What Changes the Effects of Fiscal Policy? A Case Study of Japan[*]

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Abstract

In the past two decades, the Japanese government has spent a considerable amount of money to counteract the deep recessions that have recurred since 1992. Many studies have pointed out that the effects of these expenditures have diminished since around the 1990s. None of these studies, however, have statistically tested the reasons for this diminution, which they implicitly or explicitly mention. The purpose of this study is to statistically test these reasons, using a threshold 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, we can say that a given cause does affect the structure of the macro economy, and then the effects of fiscal policy. We then estimate the impulse response functions in both sample periods as constructed based upon the threshold estimates, and compare the effects of fiscal policy in each period.

The results of the study are as follows. First, we found that the diffusion index of the attitude of financial institutions toward lending and the yearly change in the annual average of the quarterly structural-primary-budget-balance-to-potential-GDP ratio rejects the null hypothesis to a significant degree; therefore, we considered that these variables have a definite impact upon the effects of fiscal expansion. Second, the resulting impulse response functions show that the effects are basically traditional, though there are some notable differences. In particular, a crowding-in of private investment is the result of banks' relaxed attitude toward lending and the sound financial condition of the government. Finally, in bad times, the demand-enhancing effects of public investment should be considered to be weak. In this regard, non-interest rate channels of the crowding-out of private investment, excess accumulation of public capital, and non-Keynesian effects are the key operative concepts.

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1 Introduction

In the past two decades, the Japanese government has spent a considerable amount of money to counteract the recurring deep recessions that have taken place since 1992, and there has been much discussion of the effects of this fiscal expansion. Although the resulting conclusions remain controversial, almost all studies have concluded that the effects of government expenditure are weakening, and that the fiscal multiplier has decreased since the mid-to-late 1990s. For example, EPA (1998) and Kawade, Ito, and Nakazato (2004) 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 of physical stock, the weakened effectiveness of capital stock, balance sheets 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. In addition, Kamoi and Tachibanaki (2001) showed that public investments directly replaced private investments after the mid-1980s. Nakazato and Konishi (2004) found the same substitution effects, but with a different starting date of around 1990.[1]

As mentioned above, many studies have pointed out that the effects of public expenditure declined after the late 1990s; however, none of these studies 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 periods in two - before and after the mid-1990s - and then speculate upon the causes by comparing the shape of the impulse response functions of VAR for these two periods.

This paper aims to statistically test the aforementioned relationship using a threshold VAR in which the causes mentioned in the literature are adopted as the threshold. If the null hypothesis, which is defined by each of the selected threshold variables, that the estimated parameters are equal under each regime is rejected, we can say that a given cause does affect the structure of the macro economy, and then the effects of fiscal policy. Next, we estimate the impulse response functions in both sample periods as constructed based upon the cause estimates, and compare the effects of the fiscal policy in each regime.

This paper is organized as follows. Section 2 explains the statistical methodology and data, and

[1] As in other studies, Kitaura, Nagumo, and Matsuki (2005) also showed the same effects of crowding-out of private investment, but 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).

Section 3 discusses derived impulse response functions. Finally, Section 4 summarizes our findings and concludes the paper.

2 Statistical Methodology and Data

2-1 Threshold VAR

We consider a threshold VAR model with two regimes, as follows (Tong, 1990).

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

where $Y_t = (Y_t^1, Y_t^2, \cdots, Y_t^k)'$ is a vector of k variables, L is the lag operator, $V_{i,t} = (\varepsilon_{i,t}^1, \varepsilon_{i,t}^2, \cdots, \varepsilon_{i,t}^k)'$ is a $k \times 1$ vector of error terms with $V_{i,t} = N(0, \Sigma_{Vi})$ for i=1 and 2, s_t is a threshold variable, and γ is a threshold parameter. In this scheme, the coefficient matrices A_i and B_i are estimated depending on s_t, and γ is also estimated simultaneously. $V_{i,t}$ is assumed to be heteroskedastic and mutually independent between regimes 1 and 2.

To find the threshold estimates of a TVAR model, we employ a grid search, as in Pesaran and Potter (1997). The conditional log-likelihood up to a constant term is given by

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

where, $\Sigma_{Vi} = \frac{1}{N_i}[Y^i - A_i - B_i(L)Y_{-1}^i]'[Y^i - A_i - B_i(L)Y_{-1}^i]$, Y^i is the selected sample vector for regime *i*, N_i is the number of observations in regime *i*, and I_{Ni} is an $N_i \times N_i$ identity matrix.

The null hypothesis we have to test is whether the estimated parameters are equal under each regime (i.e., $H_0 : B_1 = B_2$). If this hypothesis is rejected, we can say that the cause does affect the structure of the macro economy, and thus fiscal policy effects, in turn, when we use a proxy variable of the cause as the threshold. To perform this test, however, we have to resolve the nuisance

parameter problem, the so-called Davies Problem (Davies, 1978).

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 LM statistics, depend on the nuisance parameter of γ, so 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 that are satisfied by a wide class of linear processes with i.i.d. innovation, such as the autoregressive moving average (ARMA) model, and that the null distribution of its p-value has uniform distribution asymptotically. 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 then computed the percentage of these artificial observations that exceeded the actual test statistics $g^J : p^J = (1/J)\sum_{j=1}^{J}\{g^j \geq g\}$. Although 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 $\exp T = \ln(\int_{\Gamma}\exp(1/2Z(\gamma)dW(\gamma))$, in this paper we adopt $SupT$, as in Davies (1978).

2-2 Variables in VAR

When we analyze the effects of fiscal expansion using VAR, what we must first consider is what variable should be included in the model, and how long we make their lags. As is well known, the degree of freedom is reduced by k^2 when we prolong the lag length by one. As we will mention later, this analysis employs 115 observations, which is not so few relative to those reported in the literature, but these observations need to be divided into two regimes. The number of variables, therefore, is limited.

