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Monetary Policy and the Propagation of Shocks Under Imperfect Exchange-Rate Pass-Through

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Abstract

When the Mexican Crisis of 1994 occurred, the Central Bank of Mexico was forced to abandon its fixed exchange rate system. Since then, monetary policy has been moving toward an inflation targeting regime, which finally became the operational monetary framework in 2001. Moreover, Calvo and Reinhart (2000) find evidence that the actions taken by the Mexican central bank seem to exhibit a fear of floating, which is a modern variant of managed floating. In addition, Ball and Reyes (2003) argue that the while inflation has been the number one policy issue for the Mexican central bank, at times this has required occasional intervention to offset inflationary exchange-rate shocks. However, in a low pass-through environment, the policymaker can simultaneously strictly target consumer price inflation (CPI), but still allow high volatility in the nominal exchange rate to stabilize the real economy in face of the shocks. This result emerges because the low-pass-through eliminates the trade-off between output volatility and inflation volatility. In México in the last years the elasticity of the exchange rate pass-through to general consumer prices has been very low.

* El Colegio de Mexico

1. Introduction

Recent studies, have introduced a number of realistic features into New Keynesian small economies frameworks with the aim of providing better guidance for policymakers. One main improvement has been the widespread inclusion of incomplete international asset markets into standard representative agent dynamic stochastic general equilibrium (DSGE) models. Another improvement has been the gradual move away from modelling frameworks that assume the law of one price with perfect exchange-rate pass-through. For instance, Ouchen and Ziky (2015) showed that in an environment of low exchange-rate pass-through, a monetary policy that acts to stabilize the nominal exchange rate was likely to be sub-optimal. The intuition behind this result is that when the law of one price does not hold, there no longer exists a trade-o between output volatility and in inflation volatility. These results are consistent with the findings of Justiniano and Preston (2010) who found that even when there is no strong disconnection between the nominal exchange rates and domestic series, the optimal policy should not respond to the nominal exchange rate.

The aim of this work is to investigate the importance of the degree of exchange-rate pass-through on the propagation of shocks for a small open economy like Mexico and analyze the optimal monetary under three alternatives: domestic inflation targeting, consumer inflation targeting and manage oat. The criterion of the choice of the optimal exchange rate regime is based on the examination of the volatility of the macroeconomic variables under the various alternative monetary rules.

The modelling framework employed closely follows the small open DSGE model of Justiniano and Preston (2010), where the domestic economy is characterized by imperfect com-petition and nominal price rigidities with indexation to past inflation. Furthermore, it is assumed that there exists a retail sector that operates with the monopolistic power to set local currency prices for imports, thereby breaking the law of one price assumption. International asset markets are assumed to be incomplete. However, we extend the framework of Justiniano and Preston (2010) by assuming the utility function of the representative agent to be non-separable between consumption and real money balances following Woodford (2003), and McKnight and Mihailov (2014). As McKnight and Mihailov (2015) this feature yields an additional monetary transmission mechanism, where changes in the nominal interest rate result in changes in the demand for money, which affects the output and pricing decisions of firms. This is an important difference from Justiniano and Preston (2010) since they assume a cashless economy and consequently the demand for money plays no role under an inflation targeting policy regime. For the analysis of the optimal monetary policy, we consider four domestic shocks: a productivity (technology) shock, a cost-push a shocks and monetary shock, and one external shock: a risk-premium shock. However, we will only show the results of the monetary shock.

Following Ouchen and Ziky (2015), we consider three alternative specifications for the interest-rate feedback rule: a CPI inflation targeting regime whereby the nominal interest rate responds to variations in CPI inflation and output; a domestic inflation targeting regime where the nominal interest rate reacts to variations in domestic price inflation and output; and a managed oat regime that permits the nominal interest rate to respond to adjustments in the real exchange rate. Finally, the model is calibrated for the parameters established in the literature for Mexico.

The main findings of the work are as follows. First, the degree of exchange-rate pass-through can play an important role in the propagation of shocks in open economy. This result is most clearly observed under monetary shocks whose effects on the economy are sizeable and amplified as the degree of imperfect exchange-rate pass-through is increased under all three types of monetary rules. Second, consistent with the findings of Ouchen and Ziky (2015) it is not necessary for the monetary policy to have an active role in the exchange rate, even in the presence of real exchange rate volatility. Third, an important finding is that monetary shocks generate a different transmission mechanism for the terms of trade under low degrees of exchange-rate pass-through compared to high degrees of pass-through. This is important for Mexico where there are high degrees of incomplete pass-through, this parameter has been estimated around 0.3 and 0.6 for the long term (see Ramos-Francia, 2011).

This work is related to a small literature that has focused on the importance of pricing-to-market assumptions in regard to whether a country employs producer currency pricing or local currency pricing. A key insight of Justiniano and Preston (2010) is that optimal policies do not respond to the nominal exchange rate. They argue that this is optimal because there is a disconnection between nominal exchange movements and the evolution of domestic series, through a delay in the exchange rate pass-through.

