Simple Monetary Policy Rules for Developing Countries

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Abstract

This paper evaluates the performance of simple monetary policy rules in a calibrated model for the Chilean economy. The monetary regimes considered are: exchange rate peg, money peg, inflation targeting, nontradable inflation targeting, and a Taylor rule. We develop a small open economy model with tradable and nontradable goods, monopolistic competition and staggered prices á la Calvo. Business cycles fluctuations in the economy are driven by three types of shocks: foreign interest rate, productivity, and government expenditure. In this environment, the role of monetary policy is to offset as much as possible the distortions in the economy, namely staggered prices and monopolistic competition. We ranked the rules according to their ability to smooth consumption and leisure of the representative household. The welfare analysis suggests that, depending on the source of the shock, it is optimal to stabilize either the price of tradable goods or nontradable goods. Rules with these targets are welfare superior to other monetary regimes, such as inflation targeting or a money peg. Our analysis supports some exchange rate intervention in order to achieve an efficient allocation of resources.

Keywords: Monetary policy, small open economy, nontradable goods, sticky prices.

JEL Classification: 52, 58.

1 Introduction

Due to several currency and financial crises during the 1990s, there has been a drastic change in the way developing countries conduct monetary policy. Most central banks have abandoned explicit exchange rate targets, and have switched to a floating exchange rate regime with an independent monetary policy. In this context, there is an ongoing debate about how monetary policy should be conducted in emerging economies. In particular, the academic discussion is centered around optimal policy rules[1]. A relevant question that has not been addressed by the literature is what policy rules should developing countries follow?

The New Open Economics Macroeconomics (NOEM) literature, pioneered by Obstfeld and Rogoff(1995), has contributed significantly to the study of monetary policy in open economies. This framework integrates Keynesian elements such as sticky prices and imperfect competition, into dynamic general equilibrium models. Most of the literature has focused on two-country models, which are relevant to the study of international coordination of monetary and fiscal policies.

Recently, there has been an increased interest in the study of monetary policy for small open economies in NOEM models (examples are Gali and Monacelli, 2003; Céspedes, Chang and Velasco, 2001; and McCallum and Nelson, 1999). Nevertheless, in these models the evaluation of monetary or exchange rate regimes is based on the volatility of the output gap and the inflation rate. This criterion for evaluating monetary policies is based on a second order approximation of the consumers utility function (Woodford, 2001). However, the approximation is derived under specific assumptions[2]. Under general conditions, the volatility of inflation and output gap are not going to gauge accurately the welfare costs of a monetary policy. As shown in Gali and Monacelli (2003), when the economy faces only sticky prices, the optimal monetary policy should be aimed to stabilize the markups, which implies the stabilization of the price level. However, if we consider in addition the monopolistic competition distortion, under some shocks it might be

[1] Taylor (1993) described the behavior of the Federal Funds rate with a policy rule that depends on inflation rate and output gap. Ball (1998) proposes for open economies the implementation of a rule using as a policy instrument a combination of nominal interest rate and real exchange rate.

[2] See Gali and Monacelli (2003).

optimal to induce volatility in the markups to reduce the inefficiency in the allocation of resources.

In this paper we develop a small open economy model calibrated for the Chilean economy, and we evaluate the performance of monetary policy rules using a standard welfare analysis with the consumers' utility function. The model has two sectors, tradable and nontradable, and there is monopolistic competition and staggered price-setting behavior in the nontradable sector. The role of monetary policy in the model economy is to undo these two distortions. Monopolistic competition induces lower production in the nontradable sector compared to the socially optimal allocation. On the other hand, sticky prices generate a relative price distortion among the intermediate nontradable goods and between sectors. Business cycles in this economy are generated by three types of shocks: international interest rate, sectorial productivity, and sectorial government expenditure.

In the model we evaluate five simple rules that are often discussed in academic and policy circles: exchange rate peg, money peg, inflation targeting, nontradable inflation targeting, and a Taylor rule. We simulate the model for each of the shocks and we evaluate the rules to find which one can minimize the welfare costs of business cycles fluctuations. We use a similar method to the one implemented by Lucas (1987) to measure the welfare of each monetary policy. The simulations show that the best rule is contingent on the source of the shock in the economy. For shocks to international interest rate, productivity in the nontradable sector, and tradable government expenditure the best response, among the proposed rules, is to stabilize the nominal exchange rate. When the economy is buffeted by shocks in the productivity of the tradable sector and nontradable government expenditures the best response is to stabilize the price of the nontradable goods.

The paper is organized as follows. Section 2 describes the benchmark small open economy. Section 3 discusses the calibration and solution method. Section 4 presents the numerical simulations and the welfare analysis. A summary and conclusions are presented in Section 5.

