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# The Impacts of Monetary and Fiscal Policies in the USA: A Bayesian DSGE Approach

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## Abstract

I estimate an open economy DSGE model by using Bayesian estimation technique. Monetary policy officials responded to shocks to inflation and output gap actively in the past, however they have weakly reacted to shocks to inflation and output gap over the last fifteen years. Additionally, fiscal policy officials have not focused on smoothing fiscal policies in recent years. Impulse response functions imply that smoothing policies in the past confronted severe macroeconomic volatilities. Though the estimated coefficients in the Philips curve imply that past inflation rate is also crucial for the current inflation rate, forward looking behaviour is still predominant and the data for each parameter is informative.

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## 1. Introduction

The global financial crisis, which has brought about specific phenomenons, according to many economists, has been the worst crisis since great depression. Following the crisis, central banks provide liquidity to banks and cut interest rate substantially and officials conduct policies under the difficulties of binding zero lower bound constraint that triggered the discussion about the implementability of conventional policy tools. Inevitably, many countries have focused on economic stabilization by conducting expansionary fiscal policies and unconventional monetary policies. However, there exists no consensus on the impacts of expansionary fiscal policies in crisis periods. From non-Ricardian perspective, fiscal policies might increase the economic activity, since expenditures financed by debt might facilitate the transfer from the future. On the other hand, expansionary fiscal policies might crowd out investment which may decrease the growth potential of the system without monetary policy intervention. All these issues increase the willingness of cooperation between fiscal and monetary policy officials in order to stabilize severe volatilities in crisis periods. Therefore, I estimate an open economy DSGE model by using Bayesian estimation technique so as to capture the interaction between monetary and fiscal policies, since fiscal consolidation inevitably will affect a number of macro variables that are reacted by monetary policy officials.

Much research analyses how monetary policy tools were conducted when times were hard and whether classical tools effectively stabilized macroeconomic volatilities. During 1970s, the US economy experienced a high inflation and weak output growth which resulted in a higher unemployment rate that reached double digits eventually. The Federal Reserve injected money into the economy directly in the early 1970s in order to target full employment level which gave rise to high inflation. The ability of policy authorities to control price stability and unemployment at the same time were extensively discussed. However, in the early 1980s, the Federal Reserve, under a different leadership, reversed its policies by raising interest rate to double digits in order to decrease the average inflation rate. Much research examines the optimal rate of inflation following the severe macroeconomic volatilities in 1970s and in the early 1980s. However, this debate dates back to Friedman (1969) who proposes a monetary policy rule that generates zero nominal interest rate, corresponding to zero inflation tax and to negative rate of inflation. In contrast to common assumption, much recent research argues that even low positive trend inflation has strong impacts on optimal monetary policy.

While monetary and fiscal policy tools substantially affect macroeconomic variables, the implementation of policy tools significantly varies across countries. Some recent research also focuses on the cyclical behaviour of fiscal and monetary policies. Cross country observations imply that monetary policy officials in developed economies have a tendency to increase (cut) interest rate during expansions (recessions), while emerging market economies are forced to cut (increase) interest rate during expansions (recessions). Similarly, developing countries increase real government spending (or cut taxes) during expansionary periods and cut spending (or raise taxes) during recessions that result in more severe macroeconomic volatilities. Countercyclical fiscal policy is even more effective when monetary policy has become powerless because the policy interest rate has hit the zero bound. Frankel et. all (2013) evidence that a substantial number of countries has shifted from procyclical to countercyclical fiscal policy since 2000. However, as the extend and the nature of fiscal policies varied across countries, public sector deficits also started to expand sharply since 2000 in many developed economies. In particular, budget deficits increased by about 5% of GDP in the US during crisis periods which makes the public finances highly vulnerable to further shocks. Therefore, this paper examines how successfully fiscal and monetary policy tools have been conducted since 2000 to stabilize volatilities in the US economy.

I estimate an open economy DSGE model to take the advantages of general equilibrium. An and Schorfheide (2007) and Fernandez-Villaverde and Rubio-Ramirez (2004) argue the appropriateness of alternative estimation techniques such as GMM, calibration. They support that even in the case of misspecified models, Bayesian estimation and model comparison are consistent. I focus on the estimation of parameters in the policy functions, therefore, I use a very simple model and estimate it in quarterly frequency in order to reveal the short run interactions. I assume that policy officials attaches heavier weight to volatilities in inflation and the US economy has the same prior distributions over the periods.

The paper proceed as follows: the following section represents the model economy. Section 3 discusses

the econometric methodology and describes the data. Section 4 represents the estimation results. I provide a brief summary of the results and concluding remarks in the last section.

## 2. The Model Economy

### 2.1 Households

The economy is populated by a unit measure of infinitely lived households. The representative household's preferences over consumption and labour are described by the following expected utility function:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \frac{C_t^{1-\sigma}}{1-\sigma} + \chi \frac{G_t^{1-\sigma}}{1-\sigma} - \frac{N_t^{1+\phi}}{1+\phi} \right\} \tag{1}$$

The representative household faces the following budget constraint given price index $P_t$:

$$P_t C_t + E_t\{Q_{t,t+1} D_{t+1}\} + T_t \leq D_t + (1-\tau_t) W_t N_t \tag{2}$$

here $t$ indexes time, $\beta$ shows the time-discount parameter, $\sigma$ is the inverse of the elasticity of intertemporal substitution and $\phi$ denotes the inverse of the Frisch-elasticity of labour supply. $C_t$ shows private consumption which consists of domestically produced goods $C_{Ht}$, and imported goods $C_{Ft}$. $G_t$ captures government spending and $L_t$ displays labour supply. $W_t$ corresponds to nominal wage. $\tau_t$ shows income tax rate and $T_t$ denotes lump sum taxes. $Q_{t,t+1}$ is the stochastic discount factor of nominal portfolio $D_t$.