Ouchen and Ziky (2015) also investigate how different degrees of exchange-rate pass-through affect the propagation of shocks, but with the key difference that they assume complete international asset markets. Ouchen and Ziky (2015) analyze the implications of four alternative monetary policy regimes for their small open economy: Domestic Inflation Targeting (DIT), Manage Float (MF), Consumer Inflation Targeting (CIT) and an exchange rate peg. In their analysis, the economy experiences only two kind of shocks: internal shocks (productivity shocks) and external shocks (terms of trade and foreign demand). In our set-ting, while we also have a productivity shock, we depart from Ouchen and Ziky (2015) by considering risk premium shocks due to incomplete asset markets, cost-push shock, and monetary shocks from the inclusion of real balance effects. Similar to our results for productivity results, they and that the degree of exchange-rate pass-through is important for assessing different monetary policy rules. They also found that CPI inflation targeting was the best policy for an economy that exhibited lagged exchange rate pass-through. Under a low degree of pass-through, this enables domestic and the overall inflation to respond sluggishly to shocks, and therefore it is more efficient for the monetary authority to target the overall CPI rather than just domestic prices.

The remainder of the work proceeds as follows. Section 2 discusses the model and Section 3 outlines the log-linearized equilibrium system and discusses its calibration. Section 4 presents the results under a CPI inflation targeting monetary policy regime, whereas Section 5 considers the implications of targeting domestic and the real exchange rate. Finally, in Section 6 we discuss the results and the conclusions.

2. The Model

This section outlines the model economy. Following Justiniano and Preston (2010), we utilize a small open economy framework with incomplete international asset markets. The global economy consists of two countries, Home and Foreign. The Home country is populated by a representative infinitely-lived household, a continuum of domestic good producers and retail firms who import foreign-produced goods, and a monetary authority. Both domestic good producers and retail firms are assumed to operate under imperfect competition and set prices in a staggered way according to Calvo (1983). Market power in the retail sector violates the law of one price resulting in incomplete exchange-rate pass-through. Following Woodford (2003) and McKnight and Mihailov (2015), real money balances enter into the utility function in a non-separable way. Consequently, money demand still plays a role in the economy even if the monetary policy instrument is the nominal interest rate. In what follows, subscripts H and F denote, respectively, variables of Home and Foreign origin, and asterisks denote Foreign variables.

2.1 Representative Household

The period utility function of the representative household is assumed to be non-separable between consumption C and real money balances $m_t \equiv \frac{M_t}{P_t}$

$$U(C_t, m_t, l_t) \equiv u(C_t, m_t) - v(l_t)$$

In order to find an interior solution, we assume that $u(C_t, m_t)$ is concave and strictly increasing in each argument, and that both consumption and real money balances are normal goods. Moreover, the disutility of labor supply, $v(l_t)$, is assumed to be an increasing convex function.

The representative household chooses real consumption C_t domestic real money balances m_t and labor supply l_t to maximizes her expected discounted utility:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[u(C_t, m_t) - v(l_t)\right] \quad (2.1)$$

where $\beta \epsilon (0,1)$ denotes the discount factor and C_t is a composite consumption index:

$$C_t = \left[(1-\alpha)^{1/\gamma} C_{H,t}^{\gamma-1/\gamma} + \alpha^{1/\gamma} C_{F,t}^{\gamma-1/\gamma}\right] \quad (2.2)$$

where $\gamma > 1$ measures the elasticity of substitution between home and foreign goods and $0 < \alpha < 1$ is the share of foreign goods in the domestic consumption bundle. $C_{H,t}$ and $C_{F,t}$ represent, respectively the Dixit-Stiglitz aggregates of domestic and foreign imported products:

$$C_{H,t} = \left[\int_0^1 C_{H,t}(i)^{\frac{\theta-1}{\theta}} di\right]^{\frac{\theta}{\theta-1}}$$

$$C_{F,t} = \left[\int_0^1 C_{F,t}(i)^{\frac{\theta-1}{\theta}} di\right]^{\frac{\theta}{\theta-1}}$$

where $\theta > 1$ is the elasticity of substitution between the differentiated types of goods of both countries.

During period t, the household receives income from wages W_t from supplying labor and profits from the ownership of domestic good producers $\Pi_{H,t}$ and retail firms $\Pi_{f,t}$. In addition, the household receives lump-sum nominal transfers from the monetary authority. The household uses its income to purchase goods, money and bonds. Following Justiniano and Preston (2010), the asset market is assumed to be incomplete, where the household can purchase one-period domestic DB_t and foreign bonds FB_t that mature in period $t+1$ with corresponding nominal interest rates i_t and i_t^*. Letting e_t denote the nominal exchange rate and P_t the aggregate price-level, the period budget constraint can be expressed as:

$$P_t C_t + DB_t + e_t FB_t + M_t = DB_{t-1}(1+i_{t-1})$$
$$+ e_t FB_{t-1}(1+i_{t-1}^*) d_{t-1} + M_{t-1} + W_t l_t + \Pi_{H,t} + \Pi_{F,t} + \Upsilon_t \quad (2.3)$$

Following Justiano and Preston (2010), we assume that there is a debt-elastic interest-rate premium: ϕ_t

$$\phi_t = exp[-\kappa(d_t + \tilde{\phi}_t)]$$

where:

$$d_t \equiv \frac{e_t FB_t}{Y^{ss} P_t}$$

In the above, d_t denotes the ratio of the real quantity of foreign bond holdings (in terms of domestic currency) to steady state output Y^{ss}. If the ratio $d_t > 0$, the household is a net borrower and must repay a premium over the interest rate. As Justiniano and Preston (2010) point out, this debt-elastic interest-rate premium is sufficient to ensure that bond holdings are stationary. The parameter $\tilde{\phi}_t$ denotes an exogenous risk premium shock.