2 A Benchmark Small Open Economy Model

The basic model is a variant of the models developed by Rebelo and Vegh (1995) and Schmitt-Grohé and Uribe (2001). This is a small open economy with tradable and nontradable goods and where labor is the only factor of production. Firms in the tradable sector are perfectly competitive. On the other hand, nontradable firms operate under monopolistic competition and set their prices in a staggered fashion. In this environment, we will evaluate which policy rule maximizes the households' welfare.

2.1 Households

The economy is populated by a large number of identical households. In each period t the economy experience one event s_t. We denote by s^t the history of events up to and including period t. The probability at date 0 of any particular history is $\pi(s^t)$. The representative household seeks to maximize the following utility function:

$$\sum_{t=0}^{\infty}\sum_{s^t}\beta^t\pi(s^t)U(C^T(s^t),C^N(s^t),L(s^t),M(s^t)/P^T(s^t)) \tag{1}$$

where $0<\beta<1$ is the discount factor, and $C^T(s^t)$, $C^N(s^t)$, $L(s^t)$, and $M(s^t)$ are tradable consumption, nontradable consumption, labor and nominal money balances. In each period of time, consumers choose their allocation to maximize (1) subject to the sequence of budget constraints:

$$P^T(s^t)C^T(s^t)+P^N(s^t)C^N(s^t)+e(s^t)B^*(s^t)+M(s^t) \tag{2}$$

$$+\sum_{s_{t+1}}Q(s^{t+1}/s^t)B(s^{t+1})\leq W(s^t)L(s^t)+M(s^{t-1})$$

$$+e(s^t)B^*(s^{t-1})R^*(s^{t-1})+B(s^t)+\Pi^N(s^t)+\Pi^T(s^t)-T(s^t) \qquad (t=0,1,2,...)$$

and borrowing constraints $B(s^t) \geq \overline{B}$ and $B^*(s^t) \geq \overline{B}^3$. The initial conditions $M(s^{-1})$ and $B(s^0)$ and $B^*(s^0)$ are given. $\Pi^N(s^t)$ and $\Pi^T(s^t)$ are the profits of the tradable and nontradable firms, respectively. $T(s^t)$ is the lump sum tax collected by the government. $Q(s^{t+1}/s^t)$ is the state contingent price of the domestic bond. The consumer's first-order conditions are:

$$\frac{U_{C^N}(s^t)}{U_{C^T}(s^t)} = \frac{P^N(s^t)}{P^T(s^t)} \equiv P(s^t) \tag{3}$$

$$\frac{U_L(s^t)}{U_{C^T}(s^t)} = \frac{W(s^t)}{P^T(s^t)} \equiv w(s^t) \tag{4}$$

$$U_{C^T}(s^t) = \sum_{s_{t+1}} \pi(s^{t+1}/s^t) U_{C^T}(s^{t+1}) \beta R^*(s^t) \tag{5}$$

$$U_{C^T}(s^t) - U_{M/P^T}(s^t) = \sum_{s_{t+1}} \pi(s^{t+1}/s^t) U_{C^T}(s^{t+1}) \beta \frac{P^T(s^t)}{P^T(s^{t+1})} \tag{6}$$

$$Q(s^{t+1}/s^t) = \beta\pi(s^{t+1}/s^t) \frac{U_{C^T}(s^{t+1})}{U_{C^T}(s^t)} \frac{P^T(s^t)}{P^T(s^{t+1})} \tag{7}$$

Equation (3) determines the optimal allocation of consumption between tradable and nontradable goods. Equation (4) sets the allocation between consumption and leisure. The Euler equation is represented by (5). Equation (6) is the demand function for real money balances. Finally, (7) is the equilibrium price of the nominal contingent claim.

2.2 Firms and Price Setting

The tradable sector is perfectly competitive. The representative firm chooses labor inputs to maximize profits:

$$\underset{L}{Max} \;\; P^T(s^t) Y^T(s^t) - W(s^t) L^T(s^t)$$

[3] We are going to assume that the borrowing constraints are not binding in equilibrium. That is, $\overline{B}$ and $\overline{B}^*$ are large negative numbers.

$$subject\ \ to\ \ Y^T(s^t) = f^T(L^T(s^t), s^t) \tag{8}$$

The first-order condition of the firm is:

$$\frac{W(s^t)}{P^T(s^t)} = f_L^T(L(s^t), s^t) \tag{9}$$

Equation (9) is a standard labor demand function, where the real wage is equal to the marginal productivity of labor. The production of the nontradable goods is divided in two stages. In the first one, a continuum of monopolistic firms, indexed between 0 and 1, produce an intermediate good. These firms set their prices in a staggered fashion. Each period, only a fraction of the firms are capable of adjusting their price in response to the realization of the shocks. In the second stage, there are perfectly competitive firms that aggregate the intermediate goods and produce a final nontradable good. The final goods firms solve the following profit-maximization problem:

$$\underset{y^N(i)}{Max}\ \ P^N(s^t)Y^N(s^t) - \int_0^1 P(i,s^t)Y^N(i,s^t)di$$

$$subject\ \ to\ \ Y^N(s^t) = \left[\int_0^1 Y^N(i,s^t)^{\frac{\varepsilon-1}{\varepsilon}}\right]^{\frac{\varepsilon}{\varepsilon-1}} \tag{10}$$