The representative household chooses optimal consumption and work effort to maximise expected lifetime utility subject to the period budget constraint. After the linearization of optimality conditions, I use the national income identity so as to obtain an open economy New Keynesian IS curve given by:

$$\hat{y}_t = E_t \hat{y}_{t+1} - E_t \hat{g}_{t+1} + \hat{g}_t - \frac{1}{\sigma_\alpha} (\hat{r}_t - E_t\{\hat{\pi}_{H,t+1}\}) + \alpha(\overline{\omega} - 1)(\rho_{y^*} - 1)\hat{y}_t^* \tag{3}$$

where $\sigma_\alpha \equiv \frac{\sigma}{(1-\alpha)+\alpha\overline{\omega}}$ and $\overline{\omega} \equiv \sigma\gamma + (1-\alpha)(\sigma\eta - 1)$. Parameter $\eta > 0$ reveals the elasticity of substitution between domestic and foreign goods, $\alpha$ shows the degree of openness which is measured as the share of imported goods in domestic consumption and $\gamma$ captures the elasticity of substitution between the goods produced in different foreign countries. $\hat{y}_t = log(Y_t/\overline{Y})$, $\hat{g}_t = (G/C) log(G_t/Y_t)$ denote output gap and percent of government spending in gdp respectively. Nominal interest rate and home inflation rate are given by $\hat{r}_t = log(R_t)$ and $\hat{\pi}_{H,t} = log(P_{H,t}/P_{H,t-1})$. I suppose that world output $y_t^* = log(Y_t^*)$ and technology shock $a_t = log(A_t)$ follow an AR(1) process. An open economy IS curve in forward looking manner can be written in the gap form as follows:

$$x_t = E_t x_{t+1} - E_t\{\Delta \tilde{g}_{t+1}\} - \frac{1}{\sigma_\alpha}(\tilde{r_t} - E_t\{\tilde{\pi}_{H,t+1}\}) \tag{4}$$

where $x_t = \tilde{y_t} - \hat{y}_t^n$, $\tilde{r}_t = \hat{r}_t - \hat{r}_t^n$ and $\hat{g}_{t+1}^n = \hat{\pi}_{H,t+1}^n = 0$. Here, $\hat{y}_t^n$ denotes the natural level of output and given by:

$$\hat{y}_t^n = \frac{1+\phi}{\sigma_\alpha + \phi} \hat{a}_t - \frac{\sigma - \sigma_\alpha}{\sigma_\alpha + \phi} \hat{y}_t^* \tag{5}$$

The natural level of interest rate can be written as follows:

$$\hat{r}_t^n = \sigma_\alpha (E_t\{\hat{y}_{t+1}^n\} - \hat{y}_t^n) + \sigma_\alpha \alpha (\overline{\omega} - 1)(\rho_{y^*} - 1)\hat{y}_t^* \tag{6}$$

### 2.2 Firms and Price Setting

There exists a continuum of identical and monopolistically competitive firms indexed by $j$. Each firm produces a differentiated good $Y_t(j)$, according to the linear technology given as:

$$Y_t(j) = A_t N_t(j) \tag{7}$$

Firms hire labour $N_t(j)$ in a competitive market given wage $W_t$ and minimize labour costs subject to meeting demand at their posted price $P_t(j)$. I suppose that there are two types firms in the economy such as forward and backward looking firms. Forward looking firms are subject to Calvo (1983) frictions while setting their optimal prices. Hence, a forward looking firm either re-optimizes its price with probability

$1-\theta$ or its price stays fixed with probability $\theta$. However, the rule of thumb price setter re-indexes its price according to past inflation rate and given by:

$$p^b_{H,t} = P_{H,t-1}\frac{P_{H,t-1}}{P_{H,t-2}} \tag{8}$$

Forward looking and backward looking firms set prices $P^f_{H,t-1}$, $P^b_{H,t-1}$ respectively and aggregate price index is driven according to the following rule $P_{H,t-1} = (P^f_{H,t-1})^{1-\zeta}(P^b_{H,t-1})^{\zeta}$, where $\zeta$ captures the fraction of backward looking firms. I linearise the pricing rules around steady state and obtain the following open economy New Keysenian Phillips curve given by:

$$\hat{\pi}_{H,t} = \lambda^b\hat{\pi}_{H,t-1} + \lambda^f E_t\{\hat{\pi}_{H,t+1}\} + \kappa\hat{mc}_t + \epsilon^{\pi}_t \tag{9}$$

where $\lambda^b = \frac{\zeta}{\theta+\zeta(1-\theta(1-\beta))}$, $\lambda^f = \frac{\beta\theta}{\theta+\zeta(1-\theta(1-\beta))}$ and $\kappa = \frac{(1-\beta\theta)(1-\theta)(1-\zeta)}{\theta+\zeta(1-\theta(1-\beta))}$ and $\hat{\tau}_t = -log(1-\tau_t/Y_t)$ shows tax revenue as percentage of GDP. $\hat{mc}_t$ denotes the marginal cost of representative firm which is driven by government spending, output and tax revenue as follows:

$$\hat{mc}_t = (\sigma_\alpha + \phi)(\hat{y}_t - \hat{y}^n_t) - \sigma_\alpha\hat{g}_t + \hat{\tau}_t \tag{10}$$

### 2.3 Monetary Policy

Monetary policy officials target nominal interest rate by using a Taylor rule. They respond to deviations of output and expected future inflation from the steady state. Monetary policy rule is described as follows:

$$\hat{r}_t = \rho_r(\hat{r}_{t-1} - \hat{r}^n_{t-1}) + (1-\rho_r)[r_\pi E_t\{\hat{\pi}_{H,t+1}\} + r_y(\hat{y}_t - \hat{y}^n_t)] + \hat{r}^n_t + \epsilon^r_t \tag{11}$$

where $p_r$ shows the degree of interest rate inertia, $r_\pi$ denotes the response of interest rate to the deviations of inflation from the target and $r_y$ measures the responsiveness of interest rate to deviations in output. Monetary policy shock $\epsilon^r_t$ is distributed independently and identically.

