Fiscal Policy and the Exchange Rate: Comparative Evidence from the U.S. and Japan[±]

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Abstract

This paper investigates the effects of four different fiscal policy tools, along with the total budget deficit on the real exchange rate by using data from USA and Japan within a VAR framework. Our results show that (i) different fiscal variables have different and sometimes offsetting effects on the exchange rate, (ii) when there is an offsetting monetary policy action, it may dominate the overall effect on the exchange rate, (iii) therefore, the cross-country variation in the effects of fiscal policy on exchange rate can be explained with the composition of the fiscal response and accompanying monetary policy actions

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1. Introduction

Recent developments in World politics, especially the U.S. budget deficits and the fiscal stimulus in Japan, have revived the interest in fiscal policy and led economics researchers to focus on analyzing the dynamic effects of fiscal policy actions. There are many recent studies which try to link the relationship between fiscal policy and macroeconomic variables such as output, price level and interest rate. Edelberg *et al* (1999), for instance, studies the effect of exogenous increase in the U.S. military spending on macroeconomic variables by using a narrative approach. Fatas and Mihov (2001) investigate the impact of fiscal policy on consumption and employment in a semi-structural VAR framework. Perroti (2002) studies the effect of fiscal policy on GDP, price levels, and interest rates in five OECD countries by using a structural VAR approach. Arin and Koray (2005a,b) investigate the response of output and other macroeconomic variables such as output, interest rate and price level to innovations in different types of taxes. Arin and Koray (2005c) also determine how fiscal shocks (innovations in income taxes and national defense expenditures) originating in the U.S. affect the U.S. economy and how they are transmitted to the Canadian economy.

The effects of fiscal policy on the exchange rate, however, has been somewhat ignored in the previous literature. One of the few exceptions, Kaminsky and Klein (1994) investigate the effect of fiscal policy on the real exchange rate in the U.S. and Great Britain during the Gold Standard period 1879-1914. They investigate the effects of government spending, fiscal deficit, and import tariffs on real exchange rate.. Clarida and Prendergast (1999) investigate only the effect of fiscal stance on the real exchange rate in G3 countries since advent of floating exchange rate by using exactly-identified Vector Autoregressive model. Both papers document that fiscal policy actions affect real exchange rate only through government fiscal deficit. There are, however, no empirical studies that focus on the effect of different fiscal policy components on the real exchange rate yet. In addition, both studies fail to control for the accompanying monetary policy actions, as suggested by Eichenbaum and Evans(1995), Christiano, Eichenbaum and Evans (1998), Koray and McMillin (1999), Jang and Ogaki (2001), West (2004), and Amato *et al.* (2005).

By using a Vector Autoregressive (VAR) model, this paper examines the effects of fiscal stance and different fiscal policy variables (including government spending and three different types of taxes) on the real exchange rate in the United States and Japan. This paper contributes to the existing literature by: (i) investigating the effects of different fiscal policy variables, (ii) by calculating Monte Carlo confidence bands to test the significance of the empirical results, (iii) by controlling for the accompanying monetary policy actions. Our results show that different fiscal policy tools have different effects on exchange rate. Our results also suggest that the cross-country differences of the effects of fiscal policy on the exchange rate can be explained by using i) the composition of the fiscal response, ii) the accompanying monetary policy innovations

The remainder of this study is organized as follows: Section 2 underlines the theoretical background and previous literature of the effect of fiscal policy tools on exchange rate. Section 3 explains the data and methodology used in this paper. Section 4 explains the empirical results of the paper. Finally, section 5 concludes.

2. Previous Literature

According to the benchmark Mundell-Fleming Model, an expansionary fiscal shock (no matter which instrument is used) will lead to an appreciation in exchange rate. This is due to the fact that a rise in aggregate demand will raise domestic interest rate relative to foreign interest rate and, in turn, appreciate the real exchange rate.

Sachs and Wyplosz (1984) develop a framework to study the effect of fiscal policy on the real exchange rate. They argue that the Mundell-Fleming model on real exchange rate ignores several key channels though which fiscal policy could have affected real exchange rate: the growth of public debt resulting from fiscal expansion, fiscal measures that must be taken to service growing debt, the wealth and portfolio implications of current account deficits, and the forward-looking expectations in the asset markets. By developing the goods market equilibrium condition; they find that both short and long run fluctuations of real exchange rate responding to fiscal expansion depend on the degree of substitutability between domestic and foreign assets. Their results show that a fiscal expansion will lead to a short-run appreciation

and a long-run depreciation when domestic and foreign assets are close substitutes. The reverse is true when the degree of substitutability is low.