We now report the procedure that was used to select the VAR variables. In this study, it is essential to include real private consumption and real private investment, which are usually included in the literature in order to evaluate the effects of fiscal expansion, as well as real public investment, which is usually employed in Japan as a fiscal instrument to counteract recession. In addition, long-term interest rates need to be embedded in order to consider the crowding-out of private investment, for purposes of comparison with the existing literature. Thus, taking into account the number of observations, the number of added variables is one or two at the most.

Table 1 shows a list of the variables that other researchers have used in their studies; this list was

updated from Nakazato (2005). At a glance, we can see that there is no consensus as to what variables should be adopted, but the usual candidates to be included would be exports, price indices, and short-term rates.

If we review the literature on the term structure of interest rates in Japan, such as Sugihara et al. (2000) and Ito (2005), it can be concluded that long-term interest rates have not been affected by the call rates. Though the price theory of public finance receives much attention these days, the anticipated inflation remains at the center of the price effects on the macro economy. Considering these points and the limited number of variables in VAR, we have abandoned the use of price indices and short-term interest rates, and employ *real* long-term interest rates instead. As a result of these considerations, we adopt real exports as a fifth variable in order to control its effect, due to its large share of the GDP.

2-3 Data

2-3-1 Data on Variables in VAR

(1) Macro Economic Variables

We used the quarterly series of the *Annual Report on National Accounts 2010* from 1980:I to 2008:III, even though these data are available until 2010:I, because we cut the data after the so-called Lehmann Shock. As one can easily imagine, because macroeconomic data such as exports dropped tremendously following this shock, we should also test this structural breaks using TVAR. However, because there are only six observations available during and after the shock, TVAR does not work well, since each regime must have at least 20% of the entire sample in order to obtain stable estimates (Pesaran and Potter (1997)).

All series are seasonally adjusted by X12-ARIMA with the additive point outlier dummies of 1997:1 and 1997:II, taking into account the increase in the consumption tax rate that took place 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 upon the Carlson-Parkin method (Carlson and Parkin, 1975). The survey data 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 2010* was adopted as the price level.

2-3-2 Threshold Variable

As was discussed in Section 1, in the literature we find several sources for the reduction in fiscal multiplier effects. We have selected the proxies given in Table 2, referring to previous relevant studies.

As the proxies for excess physical stock and the weakened effectiveness of capital stock, we adopted the diffusion index (DI) of "Production Capacity (manufacturing)" that was reported in the Bank of Japan's Tankan (Short-term Economic Survey of Corporations). The DI represents the proportion of entrepreneurs who feel that they have "Excessive capacity" minus those who feel that they have "Insufficient capacity." To express the 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 when we consider the values of collateral and/or the value of capital equity as the causes that weaken the effects of fiscal expansion. We regard the DI of "Business Conditions (Forecast)" as a weak predictor of economic growth.Finally, the yearly change in the annual average of the quarterly structural-primary-budget-surplus-to-GDP ratios and the quarterly public-debt-to-GDP ratio were adopted as signals of the non-Keynesian effects that occurred, as in Perotti (1999), Giavazzi, Jappelli, and Pagano (2000) and Hjelm (2002).[2]

3 Impulse Response Functions under Each Regime

3-1 Preliminary Analysis

We used all variables in the first difference of the natural logarithm since we found that private investment is non-stationary in levels. The lag length of VAR was set at 1, based on Akaike information criterion for the entire sample.[3] The Cholesky ordering is public investment, real exports, real long-term interest rates, real private investment, and real private consumption.

Using Hansen's (1996) methodology, Table 3 reports the test results on whether threshold effects exist, assuming the alternative hypothesis that all coefficients of the VAR in the two regimes are

[2] See the Appendix for details.

[3] We use the ADF unit root test using the procedure in Doldado et al. (1990). 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 reason why the same lag length is applied to VAR under each regime is simply to compare these two resulting impulse responses under the same condition. The lag length does not change with Schwarz's information criterion.

equal. Only two of the six variables were significant at a 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 non-Keynesian literature such as Perotti (1999) and Kinari and Shibamoto (2008), was not shown to be significant.

Table 3: Estimates of Threshold Variables

		Number of Lags				
		0	1	2	3	4
Threshold Variable	Yearly Change in Yearly Average Ratio of Structural Primary Budget Surplus to Potential GDP	0.007 * (0.050)	−0.004 (0.361)	0.001 (0.305)	0.003 ** (0.013)	0.009 (0.100)
	Ratio of Debt to Potential GDP	0.780 (0.222)	0.765 (0.230)	0.746 (0.247)	0.625 (0.302)	0.635 (0.387)
	Nikkei 225 Index (Level)	17287.650 (0.407)	15307.780 (0.526)	15747.260 (0.646)	17913.060 (0.843)	17852.860 (0.523)
	DI of Business Conditions (Forecasts)	−8.000 (0.344)	−10.000 (0.794)	−7.000 (0.647)	−2.000 (0.594)	−19.000 (0.736)
	DI of Lending Attitude	16.000 (0.285)	3.000 * (0.095)	3.000 (0.223)	11.000 (0.117)	3.000 (0.198)
	DI of Excess Capital	5.000 (0.138)	3.000 (0.533)	8.000 (0.528)	5.000 (0.801)	12.000 (0.631)

Note:Bootstrap p-values are in parenthesis.

Table 4: Periods of Good Times and Bad Times

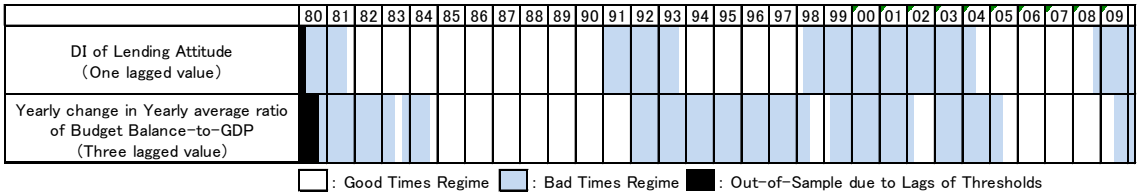

Table 4 shows the sample periods divided by the estimated threshold value. In the following analysis, we refer to the periods in which each threshold variable is greater than the estimated value in good times, and to the other periods in bad times.