### 2.4 Fiscal Policies

As in Favero and Monacelli (2005) and Forni et. all (2009), I suppose that fiscal policy officials alter government spending level, adjust tax rates so as to stabilize macroeconomic volatilities. They suppose that fiscal policy officials react government spending and tax revenue inertia, output gap and unobservable debt stock. Schmitt-Grohe and Uribe (2006) argue that linear fiscal policy rules responding to debt to gdp ratio and current output gap can approximate optimal rules. I use the following government spending rule:

$$\hat{g}_t = \rho_g\hat{g}_{t-1} + (1-\rho_g)[g_y(\hat{y}_t - \hat{y}^n_t) + g_b\hat{b}_t] + \epsilon^g_t \tag{12}$$

where $\rho_g$ determines the extent of government spending smoothing, as well as, $g_y$ and $g_b$ measure the responsiveness of government spending to the deviations in output and debt stock respectively. I use the following tax rule:

$$\hat{\tau}_t = \rho_\tau\hat{\tau}_{t-1} + (1-\rho_\tau)[\tau_y(\hat{y}_t - \hat{y}^n_t) + \tau_b\hat{b}_t] + \epsilon^\tau_t \tag{13}$$

where $b_t = log(B_t/P_{H,t-1})$ and $B_t$ shows nominal debt, $\rho_\tau$ denotes the degree of tax revenue smoothing, $\tau_y$ and $\tau_b$ determine the importance of output and debt stock in fiscal rule respectively, non-systematic parts of policy rules are distributed independently and identically.

The government collects lump-sum taxes and income taxes and issue bonds to cover government spending and bond expenses. The government finances the discrepancy between tax revenues and government expenditures by debt. Hence, nominal debt stock evolves as follows over time:

$$B_{t+1} = (1+r_t)(B_t + P_tG_t - \tau_tW_tN_t - T_t) \tag{14}$$

I suppose that in the equilibrium lump-sum tax allows a balanced budget. I linearize the fiscal policy constraint in order to identify the model, as in Fragetta and Kirsanova (2010):

$$\hat{b}_{t+1} = \hat{r}_t + \frac{1}{\beta}[\hat{b}_t - \hat{\pi}_{H,t} + \hat{g}_t + (\hat{\tau}_t - \hat{y}_t)] \tag{15}$$

## 3. Econometric Methodology and Data

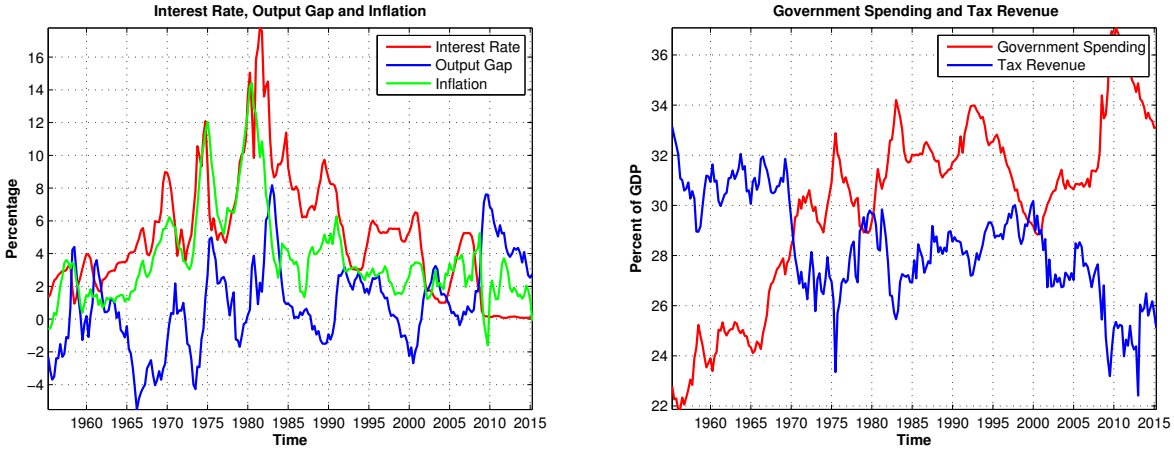
### 3.1 Methodology

I use the Bayesian estimation technique in order to identify the policy parameters and write the model equations in reduced form and then use the Kalman filter algorithm to find the maximum likelihood function of observed data. Posterior distributions can not be written in closed form. Thus, I use Markov Chain Monte Carlo (McMc) simulation method with 1000000 draws from posterior distribution and with 0.27 acceptance rate.

### 3.2 Data

I estimate the model by using five observable macroeconomic variables such as real government expenditure to gdp ratio by excluding interest payments, tax revenue to gdp ratio, output gap, inflation and nominal interest rate. All data is obtained from St. Louis Fed FRED website. I measure inflation as the growth of the GDP deflator, calculate the output gap as the deviation between actual GDP and the CBO estimate of potential. While interest rate, inflation and tax revenue are decreasing in crisis periods, output gap and government spending are raising substantially. I plot the observed variables in Figure 1.