The intermediate goods are combined with a Dixit-Stiglitz function with an elasticity of substitution ε. The demand for each intermediate good is obtained from the first-order condition of the problem:

$$Y^N(i,s^t) = \left[\frac{P^N(i,s^t)}{P^N(s^t)}\right]^{-\varepsilon} Y^N(s^t) \tag{11}$$

From the zero-profit condition, we derive the price index for the aggregate good:

$$P^N(s^t) = \left[\int_0^1 P^N(i, s^t)^{1-\varepsilon} di \right]^{\frac{1}{1-\varepsilon}} \tag{12}$$

A fraction $(1 - \eta)$ of intermediate good producers has the ability to reset the prices in response to the state of the economy. This implies that prices are sticky for $\frac{1}{1-\eta}$ periods. Each period, the representative firm solves the following problem:

$$\underset{P^N(i)}{Max} \sum_{k=0}^{\infty} \sum_{s^{t+k}} \eta^k Q(s^{t+k}/s^t) \left[P^N(i, s^t) - mc(s^{t+k}) P^N(s^{t+k}) \right] Y^N(i, s^{t+k}) \tag{13}$$

The firm i choose the price of the intermediate good to maximize the present value of its profits, conditional on the price being effective every period with probability η. The profits are discounted with the price of the state contingent domestic bond. The real marginal cost is given by:

$$mc(s^t) = \underset{L^N(i)}{Min} \frac{W(s^t)}{P^N(s^t)} L^N(i, s^t) \tag{14}$$

$$subject \;\; to \;\;\; f^N(L^N(i, s^t), s^t) = 1$$

If we assume constant returns to scale in the production function, then the real marginal cost is independent of the scale of production in each firm. For that reason, we suppress the index i of the marginal cost for each intermediate firm. The solution to problem (13) is the following pricing rule:

$$P^N(i, s^t) = \frac{\varepsilon}{\varepsilon - 1} \frac{\sum_{k=0}^{\infty} \sum_{s^{t+k}} \eta^k Q(s^{t+k}/s^t) P^N(s^{t+k})^{\varepsilon} Y^N(s^{t+k}) mc(s^{t+k})}{\sum_{k=0}^{\infty} \sum_{s^{t+k}} \eta^k Q(s^{t+k}/s^t) P^N(s^{t+k})^{\varepsilon-1} Y^N(s^{t+k})} \tag{15}$$

Equation (15) is a generalization of the static optimality condition of a monopoly. If firms were able adjust their prices freely, that is $\eta = 1$, then, their markups would be constant across business cycles. In that case, firms will set the price according to:

$$\frac{P^N(i, s^t)}{mc(s^t)} = \frac{\varepsilon}{1 - \varepsilon}$$

This condition is important to understand how different can be the equilibrium from the flexible price allocation. A monetary rule that ensures constant markups across the business cycles will undo the sticky price distortion. However, with constant markups the economy is far from the optimal allocation since the monopolistic competition prevents equality between prices and marginal costs.

2.3 Government

The government finances its expenditures with lump sum taxes $T(s^t)$ and money $M^S(s^t)$. We assume that every period the government follows a balanced budget policy:

$$T(s^t) + M^S(s^t) = P^T(s^t)G^T(s^t) + P^N(s^t)G^N(s^t) + M^S(s^{t-1})$$

2.4 Trade and Financial Integration with the Rest of the World

In standard small open economy models, the foreign bonds follow a unit root process. In this case, log-linearization methods are not appropriate to solve the model. The unit root implies that deviations from the steady state are permanent, while the log-linearization procedure is accurate only around the steady state. To overcome this problem, Schmitt-Grohé and

Uribe (2003) propose four different methods to induce stationarity of the foreign bonds. In this model, we introduce one of the methods: an upward sloping supply of funds. This is a mechanism that generates fluctuations in the international interest rate premium when the foreign bond departs from its steady state value. The functional form we assume for the debt elastic interest rate premium is:

$$R^*(s^t) = \overline{R}^* \left(\frac{B^*(s^t)}{\overline{B^*}} \right)^{\nu} \exp(\varepsilon^*(s^t)) \tag{16}$$

The upward sloping supply of funds (16) has three components. The first one is the steady state foreign interest rate, which we will assume is equal to the subjective discount factor. The second one is the risk premium, which depends on the deviation of the foreign bonds from its steady state value. The third component is an exogenous shock for the foreign interest rate, which we modeled as an AR(1) process.

Regarding the trade integration, we are going to assume the law of one price holds for tradable goods[4]:

$$P^T(s^t) = e(s^t)P^*(s^t) \tag{17}$$

Without loss of generality, we will assume that the foreign price remains constant for every state and period of time.