Frenkel and Razin (1986) employ general equilibrium intertemporal framework to study the mechanism through which fiscal policies may affect real rates of interest and real exchange rate. They study the impacts of three fiscal policy actions: government spending, government budget deficits with distortionary taxes and without distortionary taxes. Their results show that the effect of government spending depends upon two biases: (1) the intertemporal allocation of government spending relative to the domestic private sector, (2) the commodity composition of government purchases relative to the domestic private sector. If the intertemporal allocation of government spending relative to private sector is biased towards the present, then a rise in government spending on tradable goods raise the world rate of interest, and decelerates the rates of change of the domestic and foreign real interest rates. And if the government spends more on non-tradable goods real interest rate decreases and rates of change of real exchange rate accelerates. The results are reversed if the intertemporal allocation of government spending relative to private sector is biased towards the future. Their results also show that the shock to budget deficits with distortionary tax policies raises world interest rate and decreases domestic effective interest rates. In addition, it accelerates rate of change of domestic real exchange rate and decelerates the foreign rate of change. With distortionary tax policies, budget deficits affect real interest and real exchange rate through wealth effect. It lowers domestic interest rates and raises world rate of interest. Accordingly, the rise in world rate of interest leads to a low foreign spending and in turn increases foreign real exchange rate.

Kaminsky and Klein (1994) study the effect of fiscal policy on real exchange rate during the Gold Standard period by using a structural VAR model. They argue that there are three main channels through which fiscal policy could have affected the real exchange rate in the United States and Great Britain: government spending, fiscal deficit, and import tariffs. Their results, however, show that there is almost no relationship between government spending, import tariffs and the real exchange rate. There is, though, stronger evidence that shows the relationship between government budget balance and real exchange rate. Their results show that the government

surpluses in the end of 1880s in the United States are followed by the unexpected dollar depreciation, whereas the reverse fiscal stance in 1894 shows the unexpected appreciation in the real dollar. Their results also show that fiscal contraction in the United Kingdom lead to the depreciation in the pound after 1905 and the results are reversed after 1907 when there is a fiscal expansion.

Clarida and Prendergast (1997) investigate the effect of government deficit on real exchange rate, by using a VAR model; show the similarities of real exchange rate response across G3 countries. Fiscal expansion in the three countries leads to initial appreciations in the real exchange rate, however, in the long run real exchange rate decreases toward steady state. They do not, however, calculate Monte Carlo confidence bands to check the statistical significance of their impulse response functions. In addition, they do not provide further controls for the accompanying monetary policy actions or for the composition of the fiscal response.

Annicchiarico (2002) study the impact of fiscal expansion on nominal exchange rate when there finite horizons by using general equilibrium optimizing model. By either assuming that Ricardian Equivalence does not hold in which government deficits are totally financed by lump-sum taxation or government deficits are mix-financed, the paper also argues that nominal exchange rate appreciates in the short-run and depreciates in the long-run towards its initial level as responding to the fiscal expansion.

Kim and Roubini (2004) study the effects of government budget deficit shocks on the current account and real exchange rate during the exchange rate regime by using a VAR framework. By controlling for business cycle variables, they find that the shocks to government budget deficit improve the current account and depreciate real exchange rate temporarily. They further show that this improvement in the current account is, however, not suggested by the theoretical model; it is due to the increases in private saving and decreases in investment. They also suggest that the depreciation of real exchange rate is due to the depreciation of nominal exchange rate.

From the previous studies above, it may be concluded that fiscal expansion leads to a short-run appreciation of real and nominal exchange rate. These studies, however, only investigate the effects of government budget deficit, government spending and import tariffs on the exchange rate. Specifically, they find strong evidence on the effect of government budget deficit shock on the exchange rate and they also show that there is hardly any effect of import tariffs on the exchange rate. The effect of government spending on the real exchange rate is unclear. These studies fail to incorporate the effect of other fiscal tools such as the three different types of taxes. This paper, therefore, fulfills these gaps by reinvestigating the effect of each fiscal tool including structural budget balance, government spending, labor taxes, corporate taxes and indirect taxes on the real exchange rate. In addition, we also control for the effect of the accompanying monetary policy tools on the real exchange rate.

3. Data and Methodology

3.1 Data

Following Clarida and Prendergast, we first concentrate on G-3 countries. We, however, choose not to observe the effect of fiscal policy in Germany because there are not enough observations available for Germany which may not provide clear picture of the responses of real exchange rate to the fiscal shocks; (the data for Germany are only available from 1991:1 – 1999:4). For the U.S., the dataset spans the period of 1973:2 – 2001:2 (As it is difficult to control for structural breaks in a VAR framework, post 9/11 period has been excluded) and for Japan, the dataset spans the period of 1976:1 – 2004:4. All data series are obtained from the OECD Economic Outlook For exact definitions of all variables, please refer to Table 1.

3.2 Methodology

We use Vector Autoregressive Model to investigate the dynamic responses of real exchange rate to different fiscal policy shocks with the accompanying effect of monetary policy actions.

