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EFFECTS OF GOVERNMENT CONSUMPTION SHOCKS IN CHINA, JAPAN, AND KOREA

Abstract:

This paper investigates the effects of government consumption shocks on various key macro variables for China, Korea and Japan, by using a structural VAR model. The main empirical findings are as follows. First, government spending multipliers of all three countries are far larger than 1 in recent years. The government spending multiplier is larger in China than in Korea and Japan. The effectiveness of fiscal expansion has not been changed in China, but substantially changed in Korea (after Asian financial crisis) and Japan. Second, the effects on exchange rate and trade balance are different across countries. Interestingly, real exchange rate depreciates and trade balance improve more under more flexible exchange rate regime. Some empirical findings are consistent with the standard theory but others are not.

Keywords:

Structural VAR, government consumption shocks, Fiscal Multiplier, Real Exchange Rate, Current Account, China, Japan, Korea

JEL Classification: C32, E62, F41

Introduction

After the recent financial crisis, there have been huge controversies on the effects of fiscal policy. How big is the fiscal multiplier? Is it larger than 1 as in the traditional Keynesian model? Is it sometimes negative? What are the effects on consumption, investment, and real wage? Do they increase or decrease? Are the effects consistent with Neo-classical growth model or New Keynesian model?

These questions are important for both academics and policy makers all around the world at all times, and we found that they are particularly important for those in three East Asian economies, namely, China, Japan, and Korea in recent years because there have been important issues in those countries: exchange rate regime changes, a bulk of rise in capital mobility and trade openness, long period of near-zero short-term interest rate.

This paper empirically investigates the effects of fiscal policy in terms of government consumption multipliers of China, Japan and Korea. We discuss how policy regimes, institutions and country characteristics, such as exchange rate regime, capital account liberalization, monetary policy, openness, and so on, affect the results.

As in many recent studies, we use structural VAR models as the empirical methodology, which is known as to be useful to extract exogenous component of policy shocks and to examine the effects of exogenous policy changes. Also as in many recent studies¹, we focus on the effects of government consumption shocks (instead of tax shocks) because the theory is clearer for government consumption shocks and tax data is often difficult to collect.

Literature Review

In this section, we briefly review the theoretical and empirical literature focused on the effects of fiscal policy, especially government spending.

In the Keynesian models with sticky prices, increases in government consumption raise output and private consumption, which leads to rise an increase in government spending multiplier. On the other hand, in Real Business Cycle (RBC) models², forward looking agents and rational expectation are employed, which mainly drive the effect of fiscal expansions to decrease. Forward looking agents expect their future income path and they maximize their present value of lifetime expected utility. In the standard RBC models, where agents infinitely live and choose their consumption and labor schedule based on the present value of lifetime expected utility and behave in the Ricardian way, changes in government consumptions, or non-distortionary taxes

¹ Blanchard and Perotti (2002), the seminal paper, presents a key assumption in identifying the government consumption shock in their empirical work. Following this, there has been subsequent studies in studying fiscal policy empirically, such as Corsetti and Müller (2006), Ravn et al. (2007), Kim and Roubini (2008), and Ilzetski et al. (2009).

² See for example, Hall(1980), Barro(1981,1987), Aiyagari et al.(1992), Baxter and King(1993), Edelberg et al.(1999), Burnside et al.(2004).

have no, or little impact on their lifetime income. As a result, the impact would be less than the Keynesians’.