To maximize her utility in consumption goods, the household will allocate expenditures across all types of domestic and foreign goods, both intratemporally and intertemporally. Let $P_{H,t}$ and $P_{F,t}$ denote the respective price sub-index for home and imported consumption good bundles. The home demand for each variety of domestic and imported consumption good is given by:

$$C_{H,t}(i) = \left(\frac{P_{H,t}(i)}{P_{H,t}}\right)^{-\theta} C_{H,t} \quad (2.4)$$

$$C_{F,t}(i) = \left(\frac{P_{F,t}(i)}{P_{F,t}}\right)^{-\theta} C_{F,t} \quad (2.5)$$

for all i. The optimal allocation of expenditure across home and foreign goods implies the demand functions:

$$C_{H,t} = (1-\alpha)\left(\frac{P_{H,t}}{P_t}\right)^{-\gamma} C_t \tag{2.6}$$

and

$$C_{F,t} = \alpha\left(\frac{P_{H,t}}{P_t}\right)^{-\gamma} C_t \tag{2.7}$$

The consumer price index can be derived as:

$$P_t = \left[(1-\alpha)P_{H,t}^{1-\gamma} + \alpha P_{F,t}^{1-\gamma}\right]^{\frac{1}{1-\gamma}} \tag{2.8}$$

$$P_{H,t} = \left[\int_0^1 P_{H,t}^{1-\theta}(i)di\right]^{\frac{1}{1-\theta}} \tag{2.9}$$

$$P_{F,t} = \left[\int_0^1 P_{F,t}^{1-\theta}(i)di\right]^{\frac{1}{1-\theta}} \tag{2.10}$$

The household must optimally choose allocations for aggregate consumption, domestic and foreign bonds, real money balances and labor supply. The first order conditions for C_t, m_t, l_t, DB_t and FB_t from the household maximization problem yields:

$$\beta(1+i_t)E_t\left\{\frac{u_{c(C_{t+1},m_{t+1})}}{P_{t+1}}\right\} = \frac{u_{c(C_t,m_t)}}{P_t} \tag{2.11}$$

$$\frac{u_{m(C_t,m_t)}}{u_{c(C_t,m_t)}} = \frac{i_t}{1+i_t} \tag{2.12}$$

$$\frac{v_{l(l_t)}}{u_{c(C_t,m_t)}} = w_t \tag{2.13}$$

$$\lambda_t = E_t[(1+i_t)\lambda_{t+1}] \tag{2.14}$$

$$\lambda_t e_t = E_t[(1+i_t^*)\beta\phi_t\lambda_{t+1}e_{t+1}] \tag{2.15}$$

2.2 Real Exchange Rate, Terms of Trade, Uncovered Interest Parity: Some Identities

In what follows, I define the real exchange rate (for the Home country) as:

$$q_t \equiv \frac{e_t P_t^*}{P_t} \tag{2.16}$$

When the law of one price holds, this implies:

$$P_{H,t} = e_t P_{H,t}^* \tag{2.17}$$

and

$$P_{F,t}^* = \frac{P_{F,t}}{e_t} \tag{2.18}$$

Since $P_t^* = \text{e}\, P_{F,t}^*$ for the Foreign country, when the law of one price fails to hold, we have:

$$\psi_{F,t} = \frac{e_t P_t^*}{P_{F,t}} \neq 1 \tag{2.19}$$

which defines the law of one price gap. The relative price of foreign goods in terms of home goods, or the terms of trade for the Home country is defined as:

$$TR_t = \left(\frac{P_{F,t}}{P_{H,t}}\right) \tag{2.20}$$

2.3 Domestic Producers

In the domestic goods market, there are a continuum of monopolistically competitive firms $i \in [0,1]$ that produce differentiated goods. For simplicity, it is assume that the production function of each firm depends only on labor, and is represented by the linear production technology:

$$y_t(i) = \tilde{\varepsilon}_{a,t} l_t(i) \tag{2.21}$$

where $\tilde{\varepsilon}_{a,t}$ is an exogenous technology shock. Given competitive prices for labour, cost mini-mization yields:

$$mc_t = \frac{w_t}{\tilde{\varepsilon}_{a,t}}\frac{P_t}{P_{H,t}} \tag{2.22}$$

Domestic firms set prices in a staggered way according to Calvo (1983), allowing for indexation to past inflation. Similar to Justiniano and Preston (2010), at any time *t*, there is a constant probability $1-\tau_H$ that firm will be randomly selected to adjust its price optimally independently of the past; otherwise with probability $0 < \tau_H < 1$ the firm adjusts price according to the following inflation indexation rule:

$$P_{H,t}(i) = P_{H,t-1}(i)\left(\frac{P_{H,t-1}}{P_{H,t-2}}\right)^{\delta_H} \qquad (2.23)$$

where $\delta_H \in [0,1]$ measures the degree of inflation indexation. For simplicity, it is assumed that the export price of the domestic good is determined by the law of one price $P^*_{H,t} = \left({}^{1}/_{e_t}\right)P_{H,t}$.