Figure 1: Key Economic Data in the US




### 3.3 Prior Distributions

I use gamma distribution to restrict parameters on sign and beta distributions for parameters with compact support, choose normal distributions for the remaining parameters and report prior distributions for each parameter in Table 1. I suppose that all prior distributions are independent.

I set the time-discount factor $\beta = 0.99$ which leads to 4% annual interest rate. I calibrate the elasticity of substitution between domestic goods and foreign goods $\eta = 1$, as well as, the elasticity of substitution between the goods produced in different foreign countries $\gamma = 1$. I calibrate the share of imported goods in domestic consumption $\alpha = 0.66$ before 2000 and $\alpha = 0.14$ after 2000 by calculating the average value of import to gdp ratio. Steady state values for domestic debt stock to gdp ratio are calibrated as 0.44 and 0.74 for each period respectively. I compute the average values of private consumption to gdp ratio as 0.64 and 0.70.

I select prior distributions for other variables as selected in the related studies. Lubik and Schorfheide (2007) set $r_\pi = 1.5$ for inflation coefficient, $r_y = 0.25$ for output gap coefficient with gamma distribution and $\rho_r = 0.5$ for the interest rate smoothing coefficient in Taylor rule. Fragetta and Kirsanova (2010) set small values for debt in fiscal policy rules. I set $\zeta = 0.5$ for the fraction of backward looking firms and $\phi = 2.5$ for for the inverse elasticity of labor supply and $\sigma = 5$ for the inverse of the elasticity of intertemporal substitution.

Table 1: Prior Distributions

| Parameter | Description | Density | Prior Mean | Prior St. |
|---|---|---|---|---|
| Structural Parameters | | | | |
| $\theta$ | Degree of price stickiness | Beta | 0.700 | 0.050 |
| $\phi$ | Inverse elasticity of labour supply | Normal | 2.500 | 0.500 |
| $\sigma$ | Inverse elas. of subs. in cons. | Normal | 5.000 | 0.500 |
| $\zeta$ | Degree of backwardness | Beta | 0.500 | 0.250 |
| Monetary Parameters | | | | |
| $\rho_r$ | Degree of interest rate smoothing | Beta | 0.500 | 0.200 |
| $r_\pi$ | Taylor rule coefficient on inflation | Gamma | 1.500 | 0.250 |
| $r_y$ | Taylor rule coeff. on output gap | Gamma | 0.250 | 0.100 |
| Fiscal Parameters | | | | |
| $\rho_g$ | Degree of gov. spe. smoothing | Beta | 0.500 | 0.200 |
| $g_y$ | Spe. coeff. on output gap | Normal | 0.003 | 0.001 |
| $g_b$ | Spending coefficient on debt | Normal | -0.030 | 0.010 |
| $\rho_\tau$ | Degree of tax smoothing | Beta | 0.500 | 0.200 |
| $\tau_y$ | Tax coeff. on output gap | Normal | 0.003 | 0.001 |
| $\tau_b$ | Tax coefficient on debt | Normal | 0.030 | 0.010 |
| Shocks | | | | |
| $\rho_a$ | AR(1) coefficient of technology | Beta | 0.500 | 0.200 |
| $\rho_{y^*}$ | AR(1) coefficient of world output | Beta | 0.500 | 0.200 |
| $\sigma_a$ | St. error of technology innovation | Inv gamma | 0.250 | 0.015 |
| $\sigma_\pi$ | St. error of inflation innovation | Inv gamma | 0.550 | 0.015 |
| $\sigma_{y^*}$ | St. error of world output innovation | Inv gamma | 0.250 | 0.015 |
| $\sigma_r$ | St. error of interest rate innovation | Inv gamma | 0.100 | 0.015 |
| $\sigma_g$ | St. error of gov. spe. innovation | Inv gamma | 1.500 | 0.015 |
| $\sigma_\tau$ | St. error of tax innovation | Inv gamma | 1.500 | 0.015 |

## 4. Results

Table 2 shows the posterior distributions and the data for each period is informative. I increase the standard deviation of prior distributions and then move the prior means in the direction of previously estimated posterior means which significantly raises marginal density.

In the past, monetary policy officials responded to shocks to inflation and output gap respectively by $r_\pi = 1.4216$ and $r_y = 0.9264$, however, they have recently reacted by $r_\pi = 1.2863$ and $r_y = 0.4111$. Monetary policy officials have put more weight on interest rate smoothing over the last fifteen years. The extend of fiscal smoothing lessens from $\rho_g = 0.7208$ to $\rho_g = 0.5672$. Calvo parameters imply that prices remain fixed less than a year in the US. Philips curve parameters are estimated as $\lambda^b = 0.4179$ and $\lambda^f = 0.5806$ which evidence that forward looking behaviour is still predominant.

I plot the impulse response functions in the following figures to reveal further model dynamics. Results imply that smoothing policies restricted severe volatilities in the past.

Productivity shock increases output, consumption and decreases nominal interest rate which declines debt stock and stipulates government spending. Increasing marginal productivity decreases marginal cost and eventually inflation. Government spending shock raises output and nominal interest rate which leads to higher debt stock and shrinks consumption. Tax revenues move upward to finance higher debt stock. A cost push shocks rises nominal interest rate which can not outweigh the effects of higher inflation on debt stock. Hence, lower debt stock encourages higher government spending. Nominal interest rate shock decreases both inflation and output. Higher interest rate raises debt stock which leads to lower government spending and higher tax revenue. World output shock results in lower interest rate, output, tax revenue, inflation and debt level, but higher government expenditure.

