

Three Essays on Monetary Policy in Small Open and Developing Economies

by
Taufiq Carnegie Dawood

Submitted to the Department of Economics and the
Graduate Faculty of the University of Kansas
in partial fulfilment of the requirements for the degree of
Doctor of Philosophy

Professor William A. Barnett, Chairperson

Professor Bozenna Pasik-Duncan

Committee Members

Professor John W. Keating

Professor Shu Wu

Professor Jianbo Zhang

Date defended

26 April 2016

The Dissertation Committee for Taufiq Carnegie DAWOOD certifies that this is the approved version of the following dissertation

Three Essays on Monetary Policy in Small Open and Developing Economies

Professor William A. Barnett, Chairperson

Date defended

26 April 2016

Abstract

This dissertation consists of three essays organized as chapters. On the first chapter, I revisit the discussions which evaluate different fluctuations of major economic variables produced by different monetary policy rules for small open economies, given the existence of liability dollarization. In particular, monetary rules which either include or exclude exchange rate stability as a monetary policy objective. I extend these argument by adding shocks to the risk premium for foreign borrowing to a calibrated small open economy DSGE model with sticky prices and monopolistic competition in the intermediate goods market. In addition I consider two monetary policy rules; one which put high weight on real exchange rate stability, and one which puts low weight on real exchange rate stability. With this model, I analyse the fluctuations of major macroeconomic variables under these two rules. It is found that there are variations in the fluctuations of the economic variables under these rules. In particular it is found that for risk premium shock, higher weights on real exchange rate stability in the monetary policy rule, amplifies the response of the macroeconomic variables.

On the second chapter, I extend the model of the first paper by computing the optimal monetary policy rule under liability dollarization and given risk premium shocks. In this chapter I also consider three monetary policy rules; one which put high weight on real exchange rate stability, and one which puts low weight on real exchange rate stability and the optimal monetary policy rule, and analyse the fluctuations of major macroeconomic variables under these three rules. It is found that for risk premium shocks, higher weights

on real exchange rate stability in the monetary policy rule, amplifies the response of the macroeconomic variables. However the welfare maximizing monetary policy rule result in more stable macroeconomic variables, but it requires some real exchange rate fluctuations.

In the last chapter I attempt to answer two questions; how does foreign interest rate shocks and monetary policy shocks affect the quantity of bank credit to the domestic private non-financial sectors in small open developing countries? To what extent does monetary policy can influence the quantity of bank credit in these countries? This chapter uses a structural vector autoregressive (SVAR) model on a sample of six small open developing countries to answers these two questions. I found that an increase in foreign interest rates can either increase or decrease the quantity of bank credit, depending on how strong the increase in foreign interest rate shocks affect total interest income compared to the total interest cost of the bank's balance sheet. On the other hand, I found that the impact of a monetary contraction is to reduce the quantity of bank credit, which is consistent with the finding from previous literature. In addition, it is found that, at best, monetary policy can influence quantity of bank credit only in the short run. With the exception of Mexico, I found that both monetary policy and foreign interest rates influences the quantity of bank credit in these economies in the longer horizon. These results suggests that the monetary authority of the small open developing countries have limited influence on the quantity of domestic bank credit.

Acknowledgements

All praise to Allah, The Lord of the Worlds. Peace be upon His Prophet Muhammad.

I would never have been able to finish my dissertation without the grace of the Almighty God, and the help, guidance and advise of my committee members, help from friends, and support from my family and wife.

I would like to express my deepest gratitude to my advisor, Professor William Barnett, for his excellent guidance, suggestions, care, patience, and for providing me with an excellent atmosphere for doing research.

I would like to thank Professor John Keating who was always willing to help and give his best suggestions, guidance, and feedback, and for the encouragement to try something different. I would also like to thank Professor Shu Wu for the guidance, discussions and feedback to develop and sharpen my research. Special thanks go to Professors Jianbo Zhang and Bozenna Pasik-Ducan for being in my dissertation committee.

Besides, I thank Dr. Andrew Lee Smith, Dr. Boniface Yemba, Dr. Erhan Oruc, Dr. Andrew Keinsley, Saleh Alodayni, Soumya Bhadury, John Nana Francois, Su Liting and all other participants of Macroeconomics Research Seminar at the University of Kansas for their help, comments and suggestions.

Moreover, I would also like to thank my mother, Cut Nurlela, my brothers, Rahmad Da-

wood and his wife Vella Asnawi, and Daniel Achyar. They were always supporting me and encouraging me with their best wishes.

Especially I would like express my deepest gratitude to my lovely wife, Cut Nelly Afriana, and our children (Ashifa Balqis and Muhammad Al Fayad). Without their unmeasured sacrifices and support, I will not be able to complete my research.

Finally, I wish to dedicate this work to my father, the late Professor Dayan Dawood, who inspired me to learn economics.

Contents

1 Risk Premium Shocks, Monetary Policy and Economic Fluctuations in a Small Open Economy with Liability Dollarization	1
1.1 Introduction	3
1.2 The Model	5
1.2.1 Households	6
1.2.2 The Firm	9
1.2.3 The Central Bank	12
1.2.4 Market Clearing Condition	13
1.2.5 Equilibrium Conditions	13
1.3 Parameters	14
1.4 Analysis	15
1.4.1 Productivity Shock	15
1.4.2 World output shock	16
1.4.3 Foreign inflation shock	17
1.4.4 Risk Premium shock	17
1.4.5 Monetary policy shock	18
1.5 Conclusion	19
2 Optimal Monetary Policy and Economic Fluctuations in a Small Open Economy with Liability Dollarization and Risk Premium Shocks	43
2.1 Introduction	45
2.2 The Model	47
2.2.1 Households	48
2.2.2 The Firm	51
2.2.3 The Central Bank	54
2.2.4 Market Clearing Condition	55
2.2.5 Equilibrium Conditions	55

2.3	Parameters and solution method	56
2.4	Analysis	57
2.4.1	Productivity Shock	57
2.4.2	World output shock	58
2.4.3	Foreign inflation shock	58
2.4.4	Risk Premium shock	59
2.4.5	Monetary policy shock	59
2.5	Conclusion	60
3	Foreign Interest Rate Shocks, Monetary Policy Shocks and Bank Credit in Small Open Developing Economies: A Structural VAR Analysis	83
3.1	Introduction	85
3.2	Theoretical argument on how monetary policy foreign interest rate can affect bank credit	87
3.2.1	Balance sheet credit channel of transmission mechanism.	87
3.2.2	Bank lending channel transmission mechanism.	88
3.2.3	Adrian and Shin (2011)	88
3.2.4	Argument on the impact of a shock to foreign interest rate on domestic bank lending	89
3.3	Structural Vector Autoregressive (SVAR) Model	91
3.3.1	The model setup	91
3.3.2	Structural identification	92
3.3.3	Data	94
3.4	Results	94
3.4.1	Impulse Response Analysis	95
3.4.2	Variance Decomposition	96
3.4.3	Note on degree of capital controls	97
3.5	Conclusion	98

/clearpage

Chapter 1

Risk Premium Shocks, Monetary Policy and Economic Fluctuations in a Small Open Economy with Liability Dollarization

Abstract

In the literature of small open economies which employs New Keynesian models there has been discussion which evaluate the different fluctuations of major economic variables produced by different monetary policy rules which either include or exclude exchange rate stability as a monetary policy objective, given the existence of liability dollarization. However there is still some mixed results on this discussion. An important feature of these models is that they do not include shocks to the risk premium for foreign borrowing. It has been shown that risk premium in relation to foreign borrowing has an impact on macroeconomic fluctuations. Furthermore there are studies which show that liability dollarization is related to the risk premium from foreign borrowing. This paper revisits and extends this discussion. In particular this paper develops a New Keynesian Model consistent with liability dollarization, and includes shocks to the risk premium of foreign borrowing. With this model in mind this paper explore the question, how does fluctuations of major economic variables compare between monetary policy rule which put high weight on real exchange rate stability, with that of a monetary policy rule that put low weight on real exchange rate stability?

JEL: E1, E3, E5, F31, F34

Keywords: risk premium shocks, liability dollarization, fluctuations, policy rules.

1.1 Introduction

Macroeconomic stability is an important objective for many nations. An important policy instrument to achieve this objective is monetary policy. Due to many factors and complications which may influence the business cycle, conducting the appropriate monetary policy regime is not always obvious. An important factor which may influence the conduct of monetary policy in small open economies is the issue of liability dollarization. For a number of developing countries which have an open capital account, their residents may be in the following situation. On one hand if their residents borrow external funds from international capital markets, it must be denominated in foreign currency, and they must repay the principal and interest to the creditors in foreign currency as well. On the other hand they invest these funds in projects in the domestic economy which generate income in domestic currency. However the forward markets involving the domestic currencies of these countries are either non-existent or thin and illiquid.

To highlight this last point, table A.1 and A.1 in the appendix shows data on daily average turnover of foreign exchange rate derivative, from The Bank of International Settlement. This table shows that the transaction for developing countries currencies is far less than that for developed countries currencies. In addition it should be mentioned that this survey was participated by 53 countries, but the table only shows the break down for only 24 countries. The other remaining 29 participating countries currencies are lumped under the category other currencies. This highlights that the market for instruments to hedge against exchange rate risk for developing countries currencies are very limited. In addition, there are 180 legal tenders among the members of the United Nations. This highlight the point that markets for instruments to hedge against exchange rate risks for currencies of many of developing countries are not existent.

Given that the forward markets involving the domestic currencies of developing countries are either non-existent or thin and illiquid, this makes it difficult and costly to hedge against

exchange rate risk. In the literature this situation is termed as liability dollarization or currency mismatch (Eichengreen and Hausman, 1999, Calvo 2002 and Cepedes et.al. 2002, Calvo (2006), Nakamura, 2011). Furthermore Calvo (2006), has expressed concerns that liability dollarization present a challenge for small open economies in conducting monetary policy.

There are discussions on the impact of liability dollarization on the choice of monetary policy rule which in their analysis employ a New Keynesian Model. However there is still mixed results on this discussion. On one hand Cespedes et.al. (2004) assuming sticky wages concluded that a flexible exchange rate and inflation targeting provide more macroeconomic stability compared to a fixed exchange rate regime in insulating the economy against external shocks. Following from the result of this study, Nakamura (2011) also found that a monetary policy targeting rule which addresses terms of trade fluctuations by attempting to stabilize the real exchange rate is not efficient. In contrast Cook (2004) and Choi and Cook (2004) which assumes sticky prices found that a fixed exchange rate rule offer greater stability than an interest rule that targets inflation.

A common feature of the above papers is that they do not consider shocks in the risk premium from foreign borrowing as a driving force in the fluctuations of important macroeconomic variables. Honig (2009) shown that liability dollarization is a consequence and is influenced by the lack of faith of towards the government of the developing country which stems from the belief that they will not follow policies that promote long-run exchange rate stability. And political uncertainty and government policies uncertainty have an impact on the risk premium (Pastor and Veronesi 2013). Furthermore Korinek (2011) shown that there is a relationship between foreign currency debt and the risk premium from foreign borrowing. This paper further shows that a small increase in international risk aversion would have an affect the risk premium and on the volatility of macroeconomic variables in the small open economy.

The current paper revisits and extends the preceding discussion relating to monetary policy in a small open economy under liability dollarization. In particular this study develops a New Keynesian small open economy model with liability dollarization which includes shock to the risk premium from foreign borrowing. To the best of the authors knowledge, this is the first study which employs such setting in a study of monetary policy under liability dollarization. With this model in mind this paper explore the question, how does fluctuations of major macroeconomic variables compare between monetary policy rules which put high weight on real exchange rate stability with that of a monetary policy rule that put low weight on real exchange rate stability?

1.2 The Model

Consider a New Keynesian small open economy model. There are three agents in this economy: a unit mass of atomistic identical and infinitely lived households, a continuum of domestic producers and a monetary authority. These economic agents form rational expectations. There exists a world financial market. The economy is assumed as a net borrower in the world financial market. The households own labor and capital and purchase one period bonds denominated in domestic currency. The households can use the proceeds from the maturing bonds together with their wage earning and their return from capital to purchase more bonds, invest in capital and consumption goods. Further assume that the excess of households expenditure to the proceeds received is financed by borrowing foreign currency from the international capital market.

In this model we assume (1) the economy faces liability dollarization. In other words, given a world interest rate, the domestic households can only borrow and repay the principal and interest from foreign borrowing in foreign currency, (2) for simplicity assume that there is no forward foreign exchange market involving the domestic currency so that domestic

agents cannot hedge against foreign exchange rate risk using the foreign exchange futures market.

1.2.1 Households

To model the household this paper uses a modified version of Schmitt-Grohe, Uribe (2003). A representative household choose consumption and labor and seeks to maximize preference. The households own production firms. The households obtain income from supplying labor and capital to firms and lumps sum profit from the firms producing intermediate goods and firms producing final goods. In addition the household accumulate debt at the end of the period t . Furthermore assume that the households purchase one period bonds denominated in domestic currency. The households can use the proceeds from the maturing bonds together with their wage earning and their return capital to purchase more bonds, invest in capital and consumption goods. The excess of households expenditure to the proceeds received is financed by borrowing foreign currency from the international capital market. This represents the constraint faced by the household.

The representative household problem is to choose consumption of final goods and hours of work that would maximize the households utility subject to the above budget constraint. The households maximization problem can be written as follows.

$$U_t = E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{(c_t - \frac{h_t^\omega}{\omega})^{1-\gamma} - 1}{1-\gamma} \right) \quad (1.1)$$

Subject to the following budget constraint:

$$(1+r_{t-1}^D) \frac{D_{t-1}}{P_t} + rk_t K_{t-1} + w_t h_t + \frac{profit_t}{P_t} + \frac{S_t}{P_t} D_t \geq (1+r^w + pr_{t-1}) \frac{S_t}{P_t} D_{t-1}^* + c_t + i_t + \frac{\psi_k}{2} (K_t - K_{t-1})^2 + \frac{D_t}{P_t} \quad (1.2)$$

Denote $c_t, h_t, pr_t, D_t, D_t^*, Y_t, K_t, i_t, P_t, S_t$ as real consumption, hours of work, nominal

domestic interest rate, risk premium from foreign borrowing, nominal domestic bonds (measured in domestic output), nominal foreign debt (measured in foreign output), final output, capital, real investment, and the domestic price, and nominal exchange rate. Following Notz and Rosenkranz (2014), the households budget constraint presented above exhibits liability dollarization.

We assume the following definition for the gross domestic interest rate and the gross foreign interest rate as follows.

$$R_{t-1}^D = 1 + r_{t-1}^D; R_{t-1}^F = 1 + r^w + pr_{t-1} \quad (1.3)$$

In borrowing foreign funds, the house has to pay a constant risk free interest rate and a risk premium. The risk premium in turn is endogenously determined by the amount of foreign debt and it is also influenced by an exogenous risk premium shock.

$$r_t^f = r^w + pr_t(D_t^*) \quad (1.4)$$

$$pr_t(D_t^*) = \psi_p \left(e^{\left(\frac{S_t D_t^*}{P_t} \right) - \left(\frac{S_t^* D_t^*}{P} \right)} - 1 \right) + (sp_t - 1) \quad (1.5)$$

Following Notz and Rosenkranz (2014), the endogenous term of the risk premium equation above presents a feature of financial frictions.

The risk premium shock is exogenous follows an AR(1) process of the following form.

$$\ln sp_t = \rho_{sp} \ln sp_{t-1} + \varepsilon_{sp,t} \quad (1.6)$$

The first order conditions for the household optimization problem are as follows:

$$\lambda_t = \left(c_t - \frac{h_t^\omega}{\omega} \right)^{-\gamma} \quad (1.7)$$

This is the inter-temporal substitution condition of the household (Euler equation).

The intra-temporal substitution of the household between consumption and work is as follows:

$$\left(c_t - \frac{h_t^\omega}{\omega} \right)^{-\gamma} h_t^{\omega-1} = \lambda_t w_t \quad (1.8)$$

While the inter-temporal substitution between consumption and purchasing capital is as follows:

$$(1 + \psi_K(K_t - K_{t-1})) = \beta E_t \left[S_{t+1}^{DF} \left[\frac{\alpha Y_t}{K_{t-1}} + (1 - \delta) + \psi_K(i_t + \delta K_{t-1}) \right] \right] \quad (1.9)$$

The first order condition for borrowing foreign currency is the following.

$$\lambda_t = \beta \left[\left(c_t - \frac{h_t^\omega}{\omega} \right)^{-\gamma} R_t^F \frac{S_{t+1}}{S_t} \frac{P_t}{P_{t+1}} \right] \Leftrightarrow \lambda_t = \beta \left[\left(c_t - \frac{h_t^\omega}{\omega} \right)^{-\gamma} (1 + r^w + pr_t) \frac{S_{t+1}}{S_t} \frac{P_t}{P_{t+1}} \right]$$

$$\lambda_t = \beta \left[\lambda_{t+1} R_t^F \frac{S_{t+1}}{S_t} \frac{P_t}{P_{t+1}} \right] \Leftrightarrow \lambda_t = \beta \left[\lambda_{t+1} (1 + r^w + pr_t) \frac{S_{t+1}}{S_t} \frac{P_t}{P_{t+1}} \right] \quad (1.10)$$

While the first order condition for holding domestic bonds is the following.

$$\lambda_t = \beta \left[\lambda_{t+1} R_t^D \frac{1}{\pi_{t+1}} \right] \Leftrightarrow \lambda_t = \beta \left[\lambda_{t+1} (1 + r^D) \frac{1}{\pi_{t+1}} \right]$$

$$\lambda_t = \beta \left[\left(c_t - \frac{h_t^\omega}{\omega} \right)^{-\gamma} R_t^D \frac{1}{\pi_{t+1}} \right] \Leftrightarrow \lambda_t = \beta \left[\left(c_t - \frac{h_t^\omega}{\omega} \right)^{-\gamma} (1 + r^D) \frac{1}{\pi_{t+1}} \right] \quad (1.11)$$

Note if we combine equations (1.9) and (1.10) we get the uncovered interest rate parity (UIP) condition.

1.2.2 The Firm

Final goods sector

The model specification for the production sector is a modified version of Dib (2011). The goods producing sector consists of domestically produced final goods producing firms and intermediate producing firms. Assume that there are a unit measure of intermediate producing firms indexed by $i \in [0, 1]$ which produces a differentiated product. The final goods firm produces Y_t by combining the intermediate goods $Y_t(i)$ as inputs using the following constant returns to scale technology.

$$Y_t = \left(\int_0^1 Y_t(i)^{\frac{\theta-1}{\theta}} di \right)^{\frac{\theta}{\theta-1}} \quad (1.12)$$

The final goods firms sells its product in a perfectly competitive market. Given the domestic price level P_t the profit maximizing problem of the final goods producers can be written as follows.

$$\max_{\{Y_t(i)\}} \left(\int_0^1 Y_t(i)^{\frac{\theta-1}{\theta}} di \right)^{\frac{\theta}{\theta-1}} - \int_0^1 P_t(i) Y_t(i) di \quad (1.13)$$

The first order condition of the above problem into the following demand curve for each

intermediate goods producing firms products as follows.

$$Y_t(i) = \left(\frac{P_t(i)}{P_t} \right)^{-\theta} Y_t \quad (1.14)$$

For the intermediate goods producing sector, assume that the domestic intermediate goods is divided between intermediate goods domestically sold, $Y_{ht}(i)$, and exported, $Y_{xt}(i)$ so that

$$Y_t(i) = Y_{ht}(i) + Y_{xt}(i) \quad (1.15)$$

The demand function for the domestically used intermediate goods has the following form.

$$Y_{ht}(i) = \left(\frac{P_t(i)}{P_t} \right)^{-\theta} Y_{ht} \quad (1.16)$$

The production function common to all intermediate producing firms in the economy is a constant returns to scale technology which has the following form.

$$Y_t(i) = Z_t K_{t-1}^\alpha(i) h_t^\alpha(i) \quad (1.17)$$

The firms producing intermediate goods for use in the domestic economy each acts as a monopolistic competitor. Assume that the price setting ability of each of these firms are constraint the demand curve its faces for its product from the representative final goods producing firms. In addition each firms producing intermediate goods for use in the domestic economy faces a convex price adjustment cost proportional to one unit of final goods as defined by Rotemberg (1982).

$$\Phi(P_t(i), P_{t-1}(i), P_t, Y_t) = \frac{\phi}{2} \left[\frac{P_t(i)}{P_{t-1}(i)} - 1 \right]^2 Y_t \quad (1.18)$$

The profit maximizing problem of the firms producing the intermediate goods is as follows.

$$\max_{\{K_{t-1}(i), h_{t-1}(i), P_t(i)\}} E_0 \sum_{j=0}^{\infty} \beta^j S_{t+j}^{DF} \left\{ \frac{P_t(i)}{P_t} Y_t(i) - \frac{\alpha Y_t}{K_{t-1}} K_{t-1}(i) - w_t h_t(i) - \frac{\phi}{2} \left[\frac{P_t(i)}{P_{t-1}(i)} - 1 \right]^2 Y_t \right\}; \beta \in (0, 1)$$

Subject to the following constraints:

$$Y_t(i) = \left(\frac{P_t(i)}{P_t} \right)^{-\theta} Y_t$$

$$Y_t(i) = Z_t K_{t-1}^\alpha(i) h_t^{1-\alpha}(i)$$

The first order condition for the domestically used intermediate goods producing firms are the following.

The FOC for using capital is the following.

$$\frac{\alpha Y_t}{K_{t-1}} = \frac{\alpha}{1-\alpha} w + t(Y_t)^{\frac{\alpha}{1-\alpha}} (Z_t)^{-\frac{\alpha}{1-\alpha}} (K_t)^{-\frac{\alpha}{1-\alpha}} \text{Insert equation 1.20} \quad (1.19)$$

The FOC for firmi to choose the price that maximizes profit $P_t(i)$ is the following

$$(1-\theta) + \frac{\theta}{1-\alpha} w_t \left(\frac{Y_t}{K_{t-1}} \right)^{\frac{\alpha}{1-\alpha}} Z_t^{\frac{\alpha}{1-\alpha}} - \phi(\pi_t - 1)\pi_t + \beta \phi E_t \left[\frac{\lambda_{t+1} \lambda_{t-1} Y_{t+1}}{\lambda_t \lambda_t Y_t} \phi(\pi_t - 1)\pi_t \right] = 0 \quad (1.20)$$

Denote the nominal exchange rate as S_t , following Dib (2011), assume that the intermediate goods producers cannot price discriminate so that the export price of the intermediate good is $P_t(i)/S_t$. It is also assumed that the foreign demand function for domestic exports produced by firm i is the following.

$$Y_t(i) = \left(\frac{P_t(i)}{P_t} \right)^{-\theta} Y_{xt} \quad (1.21)$$

The total foreign demand for exports of domestically produced intermediate goods follows from McCallum and Nelson (1999) and Kollman (2002) and assumed to be the following.

$$Y_{xt} = \left(\frac{P_t^* S_t}{P_t} \right)^{-\eta} Y_t^* \quad (1.22)$$

1.2.3 The Central Bank

Assume that the central bank of the small open economy actively manages short term interest rate R_t in response to deviation from output Y_t inflation π_t growth of money supply μ_t and the real exchnage rate S_t . In addition the monetary policy rule faces a monetary policy shock. This modified Taylor rule can be written as:

$$\ln \left(\frac{r_t^D}{r^D} \right) = \rho_y \ln \left(\frac{Y_t}{Y} \right) + \rho_\pi \ln \left(\frac{\pi_t}{\pi} \right) + \rho_s \ln \left(\frac{S_t}{S} \right) + \ln \nu_t \quad (1.23)$$

The variables without the time subscripts are in steady state. The monetary policy shock follows the following law of motion.

$$\ln \nu_t = \rho_\nu \ln \nu_{t-1} + \varepsilon_{\nu t}; \rho_\nu \in (0, 1) \quad (1.24)$$

1.2.4 Market Clearing Condition

Following Schmitt Grohe Uribe (2003), the final goods market condition is as follows.

$$\frac{S_t D_t^*}{P_t} = (1 + r^w + pr_{t-1}) \frac{S_t D_{t-1}^*}{P_t} + Y_t + c_t + i_t + \frac{\psi_K}{2} (K_{t+1} - K_t)^2 + \frac{\phi}{2} (\pi_t - 1)^2 Y_t \quad (1.25)$$

While the trade balance is given as follows.

$$tb_t = Y_t - c_t - i_t \quad (1.26)$$

And imports of final goods are given as follows.

$$Y_{mt} = \frac{tb_t - Y_t}{rer_t} \quad (1.27)$$

1.2.5 Equilibrium Conditions

Assuming symmetry among all consumers, domestic producers and importers, firms, the equilibrium condition for this model requires $\forall t \geq 0$,

$$D_t = 0$$

$$Y_t = Y_t(i)$$

$$Y_{ht} = Y_{ht}(i)$$

$$Y_{xt} = Y_{xt}(i)$$

$$P_t = P_t(i)$$

1.3 Parameters

The Calibration of the parameters for the households and firms models for this current study follows from Schmitt-Grohe, Uribe (2003), Peters (2008), and Unsal (2013). For the elasticity of output with respect to capital α it is set at 0.32. The coefficient of relative risk aversion γ is set to be 2. The 1 plus the inverse of the intertemporal elasticity of substitution ω in labor supply is set to be 1.455. The capital adjustment cost parameter Ψ_k is set to be 0.028. The debt elastic risk premium parameter Ψ_p is set to be 0.000742. These parameter values are consistent with consistent with Schmitt-Grohe, Uribe (2003). The parameter of monopoly power ϕ is set to be 10. The parameter of price adjustment cost is set to be 120. These parameter values are consistent with Unsal (2013). Following Schmitt Grohe Uribe, the world interest rate in this model is constant. The world interest rate r^w is calibrated to be 0.02102. This implies the consumption elasticity rate of time preference β is set to be 0.979413. The output gap parameter ρ_y in the monetary policy rule is set to be 0.5. While the parameter for the inflation gap ρ_π is set to be 0.8098. This is consistent with Peters (2008).

This current study considers two different monetary policy rules. One which put a small weight on real exchange rate stabilization ρ_s in the monetary policy rule (case1). Another monetary policy rule is to put a large weight (in absolute value) on the real exchange rate stabilization in the monetary policy rule (case 2). For the small weight, this paper set the value of the real exchange rate stability in the monetary policy rule as $\rho_s = 0.15668$. For the large weight, this paper set the weight on real exchange rate stabilization to $\rho_s = 1$. And in order to get a clearer picture of the dynamics of the macroeconomic variables under case 2, this study as increases the value weight in case 2 to be $\rho_s = 6$. This in the impulse response is the ones labeled with the number3.

1.4 Analysis

In this analysis will consider the impulse responses of several macroeconomic variables. These variables are domestic output (y), consumption (c), domestic inflation, current account-to-GDP ratio (ca), trade balance-to-GDP ratio (tb), foreign debt (d) and investment (i). This study considers five shocks; productivity shocks and foreign output shock and foreign inflation shock, risk premium shock and monetary policy shocks. In the impulse responses is constructed for the two monetary policy rules; case 1 in which the weight on real exchange rate stability is low and case 2 in which the weight on real exchange rate stability is high as specified above.

1.4.1 Productivity Shock

Consider a positive productivity shock. Following a positive productivity shock, domestic output (y) rise in both case1 and case 2 monetary policy rules mentioned above. Similarly, a positive productivity shock result into a rise in investment (i) and foreign debt (d) in both monetary policy rule cases. And this shock results in a rise current account deficit-to-GDP ratio (ca) in both cases. (Figure 1 to 6 in Appendix A). In contrast, consumption and domestic inflation fell due to a positive productivity shock in both case 1 and case 2 monetary rules considered. Similarly a positive productivity shock result into a fall in trade balance surplus-to GDP-ratio. (Figures 1 to 7 in the Appendix)

For the dynamics of all variables considered above, the impulse response depicts that a monetary Policy rule which place high weight on real exchange rate stability results in less fluctuations of macroeconomic variables in the case of productivity shocks. For these variables, this supports the argument that a monetary policy which attempt to stabilize the real exchange rate would support macroeconomic stability as compared to a rule with fully flexible exchange rate.

As a note, the difference in macroeconomic variable fluctuations between the two monetary policy rule cases is relatively larger for domestic output, current account, trade balance and foreign debt. On the other hand the difference in macroeconomic variable fluctuations is relatively smaller for investment, consumption and domestic inflation. This indicates that, for the case of productivity shock, the impact of a monetary policy which attempt to stabilize the real exchange rate the effect is larger for domestic output, current account, trade balance and foreign debt, as compared to domestic output, consumption, investment and domestic inflation.

1.4.2 World output shock

Now consider a positive world output shock. Following a positive world output shock, domestic output and consumption rises in both case 1 and case 2 monetary policy rules mentioned above. Similarly, a positive world output shock result into a rise investment and foreign debt in both monetary policy rule cases. Furthermore a positive world output shock result in a rise current account deficit-to-GDP ratio in both cases. (Figures 8 to 14 in the Appendix) In contrast domestic inflation fell due to a positive world output shock in both case 1 and case 2 monetary rules considered. Similarly a positive world output shock result into a fall in trade balance surplus-to GDP-ratio.