There are five variables which are used in each VAR model. First we estimate the effect of government structural balances on real exchange rate, then the effect of each of the four fiscal policy components on real exchange rate mainly government

expenditure, indirect taxes, labour taxes and corporate taxes. Therefore all variables used in these models are: structural primary balance (is calculated as percentage of potential GDP and denoted by B_t), government expenditures (denoted by G_t), labor taxes (L_t), corporate taxes (C_t), indirect taxes (I_t), output gap (Y_t), actual budget balance (calculated as percentage of GDP and denoted by A_t), interest rate (R_t), and real exchange rate (which is in log form and denoted by E_t). In this case, all fiscal variables are cyclically adjusted and calculated as percentage of potential GDP. Real exchange is calculated as nominal exchange rate multiplied by foreign CPI and divided by domestic CPI.

According to Choleski decomposition of the variance/covariance matrix, we order variables in the VAR model in a particular fashion which allows changes in the higher ordering variables to cause contemporaneous effect on lower ordering variables whereas lower ordering variables are assumed to affect higher ordering variables only with a lag.

In this VAR model, therefore, we allow real exchange rate (E_t) to respond endogenously to each of the five different fiscal policy shocks. Each of the fiscal variables is, therefore, ordered first and real exchange rate is ordered last in the ordering. Interest rate is ordered second as we allow this accompanying monetary policy action to respond contemporaneously to fiscal shock and to exogenously affect output gap, actual balance, and exchange rate. Output gap and actual primary balance are ordered third and fourth respectively as we allow actual budget balance to respond endogenously and contemporaneously to the shocks of output gap (ordered third), the short-term interest rate (ordered second) and each fiscal policy variable (ordered first). A similar ordering has been previously suggested by Clarida and Prendergast (1999).
We can summarize this ordering by presenting a five-variable equation:

$$X_t = [F_t, R_t, Y_t, A_t, E_t] \qquad (1)$$

where F_t is the shock of each fiscal policy variable which can either be: B_t, G_t, L_t, I_t, or C_t respectively.
The benchmark of this VAR model is presented as below:

$$X_t = W_t + A(L)X_{t-1} + U_t \qquad (2)$$

Where $U_t = [\, u_t^F, u_t^R, u_t^Y, u_t^A, u_t^E]$. W_t is a constant, U_t is the vector of reduced form residuals, and A(L) is a matrix of polynomials with a lag operator L.

The equation (2) can be expressed in a matrix form as below:

$$\begin{bmatrix} Ft \\ Rt \\ Yt \\ At \\ Et \end{bmatrix} = \begin{bmatrix} W1 \\ W2 \\ W3 \\ W4 \\ W5 \end{bmatrix} + \begin{bmatrix} a11 & a12 & a13 & a14 & a15 \\ a21 & a22 & a23 & a24 & a25 \\ a31 & a32 & a33 & a34 & a35 \\ a41 & a42 & a43 & a44 & a45 \\ a51 & a52 & a53 & a54 & a55 \end{bmatrix} \begin{bmatrix} Ft-1 \\ Rt-1 \\ Yt-1 \\ At-1 \\ Et-1 \end{bmatrix} + \begin{bmatrix} U1 \\ U2 \\ U3 \\ U4 \\ U5 \end{bmatrix}$$

We compute and plot the Impulse Response Functions to analyze the dynamic responses of the real exchange rate to the shocks to fiscal variables with the accompanying monetary policy actions. We also test the statistical significance of our impulse response functions by calculating the Monte Carlo confidence bands with one standard deviation confidence intervals which are based on 10000 draws.

In the analysis of this VAR model, however, all variables are used in levels. Sims (1980) amongst others recommend against differencing even if the variables contain a unit root. They argue that the goal of a VAR analysis is to determine the inter-relationships among variables, not to determine parameter estimates. The main argument against differencing is that it throws away information concerning co-movements in the data, such as long-term cointegrating relationships between variables. We choose the lag lengths by using Akaike Information Criteria, which is chosen to be 4.

4. Empirical Results

4.1 Shocks to Structural Budget Balance

The responses of model variables to shocks to structural budget balance are presented in figure 1.1. The shocks to structural budget balance are persistent in both the U.S. and Japan. The monetary policy response is contractionary in the U.S. and expansionary in Japan. Not surprisingly, output in U.S. decreases eventually whereas it increases in Japan. Consistent with what Clarida and Prendergast (1999) finds, we observe an initial appreciation of real exchange rate for the first 6 quarters in both countries.

4.2 Shocks to Government Expenditure

The responses of model variables to shocks to government expenditure are presented in figure 1.2. The shocks to government expenditure are persistent in both countries. The monetary policy response is insignificant in the U.S. and contractionary in Japan. The responses of output gap in both countries are significant and positive. These unexpected results are consistent with the recent literature that emphasizes the non-Keynesians effect of fiscal policy (Alesina *et al*, 2002). According to this new literature, an increase in government expenditure (including wages) increases labor demand puts an upward pressure on wages and therefore decreases firm profit and private investment. Although the exchange rate depreciates in response to the fiscal shock in both countries, the effects of the increase in government spending on the exchange rate is stronger in Japan, where the accompanying monetary policy response is contractionary.

