Monetary Policy Rules and Economic Fluctuations

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Abstract

This paper found, for economies with high unhedged foreign borrowing, different monetary rules has produced differences in dynamics. In particular policy rules which place large weights on stability of the exchange rate, amplifies macroeconomic variables fluctuations. This underscores importance for caution of intervening in the exchange rate markets for economies with high percentage of unhedged foreign debt.

Keywords: risk premium shocks, foreign debt, policy rules, fluctuations.

Introduction

The goal of many economies is to achieve stability in their macroeconomic conditions. One instrument to achieve this is monetary policy. For small open developing economies, performing monetary policy maybe far from trivial, since there are of factors and obstacles which may influence economic fluctuations in their country. An important obstacle for monetary policy making is concerning “dollarization” of liabilities.

Scores of small open developing economies have residents take debt from abroad and invest in home economy which generate income in home currency. However this home debtor must repay their creditors in foreign currency. Conversely, market of instruments for hedging risk of exchange rate changes of the home country’s currency may be illiquid and thin, or even non-existent. This can be seen from data from The Bank for International Settlement which highlight this point for currency of developing countries as to that of developed countries (see table 1 and 2 of appendix).

Literature Review

As shown from the data, with thin and illiquid markets of instruments for hedging risk of exchange rate changes of the home country’s currency, causes the cost of hedging against this risk to be relatively high for residents of these economies. Such condition has long been observed in the literature, and often been labelled as liability dollarization (Eichengreen and Hausman, 1999, Calvo 2002 and Cepedes et.al. 2002, Calvo (2006), Nakamura, 2011). Scholars have also conveyed worries of the challenge of monetary policy making for a small open developing economy if faced with such situation Calvo (2006).

There are discussions of monetary policy choices under liability dollarization by using a dynamic equilibrium model. But the discussion result is still mixed. By assuming
wages is sticky, Cespedes et.al. (2004) found that targeting inflation coupled exchange rate flexibility produce stability of the macroeconomy of the developing country. This result was also found by Nakamura (2011). To the contrary, by assuming prices as sticky Choi and Cook (2004) and Cook (2004) found that a monetary policy rule of fixing the currency rate, produce higher degree of stability as compared to targeting inflation (which requires flexible exchange rate regime). A common facet from these conflicting conclusions is the lacking to consider premium of risk shocks from borrowing abroad. Scholars showed that liability dollarization is the by-product of lack of faith towards developing government’s commitment to nurture long run stability of their exchange rate (Honig, 2009). It is also a product of policy uncertainty (Pastor and Veronesi 2013). In addition minor shift in risk aversion of international markets towards a particular small open developing country would influence its risk premium and ultimately have negative impact on macroeconomic variables fluctuations (Korinek, 2011).

I extend this discussion building a dynamic general equilibrium model for a small open economy with dollarized liability, and incorporate shocks to risk premium. Then I consider policy rules which differ in their degree of exchange rate stability in the reaction function of the central bank, and analyze its impact on the amplification on macroeconomic variables. The aim is to study the impact of different policy rules on macroeconomic fluctuations.

**Research Method**

The analysis method used in this study is calibration of a dynamic general equilibrium model. The steps in applying this method setting up the dynamic general equilibrium model, then this model is then calibrated to the parameter values in the literature. This model is then solved by using the mathematical package Dynare (see Adjemian et.al. 2017).

The model used in this study a New Keynesian small open economy consisting of three economic entities; households, firms and a central bank. It is assumed that they have rational expectations. The economy is assumed to face liability dollarization; households in home economy can only borrow from foreign countries $d$ and repay debt in currency of foreign country, but markets of instruments for hedging risk of exchange rate changes of the home country’s currency is non-existent.

The setup of the model for households follows modifies that of Schmitt-Grohe, Uribe (2003), and is written as follows. In this economy, the representative household’s is the owner and supplier of labor $l$ and capital $k$ to firms, also holds home country’s currency bonds. Its economic activity is choosing consumption $C$ and the amount of hours work $l$ to maximize its discounted sum of lifetime wellbeing $U$. It choose the uses earnings from supplying labor $W$ and bonds which matured and capital return to consume buy more bonds of home country $d$ and investment in capital $I$. Household’s spending deficit with respect to its earnings is funded by funds borrowed in foreign currency and face a world interest rate $R^w$. In addition to world interest rate, it also faces risk premium from taking foreign funds $pr$. The following is the household optimization problem.
The symbols $S_t$, $P_t^*$, nominal rate of exchange and home and foreign prices.

This budget constraint displays existence of liability dollarization (Notz and Rosenkranz (2014)).