For the dynamics of all variables considered above, the impulse response depicts that a monetary Policy rule which place high weight on real exchange rate stability results in less fluctuations of macroeconomic variables in the case of world output shocks. For these variables, this result supports the argument that a monetary policy which attempt to stabilize the real exchange rate would provide higher macroeconomic stability as compared to a rule with fully flexible exchange rate.

As a note, the difference in macroeconomic variable fluctuations between the two mone-

tary policy rule cases is relatively larger for foreign debt. On the other hand the difference in macroeconomic variable fluctuations is relatively smaller for domestic output, consumption, investment, current account deficit-to-GDP ratio, trade balance surplus-to GDP-ratio and domestic inflation. This indicates that, for the case of world output shock, the impact of a monetary policy which attempt to stabilize the real exchange rate the effect is larger for foreign debt, as compared to the other macroeconomic variables.

1.4.3 Foreign inflation shock

Now consider a positive foreign inflation shock. Following a positive foreign inflation shock, this would increase domestic output and domestic inflation. Furthermore a positive foreign inflation shock increases the trade balance surplus-to-GDP ratio and foreign debt. Also this shock increases the deficit of current account deficit-to-GDP ratio. However, a positive foreign inflation shock results in a decrease in consumption and investment. (Figures 15 to 21 in the Appendix).

The impulse response also depicts that a monetary Policy rule which place high weight on real exchange rate stability gives less fluctuations of macroeconomic variables in the case of world output shocks. This supports the argument that a monetary policy which attempt to stabilize the real exchange rate would support macroeconomic stability as compared to a rule with fully flexible exchange rate.

1.4.4 Risk Premium shock

Now consider a positive monetary policy shock. Following a positive risk premium shock, domestic output (y) and consumption (c) rises in both case1 and case 2 monetary policy rules mentioned above. Similarly, a positive monetary policy shock result into a rise in domestic inflation, surplus of trade balance to GDP ratio, in both monetary policy rule cases. In

contrast a positive monetary policy shock results in a fall of the foreign debt and the deficit of current account-GDP-ratio and investment, in both case 1 and case 2 monetary rules considered. (Figures 22 to 28 in the Appendix)

For the dynamics of all variables considered above, the impulse response depicts that a monetary Policy rule which place low weight on real exchange rate stability gives less fluctuations of macroeconomic variables under consideration in the case of risk premium shocks. This supports the argument that a monetary policy with a flexible exchange rate would support macroeconomic stability as compared to a rule which attempt to stabilize the real exchange rate.

As a note, the difference in macroeconomic variable fluctuations between the two monetary policy rule cases is relatively larger for investment, the deficit of current account-GDP-ratio, trade balance surplus-to GDP-ratio and foreign debt. On the other hand the difference in macroeconomic variable fluctuations is relatively smaller for domestic output, consumption and domestic inflation. This indicates that, for the case of risk premium shock, the impact of a monetary policy which attempt to stabilize the real exchange rate the effect is larger for investment, the deficit of current account-GDP-ratio, trade balance surplus-to GDP-ratio and foreign debt, as compared to domestic output, consumption and domestic inflation.

1.4.5 Monetary policy shock

Finally consider a positive monetary policy shock. Following a positive monetary policy shock, domestic output and consumption falls in both case1 and case 2 monetary policy rules mentioned above. Similarly, a positive monetary policy shock result into a fall in domestic inflation, foreign debt and the deficit of current account-GDP-ratio in both monetary policy rule cases. In contrast a positive monetary policy shock results in a rise of domestic

investment and the surplus of trade balance to GDP ratio in both case 1 and case 2 monetary rules considered. (Figures 29 to 35 in the Appendix).

For the dynamics of all variables considered above, the impulse response depicts that a monetary Policy rule which place high weight on real exchange rate stability gives less fluctuations of macroeconomic variables under consideration in the case of monetary policy shocks. This supports the argument that a monetary policy which attempt to stabilize the real exchange rate would support macroeconomic stability as compared to a rule with a flexible exchange rate.

As a note, the difference in macroeconomic variable fluctuations between the two monetary policy rule cases is relatively larger the deficit of current account-GDP-ratio, trade balance surplus-to GDP-ratio, investment and foreign debt. In contrast the impulse response curves do not depict any difference in fluctuations for domestic output, consumption, and domestic inflation. This indicates that, for the case of monetary policy shock, the impact of a monetary policy which attempt to stabilize the real exchange rate, the effect is larger for the deficit of current account-GDP-ratio, trade balance surplus-to GDP-ratio, investment and foreign debt, compared to domestic output, consumption, and domestic inflation.

1.5 Conclusion

By specifying a New Keynesian model with liability dollarization and risk premium shocks, results from this paper depicts that there are variations in the fluctuations of domestic output, consumption, domestic inflation, current account deficit to-GDP-ratio, trade balance surplus-to-GDP ratio, foreign debt and investment between a monetary policy rule which put high weight on real exchange rate stability on one hand, and one which put which put a low weight. Among them however, current account deficit-to-GDP ratio and foreign debt consistently depicts large difference in magnitude of their fluctuations between the two policy

rules under all five shocks considered. This result is consistent with the conclusion of Korinek (2011). Moreover, for productivity shocks, world output shocks, monetary policy shocks and foreign inflation shocks, the above analysis indicates that a monetary Policy rule which place high weight on real exchange rate stability shows less fluctuation of the macroeconomic variables. This supports the argument that a monetary policy which attempt to stabilize the real exchange rate would support macroeconomic stability as compared to a rule with more flexible exchange rate. Conversely for risk premium shocks, it supports the argument that a monetary policy with more flexible exchange rate would support macroeconomic stability. The future work of this paper is to extend the analysis to consider the optimal monetary policy rule and analyze, how the dynamics of the macroeconomic variables under the optimal monetary policy compares with that of the two monetary policy rules.

Bibliography

- [1] Calvo, Guillermo A., 2002. “On dollarization”. *Economics of Transition*, 10 pp.393403.
- [2] Cespedes, Luis Felipe, Roberto Chang, and Andrs Velasco, 2002. “Dollarization of Liabilities, Net worth Effects, and Optimal Monetary Policy”, in *Preventing Currency Crises in Emerging Markets*, Sebastian Edwards and Jeffrey A. Frankel (eds).
- [3] Cespedes, Luis Felipe, Roberto Chang, and Andrs Velasco, 2004. “Balance Sheets and Exchange Rate Policy”, *The American Economic Review*, Vol. 94, No. 4 (Sep., 2004), pp. 1183-1193
- [4] Calvo, G.A, 2006. Monetary policy challenges in emerging markets: sudden stop, liability dollarization, and lender of last resort, , 12788.*NBER Working Paper*, No.12788.
- [5] Cavoli, Tony, 2009. “Is the fear of floating justified?: The East Asian experience”, *Journal of policy modeling*, Vol. 31, pp.1-16
- [6] Choi, Woon Gyu and David Cook. 2004. Liability dollarization and the bank balance sheet channel, *Journal of International Economics*, 64 (2004) 247 275.
- [7] David, Cook. 2004. “Monetary policy in emerging markets: Can liability dollarization explain contractionary devaluations?”, *Journal of Monetary Economics*, No.51 (2004), pp. 1155 1181.
- [8] Dib, Ali, 2011. “Monetary Policy in Estimated Models of Small Open and Closed Economies”, *Open Economic Review*, No.22, pp.769-796.
- [9] Eichengreen, Barry and Ricardo Hausmann, 1999. “Exchange Rate and Financial Fragility”.*NBER working papre*,No. 7418
- [10] Honig, A. (2009). “Dollarization, exchange rate regimes and government quality”.*Journal of International Money and Finance* ,Vol.2, No.28,

- [11] Kaminsky, Graciela L. and Carmen M. Reinhart, 1998. "Financial Crises in Asia and Latin America: Then and Now", *The American Economic Review* , Vol.88, No.2, pp. 444-448.
- [12] Kollman, Robert. 2002. The Exchange Rate in a Dynamic-Optimizing Business Cycle Model with Nominal Rigidities: A Quantitative Investigation., *Journal of International Economics* , No.55, pp.243-262.
- [13] Korinek, Anton. 2011. "Foreign Currency Debt, Risk Premia and Macroeconomic Volatility", *European Economic Review* , Vol.55, pp. 371-385.
- [14] McCallum, B.T, and E. Nelson. 1999. "Nominal Income Targeting in an Open Economy Optimizing Model.", *Journal of Monetary Economics*, No.43, pp.553 578.
- [15] Nakamura, Chikafumi, 2011. "Currency Mismatch, Balance-sheet effect and Monetary Policy", *Journal of International Economic Studies* , Vol.25 pp. 103128.
- [16] Notz, Stefan and Peter Rosenkranz, 2014. "Business Cycles in Emerging Markets: the Role of Liability Dollarization and Valuation Effects". *University of Zurich Working Paper*, No.163.
- [17] Pastor, Lubos, Pietro Veronesi. 2013. Political Uncertainty and Risk Premia , *Journal of Financial Economics*, No. 110, pp. 520545.
- [18] Peters, Amos C., 2008. "Exchange Rate targeting in an Estimated Small Open Economy", mimeo, University of North Carolina-Chapel Hill.
- [19] Rotemberg, J.J. 1982. "Sticky Prices in the United States", *Journal of Political Economy*, Vol.90, No.6, pp. 11871211.

Appendices

Figure 1.1: Global foreign exchange market turnover by instrument, currency and counterparty. Daily averages in April 2013, in billions of US dollars.

Instrument/ currency/ counterparty	Total	Spot transactions	Outright forwards	Foreign exchange swaps	Currency swaps	FX options
<i>By currency</i>						
Developed countries currency						
US Dollar	4,652	1,691	588	2,030	50	293
Euro	1,786	754	178	766	18	70
Japanese Yen	1,231	612	123	332	11	153
Pound Sterling	631	227	69	301	5	29
Australian Dollar	462	196	50	183	6	27
Swiss Franc	275	84	27	149	1	14
Canadian Dollar	244	93	36	101	2	12
New Zealand Dollar	105	39	11	50	2	3
Swedish Krone	94	27	12	53	1	2
Norwegian Krone	77	21	10	43	0	2
Hong Kong Dollar	77	21	7	47	0	1
Korean Won	64	19	24	16	1	4
Danish Krone	42	7	5	29	0	0
Offshore centers countries currency						
Singapore Dollar	75	20	11	40	1	3

Source: Bank of International Settlement

Figure 1.2: : Global foreign exchange market turnover by instrument, currency and counterparty. Daily averages in April 2013, in billions of US dollars (continued).

Developing countries currency	Total	Spot transactions	Outright forwards	Foreign exchange swaps	Currency swaps	FX options
Mexican Peso	135	57	14	58	1	6
Yuan Renminbi	120	34	28	40	1	17
Russian Rouble	85	37	9	37	0	3
Turkish Lira	70	16	10	39	3	3
South African Rand	60	19	7	31	0	2
Brazilian Real	59	11	34	1	3	11
Indian Rupee	53	15	24	10	0	3
Polish zloty	37	11	6	20	0	1
New Taiwan Dollar	24	6	11	6	0	1
Hungarian Forint	22	7	3	10	0	1
Other currencies	207	66	64	65	2	12

Source: Bank of International Settlement

Figure 1.3: Domestic output with respect to productivity shock

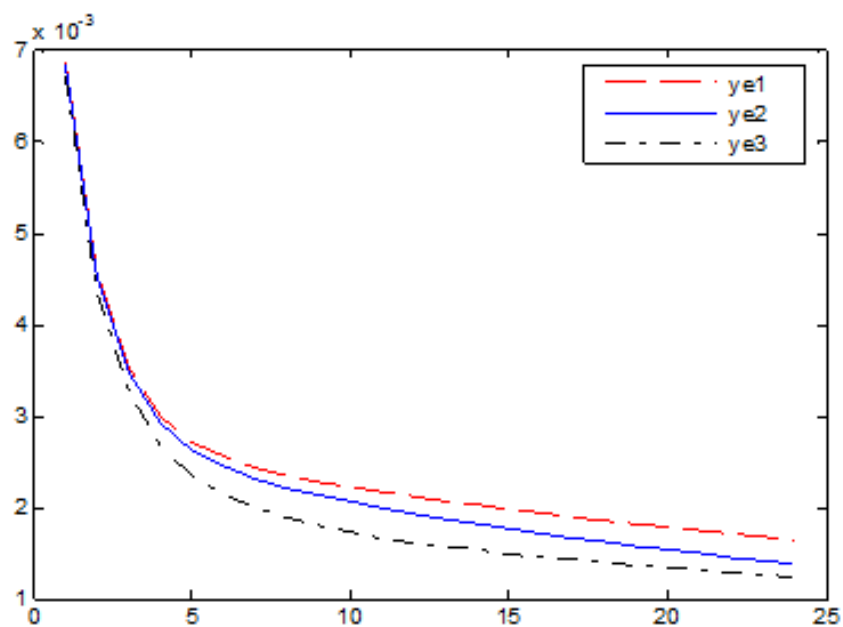


Figure 1.4: Consumption with respect to productivity shock

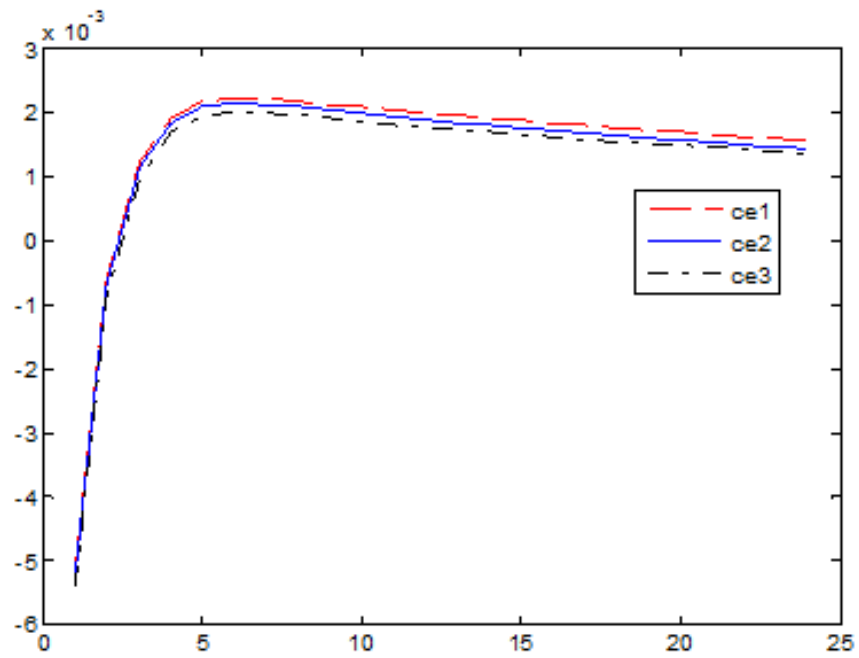


Figure 1.5: Current account deficit to GDP ratio with respect to productivity shock

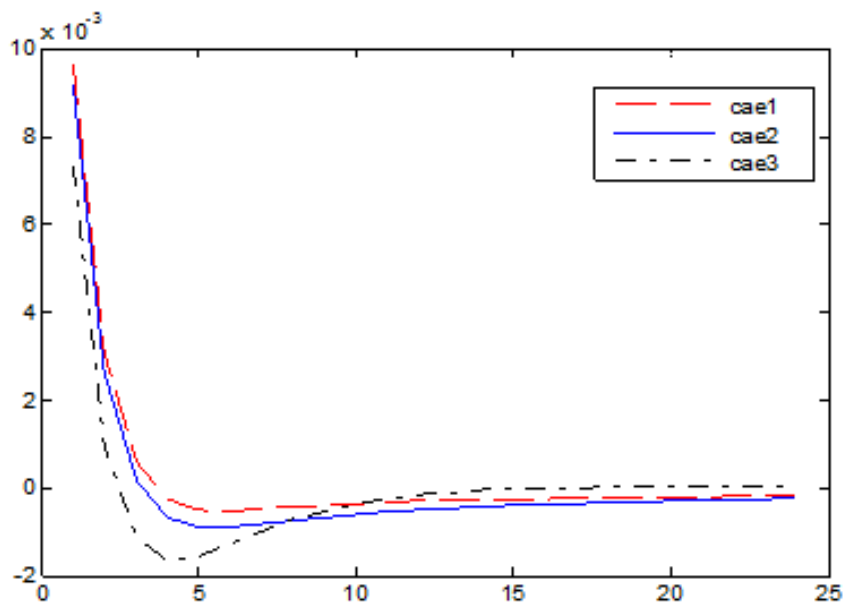


Figure 1.6: Surplus of trade balance to GDP ratio with respect to productivity shock

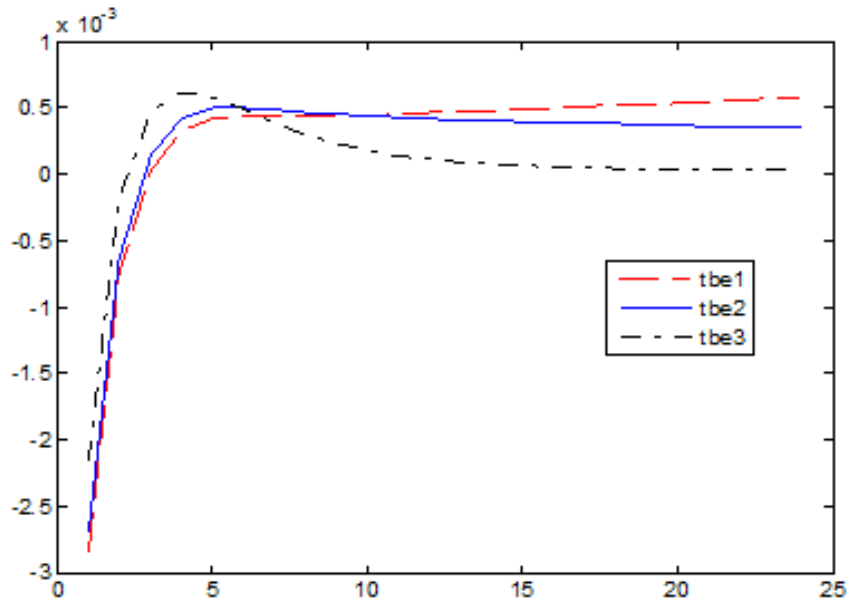


Figure 1.7: Foreign debt with respect to productivity shock

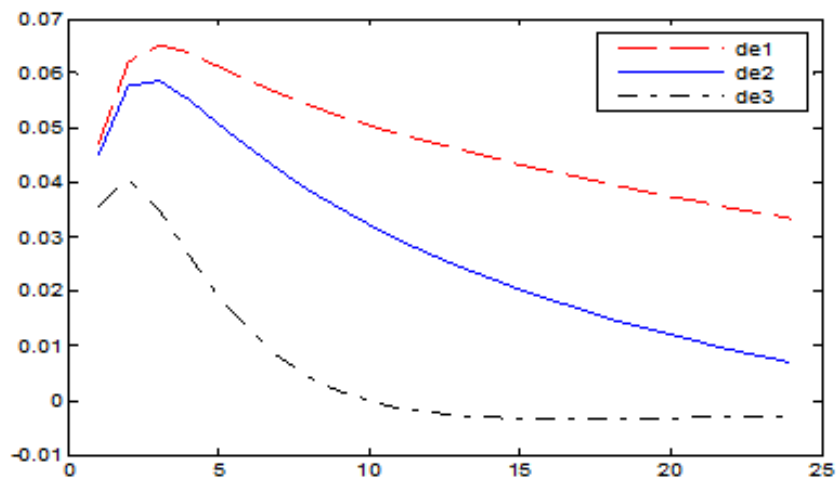


Figure 1.8: Investment respect to productivity shock

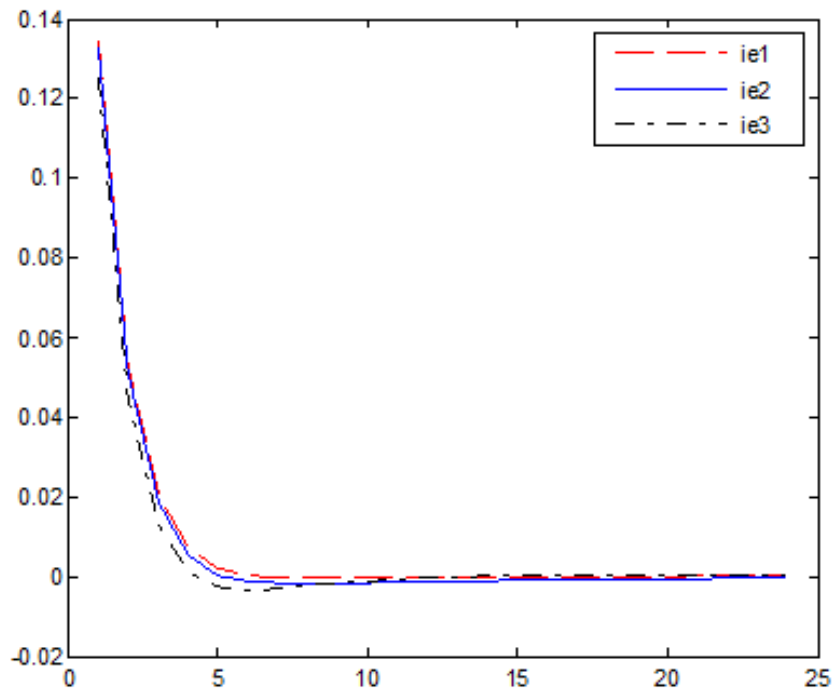


Figure 1.9: Inflation respect to productivity shock

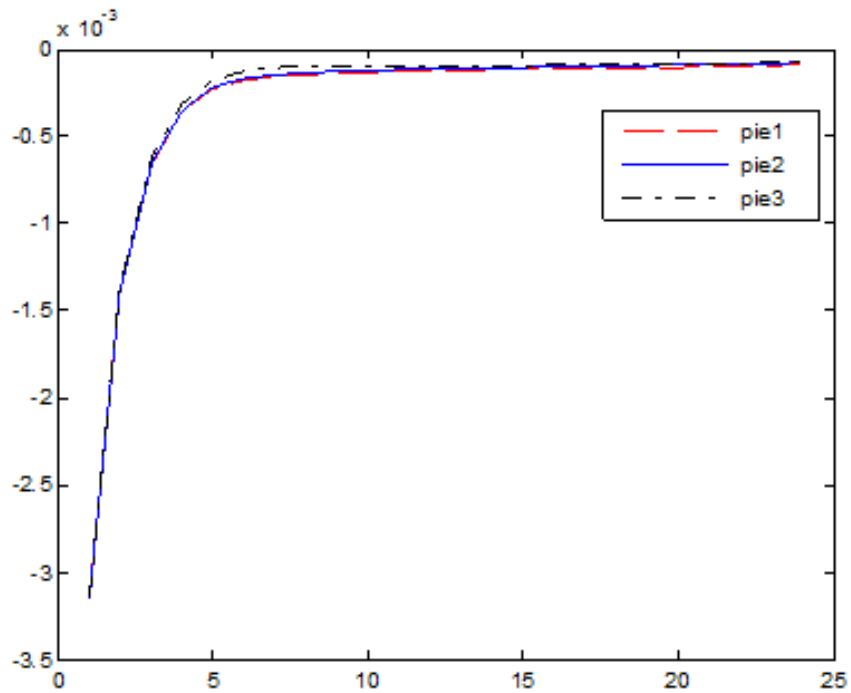


Figure 1.10: Domestic output with respect to world output shock

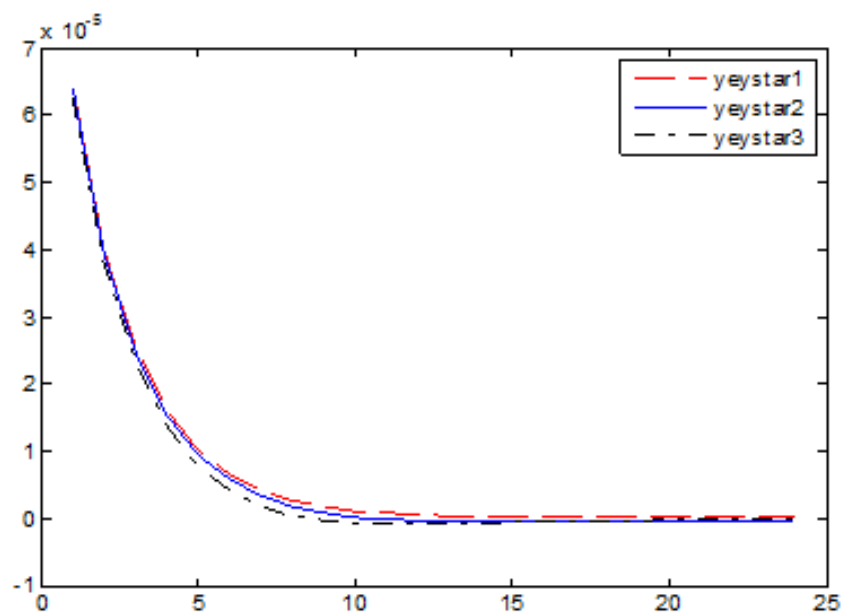


Figure 1.11: Consumption with respect to world output shock

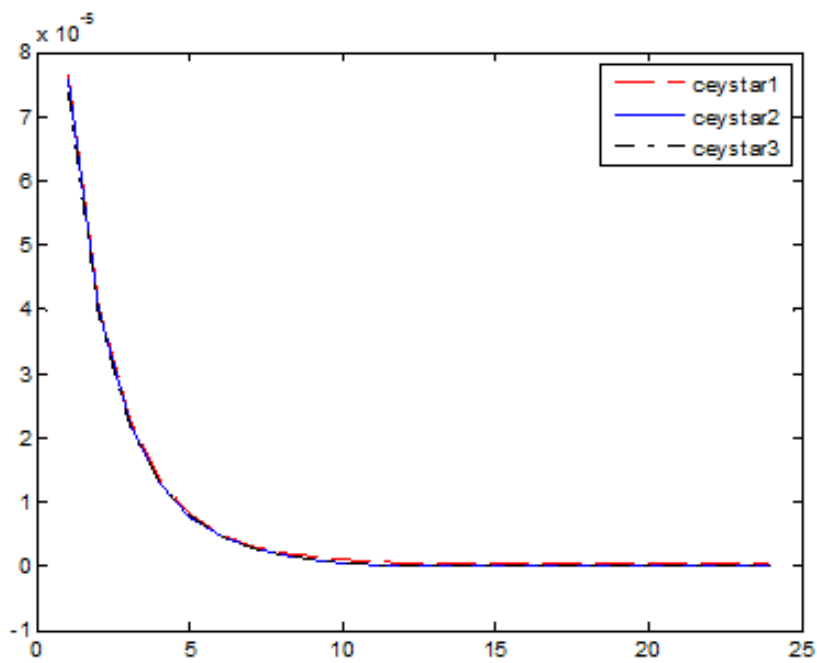


Figure 1.12: Current account deficit to GDP ratio with respect to world output shock

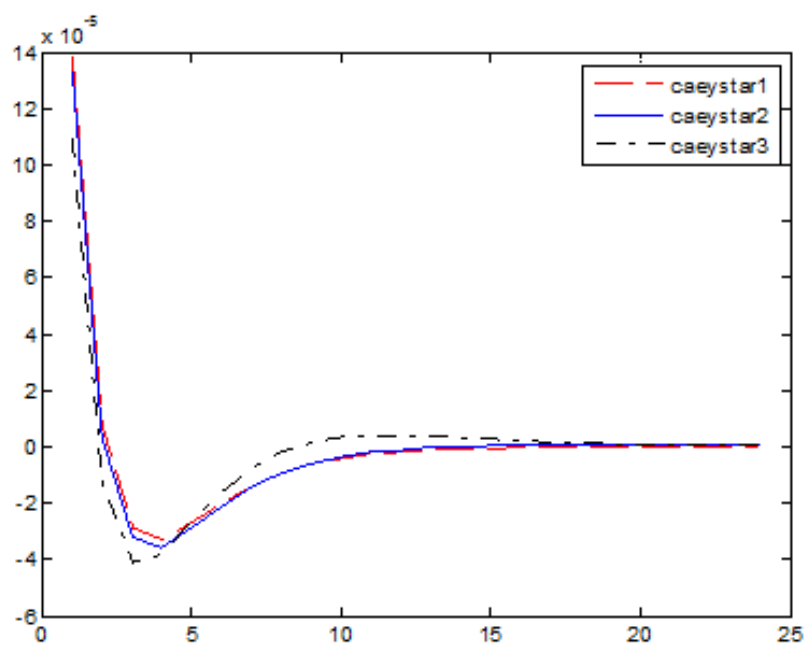


Figure 1.13: Surplus of trade balance to GDP ratio with respect to world output shock