In the empirical literature, there has been various studies about the effects of government consumption shocks. However, little consensus has been reached in the VAR literature, even for U.S. economy. Specifically, how the aggregate GDP and its components, especially private consumption and real wage, respond to the change of government spending is at the center of empirical research, but there are no firm consensus on the empirical result. There are four types of different identification methods of VAR literature on fiscal policy: recursive, non-recursive (such as Blanchard Perotti, 2002), sign-restriction, and narrative approach. A key assumption for identification in Blanchard and Perotti (2002) is that government spending is contemporaneously exogenous to other variables in quarterly frequency. This identification restriction is frequently employed in subsequent studies, for example, Fatas and Mihov (2001), Galí et al. (2007), Kim and Roubini (2008), Ilzetzki et al. (2009), Beetsma et al. (2008), Corsetti and Müller (2006), Ravn et al. (2007), and Kim (2009), among many others. Blanchard and Perotti (2002) and their follow-up works find similar results on the aggregate output, consumption, and real wage. They show that a positive government consumption shock raise not only output and hours worked, but also consumption and real wage. Among open-economy literature, Enders et al.(2011) imposes sign restrictions derived from the DSGE models to identify government consumption shocks in an open economy set-up. In this paper, they find the depreciation in real exchange rate in response to expansionary government consumption shocks. Narrative type of identification addresses the exogeneity issue of government consumption shock identified by structural VAR literature. In the Ramey and Shapiro(1998) and the subsequent studies using narrative approach, for example, Edelberg et al. (1999), Burnside et al. (2004), Cavallo(2005), and Ramey(2011b), find that positive effects on output and hours worked, but negative effects on consumption, real wage, and investment. Corsetti et al.(2012) employs Ramey(2011)’s richer narrative records about defense spending in their VAR model and find real exchange rate depreciates, while trade balance show insignificant from zero.

The empirical evidences mentioned above are non-exhaustive summary from various research methods which study U.S. economy. However, as shown in Ilzetzki et al.(2013), Born et al.(2013), Kim(2015), the aggregate economy responses crucially depend on the country characteristics of studied economy. For China, several studies estimate government spending multiplier. Using structural VAR model with annual data of 1978-2011, Wang and Wen (2013) find notably large GDP multipliers, like 5.5 at its peak and 4.86 in the long-run, and also positive multipliers on consumption and investment. For province level, they find also relatively large multipliers, like 2.83 in the short-run and 6.51 in the long-run. In contrast, Guo and Ma (2015) find that GDP multipliers is 0.6 based on OLS regressions using annual data for public spending data of China county. He, Zhang and Zhang (2009) also find GDP multiplier as approximately 0.84 using input-output table analysis. Related to Korean economy, several studies employ Blanchard-Perotti type VAR model and show different size of

GDP multipliers according to estimation period. With data of 1979:1 ~ 2000:4, Hur (2007) shows also insignificant effects of government consumption shock on the Korean economy. Kwak (2014) employs short-run and long-run restrictions on VAR model for Korean economy in period of 1994:1-2012:2. In this paper, cumulative GDP multiplier is 0.9~1.6. Interestingly, Kim (2011) finds relatively large GDP multipliers on government spending with data of 1999:1-2010:1. In Japan, Kuttner and Posen (2002) examines the effects of fiscal policy on GDP following Blanchard and Perotti (2002) using annual data from 1976 to 1999. They provide evidence that tax cuts or expanding government spending had positive effects on GDP with the multipliers are over 1. Also, Auerbach and Gorodnichenko (2014) estimates the state dependent government spending multipliers of Japan following Auerbach and Gorodnichenko (2013). The estimated GDP multipliers are approximately 1.6 when recession and -5 when expansion.

Empirical Methodology

Here we assume that the economy is described by a structural form equation as follows:

$$G_0 Y_t = P + \sum_{i=1}^I G_i Y_{t-i} + \sum_{j=0}^J F_j Z_{t-j} + \beta D_t + \varepsilon_t, \quad (1)$$

where Y_t is a $K \times 1$ endogenous data vector, Z_t is a $M \times 1$ exogenous data vector, D_t is an $N \times 1$ indicator for a given quarter t , and P is a $K \times 1$ constant vector. ε_t is a $K \times 1$ structural disturbances vector, which is assumed to be serially uncorrelated and $\text{var}(\varepsilon_t) = \Lambda$ and Λ is a diagonal matrix, where the diagonal elements are the variances of structural disturbances. Hence, ε_t is assumed to be mutually uncorrelated. G_0 is a $K \times K$ matrix of contemporaneous coefficients of the endogenous variable in the structural form equation and matrix G_i contains coefficients of lagged endogenous variables. F_j is also a matrix of $K \times M$ of coefficients on both current and lagged exogenous variables. The coefficient on the indicator, β , is a $K \times N$ vector capturing effects of an unobservable factor or structural changes at a given quarter t . In the baseline model, the endogenous data vector, Y_t , is [RGOV, RGDP, RIR, RER, TB]. RGOV is the log of real government consumption and RGDP is the log of real GDP. RIR is (ex-post) real interest rate.³ RER is the log of the real effective exchange rate, where an increase of RER represents the appreciation of a currency. TB is the trade balance on goods and services constructed as the log of real exports over real imports.⁴ RGDP represents the general economic activity and is included to capture the (lagged) endogenous responses of government consumption to economic activities and to analyze the effect on real GDP. RIR is included due to its importance in the transmission of fiscal policy. RER and TB are