4.3 Shocks to Labor Taxes

The responses of model variables to shocks to labor taxes are presented in figure 1.3. The shocks to labor taxes are persistent in both U.S. and Japan. The response of monetary policy is contractionary in the U.S. and expansionary in Japan. Output, in response, decreases in the U.S. initially then increases eventually whereas it increases for Japan. We also observe that in response to labor tax shocks, the actual budget

balance significantly improves in both countries—which hints that those labor tax increases might be associated with cuts in unproductive government spending. There is an appreciation in the exchange rate in both countries as well.

4.4 Shocks to Corporate Taxes

The responses of model variables to shocks to corporate taxes are presented in figure 1.4. The monetary policy response is contractionary in the U.S. and it is insignificant in Japan. In the U.S., output gap increases initially then decreases eventually whereas the response of output gap in Japan is insignificant. We observe an initial appreciation of real exchange rate in both countries for about 7 quarters.

4.5 Shocks to Indirect Taxes

The responses of model variables to shocks to indirect taxes are presented in figure 1.5. The shocks to indirect taxes are persistent in both U.S. and Japan. The accompanying monetary policy actions in both U.S and Japan are expansionary. In response, output increases for both countries. We observe an appreciation of real exchange rate in the U.S. for more than two years whereas real exchange rate in Japan appreciates only for the first quarter and depreciates eventually.

4.6 Variance Decompositions

We further investigate the relative impact of monetary and fiscal policy shocks on the exchange rate by using variance decompositions. Variance decompositions show the proportion of forecast error variance for each variable that is attributable to its own innovations and to shocks to the other variables in the system. The results for variance decompositions are presented in Table 2, which suggest that a larger percentage of the forecast error variance of the exchange rate can be explained by shocks to monetary policy.

5. Concluding Remarks

Within a VAR framework, we find that real exchange rate responds differently to each fiscal variable. The cross-country variation in the effects of fiscal policy of both countries on real exchange rate can be explained with the composition of the fiscal response and accompanying monetary policy actions.. The fluctuations of real exchange rate due to fiscal policy actions can be partially or fully offset and sometimes enhanced by monetary policy actions. Further research along those lines will help us to understand the effects of fiscal policy shocks on other major macroeconomic variables as well.

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TABLE 1

Definition and Source of the data used

VARIABLE	DEFINITION	DATA SOURCE
Structural budget Balance	Primary balance, deficits or surpluses relative to potential GDP	OECD Economic Outlook data
Government Expenditures	Government total disbursements; government consumption expenditures and gross investment	OECD Economic Outlook data
Labor Taxes	Direct Taxes for Households, federal, state, and local; income, Social Security, other.	OECD Economic Outlook data
Corporate Taxes	Direct taxes for business; federal, state ,and local	OECD Economic Outlook data
Indirect Taxes	federal, state, and local; excise tax, custom duties, sales taxes, proper taxes	OECD Economic Outlook data
Output Gap	Unemployment gap, recessionary gap	OECD Economic Outlook data
Actual Budget Balance	Current Balance; budget deficits; budget surpluses	OECD Economic Outlook data
Interest Rate	Short term interest rate; federal funds rate; 3-month treasury bill rate	OECD Economic Outlook data
Real Exchange rate	Units of Local Currency per foreign currency	OECD Economic Outlook data

Table 2

The Variance Decompositions of the first 4 quarters of Real Exchange Rate responses in the G3 Countries [1]

1. Variance Decomposition of Real Exchange Rate in the U.S.

	structural budget balance		Government Expenditure		Labor taxes		Corporate Taxes		indirect taxes	
Period	structural Balance	Interest Rate	Government Expenditure	Interest Rate	Labor Taxes	Interest Rate	Corporate Taxes	Interest Rate	Indirect Taxes	Interest Rate
1	0.000439	0.235868	9.19E-05	0.359569	0.001284	0.717808	0.000246	0.55573	9.30E-05	1.343629
2	0.000336	0.236252	0.000139	0.785889	0.001258	0.853945	0.00022	0.318008	7.99E-05	2.355086
3	0.000285	0.309294	0.000176	1.385999	0.001216	0.714264	0.000235	0.322909	7.26E-05	3.149539
4	0.000237	0.368772	0.00023	2.711561	0.001093	0.712253	0.000237	0.414091	6.08E-05	4.302178