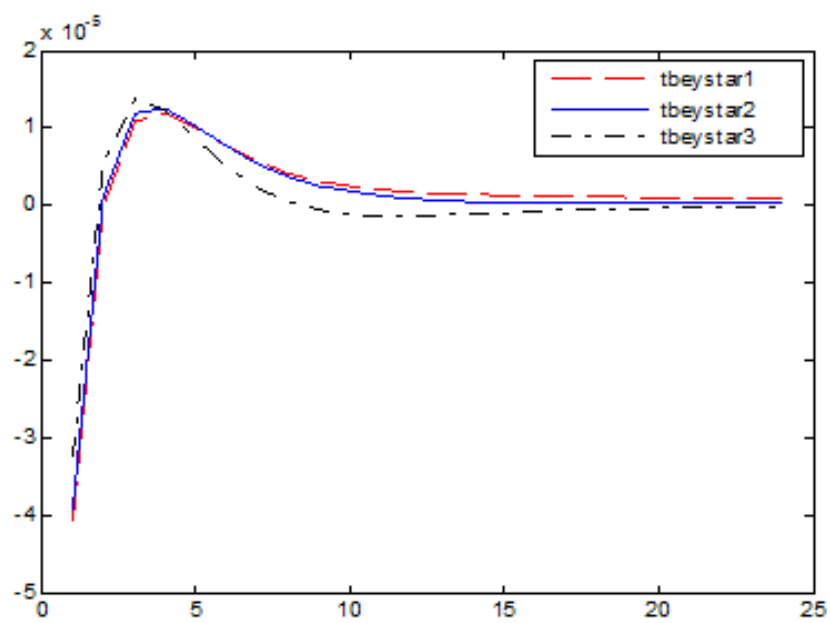


Figure 1.14: foreign debt with respect to world output shock

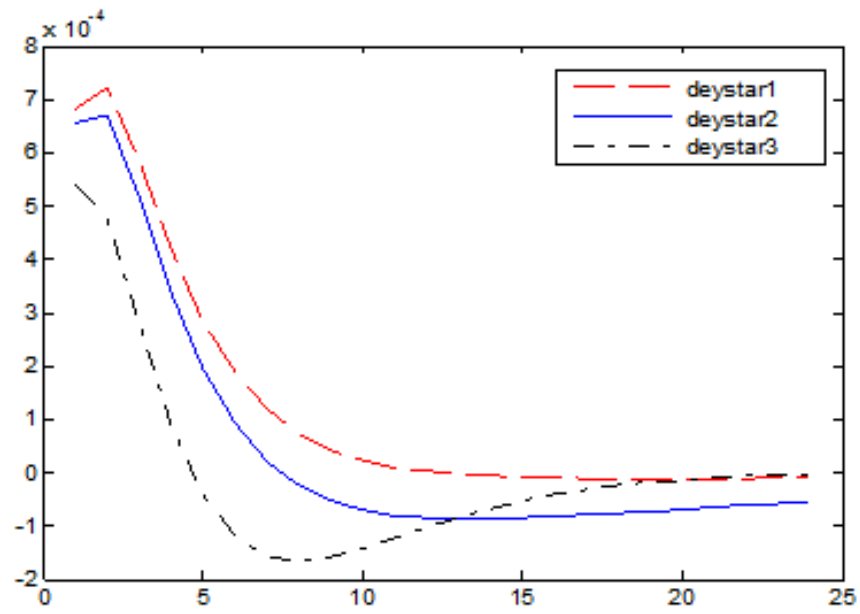


Figure 1.15: Investment with respect to world output shock

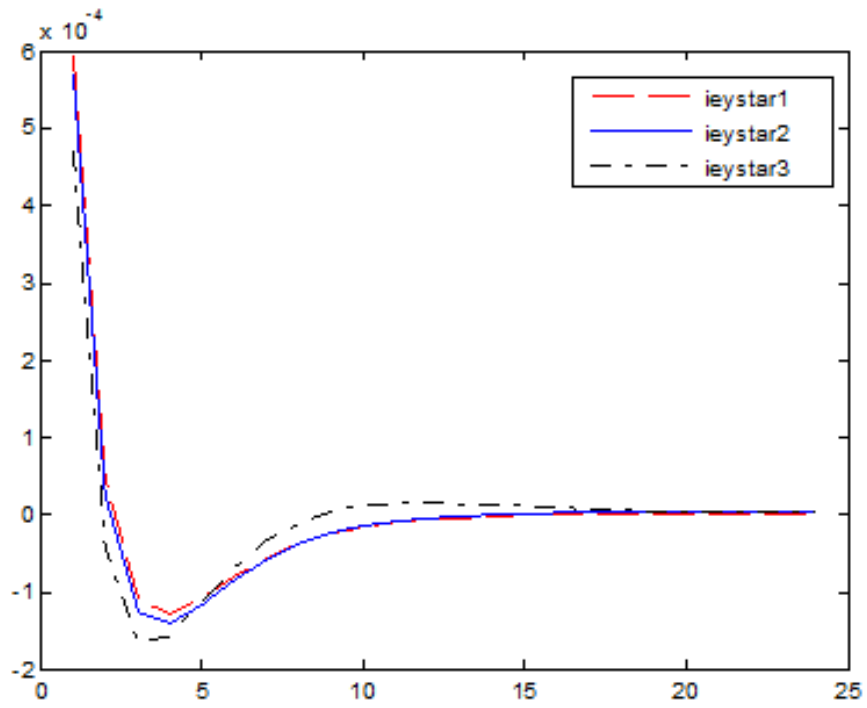


Figure 1.16: Domestic inflation with respect to world output shock

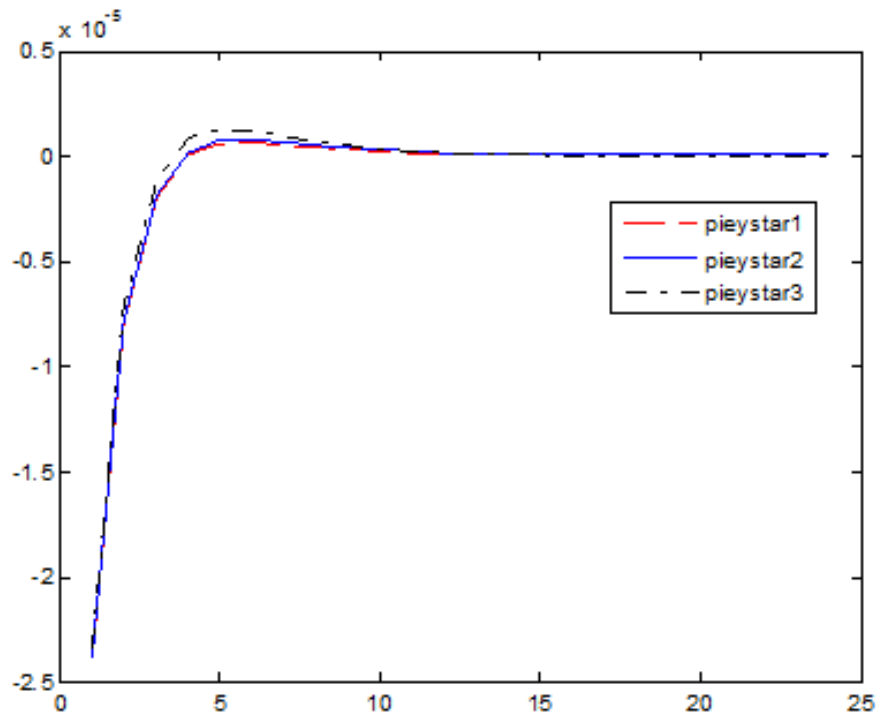


Figure 1.17: Domestic output with respect to foreign inflation shock

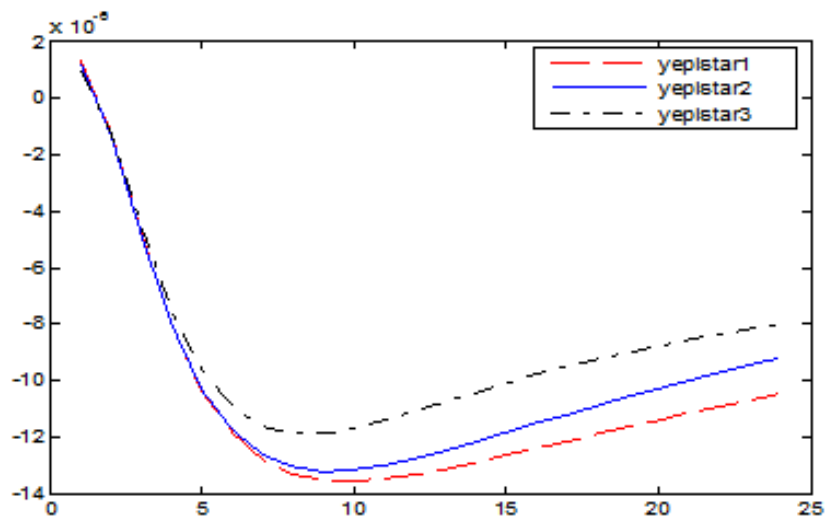


Figure 1.18: Consumption with respect to foreign inflation shock

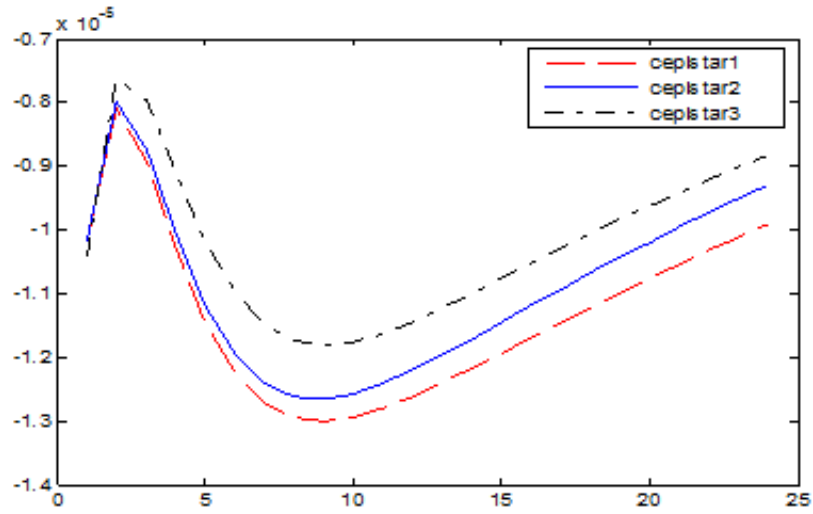


Figure 1.19: Current account deficit to GDP ratio with respect to foreign inflation shock

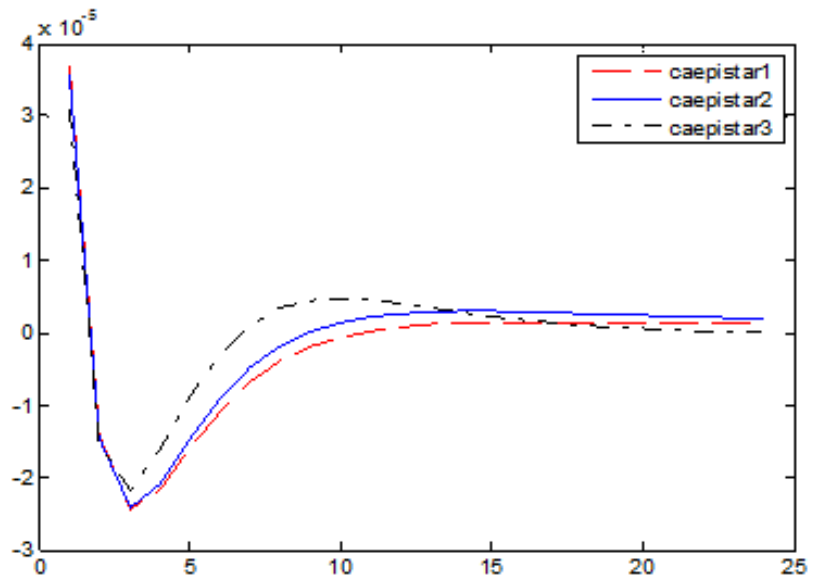


Figure 1.20: Trade balance surplus to GDP ratio with respect to foreign inflation shock

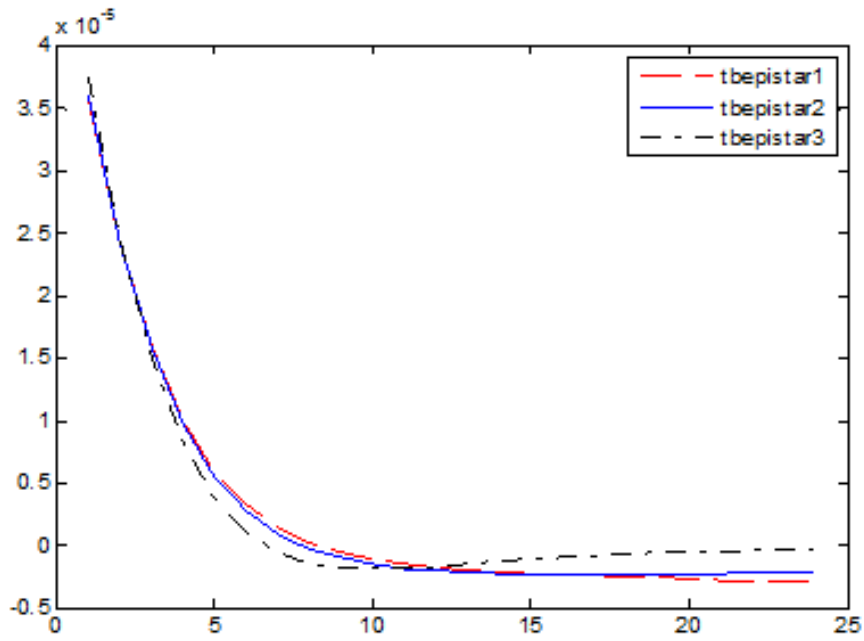


Figure 1.21: Foreign debt with respect to foreign inflation shock

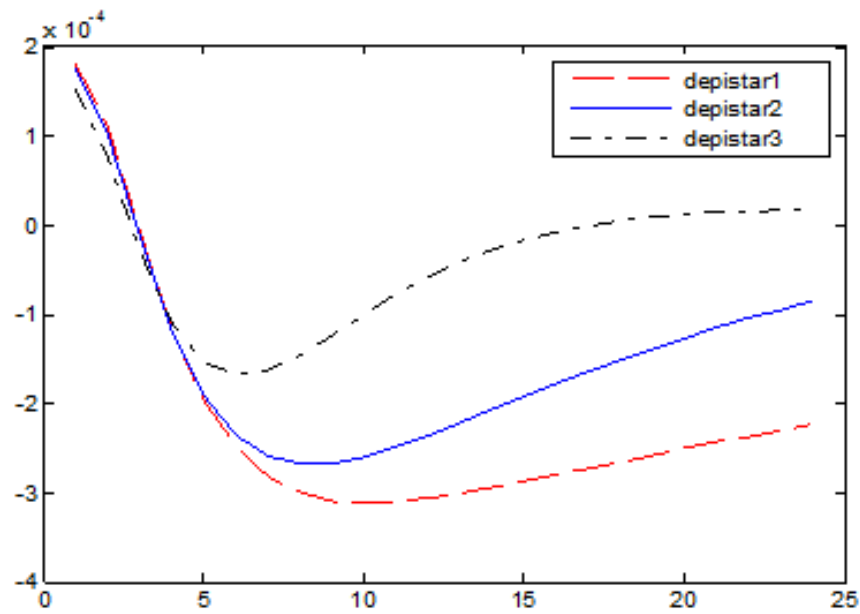


Figure 1.22: investment with respect to foreign inflation shock

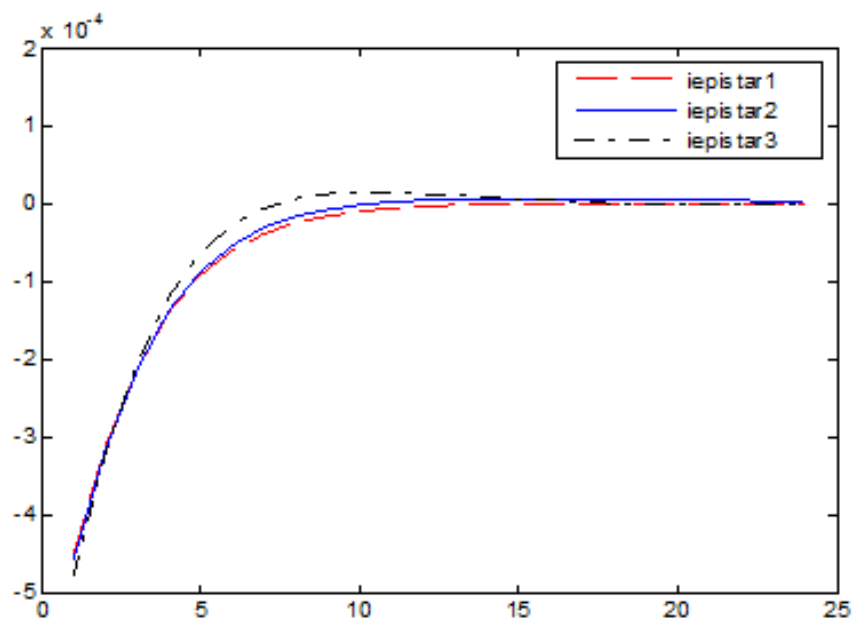


Figure 1.23: Domestic inflation with respect to foreign inflation shock

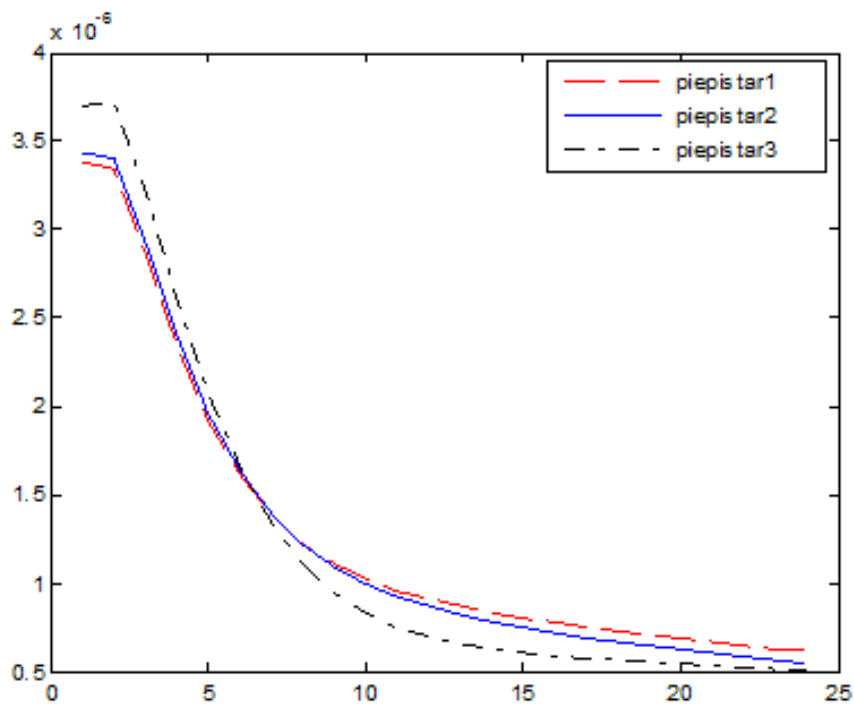


Figure 1.24: Domestic output with respect to risk premium shocks

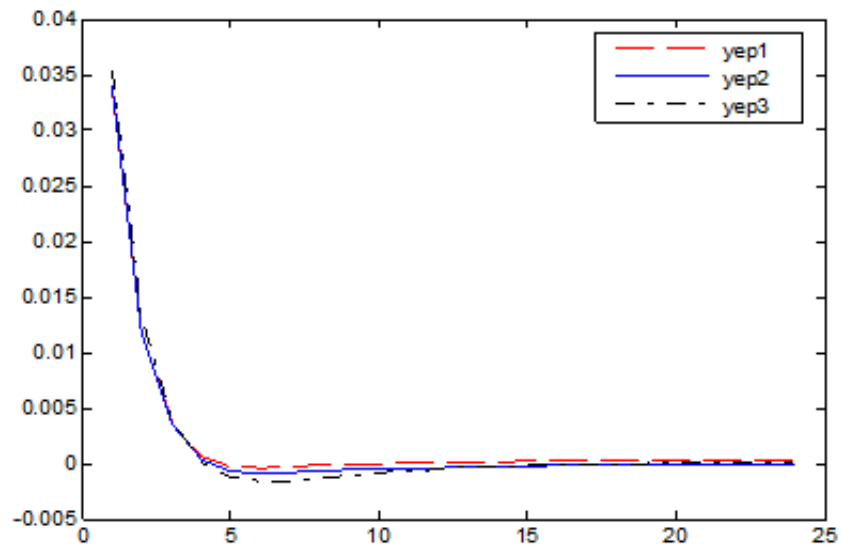


Figure 1.25: Consumption with respect to risk premium shocks

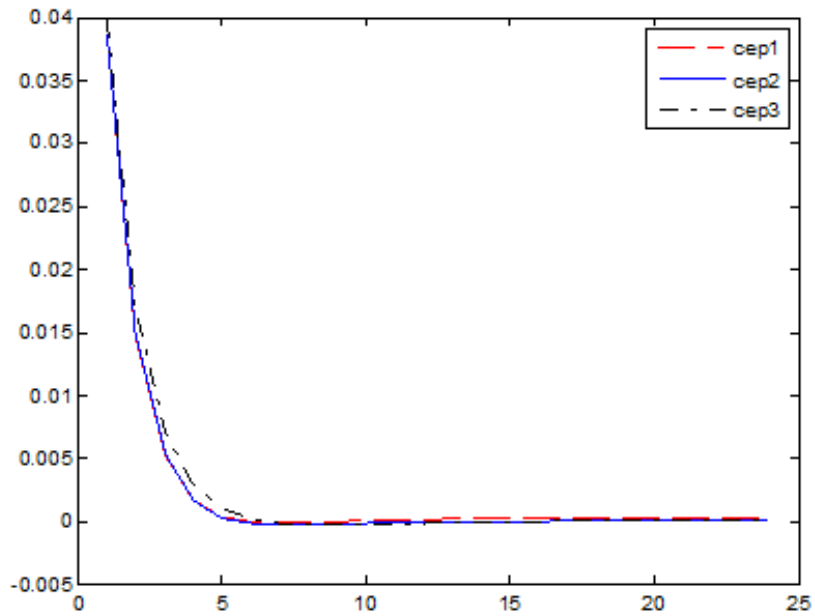


Figure 1.26: Current account deficit-to-GDP ratio with respect to risk premium shocks

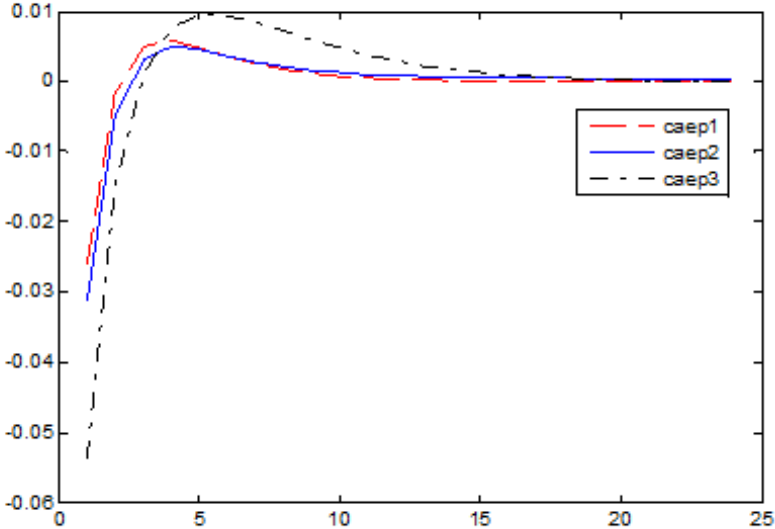


Figure 1.27: Trade balance surplus-to-GDP ratio with respect to risk premium shocks