³ For the real interest rate of Korea and Japan, the annualized quarterly GDP deflator inflation rate is subtracted from the money market rate. To construct the real interest rate of China, the quarterly CPI inflation rate is subtracted from the lending rate.

⁴ All real variables are in domestic terms.

included because they are the most important open economy variables and they are useful in inferring the transmission of fiscal policy. The exogenous data vector, Z_t , is [USRGOV], and USRGOV is the real government consumption of U.S. This variable is included to control the effects of U.S. fiscal policy. In addition to the foreign fiscal policy effects, we also try to control for the country-specific changes in policy regime and economic environments by introducing the country-specific period dummy variable denoted as D_t . The variable is intended to capture the effects of Asian Financial Crisis and the transition to more flexible exchange rate regime and more liberalized capital account (Korea), zero interest rate (Japan), and the accession to the WTO (China). Finally, all variables except for RIR and dummy variables are in logarithm and multiplied by 100 and two lags are assumed for both endogenous and exogenous variables.⁵

We estimate the following reduced form VAR:

$$Y_t = Q + \sum_{i=1}^l B_i Y_{t-i} + \sum_{j=0}^l C_j Z_{t-j} + \gamma D_t + u_t, \quad (2)$$

where Q is a $K \times 1$ constant vector, B_i and C_j are coefficient vectors on lagged endogenous and exogenous variables, and γ is a $K \times N$ vector. u_t is a $K \times 1$ reduced form residuals where $\text{var}(u_t) = \Sigma$.

To recover the parameters of the structural form equation from estimated parameters of the reduced form equation, we impose recursive zero restrictions on contemporaneous structural parameters by applying Cholesky decomposition to the variance-covariance matrix of reduced form residuals, Σ , as in Sims (1980). To identify the government consumption shock, we follow the assumption, proposed by Blanchard and Perotti (2002) that at least one quarter is required for the fiscal authority to respond to changes in the state of the domestic economy. Hence, we assume that the government consumption is contemporaneously exogenous to all other endogenous variables. This assumption is adopted widely in the related literature since it reflects practical implementation lags of fiscal policy. Fiscal authorities tend to take more than a quarter in assessing the state of the economy, determining what changes are required to the government consumption in response to the state of the economy, enacting policy changes via the legislature, and implementing the new policy.

In this study, we calculate the cumulative multipliers to measure the effects of discretionary government spending on output at various horizons and to compare the short- and long-run effects across three countries at different sample periods. Following definitions from Mountford and Uhlig (2009), the net present value of the cumulative multipliers at horizon T , $CM(T)$, is defined as

$$CM(T) = \frac{\sum_{t=0}^T (1+i)^{-t} \Delta y_t}{\sum_{t=0}^T (1+i)^{-t} \Delta g_t} \approx \frac{\sum_{t=0}^T (1+i)^{-t} \Delta \log(y_t) \bar{y}}{\sum_{t=0}^T (1+i)^{-t} \Delta \log(g_t) \bar{g}} \quad (3)$$

⁵ The statistical inference in this paper is not problematic in the presence of unit roots and cointegrating relation, since we apply the Bayesian inference. See Sims (1988) and Sims and Uhlig (1991) for a general discussion of Bayesian inference in the presence of unit roots and cointegrating relations.

where i is the average interest rate in the sample, y and g are output and government consumption respectively. Since output and government consumptions are in logarithm, we compute the approximate value of the defined cumulative multipliers as follows:

Table 1 shows that sample periods, the periods for dummy variables, and the subsample periods for each country. Sample periods differ across countries mainly due to the data availability. The periods for dummy variables and the subsample periods are selected according to changes in the policy regimes and economic environments. China joined WTO in December, 2001. To take account of such effects, we consider the dummy variable and subsample periods of 2002:1 – 2015:2. Korea experienced Asian financial crisis in 1997. During the Asian financial crisis, the economy may have behaved abnormally. In addition, after Asian financial crisis, Korea experienced various changes in policy regimes. Korea adopted inflation targeting, introduced the short-term interest rate as monetary policy instrument, liberalized capital account substantially, and adopted floating exchange rate regime. Hence, two period dummy variables of 1997:4 - 1998:2 and 1999:1 - 2015:2 are included in the baseline model and we perform subsample exercises of 1980:1 - 1997:2 (before the crisis) and 1999:1 - 2015:2 (after crisis). For Japan, we also consider dummy variable (1995:2-2015:2) and subsample analysis for the period before and after the nominal interest rate reached near zero (1980:1-1994:4 vs. 1995:2-2015:2). Refer to the Appendix for details of the data source.

Table 1: Sample periods for three countries

	Full Sample periods	Dummy periods	Subsample periods
China	1994:1 - 2015:2	2002:1 - 2015:2	2002:1 - 2015:2
Korea	1980:1 - 2015:2	1997:4 - 1998:2 1997:4 - 2015:2	1980:1 - 1997:2 1999:1 - 2015:2
Japan	1980:1 - 2015:2	1995:2 - 2015:2	1980:1 - 1994:4 1995:2 - 2015:2

Empirical Results

In this section, we report the empirical results from the baseline VAR model for China, Korea, and Japan. The upper left panel of the figure 1 shows the impulse response of China. The impulse responses of each variable to government spending over seven years with a one standard error band (68% probability bands) are reported. The names of responding variables are denoted at the far left of each row. In response to a positive government consumption shock, government consumption rises persistently. In seven years after the shock, government consumption is still 0.5% above the initial level. In response to such a positive government consumption shock, output also increases persistently. Output increases approximately 0.5% initially. Output response is still significantly positive even in seven years after the shock. The real interest rate increases, but the increase is insignificant although it is almost significant at its peak. The real exchange rate depreciates but insignificant on impact, and in two years it persistently appreciates, which is different from zero with 84% probability. In contrast

with exchange rate responses, trade balance worsens on impact, which is different from zero with 84% probability, but quickly recovers to its normal level. The upper right panel of the figure 1 shows the impulse response of Korea in the baseline model. In the baseline model, government consumption sharply increases on impact and slowly returns to the initial level, but it is still significantly positive in seven years after the shock. In contrast with China, output response is not significantly different from zero at any horizons.⁶ The real interest rate increases significantly for about two years, and become insignificant. The real exchange rate appreciation is not significant, but it is almost significant at its peak. The trade balance deteriorates significantly on impact, and recovers to its initial level in approximately 4 quarters. These effects are consistent with standard theory, which predicts a rise of interest rate, an appreciation of real exchange rate, and a deterioration of trade balance. The lower left panel of the figure 1 shows the impulse response of the Japan. The impulse responses in the Japanese economy also show weak responses of output. However, the signs of real exchange rate and trade balance are the opposite to those found in Korea. Figure 8 shows the benchmark impulse responses of Japan. The structure of the graph is also identical with former cases. Analogous to the results of China and Korea, in response to a positive government consumption shock, government consumption soars on impact and increases persistently. However, in contrast with China, and likewise the case of Korea, output response is not significantly different from the zero level for the whole estimation periods. The real interest rate rises on impact, but insignificant. Rather, it decreases significantly in four quarters. Even though the positive change of government spending is quite persistent, the real interest rate falls significantly, and consequently, the real exchange rate depreciates and the trade balance improves persistently and significantly.

We perform subsample exercises to take into account of institutional and policy regime changes and/or structural changes. The upper left panel of the figure 2 displays impulse responses in the baseline model for the full sample period and subsample period 1 (2002:1 – 2015:2). Overall, the responses of the economy show similar patterns. However, the probability bands for impulse responses in the subsample period tend to be wider than those in the full sample period, since the degree of freedom is lower in the subsample period than in the full sample period. Government consumption increases persistently in both samples, and it is still positive in seven years after the shock. Output shows more positive response in the subsample period. The GDP multipliers are also larger in the subsample period than in the full sample period. Real interest rate responses are larger in subsample period 1 than in full sample period. Real interest rate responses become significant and positive at its peak in the subsample period. The real exchange rate responses are not significant in the subsample period. The responses of trade balance, consumption, and investment are insignificant in the subsample period 1. The upper right panel of the figure 2 shows the impulse responses in the baseline model of Korea for

⁶ This muted response is consistent with Hur (2007) and Kwak (2014), which analyze government consumption shock in the Korean economy during period of before and after the Asian financial crisis.

subsample 1(1980:1-1997:2) and subsample 2(1999:1-2015:2). Korea had experienced profound changes in its regimes, which can be summarized as increases in trade openness, exchange rate flexibility, and capital mobility. Comparing to China, changes in exchange rate flexibility and capital mobility are clearer in Korea. Consequently, overall patterns of the responses of the Korean economy to a positive government consumption shock are significantly shifted in subsample 2 under a similar nature of government consumption shocks. In both samples, government consumption sharply increases on impact and slowly decreases over time, and it is still significantly positive in seven years after the shock. After Asian financial crisis, Korean economy has been involved with radical transformations in policy regimes and economic structure. Like China, the situation can be summarized as increase in capital mobility, exchange rate flexibility, and trade openness, but the increase is larger in Korea. These characteristics are consistent with the stark changes which are shown in the results of Korean economy between subsample 1 and 2. However, theoretical predictions about the effects of these changes in Korea may not be easily reconciled with the empirical results. The weak responses of interest rate, exchange rate and trade balance can be summarized as a mitigation of expenditure-switching effects on the Korean economy. The insignificant response of interest rate can reduce the expenditure-switching effect, and increase in capital mobility can lower interest rates by allowing a fast evaporation of interest rate differential in small open economy with flexible exchange rate regime. However, in the standard theory, increase in capital mobility and exchange rate flexibility appreciates exchange rate, therefore trade balance may be worsened, which are not shown in the results of subsample 2. Relatively speaking, increase in trade openness can generate weak expenditure-switching effects in standard theory. But increase in trade openness predict less worsening of trade balance, but in the empirical results, improvement of trade balance is significant. The lower left panel of the figure 2 16 displays the baseline impulse responses of Japan, for subsample 1(1980:1-1994:4) and subsample 2(1995:2-2015:2). In subsample 2, Japanese economy shows more expansionary effects of government consumption shock, higher in subsample 2. Insignificant output response in subsample 1 turn into significantly positive in subsample 2, and it is still positive, like government consumption, in seven years after the shock in subsample 2. The real interest rate is insignificant on impact and decreases significantly in both samples. The size of decline is larger in subsample 1, but the persistence is higher in subsample 2. In subsample 2, a fall in interest rate lasts for seven years.

Conclusion

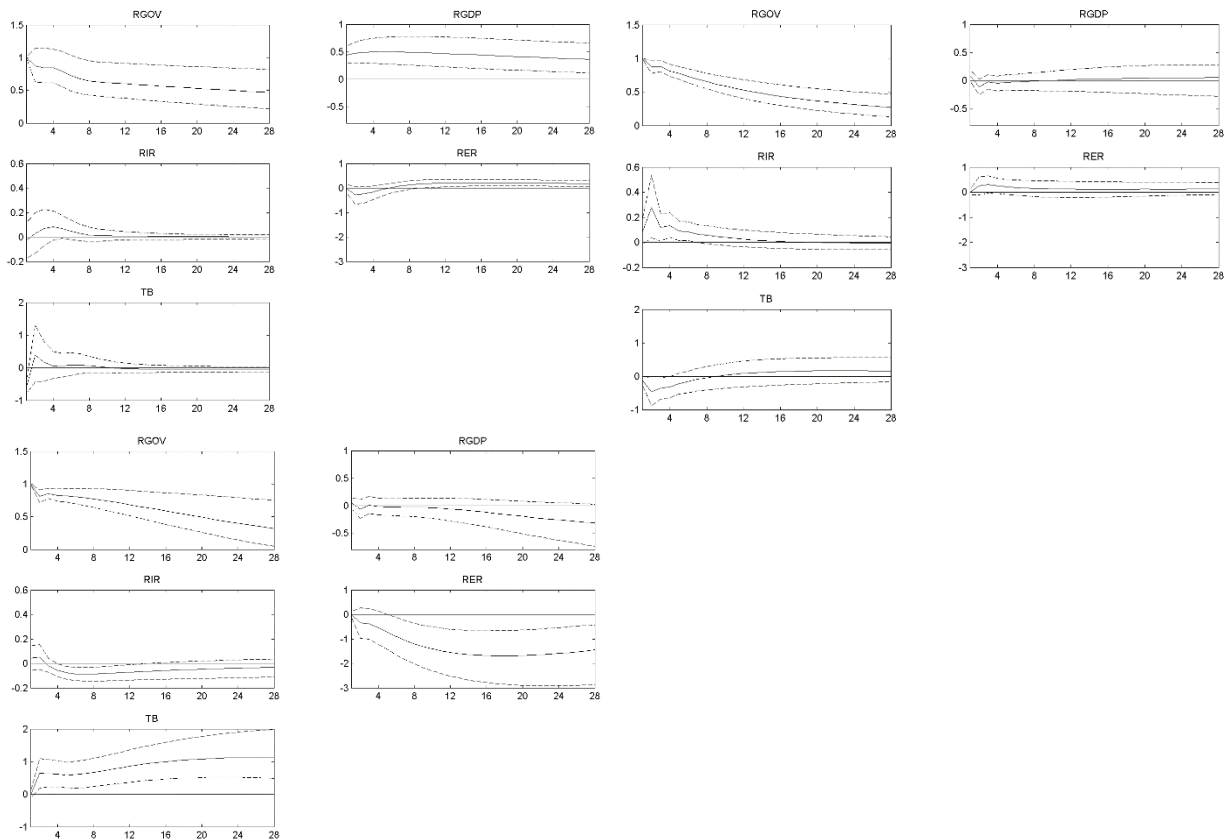
We investigate the effects of government spending shocks on various key macro variables for China, Korea and Japan. Specifically, the key questions are 1) how big is the fiscal multiplier 2) what are the effects on the components of GDP such as consumption, investment, and trade balance and key macro variables such as exchange rates and hours worked 3) what are the effects of changes in the policy regimes and economic structures, such as exchange rate regime, capital account liberalization, monetary policy, trade openness, on the effects of fiscal policy. We find

the government spending multiplier of China well exceeds the unity throughout the sample period under consideration. In addition, we find that the government spending multipliers of all three countries are far larger than 1 in the recent period. The effectiveness of fiscal expansion has not been changed in China, but substantially changed in Korea (after Asian financial crisis) and Japan (zero lower bound). Also, we find that the effects of trade balance and exchange rate are different across countries. We also find that real exchange rate tends to depreciate more and trade balance tends to improve more as exchange rate becomes more flexible.