2.5 Equilibrium

Domestic and foreign bond market clearing condition requires:

$$B(s^t) = 0 \tag{18}$$

[4] Even though there are several studies that show that the law of one price does not hold in the data (Engel, 1999), we consider that this assumption is a simple way to model the trade integration with the rest of the world. Under some settings, the law of one price is consistent with pricing-to-market assumptions (Obstfeld and Rogoff,2000)

$$B^*(s^t) = B^*(s^{t-1})R^*(s^{t-1}) + Y^T(s^t) - C^T(s^t) - G^T(s^t) \tag{19}$$

The market clearing condition for the final and intermediate nontradable goods are given by:

$$Y^N(s^t) = G^N(s^t) + C^N(s^t) \tag{20}$$

$$Y^N(s^t, i) = f^N(L^N(s^t, i), s^t) \tag{21}$$

Finally, we need equilibrium conditions in the labor and money market:

$$L(s^t) = L^T(s^t) + \int_0^1 L^N(i, s^t)di \tag{22}$$

$$M(s^t) = M^S(s^t) \tag{23}$$

An equilibrium for this model is a sequence of prices $\{P^T(s^t), P^N(i, s^t), P^N(s^t), W(s^t), Q(s^{t+1}/s^t), R^*(s^t), mc(s^t)\}_{t=0}^{\infty}$, allocations $\{C^T(s^t), C^N(s^t), B^*(s^t), B(s^{t+1}), M(s^t), L(s^t), L^T(s^t), L^N(i, s^t), Y^N(s^t)\}_{t=0}^{\infty}$, and policies $\{T(s^t), M^S(s^t)\}_{t=0}^{\infty}$ such that the conditions in equations (2) - (12), and (14)-(23) hold for t=0,1,2,...∞.

3 Calibration

In this section, we describe the functional forms and the calibration of the parameters for the baseline model. We consider the following utility function:

$$U(C^T, C^N, L, \frac{M}{P^T}) = \frac{C^{1-\sigma}}{1-\sigma} + \omega\frac{(M/P^T)^{1-\sigma}}{1-\sigma} + \psi\frac{(1-L)^{1-\sigma}}{1-\sigma} \tag{24}$$

$$C = \left[\theta(C^T)^\rho + (1-\theta)(C^N)^\rho\right]^{1/\rho} \tag{25}$$

The utility function (24) is similar to the one used by Chari et al (2002).In order to obtain sensible business cycles patterns in a model with Taylor-type monetary rules, consumption and money real balances must be separable. As is standard in the literature, we assume a CES aggregation for the tradable and nontradable consumption goods.

We assume a production function that depends on labor inputs and an exogenous productivity shock:

$$Y_t^i = f(L_t^i) = A^i L^{\alpha_i} \exp(z_t^i) \tag{26}$$

$$z_t^i = \rho z_t^i + \varepsilon_t^z \qquad i = T, N \tag{27}$$

The same production function is assumed for the tradable and the nontradable sectors. Nevertheless, the parameters are calibrated specifically for each sector.

For the preference parameters, we choose their values as follows. The discount factor β is set to 0.99, value that is consistent with an annual foreign interest rate of 4 per cent per year. This is the value generally assumed for the US real interest rate. For the risk aversion parameter σ, we rely on the study by Reinhart and Végh (1995), and set its value to 5.26. To the best of our knowledge, there are no empirical estimates of the preferences parameters for tradable and nontradable goods for the Chilean economy. Thus, we assume that the weight in the utility function θ is equal to 0.5. Based on the work of Arellano (2003), we set the intratemporal elasticity of substitution to $1/(1-\eta)$ to 0.48. We assume that the preference weight on real money balances ω is 1. Finally, we chose ψ consistent with 20 percent of working time in the steady state.

For the technology parameters, we set the labor shares in the tradable and nontradable sectors to $\alpha^T = 0.4$ and $\alpha^N = 0.63$. We obtain these values from Guajardo (2003), and are consistent with the national accounts statistics of Chile. We chose $\varepsilon = 10$, which implies a steady state markup of 10 percent. This parameter value is taken from Chari et al (2000).

We assume that prices are sticky for one year which implies $\eta = 0.75$. We chose a money growth rate of 4 per cent, which in the steady state is the growth rate of all nominal variables. This is the growth rate of M1 for the chilean economy during the 1990s. Finally, we set $\nu = 0.001$. As argued by Schmitt-Grohé and Uribe (2001), a small elasticity of the supply of funds schedule reduce the fluctuations in the country risk premium. We calibrate the parameter with a low value in order to not modify the short run properties of the model. This implies that the allocation of resources will be approximately the same with or without the funds schedule. The parameter values are summarized in table 1.