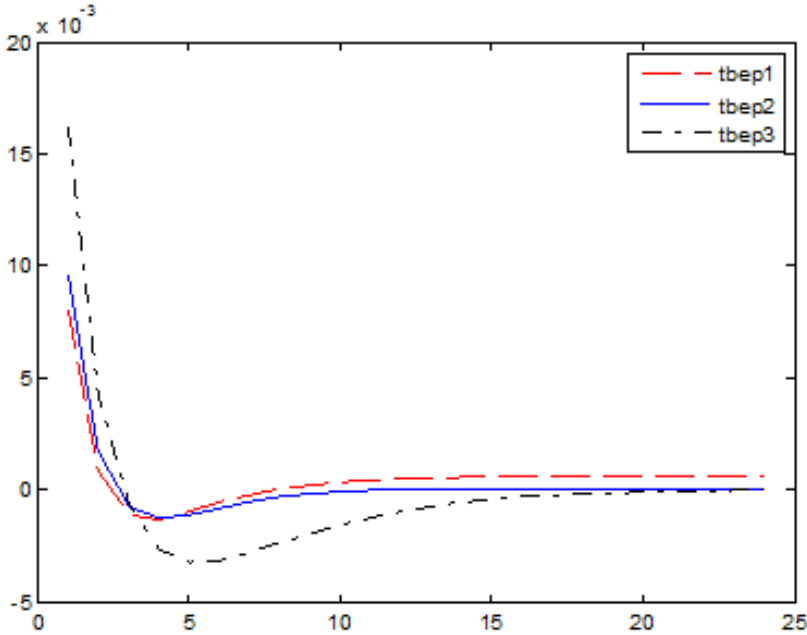


Figure 1.28: Foreign debt with respect to risk premium shocks

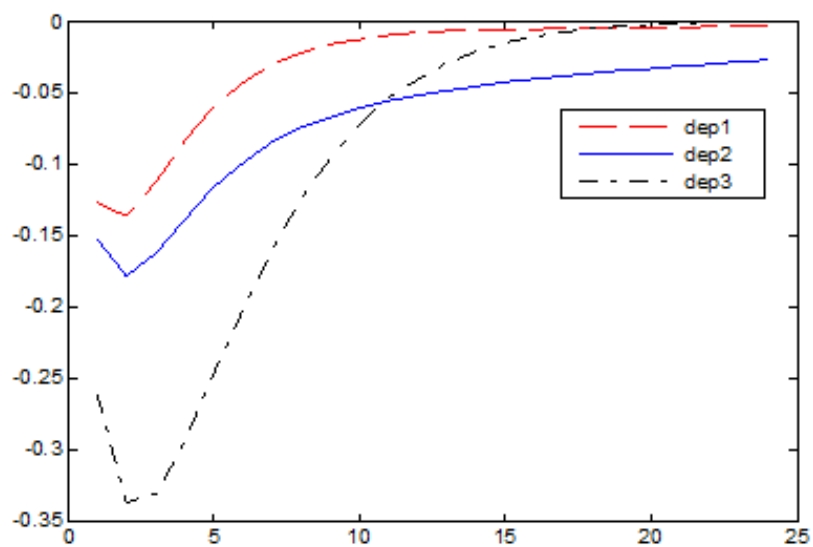


Figure 1.29: Investment with respect to risk premium shocks

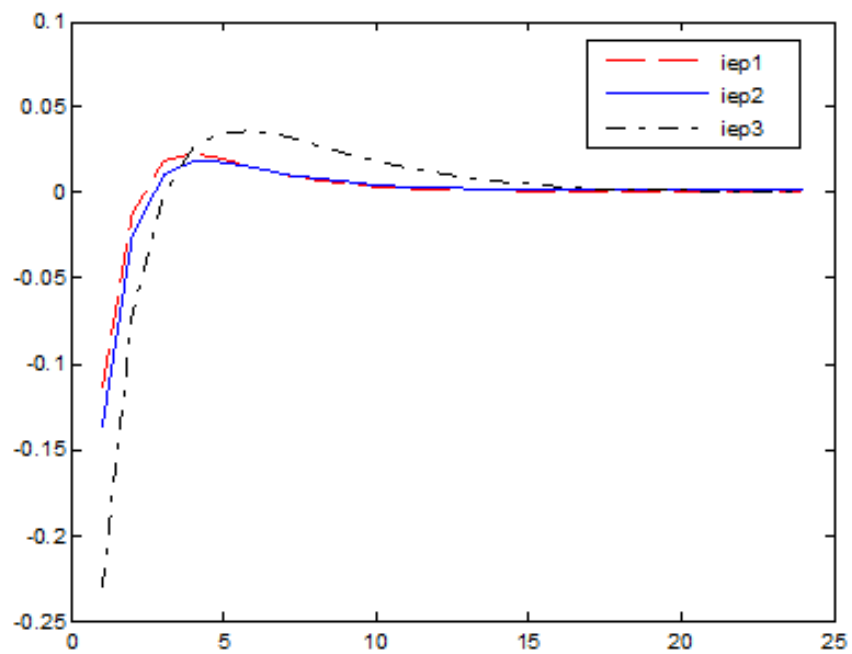


Figure 1.30: Domestic inflation with respect to risk premium shocks

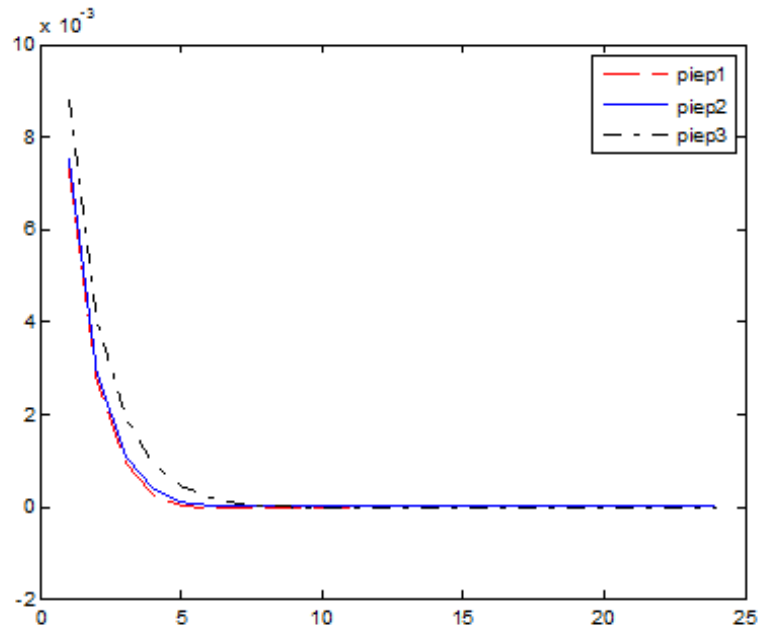


Figure 1.31: Domestic output with respect to monetary policy shocks

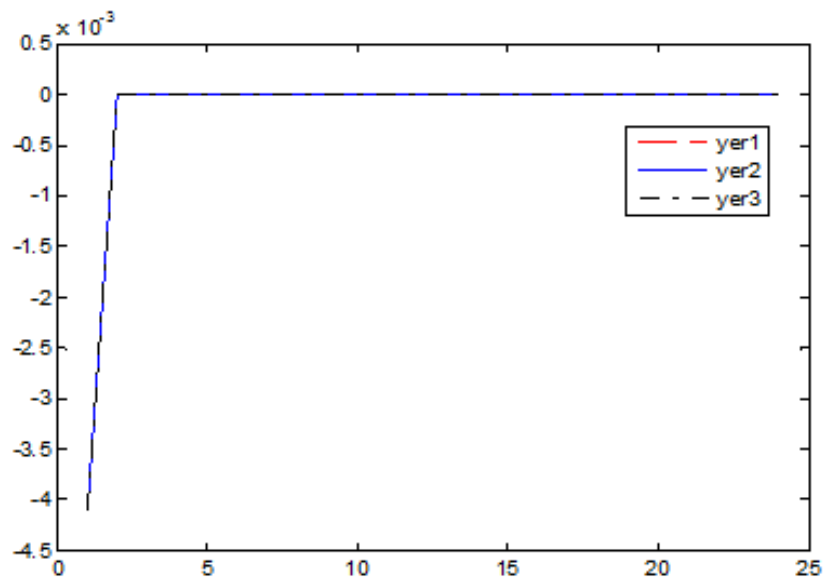


Figure 1.32: Consumption with respect to monetary policy shocks

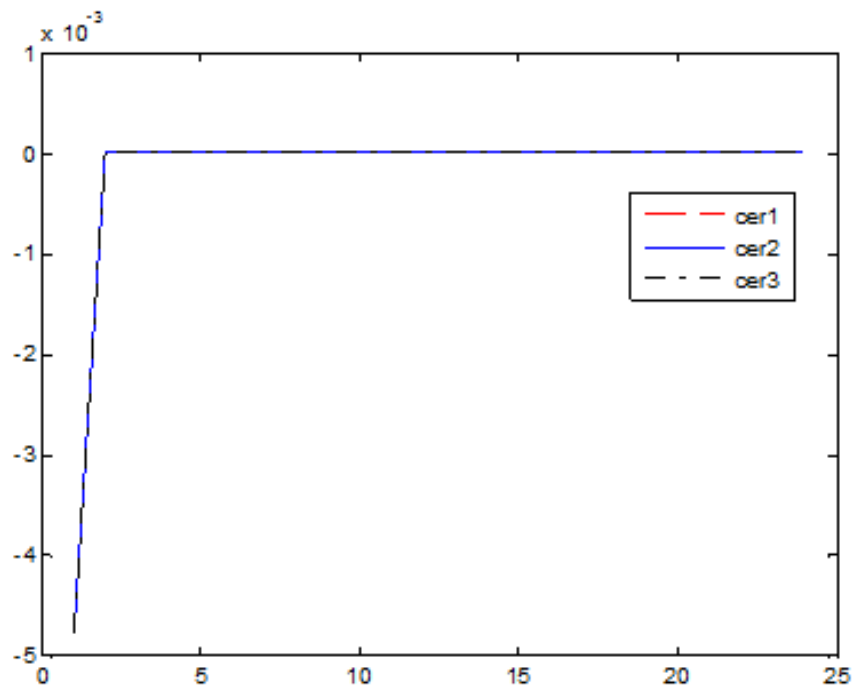


Figure 1.33: Current account deficit-to-GDP ratio with respect to monetary policy shocks

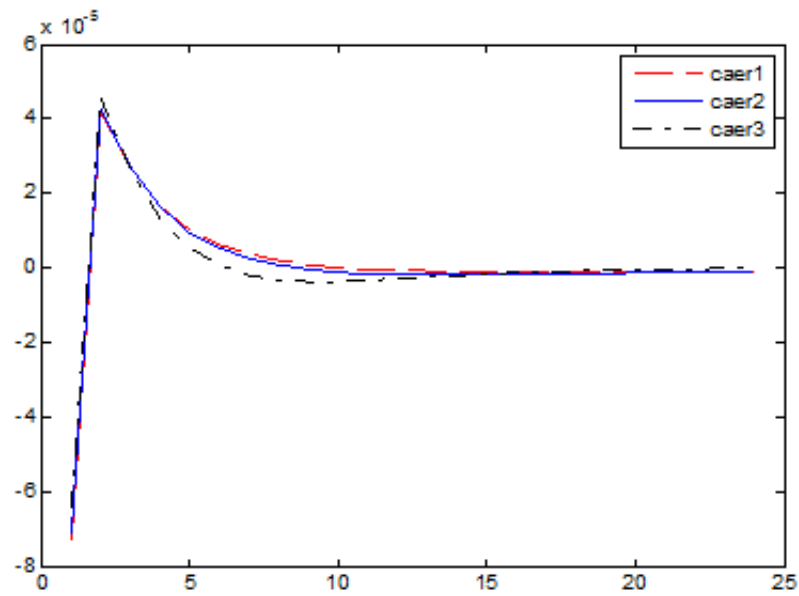


Figure 1.34: Trade balance surplus-to-GDP ratio with respect to monetary policy shocks

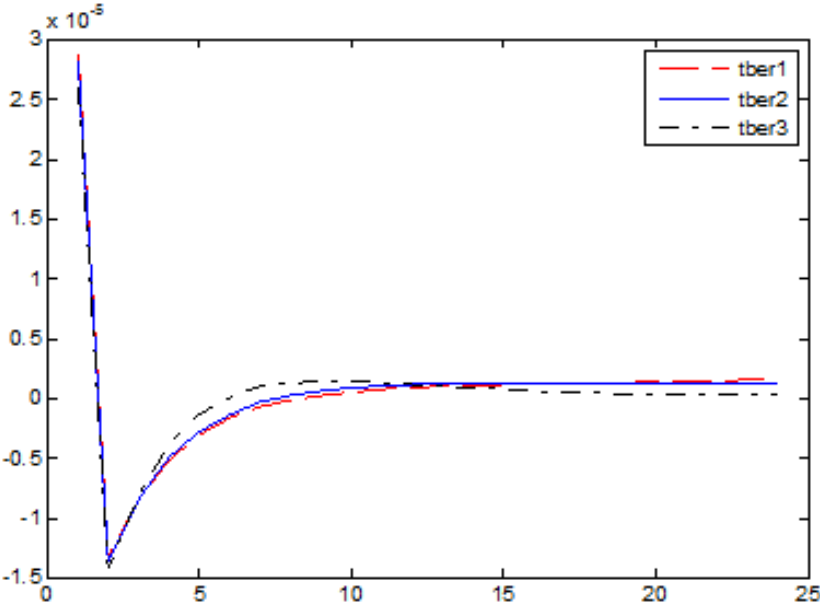


Figure 1.35: Foreign debt with respect to monetary policy shocks

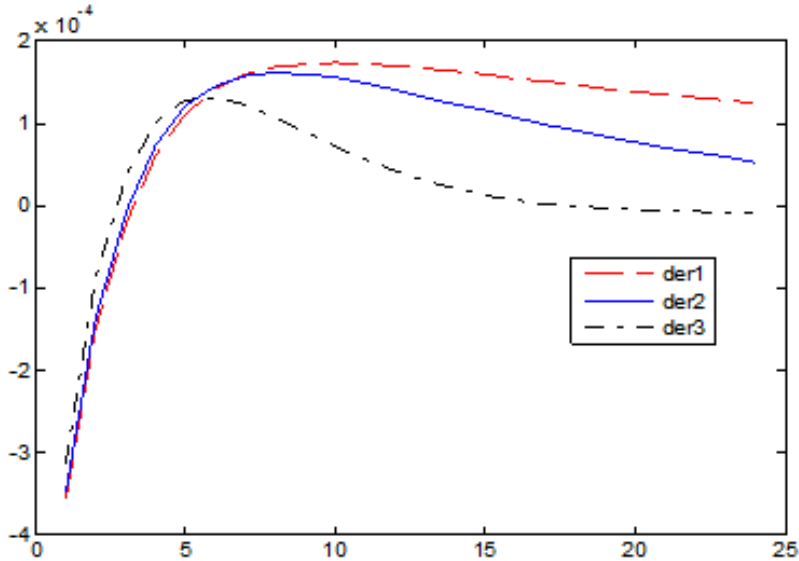


Figure 1.36: Investment with respect to monetary policy shocks

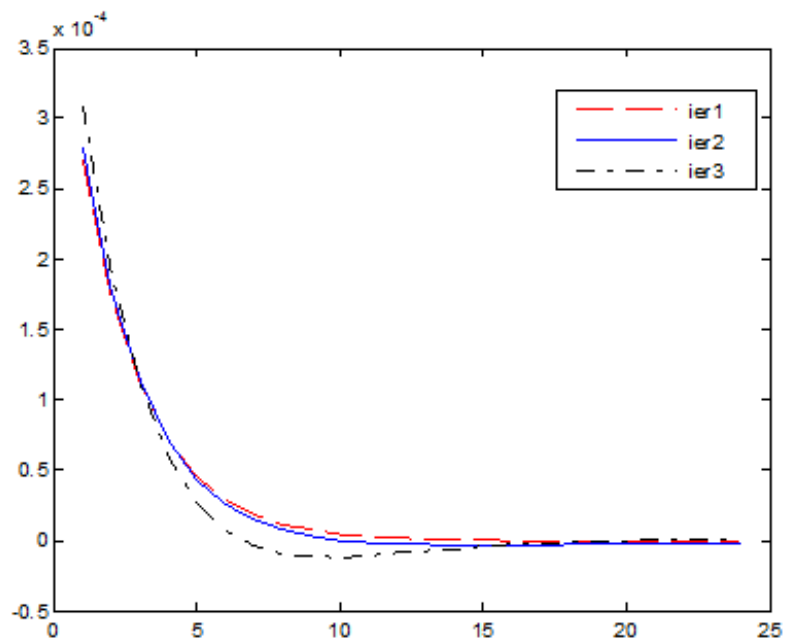
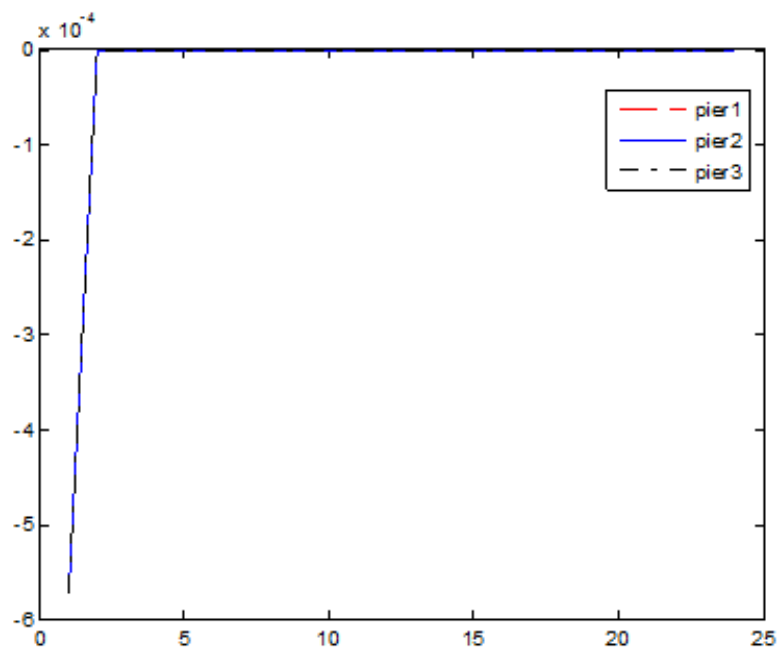


Figure 1.37: Domestic inflation with respect to monetary policy shocks



Chapter 2

Optimal Monetary Policy and Economic Fluctuations in a Small Open Economy with Liability Dollarization and Risk Premium Shocks

Abstract

In the literature of small open economies which employs dynamic general equilibrium models there has been discussions of optimal monetary policy rules, given the existence of liability dollarization. However there is still some mixed results on this discussion. An important feature of these models is that they do not include shocks to the risk premium from foreign borrowing. It has been shown that risk premium in relation to foreign borrowing has an impact on macroeconomic fluctuations. Furthermore there are studies which shows that liability dollarization is related to the risk premium from foreign borrowing. This paper revisits and extend this discussion. In particular this paper develops a New Keynesian Model consistent with liability dollarization, and includes shocks to the risk premium of foreign borrowing, and asks, what is the optimal monetary policy rule in this setting? In addition this paper compares the fluctuations of major macroeconomic variables under the optimal monetary policy rule, with that of a monetary policy rule which put high weight on real exchange rate stability and a monetary policy rule which put low weight on real exchange rate stability.

JEL: E1, E3, E5, F31, F34

Keywords: risk premium shocks, liability dollarization, fluctuations, optimal monetary policy.

2.1 Introduction

Macroeconomic stability is an important objective for many nations. An important policy instrument to achieve this objective is monetary policy. Due to many factors and complications which may influence the business cycle, conducting the appropriate monetary policy is not always obvious. An important factor which may influence the conduct of monetary policy in small open economies is the issue of liability dollarization. For a number of developing countries which have an open capital account, their residents may be in the following situation. On one hand if their residents borrow external funds from international capital markets, it must be denominated in foreign currency, and they must repay the principal and interest to the creditors in foreign currency as well. On the other hand they invest these funds in projects in the domestic economy which generate income in domestic currency. However the forward markets involving the domestic currencies of these countries are either non-existent or thin and illiquid. This makes it difficult and costly to hedge against exchange rate risk. In the literature this situation is termed as liability dollarization or currency mismatch (Eichengreen and Hausman, 1999, Calvo 2002 and Cepedes et.al. 2002, Calvo (2006), Nakamura, 2011). Furthermore Calvo (2006), has expressed concerns that liability dollarization present a challenge for small open economies in conducting monetary policy.

There are discussions on the impact of liability dollarization on the choice of monetary policy rule which in their analysis employ a New Keynesian Model. However there is still mixed results on this discussion. On one hand Cespedes et.al. (2004) assuming sticky wages concluded that a flexible exchange rate and inflation targeting provide more macroeconomic stability compared to a fixed exchange rate regime in insulating the economy against external shocks. In contrast Cook (2004) and Choi and Cook (2004) which assumes sticky prices found that a fixed exchange rate rule offer greater stability than an interest rule that targets inflation.

A common feature of the above papers is that they do not consider shocks in the risk premium from foreign borrowing as a driving force in the fluctuations of important macroeconomic variables. Honig (2009) shown that liability dollarization is a consequence and is influenced by the lack of faith of towards the government of the developing country which stems from the belief that they will not follow policies that promote long-run exchange rate stability. And political uncertainty and government policies uncertainty have an impact on the risk premium (Pastor and Veronesi 2013). Furthermore Korinek (2011) shown that there is a relationship between foreign currency debt and the risk premium from foreign borrowing. This paper further shows that a small increase in international risk aversion would affect the risk premium and then the volatility of macroeconomic variables in the small open economy.

In relation to monetary policy and macroeconomic stability, there are discussions on optimal monetary policy rules in small open economies. Kollmann (2002) computes a welfare maximizing Taylor rule in a business cycle model for a small open economy. This paper concludes that the optimal monetary policy rule is a Taylor rule of strict inflation targeting with strong anti-inflationary stance which entail significant nominal and real exchange rate volatility. Similarly Gali and Monacelli (2005) which also compute a welfare based optimal monetary for small open economies concluded that inflation targeting coupled substantial volatility of the exchange rate and the terms of trade is the optimal monetary policy for this small open economy. It should be noted that these paper are calibrated for developed countries small open economies and assume a frictionless international financial markets.

In contrast to the above Monacelli (2013) showed that openness of the economy requires optimal monetary policy to deviate from the canonical principle of strict price stability. Furthermore this paper concluded that the optimal monetary policy for an open economy is price stability coupled with some degree of real exchange rate stability. In addition Corsetti, Dedola and Leduc (2011), which incorporates international financial market imperfections

concluded that the optimal monetary policy is characterized by inflation targeting, output gap targeting and real exchange rate gap targeting.

The current paper revisits and extends the preceding discussion relating to optimal monetary policy in a small open economy under liability dollarization. In particular this study develops a New Keynesian small open economy model with liability dollarization which includes shock to the risk premium from foreign borrowing. To the best of the authors knowledge, this is the first study which employ such setting in a study of monetary policy under liability dollarization. With this model in mind this paper explore the questions what is the optimal monetary policy rule in this setting, and how does fluctuations of major macroeconomic variables compare between the optimal monetary policy rule with monetary policy rules which put high weight on real exchange rate stability with that of a monetary policy rule that put low weight on real exchange rate stability?

2.2 The Model

Consider a New Keynesian small open economy model. There are three agents in this economy: a unit mass of atomistic identical and infinitely lived households, a continuum of domestic producers and a monetary authority. These economic agents form rational expectations. There exists a world financial market. The economy is assumed as a net borrower in the world financial market. The households own labor and capital and purchase one period bonds denominated in domestic currency. The households can use the proceeds from the maturing bonds together with their wage earning and their return from capital to purchase more bonds, invest in capital and consumption goods. Further assume that the excess of households expenditure to the proceeds received is financed by borrowing foreign currency from the international capital market. In this model we assume (1) the economy faces liability dollarization. In other words, given a world interest rate, the domestic

households can only borrow and repay the principal and interest from foreign borrowing in foreign currency, (2) for simplicity assume that there is no forward foreign exchange market involving the domestic currency so that domestic agents cannot hedge against foreign exchange rate risk using the foreign exchange futures market.

2.2.1 Households

To model the household this paper uses a modified version of Schmitt-Grohe, Uribe (2003). A representative household choose consumption and labor and seeks to maximize preference. The households own production firms. The households obtain income from supplying labor and capital to firms and lumps sum profit from the firms producing intermediate goods and firms producing final goods. In addition the household accumulate debt at the end of the period t . Furthermore assume that the households purchase one period bonds denominated in domestic currency. The households can use the proceeds from the maturing bonds together with their wage earning and their return capital to purchase more bonds, invest in capital and consumption goods. The excess of households expenditure to the proceeds received is financed by borrowing foreign currency from the international capital market. This represents the constraint faced by the household.

The representative household problem is to choose consumption of final goods and hours of work that would maximize the households utility subject to the above budget constraint. The households maximization problem can be written as follows.

$$U_t = E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{(c_t - \frac{h_t^\omega}{\omega})^{1-\gamma} - 1}{1-\gamma} \right) \quad (2.1)$$

Subject to the following budget constraint:

$$(1+r_{t-1}^D)\frac{D_{t-1}}{P_t}+rk_tK_{t-1}+w_t h_t+\frac{profit_t}{P_t}+\frac{S_t}{P_t}D_t \geq (1+r^w+pr_{t-1})\frac{S_t}{P_t}D_{t-1}^++c_t+i_t+\frac{\psi_k}{2}(K_t-K_{t-1})^2+\frac{D_t}{P_t} \quad (2.2)$$

Denote $c_t, h_t, pr_t, D_t, D_t^*, Y_t, K_t, i_t, P_t, S_t$ as real consumption, hours of work, nominal domestic interest rate, risk premium from foreign borrowing, nominal domestic bonds (measured in domestic output), nominal foreign debt (measured in foreign output), final output, capital, real investment, and the domestic price, and nominal exchange rate. Following Notz and Rosenkranz (2014), the households budget constraint presented above exhibits liability dollarization.

We assume the following definition for the gross domestic interest rate and the gross foreign interest rate as follows.

$$R_{t-1}^D = 1 + r_{t-1}^D; R_{t-1}^F = 1 + r^w + pr_{t-1} \quad (2.3)$$

In borrowing foreign funds, the house has to pay a constant risk free interest rate and a risk premium. The risk premium in turn is endogenously determined by the amount of foreign debt and it is also influenced by an exogenous risk premium shock.

$$r_t^f = r^w + pr_t(D_t^*) \quad (2.4)$$

$$pr_t(D_t^*) = \psi_p \left(e^{\left(\frac{S_t D_t^*}{P_t} \right) - \left(\frac{S_t^*}{P} \right)} - 1 \right) + (sp_t - 1) \quad (2.5)$$

Following Notz and Rosenkranz (2014), the endogenous term of the risk premium equation above presents a feature of financial frictions.

The risk premium shock is exogenous follows an AR(1) process of the following form.

$$\ln sp_t = \rho_{sp} \ln sp_{t-1} + \varepsilon_{sp,t} \quad (2.6)$$

The first order conditions for the household optimization problem are as follows:

$$\lambda_t = \left(c_t - \frac{h_t^\omega}{\omega} \right)^{-\gamma} \quad (2.7)$$

This is the inter-temporal substitution condition of the household (Euler equation).

The intra-temporal substitution of the household between consumption and work is as follows:

$$\left(c_t - \frac{h_t^\omega}{\omega} \right)^{-\gamma} h_t^{\omega-1} = \lambda_t w_t \quad (2.8)$$

While the inter-temporal substitution between consumption and purchasing capital is as follows:

$$(1 + \psi_K(K_t - K_{t-1})) = \beta E_t \left[S_{t+1}^{DF} \left[\frac{\alpha Y_t}{K_{t-1}} + (1 - \delta) + \psi_K(i_t + \delta K_{t-1}) \right] \right] \quad (2.9)$$

The first order condition for borrowing foreign currency is the following.

$$\lambda_t = \beta \left[\left(c_t - \frac{h_t^\omega}{\omega} \right)^{-\gamma} R_t^F \frac{S_{t+1}}{S_t} \frac{P_t}{P_{t+1}} \right] \Leftrightarrow \lambda_t = \beta \left[\left(c_t - \frac{h_t^\omega}{\omega} \right)^{-\gamma} (1 + r^w + pr_t) \frac{S_{t+1}}{S_t} \frac{P_t}{P_{t+1}} \right]$$

$$\lambda_t = \beta \left[\lambda_{t+1} R_t^F \frac{S_{t+1}}{S_t} \frac{P_t}{P_{t+1}} \right] \Leftrightarrow \lambda_t = \beta \left[\lambda_{t+1} (1 + r^w + pr_t) \frac{S_{t+1}}{S_t} \frac{P_t}{P_{t+1}} \right] \quad (2.10)$$

While the first order condition for holding domestic bonds is the following.

$$\lambda_t = \beta \left[\lambda_{t+1} R_t^D \frac{1}{\pi_{t+1}} \right] \Leftrightarrow \lambda_t = \beta \left[\lambda_{t+1} (1 + r^D) \frac{1}{\pi_{t+1}} \right]$$

$$\lambda_t = \beta \left[\left(c_t - \frac{h_t^\omega}{\omega} \right)^{-\gamma} R_t^D \frac{1}{\pi_{t+1}} \right] \Leftrightarrow \lambda_t = \beta \left[\left(c_t - \frac{h_t^\omega}{\omega} \right)^{-\gamma} (1 + r^D) \frac{1}{\pi_{t+1}} \right] \quad (2.11)$$

Note if we combine equations (1.9) and (1.10) we get the uncovered interest rate parity (UIP) condition.

2.2.2 The Firm

The model specification for the production sector is a modified version of Dib (2011). The goods producing sector consists of domestically produced final goods producing firms and intermediate producing firms. Assume that there are a unit measure of intermediate producing firms indexed by $i \in [0, 1]$ which produces a differentiated product. The final goods firm produces Y_t by combining the intermediate goods $Y_t(i)$ as inputs using the following constant returns to scale technology.

$$Y_t = \left(\int_0^1 Y_t(i)^{\frac{\theta-1}{\theta}} di \right)^{\frac{\theta}{\theta-1}} \quad (2.12)$$

The final goods firms sells its product in a perfectly competitive market. Given the domestic price level P_t the profit maximizing problem of the final goods producers can be written as follows.

$$\max_{\{Y_t(i)\}} \left(\int_0^1 Y_t(i)^{\frac{\theta-1}{\theta}} di \right)^{\frac{\theta}{\theta-1}} - \int_0^1 P_t(i) Y_t(i) di \quad (2.13)$$

The first order condition of the above problem into the following demand curve for each intermediate goods producing firms products as follows.

$$Y_t(i) = \left(\frac{P_t(i)}{P_t} \right)^{-\theta} Y_t \quad (2.14)$$

For the intermediate goods producing sector, assume that the domestic intermediate goods is divided between intermediate goods domestically sold, $Y_{ht}(i)$, and exported, $Y_{xt}(i)$ so that

$$Y_t(i) = Y_{ht}(i) + Y_{xt}(i) \quad (2.15)$$

The demand function for the domestically used intermediate goods has the following form.

$$Y_{ht}(i) = \left(\frac{P_t(i)}{P_t} \right)^{-\theta} Y_{ht} \quad (2.16)$$

The production function common to all intermediate producing firms in the economy is a constant returns to scale technology which has the following form.

$$Y_t(i) = Z_t K_{t-1}^\alpha(i) h_t^\alpha(i) \quad (2.17)$$

The firms producing intermediate goods for use in the domestic economy each acts as a monopolistic competitor. Assume that the price setting ability of each of these firms are constraint the demand curve its faces for its product from the representative final goods

producing firms. In addition each firms producing intermediate goods for use in the domestic economy faces a convex price adjustment cost proportional to one unit of final goods as defined by Rotemberg (1982).

$$\Phi(P_t(i), P_{t-1}(i), P_t, Y_t) = \frac{\phi}{2} \left[\frac{P_t(i)}{P_{t-1}(i)} - 1 \right]^2 Y_t \quad (2.18)$$

The profit maximizing problem of the firms producing the intermediate goods is as follows.

$$\max_{\{K_{t-1}(i), h_{t-1}(i), P_t(i)\}} E_0 \sum_{j=0}^{\infty} \beta^j S_{t+j}^{DF} \left\{ \frac{P_t(i)}{P_t} Y_t(i) - \frac{\alpha Y_t}{K_{t-1}} K_{t-1}(i) - w_t h_t(i) - \frac{\phi}{2} \left[\frac{P_t(i)}{P_{t-1}(i)} - 1 \right]^2 Y_t \right\}; \beta \in (0, 1)$$

Subject to the following constraints:

$$Y_t(i) = \left(\frac{P_t(i)}{P_t} \right)^{-\theta} Y_t$$

$$Y_t(i) = Z_t K_{t-1}^\alpha(i) h_t^{1-\alpha}(i)$$

The first order condition for the domestically used intermediate goods producing firms are the following.