A domestic firm *i*, faced with changing its price at time *t*, has to choose $P_{H,t}(i)$ to maximize its expected discounted value of profits, taking as given the indexes $P_{H,t}$, $C_{H,t}$ and $C^*_{H,t}$:

$$\max_{P_{H,t}(i)} E_t \sum_{t=0}^{\infty} X_{t,t+s}(\beta\tau_H)^s \left[P_{H,t-1}(i)\left(\frac{P_{H,s-1}}{P_{H,t-1}}\right)^{\delta_H} - \tilde{\varepsilon}_{cp,t+s}P_{H,t+s}MC_{t+s}\right]Y_{H,t+s}(i)$$

where

$$Y_{H,t+s}(i) = \left(\frac{P_{H,t}(i)}{P_{H,t+s}}\left(\frac{P_{H,t+s-1}}{P_{H,t-1}}\right)^{\delta_H}\right)^{-\theta}\left(C_{H,+t+s} + C^*_{H,t+s}\right)$$

is the demand curve that each firm faces, and $\tilde{\varepsilon}_{cp,t+s}$ is a cost-push shock. The first order condition is:

$$E_t \sum_{t=0}^{\infty} X_{t,t+s}(\beta\tau_H)^s Y_{H,t+s}(i)\left[P_{H,t-1}(i)\left(\frac{P_{H,s-1}}{P_{H,t-1}}\right)^{\delta_H} - \left(\frac{\theta}{\theta-1}\right)\tilde{\varepsilon}_{cp,t+s}P_{H,t+s}MC_{t+s}\right] = 0 \qquad (2.24)$$

Solving the above for $P_{H,t}(i)$, gives the following price-settings condition:

$$\tilde{P}_{H,t} = \tilde{\varepsilon}_{cp,t+s}\frac{\theta}{\theta-1}\frac{E_t\sum_{t=0}^{\infty}X_{t,t+s}(\beta\tau_H)^s X_{t,H,t+s}Y_{H,t+s}(i)P_{H,t+s}MC_{t+s}}{E_t\sum_{t=0}^{\infty}X_{t,t+s}(\beta\tau_H)^s X_{t,H,t+s}Y_{H,t+s}(i)P_{H,t+s}\left(\frac{P_{H,s-1}}{P_{H,t-1}}\right)^{\delta_H}} \qquad (2.25)$$

Where the optimal price is a mark-up ${}^{\theta}/_{\theta-1}$ of a weighted average of expected future nominal marginal cost. Then , the aggregate price level evolves according to:

$$P_{H,t} = \left[(1-\tau_H)\tilde{P}_{H,t}^{\ 1-\theta} + \tau_H\left(P_{H,t-1}\left(\frac{P_{H,t-1}}{P_{H,t-2}}\right)^{\delta_H}\right)^{1-\theta}\right]^{\frac{1}{1-\theta}} \qquad (2.26)$$

2.4 Retail Firms

In the retail sector, there is a continuum of monopolistically competitive firms indexed by $j \in (0,1)$, that import differentiated goods from the Foreign country. It is assume that while the law of one price holds for foreign goods, retail firms have the power to determine the domestic currency price of the imported good, which results in a violation of the law of one price for final good consumption.

As in the case of domestic firms, retail firms set prices in a staggered way according to Calvo (1983), where a fraction of $1-\tau_F$ of retail firms set prices in an optimal way, and a fraction $0 < \tau_F < 1$ adjust prices according to an inflation indexation rule similar to (2.23). It is important to stress that in the analysis τ_F determines the degree of exchange-rate pass-through. A retail firm *j* that can set its price optimally at time *t*, imports a good at a cost $e_t P^*_{F,t}(j)$ and chooses a price $P_{F,t}(j)$ to maximize its expected discounted value of profits, taking as given $P_{F,t}$ and $C_{F,t}$.

$$\max_{P_{F,t}(i)} E_t \sum_{t=0}^{\infty} X_{t,t+s}(\beta\tau_F)^s \left[P_{F,t}(i)\left(\frac{P_{F,s-1}}{P_{F,t-1}}\right)^{\delta_F} - e_{t+s}P^*_{F,t+s}(j)\right]Y_{F,t+s}(i)$$

where

$$Y_{F,t+s}(i) = \left(\frac{P_{F,t}(i)}{P_{F,t+s}}\left(\frac{P_{F,t+s-1}}{P_{F,t-1}}\right)^{\delta_F}\right)^{-\theta}\left(C_{F,t+s}\right)$$

is the demand function faced by retail firms. The first order condition is given by:

$$E_t \sum_{t=0}^{\infty} X_{t,t+s}(\beta\tau_F)^s Y_{F,t+s}(i)\left[P_{F,}(i)\left(\frac{P_{F,t+s-1}}{P_{F,t-1}}\right)^{\delta_F} - \left(\frac{\theta}{\theta-1}\right)e_{t+s}P^*_{F,t+s}(j)\right] = 0 \qquad (2.27)$$