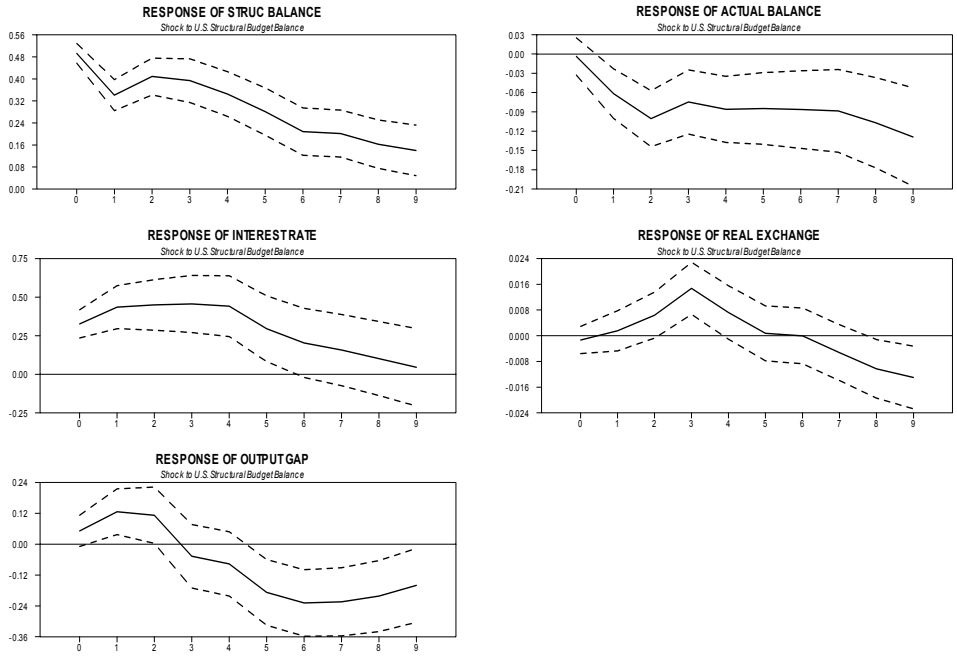
2. Variance Decomposition of Real Exchange Rate in Japan

	structural budget balance		Government Expenditure		Labor taxes		Corporate Taxes		indirect taxes	
Period	Structural Balance	Interest Rate	Government Expenditure	Interest Rate	Labor Taxes	Interest Rate	Corporate Taxes	Interest Rate	Indirect Taxes	Interest Rate
1	0.000857	1.537779	1.80E-04	2.739161	0.000251	1.426871	0.000404	0.614657	2.33E-06	2.080418
2	0.000834	0.980305	0.000182	2.387401	0.000255	1.140934	0.000344	0.2663	3.31E-06	1.782224
3	0.000778	1.353926	0.000177	1.759998	0.000232	0.79626	0.000268	0.928703	6.87E-06	1.258648
4	0.000723	4.183751	0.00017	1.464001	0.000225	1.302275	0.000204	3.237435	1.03E-05	1.135963

[1] According to the variance decompositions of the real exchange rates' responses in the first 4 quarters, we find that the effects of real interest rates are stronger than the effects of fiscal variables in the G3 countries. We report only the first four quarters because the effects of short-term interest rates in other periods are also stronger than the effects of fiscal tools on real exchange rates.

Figure 1.1

Shocks to structural budget balance in U.S.



Shocks to structural budget balance in Japan

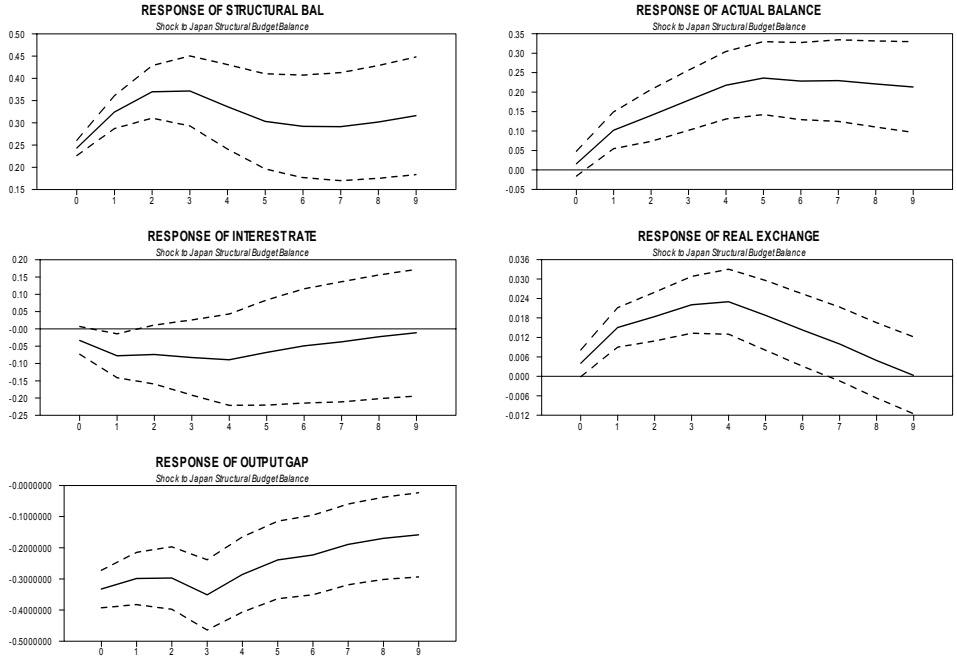
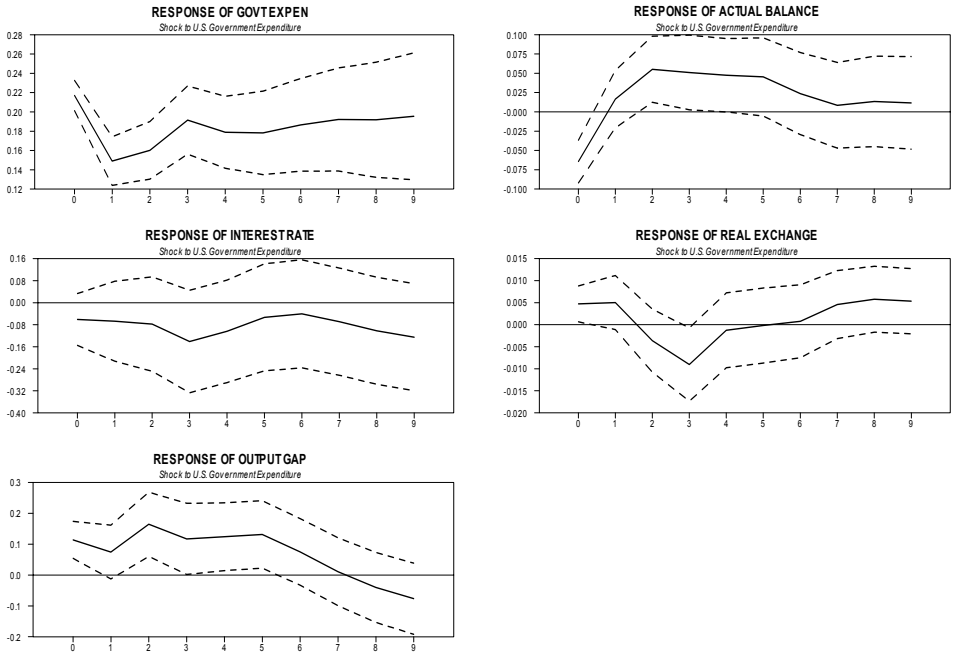