Table 1. Benchmark Economy Parameter Values

Name	Symbol	Value
Tradable output share	$\frac{Y^T}{Y^T+pY^N}$	0.36
Government expenditure share	$\frac{G^T+pG^N}{Y^T+pY^N}$	0.20
Net exports share	$\frac{NX}{Y^T+pY^N}$	0.02
Labor supply	$\bar{l}$	0.20
Discount factor	β	0.99
Tradable weight	θ	0.50
Risk Aversion	σ	5.26
Intratemporal Elasticity of Substitution	$\frac{1}{1-\rho}$	0.48
Money weight	ω	1
Labor share in the tradable sector	α^T	0.40
Labor share in the nontradable sector	α^N	0.63
Elasticity of intermediate goods	ε	10
Price stickiness	η	0.75
Money growth rate	μ	1.04
Foreign interest rate elasticity	ν	0.001

4 Welfare Analysis of Simple Monetary Policy Rules

Up to this point, we have not explicitly modeled the money supply process in the economy. We will assume that the monetary authority introduces money to the economy according to five rules. The policies considered are: exchange rate peg, money peg, inflation targeting, nontradable inflation targeting, and a Taylor rule. The regimes in terms of log-linearized variables are:

$$e_t = 0 \tag{28}$$

$$m_t = 0 \tag{29}$$

$$\pi_t^N = 0 \tag{30}$$

$$\theta\pi_t^N + (1-\theta)e_t = 0 \tag{31}$$

$$i_t = \phi_\pi(\theta e_t + (1-\theta)\pi_t^N) + \phi_y(\theta y_t^T + (1-\theta)y_t^N) \tag{32}$$

When we evaluate the policy rules, the underlying assumption is that the central bank does not have any credibility problems. All the agents in the economy believe that when the monetary authority chooses a rule, she will not deviate from the announced policy.

We compute the welfare of each policy rule with a similar procedure to the one implemented by Lucas (1987). We find how much the households are willing to give up to eliminate consumption and leisure fluctuations. The welfare cost of each policy is measured as a fraction of the aggregate consumption in the steady state. This fraction is computed comparing the utility of the household when all variables are in the steady state, with the one obtained with simulated variables. The welfare costs are obtained from the solution to the following equation:

$$U(\overline{C}(1-\lambda),\overline{L}) = U(\{C(s^t)\}_{t=0}^{\infty}, \{L(s^t)\}_{t=0}^{\infty}) \tag{33}$$

In the welfare analysis, we excluded the real money balances from the utility function. This implies that $\omega \to 0$. The left hand side of (33) is computed with the steady values of consumption and leisure. The right hand side is obtained from the simulated data of the model. We simulate the model with one policy rule for 100 periods, and then we calculate the household's welfare. We repeat the procedure 1000 times and compute the average welfare. Since the utility function is concave in all of its arguments, the utility from the RHS will be lower than the LHS. The difference, or the welfare cost of economic fluctuations, is captured by the parameter λ. This parameter measures how much a specific policy contributes to reduce the fluctuations in consumption and labor.

We simulate the model, introducing shocks with an autoregressive parameter of 0.95 and a standard deviation of 2 percent. Table 2 reports the welfare cost for each monetary policy rule. Table 3 shows the ranking of policy rules implied by the welfare costs. The welfare cost of each policy rule is in the range between 7.2 an 0.0003 percent. This is the fraction of the aggregate consumption, that the households are willing to give up in order to eliminate business cycles.

Table 2. Welfare Analysis of Alternative Policy Rules

Policy Rule	r^*	z^T	z^N	g^T	g^N
Exchange Rate Peg	6.6777	0.0284	0.1527	0.0003	0.0030
Nontradable Inflation Targeting	7.1324	0.0272	0.1591	0.0003	0.0028
Inflation Targeting	6.7742	0.0280	0.1537	0.0003	0.0029
Money Peg	6.8449	0.0280	0.1528	0.0003	0.0030
Taylor Rule	7.0364	0.0276	0.1541	0.0003	0.0029

Note: Each column represents a structural shock of the model economy. r^* denotes foreign interest rate, z^T denotes productivity in the tradable sector, z^N denotes productivity in the nontradable sector, g^T denotes tradable government expenditure shock, and g^N denotes nontradable expenditure shock.

Table 3. Ranking of Alternative Policy Rules

Policy Rule	r^*	z^T	z^N	g^T	g^N
Exchange Rate Peg	1	5	1	1	4
Nontradable Inflation Targeting	5	1	5	5	1
Inflation Targeting	2	3	3	3	3
Money Peg	3	4	2	2	5
Taylor Rule	4	2	4	4	2

From the five rules proposed, the exchange rate peg and the nontradable inflation targeting provide the highest welfare. To understand why these rules perform better than the rest, we plot the impulse response of the components in the utility function. The impulse responses give us some information about how sensitive the variables in the model are to random disturbances. Figures 1 through 5 illustrate them. For most cases, there is a tradeoff between consumption smoothing and leisure smoothing. The policy rule that gives the flattest consumption profile, at the same time induces greater volatility in the labor supply. The influence of the policy rule on the relative price of nontradable goods induces different allocations of consumption and labor across sectors, and therefore affects the volatility of these variables.