Data Appendix

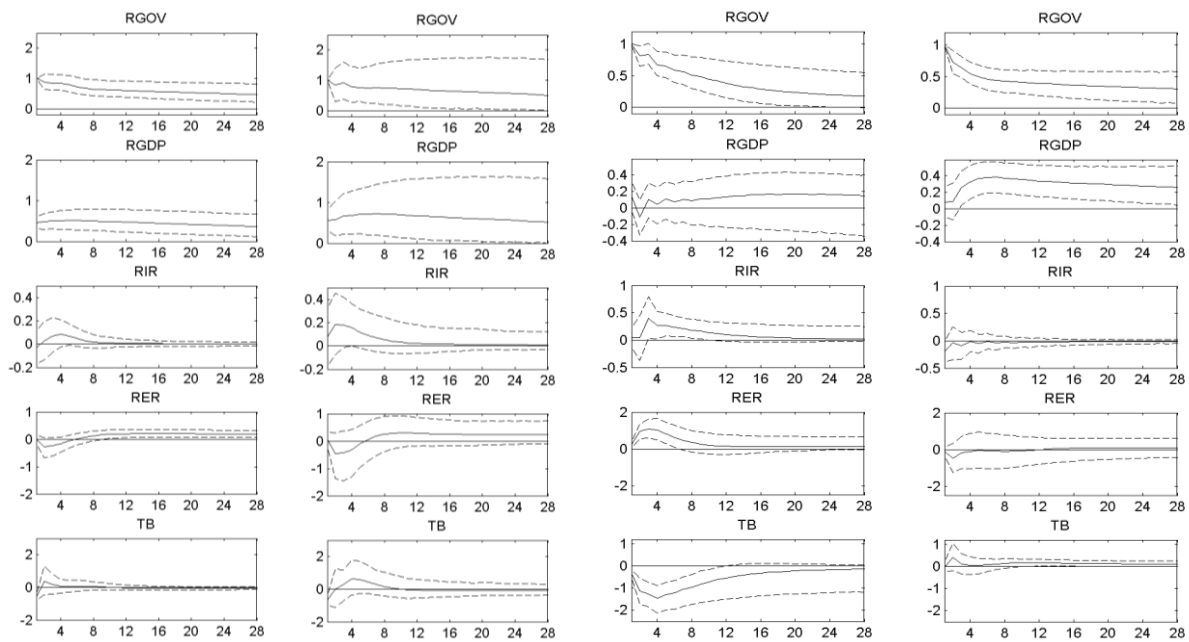
Quantity data, such as real GDP, real government consumption, real private consumption, real private investment, real exports and real imports are obtained from the national accounts for each country and all are seasonally adjusted. We obtain data for China from IMF. The OECD Quarterly National Accounts is used for Japan and national accounts of Korea is obtained from Economic Statistic System of Bank of Korea. For the exchange rates, BIS nominal and real effective exchange rates are used. Narrow indices are used for Korea and Japan and broad indices are used for China. GDP deflator of Korea and Japan and consumer price index of China are obtained from IMF IFS. Since it is difficult to acquire GDP deflator of China, we use consumer price index following Wang and Wen (2013). For the short-run nominal interest rate, we use money market rate from IMF IFS for cases in Korea and Japan. The lending rate within a year is used for China from IMF IFS. We use employment by economic activity obtained from OECD. For the data availability we use the ratio of government debt to GDP from OECD for Japan only. Finally we use U.S. real government consumption expenditures and gross investment from NIPA table (BEA table 3.9.5 line 1) for the U.S. government spending data.

Figure 1: Impulse responses with respect to 1% shock to government consumption:

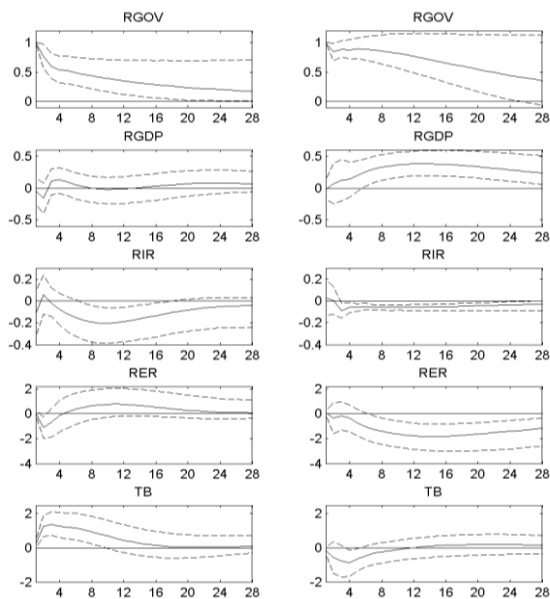


Baseline VAR model, China, Korea and Japan, respectively.

Figure 2: Impulse response with respect to 1% shock to government consumption:



Subsample VAR analyses of China, Korea and Japan, respectively.



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