Solving the above for $P_{F,t}(i)$, gives the following price-settings condition:

$$\tilde{P}_{F,t} = \frac{\theta}{\theta-1}\frac{E_t\sum_{t=0}^{\infty}(\beta\tau_F)^s X_{t,t+s}Y_{F,t+s}(j)P_{F,t+s}e_{t+s}}{E_t\sum_{t=0}^{\infty}(\beta\tau_F)^s X_{t,F,t+s}Y_{F,t+s}(j)}\left(\frac{P_{F,s-1}}{P_{F,t-1}}\right)^{\delta_F} \qquad (2.28)$$

$$P_{F,t} = \left[(1-\tau_F)\tilde{P}_{F,t}^{\ 1-\theta} + \tau_F\left(P_{F,t-1}\left(\frac{P_{F,t-1}}{P_{F,t-2}}\right)^{\delta_F}\right)^{1-\theta}\right]^{\frac{1}{1-\theta}} \qquad (2.29)$$

Rational Expectations Equilibrium: Given an exogenous sequence for foreign consumption $\{C^*_t\}$, initial conditions for DB_0, FB_0 and M_0 and the exogenous sequence of the shocks, a rational expectations equilibrium for the small open economy consists of a sequence of prices $\{P_t, P_{H,t}, P_{F,t}, \tilde{P}_{H,t}, \tilde{P}_{F,t}, w_t, MC_t, e_t\}$, a sequence of allocations $\{C_t, Y_t, L_{,t}, DB_t, FB_t, m_t,\}$, and a monetary policy rule i_t satisfying:

(i) the optimality conditions of the household (2.11-2.13) and the interest-rate parity condition (2.16);
(ii) the optimality conditions of domestic firms (2.21-2.22), and price-setting behavior of domestic goods producers (2.25-2.26) and retail firms (2.28-2.29);
(iii) a monetary policy rule;
(iv) the goods, money and bond markets clear (2.30-2.32); and (v) the consumer price index (2.8).

3 The Log-Linearized Model and Calibration

3.1 The Log-Linearized Model

The model of the previous section is log-linearized around a deterministic zero-inflation steady state $\pi^{ss} = 0$, where in the steady state, domestic and foreign bonds are zero $DB^{ss} = FB^{ss} = 0$ and the steady-state terms of trade equals the steady-state nominal exchange rate which equals one: $DB^{ss} = FB^{ss} = 1$. All variables (with hats) represents log deviations from their respective steady-states values i.e. $\hat{X}_t = ln\left({}^{X_t}/_{X^{ss}}\right)$. As is common in the existing literature, we assume that the log-deviations for Foreign variables are all equal to zero.

A log-linear approximation to the household Euler equation (2.11) generates the IS equation for this economy:

$$\hat{C}_t = E_t\hat{C}_{t+1} - \sigma[\hat{\imath}_t - E_t\hat{\pi}_{t+1} + \mu(E_t\widehat{m}_{t+1} - \widehat{m}_t)] \quad (3.1)$$

where $\sigma \equiv {}^{-u_c}/_{u_{cc}C^{ss}}$ represents the intertemporal elasticity of substitution in consumption and $\mu \equiv m^{ss}\, {}^{u_{cm}}/_{u_c}$ is the degree of non-separability between real money balances and consumption. Log-linearizing (2.12) yields the LM equation

$$\widehat{m}_t = \eta_c\hat{C}_t - \eta_i\hat{\imath}_t \quad (3.2)$$

where $\eta_c > 0$ and $\eta_i > 0$ are the consumption and interest-rate semi-elasticity of money demand, which are defined as follows:

$$\eta_c \equiv \frac{\sigma^{-1} + \nu}{\mu + \sigma_m^{-1}}$$

and

$$\eta_i \equiv \left(\frac{\beta}{1-\beta}\right)\left(\frac{1}{\mu + \sigma_m^{-1}}\right)$$

where $\sigma_m^{-1} \equiv {}^{-m^{ss}u_{mm}}/_{u_m}$, $\nu \equiv -C^{ss}\, {}^{u_{cm}}/_{u_m}$, and $\mu = s_m\nu$, where $s_m \equiv {}^{m^{ss}u_m}/_{u_c\,C^{ss}}$

To derive a relationship for aggregate supply for domestic goods, it is necessary to log-linearize the price-setting equations (2.25-2.26). This generates the so-called New Keynesian Phillips Curve (NKPC):

$$\widehat{\Pi}_{H,t} - \delta_H\widehat{\Pi}_{H,t} = E_t\left(\widehat{\Pi}_{H,t+1} - \delta_H\widehat{\Pi}_{H,t}\right) + \frac{(1-\tau_H)(1-\tau_H\beta)}{\tau_H}\left(\widehat{mc}_t + \hat{\varepsilon}_{cp,t}\right) \quad (3.3)$$

Where the inflation rate for domestic prices is $\widehat{\Pi}_{H,t} = \hat{P}_{H,t} - \hat{P}_{H,t-1}$ and:

$$mc_t = \omega\hat{Y}_t - (1-\omega)\varepsilon_{a,t} + \frac{1}{\sigma}\hat{C}_t - \mu\widehat{m}_t + \alpha\widehat{TR}_t \quad (3.4)$$

The above expression for real marginal cost is obtained by combining the log-linearized versions of (2.13), the aggregate version of the production function (2.21), the cost-minimization condition (2.22), and the CPI index (2.8). Note that (2.8) implies the following expression for the terms of trade $\hat{P}_t - \hat{P}_{H,t} = \alpha\widehat{TR}_t$ after using (2.20).