Figure 1.2

Shock to Government Expenditure in U.S.



Shock to Government expenditure in Japan

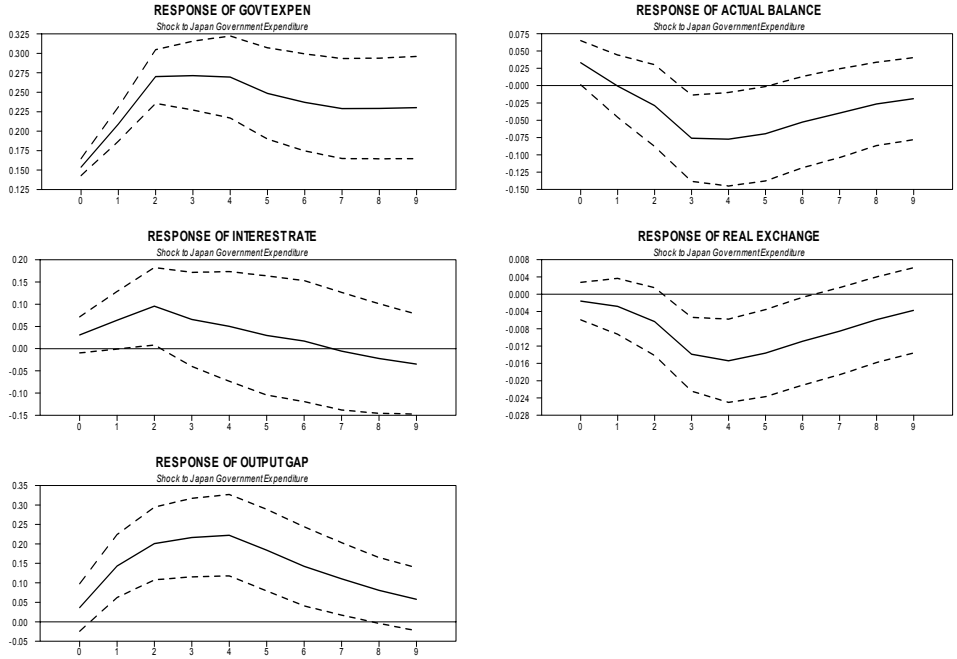
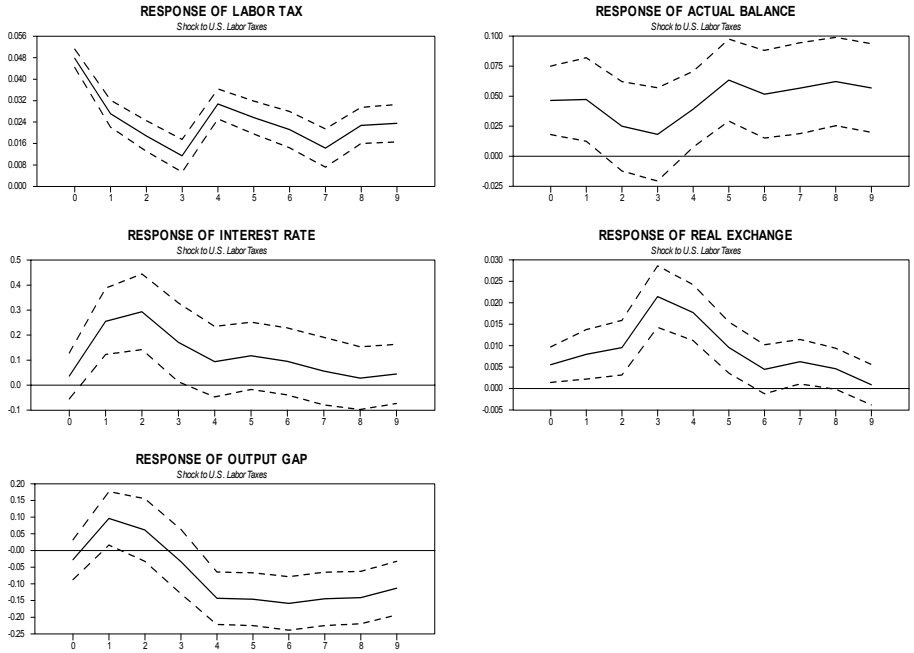