The FOC for using capital is the following.

$$\frac{\alpha Y_t}{K_{t-1}} = \frac{\alpha}{1-\alpha} w + t (Y_t)^{\frac{\alpha}{1-\alpha}} (Z_t)^{-\frac{\alpha}{1-\alpha}} (K_t)^{-\frac{\alpha}{1-\alpha}} \text{Insert equation 1.20} \quad (2.19)$$

The FOC for firmi to choose the price that maximizes profit $P_t(i)$ is the following

$$(1-\theta) + \frac{\theta}{1-\alpha} w_t \left(\frac{Y_t}{K_{t-1}} \right)^{\frac{\alpha}{1-\alpha}} Z_t^{\frac{\alpha}{1-\alpha}} - \phi(\pi_t - 1)\pi_t + \beta \phi E_t \left[\frac{\lambda_{t+1} \lambda_{t-1} Y_{t+1}}{\lambda_t \lambda_t Y_t} \phi(\pi_t - 1)\pi_t \right] = 0 \quad (2.20)$$

Denote the nominal exchange rate as S_t , following Dib (2011), assume that the intermediate goods producers cannot price discriminate so that the export price of the intermediate good is $P_t(i)/S_t$. It is also assumed that the foreign demand function for domestic exports produced by firm i is the following.

$$Y_t(i) = \left(\frac{P_t(i)}{P_t} \right)^{-\theta} Y_{xt} \quad (2.21)$$

The total foreign demand for exports of domestically produced intermediate goods follows from McCallum and Nelson (1999) and Kollman (2002) and assumed to be the following.

$$Y_{xt} = \left(\frac{P_t^* S_t}{P_t} \right)^{-\eta} Y_t^* \quad (2.22)$$

2.2.3 The Central Bank

Assume that the central bank of the small open economy actively manages short term interest rate R_t in response to deviation from output Y_t inflation π_t growth of money supply μ_t and the real exchnage rate S_t . In addition the monetary policy rule faces a monetary policy shock. This modified Taylor rule can be written as:

$$\ln \left(\frac{r_t^D}{r^D} \right) = \rho_y \ln \left(\frac{Y_t}{Y} \right) + \rho_\pi \ln \left(\frac{\pi_t}{\pi} \right) + \rho_s \ln \left(\frac{S_t}{S} \right) + \ln \nu_t \quad (2.23)$$

The variables without the time subscripts are in steady state. The monetary policy shock follows the following law of motion.

$$\ln \nu_t = \rho_\nu \ln \nu_{t-1} + \varepsilon_{\nu t}; \rho_\nu \in (0, 1) \quad (2.24)$$

2.2.4 Market Clearing Condition

Following Schmitt Grohe Uribe (2003), the final goods market condition is as follows.

$$\frac{S_t D_t^*}{P_t} = (1 + r^w + pr_{t-1}) \frac{S_t D_{t-1}^*}{P_t} + Y_t + c_t + i_t + \frac{\psi_K}{2} (K_{t+1} - K_t)^2 + \frac{\phi}{2} (\pi_t - 1)^2 Y_t \quad (2.25)$$

While the trade balance is given as follows.

$$tb_t = Y_t - c_t - i_t \quad (2.26)$$

And imports of final goods are given as follows.

$$Y_{mt} = \frac{tb_t - Y_t}{rer_t} \quad (2.27)$$

2.2.5 Equilibrium Conditions

Assuming symmetry among all consumers, domestic producers and importers, firms, the equilibrium condition for this model requires $\forall t \geq 0$,

$$D_t = 0$$

$$Y_t = Y_t(i)$$

$$Y_{ht} = Y_{ht}(i)$$

$$Y_{xt} = Y_{xt}(i)$$

$$P_t = P_t(i)$$

2.3 Parameters and solution method

To obtain the optimal monetary policy parameters, the model in this paper is solved model by using Sims (2000) second order accurate method. Welfare is evaluated by taking a second-order Taylor expansion of the utility function around the steady state. The solution of the model shows that the parameters for optimal for the monetary policy rule for output gap , for real exchange rate gap is while the optimal parameter value for inflation gap is . The calibration for the non-policy parameters follows from Schmitt-Grohe, Uribe (2003), Peters (2008), and Unsal (2013). For the elasticity of output with respect to capital α it is set at 0.32. The coefficient of relative risk aversion γ is set to be 2. The 1 plus the inverse of the intertemporal elasticity of substitution ω in labor supply is set to be 1.455. The capital adjustment cost parameter Ψ_k is set to be 0.028. The debt elastic risk premium parameter Ψ_p is set to be 0.000742. These parameter values are consistent with consistent with Schmitt-Grohe, Uribe (2003). The parameter of monopoly power ϕ is set to be 10. The parameter of price adjustment cost is set to be 120. These parameter values are consistent with Unsal (2013). Following Schmitt Grohe Uribe, the world interest rate in this model is constant. The world interest rate r^w is calibrated to be 0.02102. This implies the consumption elasticity rate of time preference β is set to be 0.979413. The output gap parameter ρ_y in the monetary policy rule is set to be 0.5. While the parameter for the inflation gap ρ_π is set to be 0.8098. This is consistent with Peters (2008).

This current study considers two different monetary policy rules. One which put a small weight on real exchange rate stabilization ρ_s in the monetary policy rule (case1). Another monetary policy rule is to put a large weight (in absolute value) on the real exchange rate

stabilization in the monetary policy rule (case 2). For the small weight, this paper set the value of the real exchange rate stability in the monetary policy rule as $\rho_s = 0.15668$. For the large weight, this paper set the weight on real exchange rate stabilization to $\rho_s = 6$.

2.4 Analysis

In this analysis will consider the impulse response functions of seven macroeconomic variables. These variables are domestic output (y), consumption (c), domestic inflation, current account-to-GDP ratio (ca), trade balance-to-GDP ratio (tb), foreign debt (d) and investment (i). This study considers five shocks; productivity shocks and foreign output shock and foreign inflation shock, risk premium shock and monetary policy shocks. The impulse responses is constructed for the three monetary policy rules; case 1 in which the weight on real exchange rate stability is low and case 2 in which the weight on real exchange rate stability is high as specified above and the optimal monetary policy rule case.

2.4.1 Productivity Shock

Consider a positive productivity shock. Following a positive productivity shock, domestic output (y) rise under the optimal monetary policy rule and, case1 and case 2 monetary policy rules mentioned above. Similarly, a positive productivity shock result into a rise in investment (i) and foreign debt (d) in all three monetary policy rule cases. And this shock results in a rise current account deficit-to-GDP ratio (ca) in all cases. Similarly a positive productivity shock result into a fall in trade balance surplus-to GDP-ratio in all three cases. In contrast, consumption and domestic inflation fell due to a positive productivity shock in case 1 and case 2 but it rose in the optimal monetary policy rule. (Figures 1 to 7 in the Appendix) On the dynamics of the fluctuations of macroeconomic, between the three monetary policy rules, the fluctuations of the macroeconomic variables under the optimal

monetary policy lies in between the monetary policy rules which put high weight on real exchange rate stability with monetary policy rules which put low weight on real exchange rate stability.

2.4.2 World output shock

Consider a positive productivity shock. Following a positive world output shock, domestic output (y) and consumption (c) rise under the optimal monetary policy rule and, case 1 and case 2 monetary policy rules mentioned above. Similarly, a positive productivity shock result into a rise in investment (i) and foreign debt (d) in all three monetary policy rule cases. And this shock results in a rise current account deficit-to-GDP ratio (ca) in all cases. Similarly a positive productivity shock result into a fall in trade balance surplus-to GDP-ratio in all three cases. In contrast, surplus of trade balance-to GDP ratio and domestic inflation fell due to a positive productivity shock in case 1 and case 2 but it rose in the optimal monetary policy rule. (Figures 8 to 14 in the Appendix) On the dynamics of the fluctuations of macroeconomic, between the three monetary policy rules, the fluctuations of the macroeconomic variables under the optimal monetary policy lies in between the monetary policy rules which put high weight on real exchange rate stability with monetary policy rules which put low weight on real exchange rate stability.

2.4.3 Foreign inflation shock

Now turning to a positive foreign inflation shock. Following a positive foreign inflation shock, this would increase domestic output on impact, then it fall. In addition a positive foreign inflation shock would increase current account deficit-to-GDP ratio, and domestic inflation. Furthermore a positive foreign inflation shock increases the trade balance surplus-to-GDP ratio and foreign debt. Also this shock increases the deficit of current account deficit-to-

GDP ratio. However, a positive foreign inflation shock results in a decrease in investment. (Figures 15 to 21 in the Appendix) Similarly as with Productivity shock and world output shock, the fluctuations of the macroeconomic variables under the optimal monetary policy lies in between the monetary policy rules which put high weight on real exchange rate stability with monetary policy rules which put low weight on real exchange rate stability.

2.4.4 Risk Premium shock

Consider a positive risk premium shock. Following a positive risk premium shock, domestic output (y) and consumption (c) rise under the optimal monetary policy rule and, case1 and case 2 monetary policy rules mentioned above. Similarly, a positive risk premium shock result into a rise in inflation and trade balance surplus-to-output ratio in all three monetary policy rule cases. However this shock results in a fall current account deficit-to-GDP ratio (ca) in all cases. Similarly a positive productivity shock result into a fall in foreign debt and investment in all three cases. (Figures 22 to 28 in the Appendix) Similarly as with Productivity shock foreign inflation shock and world output shock, the fluctuations of the macroeconomic variables under the optimal monetary policy lies in between the monetary policy rules which put high weight on real exchange rate stability with monetary policy rules which put low weight on real exchange rate stability.

2.4.5 Monetary policy shock

Finally consider a positive monetary policy shock. Following a positive risk premium shock, domestic output (y) and consumption (c) fall under the optimal monetary policy rule and, case1 and case 2 monetary policy rules mentioned above. Similarly, a positive monetary policy shock result into a fall in foreign debt, domestic inflation and current account deficit over GDP ratio in all three monetary policy rule cases. However this shock results in a

rise trade balance surplus to GDP ratio in all cases. Similarly a positive productivity shock result into a rise investment in all three cases. (Figures 29 to 35 in the Appendix). On the dynamics of the fluctuations of macroeconomic, between the three monetary policy rules, the fluctuations of domestic output, consumption and domestic inflation under the optimal monetary policy is the same with monetary policy rules which put high weight on real exchange rate stability with monetary policy rules which put low weight on real exchange rate stability except on impact of the monetary policy shock. The fall of domestic output on impact of the positive monetary policy shock under the optimal rule is less pronounced than under the other two monetary policy rules. However for foreign debt, current account deficit over GDP ratio, trade balance surplus to GDP and investment the fluctuations of the macroeconomic variables under the optimal monetary policy lies in between the monetary policy rules which put high weight on real exchange rate stability with monetary policy rules which put low weight on real exchange rate stability.

2.5 Conclusion

By specifying a New Keynesian model with liability dollarization and risk premium shocks, and computing the welfare maximizing optimal monetary policy, this paper found that the optimal monetary policy rule is characterized by price stability, output gap stability and some degree of exchange rate stability. This result is in line with the conclusion of Corsetti, Dedola and Leduc (2011) and Monacelli (2013). In addition the paper found that the optimal monetary policy rule entails that it is welfare maximizing for agents in the small open under liability dollarization to tolerate some degree of macroeconomic fluctuations and some degree of real exchange rate fluctuations.

Bibliography

- [1] Calvo, Guillermo A., 2002. “On dollarization”. *Economics of Transition*, 10 pp.393403.
- [2] Cespedes, Luis Felipe, Roberto Chang, and Andrs Velasco, 2002. “Dollarization of Liabilities, Net worth Effects, and Optimal Monetary Policy”, in *Preventing Currency Crises in Emerging Markets*, Sebastian Edwards and Jeffrey A. Frankel (eds).
- [3] Cespedes, Luis Felipe, Roberto Chang, and Andrs Velasco, 2004. “Balance Sheets and Exchange Rate Policy”, *The American Economic Review*, Vol. 94, No. 4 (Sep., 2004), pp. 1183-1193
- [4] Calvo, G.A, 2006. Monetary policy challenges in emerging markets: sudden stop, liability dollarization, and lender of last resort, , 12788.*NBER Working Paper*, No.12788.
- [5] Cavoli, Tony, 2009. “Is the fear of floating justified?: The East Asian experience”, *Journal of policy modeling*, Vol. 31, pp.1-16
- [6] Choi, Woon Gyu and David Cook. 2004. Liability dollarization and the bank balance sheet channel, *Journal of International Economics*, 64 (2004) 247 275.
- [7] Corsetti, Giancarlo, Luca Dedola and Sylvain Leduc, 2011. “Optimal monetary policy in an open economies.”, *Handbook of Monetary Economics*, Benjamin M. Friedman and Michael Woodford (ed.), edition 1, Vol. 3, No. 16, pp. 861933.
- [8] David, Cook. 2004. “Monetary policy in emerging markets: Can liability dollarization explain contractionary devaluations?”, *Journal of Monetary Economics*, No.51 (2004), pp. 1155 1181.
- [9] Dib, Ali, 2011. “Monetary Policy in Estimated Models of Small Open and Closed Economies”, *Open Economic Review*, No.22, pp.769-796.
- [10] Eichengreen, Barry and Ricardo Hausmann, 1999. “Exchange Rate and Financial Fragility”. *NBER working papre*, No. 7418

- [11] Honig, A. (2009). “Dollarization, exchange rate regimes and government quality”. *Journal of International Money and Finance* ,Vol.2, No.28,
- [12] Kaminsky, Graciela L. and Carmen M. Reinhart, 1998. “Financial Crises in Asia and Latin America: Then and Now”, *The American Economic Review* , Vol.88, No.2, pp. 444-448.
- [13] Kollman, Robert. 2002. The Exchange Rate in a Dynamic-Optimizing Business Cycle Model with Nominal Rigidities: A Quantitative Investigation., *Journal of International Economics* , No.55, pp.243-262.
- [14] Korinek, Anton. 2011. “Foreign Currency Debt, Risk Premia and Macroeconomic Volatility”, *European Economic Review* , Vol.55, pp. 371-385.
- [15] McCallum, B.T, and E. Nelson. 1999. “Nominal Income Targeting in an Open Economy Optimizing Model.”, *Journal of Monetary Economics*, No.43, pp.553 578.
- [16] Monacelli, Tommaso, 2013. “Is monetary policy in an open economy fundamentally different? “, *IMF Economic Review*, Vol.61, No.1, pp. 6-22.
- [17] Nakamura, Chikafumi, 2011. “Currency Mismatch, Balance-sheet effect and Monetary Policy”, *Journal of International Economic Studies* , Vol.25 pp. 103128.
- [18] Notz, Stefan and Peter Rosenkranz, 2014. “Business Cycles in Emerging Markets: the Role of Liability Dollarization and Valuation Effects”. *University of Zurich Working Paper*, No.163.
- [19] Pastor, Lubos, Pietro Veronesi. 2013. Political Uncertainty and Risk Premia , *Journal of Financial Economics*, No. 110, pp. 520545.
- [20] Peters, Amos C., 2008. “Exchange Rate targeting in an Estimated Small Open Economy”, mimeo, University of North Carolina-Chapel Hill.
- [21] Rotemberg, J.J. 1982. “Sticky Prices in the United States”, *Journal of Political Economy*, Vol.90, No.6, pp. 11871211.

Appendices

Figure 2.1: Domestic output with respect to productivity shock

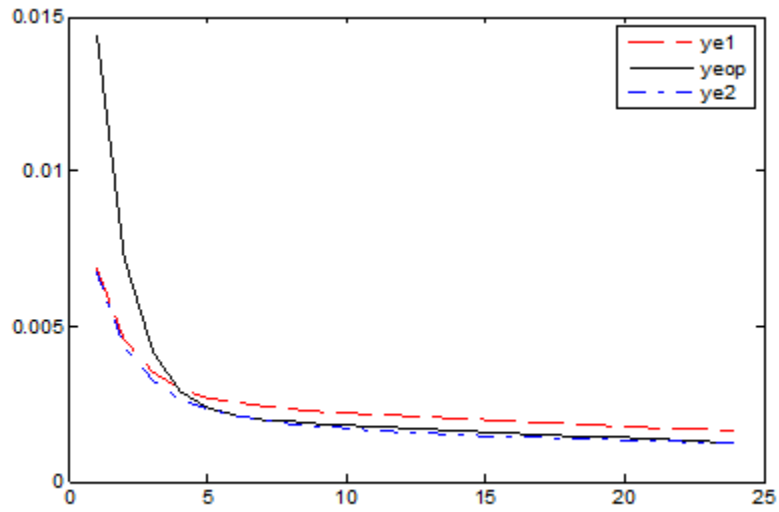


Figure 2.2: Consumption with respect to productivity shock

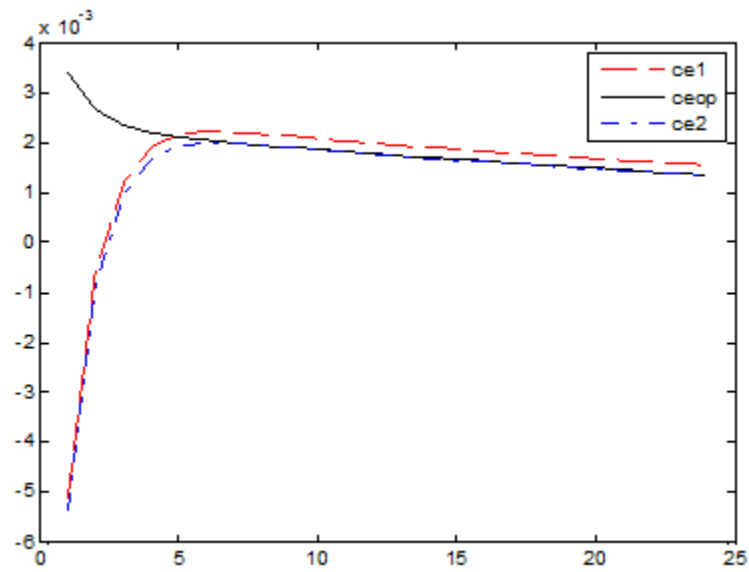


Figure 2.3: Current account deficit to GDP ratio with respect to productivity shock

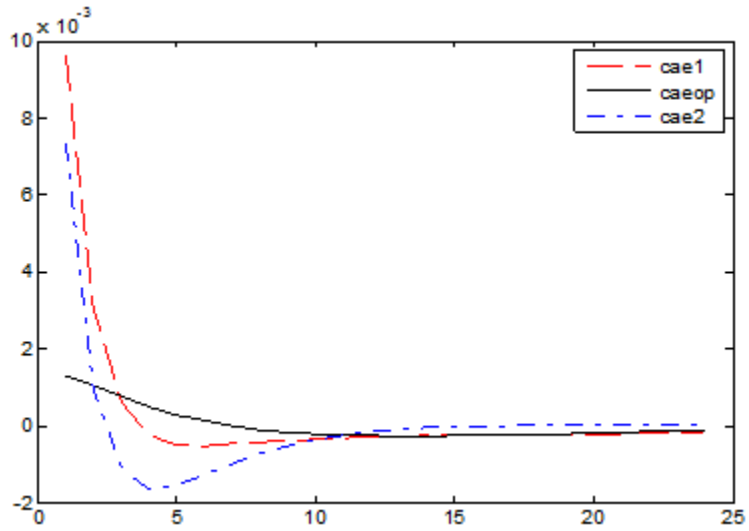


Figure 2.4: Surplus of trade balance to GDP ratio with respect to productivity shock

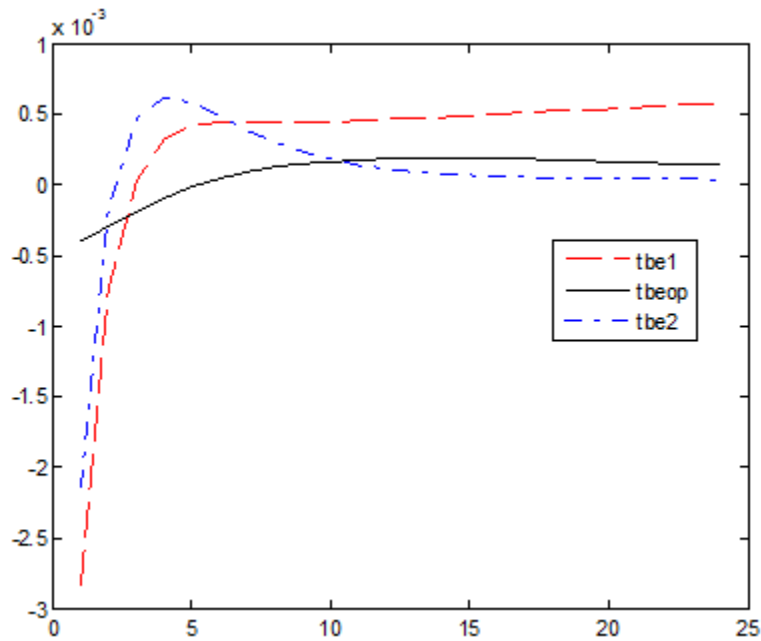


Figure 2.5: Foreign debt with respect to productivity shock

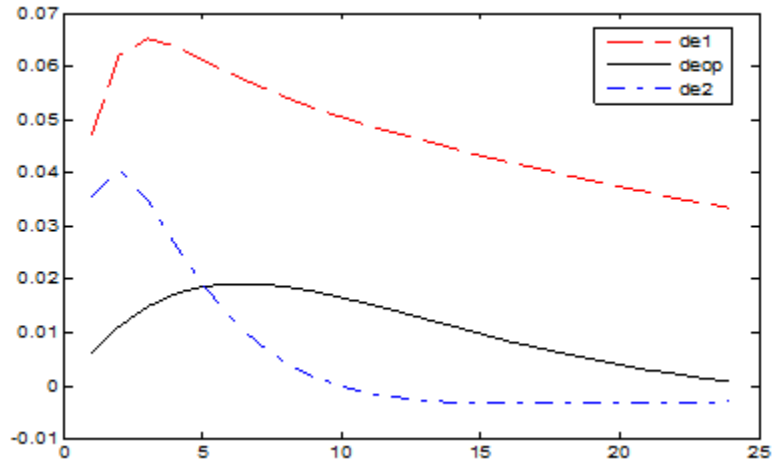


Figure 2.6: Investment respect to productivity shock

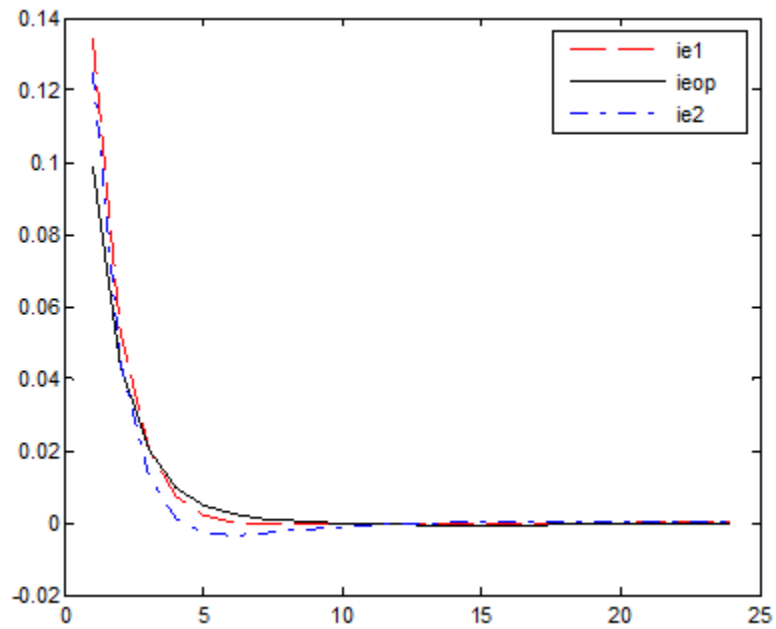


Figure 2.7: Inflation respect to productivity shock

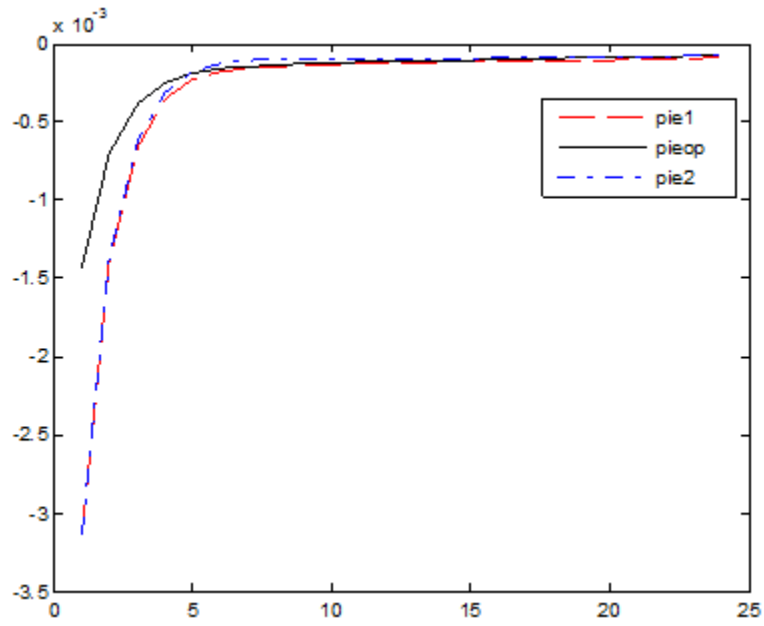


Figure 2.8: Domestic output with respect to world output shock

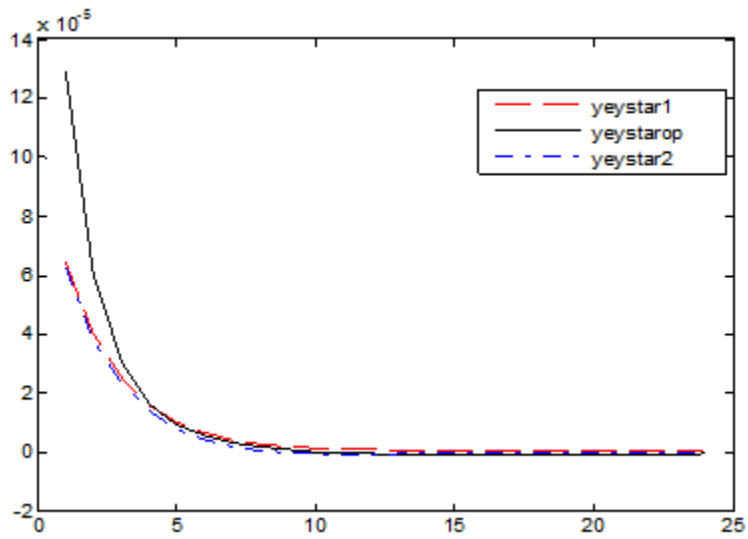


Figure 2.9: Consumption with respect to world output shock

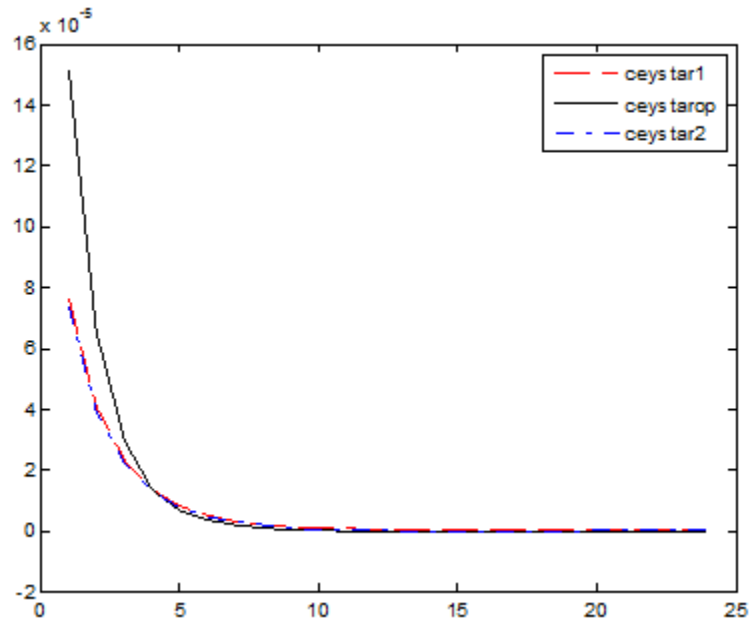


Figure 2.10: Current account deficit to GDP ratio with respect to world output shock

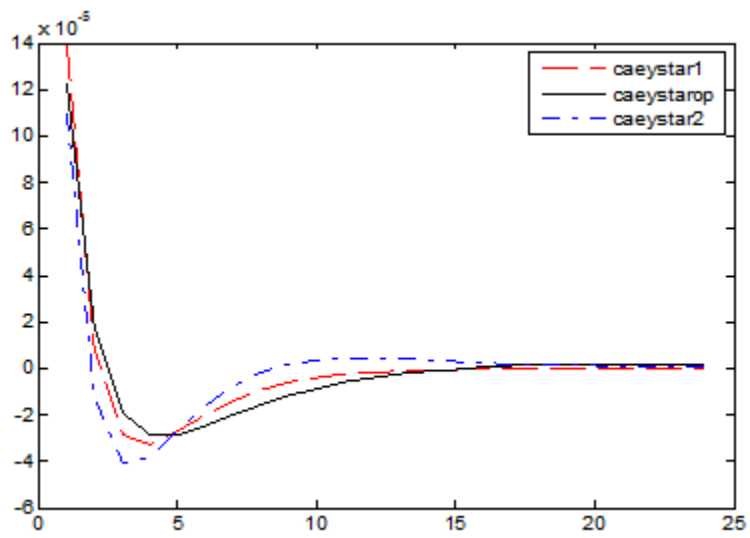


Figure 2.11: Surplus of trade balance to GDP ratio with respect to world output shock

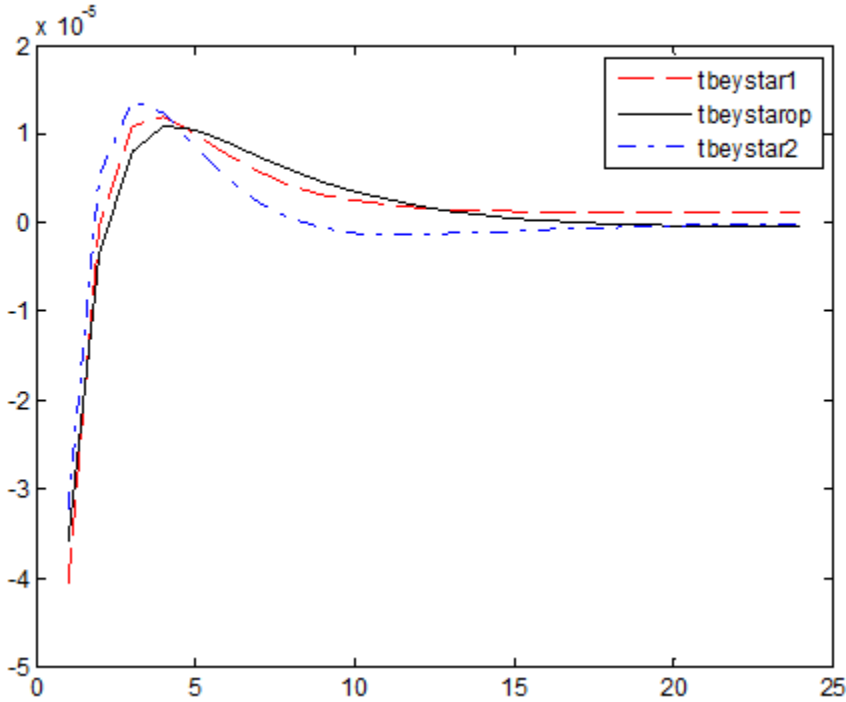


Figure 2.12: foreign debt with respect to world output shock

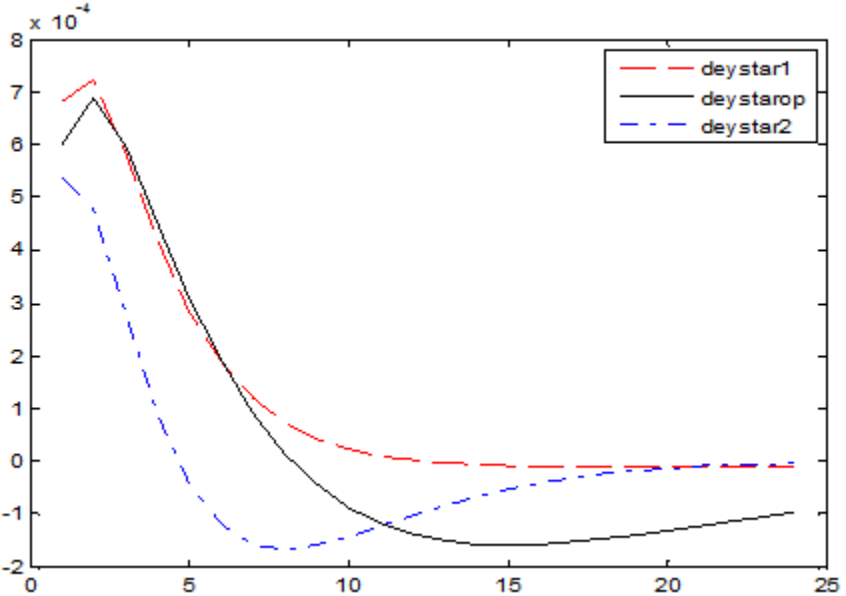


Figure 2.13: Investment with respect to world output shock

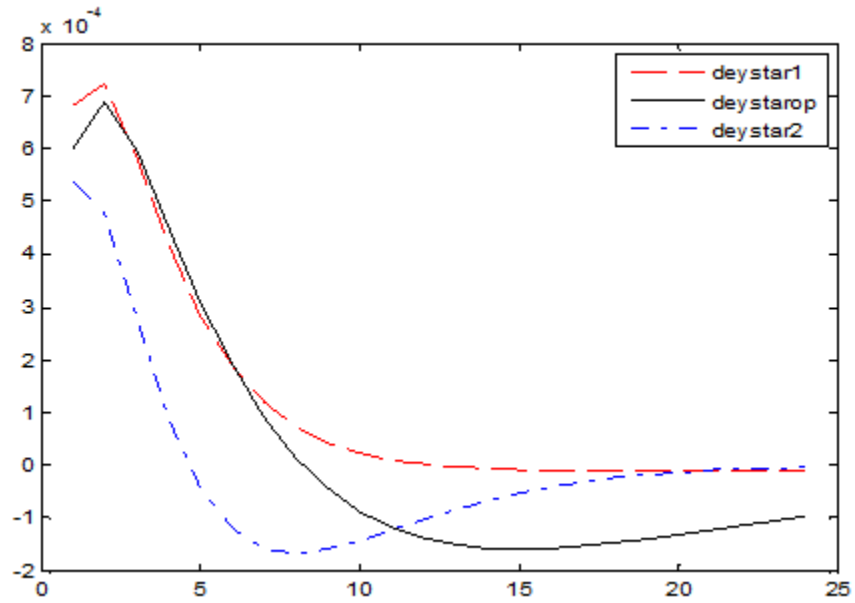


Figure 2.14: Domestic inflation with respect to world output shock

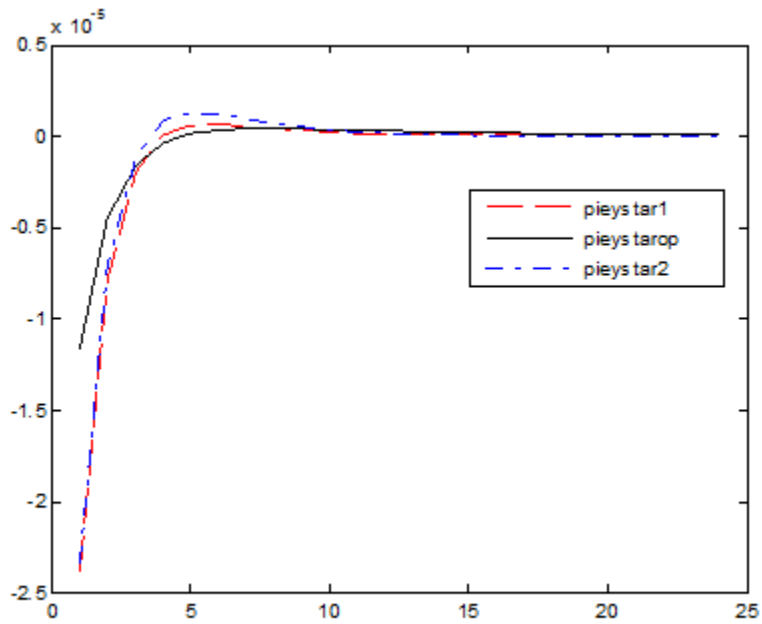


Figure 2.15: Domestic output with respect to foreign inflation shock

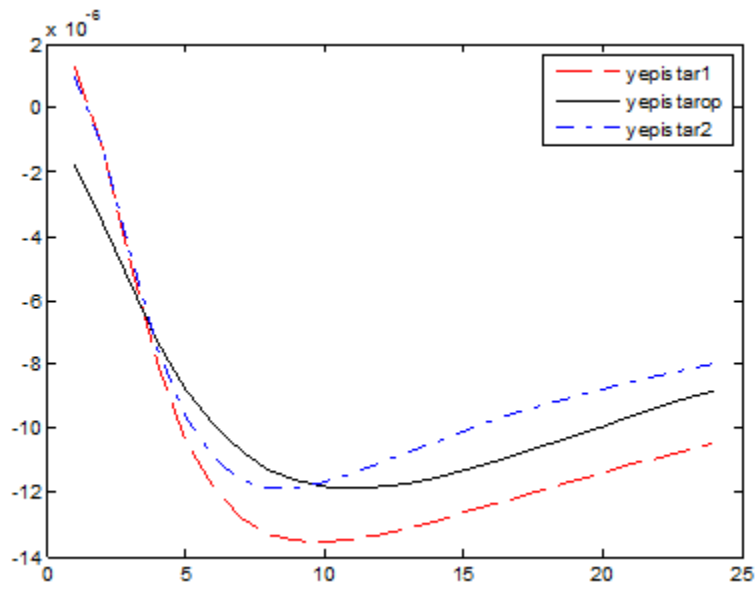


Figure 2.16: Consumption with respect to foreign inflation shock

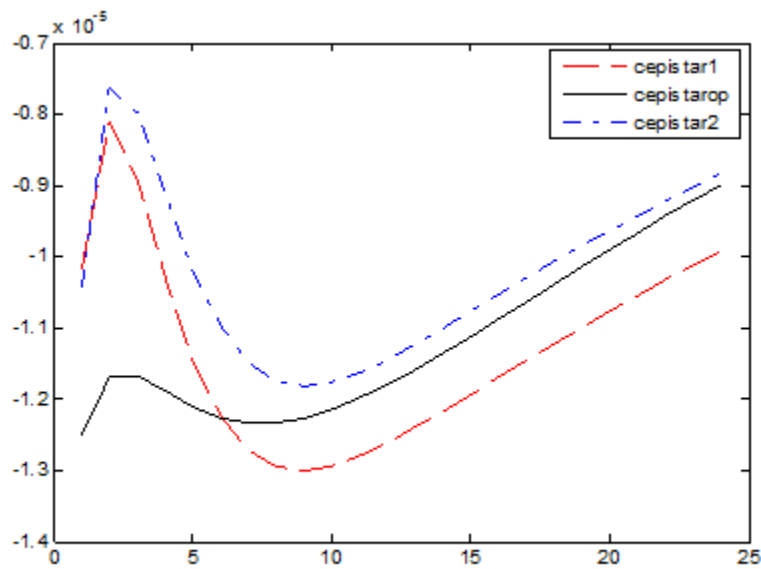


Figure 2.17: Current account deficit to GDP ratio with respect to foreign inflation shock

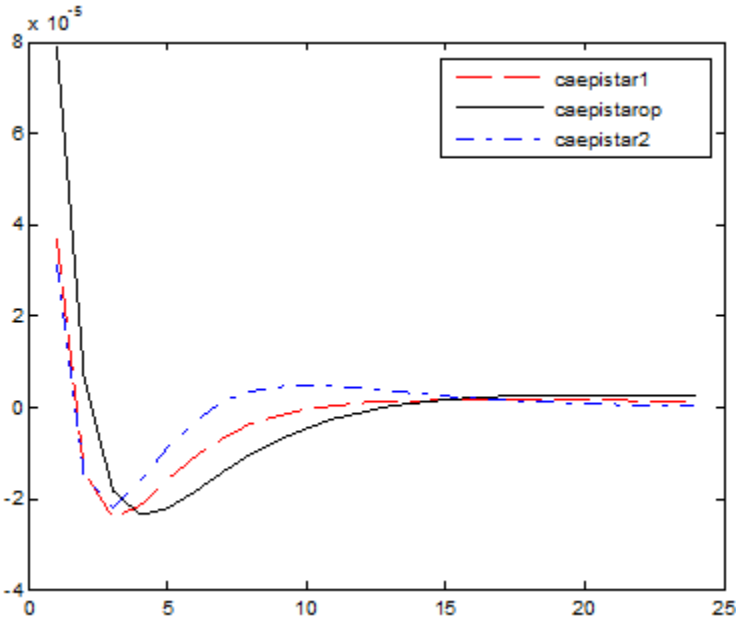


Figure 2.18: Trade balance surplus to GDP ratio with respect to foreign inflation shock

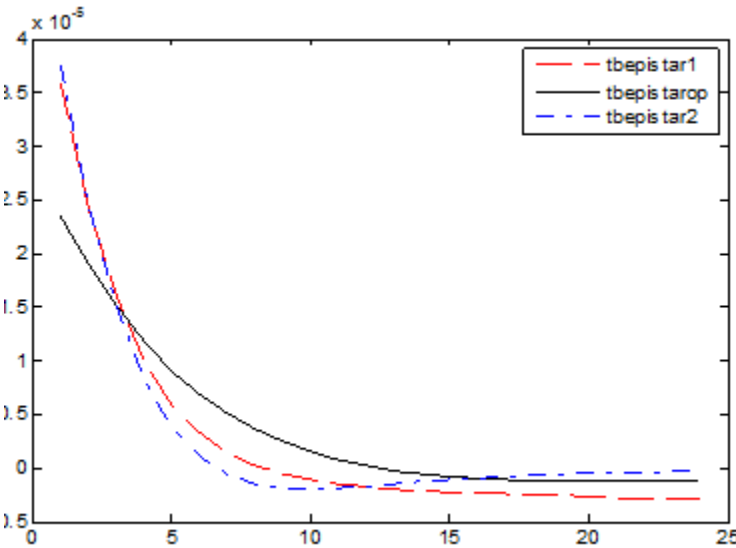


Figure 2.19: Foreign debt with respect to foreign inflation shock

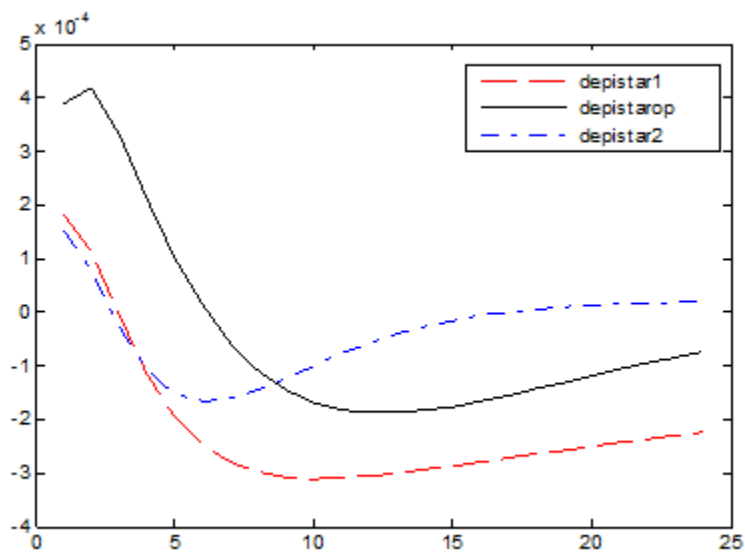


Figure 2.20: investment with respect to foreign inflation shock

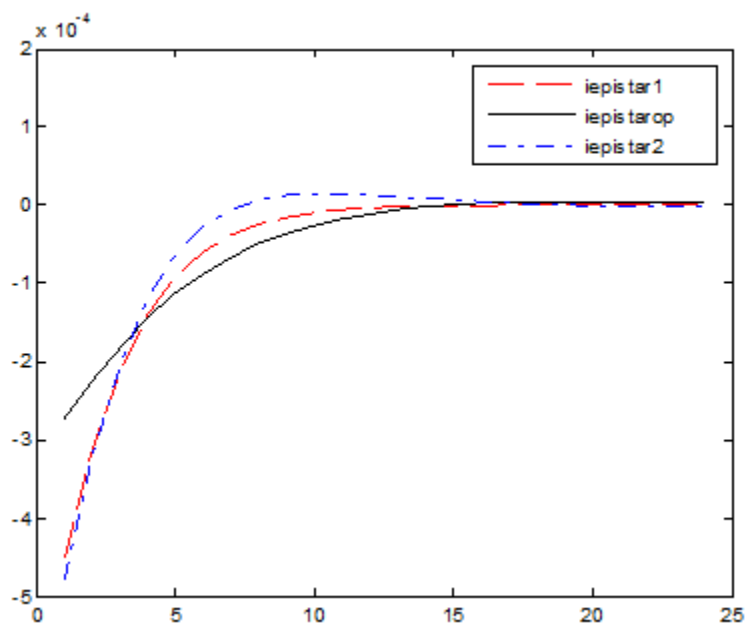


Figure 2.21: Domestic inflation with respect to foreign inflation shock

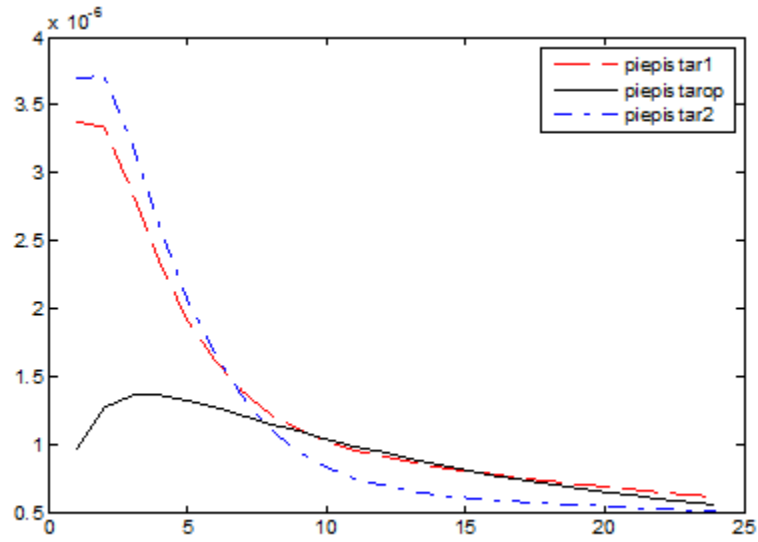


Figure 2.22: Domestic output with respect to risk premium shocks

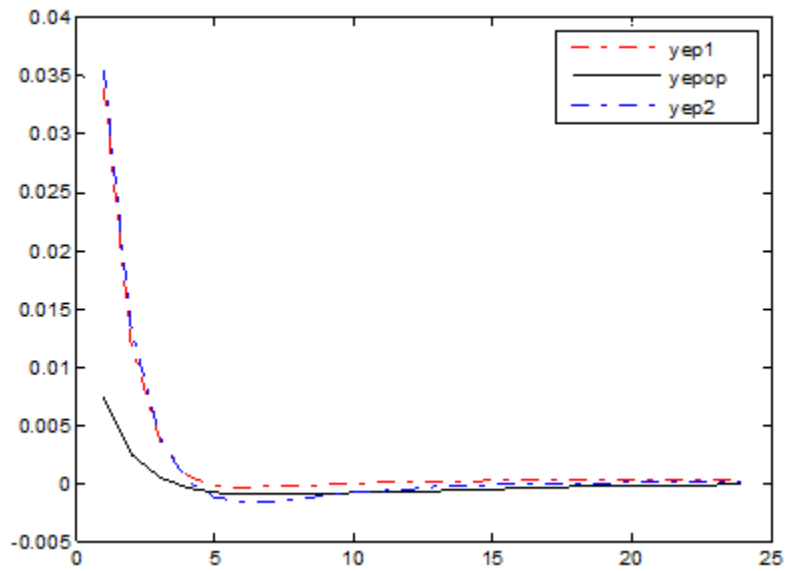


Figure 2.23: Consumption with respect to risk premium shocks

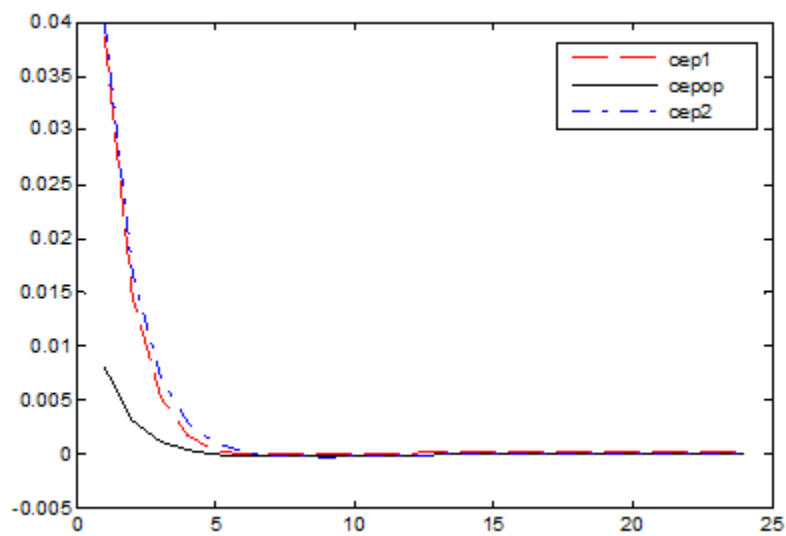
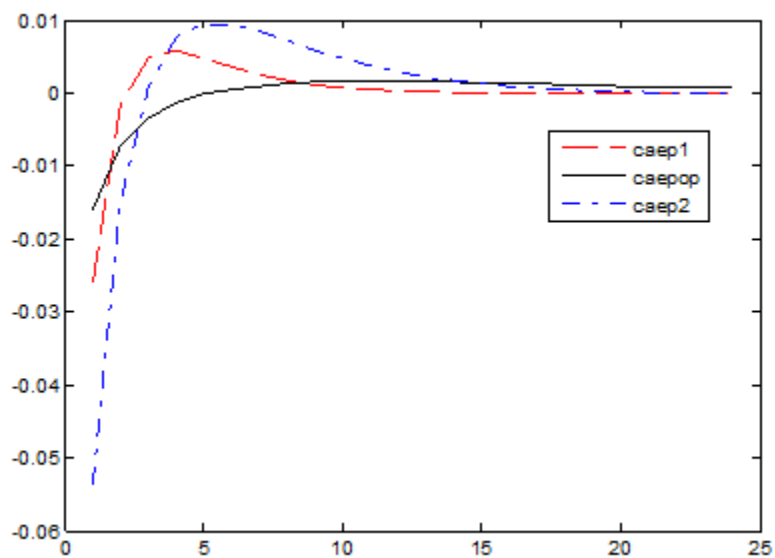


Figure 2.24: Current account deficit-to-GDP ratio with respect to risk premium shocks



|

Figure 2.25: Trade balance surplus-to-GDP ratio with respect to risk premium shocks

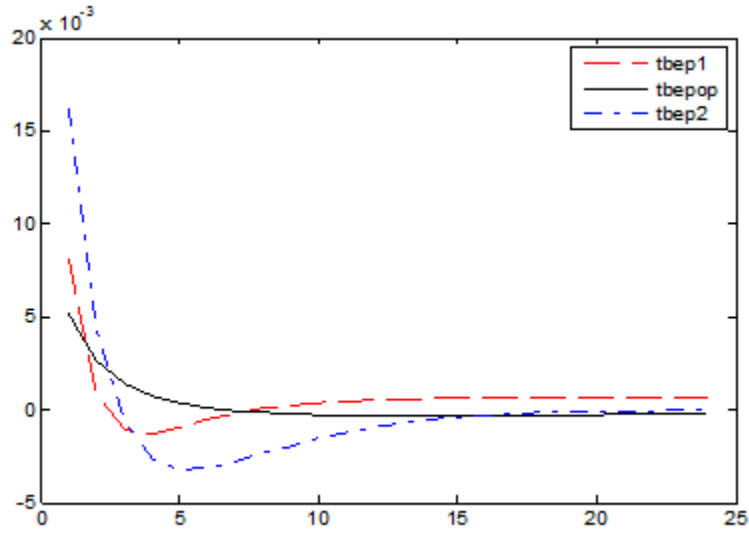


Figure 2.26: Foreign debt with respect to risk premium shocks

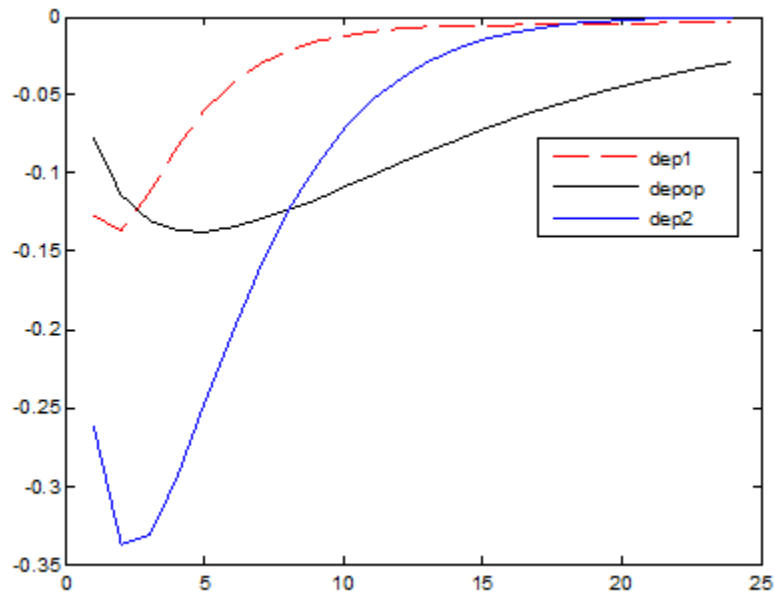


Figure 2.27: Investment with respect to risk premium shocks

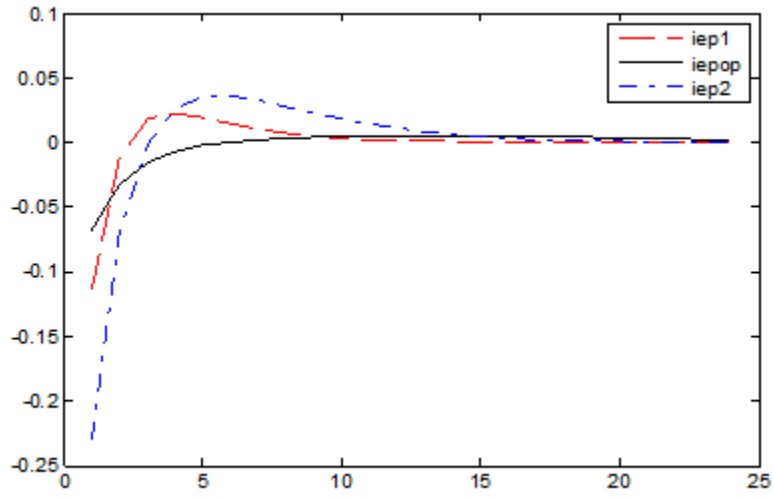


Figure 2.28: Domestic inflation with respect to risk premium shocks

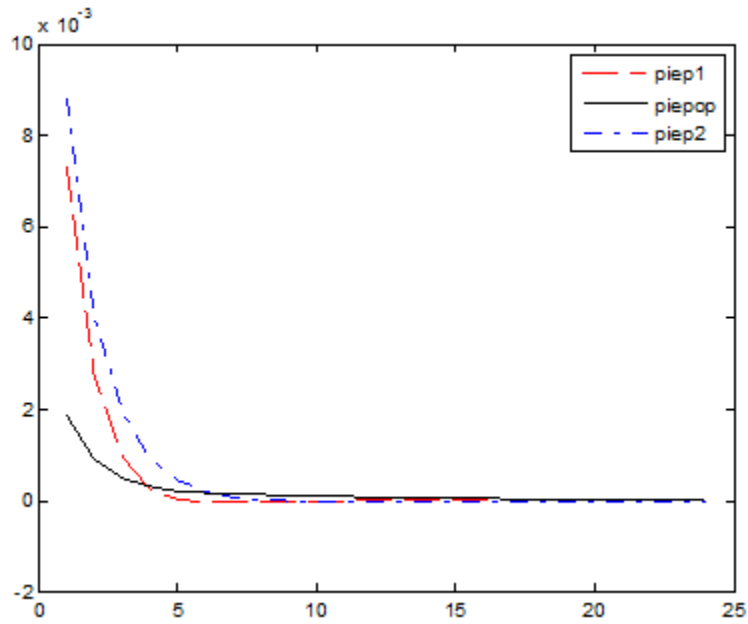


Figure 2.29: Domestic output with respect to monetary policy shocks

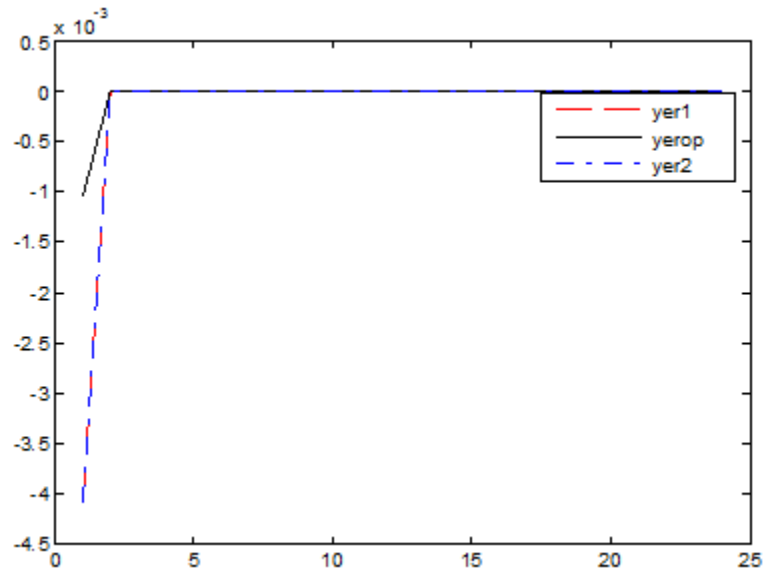


Figure 2.30: Consumption with respect to monetary policy shocks

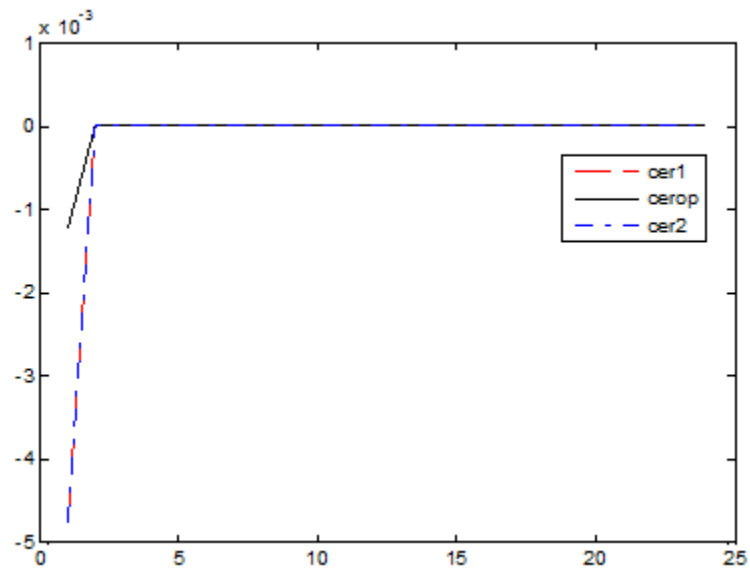


Figure 2.31: Current account deficit-to-GDP ratio with respect to monetary policy shocks

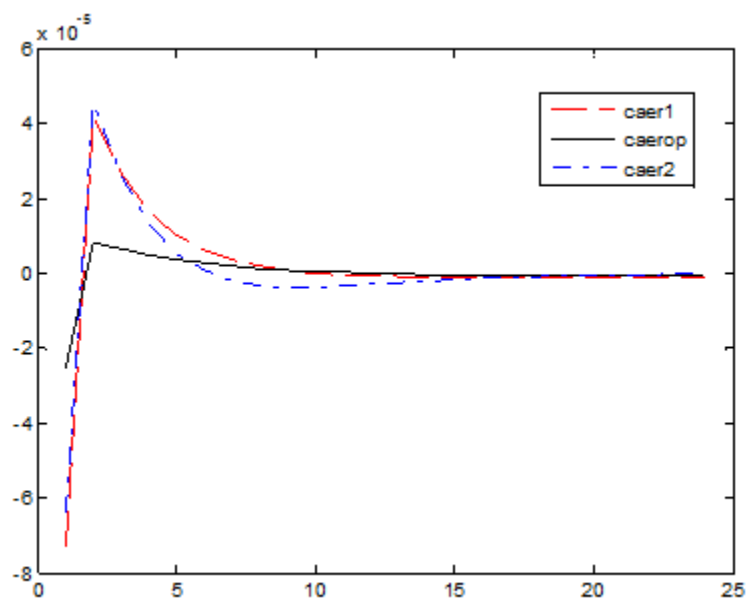


Figure 2.32: Trade balance surplus-to-GDP ratio with respect to monetary policy shocks

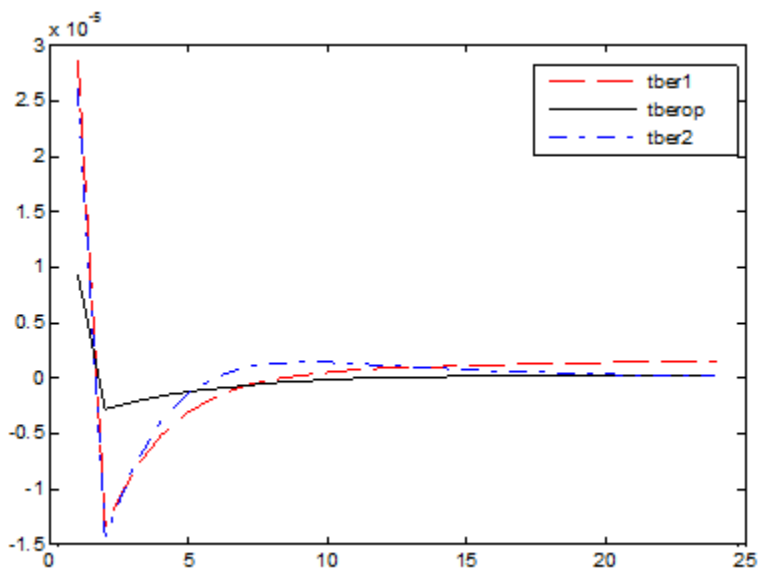


Figure 2.33: Foreign debt with respect to monetary policy shocks

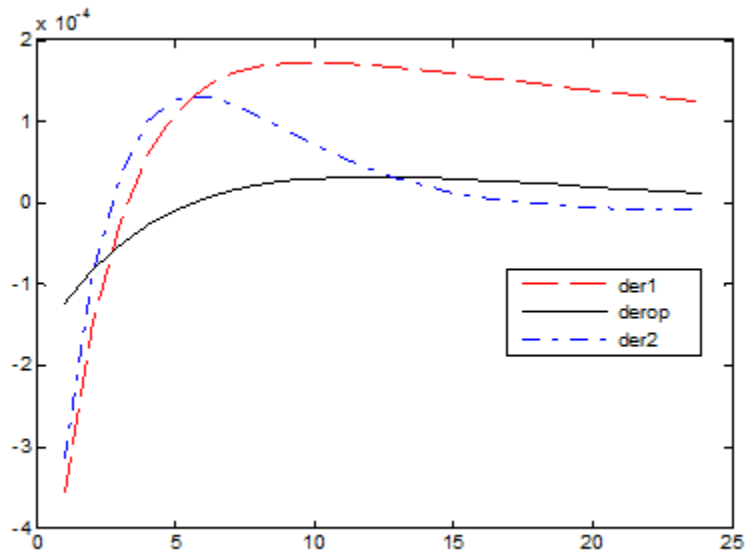


Figure 2.34: Investment with respect to monetary policy shocks

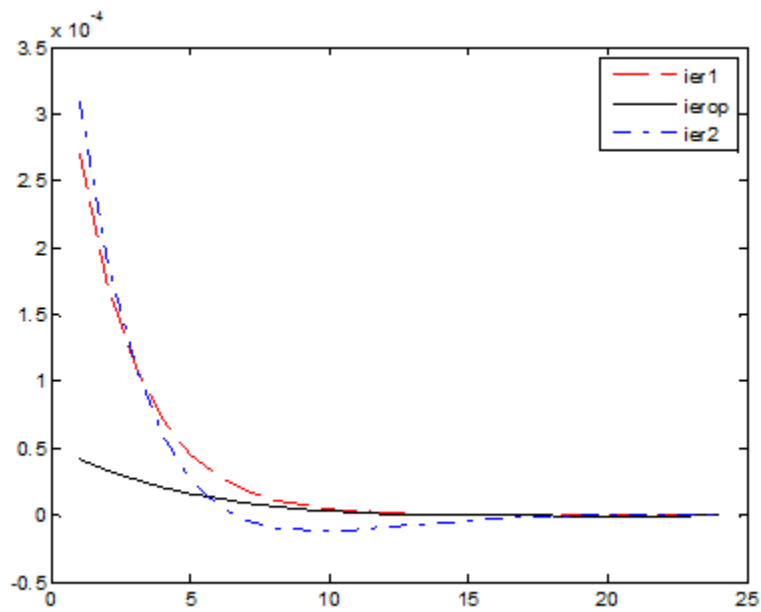
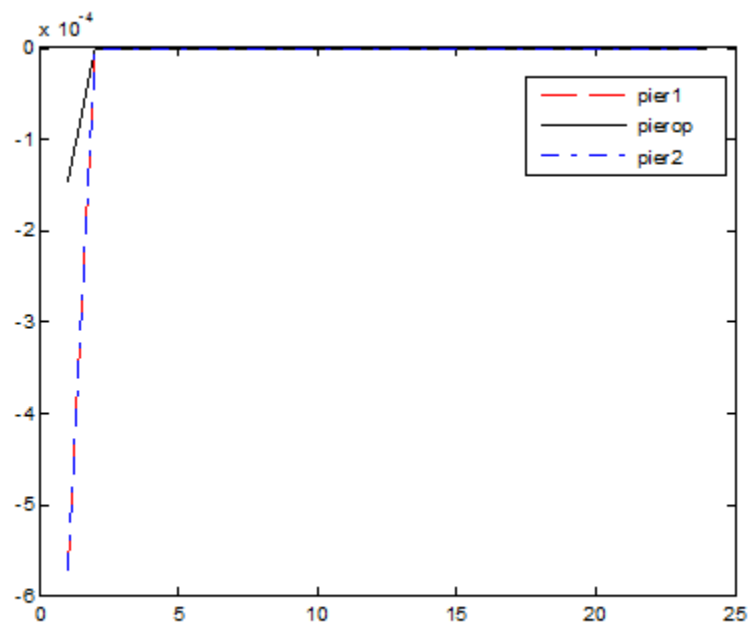


Figure 2.35: Domestic inflation with respect to monetary policy shocks



Chapter 3

Foreign Interest Rate Shocks, Monetary Policy Shocks and Bank Credit in Small Open Developing Economies: A Structural VAR Analysis

Abstract

How does foreign interest rate shocks and monetary policy shocks affect the quantity of bank credit to the domestic private non-financial sectors in small open developing countries? To what extent does monetary policy can influence the quantity of bank credit in these countries? This paper uses a structural vector autoregressive (SVAR) model on a sample of six small open developing countries to answers these two questions. This paper found that an increase in foreign interest rates can either increase or decrease the quantity of bank credit, depending on how strong the increase in foreign interest rate shocks affect total interest income compared to the total interest cost of the banks balance sheet. On the other hand, it is found that the impact of a monetary contraction is to reduce the quantity of bank credit, which is consistent with the finding from previous literature. In addition, it is found that, at best, monetary policy can influence quantity of bank credit only in the short run. With the exception of Mexico, this paper found that both monetary policy and foreign interest rates influences the quantity of bank credit in these economies in the longer horizon. For Mexico, foreign interest rates dominates monetary policy in influencing the quantity of bank credit in the longer horizon. These results suggests that the monetary authority of the small open developing countries have limited influence on the quantity of domestic bank credit.

JEL: E44, E51, F34, E52

Keywords: monetary policy, foreign interest rate, bank credit, developing countries

3.1 Introduction

Macroeconomic stability is an important goal for many nations. An instrument to achieve this objective is monetary policy. One of the channels in which monetary policy decisions can be transmitted into changes of macroeconomic variables is through the credit channel transmission mechanism. According to Adrian and Shin (2011), the global financial crisis which erupted in 2007 has demonstrated the importance of financial intermediation for macroeconomic stability and monetary policy decision making.

A sector which has an important role in the provision of credit to the private non-financial sector is the banking sector. In developing countries, the banking sectors role in credit provision is more important than non-bank financial institutions. According to the data from The Bank of International settlement, in developing countries, roughly 81 percent of credit to the private non-financial sector was provided by the banking sector. While in developed countries, around 56 percent was provided by the banking sector. (See tables A1. And A.2 in the Appendix).

There is a large literature which focuses on the impact of monetary policy shocks on bank credit. A notable work among them is the paper by Bernanke and Blinder (1992). This paper provided the first empirical evidence of the bank lending channel transmission mechanism for the United States. This paper found that a 1 standard deviation shock of the Feds Funds Rate (a monetary contraction) results in a fall of the quantity of bank credit, but with a lag. Vera (2012) extended the work of Bernanke and Blinder (1992) by augmenting the data set to include current data points. This paper found similar conclusions as Bernanke and Blinder (1992), but in addition it found that the effect of monetary policy shocks on quantity of bank credit has significantly decreased over time.

For small open economies, their macroeconomic conditions, and monetary policy decision may be influenced by shocks to foreign interest rates such as shocks to the Federal

Funds Rate. In turn this shocks may also have an impact on quantity of bank lending to the private non-financial sector in these set of countries.

Surprisingly, there are relatively few literature which focus on how foreign interest rate affects quantity of bank credit to the private non-financial sector in a small open economy. Zanforlin (2011) found that the real effective exchange rate appears to be positively associated with the quantity of domestic bank credit to the private sector. And the cost of foreign funding is negatively associated with the quantity of domestic bank credit.

Considering that on one hand for a small open developing economy, opening up its domestic economy's financial system results in shocks to international capital markets, such as shocks to foreign interest rates, exerting some influence on the domestic economy. On the other hand monetary authority of these countries conducts monetary policy as an attempt to influence the macroeconomic outcomes of their domestic economy. And based on arguments previously mentioned above, both monetary policy shocks and foreign interest rate shocks, may have an influence on the quantity of domestic bank credit to the private non-financial sector in a small open developing economy. Considering these arguments, it would be interesting to investigate more closely, what is the impact of foreign interest rate shock and monetary policy shocks on the quantity of domestic bank credit to the private non-financial sector in a small open developing economy? In addition it would be interesting to analyze the contribution of monetary policy shocks and foreign interest rate shocks towards variation of the quantity of domestic bank credit in these set of countries. In particular we ask the question, among the aforementioned two shocks, which one (if any) dominates the variation of the quantity of domestic bank credit to the private non-financial sector in these countries? To the best of the authors knowledge, this is the first paper which poses such questions.

The contribution of this paper to the literature is to contribute to the currently limited discussion on how monetary policy shock in one hand and foreign interest rate on the other hand, affects the quantity of domestic bank credit in a small open developing economy. In

addition this paper would provide insight on to what extent does central banks of small open developing economies can influence the quantity of their domestic private bank lending in the face of foreign interest rates shocks.

3.2 Theoretical argument on how monetary policy for- eign interest rate can affect bank credit

This section presents three arguments on how monetary policy can effect bank lending to the private non-financial sectors. The first is the balance sheet credit channel of transmission mechanism proposed by Bernanke and Gertler (1999). The second is the bank lending channel transmission mechanism proposed by Bernanke and Blinder (1992). The third is the argument proposed by Adrian and Shin (2011).

3.2.1 Balance sheet credit channel of transmission mechanism.

The balance sheet credit channel of transmission mechanism was proposed by Bernanke, Gertler and Gilchrist (1999). This argument posits that a contractionary monetary policy results to an increase of interest rate. The increase in interest rate result in a fall in the value of the firms balance sheets. The reason for this result is because of the negative relationship between price bonds and rate of return of bonds. The rise in the interest rate would decrease the price of bonds, and thus reduce the value of firms balance sheet.

Assuming that firms are financially constrained, a decrease in the value of their balance sheets results in the fall in the ability of the firm to supply sufficient collateral to obtain bank credit. This in the end reduces ability of the firm to obtain bank credit. All else equals and assuming that banks are willing to supply credit as long as they are provided with sufficient collateral, thus in the end the quantity of bank credit falls. For future reference

for the ordering of variables in order to identify shocks in a vector autoregressive (VAR) analysis, the above argument suggests that bank lending should come after the monetary policy instrument.

3.2.2 Bank lending channel transmission mechanism.

The bank lending channel transmission mechanism was put forward by Bernanke and Blinder (1992). The argument is as follows. Given a contractionary monetary policy, this results in an increase of interest rate. The increase in interest rate result in a fall in the value of the banks balance sheets. This result in the value of banks assets set aside for reserves falls. Because banks has to meet their required reserves and may wish to hold a certain amount of non-required reserves (or excess reserves), thus they may have to reduce their new lending supplies (and or retire some existing loans by increasing the interest rate charged on these loans) in order to meet these reserve needs. With the assumptions that firms are financially constrained, in the end the quantity of bank credit falls. For ordering of variables (identification of shocks) in a VAR analysis, Bernanke and Blinder (1992) suggests that bank credit should come after the monetary policy instrument (policy rate of the domestic economy).

3.2.3 Adrian and Shin (2011)

A third argument on how monetary policy shocks can effect bank lending to the private non-financial sectors is put forward by Adrian and Shin (2011). This paper uses the concept of Net Interest Margin and term spread. Net Interest Margin (NIM) in this paper is defined as the difference between the total interest income on the asset side of the banks balance sheet and the interest expense on the liabilities side of its balance sheet. It determines the profitability of bank lending and increases the present value of bank income, thereby

increasing the forward-looking measures of bank capital. NIM is an average concept that applies to the stock of all loans and liabilities on the balance sheet. Whereas the term spread indicates the profitability of the marginal loan that is added to the balance sheet of the bank. Adrian and Shin (2011) argues that the term spread influences future NIM.

The argument on how monetary policy can affect bank lending according to Adrian and Shin (2011) is as follows. A monetary contraction result into a rise in short term interest rate. The rise in short term interest rate results in a fall of the term spread between long-term and short term interest rate. The fall in the term spread result in a fall the marginal profitability of an extra dollar of loans in the banks balance sheets. This result in lower NIM. A fall of NIM result in a fall of the present value of banks income and a fall in the forward looking measure of banks capital. The fall in the forward looking measure of banks capital reduces the risk bearing capacity of the banks. And thus banks lending supply falls. With the assumptions that firms are financially constrained, in the end the quantity of bank credit falls. For ordering of variables (identification of shocks) in a VAR analysis, the argument for this paper suggests that bank credit should come after the monetary policy instrument (policy rate of the domestic economy).

3.2.4 Argument on the impact of a shock to foreign interest rate on domestic bank lending

To provide an argument how shocks to foreign interest rate affects domestic bank lending in a small open developing economy which borrows in the international capital market, I follow and modify the argument from Adrian and Shin (2011).

Given a small open developing economy with a bank system which hold foreign assets in their portfolio and also borrows from international capital market. Suppose there is a rise in foreign interest rate. This would increase the cost of borrowing of foreign funds and

the interest income from holding foreign assets for the domestic banks of the small open economy. Following the argument of Adrian and Shin (2011), I argue that, due to the rise in foreign interest rate, there are two possibilities that bank credit may be affected. Bank credit may increase or instead it may decrease.

For the argument where the effect of a rise in foreign interest rate is to decrease bank credit is as follows. By the argument of Adrian and Shin (2011), a rise in foreign interest rate results in an increase of the total interest cost of the liabilities side of the banks balance sheets. If this increase of the total interest cost is not matched by an increase of interest income from foreign assets held by the bank, then total interest cost of the liabilities side increases relative to the total interest income of the asset side of the banks balance sheet. This would result in reduction of NIM. As argued by Adrian and Shin (2011), a fall of NIM (or a negative NIM) result in a fall of the present value of bank income and a fall in the forward looking measure of the banks capital. The fall in the forward looking measure of the banks capital reduces the risk bearing capacity of the banks. The fall of the risk bearing capacity of the banks result in bank lending supply to fall. With the assumptions that domestic firms are financially constrained, in the end bank credit falls.

Conversely if instead, the rise in foreign interest rate increases the total interest income from foreign assets held by the bank relative to the rise of total interest cost of the liabilities side. This would result in an increase of NIM. A rise of NIM results in a rise of the present value of bank income and a rise in the forward looking measure of bank capital. The rise in the forward looking measure of bank capital increases the risk bearing capacity of the banks, and thus results in bank lending supply to rise. With the assumptions that domestic firms are financially constrained, in the end quantity of bank credit rises in this economy. For ordering of variables (identification of shocks) in a VAR analysis, the above argument suggest that bank credit should come after foreign interest rate.

3.3 Structural Vector Autoregressive (SVAR) Model

In this section I outline the setup of the eight variable SVAR model, its identification scheme, and data used in the analysis. The identification scheme of the SVAR model which I apply in this analysis is an extension of the model proposed by Kim and Roubini (2000).

3.3.1 The model setup

The model in this paper considers eight endogenous variables. Seven of the variables are world oil price, Federal Funds Rate, industrial production, consumer price index (CPI), base money (M1), short term domestic interest rate, nominal exchange rate. These variables follows directly from the Kim and Roubini (2000) model. In our analysis we add bank credit to the private non-financial sector to the framework.

The setup of the model is as follows. Let $X_t = (opw_t, ffr_t, ip_t, cpi_t, m1_t, rdom_t, er_t, l_t)$ be a vector of endogenous variables, where opw_t is the world oil price, ffr_t is the Federal Funds rate (which is used as the proxy for foreign interest rate in the model) , ip_t is industrial production, cpi_t is consumer price index, $m1_t$ is base money, $rdom_t$ is domestic interest rate, er_t is nominal exchange rate and l_t is bank credit to the private non-financial sector. Let $u_t = (u_t^{opw}, u_t^{ffr}, u_t^{ip}, u_t^{cpi}, u_t^{m1}, u_t^{rdom}, u_t^{er}, u_t^{LN})$ represent a vector of exogenous structural shocks to world oil prices, the Federal Funds rate, industrial production, consumer price index, base money, domestic interest rate, nominal exchange rate and the quantity of bank credit to the private non-financial sector respectively. The system of equations representing the structural model in vector form can be written as follows.

$$B_0 X_t = k + B_1 X_{t-1} + B_2 X_{t-2} + \dots + B_p X_{t-p} + u_t \quad (3.1)$$

Assuming that the inverse of B_0^{-1} exists so we can rewrite the above as follows.

$$X_t = B_0^{-1}k + B_0^{-1}B_1X_{t-1} + B_0^{-1}B_2X_{t-2} + \dots + \dots + B_0^{-1}B_pX_{t-p} + B_0^{-1}u_t \quad (3.2)$$

Thus X_t is assumed to follow the vector autoregressive process as follows.

$$X_t = \psi_0 + \psi_1X_{t-1} + \psi_2X_{t-2} + \dots + \dots + \psi_pX_{t-p} + Su_t \quad (3.3)$$

Where $S = B_0^{-1}$ Rewriting by using lag operators we get the following.

$$X_t = \psi_0 + \psi(L)X_t + Su_t \quad (3.4)$$

Where L denotes a lag operator such that $\psi(z) = \psi_1z + \psi_2z^2 + \dots + \dots + \psi_pz^p$, where p represents the number of lags in the model. Considering this specification, the moving average representation is given by:

$$X_t = (I - \psi_1)^{-1}\psi_0 + (I - \psi_1)^{-1}\psi(L)Su_t \quad (3.5)$$

By the Akaike (1974) information criterion, it is found that 13-lag vector autoregressive best fits the data.

3.3.2 Structural identification

Since this model apply an extension model of the Kim and Roubini (2000) framework, the ordering and identification of the seven variables (Fed Funds rate, world oil prices, industrial production, CPI, M1 monetary aggregate, domestic short term interest rate and the nominal exchange rate), follows the specification of the aforementioned paper. We extend the identification scheme of the aforementioned model by adding the quantity of bank credit.

Consider The Federal funds rate, the world oil price and the exchange rate are variables as foreign variables, and domestic interest rate, domestic short term interest rate, industrial production, CPI, M1 and quantity of bank credit as domestic variables. To identify the structural shocks, we specify an identification restriction on the matrix S . The argument for the identification scheme is as follows. The first variable is world oil price, and it is assumed to be exogenous and is not affected by domestic variables contemporaneously. A second variable is the Federal Funds Rate. This variable is assumed to be affected by world oil prices contemporaneously, but not by domestic variables. Following from Kim and Roubini (2000), these two variables are included in the model to isolate and control for the exogenous component of monetary policy shocks.

The third and fourth variables are industrial production and Consumer Price Index (CPI). These variable are assumed to be affected contemporaneously by world oil price and Rate, but are not affected contemporaneously by the Federal Funds, monetary policy rate, exchange rate or bank credit. Money demand is assumed to be contemporaneously affected by prices and output. The monetary policy equation is the monetary authority reaction function which sets the domestic interest rates after observing current value of money demand, interest rate and exchange rate. In addition it is assumed that the monetary authority does not take into account current quantity of bank credit in their decision making.

The exchange rate is assumed to be contemporaneously affected by the Fed Funds rate, world oil prices, industrial production, CPI, M1 monetary aggregate, domestic short term interest rate). Finally, assume that quantity of bank credit is contemporaneously affected by all the preceding seven endogenous variables. To justify the restriction that quantity of bank credit does not affect the domestic interest rate contemporaneously is that, I assume that the monetary authority reaction function which sets domestic interest rates after observing current value of money demand, domestic interest rate and exchange rate but not to the current amount of bank credit. This implies that bank credit does not affect domestic

interest rates contemporaneously.

In matrix form the identification scheme can be written as follows.

$$\begin{pmatrix} u_t^{opw} \\ u_t^{ffr} \\ u_t^{ip} \\ u_t^{cpi} \\ u_t^{m1} \\ u_t^{rdom} \\ u_t^{er} \\ u_t^{LN} \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{2,1} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{3,1} & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ b_{4,1} & 0 & b_{4,3} & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{5,3} & b_{5,4} & 1 & b_{5,6} & 0 & 0 \\ b_{6,1} & 0 & 0 & 0 & b_{6,5} & 1 & b_{6,7} & 0 \\ b_{7,1} & b_{7,2} & b_{7,3} & b_{7,4} & b_{7,5} & b_{7,6} & 1 & 0 \\ b_{8,1} & b_{8,2} & b_{8,3} & b_{8,4} & b_{8,5} & b_{8,6} & b_{8,7} & 1 \end{pmatrix} \begin{pmatrix} \varepsilon_t^{opw} \\ \varepsilon_t^{ffr} \\ \varepsilon_t^{ip} \\ \varepsilon_t^{cpi} \\ \varepsilon_t^{m1} \\ \varepsilon_t^{rdom} \\ \varepsilon_t^{er} \\ \varepsilon_t^{LN} \end{pmatrix}$$

3.3.3 Data

The analysis uses monthly data for Chile for May 1995 to November 2015, India for June 1997 to September 2015, Mexico for January 1997 to September 2015, South Africa for January 1997 to November 2015, Colombia for July 1995 to December 2015 and Turkey for January 2002 to December 2015. The world oil prices, the Federal Funds rate and nominal exchange rate for India data was obtained the Federal Reserve Bank of St. Louis Fred database. The data for industrial production, consumer price index, base money for all six countries and domestic short term interest rate for Colombia and South Africa was obtained from the OECD database. The data for domestic short term interest rate for Chile, India, Mexico and Turkey, and data for the quantity of bank credit to the private non-financial sector for each countries was obtained from their respective central banks.

3.4 Results

In this section we discuss the results of the eight-variable SVAR model.

3.4.1 Impulse Response Analysis

To study the effect of foreign interest rate shocks and monetary policy shocks on the quantity of bank credit to the domestic private non-financial sectors in small open developing countries I analyze the impulse responses.

Figure A.1 to figure A.6 in the appendix shows the impulse response function of the eight endogenous variables with respect to the two shocks which the focus of this study; foreign interest rate shocks (using the Federal Funds Rate as a proxy), and monetary policy shocks. The statistical significance of impulse response is examined using the Bayesian Monte Carlo integration in RATS. The Random Walk Metropolis Hastings method is used to draw 10,000 replications for the SVAR model (see Doan (2013)).

Now let us focus on the impact of quantity of bank lending due to foreign interest rate shocks and monetary policy shocks respectively. In figure (2), the foreign interest rate shocks is denoted as (ffr) while monetary policy shocks is denoted as (rdom). Consider the impact of a positive shock to foreign interest rates. A one percent increase in the foreign interest rate results an increase in bank credit to the domestic private non-financial sectors in India, Mexico, Turkey, Colombia and South Africa. To provide a reason for this result, I use the argument of Adrian and Shin (2011) presented earlier. If an increase in foreign interest rate increases the total interest income from foreign assets held by the bank by more relative to the rise of total interest cost of the liabilities side of its balance sheet, this would result in an increase of Net Interest Margin (NIM). A rise of NIM results in a rise of the present value of bank income and a rise in the forward looking measure of bank capital. This increases the risk bearing capacity of the banks, and thus results in the quantity of bank credit to private sectors to rise.

Conversely for Chile, a one percent increase in the Fed Funds Rate results a decrease in quantity of bank credit to the domestic private non-financial sectors. Again using the

argument by Adrian and Shin (2011), if an increase in foreign interest rate increases the total interest income from foreign assets held by the bank by less relative to the rise of total interest cost of the liabilities side of its balance sheet, this would result in a decrease of (NIM). A fall of NIM results in a fall of the present value of bank income and a fall in the forward looking measure of bank capital. This decreases the risk bearing capacity of the banks, and thus results in quantity of bank credit to private sectors to fall.

Now consider the response of bank credit to a monetary policy shock. A one percent increase in domestic interest rate (a monetary contraction) results in a decrease in the quantity of bank credit to the domestic private non-financial sectors, but with a lag in all six countries. This result is consistent with the finding of Bernanke and Blinder (1992) for the United States.

3.4.2 Variance Decomposition

To answer the question, to what extent does monetary policy can influence the quantity of bank credit in these countries, I analyze the forecast variance decomposition. The analysis of forecast variance decomposition will focus on variation of amount of bank credit with respect to variation of foreign interest rate shocks and monetary policy shocks. The results is presented in table A.3a to A.3b in the appendix.

On impact, monetary policy constitute a larger portion of variation of bank credit to the domestic private non-financial sectors than the variation of foreign interest rate for India, and Mexico. But after three months, the variation to foreign interest rate exceeds the variation of monetary policy instruments with respect to bank credit for Mexico. Conversely, on impact variation to foreign interest rate constitute a larger portion of variation of bank credit than monetary policy on impact for Colombia and Turkey. However there are no significant difference between the foreign interest rate and the variation of monetary policy

with respect to the variation of the quantity of bank credit for Chile and South Africa on impact. After 48-months, both the variation of foreign interest rate and the variation of monetary policy influences the variation of quantity of bank credit to the domestic private non-financial sectors for Colombia, Turkey, Chile South Africa and India. Only for Mexico, the variation of foreign interest rate dominate the variation of monetary policy with respect to variation of quantity of bank credit to the domestic private non-financial sectors. This for Mexico may be due to the proximity and the level of integration of the economy of Mexico with the United States (which in this study, The Federal Funds Rate is used as the proxy for foreign interest rate).

The above result suggest that in addition to monetary policy, foreign interest rates also influences bank credits in small open developing economies. This result also suggests that the monetary authority of the small open developing countries may have limited influence on the quantity of domestic bank credit in the longer time horizon.

3.4.3 Note on degree of capital controls

It should be mentioned that all six countries used in this study has some degree of capital controls and that their degrees differ. As a measure of degree of capital control, I use the measure proposed by Fernandez.et.al. (2015). Following Klein (2013), this measure categorize the degree of capital controls into three levels; open, gate and wall. According to this measure, an open country virtually has no capital controls on any asset and sample periods considered in that paper (1990 to 2013). In contrast a wall country has pervasive capital controls across all, or almost all, categories of assets and sample periods considered in that study. While a gate country uses capital control episodically, in the sense that these countries have little or no capital controls in tranquil times but increase or erect capital controls when faced with capital inflows which threaten to cause unwanted appreciation of the exchange rate or a destabilizing asset market boom (Klein, 2013).

Based on the above measure of degree of capital controls, Chile, Colombia, Mexico, South Africa and Turkey fall under the category of gate, while India falls under the category of wall. Considering the degree of capital controls, this provide explanation on why the impact of the variation of monetary policy on the variation of quantity of bank credit is largest for India on impact, and also up to six months as compared to Chile, Colombia, Turkey and South Africa in the variance decomposition. However for longer horizon (after 6 months), both variation of foreign exchange rate and variation of monetary policy affect the variation of quantity of bank credit in that country.

3.5 Conclusion

In this paper I prompted two questions. The first is, how does foreign interest rate shocks and monetary policy shocks affects bank credit to the domestic private non-financial sectors in small open developing countries? The second is, to what extent does monetary policy can influence bank credit in these countries? The results show that if the increase of total interest income from foreign assets held by the bank due to the rise in foreign interest rate is higher than the rise of total interest cost of the liabilities side of the banks balance sheet, thus bank credit would rise. However if the opposite is true then bank credit would instead fall. On the other hand, the impact of a monetary contraction is to reduce bank credit. This result is consistent with the finding from previous literature. In relation to the second question, the results from variance decomposition suggests that, at best, monetary policy can influence bank credit only in the short-run. In the longer horizon, both foreign interest rates and monetary policy influences domestic bank credit. In sum the results suggests that the monetary authority of the small open developing countries may have limited influence on the quantity of domestic bank credit for the longer horizon.

Bibliography

- [1] Adrian, Tobias, Hyun Song Shin, 2011. “Financial Intermediaries and Monetary Economics”. *Handbook Of Monetary Economics*, 3A, ch. 12, Benjamin Friedman and Mich
- [2] Akaike, H, 1974. “A New Look at the Statistical Model Identification”, in *IEEE Transactions on Automatic Control*, Vol.19, No.6, pp. 716-723.
- [3] Bernanke, Ben S. and Allan S. Blinder, 1992. , “The Federal Funds Rate and the Channels of Monetary Transmission”, *The American Economic Review*, Vol. 82, No. 4.
- [4] Bernanke, Ben S., Mark Gertler and Simon Gilchrist. 1999., “The Financial Accelerator in a Quantitative Business Cycle Framework”, , 12788. *Handbook of Macroeconomics*, 3A, ch. 21, John B. Taylor and Michael Woodford (eds), pp.1342-1393.
- [5] Doan, T. 2013., *RATS Manual, Version 8.3*, Estima, Evanston, IL.
- [6] Fernandez, Andres, et.al. 2015. Capital Control Measures: A New Data Set, *NBER working paper* No.2097.
- [7] Kim, S. and N. Roubini, 2000. “Exchange Rate Anomalies in the Industrial Countries: A Solution with a Structural VAR Approach”, *Journal of Monetary Economics*, Vol.45 No.3. pp. 561 586.
- [8] Klein, Michael W., 2012. “Capital Controls: Gates versus Walls”, *Brookings Papers on Economic Activity*, Fall 2013, Vol.2, pp.317-367.
- [9] Vera, David, 2012. “How Responsive are Banks to Monetary Policy?”. *Applied Economics*, Vol.44, pp.2335-2346.
- [10] Zanforlin, Luisa, 2011. “Domestic Lending when Financial Markets are Integrated: Is it all for Real”. *Applied Economics Letters* , Vol.18, pp.1517-1520.

Appendices

Figure 3.1: Proportion of bank credit to total credit to private non-financial sector for developing countries

Country	Year				Quarter			
	2011	2012	2013	2014	Q3 14	Q4 14	Q1 15	Q2 15
Argentina	75%	78%	78%	79%	77%	79%	79%	79%
Brazil	95%	95%	93%	93%	93%	93%	92%	92%
China	82%	79%	75%	74%	74%	74%	74%	74%
Malaysia	97%	100%	100%	98%	99%	98%	98%	97%
Mexico	47%	48%	47%	45%	46%	45%	45%	44%
Hungary	43%	40%	38%	36%	37%	36%	35%	33%
India	93%	92%	92%	93%	93%	93%	93%	93%
Indonesia	93%	92%	89%	88%	88%	88%	87%	88%
Greece	89%	87%	89%	89%	88%	89%	89%	88%
Thailand	98%	99%	97%	96%	97%	96%	96%	96%
Turkey	84%	88%	89%	89%	90%	89%	89%	90%
Poland	67%	65%	65%	64%	65%	64%	65%	65%
Saudi Arabia	90%	97%	95%	95%	91%	95%	95%	95%
South Africa	97%	95%	93%	94%	94%	94%	93%	93%
average for developing countries	82%	82%	81%	81%	81%	81%	81%	80%

Source: Bank of International Settlement

Figure 3.2: Proportion of bank credit to total credit to private non-financial sector for developed countries

Country	Year				Quarter			
	2011	2012	2013	2014	Q3 14	Q4 14	Q1 15	Q2 15
United Kingdom	58%	55%	56%	56%	57%	56%	57%	57%
United States	33%	33%	33%	33%	33%	33%	33%	33%
Euro area	62%	60%	59%	58%	58%	58%	57%	57%
Canada	51%	53%	53%	52%	53%	52%	51%	51%
Australia	70%	69%	68%	68%	68%	68%	67%	67%
Austria	64%	63%	61%	59%	61%	59%	59%	59%
Belgium	27%	26%	27%	28%	28%	28%	29%	29%
Czech Republic	59%	58%	56%	56%	56%	56%	57%	58%
Denmark	72%	72%	74%	74%	74%	74%	75%	75%
Finland	53%	53%	52%	53%	53%	53%	52%	51%
France	54%	53%	53%	51%	51%	51%	51%	51%
Germany	75%	75%	73%	72%	72%	72%	72%	71%
Italy	75%	72%	71%	71%	71%	71%	71%	72%
Japan	63%	65%	67%	67%	67%	67%	68%	68%
Korea	71%	69%	67%	67%	67%	67%	67%	67%
Netherlands	50%	52%	51%	49%	50%	49%	49%	48%
Norway	35%	33%	33%	33%	33%	33%	33%	33%
Spain	74%	72%	69%	67%	67%	67%	67%	67%
Sweden	56%	57%	57%	56%	56%	56%	55%	56%
Switzerland	76%	77%	77%	77%	77%	77%	77%	77%
Luxembourg	21%	20%	21%	23%	21%	23%	21%	24%
Ireland	36%	36%	35%	29%	31%	29%	28%	28%
Portugal	69%	65%	64%	62%	64%	62%	61%	62%
Russia	76%	79%	78%	76%	78%	76%	76%	76%
average for developed countries	58%	57%	57%	56%	56%	56%	56%	56%

Source: Bank of International Settlement

Figure 3.3: Forecast Error Variance Decomposition Analysis

months	Chile			Colombia			Turkey		
	standard error	FFR	<u>rdom</u>	standard error	FFR	<u>rdom</u>	standard error	FFR	<u>rdom</u>
1	0.8251	3.226	2.041	0.50959	3.934	2.122	0.65062	5.137	0.099
3	1.37725	8.769	0.958	1.04306	7.082	1.154	1.10563	3.132	0.336
4	1.55316	8.115	0.893	1.3034	8.975	1.23	1.35547	2.698	0.241
6	1.84451	9.846	0.806	1.86731	14.488	0.754	1.79768	1.554	0.171
12	2.75141	6.983	1.986	3.22465	15.955	2.239	2.8795	6.576	3.694
24	4.17078	4.195	1.101	5.53573	10.847	1.204	4.11885	7.338	6.049
48	7.22032	6.964	1.979	9.60665	5.484	7.006	5.91304	6.664	11.002
72	13.9364	16.1	6.846	16.4202	10.185	3.804	7.04131	5.8	9.862

Figure 3.4: Forecast Error Variance Decomposition Analysis (continued)

months	India			Mexico			South Africa		
	standard error	FFR	<u>rdom</u>	standard error	FFR	<u>rdom</u>	standard error	FFR	<u>rdom</u>
1	1.02347	0.015	10.055	0.60019	1.251	4.005	12.7752	0.024	0.926
3	1.58899	1.318	8.471	0.89852	5.556	9.292	13.6563	0.888	0.95
4	1.78449	3.512	6.966	1.07079	11.78	8.148	14.3179	1.208	1.014
6	2.09756	8.577	5.154	1.44408	29.19	4.739	14.6525	1.221	1.827
12	2.8856	11.703	3.419	2.78641	41.642	2.084	15.7327	2.881	2.182
24	4.38523	11.725	2.402	6.25665	41.254	6.336	17.7302	5.609	3.59
48	6.48407	5.894	3.65	8.81781	40.274	5.144	19.3948	7.093	4.733
72	8.21132	3.865	2.867	9.18084	41.093	4.983	19.9276	7.302	5.076

Figure 3.5: Mexico

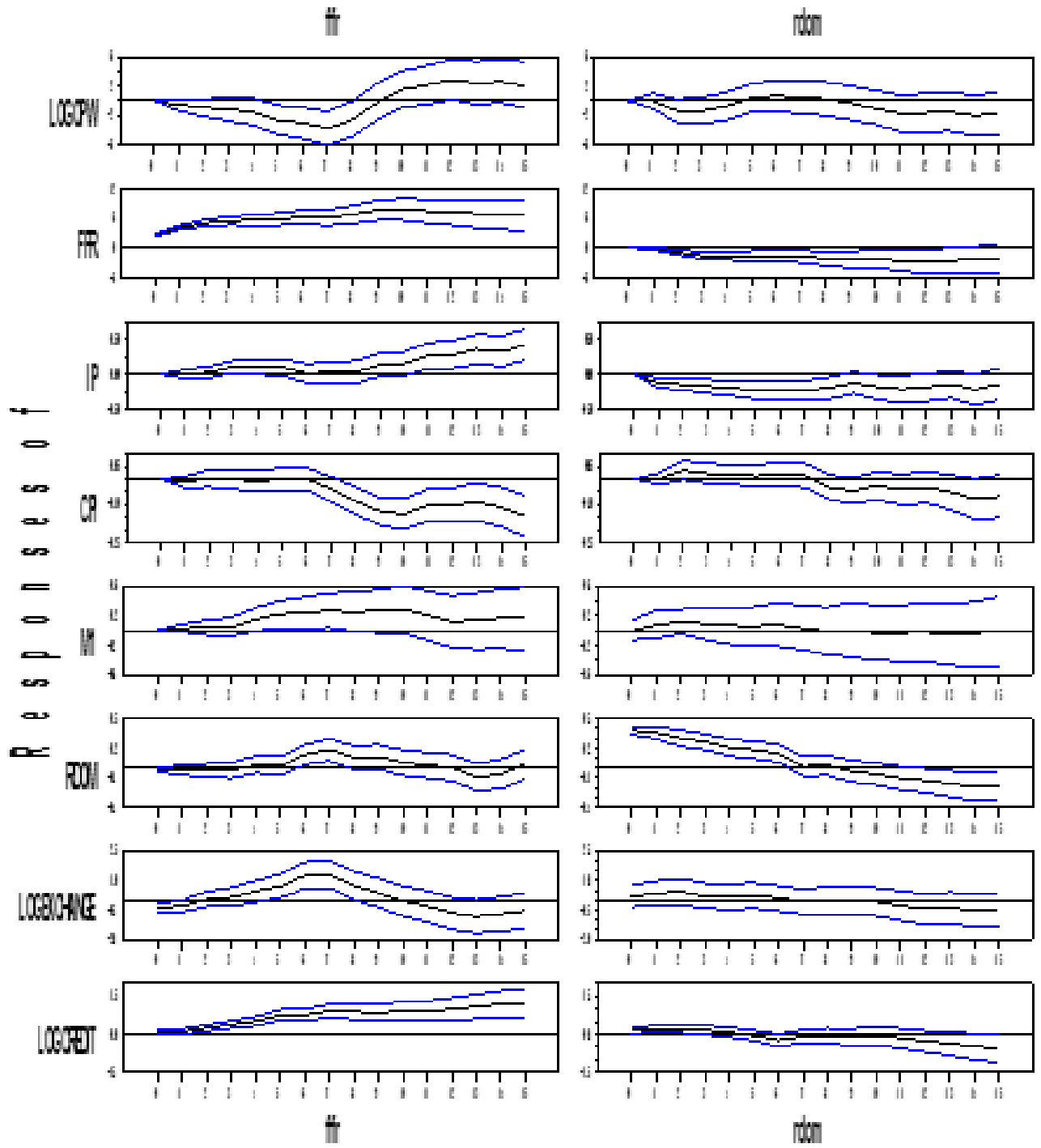


Figure 3.6: Turkey

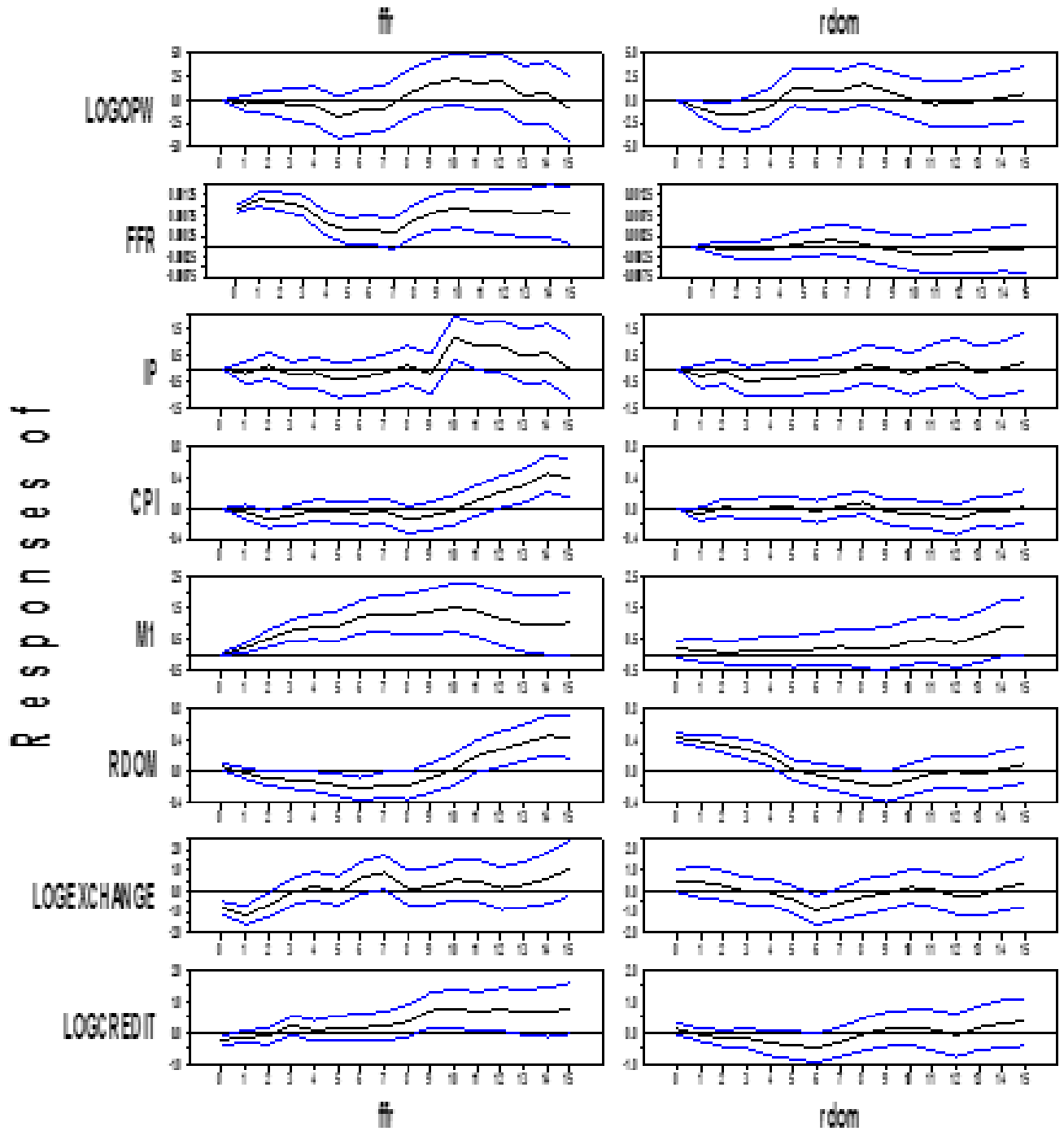


Figure 3.7: Chile

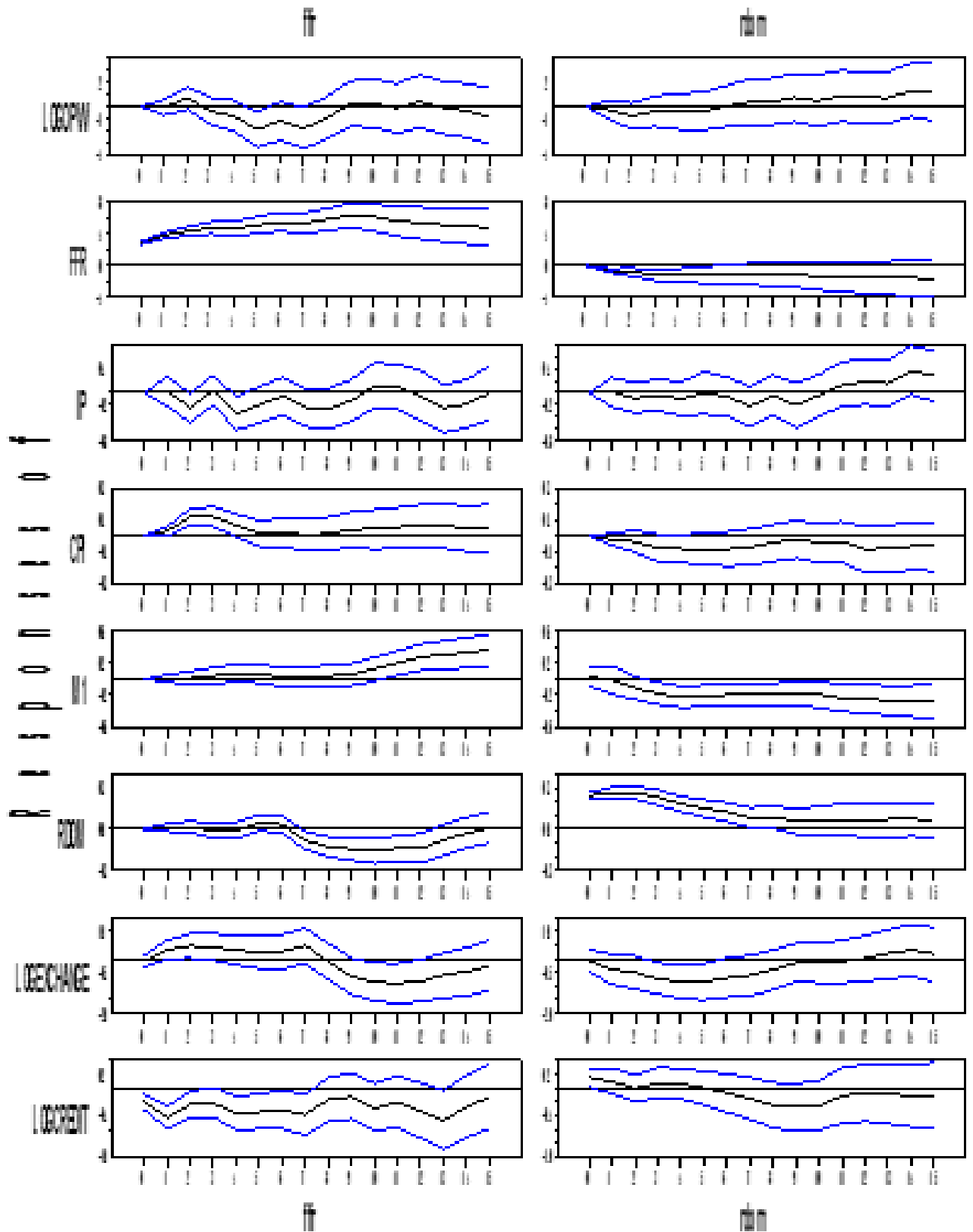


Figure 3.8: Colombia

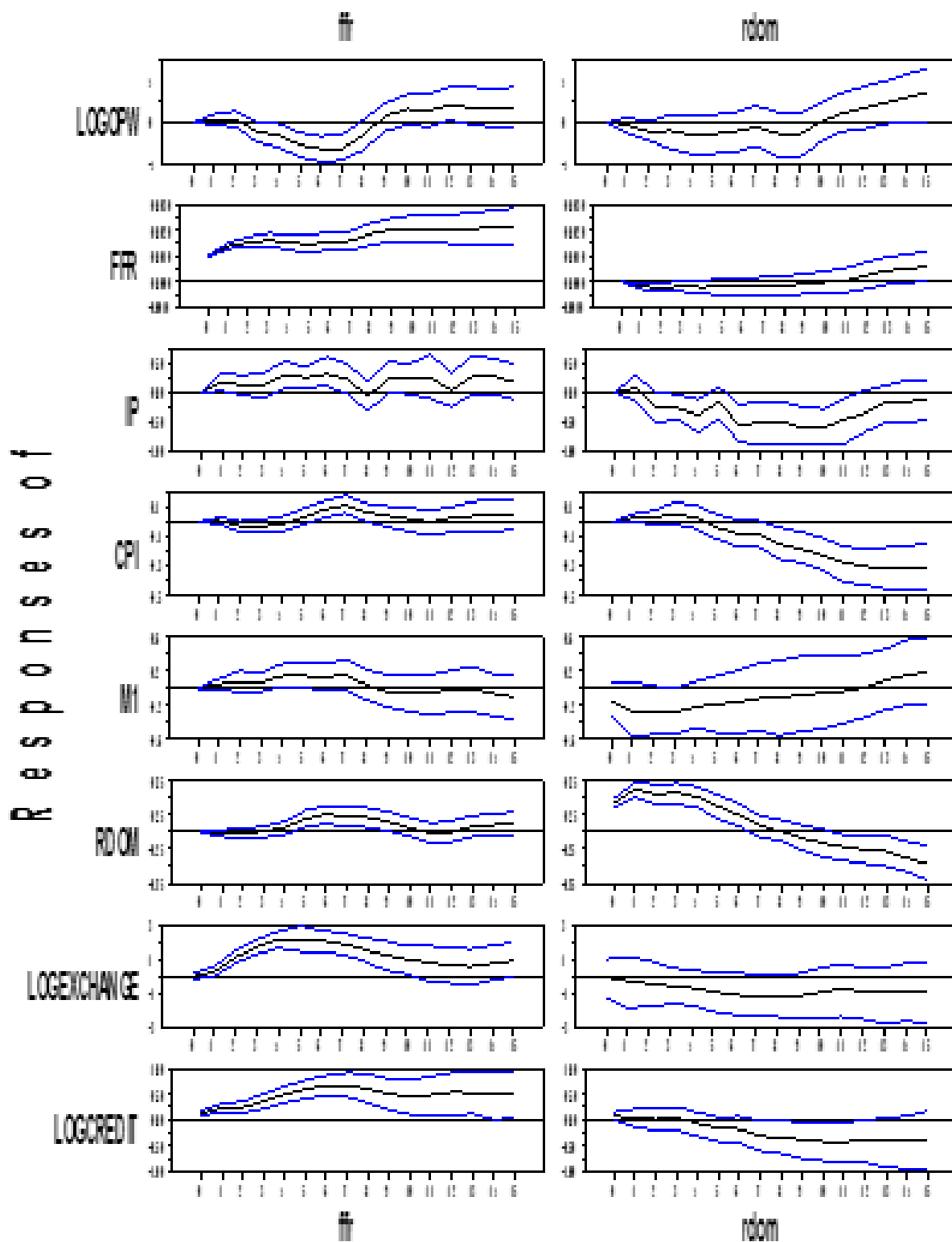


Figure 3.9: South Africa

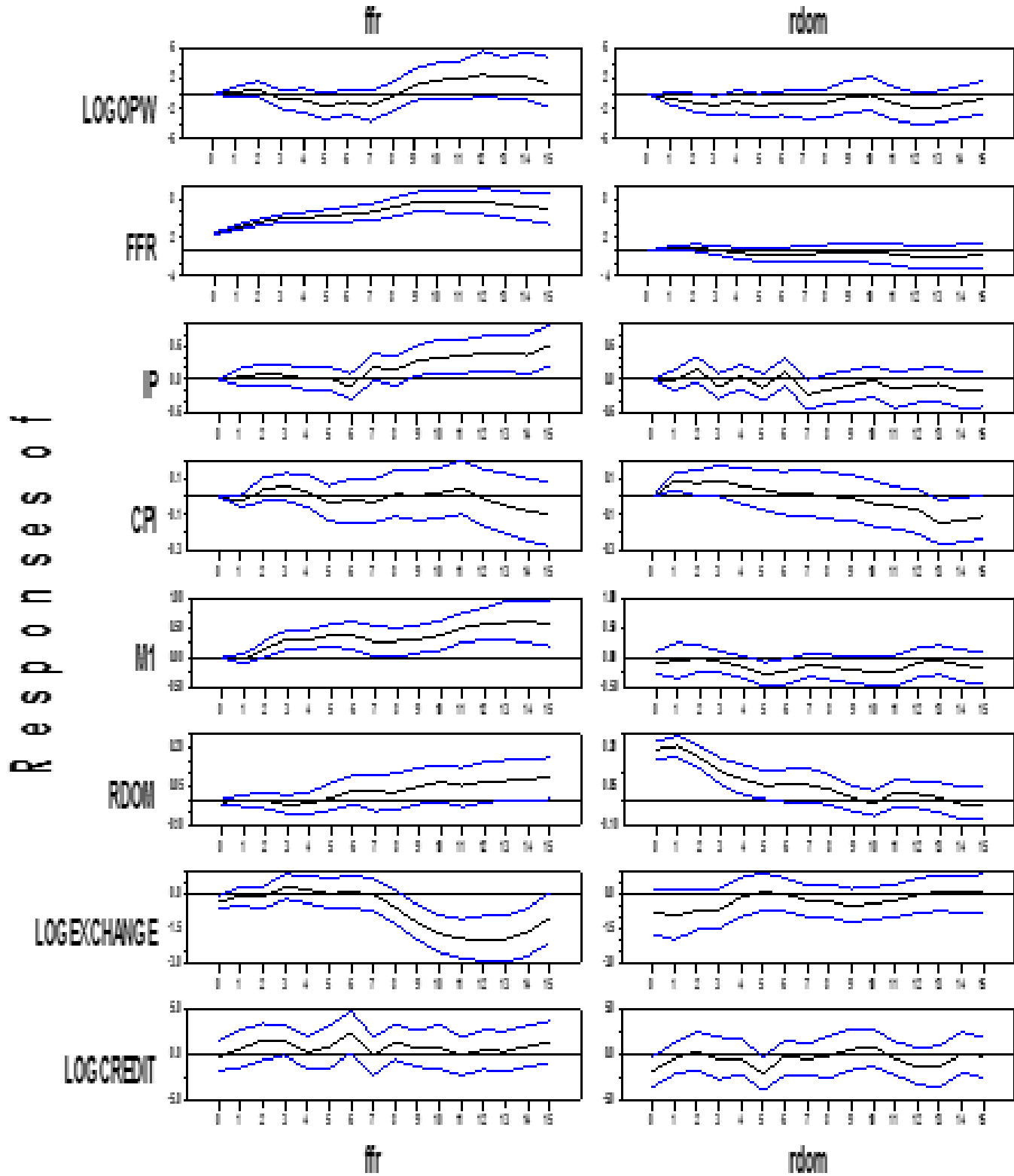


Figure 3.10: India