According to (3.3), domestic-price inflation, is driven by current marginal cost, expectations about domestic-price inflation in the next period, and as a result of price indexation, a fraction of past and observed domestic-price inflation. When the indexation to past domestic-price in flation is zero, $\delta_H = 0$, equation (3.3) collapses to the familiar forward-looking version of the NKPC. In contrast to a closed-economy setting, domestic-price inflation, via real marginal cost, not only depends on domestic variables but also on the terms of trade.[1] Finally, the cost-push shock in equation (3.3) captures inefficient variations in firm mark-ups.

After log-linearizing the price-setting conditions for retail firms (2.28-2.29), we can obtain the following aggregate supply for retail goods:

$$\widehat{\Pi}_{F,t} - \delta_F\widehat{\Pi}_{F,t} = E_t\left(\widehat{\Pi}_{F,t+1} - \delta_F\widehat{\Pi}_{F,t}\right) + \frac{(1-\tau_F)(1-\tau_F\beta)}{\tau_F}\left(\hat{\psi}_{F,t}\right) \quad (3.5)$$

where $\widehat{\Pi}_{F,t} = \hat{P}_{F,t} - \hat{P}_{F,t-1}$ and $\hat{\psi}$ denotes the log-linearized version of the law of one price gap (2.19)

$$\hat{\psi}_t \equiv \hat{e}_t + \hat{P}^* - \hat{P}_{F,t}$$

1 See McKnight and Mihailov (2015) for further discussion.

Here, retail price inflation (i.e., the domestic currency price of imports), $\widehat{\Pi}_{F,t}$, is determined by a fraction of past retail in ation, observed retail in ation, expectations about next period's retail in ation and by deviations of the law of one price $\hat{\psi}_t$.

For the purposes of this study, it is important to derive the relationship between the terms of trade, the law of one price gap and the real exchange rate, in order to analyst the implications of imperfect exchange-rate pass-through. Log-linearizing (2.8), the real exchange rate definition and the terms of trade (2.20) yields:

$$\hat{q}_t = \hat{\psi}_t + (1-\alpha)\widehat{TR}_t \tag{3.6}$$

First differencing the log-linear version of (2.21), we obtain how the terms of trade adjusts overtime:

$$\widehat{TR}_t - \widehat{TR}_{t-1} = \widehat{\Pi}_{F,t} - \widehat{\Pi}_{H,t} \tag{3.7}$$

By log-linearizing (2.8) and first-differencing, we obtain the CPI inflation index as a weighted combination of domestic-price inflation and imported inflation:

$$\widehat{\Pi}_t = (1-\alpha)\widehat{\Pi}_{F,t} + \alpha\widehat{\Pi}_{H,t} \tag{3.8}$$

In this economy, the interest-rate parity condition (2.16) determines how the nominal (and hence real) exchange rate fluctuates given domestic and world interest rates. Therefore, combining the log-linear version of (2.16) and (3.6) gives:

$$\left(\hat{\imath}_t - E_t\widehat{\Pi}_{F,t+1}\right) = E_t(\hat{q}_{t+1} - \hat{q}_t) - \kappa\left(\hat{d}_t + \hat{\phi}_t\right) \tag{3.9}$$

where $\hat{\phi}_t$ captures a risk premium shock, which represents deviations from real interest rate parity and $\hat{d}_t \equiv \ln({}^{e_t FB_t}/_{P_r Y^{ss}})$ is the log real net foreign asset position as a fractions of steady-state output.

As discussed by Justiniano and Preston (2010), in equilibrium households nominal income is equal to: $W_t N_t + \Pi_t = P_{H,t} Y_t + \left(P_{F,t} - e_t P_t^*\right) C_{F,t}$. Substituting this into the household budge constraint (2.3) and using the market clearing condition for money (2.31) and domestic bonds (2.32) and then log-linearizing generates:

$$\hat{C}_t + \hat{d}_t = \frac{1}{\beta}\hat{d}_{t-1} - \alpha\left(\widehat{TR}_t + \hat{\psi}_{F,t}\right) + \hat{Y}_t \tag{3.10}$$

The above equation determines the evolution of debt in the model economy. Finally, to obtain a condition for output we log-linearize the goods market clearing condition (2.30):

$$\hat{Y}_t = (1-\alpha)\hat{C}_t + \alpha\gamma\hat{q}_t\widehat{TR}_t \tag{3.11}$$

3.2 Monetary Policy Rules

Finally, to complete the log-linearized equilibrium system for this economy, it is necessary to specify a monetary policy rule. Following Ouchen and Ziky (2015), we consider three alternative interest-rate rule specifications.