Define gross domestic and foreign rate of interest, and the risk premium from borrowing form abroad as follows.

$$
D_t = \frac{d_t}{P_t} + \frac{\text{profit}_t}{P_t} + \frac{d_t \cdot (1 + R_{i,t})}{P_t} + C_t + I_t + \frac{\psi_t}{2} (k_t - k_{t-1}) + \frac{d_t}{P_t},
$$

The stochastic process of the risk premium shocks $sp_t$ follows an autoregressive of order one.

$$\ln sp_t = \rho \ln sp_{t-1} + \epsilon_{sp_t}; \rho \in (0,1)
$$

First order optimization of the representative household for consumption and labor are.

$$\lambda_t = \left( C_t - \frac{L_t^\omega}{\alpha} \right)^{-\gamma}
$$

The FOC between acquiring capital and to consume.

$$
\left[ 1 + \psi_t \left( K_t - K_{t-1} \right) \right] = \beta E_t \left[ \frac{\alpha Y}{K_t} + (1 - \delta) + \psi_t \left( i_t + \delta k_{t-1} \right) \right]
$$

The following is the FOC for obtaining loans from abroad.

$$\lambda_t = \beta E_t \left[ \lambda_{t+1} \left( 1 + R^w_{t+1} + pr_t \right) \frac{S_t}{S_{t+1}} \frac{P_t}{P_{t+1}} \right]
$$

The following is the domestic bonds holding FOC.

$$\lambda_t = \beta E_t \left[ \lambda_{t+1} \left( 1 + R^d_{t+1} \right) \frac{1}{P_t} \right]
$$

The setup for the firm follows a modification of Dib(2011). Firm sector comprises of home manufactured final and intermediate goods producers $y_t$ and $y_t(i)$ are related as follows.
\[ \text{Max } p \left( \frac{1}{2} y_i(t)^{\frac{\alpha}{1-\alpha}} dt \right)^{\frac{1}{\alpha}} - \frac{1}{2} p_i(t)y_i(t) \]  

Assuming perfect competition in the final goods market, the optimization of these firms are the following.

\[ \text{Max } P \left( \frac{1}{2} Y_t(i)^{\frac{\alpha}{1-\alpha}} dt \right)^{\frac{1}{\alpha}} - \frac{1}{2} p_i(t)Y_t(i) \]

The FOC and the demand function for each intermediate goods manufacturer is

\[ Y_i(t) = \left( \frac{P_i(t)}{P_t} \right)^{\frac{1}{\alpha}} \]

Relation between intermediate products sold at home \( y_d(i) \) and exported \( y_e(i) \) is.

\[ y_i(t) = y_d(i) + y_e(i) \]

Demand curve for intermediate products sold at home is the following.

\[ y_a(t) = \left( \frac{p_i(t)}{y_t} \right)^{\frac{1}{\alpha}} \]

The intermediate goods production function is.

\[ Y_t(i) = Z \cdot K_t(i) h_t(i) \]

Price adjustment mechanism of intermediate products firm follows Rotenberg (1982).

\[ \varphi(p_i(t), P_{t-1}(i), p_i, y_t) = \frac{\alpha}{2} \left[ \frac{p_i(t)}{P_{t-1}(i)} - 1 \right] y_t \]

The following is intermediate products companies' optimization.

\[ \text{Max } E \sum_{t=1}^{\infty} \beta^t SDF_{r_t} \left[ \frac{P_t(i)}{P_t} Y_t(i) - \frac{\alpha}{\lambda} \text{Max } p_i(t) - W_i L_{t-1}(i) + \frac{\alpha}{2} \left[ \frac{p_i(t)}{P_{t-1}(i)} - 1 \right] y_t \right] \]

Bounded by two constraints.

\[ y_s(i) = \left( \frac{p_i(t)}{P_t} \right)^{1-\alpha} \quad \text{and} \quad y_t(i) = z_i K_{t-1}(i) l_t(i) \]

Choosing amount of capital and selling price \( p_i(t) \) FOCs are as follows.

\[ \frac{\alpha Y_t}{K_{t-1}} = \frac{\alpha}{1-\alpha} W_t \left( Y_t \right)^{\frac{1}{1-\alpha}} Z^{-1} \frac{1}{\alpha} K_{t-1}^{\frac{1}{\alpha}} \]

\[ (1-\theta) + \frac{\theta}{1-\alpha} W_t \left( \frac{y_t}{y_{t-1}} \right)^{\frac{1}{1-\alpha}} - 1 + \beta \theta E \left[ \frac{\lambda}{\lambda_i L} \right] \frac{1}{\alpha} [\lambda, y_t, \pi_{t+1}, \pi_{t}]^{\frac{1}{\alpha}} \]

The total demand function of intermediate products by foreign is.