3-3 Impulse Response Functions

To compare two impulse response functions (hereafter, IRFs) in the two regimes, we employed the following devices. In general, fiscal authorities make additional expenditures in a recession that follows the primary fiscal expansion, in order to ensure the recovery of the economy. In contrast, during good times, they do nothing to the economy, and fiscal expenditure is reduced, along with the automatic fiscal stabilizing effects. Therefore, if we simply compare these IRFs in the two regimes, the cumulative impulses of the expenditures 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 derived the IRFs by assigning zeros to all the parameters of the first equation in the VAR, in order to exclude the feedback effects of other variables upon the real public investment.

In the following subsections, we consider the effects of a one percentage point increase in public investment and its dynamic effects on the variables in TVAR, assuming that the shock is not so large as to entail a shift to another regime.

3-3-1 Lending Attitudes of Financial Institutions[4]

Before comparing the impulse response functions (hereafter, IRFs) under the two regimes, it would be useful to check the IRFs as derived by full sample estimation. The results are shown in the four graphs in the first column in Figure 1. An increase of one percentage point in real public investment immediately raised real long-term interest rates by about 0.02-0.04%, and by 0.01-0.02% in the long run.[5] This rise in interest rates crowds out real private investment in the short run, but in the long run it crowds it in, accompanied by a growth in consumption. The movements of exports are insignificant and negligible. Private consumption also increases in the short run as well as in the long run. In short, the responses are for the most part in accordance with textbook IS-LM behavior.

Next, based on Tables 3 and 4, 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 3, and in bad times, when it was not greater than 3.

As shown in Column 2 in Figure 1, the IRFs in good times are not very different from those in the entire sample case, which operated in a typical fashion. However, the growth rate of private investment is somewhat high. More relaxed attitudes toward lending among financial institutions might hinder the resulting decrease in the volume of loans to the private sector and private investments.

On the contrary, public investment should be considered to be a less effective tool for enhancing demand in bad times. We should first focus on the results that show that real long-term interest rates *decrease* simultaneously with an increase in public investment.[6] The seemingly contradictory phenomenon can be explained consistently as follows. Even as there may be an increase in public investment, private investment could decrease if we consider that the crowding-out of private investment is caused through non-interest rate channels such as (1) direct substitution for private investments; (2) the labor market channel described in Alesina et al. (2002), in which public investment reallocates labor forces from the public sector to the private sector, which in turn depresses private investment due to the increased capital/labor ratio; and (3) firms' expectations of tax hikes. Assuming that these non-interest rate channels work, the real interest rates could possibly

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[4] Kamoi and Tachibanaki (2001) emphasized this effect.

[5] The convergence speed is slow in this VAR; thus, most of the IRFs have a positive value even when sixteen quarters have passed, as shown in the figures.

[6] For empirical studies that use the Bank of Japan's diffusion index of the attitudes toward lending among financial institutions, see the works of Motonishi and Yoshikawa (1999) and Ogawa (2003, 2005).

decrease if the resulting decrease in private investment is greater than the initial increase in public investment and other demand components, such as private consumption. In particular, considering the labor market channel mentioned above, it would be easy for this outcome to occur when financial institutions adopt a strict attitude toward lending, since the adjustment of private capital could then be more rapid.

In addition, we can consider another possibility of this phenomenon that is derived from an excess accumulation of public capital, which is explained in Aschauer (1989) and Mitsui, Takesawa, and Kawachi (1995). As is well-known, strict attitudes toward lending that resulted from the consequences of bad loans and BIS regulations depressed private investment through the so-called credit crunch, and brought private money to public banking sectors, such as postal savings. This concentration of capital eased the enactment of public investment, as was shown by Atoda et al. (2003), but the productivity of public capital is less than that of private capital (Iwamoto, 2005; Tanaka, 2001), etc.). Therefore, an increase in public investment can possibly decrease the real interest rates with a simultaneous decrease in private investment.

A decrease in exports implies that there is no so-called Mundell-Fleming effect, but this is not strange if we consider this decrease in terms of the absorption approach, in which changes in the "absorption," which means domestic demand, determine current accounts under fixed domestic production.[7] Finally, the effects of public investment on private consumption are weak relative to those in good times, which can be explained by the existence of liquidity-constrained households. Taking the aforementioned points into account, we can say that the demand-enhancing effects of public investment are limited when financial institutions adopt strict and tight attitudes toward lending. In this dynamic, the non-interest rate channels of the crowding-out of private investment, excess accumulation of public capital, and the existence of liquidity-constrained households are the key operative concepts.

3-3-2 The Ratio of Structural-Primary-Budget Surplus to Potential GDP

We derived the impulse responses under the two regimes based on the 3-quarter-lagged yearly change in the yearly average of the ratio of the structural-primary-budget-surplus-to-potential-GDP in the same manner as in the previous sections: in good times, when the change was greater than 0.003, and in bad times, when it was less than 0.003 (Figure 2).

Needless to say, the most important difference we should consider is that of private consumption, from the perspective of the non-Keynesian effects. As can be seen at a glance in the figure, the increase in private consumption in good times is greater than it is in bad times. This is demonstrated more clearly in the cumulative responses, where one finds a positive sloped line of the cumulative

[7] As regards the absorption approach, see Krugman (1991) and Fuako (1990).

response functions in good times, in the lower panel.[8] These points imply that non-Keynesian effects exist in Japan, and that the bad fiscal situation decreases the fiscal multiplier effects, as pointed out by EPA (1998); Kawade, Ito, and Nakazato (2004); and Nakazato and Konishi (2005).