Table 2: Bayesian Estimation Results

| Parameter | Prior Mean | Posterior Mean | | Posterior Std. | | Confidence Interval | |
|---|---|---|---|---|---|---|---|
| | | 1955-1999 | 2000-2015 | 1955-1999 | 2000-2015 | 1955-1999 | 2000-2015 |
| Structural Parameters | | | | | | | |
| $\theta$ | 0.700 | 0.6996 | 0.6994 | 0.0507 | 0.0507 | 0.6222 - 0.7866 | 0.6177 - 0.7804 |
| $\phi$ | 2.500 | 5.3346 | 4.1242 | 0.4417 | 0.4592 | 4.9678 - 5.6804 | 3.3692 - 4.8970 |
| $\sigma$ | 5.000 | 3.4487 | 3.3349 | 0.1471 | 0.3774 | 3.1827 - 3.7026 | 2.6621 - 4.0629 |
| $\zeta$ | 0.500 | 0.5022 | 0.4967 | 0.5000 | 0.5000 | 0.1063 - 0.9053 | 0.0728 - 0.8831 |
| Monetary Parameters | | | | | | | |
| $\rho_r$ | 0.500 | 0.5095 | 0.5764 | 0.0398 | 0.0529 | 0.4446 - 0.5741 | 0.4903 - 0.6638 |
| $r_\pi$ | 1.500 | 1.4216 | 1.2863 | 0.0886 | 0.0894 | 1.2612 - 1.5694 | 1.1177 - 1.4437 |
| $r_y$ | 0.250 | 0.9264 | 0.4111 | 0.2004 | 0.1266 | 0.5824 - 1.2423 | 0.2078 - 0.6316 |
| Fiscal Parameters | | | | | | | |
| $\rho_g$ | 0.500 | 0.7208 | 0.5672 | 0.0449 | 0.1735 | 0.6273 - 0.8082 | 0.2448 - 0.8626 |
| $g_y$ | 0.003 | 0.0030 | 0.0030 | 0.0010 | 0.0010 | 0.0014 - 0.0047 | 0.0013 - 0.0046 |
| $g_b$ | -0.030 | -0.0303 | -0.0248 | 0.0098 | 0.0107 | -0.0468 - -0.0147 | -0.0426 - -0.0063 |
| $\rho_\tau$ | 0.500 | 0.4545 | 0.4698 | 0.2433 | 0.2758 | 0.1614 - 0.7711 | 0.1691 - 0.8000 |
| $\tau_y$ | 0.003 | 0.0030 | 0.0030 | 0.0010 | 0.0010 | 0.0014 - 0.0047 | 0.0014 - 0.0047 |
| $\tau_b$ | 0.030 | 0.0300 | 0.0315 | 0.0100 | 0.0101 | 0.0134 - 0.0460 | 0.0150 - 0.0477 |
| Shocks | | | | | | | |
| $\rho_a$ | 0.500 | 0.7811 | 0.5515 | 0.0569 | 0.2912 | 0.6582 - 0.9193 | 0.2547 - 0.8850 |
| $\rho_{y^*}$ | 0.500 | 0.6382 | 0.4996 | 0.0265 | 0.0563 | 0.5916 - 0.6803 | 0.3953 - 0.5907 |
| $\sigma_a$ | 0.250 | 0.0439 | 0.0964 | 0.0051 | 0.0182 | 0.0348 - 0.0525 | 0.0530 - 0.1404 |
| $\sigma_\pi$ | 0.550 | 0.4904 | 0.5288 | 0.0119 | 0.0138 | 0.4709 - 0.5082 | 0.5051 - 0.5506 |
| $\sigma_{y^*}$ | 0.250 | 0.2638 | 0.2747 | 0.0146 | 0.0153 | 0.2389 - 0.2876 | 0.2496 - 0.2998 |
| $\sigma_r$ | 0.100 | 0.0564 | 0.0811 | 0.0044 | 0.0083 | 0.0487 - 0.0626 | 0.0656 - 0.0960 |
| $\sigma_g$ | 1.500 | 1.4740 | 1.4918 | 0.0145 | 0.0148 | 1.4498 - 1.4975 | 1.4678 - 1.5159 |
| $\sigma_\tau$ | 1.500 | 1.4745 | 1.4913 | 0.0143 | 0.0148 | 1.4503 - 1.4977 | 1.4671 - 1.5153 |