On the other hand, the policy rule also affects the average level of consumption and leisure. Monopolistic competition generates in steady state a lower production of nontradable goods compared to the socially optimal quantity. The monetary policy rules we consider can squeeze monopolists profits to achieve a better outcome, but at the cost of distorting the relative price of nontradable goods.

The leading rule in each case is the one that mitigate as much as possible these distortions in the economy, and gives the lowest combination of consumption and labor volatility according to the utility function (24).

5 Concluding Remarks

Currently, there is an intense debate about which monetary policy is suitable for developing countries. At the present time, many emerging market economies are adopting an inflation targeting scheme. This regime has been successfully applied in developed countries. Nevertheless, nothing guarantees that the same degree of success will be achieved in all developing countries. The difference in the economic structure and in the access to international capital markets makes these economies more vulnerable to international shocks. Hence, a monetary policy should be designed to cope with particular features present in emerging economies.

The aim of this paper is to contribute to the theoretical discussion of which policy rules are relevant to developing countries. We found in a two-sector model with sticky prices that, depending on the source of the shock, it is optimal to stabilize either the nominal exchange rate or the price of nontradable goods. On the other hand, a noncontingent rule such as inflation targeting delivers an inferior combination of consumption and leisure for the households. This results gives some theoretical support for stabilizing the nominal exchange rate under some shocks in order to achieve an efficient allocation of resources. These results are conditional on the underlying distortions present in the model economy, which are monopolistic competition and sticky prices.

As an extension of the paper, we plan to introduce additional frictions that are common to developing countries. The objective is to find how the ranking of rules changes in the presence of financial frictions such as a endogenous borrowing constraint for the international bonds, or a segmentation in the asset markets. With these financial imperfections, the role of monetary policy is to provide insurance to the households against real shocks. For instance, under asset market segmentation, only a fraction of the households have access to state-contingent securities, and the money supply is capable of smoothing the consumption of agents that do not participate in the asset market. We believe these distortions are important features to take into account in the design of monetary policy in developing countries.

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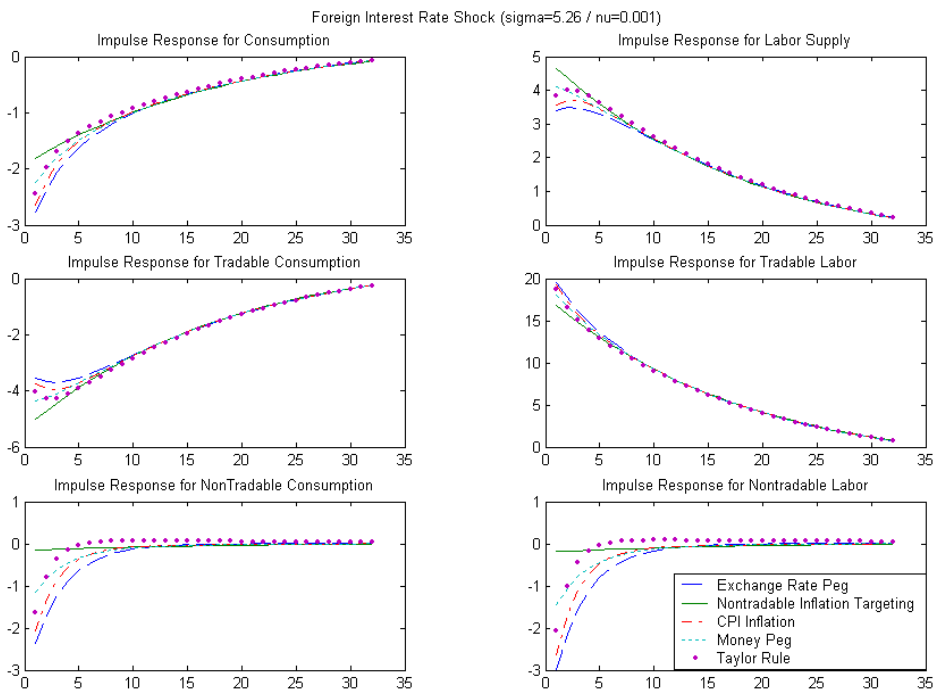
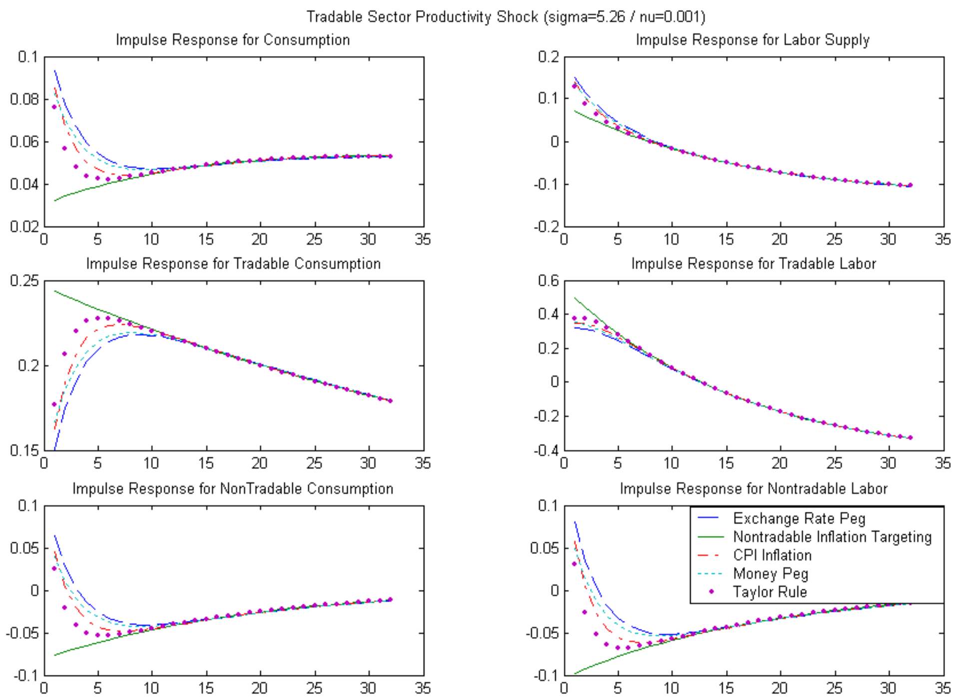