As regards private investment, we can observe crowding-in effects in good times, but crowding-out effects in bad times. These changes would be awkward 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 times. This dynamic, however, can be understood in terms of the aforementioned non-interest rate channel if the effects of the ordinary interest rate channels are negligible. Assuming that an increase in future earnings may enhance private investments, private investments should increase when the future earnings effect dominates the effects of the non-interest rate channels, and vice versa. Thus, private investment increases in good times, but decreases in bad times.

Like private investment, exports also appear contradictory in terms of the movement of real interest rates. However, these movements are also reasonable when we remember to consider them in terms of the absorption approach to current accounts and the J-curve effects.[9] Using the absorption approach, we will have current account deficits when government expenditures increase. However, this increase in government expenditures raises real interest rates as well, which in turn induces the appreciation of exchange rates. This appreciation *increases* exports through the J-curve effects, and this effect should be stronger in good times than in bad times, since real interest rates rise higher in good times than in bad. Thus, exports increase in good times but decrease in bad times.

Taking the aforementioned points into account, we can say that the demand-enhancing effects of public investment are limited when the government's fiscal stance is bad, and, needless to say, the non-Keynesian effects would be a key concept in this regard.

4 Concluding Remarks

In this paper, we have investigated the cause of the decline in demand-enhancement effects of fiscal expansion that have been mentioned in a number of studies over the past two decades. Using TVAR and a test that controls the nuisance parameter problem, we found that the diffusion indices for financial institutions' attitudes toward lending and the yearly change in the annual average of the quarterly structural-primary-budget-balance-to-potential-GDP ratio are significant factors. Thus, we divided our sample periods by these threshold estimates in order to estimate the true response functions.

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[8] As a point of information, we confirmed that the cumulative response converges to zero even though its slope looks positively constant.

[9] See Krugman (1991) for details of the applicability of the J-curve effects to the Japanese economy.

The resulting impulse response functions showed that the effects of fiscal expansion generally followed traditional principles, and were accompanied by some notable findings. First, the attitudes of financial institutions toward lending make their responses different, especially in the sense that the impulse response function in bad times shows a decrease in real investment simultaneous with an decrease in real interest rates. This phenomenon implies the existence of non-interest rate channel such as the labor market channel in Alesina et al. (2002) and the excess accumulation of public capital. Second, the non-Keynesian effects are certainly a reality. The structural-primary-budget-balance-to-potential-GDP ratio altered the responses of private consumption and private investment: there was more private consumption and less crowding-out of private investments in good times regarding the ratio.

In short, during bad times, the demand-enhancing effects are considered to be weak for financial institutions' attitudes toward lending as well as for the budget balance. In this regard, the non-interest rate channels of the crowding-out of private investment, excess accumulation of public capital, and the causes of non-Keynesian effects such as huge budget deficits would be the operative concepts.

Data Appendix

[Public Debt Data]

We construct 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[10] by the ratio of total government debt to central government debt. The ratio is calculated based on Kawade, Ito, and Nakazato (2004), in which quarterly data are linearly estimated from annual data of this ratio found in *Trends of Long-Term Debt Outstanding since FY1970*.[11]

[Structural Primary Budget Deficit]

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

[Structural Budget Surplus]

Using the output gap data computed below, we construct the structural budget surplus following the practice of the Cabinet Office, Government of Japan (2001), in which income tax, computation tax,

[10] http://www.mof.go.jp/english/pri/publication/mf_review/index.htm
[11] http://www.mof.go.jp/english/budget/statistics/200910/d200910_08.pdf

corporate tax, and net social contributions are cyclically adjusted.[12]

For the pre-adjusted budget surplus, we employ "Net lending/net borrowing" found in the *Capital Finance Accounts* of the general government sector in the *Annual Report on National Accounts 2009*, after making appropriate changes, for the sake of data consistency, to reflect changes in the government's definitions of accounts, based upon 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/kakuhou/kekka/h21_kaku/23annual_report_e.html). These data, however, are available only on an annual basis of the calendar year and fiscal year. To translate them into quarterly data, we use more detailed subjects in the *Capital Finance Accounts*, which is available on a quarterly basis, and as for the other subjects, we simply divided them by four equally. We then compute "Net lending/net borrowing" on a quarterly basis. One exception is that a datum in the 1st quarter of 1980 is not available, since these series were begun on a fiscal year basis in 1980. Thus, we use a quarter of the value of the calendar-year-basis data, which are not available on a quarterly basis.

[Output Gap]

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

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

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

For the sake of simplicity, we use 2/3 for the capital-labor ratio. The data construction methodologies are as follows.

Actual capital stock

This data is computed by being divided into manufacturing sectors and non-manufacturing sectors. For manufacturing sectors, we use the gross capital stock data (on an excluding-construction-in-progress basis) found in *Gross Capital Stock of Private Enterprises* (Cabinet Office, Japan), after adjusting the effects of privatization of the Japan Railways Group, National Telcomunication and Electric Power Development Co., Ltd. For the details of these adjustments, see Nakahigashi (2008) and Kameda and Li (2008), and the multiplication of the capacity utilization rate (=100 in 2005) in manufacturing sectors found in *Indices of Industrial*

[12] http://www5.cao.go.jp/zenbun/wp-e/wp-je01/wp-je01-000i2-12.html

Production (Ministry of International Trade and Industry). For non-manufacturing sectors, we adopt the same data source, but not multiplied by capacity utilization, due to its availability.

Potential capital stock

These data are computed using the same procedure as that used for actual capital stock above, with the average capital utilization in manufacturing (=100.0746).

Working hours per capita

Total working hours in all industries at establishments with 30 or more regular employees, as found in the *Monthly Labor Survey* (Ministry of Labor).

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Potential working hours per capita

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

Number of workers

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

Number of labor force multiplied by the average ratio of seasonally adjusted employed persons to seasonally adjusted labor force (=0.967).