Figure 2: Responses to Productivity Shock

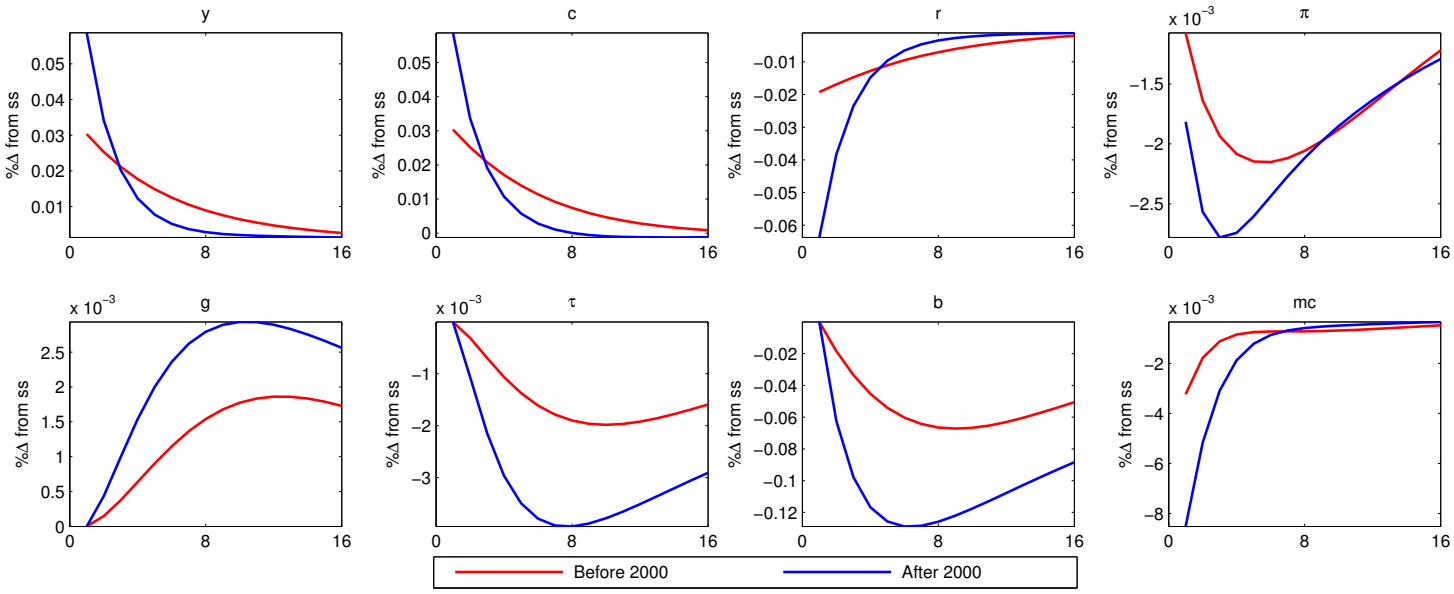


Figure 3: Responses to Inflation Shock

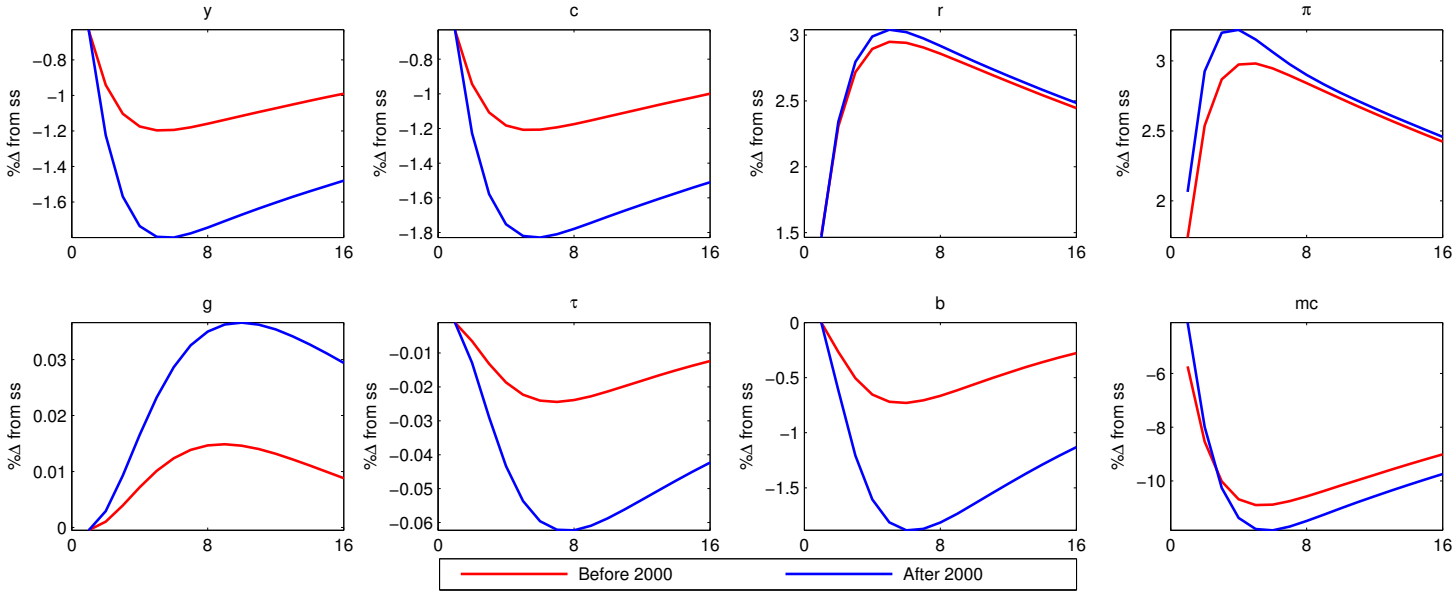



Figure 4: Responses to Nominal Interest Rate Shock

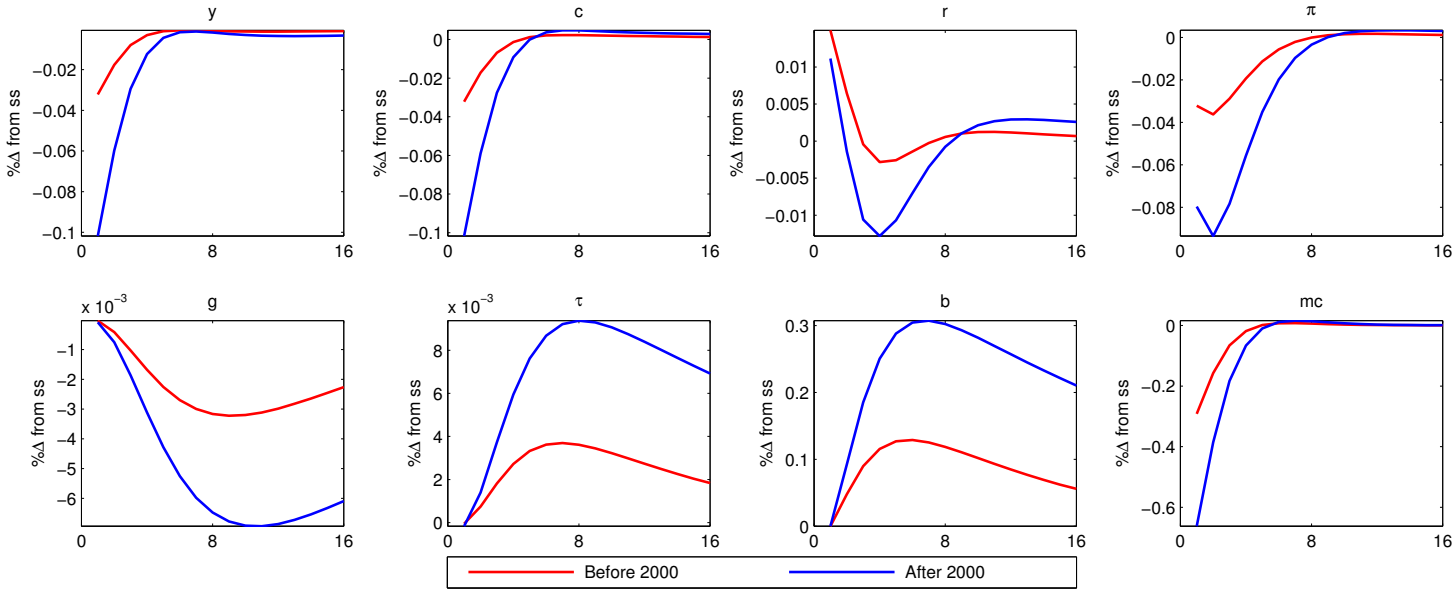


Figure 5: Responses to World Output Shock

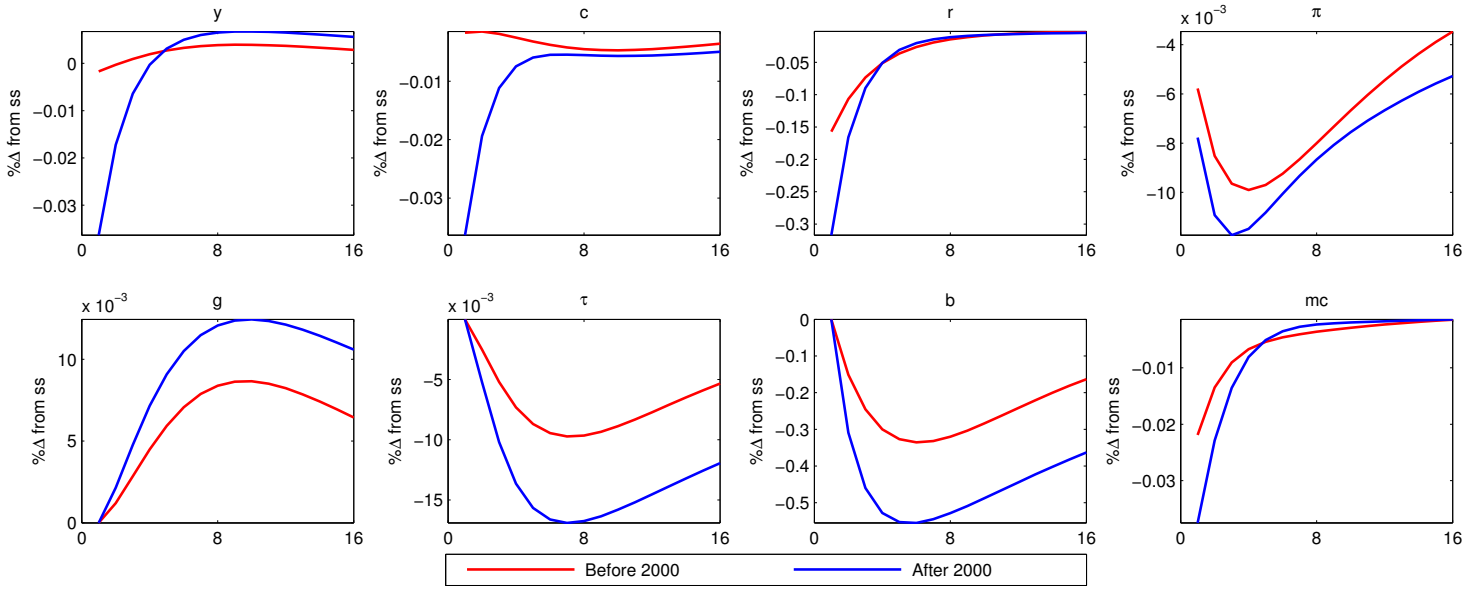



Figure 6: Responses to Government Spending Shock

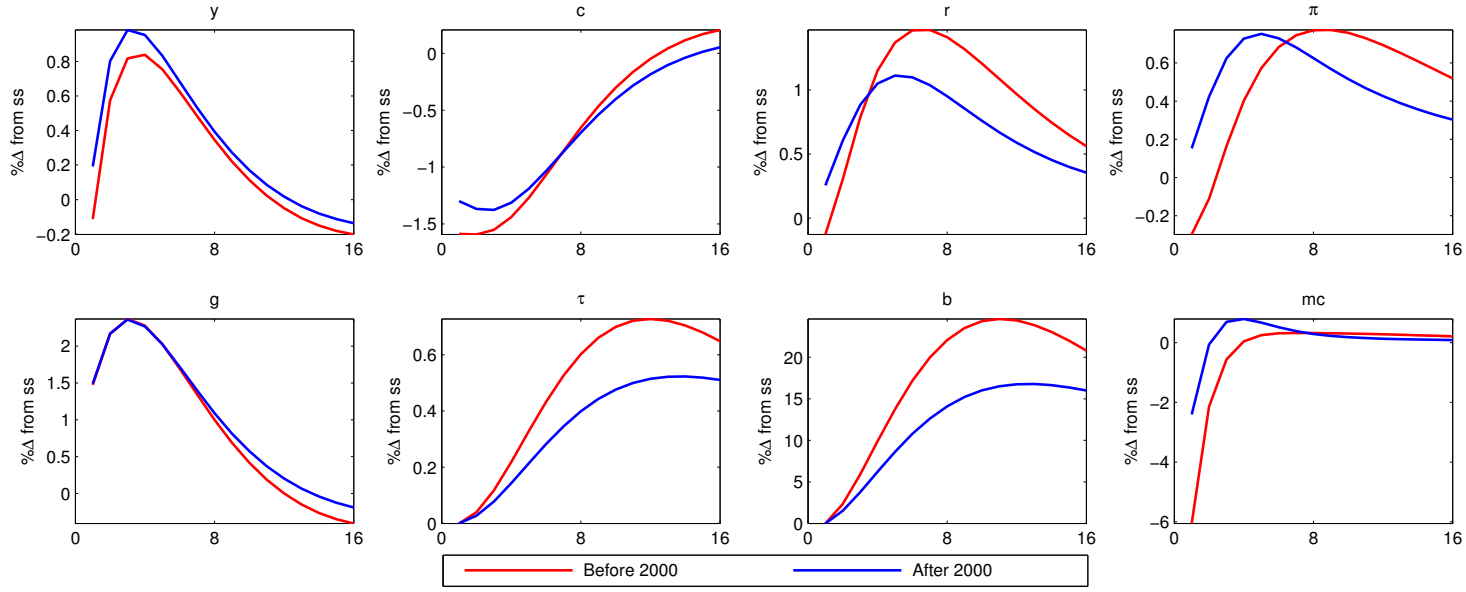
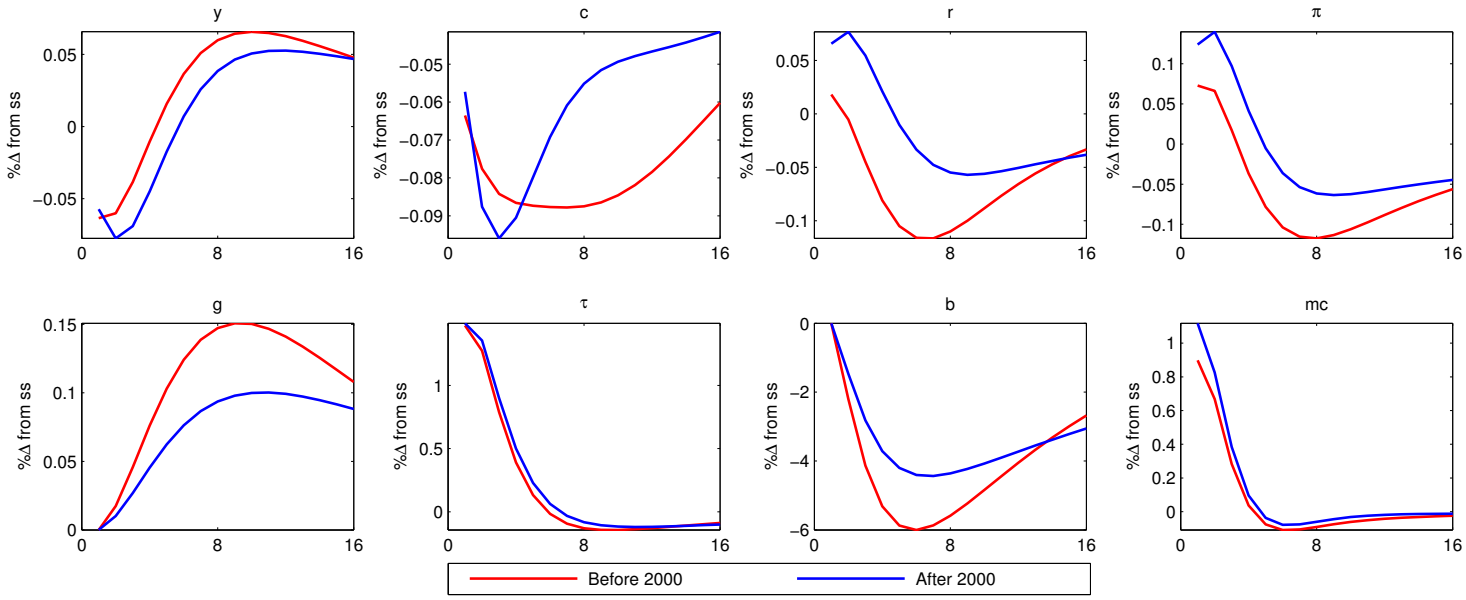


Figure 7: Responses to Tax Revenue Shock




## 5. Conclusion

I estimate an open economy dynamic stochastic general equilibrium model by Bayesian technique so as to analyse recent changes in policy reactions to shocks. I estimate the model by using five observable macroeconomic variables such as real government expenditure to gdp ratio by excluding interest payments, tax revenue to gdp ratio, output gap, inflation and nominal interest rate. I estimate the model without fiscal data and a maximum likelihood comparison of models evidence that the estimated model with fiscal data fits better than the model without fiscal data. In addition, the data for each estimated parameter is informative.

Monetary policy officials responded to shocks to inflation and output actively in the past, however they have weakly reacted to shocks to inflation and output over the last fifteen years. While fiscal policy officials considered government spending and tax revenue smoothing in the past, they have not focused on smoothing in recent years. Though the estimated coefficients in the Philips curve imply that past inflation rate is also crucial for the current inflation rate, forward looking behaviour is still predominant.

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