Figure 1.3

Shock to Labor Taxes in U.S.



Shock to Labor Taxes in Japan

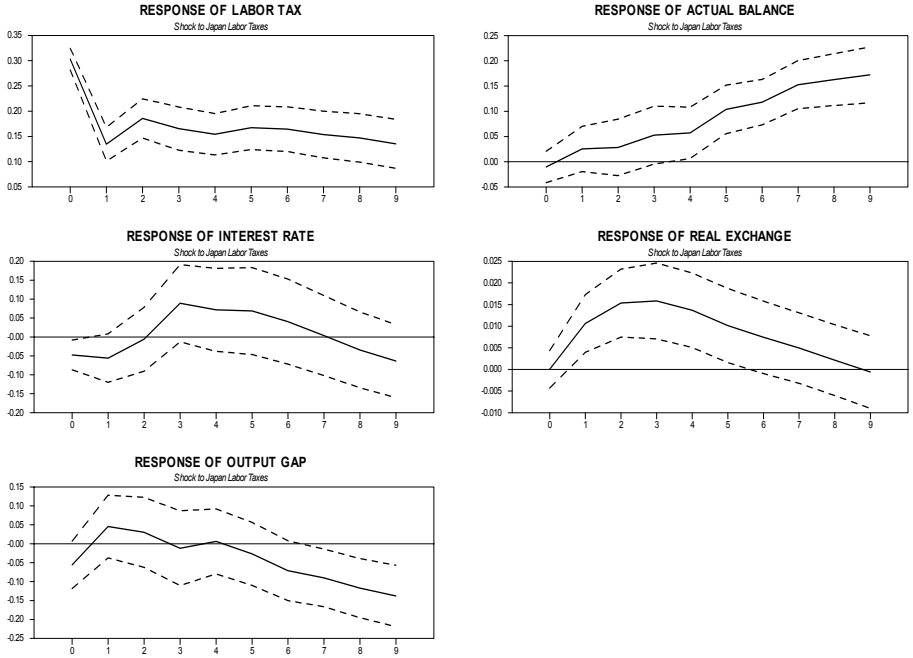
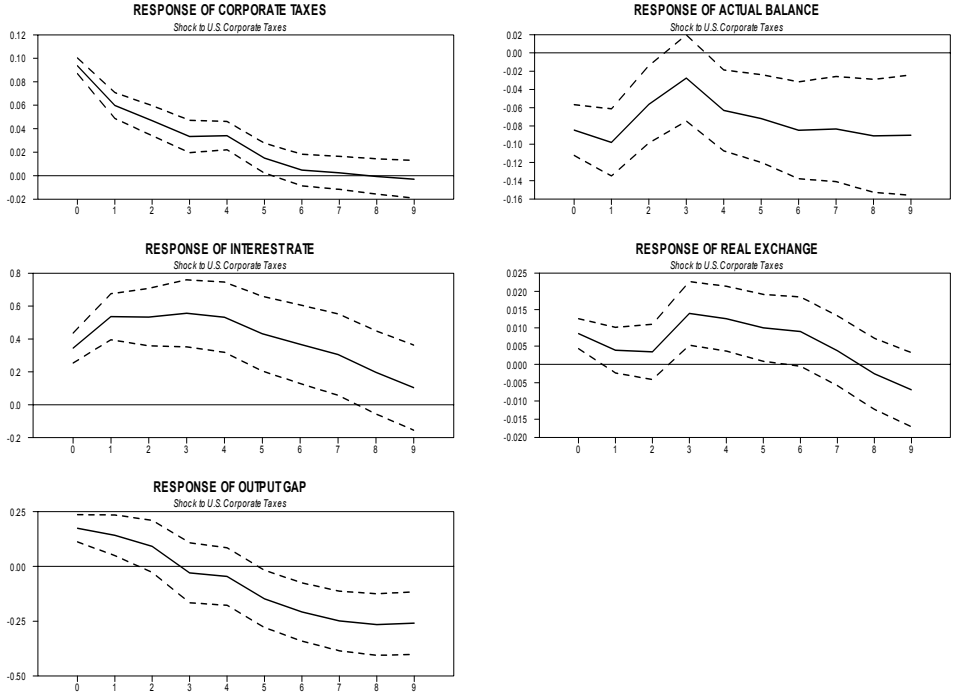