- **CIT** Consumer Inflation Targeting: the policy rule responds to CPI inflation
- **DIT** Domestic Inflation Targeting: the policy rule responds to domestic price inflation
- **MF** Managed Float: a policy rule that responds to movements in the real exchange rate

3.2.1 CPI Inflation Targeting

Under a CPI inflation targeting policy, the central bank reacts to changes in output and CPI inflation. Formally, such a policy is specified as:

$$\hat{\imath}_t = \beta_0\hat{\imath}_{t-1} + (1-\beta_0)\left(\beta_1\widehat{\Pi}_t + \beta_2\widehat{Y}_t\right) + \upsilon_t \tag{3.12}$$

where $\hat{\imath}_t$, $\widehat{\Pi}_t$, $\hat{y}_t$, are log deviations of the interest rate, CPI inflation and output from their steady-state values $0 < \beta < 1$ is the interest-rate smoothing parameter, $\beta_1 > 0$ is the in ation response coe cient and $\beta_2 > 0$ is the output response coefficient.

3.2.2 Domestic Inflation Targeting

Under a domestic inflation targeting policy, the central bank reacts to changes in output and domestic price inflation:

$$\hat{\imath}_t = \beta_0\hat{\imath}_{t-1} + (1-\beta_0)\left(\beta_1\widehat{\Pi}_{H,t} + \beta_2\widehat{Y}_t\right) + \upsilon_t \tag{3.12}$$

3.2.3 Managed Float

Under a managed float the real exchange rate $\hat{q}_t$ enters into the interest-rate rule[2]:

$$\hat{\imath}_t = \beta_0\hat{\imath}_{t-1} + (1-\beta_0)\left(\beta_1\widehat{\Pi}_{H,t} + \beta_2\widehat{Y}_t\right) + \upsilon_t \tag{3.13}$$

where is the real exchange rate response coefficient:

2 An alternative specification would be for the nominal exchange rate to enter into the monetary policy rule. See Monacelli (2004) for further discussion.

3.3 Calibration

The baseline parameter values used to compute the equilibrium are summarized in Table 1. As far as is possible, the parameter values are chosen to match estimates for Mexico. In cases where no reliable parameter estimates exists, we use values commonly used in the open-economy New Keynesian literature.

Following the Mexican estimates of Ramos-Francia and Torres (2008), we set the discount Factor $\beta = 0.9962$, the output elasticity of real marginal cost $\omega = 0.82$ and the degree of price stickiness of domestic goods $\tau_H = 0.75$. For the intertemporal elasticity of substitution in consumption, we follow the estimation of Ostry and Reinhart (1992) in setting $\sigma = 0.75$. Following Mankiw and Summer (1986), we set the consumption elasticity of money demand $\eta_c = 1$ and following Arrau and Gregorio (1991) we set the interest-rate semi-elasticity of money demand $\eta_c = 28$. We follow Woodford (2003) and McKnight and Mihailov (2015) and set a value for real balance effects $\mu = 0.03$. Consistent with the estimates of Bergin and Glick (2004), we choose a value for the substitution between home and foreign goods $\gamma = 1$. We follow McKnight, Mihailov and Pompa-Rangel (2016) in setting the degree of trade $\alpha = 0.44$, the degree of inflation indexation of domestic goods $\delta_H = 0.08$ the degree f in ation indexation of imported goods $\delta_H = 0.55$ the and the incomplete asset market parameter $\kappa = 0.01$.

In regard to the coefficients for the three alternative specifications for the Taylor-type rules, we follow Carrillo and Elizondo (2015) in setting the interest-rate smoothing parameter $\beta_0 = 0.8$ and the output response coefficient $\beta_0 = 0.5$ Following Schmitt-Grohe and Uribe (2000), the in ation response coefficient is set $\beta_1 = 1.53$ and following estimates by Muhammad (2011) we set the real exchange rate response coefficient $\beta_3 = 0.14$. We also use

Table 3.1: Benchmark Parameter Values

Parameter	Description	Value	Reference
β	Discount factor	0.9962	Ramos-Francia and Torres (2008)
σ	Intertemporal elasticity of substitution in consumption	0.373	Ostry and Reinhart (1991)
ω	Output elasticity of real marginal cost	0.82	Ramos-Francia and Torres (2008)
τ_H	Degree of price-stickiness	0.75	Ramos-Francia and Torres (2008)
τ_F	Degree of incomplete exchange-rate pass-through	0, 0.5, 0.75, 0.99	
δ_H	Degree of inflation indexation (domestic goods)	0.8	McKnight et al. (2016)
δ_F	Degree of inflation indexation (imported goods)	0.55	McKnight et al. (2016)
μ	Degree of non-separability of the utility function	0.03	Woodford (2003)
η_c	Consumption elasticity of money demand	1	Mankiw and Summers (1986)
η_i	Interest-rate semi-elasticity of money demand	28	Arrau and Gregorio (1991)
γ	Elasticity of substitution between home and foreign goods	1	Bergin and Glick (2004)
α	Degree of trade openness	0.44	McKnight et al. (2016)
κ	Incomplete asset markets parameter	0.01	McKnight et al. (2016)
β_0	Interest-rate smoothing coefficient	0.8	Carrillo and Elizondo (2015)
β_1	Inflation response coefficient	1.53	Schmitt-Grohe and Uribe (2000)
β_2	Output response coefficient	0.5	Carrillo and Elizondo (2015)
β_3	Real exchange rate response coefficient	0.14	Muhammad (2011)
$\beta_3 a$	Real exchange rate response coefficient	0.55	Ball and Reyes (2004)
$\rho_{a,t}$	Persistence of productivity shocks	0.9	Galí (2008)
$\rho_{v,t}$	Persistence of monetary shocks	0.5	Galí (2008)
$\rho_{cp\ t}$	Persistence of cost-push shocks	0.5	Galí (2008)
$\rho_{\phi\ t}$	Persistence of risk premium shocks	0.8	Galí and Monacelli (2005)

a higher value of $\beta_3 = 0.55$ calibrated by Ball and Reyes (2004) to analyze the sensitivity of our results.