\[ Y_e = \left( \frac{P_{t+1} S_{t+1}}{P_t} \right)^{\frac{1}{\alpha}} \]
The reaction function of the central bank is as follows.

\[
\ln \left( \frac{L_t}{P_t} \right) = \rho \ln \left( \frac{Y_t}{y_t} \right) + \rho_s \ln \left( \frac{S_t}{s_t} \right) + \ln V_t.
\]

(23)

The stochastic process of monetary shocks \( V \) follows an AR (1) process.

\[
\ln V_t = \rho \ln V_{t-1} + \varepsilon_t, \quad \rho \in (0,1)
\]

(24)

The following he market clearing conditions for this model.

\[
\frac{d_y}{d_s} = (1 + R^w + pr_{w})\frac{d_y}{d_s} - y + C + I + \frac{w}{2}(k_{t+1} - k_t) + \frac{2}{2}[\pi_t - 1]y_t,
\]

\[
tb_y = y_t - C_t - I_t, \quad \text{and} \quad y_{rr} = \frac{tb_y - y_{rr}}{rer}.
\]

(25)

(26) and (27)

The requirement for equilibrium is \( d_y = 0 \), \( y = y_t(i), y_{rr} = y_{rr}(i) \).

The parameters calibrated for this model follows Schmitt-Grohe, Uribe (2003), Peters (2008), and Unsal (2013).

**Results and Discussion**

This paper contemplates three rules for monetary policy making depending on the degree of weights placed on exchange rate stability; low weight as case 1, high weight as case 2, and case 3 is with weights much higher than in case 2.

Given that the economy is hit by a shock to premium of risk from borrowing abroad, it is found that it increases production plus consumption for cases 1, 2 and 3. And this also causes balance of trade and home inflation to rise in all three cases. However investment, foreign debt and current account declined. In terms of the dynamics as depicted by the IRF, it is found that higher weight on the stability of the exchange rate within the policy rules increases volatility of variables considered in this study. This finding is in line with the view that monetary policy that put less focus in stabilizing the exchange rate would enhance the stability of their macroeconomic condition. In policy making terms, this conclusion underscores the need for caution of central banks in intervening in the exchange rate market. In particular for countries with high percentage of unhedged borrowing in foreign currency.

**Conclusions**

By constructing a dynamic general equilibrium model of an small open economy with liability dollarization, and hitting it with shocks to the risk premium, this paper found that different monetary rules has produced differences in dynamics. In particular policy rules which place large weights on stability of the rate of exchange of home currency, amplifies macroeconomic variables volatility. This underscores the need for caution of intervening in the exchange rate markets for economies with high percentage of unhedged foreign debt.

**References**


Appendices

Table 1. Developed countries turnover of foreign exchange instruments.

<table>
<thead>
<tr>
<th>Instrument/ currency/ counterparty (By currency)</th>
<th>Total</th>
<th>Spot transactions</th>
<th>Outright forwards</th>
<th>Foreign exchange swaps</th>
<th>Currency swaps</th>
<th>FX options</th>
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<tbody>
<tr>
<td>Developed countries currency</td>
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<td>1,691</td>
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<td>766</td>
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<td>123</td>
<td>332</td>
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<td>27</td>
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<td>36</td>
<td>101</td>
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<td>11</td>
<td>40</td>
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<td>3</td>
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</table>

Source: Bank for International Settlements

Table 2. Developing countries turnover of foreign exchange instruments.

<table>
<thead>
<tr>
<th>Developing countries currency</th>
<th>Total</th>
<th>Spot transactions</th>
<th>Outright forwards</th>
<th>Foreign exchange swaps</th>
<th>Currency swaps</th>
<th>FX options</th>
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</thead>
<tbody>
<tr>
<td>Mexican Peso</td>
<td>135</td>
<td>57</td>
<td>14</td>
<td>58</td>
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<tr>
<td>Yuan Renminbi</td>
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<td>9</td>
<td>37</td>
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<td>16</td>
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<td>3</td>
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<tr>
<td>Brazilian Real</td>
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<td>34</td>
<td>1</td>
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<td>Indian Rupee</td>
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</tr>
</tbody>
</table>

Source: Bank for International Settlements

Figure 1: Shocks to risk premium on domestic output.

Figure 2. Shocks to risk premium consumption.
**Figure 3.** Shocks to risk premium on the deficit of ratio between current account-GDP.

**Figure 4.** Shocks to risk premium on ratio surplus trade-to-GDP.

**Figure 5.** Shocks to risk premium on borrowing from abroad.

**Figure 6.** Shocks to risk premium on investment.

**Figure 7.** Shocks to risk premium on inflation of home country.