Figure 1.4

Shock to Corporate Taxes in U.S.



Shock to Corporate Taxes in Japan

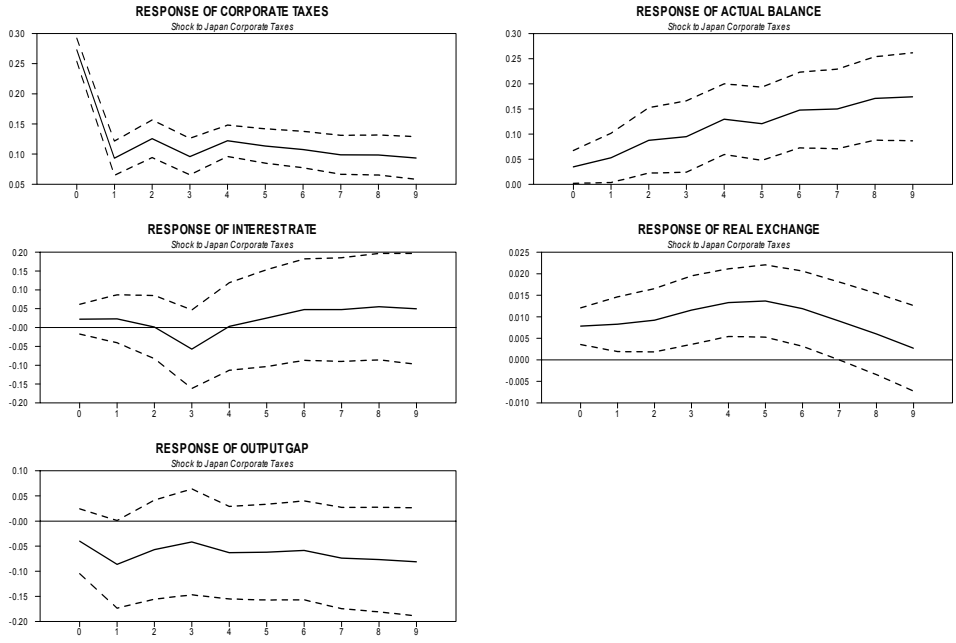
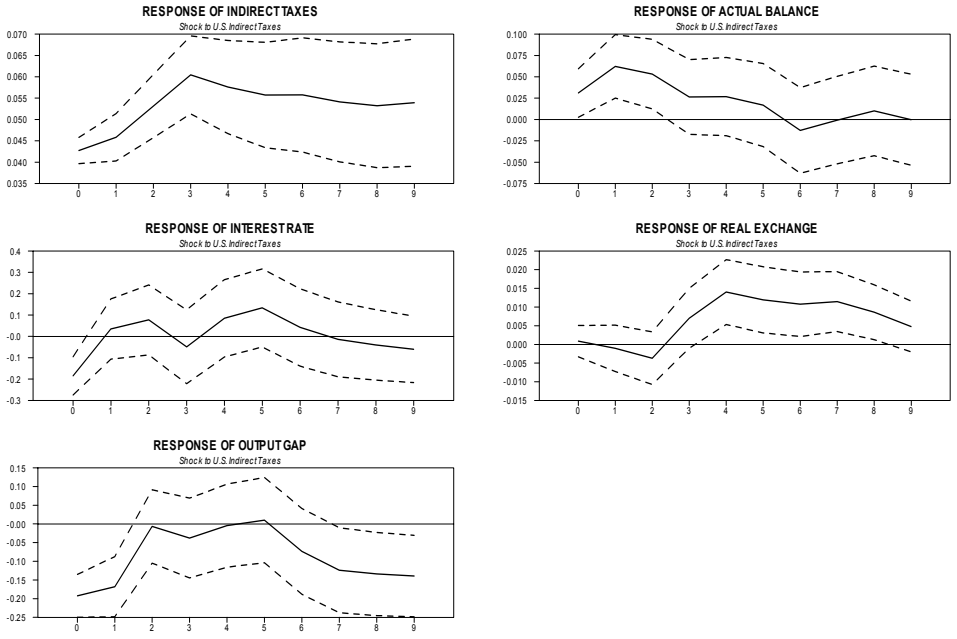


Figure 1.5

Shock to Indirect Taxes in U.S.



Shock to Indirect Taxes in Japan