Working Hours

Working hours per capita times number of workers.

Potential Working Hours

Potential working hours per capita times potential number of workers.

[Potential GDP]

Seasonally adjusted actual GDP divided by the output gap, as explained above.

References:

Aschauer, D. A. (1989), “Does Public Capital Crowd Out Private Capital?” *Journal of Monetary Economics*, Vol. 24, 177-200.

Alesina, P., Ardagna, S., Perotti, R., and Schiantarelli, F. (2002), “Fiscal Policy, Profits, and Investment,” *The American Economic Review*, Vol. 92 No. 3, 571-589.

Bayoumi, Tamim (2001) “The Morning After: Explaining the Slowdown in Japanese Growth in the 1990s,” *Journal of International Economics*, 53. 241-259.

Bertola, G. B. and Drazen, A. (1993), “Trigger points and budget cuts: Explaining the effects of austerity,” *American Economic Review*, 83, 11-26.

Cabinet Office, Government of Japan (2001). *Annual Report on Japan's Economy and Public Finance 2000-2001- No Gains Without Reforms*.

Choi and Devereux (2006), “Asymmetric Effects of Government Spending: Does the Level of Real Interest Rates Matter?” *IMF Staff Papers*, Vol. 53, Special Issue, 147-181.

Doldado, J., Jenkinson, T., and Sosvilla-Rivero, S. (1990), “Cointegration and Unit roots,” *Journal of Economic Surveys*, 4, 249-273.

Economic Planning agency, Government of Japan (1998) *Economic Survey of Japan*, Printing Bureau, Ministry of Finance, Government of Japan. (In Japanese)

Fukao, M. (1990) *International Monetary Economics*. Toyo-Keizai.

Giavazzi, F., Jappelli. T., and Pagano, M. (2000), “Searching for Non-Keynesian Effects of Fiscal Policy: Evidence from Industrial and Developing Countries,” *European Economic Review*, 44, 1259-1289

Giavazzi, F., Jappelli. T., and Pagano, M. (2005), “Searching for Non-Monotonic Effects of Fiscal Policy: New Evidence,” Working Paper No. 142, Centre for Studies in Economics and Finance.

Hatano, E. (2008), “The Effects of Public Investment on Private Investment—Verification Based on an Error Correction Model Designed for a Stock Equilibrium,” *Financial Review*, Vol. 89. Policy Research Institute, Ministry of Finance, Government of Japan. 30-42. (In Japanese)

Hansen, Bruce E. (1996), “Inference When a Nuisance Parameter Is Not Identified Under the Null Hypothesis,” *Econometrica*, Vol. 64 (March), pp. 413–30.

Hansen, Bruce E. (1997), “Inference in TAR Models,” *Studies in Nonlinear Dynamics & Econometrics*: Vol. 2: No. 1, Article 1.

Hansen, Bruce E. (2000), “Sample Splitting and Threshold Estimation,” *Econometrica*, Vol. 68 (May), pp. 575–604.

Hjelm, G. (2002), “Is private consumption growth higher (lower) during periods of fiscal contractions (expansions)?” *Journal of Macroeconomics*, 24, 17-39.

Hori, M. and Ito, Y. (2002), “Fiscal Policy or Monetary Policy? Approach by the Time Series Analysis,” Harada, Y and Iwata, K. (Eds.). *Empirical Analysis of Deflation-led Recession*, Ch.3. Toyo Keizai Shinpo-sha. (In Japanese)

Hori, M, Suzuki, S., and Kayasono, O. (1998), “The EPA Short-Run Macroeconometric Model of the Japanese Economy—Basic Structure, Multipliers, and Economic Policy Analyses,” *Economic Analysis Series*, No. 157. Economic and Social research institute, Cabinet Office, Government of Japan. (In Japanese)

Ito, T. (2005) Long-Term Interest Rates and Central Bank. Nihon Hyoron-sha. (In Japanese)

Ito, A. and Watanabe, T. (2004), “Non-Keynesian Effects of Fiscal Policy: Prefectural Data Analysis,” The Economic Review, Vol. 55. No. 4. Institute of Economic Research, Hitotsubashi University. (In Japanese)

Ihori, T., Nakazato, T., and Kawade, M. (2002), “Japan's Fiscal Policy in the 1990s,” *Financial Review*, Vol. 63. Policy Research Institute, Ministry of Finance, Government of Japan. 36-68. (In Japanese)

Kato, H. (2001), “Effects of Government Expenditure: Structural VAR Approach,” Discussion Paper. Institute of Population and Social Security Research. (In Japanese)

Kato, R. (2003), “Comparison of the Fiscal Multiplier Between Japan and the U.S.: An Approach to Structural VAR with Institutional Factors,” International Department Working Paper Series, 03-J-4. (In Japanese)

Kamata, K. and Masuda, K. (2000), “Effects of Measurement Error on the Output Gap in Japan,” Research and Statistics Department Working Paper Series 00-15

Kameda, K. and Li, H. (2008), “Comparison of Productivity of Public Capital among Central Government, Local Governments and Nationally Subsidies”. *The Japan Institute of Public Finance ed.s*, *The Road to Fiscal Health and Tax Reform*, *Public Finance Study* (Zaisei Kenkyu) 5. 148-164 (in Japanese)

Kawade, M., Ito, A., and Nakazato, T. (2004), “Effects of Fiscal Policy and Its Change since 1990,” in Ihori, T. eds, Budget deficits in Japan, 105-124. Iwanami Shoten. (in Japanese)

Kinari, Y. and Shibamoto, M. (2007), “Efficacy of Fiscal Policy in Japan: Keynesian and Non-Keynesian Effects on Aggregate Demand,” Unpublished paper presented at annual meetings of the Japan Society of Monetary Economics 2007.