Foreign Interest Rate Shock (sigma=5.26 / nu=0.001)
Impulse Response for Consumption
Impulse Response for Labor Supply
Impulse Response for Tradable Consumption
Impulse Response for Tradable Labor
Impulse Response for NonTradable Consumption
Impulse Response for Nontradable Labor
Exchange Rate Peg
Nontradable Inflation Targeting
CPI Inflation
Money Peg
Taylor Rule

Figure 1:



Tradable Sector Productivity Shock (sigma=5.26 / nu=0.001)
Impulse Response for Consumption
Impulse Response for Labor Supply
Impulse Response for Tradable Consumption
Impulse Response for Tradable Labor
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Figure 2:

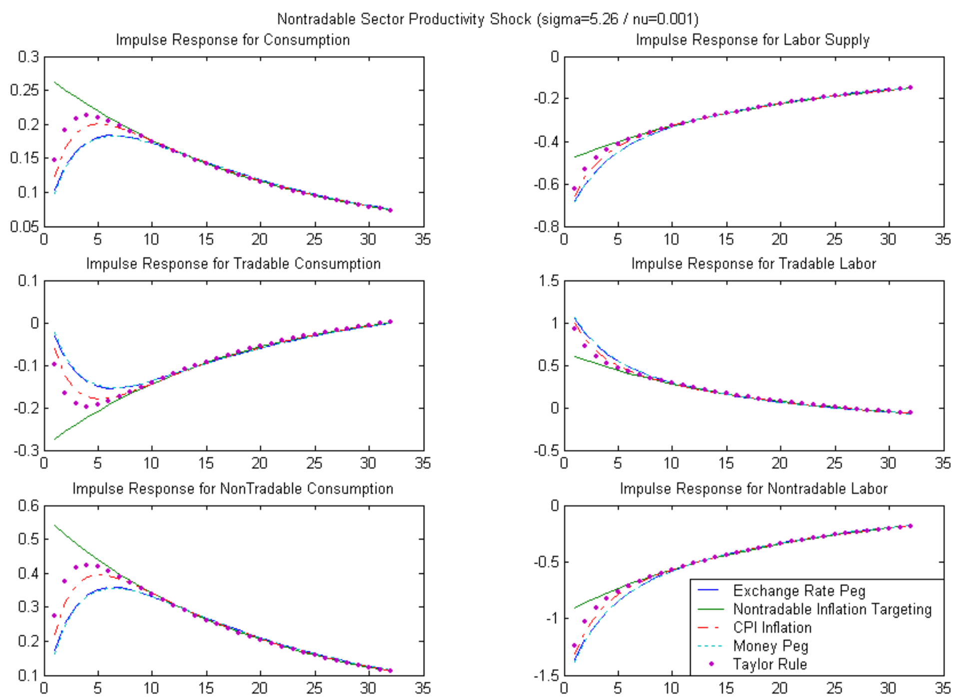
Nontradable Sector Productivity Shock (sigma=5.26 / nu=0.001)
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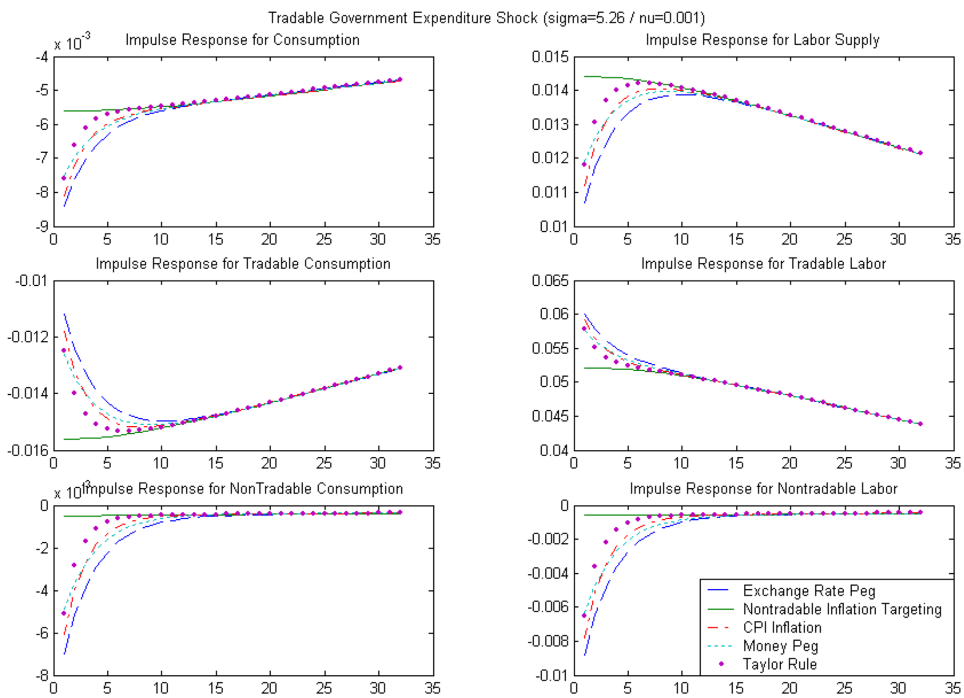
Figure 3:


Tradable Government Expenditure Shock (sigma=5.26 / nu=0.001)
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Impulse Response for Tradable Labor
Impulse Response for NonTradable Consumption
Impulse Response for Nontradable Labor
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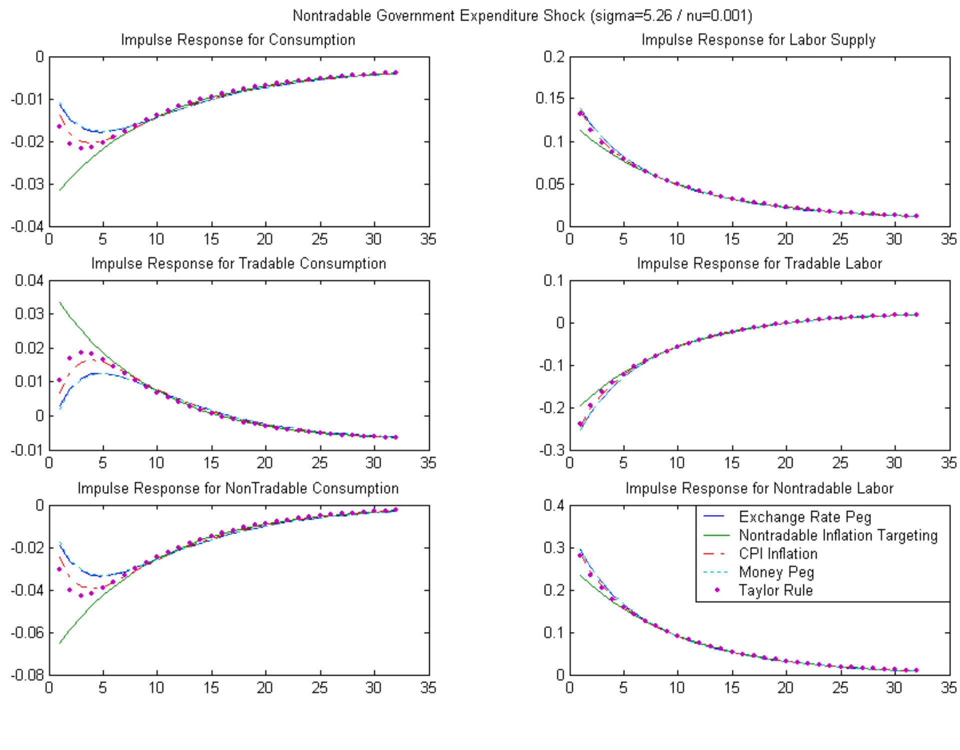
Figure 4:


Nontradable Government Expenditure Shock (sigma=5.26 / nu=0.001)
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Impulse Response for Tradable Labor
Impulse Response for NonTradable Consumption
Impulse Response for Nontradable Labor
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Figure 5: