policies are considered to have been effective and useful in Japan before the 1980s; thus, it is important to analyze what factors worked to limit the effectiveness of fiscal expansion.

3 Statistical Methodology and Data

3-1 Threshold VAR

We employ the following threshold VAR model with two regimes (Tong, 1990).

$$\begin{aligned} Y_t &= A_1 + B_1(L)Y_{t-1} + V_{1,t} \qquad if \quad s_t \le \gamma \\ &= A_2 + B_2(L)Y_{t-1} + V_{2,t} \qquad otherwise \end{aligned} \tag{1}$$

where $Y_t = (Y_t^1, Y_t^2, \cdots, Y_t^k)'$ is a vector of k variables, L is the lag operator, $V_{i,t} = (u_{i,t}^1, u_{i,t}^2, \cdots, u_{i,t}^k)'$ is a $k \times 1$ vector of error terms with $V_{i,t} \sim N(0, \Sigma_{Vi})$ for i=1 and 2, s_t is a threshold variable, and γ is a threshold parameter. Regime 1 is defined as the subperiod when $s_t \le \gamma$ and Regime 2 is defined as that when $s_t > \gamma$. The coefficient matrices A_i and B_i are estimated depending on s_t, and γ too is estimated simultaneously. $V_{i,t}$ is assumed to be independent, identically distributed over time, and heteroskedastic, and to be mutually independent between regimes 1 and 2.

In order to obtain the threshold estimates of a threshold VAR model, we employ a grid search, as

[4]The estimation of pure expenditure is rather difficult. See Ishi and Wada (1998) and Komine and Okada (2011) for details.

in Pesaran and Potter (1997) and Choi and Devereux (2006). The conditional log-likelihood up to a constant term is given by

$$
\begin{aligned}
& l(A, B, \Sigma_{Yi}, \gamma) \\
& \quad = -\frac{1}{2}\sum_{i=1}^{2} N_i \ln\left|\Sigma_{Vi}\right| \\
& \quad -\frac{1}{2}\sum_{t=1}^{2}\{[Y^i - \iota_{N_i} \otimes A_i - (I_{N_i} \otimes B_i(L))Y_{-1}^i]'[I_{Ni} \otimes \Sigma_{Vi}]^{-1}[Y^i - \iota_{N_i} \otimes A_i - (I_{N_i} \otimes B_i(L))Y_{-1}^i]\}
\end{aligned} \tag{2}
$$

where Y^i and Y_{-1}^i are the selected sample vectors for regime i and N_i is the number of observations in regime i. ι_{Ni} is $N_i \times 1$ vector of ones and I_{Ni} is an $N_i \times N_i$ identity matrix . Needless to say, these four depend on γ .

The null hypothesis we need to test is whether the estimated parameters are equal in both regimes (i.e., $H_0 : B_1 = B_2$). If this hypothesis is rejected, we can conclude that the cause does affect the macroeconomic structure and, therefore, the fiscal policy effects, when we use a proxy variable for the cause as the threshold. However, to perform this test, we have to resolve the nuisance parameter problem, the so-called Davies problem (Davies, 1977).

This problem originates from the fact that we cannot identify the threshold parameter γ under the null hypothesis. If we know γ a priori, the Wald statistics of the null hypothesis have an approximate chi-square distribution in large samples. However, the threshold γ would generally be unknown ex ante. Therefore, test statistics such as the Wald statistic depend on the nuisance parameter of γ ; thus, it is impossible to perform the usual test procedures.

To deal with this nuisance parameter problem, Hansen (1996) shows that the asymptotic null distribution of the test statistics has a marginal chi-square distribution for each $\gamma \in \Gamma$ under some general conditions satisfied by a wide class of linear processes with i.i.d. innovation (e.g., the autoregressive moving average (ARMA) model) and that the null distribution of its p-value has uniform distribution asymptotically. Then, using the simulation method, Hansen (1996) made J random samples $(g^1, \cdots, g^J)$ of a continuous, monotonic, uniform metric function of test statistics, and computed the percentage of these artificial observations that exceeded the actual test statistics $g^J : p^J = (1/J)\sum_{j=1}^{J}\{g^j \geq g\}$. The following three functions are proposed for the functional form of g : $SupT = Sup_{\gamma \in \Gamma} T(\gamma)$, $aveT = \int_{\Gamma} T(\gamma) dW(\gamma)$, and $\exp T = \ln(\int_{\Gamma} \exp(1/2 Z(\gamma) dW(\gamma))$; however, in this paper, we adopt $SupT$, as in Davies (1977).

3-2 Variables in VAR

While analyzing the fiscal expansion effects by using VAR, we must first consider what variables should be included in the model and how long the lags should be. The degrees of freedom are known to reduce by k^2 when the lag length is increased by one. As we will discuss later, this analysis employs 115 observations, not too small a number, considering sample sizes used in previous studies. However, since these observations need to be divided into two regimes, the number of variables is limited.

The procedure used to select the VAR variables is as follows. In this study, it is essential that we include real private consumption and real private investment—usually considered in the literature to evaluate fiscal expansion effects, as shown in Table 2 updated from Nakazato (2005)—as well as real public investment (typically employed in Japan as a fiscal instrument to counteract recession) and tax revenues. In addition, it would be quite interesting to embed long-term interest rates, although, surprisingly, no Japanese study except Kitaura et al. (2005), as shown in Table 2. Needless to say, it is better to use *real* long-term interest rates for this purpose. Therefore, in this paper, we conduct VAR using a set of five variables, $Y_t^{'} = [G_t, T_t, r_t, I_t, C_t]$, where G_t, T_t, r_t, I_t, and C_t indicate public investment, tax revenues, real interest rates, private investment, and private consumption, respectively.[5][6]

(Table 2 here)

3-3 Data[7]

3-3-1 Data on Variables in VAR

(1) Macroeconomic Variables

We used the quarterly series of the *Annual Report on National Accounts 2009* from 1980:I to 2008:III. Although these series are available until 2010:I, we excluded the data after the so-called Lehmann shock. If we include post-Lehmann shock data, we would need to consider the structural break by the shock. However, because there are only six observations available during and after the shock and since each regime must have at least 20% of the entire sample in order to obtain stable estimates (Pesaran and Potter, 1997; Atanasova, 2003), the threshold VAR does not work well if we include the sample period after the shock.

---

[5] We did not employ the threshold variables as dependent variables in the VAR here since budget balance and government debt, both of which are included in the list of thresholds, can respond to the shocks violating the government budget constraint.

[6] If we move the order of real long-term interest rates to the bottom and change accordingly the restriction matrix of A in (3) explained later, the IRFs show no conspicuous difference.

[7] See the Appendix 1 for details.

All series are seasonally adjusted by X12-ARIMA with the additive point outlier dummies of 1997:I and 1997:II, with due consideration to the increase in the consumption tax rate in April 1997.

(2) Real Long-term Interest Rates

We used the closing yields of 10-year Japanese government bonds for the nominal long-term interest rates and then subtracted the anticipated inflation rate, which was estimated using Kanoh's (2006) method, which in turn is based on the Carlson-Parkin method (Carlson and Parkin, 1975). The survey data to build the anticipated inflation rate was obtained from the *Consumer Confidence Survey* published by the Cabinet Office of the Government of Japan, and the deflator of household consumption provided in the *Annual Report on National Accounts 2009* was adopted as the price level.

3-3-2 Threshold Variable

As discussed in Section 1, we find several sources in the literature for the reduction in fiscal multiplier effects. We selected the proxies referring to relevant previous studies, as shown in Table 3.

We adopted the diffusion index (DI) of "Production Capacity (manufacturing)," reported in Bank of Japan's Tankan (Short-term Economic Survey of Corporations) as proxies for excess physical stock and the weakened effectiveness of capital stock. The DI represents the proportion of entrepreneurs who feel they have "excessive capacity" minus those who feel they have "insufficient capacity." To express balance sheet adjustments, we use the DI of "the lending attitude of financial institutions," that is, the proportion of entrepreneurs who feel that the present attitude of financial institutions is "accommodative" minus those who feel that the present attitude is "severe." The Nikkei 225 index was used to indicate the slump in the asset markets. The reason we do not use either its change or its growth rate here is that the absolute value of assets is an adequate measure for the evaluation of collateral and/or the market value of equity capital as factors weakening fiscal expansion effects. We regard the DI of "Business Conditions (Forecast)" as a weak predictor of economic growth. Finally, the yearly change in the annual average of lag 0 to -3 quarterly ratios of the structural primary budget surplus to the potential GDP and the ratio between the public debt and the GDP were adopted as signals of the non-Keynesian effects, as in Perotti (1999), Giavazzi et al. (2000), and Hjelm (2002).

3-4 Estimation Procedure

We used the first differences of the natural logarithms of all variables since we found that private investment is non-stationary in levels. The lag length of VAR was set at 1, against the maximum lag

length of 4, based on the Akaike information criterion for the entire sample.[8] [9]

To identify fiscal shocks, we apply the standard approach of Blanchard and Perotti (2002). This approach identifies fiscal shocks by imposing restrictions that allow two structural fiscal shocks for government expenditure and tax revenue, $\varepsilon_{i,t}^{g}$ and $\varepsilon_{i,t}^{t}$, respectively, to be extracted from the reduced-form residuals, $V_{i,t}$. Blanchard and Perotti (2002) focused on the fact that it typically takes longer than a quarter for discretionary fiscal expansion to respond to macroeconomic movements. Based on this finding, they considered that, at least at a quarterly frequency, the contemporaneous discretional response of fiscal policy to the macroeconomy is limited and only automatic-stabilizer-components should be included as a response. To this end, they estimated the elasticities of tax revenues and government spending with respect to macroeconomic variables, using institutional information.

Applying this identification techniques, we identified the structural shocks to government spending and tax revenues by imposing the following on $\mathbf{A}_i$ and $\mathbf{B}_i$ matrices in $\mathbf{A}_i V_{i,t} = \mathbf{B}_i \boldsymbol{\varepsilon}_{i,t}$.

$$\begin{pmatrix} 1 & 0 & a_i^{Gr} & a_i^{GI} & a_i^{GC} \\ 0 & 1 & a_i^{Tr} & a_i^{TI} & a_i^{TC} \\ \theta_i^{rG} & \theta_i^{rT} & 1 & 0 & 0 \\ \theta_i^{IG} & \theta_i^{IT} & \theta_i^{Ir} & 1 & 0 \\ \theta_i^{CG} & \theta_i^{CT} & \theta_i^{Cr} & \theta_i^{CI} & 1 \end{pmatrix} \begin{pmatrix} u_{i,t}^{G} \\ u_{i,t}^{T} \\ u_{i,t}^{r} \\ u_{i,t}^{I} \\ u_{i,t}^{C} \end{pmatrix} = \begin{pmatrix} b_i^{11} & 0 & 0 & 0 & 0 \\ b_i^{21} & b_i^{22} & 0 & 0 & 0 \\ 0 & 0 & b_i^{33} & 0 & 0 \\ 0 & 0 & 0 & b_i^{44} & 0 \\ 0 & 0 & 0 & 0 & b_i^{55} \end{pmatrix} \begin{pmatrix} \varepsilon_{i,t}^{G} \\ \varepsilon_{i,t}^{T} \\ \varepsilon_{i,t}^{r} \\ \varepsilon_{i,t}^{I} \\ \varepsilon_{i,t}^{C} \end{pmatrix} \qquad (3)$$

where u_i^j ($j = G, T, r, I, C$) represents the individual components of the vector of reduced-form residuals, $V_{i,t}$, and $\boldsymbol{\varepsilon}_{i,t}^{j}$ ($j = G, T, r, I, C$) indicates those of structural shocks, $\boldsymbol{\varepsilon}_{i,t}$. Since we identify a_i^{Gr}, a_i^{GI}, a_i^{GC}, a_i^{Tr}, a_i^{TI}, and a_i^{TC} by using external information, only 15 parameters (θ s and β s) need to be estimated, which means the VAR is just identified.[10] We assign values to the *a* parameters as follows. Following Watanabe et al. (2011), who applied the Blanchard and Perotti (2002) procedure to the Japanese economy, we set $a_i^{GI} = a_i^{GC} = 0$ because the automatic response of

[8] We use the ADF unit root test based on the Doldado et al. (1990) procedure. Although we should possibly use level values in VAR, as proposed by Sims (1980), we did not do so because the resulting impulse responses were divergent. The only reason the same lag length is applied to VAR for both regimes is that the resulting impulse responses can be compared under the same condition.

[9] The lag length does not change with Schwarz's information criterion.

[10] Here, we assume that structural tax shock does not have an impact on government spending: $b_i^{12} = 0$.

government expenditure to output fluctuations within a quarter is limited. We assume that a_i^{Gr} = a_i^{Tr} = 0 because property income is excluded from both expenditure and tax revenue. We construct the elasticity of real tax revenues with respect to real private investment, a_i^{TI}, and real private consumption, a_i^{TC}, following Blanchard and Perotti (2002) and Perotti (2004).[11]

To compare the IRFs of the two regimes, we added the following devices. In general, to ensure economic recovery, fiscal authorities incur additional expenditure and tax reduction when a recession prolongs even after a primary fiscal expansion. In contrast, during good times, they do nothing to stimulate the economy, so fiscal expenditure decreases and tax revenue increases with automatic fiscal stabilizing effects. Therefore, if we simply compare these IRFs in the two regimes, the cumulative impulses of the expenditures and the tax reduction in a recession would be greater than those in boom times, and the impulse responses of other variables, such as real private investment, would also be greater. To avoid an invalid comparison, we set $u_{i,t}^T = 0$ when deriving the IRFs to public investment shocks and $u_t^G = 0$ when deriving the IRFs to tax revenue shocks, respectively, to exclude the effects of tax revenue shocks in a public investment setting, and vice versa. In addition, we assign zeros to all the parameters of the first two equations in the VAR so that the feedback effects of other variables on the real fiscal variables could be excluded.[12][13]

The IRFs and the 16-th and 84-th percentile credible intervals of these IRFs are derived by 1000 times Monte Carlo simulations assuming a popular noninformative prior for multivariate regression models, called the diffuse prior, consisting of a constant prior for the VAR coefficients and a Jeffreys prior for the covariance matrix. Since we have already assumed a multivariate normal distribution for the prior, the posterior for the VAR coefficient is also a multivariate normal and that for the covariance matrix is an inverse Wishart distribution. The IRFs are the posterior mean of sampled impulse responses. It should be noted that, under these priors, expected values of these parameters

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11 See Appendix 2 for details.

12 Having said that, it would also be interesting to analyze the effects incorporating the automatic fiscal stabilizer. However, we obtain qualitatively same results even if we take the stabilizer into account by removing both the restrictions of $u_{i,t}^T = 0$ and the zero coefficient restrictions to all the parameters of the second equation in the VAR.

13 It should be noted that the resulting IRFs are not the same as those derived in a four-variant VAR without one of the fiscal variables, since the estimated coefficient in the VAR and the estimated covariance matrix are different from those in a five-variant VAR,.

are identical to those of the maximum likelihood estimators. [14]

In the following subsections, we consider the effects of a one-percentage-point increase in public investment and a one-percentage-point *decrease* in tax revenues in the threshold VAR, assuming that the shock is not so large as to entail a shift to another regime; i.e., the IRFs are conditional on the state of the economy when the shock happens.

4 Empirical Results

4-1 Test for Structural Change

Using Hansen's (1996) methodology, Table 4 reports the test results of whether threshold effects exist, assuming the alternative hypothesis that all coefficients of the VAR in the two regimes are equal.[15] Only two of the six variables were significant at the 5% level, namely, DI with regard to the attitude of financial institutions toward lending and the ratio of budget surplus to GDP. Notably, the ratio of public debt to GDP, which is often adopted in the non-Keynesian literature, such as Perotti (1999) and Kinari and Shibamoto (2007), was not shown to be significant as in Kameda (2012).

Table 5 presents the sample periods divided by the estimated threshold value. In the following analysis, we refer to the periods in which each threshold variable is greater than the estimated value as "good times" and to the other periods as "bad times."

4-2 Benchmark: Full-Sample Estimation

Before comparing the IRFs under the two regimes, it would be useful to check the IRFs as derived by full-sample estimation. The results are presented in three graphs in the first column of Figure 3 and 4. In this figure and the next, the IRFs are presented in Panel A and the cumulative IRFs are presented in Panel B.

A one-percentage-point increase in real public investment raised real long-term interest rates by approximately 0.025% in the immediate term (Panel A of Figure 3), and by 0.2–0.25% in the long term (Panel B). It should be noted that this rise in interest rates crowds out real private investment in the short run; however, in the long run, it crowds it in, accompanied by a growth in consumption. This outcome reminds us of the accelerator effects in the long run. Private consumption increases in the short run as well as in the long run, resulting in an increase in tax. In short, the responses are, for the most part, in accordance with textbook IS-LM behavior.

Tax reduction effects also follow the classic IS-LM pattern, but are short-lived. A

[14] See Koop (2003) and Doan (2010) for details.
[15] We performed the test with GAUSS using a code provided by Atanasova (2003).

one-percentage-point decrease in the tax revenues raises private consumption by approximately 0.05% in the immediate term, but the effects decline gradually over the long term (Figure 4). Private investment is crowded out when tax shock is added, but soon recovers by the accelerator effects through an increase in private consumption. Unlike these two variables, negative movement of real interest rates is inconsistent with IS-LM; however, we should consider the fact that the responses of real interest rates are insignificant and changes in demand components are short-lived. If market players are forward-looking, interest rates should be invariant from the outset, as observed in the Figures 3.

4-3 Lending Attitudes of Financial Institutions

Next, based on Tables 4 and 5, we estimated the VAR (1) model and derived the IRFs under two regimes: in good times, when the lagged DI of the present lending attitude of financial institutions was greater than 2, and in bad times, when it was not greater than 2.

Public Investment

As shown in Column 2 of Figure 3, the IRFs in good times are not very different from those for the entire sample, which operate in a typical fashion. However, the growth rate of private investment is higher. A more relaxed attitude among financial institutions toward lending might mitigate the resulting decrease in the volume of loans to the private sector and the crowding-out of private investments.

On the contrary, in bad time, public investment should be considered a less effective tool for enhancing demand. To consider this reason in depth, we should first focus on the result that real long-term interest rates is invariant with an increase in public investment. This seemingly contradictory phenomenon can be consistently explained in the following manner.

Private investments, being irrelevant to real interest rates, could decrease if there are non-interest rate channels, such as the labor market channel described in Alesina et al. (2002). In this channel, public investment reallocates labor forces from the public sector to the private sector, which in turn depresses private investment owing to the increased capital/labor ratio.[16] On the other hand, we can also consider the possibility that private investment *increases* regardless of interest rates if we remember the accelerator effect channel mentioned above. On the basis of these channels, along with the ordinary interest rate channel, we can consistently explain the phenomenon under the conditions of (1) negligible interest rate channel, (2) a strong negative non-interest rate channel that results in

[16] As other non-interest rate channels, we can consider direct substitution for private investments and expected tax hikes for firms in the future.

the reduction of aggregate demand, and (3) weak accelerator effects in bad times that are responsible for the difference in IRFs of consumptions under each regime (Figure 5). Incidentally, the reduction in aggregate demand is also found in previous studies, for example, by Kamoi and Tachibanaki (2001), who show a negative fiscal multiplier in their IRFs.

The week effects of public investment on private consumption in bad times can be explained by the existence of liquidity-constrained households, which would tend to save more under a severe lending condition.

In short, we can say that the demand-enhancing effects of public investment are limited when financial institutions adopt strict and stringent attitudes toward lending. In this dynamic, the key operative concepts are the weaker accelerator effects of the crowding-in of private investment in bad times and the existence of liquidity-constrained households.

Tax Reduction

The effects of tax reduction are also different under each regime. As shown in Figure 4, demand-enhancing effects are much weaker in bad times, especially on private consumption. A severe attitude among financial institutions toward lending would drive households to save more to provide against more stringent conditions in the future.

In contrast to private consumption, and similar to the entire sample case, changes in private investment and real interest rates are insignificant both in the short and long terms. The insignificant responses of the real interest rate might seem inconsistent with the significantly positive trends of private consumption. However, the rate should be stable considering its short-lived responses and the existence of forward-looking investors as mentioned before. The absence of crowding-in of private investment does not contradict our interpretation in Subsection 4.2, which is based on the negligible interest rate channel of private investment.

In short, as in the public investment case, we can conclude that the demand-enhancing effects are limited when financial institutions adopt strict and stringent attitudes toward lending.

Discussion

At this stage, it is noteworthy that some papers have argued that fiscal policies are more effective in severe financial conditions, such as the aftermath of the Lehmann shock. For instance, Baldacci et al. (2009) showed countercyclical fiscal measures contribute to shortening the crisis duration. Spilimbergo et al. (2009) reported that government spending is more effective than tax reduction in enhancing aggregate demand because of the first-round effects of the fiscal multiplier mechanism. However, these studies do not compare the fiscal expansion effects between a normal financial

situation and its bad times and, thus, are not comparable with our findings.

On the other hand, calibrating a dynamic stochastic general equilibrium (DSGE) model including financial frictions and fiscal policy to the US economy, Fernàndez-Villaverde (2010) shows that financial frictions increase the effectiveness of government expenditure. This is because a shock to government expenditure increases not only aggregate demand but also the inflation rate, the wealth of entrepreneurs increasing through "Fischer effects," which reduces the finance premium on their loans and, in turn, mitigates the crowding out of private investment caused by government expenditure. In addition, Carrilo and Poilly (2012) found this effect becomes greater when the nominal interest rate is constrained by the zero lower bound.

These studies yielded results inconsistent with ours. However, we should take notice of the fact that, during our sample period, the net wealth *decreased* in bad times, contrary to the simulation results in the literature. The average growth rate of net wealth is –6.54% in bad times of the lending attitude (1990-92 and 1998-2003) and 1.60% in good times.[17] Furthermore, they considered neither the non-interest rate channel of private investment nor the liquidity-constrained households. On the basis of these facts as well as our results, we can conclude that, at least with regard to Japanese fiscal expansion, the effects of the non-interest rate channel overwhelm the "Fischer effects" emphasized in the literature.

4-4 The Ratio of Structural-Primary-Budget Surplus to Potential GDP

We derived the impulse responses under the two regimes on the basis of the three-quarter-lagged yearly change in the annual average of the ratio between the structural-primary-budget-surplus and the potential GDP in the same manner as in the previous sections: in good times, when the change was greater than 0.00176, and in bad times, when it was less than 0.00176 (Figure 6 and 7).

Public Investment

Needless to say, from the perspective of non-Keynesian effects, we should focus on private consumption in the first place. As shown in the figure, the increase in private consumption in good times is greater than it is in bad times, though slightly. This is also demonstrated in the cumulative responses (Panel B), where one finds a positively sloped line of the cumulative response functions in good times. Following non-Keynesian studies, we should obtain the negative response of private consumption in bad times if the effects exist. Therefore, we cannot address the presence of non-Keynesian effects in Japan. However, the IRFs show that the bad fiscal situation reduces the

[17] These percentages are based on annual data in the Annual Report on National Accounts 2009. Quarterly data are not available.

fiscal multiplier effects, which implies that the effects operate to some extent.

With regard to private investment, we can observe crowding-in effects in good times and crowding-out effects in bad times. However, these changes would be odd compared to the responses of the real interest rates, since there is a greater increase in real interest rates in good times than in bad. However, this dynamic can be understood in terms of the aforementioned three channels: if the interest rate channels are negligible and the magnitude of the accelerator effect depends on consumption growth, the greater increase in private investment should be observed in the good times (Figure 4).

Taking these aspects into account, we can say that the demand-enhancing effects of public investment are limited when the government's fiscal stance is bad; needless to say, non-Keynesian effects would be conceptually important in this regard.

Tax Reduction

As shown in Column 3 in Panel B in Figure 7, private consumption is invariant in bad times of fiscal condition, differently from the case of good times in Column 2. Thus, similar to the public investment case, we can say that we do not have non-Keynesian effects in tax reduction. However, as is evident from the difference between Column 2 and 3, non-Keynesian tendency can be observed more extensively in tax reduction case. We should consider that non-Keynesian effect is one of the key concept to analyze the demand-enhancing effects.

Responses of private investment are also similar to those in public investment case, although both of crowding-in and-out effects are relatively weak relatively to the public investment case. Negative impulses of real interest rates in bad times are not necessarily consistent with the existence of non-Keynesian effects, however, it can happen if the tax reduction worsens future tax distortion and intertemporal optimizers increase their savings (Blanchard (1990), Perotti (1999))

In short, as well as public investment case, we can say that the demand-enhancing effects are qualified in bad times of fiscal condition.

Discussion

Summarizing previous studies in Japan, Kameda (2009) pointed out the possibility that non-Keynesian effects could be observed in the literatures increased as their definition of bad times concerning the fiscal situation became more stringent. In the literature, bad time periods ranged from approximately 10% to 45% of the total sample period (Kameda, 2009). Therefore, the definition of bad times in this study is relatively weak, which might affect our results on the limited scope of the non-Keynesian effects of public investment.

Figure 8 compares the IRFs of public investment shocks shown in Figure 6 with those based on the threshold value of the fiscal index artificially set at -0.003. The resulting period of bad times are 1993:II-1997:III, 1999:II-2001:III, and 2003:II-2005:I. As shown in the last row of Figure 8, the response of private consumption is clearly different in the latter case, confirming that non-Keynesian effects do have a role in the demand-enhancing effects of public investment.

5 Conclusions

In this paper, we investigated the cause of the decline in demand-enhancement effects of fiscal expansion, mentioned in a number of studies over the past two decades. Using a threshold VAR and a test that controls for the nuisance parameter problem, we found that the diffusion indices for financial institution attitudes toward lending and the yearly change in the annual average of the quarterly ratios of the structural primary budget balance to potential GDP are significant factors for the macroeconomic structure. Thus, we divided our sample period on the basis of these threshold values to estimate the actual IRFs and the fiscal expansion effects.

The resulting IRFs showed that the fiscal expansion effects generally followed traditional principles but were accompanied by some noteworthy findings. First, financial institution attitudes toward lending make their responses different, particularly in the sense that the IRF shows a smaller private consumption increase in bad times than in good times, as well as a decrease in real investment, although real interest rates decrease simultaneously. The former implies the existence of liquidity-constrained households and the latter suggests the coexistence of a non-interest rate channel of private investment, such as the labor market channel in Alesina et al. (2002), with the traditional accelerator effects of private investment. Second, although the fiscal multiplier is positive, non-Keynesian effects certainly operate. The structural primary budget balance to potential GDP ratio altered private consumption and private investment responses; with reference to the ratio, there was less private consumption and more crowding-out of private investments in bad times.

In short, when financial institution attitudes toward lending are tight and the government's financial situation is bad, the demand-enhancing effects of fiscal expansion are considered weak. In this regard, the accelerator effects of private investment, the existence of liquidity-constrained households, and the causes of non-Keynesian effects (such as huge budget deficits) would be the operative concepts.

In our estimation, the two kinds of bad times are repeated in turn from the bubble burst to 2005. This implies that these two sources had constantly weakened the demand enhancing effects. Thus, the policy implication of the paper is we should have needed to improve at least one of financial and budget conditions to ensure the efficacy of fiscal stimuli after the Japanese bubble burst.

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Appendix 1: Data

[Public Debt Data]

We constructed quarterly total government debt data by multiplying central debt data (government bonds + borrowings) obtained from various issues of the *Monthly Financial Review* published by the Ministry of Finance[56] by the ratio of total government debt to central government debt. The ratio is calculated as shown by Kawade et al. (2004), who estimate quarterly data linearly from annual data of this ratio, available in *Trends of Long-Term Debt Outstanding since FY1970*.[57] Then, to adjust for the effects of the privatization of the Postal Savings System, we add 48.7374 trillion yen to this debt data series from 2003Q2 onward.

[Structural Primary Budget Deficit]

We constructed structural primary budget deficits by subtracting the net interest payments from the following structural primary budget deficits. Net interest payments are calculated by deducting interest payments in "Property income, payable" from interest receipts in "Property income, receivable" in the table *Income and Outlay Accounts* of the government sector, provided in the *Annual Report on National Accounts 2009.*

[Structural Budget Surplus]

Using the output gap data computed below, we constructed the structural budget surplus following Cabinet Office, Government of Japan (2001), in which income tax, computation tax, corporate tax, and net social contributions are cyclically adjusted.[58]

For the pre-adjusted budget surplus, we employed "Net lending/net borrowing" in the *Capital Finance Accounts* of the general government sector, provided in the *Annual Report on National Accounts 2009*, after making appropriate changes for consistency with the government's definitions of accounts.[59] However, these data are available only on a calendar year and fiscal year basis. In order to translate them into quarterly data, we used more detailed subjects in the *Income Expenditure Accounts*, which is available on a quarterly basis; for the other subjects not covered by the *Income Expenditure Accounts* (i.e., capital transfers and land purchase), we obtained the data by simply

[56]See http://www.mof.go.jp/english/pri/publication/mf_review/index.htm, last accessed on April 3, 2012.
[57]See http://www.mof.go.jp/english/budget/statistics/200910/d200910_08.pdf, last accessed on April 3, 2012.
[58]See http://www5.cao.go.jp/zenbun/wp-e/wp-je01/wp-je01-000i2-12.html, last accessed on April 3, 2012.
[59] To keep time consistency of definitions of the scope of the government, we make appropriate changes in pre-adjusted budget surplus on the basis of the footnotes given in "F.Y(1) Nonfinancial" sheet in the Excel file named 21c3_en.xls on the website http://www.esri.cao.go.jp/en/sna/data/kakuhou/files/2009/23annual_report_e.html (last accessed March 4, 2012).

dividing the annual base data into four parts. Then, we computed "Net lending/net borrowing" on a quarterly basis. One exception is that some quarterly data are not available in the first-quarter of 1980. Thus, we used a quarter of the calendar-year data values for these data.

[Output Gap]

We estimated the output gap following the practice of the Bank of Japan (Research and Statistics Department, 2006). The output gap is defined as the discrepancy between actual and potential output.

$$(Y^* - Y)/Y = \ln Y^* - \ln Y = \alpha(\ln L^* - \ln L) + (1-\alpha)(\ln K^* - \ln K)$$

Y, K, and L indicate GDP, capital stock, and working hours, respectively. The asterisk implies potential value, as explained below. Here, we adopt the average values for the potential value, not the maximum values, but this does not affect the value of the output "gap" conceptually.

As discussed in Kamada and Masuda (2001), the estimation method for the labor share of income, α, is not unique. For example, if we calculate it as the share of compensation of employees to GDP net of net indirect taxes (consumption of fixed capital + operating surplus + compensation of employees) using data in the *Annual Report on National Accounts 2009*, the historical mean in our sample period is approximately 0.68. However, it can have another value. Thus, for the sake of simplicity, we use 2/3 for it here as often employed in textbooks, such as Romer (2006).

[Actual capital stock]

We computed these data by sector—manufacturing and non-manufacturing sectors. For the manufacturing sectors, we use gross capital stock data (excluding construction in progress) available in *Gross Capital Stock of Private Enterprises* (Cabinet Office, Japan), after adjusting the effects of privatization of the Japan Railways Group, National Telecommunication Ltd., and Electric Power Development Co., Ltd. For details of these adjustments, see Nakahigashi (2008) and Kameda and Li (2008).We multiplied the stock data in manufacturing sector with its capacity utilization rate (=100 in 2005) which is available in the *Indices of Industrial Production* (Ministry of International Trade and Industry). In contrast, for non-manufacturing sectors, values are not multiplied by the capacity utilization rate because it is not available.

[Potential capital stock]

We computed these data following the same procedure described above for the actual capital stock with the average capital utilization in manufacturing (=100.0746).

[Working hours per capita]

This is the total number of working hours in all industries at establishments with 30 or more regular employees, available in the *Monthly Labor Survey* (Ministry of Labor).

[Potential working hours per capita]

We estimated the potential number of working hours per capita by the sum of the scheduled and historical average of unscheduled working hours. Information on both scheduled and unscheduled working hours is available in the *Monthly Labor Survey* (Ministry of Labor).

[Number of workers]

This is the seasonally adjusted number of employed persons in all industries, which is available in the *Labor Force Survey* (Management and Coordination Agency).

[Potential number of workers]

This is the number of members of the labor force multiplied by the average ratio of seasonally adjusted employed persons to seasonally adjusted labor force (=0.967).

[Working hours]

We calculated this as working hours per capita multiplied by the number of workers.

[Potential working hours]

We calculated this as potential working hours per capita multiplies by the potential number of workers.

[Potential GDP]

This is the seasonally adjusted actual GDP divided by the output gap, as explained above.

Appendix 2: Estimation of Elasticities

We construct the elasticity of real tax revenues with respect to real private investment, a_i^{TI}, and real private consumption, a_i^{TC}, following Blanchard and Perotti (2002) and Perotti (2004). First, we decompose the elasticity as follows:

$$a_i^{TD} = \sum_j \eta_{Tj,Bj}\eta_{Bj,D}\frac{\widetilde{T}_j}{\widetilde{T}} \qquad (D = I, C)$$

where $\eta_{Tj,Bj}$ is the tax elasticity with respect to its own base, $\eta_{Bj,D}$ is the elasticity of the tax base with respect to demand components $\widetilde{T}_j$ refers to each category of revenue *level*, and $\widetilde{T} = \sum \widetilde{T}_j$. Thus $\widetilde{T}_j / \widetilde{T}$ is the proportion of each category of revenue in total revenue. We consider three categories of revenues: personal income taxes, corporate income taxes, and indirect taxes. In contrast to Blanchard and Perotti (2002), Perotti (2004), and Watanabe, Yabu, and Ito (2009), who applied the Blanchard and Perotti (2002) procedure to the Japanese economy, we use accrual-based data from the Annual Report on National Accounts 2009 (henceforth National Accounts).Thus, we do not mention the collection lags below. All data are seasonally adjusted using the X12-ARIMA program with additive outliers on 1997:I and II, as in Section 3-3-1 of the main text. The data names in the source are shown within parentheses below.

Personal Income Taxes (*Current taxes on Income, Wealth, etc., Payable: Household*)

Let $T_{PI,t} = S(W_t)W(E_t)E(D_t)$, where $T_{PI,t}$ is the revenue from personal income tax, S the tax rate, W_t the wage, and E_t the employment. Taking the logarithm values and totally differentiating, we obtain

$$d\log T_{PI,t} = \left[\left(\frac{\partial \log S}{\partial \log W_t} + 1\right)\frac{\partial \log W_t}{\partial \log E_t} + 1\right]\frac{\partial \log E_t}{\partial \log D_t} d\log D_t$$

The coefficient of $d\log D_t$ on the right-hand side is equal to $\eta_{Tj,Bj}\eta_{Bj,D}$ in the construction. Regressing log man-hours (employment multiplied by working hours) on lags 4 to -1 log real private consumption or lags 4 to -1 log real private investment, we find that the lag 0 coefficients, which are employed as $\partial \log E_t / \partial \log I_t$ or $\partial \log E_t / \partial \log C_t$ in the above equation, are not significant. Thus, we set the elasticity of personal income tax with respect to private consumption and private investment as zero.

**Corporate Income Taxes (*Current Taxes on Income, Wealth, Payable: Financial and*

***Non-financial*)**

We estimate $\eta_{Bj,D}$ as the lag 0 coefficient of explanatory variables from a regression of log quarterly corporate profit on lags 4 to -1 log real private consumption or lags 4 to -1 log real private investment As the profit, we employ the sum of the *net operating surplus* from the financial and non-financial sectors in the *National Accounts*. This gives a coefficient for $\eta_{Bj,I}$ and $\eta_{Bj,C}$ in the first two rows of Table A1. In the case that the coefficient is insignificant, we assign zero for it.

We estimate $\eta_{Tj,Bj}$ from a regression of the log tax recipient on the tax base mentioned above. For the data of the tax recipient, we use the sum of the *current taxes on income, wealth, other taxable items, and receivable* from the financial and the non-financial sectors in the *National Accounts*. This gives a coefficient as in the third row of Table A1.

Indirect Taxes (*Taxes on Production and Imports, Receivable: General Government*)

In Blanchard and Perotti (2002), both $\eta_{Tj,Bj}$ and $\eta_{Bj,D}$ with regard to GDP are assumed to be equal to 1. Thus, we also assume $\eta_{Tj,Bj}$ to be equal to 1 and $\eta_{Bj,I}$ as equal to the ratio of private investment to the sum of private consumption and private investment, and $\eta_{Bj,C}$ to be equal to 1- $\eta_{Bj,I}$.

Following these procedure, we obtain the elasticities under each regime as in Table A1 below.

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Table 1: Economic Countermeasures after the Bubble Burst in Japan

Economic Packages	P.M.	Final Determination	Amount (Trillion)
Comprehensive Economic Measures	Miyazawa	1992/8/28	10.7
Comprehensive Economic Measures	Miyazawa	1993/4/13	13.2
Emergency Economic Countermeasures	Hosokawa	1993/9/16	6
Comprehensive Economic Measures	Hosokawa	1994/2/8	15.25
Emergency measures for economy and appreciation of Yen	Murayama	1994/4/14	7
Economic Countermeasures	Murayama	1995/9/20	14.22
Comprehensive Economic Measures	Hashimoto	1998/4/24	16
Emergency Economic Package	Obuchi	1998/11/16	23
measures for the rebirth of the Japanese economy	Obuchi	1999/11/11	17
Policy Package for New Economic Development Measures for the Rebirth of Japan	Mori	2000/10/19	11
Front-Loaded Reform Program	Koizumi	2001/10/26	5.8
Immediate Economic Action Package	Koizumi	2001/12/14	4.1
Program to Accelerate Reforms	Koizumi	2002/12/12	4.4
Comprehensive Immediate Policy Package –Easing Public Anxiety-	Fukuda	2008/8/29	11.5
Measures to Counter Difficulties in People's Daily Lives	Aso	2008/10/30	26.9
Countermeasures to Address the Economic Crisis	Aso	2009/12/19	37
Policy Package to Address Economic Crisis	Aso	2009/4/10	56.8
Emergency Economic Countermeasures for Future Growth and Security	Hatoyama	2009/12/8	24.4
The Three-Step Economic Measures for the Realization of the New Growth Strategy～Emergent Action to Currency Appreciation and Deflation～	Kan	2010/9/10	9.8
Comprehensive Emergency Economic Measures in Respose to Yen Appreciation and Deflation-- Step 2 toward the Realization of the New Growth Strategy	Kan	2010/10/8	21.1
Comprehensive Package Responding to the Yen Appreciation	Noda	2011/10/21	23.6

Source: Nakao (2002) and the website of the Cabinet Office of Japan (www5.cao.go.jp/keizai1/keizaitaisaku/keizaitaisaku.html). We hear English names of the measures directly from the Cabinet Office.

Table 2: List of Variables used in the Literature

		EPA (1998)	Ramaswamy and Rendu (2000)	Bayoumi (2001)	Kuttner and Posen (2001)	Kato (2001)	Ihori et al. (2002)	Tanaka and Kitano (2002)		Nakazawa et al. (2002)		Hori and Ito (2002)	Kato (2003)
								A	B	A	B		
Sample Period		70:3-97:1	73:1-98:2	86:1-98:1	76-99(annual)	70:1-99:1	60:1-99:4	80:1-00:4		80:1-01:2		75:1-01:1	83:1-02:3
Sub Sample Period		70:3-89:4 70:3-97:1	na	na	na	70:1-84:4 85:1-99:1	60:1-89:4 90:1-99:4	na	na	na	na	90:1-00:1	na
Number of variables		6	8	8	3	4	6	7	7	7	7	5	5
Demands	GDP			○	○			○	○	○	○	○	○
	Domestic Demand					○							
	Domestic Private Demand	○											
	Private Consumption		○				○						
	Private Investment		○*				○						
	Government Expenditure			○	○	○			○				○
	Government Consumption		○										
	Public Investment	○	○				○	○		○	○	○	
	Change in Inventories		○										
	Exports	○	○				○	○	○	○	○		
	Imports		○				○						
Pieces	GDP Deflator									○	○	○	○
	Domestic Demand Deflator	○											
	Consumer Price Index							○	○				
	Inflation Rate												
Interests	Long-term Rate	○								○		○	○
	Short-term Rate			○				○	○		○		
	Money Supply							○	○	○	○	○	
Exchange	Nominal Exchange Rate	○								○	○		
	Effective Exchange Rtae			○				○	○				
	Tax			○	○	○	○						○
Others				Nikkei 225, Land price, Bank loan outstanding		Unemploy-ment rate							

Note 1: This table is updated from Nakazato (2005).

Note 2: * implies private investment is divided into residential and non-residential. ** implies private consumption is divided into durable and non-durable.

Note 3: Kondo (2011) employes prefecture-level panel data.

Table 2: List of Variables used in the Literature (Cont.)

		Kawade et al. (2004)	Kitaura et al. (2005)			Nakazato and Konishi (2004)	Watanabe et al. (2009)	Miyazaki (2010)		Kondo (2011)	Kozuka et al. (2011)	Ko and Morita (2011)	
			A	B	C			A	B				
Sample Period		66:2-02:4	81:2-03:3			81-01:1	65:1-04:4	80:1-03:1		60-07(Annual)	83:2-08:1	70:1-04:4	
Sub Sample Period		66:2-91:2	81:2-92:2			90:1-00:1	65:1-86:4	80:1-97:1		60-90	na	70:1-86:4	
			92:3-03:3				87:1-04:4	97:2-03:1		91-07		87:1-04:4	
Number of variables		4	6	7		5	3	5	7	6	137	5	
Demands	GDP					○	○			○	Estimating the factor augmented VAR (FAVAR) developed by Bernanke et al. (2005).	○	5
	Domestic Demand												0
	Domestic Private Demand												0
	Private Consumption	○	○	○	○	○		○	○**	○			8
	Private Investment	○	○*	○*	○*	○		○	○*	○			8
	Government Expenditure		○				○					○	3
	Government Consumption									○			1
	Public Investment	○		○	○	○				○			5
	Change in Inventories												0
	Exports		○		○								2
	Imports		○		○								2
Pieces	GDP Deflator			○									1
	Domestic Demand Deflator												0
	Consumer Price Index												0
	Inflation Rate											○	1
Interests	Long-term Rate			○								○	2
	Short-term Rate												0
	Money Supply					○							1
Exchange	Nominal Exchange Rate			○									1
	Effective Exchange Rtae												0
	Tax						○					○	2
Others		Public Debt			Public Debt			Unemployment rate, Nikkei 225, and fiscal dummies to employ the narrative approach developed by Ramey and Shapiro (1998).		Labor Force		Embedding the debt feedback equation in VAR following Favero and Giavazzi (2007).	

Note 1: This table is updated from Nakazato (2005).

Note 2: * implies private investment is divided into residential and non-residential. ** implies private consumption is divided into durable and non-durable.

Note 3: Kondo (2011) employees prefecture-level panel data.

Table 3: List of Threshold Variables and their Proxies

Possible Source in the Literature	Proxy Variable	Data Source
Excess Physical Stock	DI of Production Capacity (Manufacturing)	The Bank of Japan Tankan
Decreased effectiveness of Capital		
Balance Sheet Adjustments	DI of Lending Attitude of Financial Institutions	The Bank of Japan Tankan
Slump in the Asset Markets	Nikkei 225 Index	Nikkei NEEDS (On-line Database)
Decline in Expected Growth	DI of Business Conditions (Forecasts)	The Bank of Japan Tankan
Non-Keynesian Effects	Budget Balance-to-GDP Ratio	National Accounts (Cabinet Office, Japan)
	Public Debt-to-GDP Ratio	Monthly Finance Review (Ministry of Finance,Japan)

Table 4: Estimates of Threshold Variables

		Number of Lags				
		0	1	2	3	4
Threshold Variable	Yearly Change in Annual Average Ratio of Structural Primary Budget Surplus to Potential GDP	0.005 *	0.008	0.001	0.002 *	0.005
		(0.091)	(0.367)	(0.155)	(0.067)	(0.089)
	Ratio of Debt to Potential GDP	0.780	0.766	0.745	0.628	0.631
		(0.219)	(0.226)	(0.262)	(0.215)	(0.360)
	Nikkei 225 Index (Level)	17287.650	18934.340	15747.260	18138.360	18591.450
		(0.219)	(0.631)	(0.823)	(0.814)	(0.793)
	DI of Business Conditions (Forecasts)	-7.000	-17.000	-19.000	-17.000	-19.000
		(0.410)	(0.206)	(0.522)	(0.464)	(0.249)
	DI of Lending Attitude	3.000	2.000 *	1.000	3.000	6.000
		(0.283)	(0.063)	(0.277)	(0.289)	(0.343)
	DI of Excess Capital	5.000	17.000	17.000	14.000	11.000
		(0.646)	(0.443)	(0.424)	(0.521)	(0.314)

Note: Bootstrap p-values are given in parenthesis.

Table 5: Periods of Good Times and Bad Times

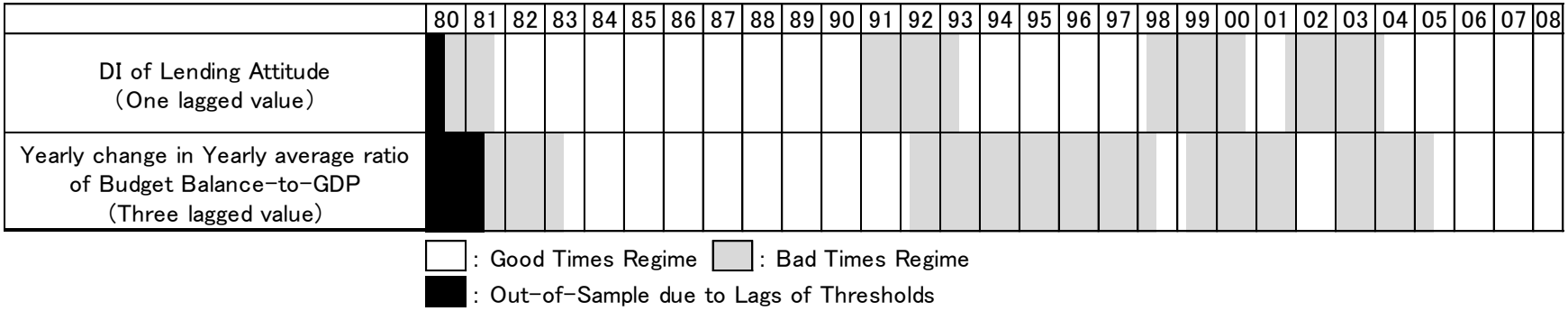
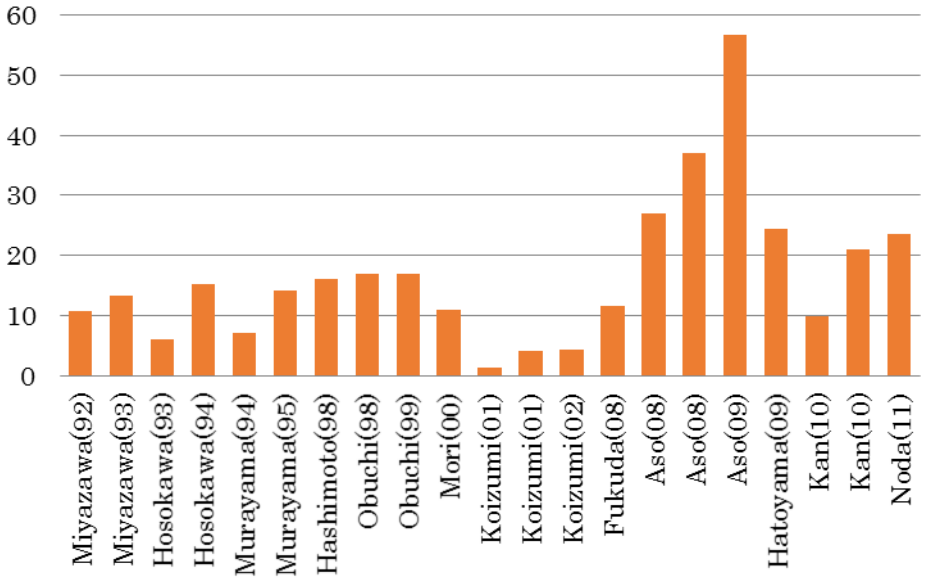


Figure 1: Economic Countermeasures after the Bubble Burst in Japan

(total amount, trillions of yen)



Source: Nakao (2002) and the website of the Cabinet Office of Japan (http://www5.cao.go.jp/keizai/index-e.html, last accessed April 10, 2012.).

Note 1: The amount includes financial support given to the private sector, such as credit guarantees.

Note 2: The eighth of Obuchi (98) includes a tax cut of 6 trillion.

Note 3: The sixteenth of the second Aso (08) includes an additional 5 trillion, which has already been counted in the last measure of the first Aso (08).

Figure 2: Economic Growth in Other Developed and Asian Countries (%)

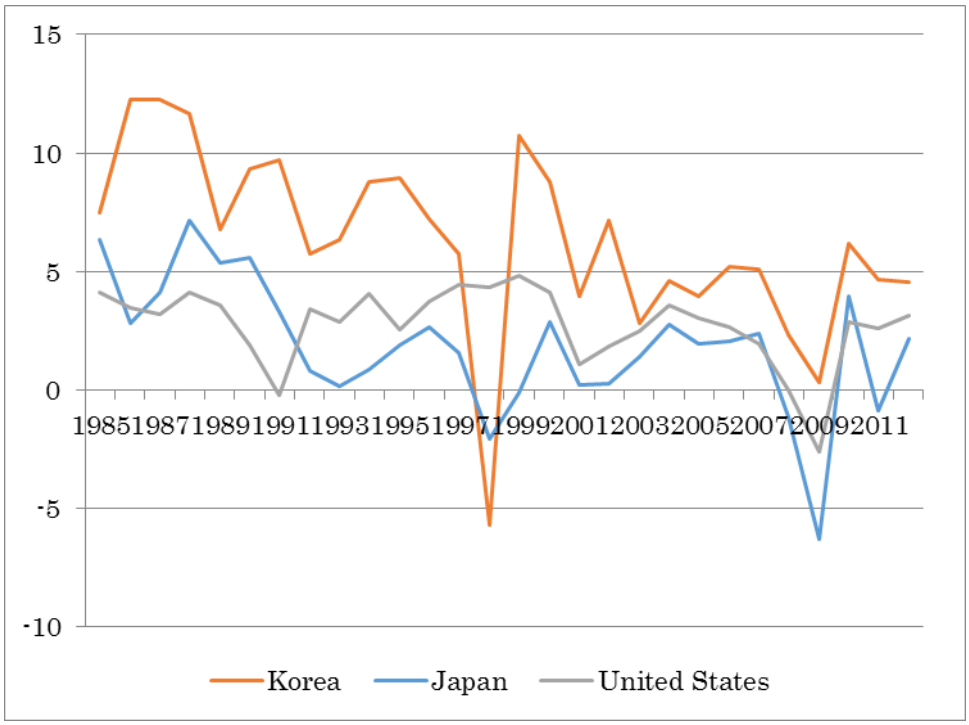
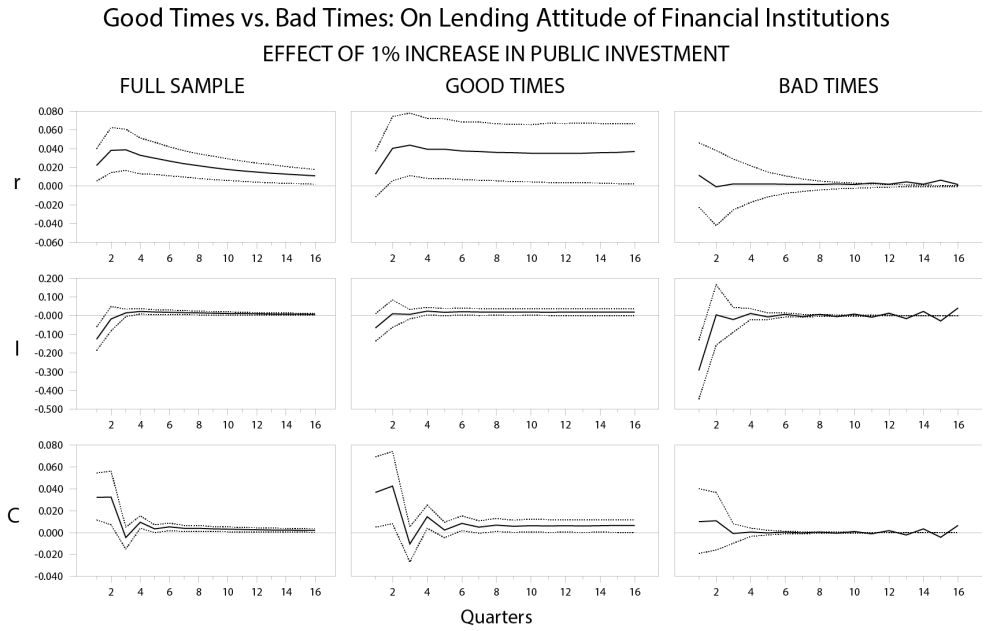
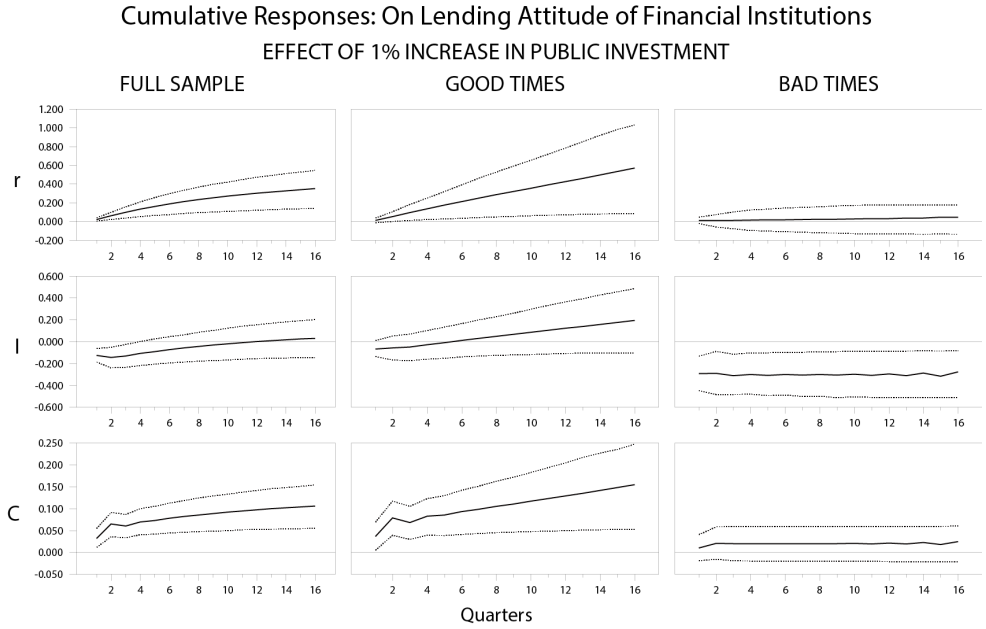


Figure 3: Impulse Responses to Public Investment Shock in Good and Bad Times in regard to Lending Attitude of Financial Institutions

Panel A: Impulse Response Functions



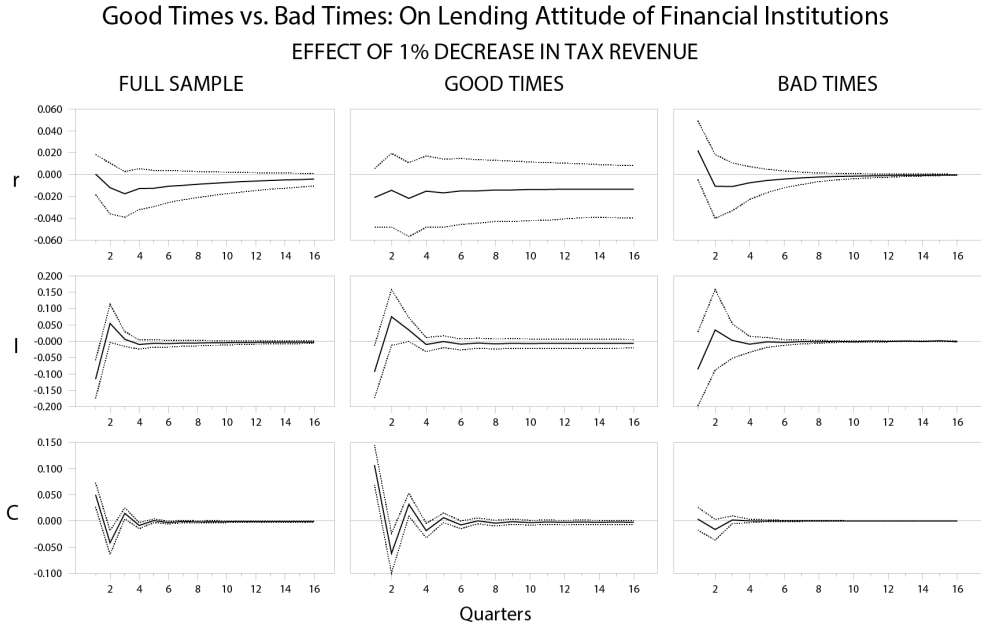
Panel B: Cumulative Impulse Functions



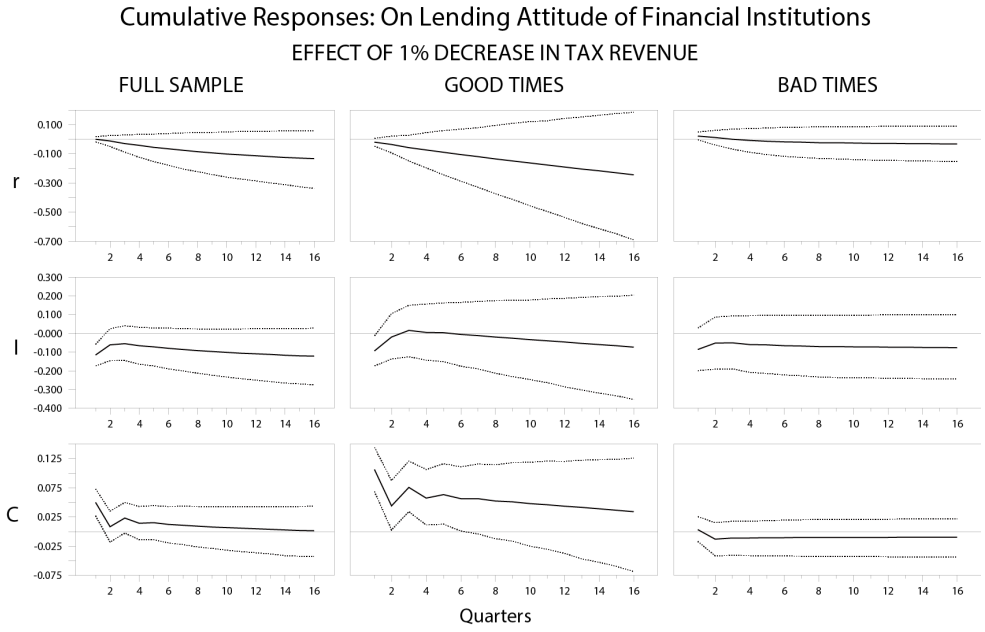
Note: Responses to one percentage increase in public investment. The solid lines indicate the posterior mean of sampled impulse responses and the dotted lines give the 16-th and 84-th percentile credible intervals, computed by 1000 times Monte Carlo simulations. The vertical labels r, I, and C are real long-term interest rate, real private investment, and real private consumption, respectively.

Figure 4: Impulse Responses to Tax Reduction Shock in Good and Bad Times in regard to Lending Attitude of Financial Institutions

Panel A: Impulse Response Functions



Panel B: Cumulative Impulse Functions



Note: Responses to one percentage increase in public investment. The solid lines indicate the posterior mean of sampled impulse responses and the dotted lines give the 16-th and 84-th percentile credible intervals, computed by 1000 times Monte Carlo simulations. The vertical labels r, I, and C are real long-term interest rate, real private investment, and real private consumption, respectively.

Figure 5: Transmission Channels of Public Investments to Private Investments

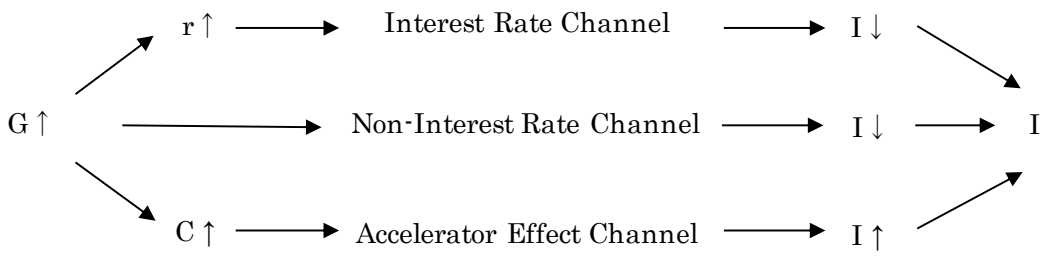
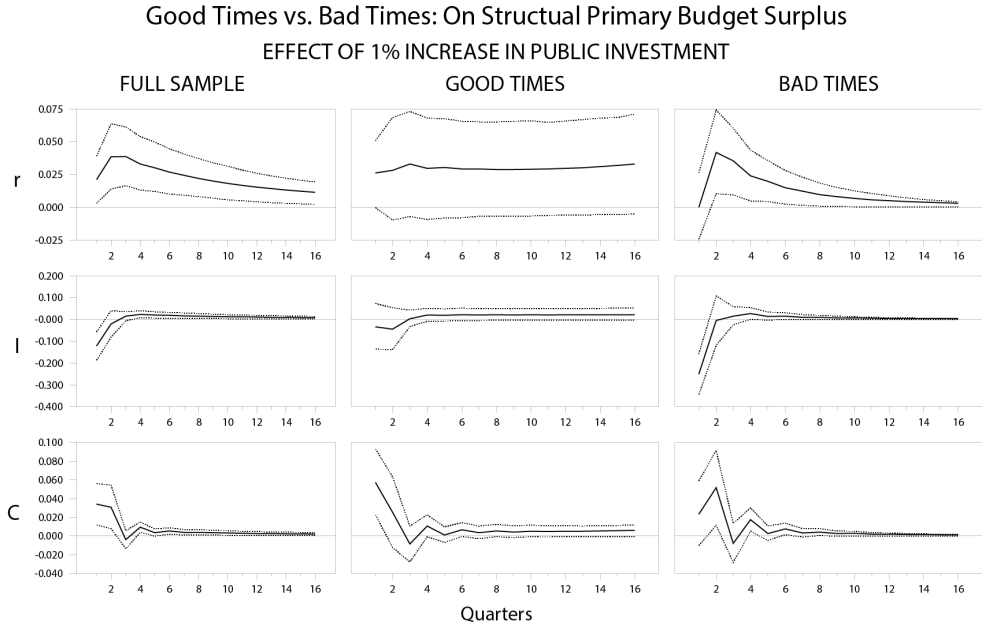
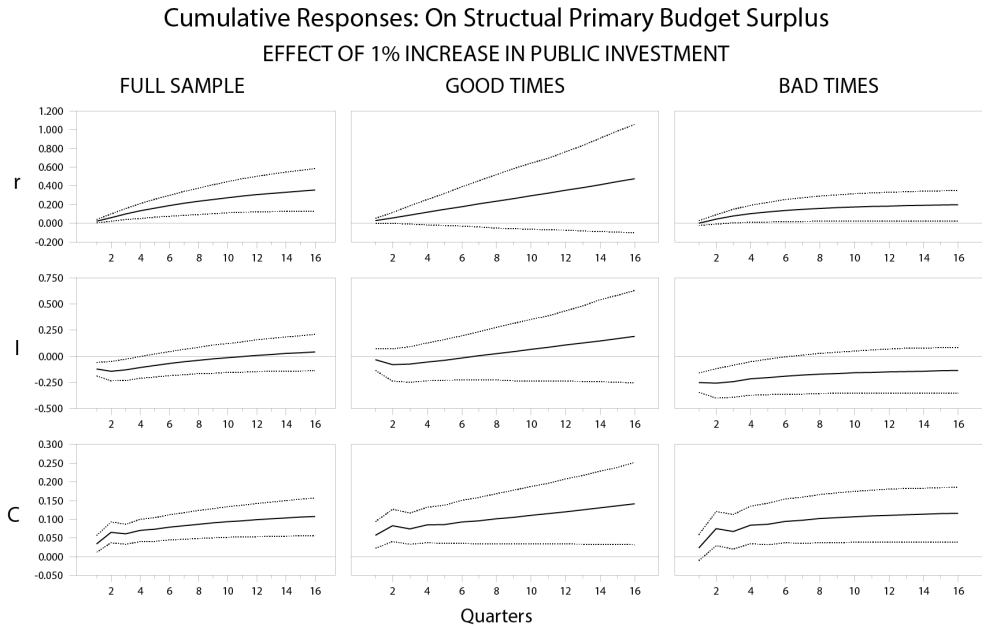


Figure 6: Impulse Responses to Public Investment Shock in Good and Bad Times in regard to Structural Primary Budget Surplus

Panel A: Impulse Response Functions



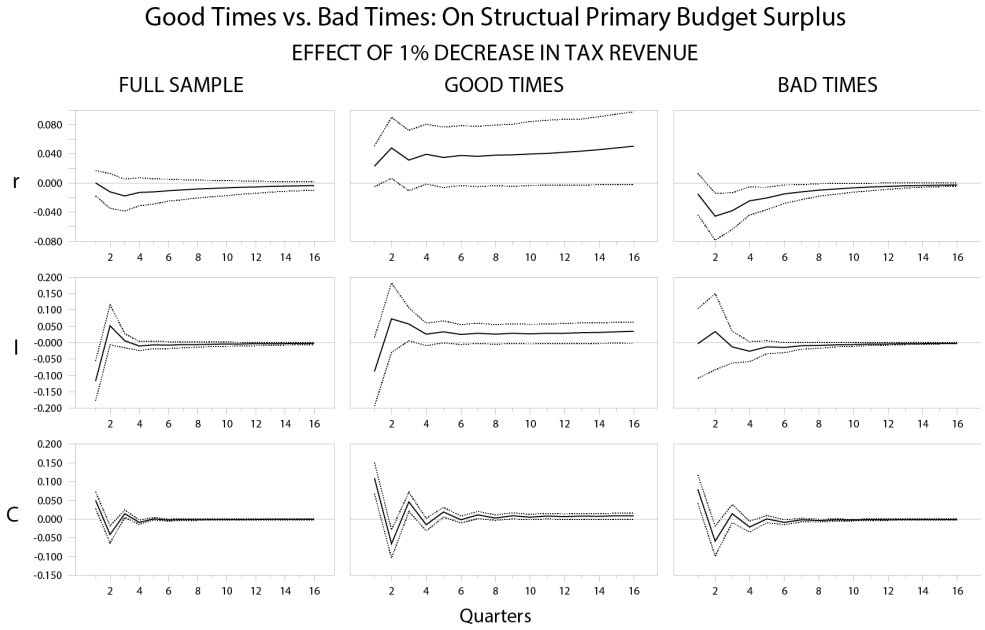
Panel B: Cumulative Impulse Functions



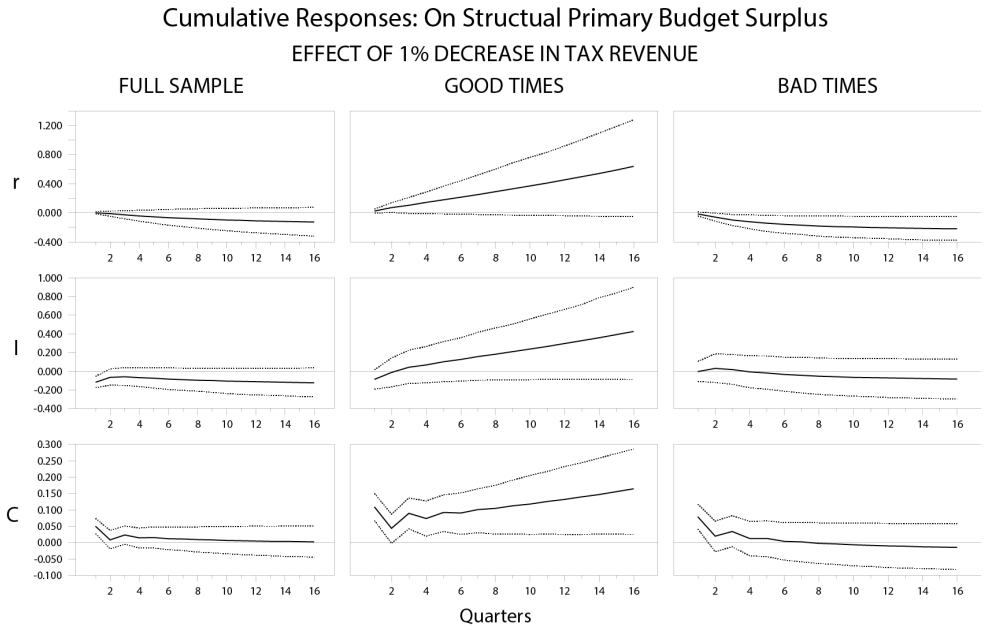
Note: Responses to one percentage increase in public investment. The solid lines indicate the posterior mean of sampled impulse responses and the dotted lines give the 16-th and 84-th percentile credible intervals, computed by 1000 times Monte Carlo simulations. The vertical labels r, I, and C are real long-term interest rate, real private investment, and real private consumption, respectively.

Figure 7: Impulse Responses to Tax Reduction Shock in Good and Bad Times in regard to Structural Primary Budget Surplus

Panel A: Impulse Response Functions

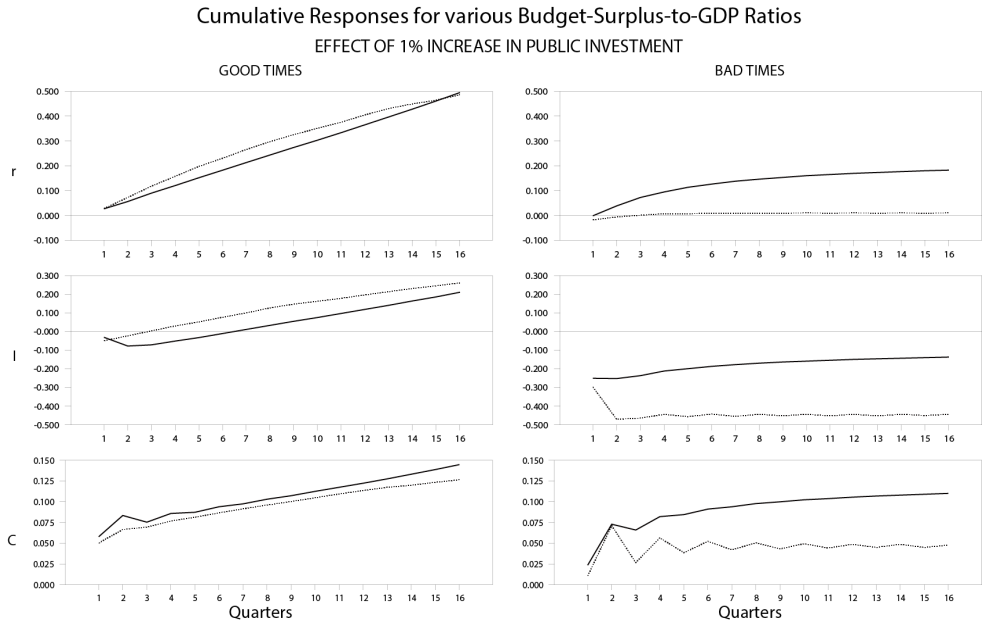


Panel B: Cumulative Impulse Functions



Note: Responses to one percentage increase in public investment. The solid lines indicate the posterior mean of sampled impulse responses and the dotted lines give the 16-th and 84-th percentile credible intervals, computed by 1000 times Monte Carlo simulations. The vertical labels r, I, and C are real long-term interest rate, real private investment, and real private consumption, respectively.

Figure 8: Cumulative Responses for various Budget-Surplus-to-GDP Ratios



Note: The solid lines indicate the posterior mean of sampled impulse responses under the threshold estimate (0.00176) of the ratio of budget surplus to trend GDP, as in Figure 6. The dotted lines show the posterior mean of sampled impulse responses given an artificial threshold value of the ratio (–0.003). The vertical labels r, I, and C are real long-term interest rate, real private investment, and real private consumption, respectively.

Table A1: Elasticities under Each Regime

	Full Sample Estimation	DI of Lending Attitude		Ratio of Budget Surplus to GDP	
		Good Times	Bad Times	Good Times	Bad Times
Elasticity of Cooperate Profit w.r.t Private Investment:	0.462 (0.637)	0.565 (0.821)	0.162 (0.099)	1.485 (1.595)	-0.224 (-0.201)
Elasticity of Cooperate Profit w.r.t Private Consumption	3.864 * (1.936)	4.641 *** (2.677)	-5.052 (-0.565)	8.781 *** (3.205)	0.051 (0.016)
Cooperate Tax Elasticity w.r.t. Cooperate Profits	0.790 *** (11.609)	0.825 *** (9.464)	0.713 *** (5.487)	0.895 *** (13.021)	0.440 *** (2.997)
Proportion of Cooperate Tax Revenue in Total Tax Revenue	0.224	0.233	0.206	0.236	0.204
Proportion of Indirect Tax Revenue in Total Tax Revenue	0.435	0.426	0.454	0.427	0.451
Private Consumption / (Private Consumption + Private Investment)	0.746	0.745	0.749	0.742	0.748
Tax Elasticitiy w.r.t. Private Investment	0.110	0.108	0.113	0.109	0.113
Tax Elasticitiy w.r.t. Private Consumption	1.010	1.209	0.341	2.172	0.338

Note: t-values are reported in parentheses. ***, **, * denotes significance at the 1, 5 and 10 percent level respectively.