Kitaura, N. and Nagumo, N. and Matsuki, T. (2005), “Effects of Fiscal Policies on Real GDP in Japan,” *Financial Review*, Vol. 78. Policy Research Institute, Ministry of Finance, Government of Japan. 131-170. (In Japanese)

Krugman, P. (1991), "Has the Adjustment Process Worked?" in C. Fred Bergsten, ed., International adjustment and financing: The lessons of 1985-1991. Washington, D.C.: Institute for International Economics.

Kuttner, Kenneth, and Adam Posen (2001), “The Great Recession: Lessons for Macroeconomic Policy from Japan,” Brookings Papers on Economic Activity 2, 93-185.

Miyazaki, T. (2008), “The effects of fiscal policy in the 1990s of Japan: VAR analysis with event

studies," Discussion Paper series, Nagoya Gakuin University.

Motonishi, T and Yoshikawa, H. (1999), "Causes of the Long Stagnation of Japan during the 1990s: Financial or Real?" *Journal of the Japanese and International Economies*, 13, 181–200.

Nakahigashi, M., 2008. "Evaluation of Public Capital: An Approach to Productivity Effects", *Government Auditing Review* 37. 57-67. (in Japanese)

Nakazato, T. (2002), "Non-Keynesian Effects of Fiscal Policy: A Survey," *Economic Analysis Series*, No. 163. Economic and Social Research Institute, Cabinet Office, Government of Japan. (In Japanese)

Nakazato, T. and Konishi, M. (2004), "Long Stagnation and Fiscal Policy in the 1990s," Hamada, K., Horiuchi, A, Economic and Social Research Institute. (Eds.). *Discussion on Economic Crisis in Japan*. Nihon Keizai Shinbun-Sha. (In Japanese)

Nakazato, T. (2005), "Fiscal Adjustments and Economic Activities," *Financial Review*, Vol. 76. Policy Research Institute, Ministry of Finance, Government of Japan. 3-18. (In Japanese)

Nakazawa, M. Onishi, M., and Harada, Y. (2002), "Fiscal and Monetary Policy in the 1990s and Business Cycle: a VAR Analysis," Discussion Paper Series, 02-A-02. Policy Research Institute, Ministry of Finance, Government of Japan. (In Japanese)

Nishizaki, K. and Nakagawa, Y. (2000), "Estimation of Structural Budget Balance in Japan," Research and Statistics Department Working Paper Series 00－16. Bank of Japan. (In Japanese)

Nood, P., "The Size and Role of Automatic Fiscal Stabilizers in the 1990s and Beyond," OECD Economics Department Working Papers, No. 230, January 2000.

Ogawa, K. (2005), "Debt, R&D investment and technological progress: A panel study of Japanese manufacturing firms' behavior during the 1990s," *Journal of the Japanese and International Economies*, 21, 403–423.

Perotti, R. (1999), "Fiscal policy in good times and bad," *Quarterly Journal of Economics*, 114, No. 4, 1399-1439.

Ramaswamy, R. and Christel, R. (2000), "Japan's Stagnant Nineties: A Vector Autoregression Retrospective," *IMF Staff Papers*, 47. 259-277.

Research and Statistics Department. (2006), "The New Estimates of Output Gap and Potential Growth Rate," *Bank of Japan Review*, 2006-E-3.

Roubini, N. and Sachs, J. (1989), "Political and Economic Determinants of Budget Deficits in the Industrial Democracies," *European Economic Review*, 33. 903-938.

Sugihara, S., Mihira, T., Takahashi, T., and Takeda, M. (2000), "Monetary Policy in Japan—Instruments, Transmission Mechanisms, and Effects," *Economic Analysis Series*, No. 162. Economic and Social Research Institute, Cabinet Office, Government of Japan. (In Japanese)

Takeda, Y., Komaki, Y., and Yazima, K. (2005). "Non-Keynesian Effects and Rule-of-Thumb Household," Takeda, Y., Komaki, Y., and Yazima, K. (Eds.). *Heterogeneousness of Expectation*

Formation and Macroeconomic Policy. Ch. 10. Toyo keizai Shinpo-sha. (In Japanese)

Tanaka, H. and Kitano, Y. (2002), "Macro-economic Effects of Fiscal Policy in OECD Countries," *Financial Review*, Vol. 63. Policy Research Institute, Ministry of Finance, Government of Japan. 114-159. (In Japanese)

Tong, Howell (1990), Non-linear Time Series: A Dynamical System Approach (New York: Oxford University Press).

Watanabe, T., Yabu, T., and Ito, A. (2009), "Estimation of the Fiscal Multiplier based on Institutional Information," Ihori, T. (Ed.). *Fiscal Policy and Social Insurance*. Economic and Social Research Institute, Cabinet Office, Government of Japan. (In Japanese)

Yoshino, N., Kaji, S., and Kameda, K. (1998), "Monetary Policy Tools and the Keynesian Multiplier," *Financial Review*, Vol. 45. Policy Research Institute, Ministry of Finance, Government of Japan. (In Japanese)

Yoshino, N. and Kameda, K. (1999), "Demand Enhancement Effects of Public Investment," In: Yoshino, N., and Nakajima, T. (Eds.). *Economic Effects of Public Investment*. 89-158. (In Japanese)

Table 1: List of Variables used in the Literature

		EPA (1998)	Ramaswamy and Rendu (2000)	Bayoumi (2001)	Kuttner and Posen (2001)	Kato (2001)	Ihori, Nakazato, and Kawade (2002)	Tanaka and Kitano (2002)		Nakazawa, Onishi, and Harada (2002)		Hori and Ito (2002)	Kato (2003)	Kawade, Ito, and Nakazato (2004)	Kitaura and Nagumo (2004)		Nakazato and Konishi (2004)	Miyazaki (2008)	Watanabe, Yabu, and Ito (2009)	
								A	B	A	B				A	B				
Number of variables		6	8	8	3	4	6	7	7	7	7	5	5	4	6	6	5			
GDP				○	○			○	○	○	○	○	○			○	○		○	10
Demands	Domestic Demand					○														1
	Domestic Private Demand	○																		1
	Private Consumption		○				○							○	○		○	○		5
	Private Investment		○*				○							○	○*	○	○	○		6
	Government Expenditure			○	○	○	○		○				○		○	○			○	8
	Government Consumption		○																	1
	Public Investment	○	○					○		○	○	○		○		○	○			9
	Change in Inventories		○																	1
	Exports	○	○				○	○	○	○	○				○					8
	Imports		○				○								○					3
Pieces	GDP Deflator									○	○	○	○			○				5
	Domestic Demand Deflator	○																		1
	Consumer Price Index							○	○											2
Interests	Long term Rate	○								○		○	○				○			5
	Short term Rate			○				○	○		○									4
	Money Supply							○	○	○	○	○								5
Exchange	Nominal Exchange Rate	○								○	○					○				4
	Effective Exchange Rtae			○				○	○											3
	Tax			○	○	○	○						○						○	5
Others				Stock Prices, Land plice, Bank loan ooutstanding		Unemploy-ment rate								Public Debt						

1) * implies private investment is devided into residential and non-residential.
2) Miyazaki (2008) uses the narrative approach with supplementary budget dummy.

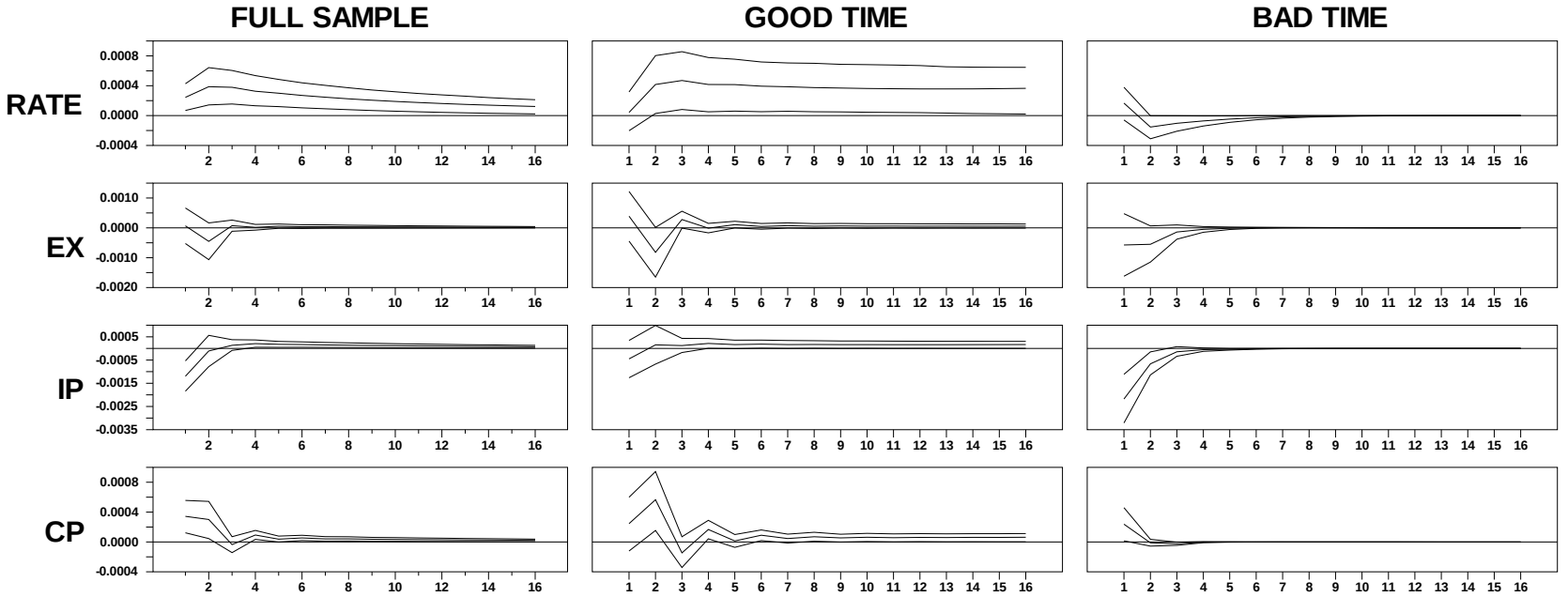
Table 2: List of Threshold Variables and their Proxies

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

Figure 1

Good Times vs. Bad Times: On Lending Attitude of Financial Institutions

EFFECT OF 1% INCREASE IN PUBLIC INVESTMENT



The Dotted lines give one-standard deviation bands computed by Monte Carlo simulations.

Cumulative Responses: On Lending Attitude of Financial Institutions

EFFECT OF 1% INCREASE IN PUBLIC INVESTMENT

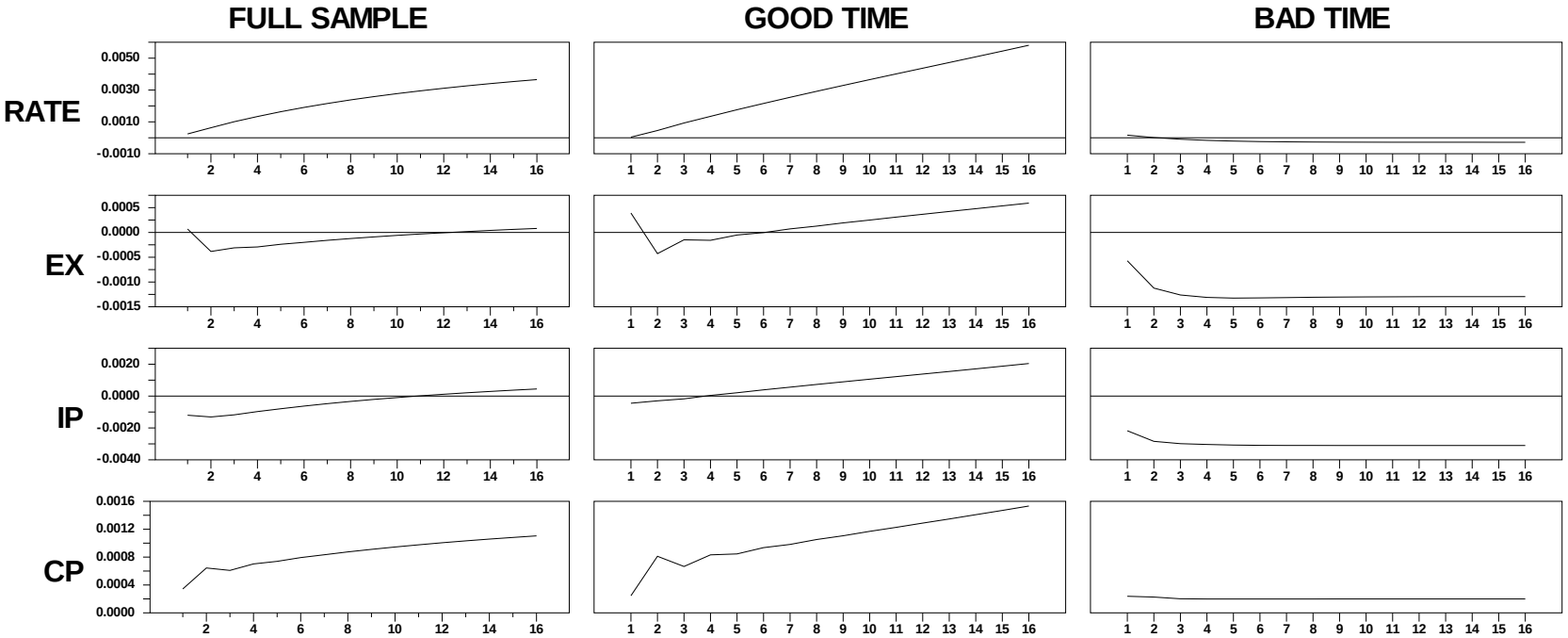
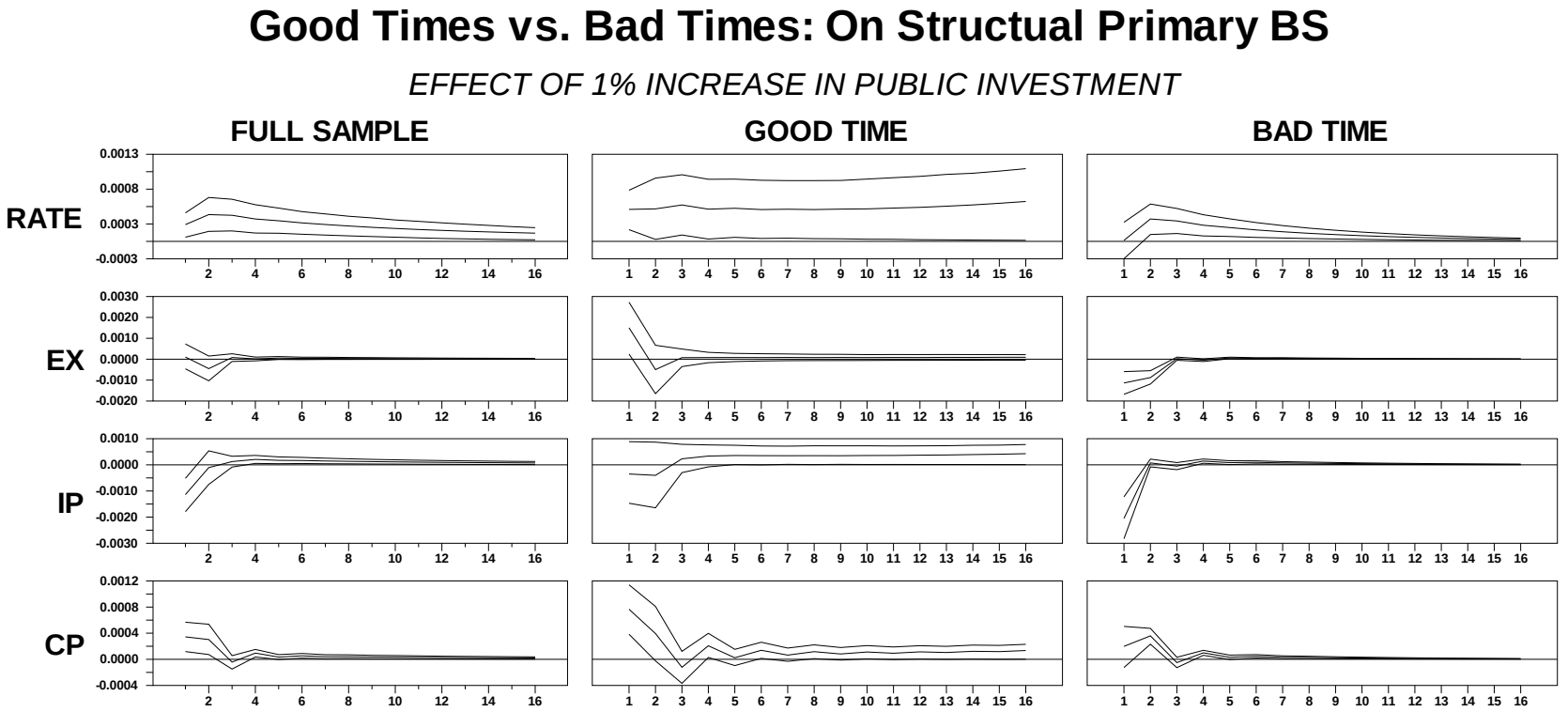


Figure 2



The Dotted lines give one-standard deviation bands computed by Monte Carlo simulations.

Cumulative Responses: On Structual Primary BS

EFFECT OF 1% INCREASE IN PUBLIC INVESTMENT