For illustrative purposes, the analysis consider four different values for the degree of exchange-rate pass-through τ_F = 0; 0:5; 0:75; 0:99. [3]

Following much of the literature, the disturbances $\{\varepsilon_{a,t}, \varepsilon_{cp,t}, \phi_t, \upsilon_t\}$ are independent AR(1) process:

$$\varepsilon_{x,t} = \rho_x \varepsilon_{x,t-1}$$

where $\rho_x \epsilon (0,1)$, $var(\varepsilon_{x,t}) = \sigma_x^2$, $\varepsilon_{x,t} \sim iid(0, \sigma_x^2)$ for $x = a, cp, \phi$ and υ. For the values of the persistence of the shocks, we follow Galí (2008) in setting the persistence of productivity shocks $\rho_a = 0.9$, monetary shocks $\rho_v = 0.5$ and cost-push shocks $\rho_{cp} = 05$. For risk premium shocks, we follow Galí and Monacelli (2005) and set $\rho_\phi = 0.8$.

3 For Mexico there are high degrees of incomplete pass-through, this parameter has been estimated around 0.3 and 0.6 for the long term (see Ramos-Francia, 2011).

4. Baseline Results: CPI Inflation Targeting Rule

This section presents the impulse-response analysis for the small open economy model under a CPI inflation targeting interest-rate rule. For the monetary shock, the impulse response analysis is conducted for three alternative values for the degree of exchange-rate pass-through: $\tau_F = 0;\ 0.5, 0.99$. Recall that $\tau_F = 0$ represents the perfect pass-through benchmark, where there are no deviations from the law of one price.

The monetary shock is positive change in and should be interpreted as a contractionary monetary policy shock leading to a rise in the nominal interest rate. The impulse responses for this shock are displayed in Figure 4.1. Note that in the case of perfect pass-through we do not observe an immediate increase in the nominal interest rate[4]. However, output, consumption and real money balances all immediately fall. The contraction in aggregate demand in the economy decreases domestic inflation, imported inflation and overall inflation, while the terms of trade improve and the real exchange rate appreciates.

4 This can be explained by the nature of the interest-rate rule which includes significant interest-rate smoothing.

Figure 4.1: Monetary shock and perfect exchange-rate pass-through ($\tau_F = 0$): CIT Policy Regime

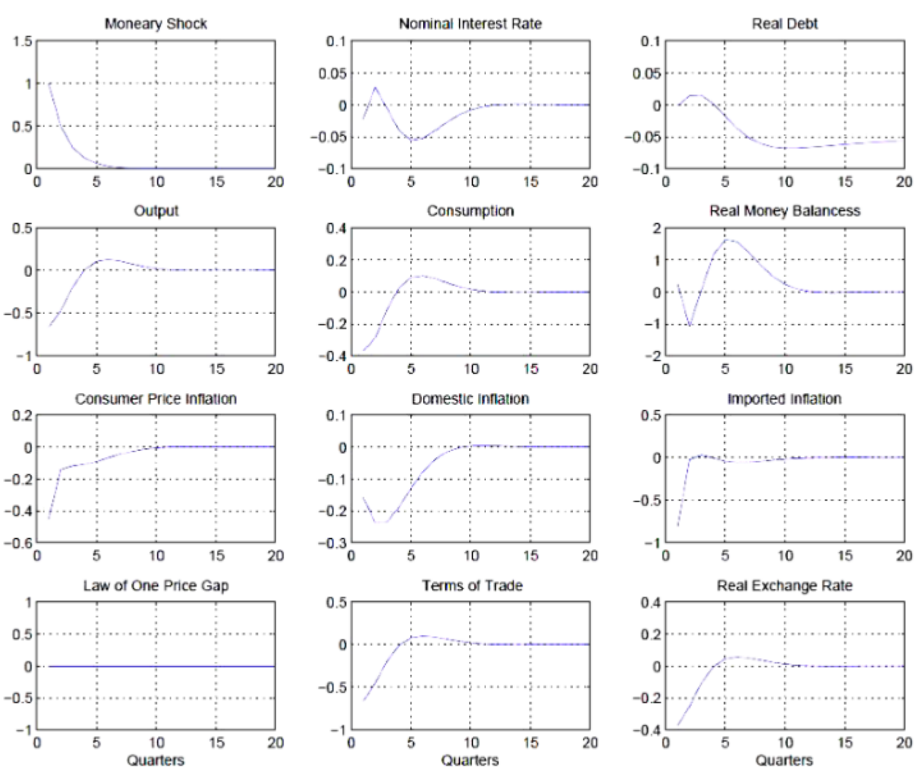


Figure 4.2: Monetary shock and incomplete exchange-rate pass-through ($\tau_F = 0.5$): CIT Policy Regime

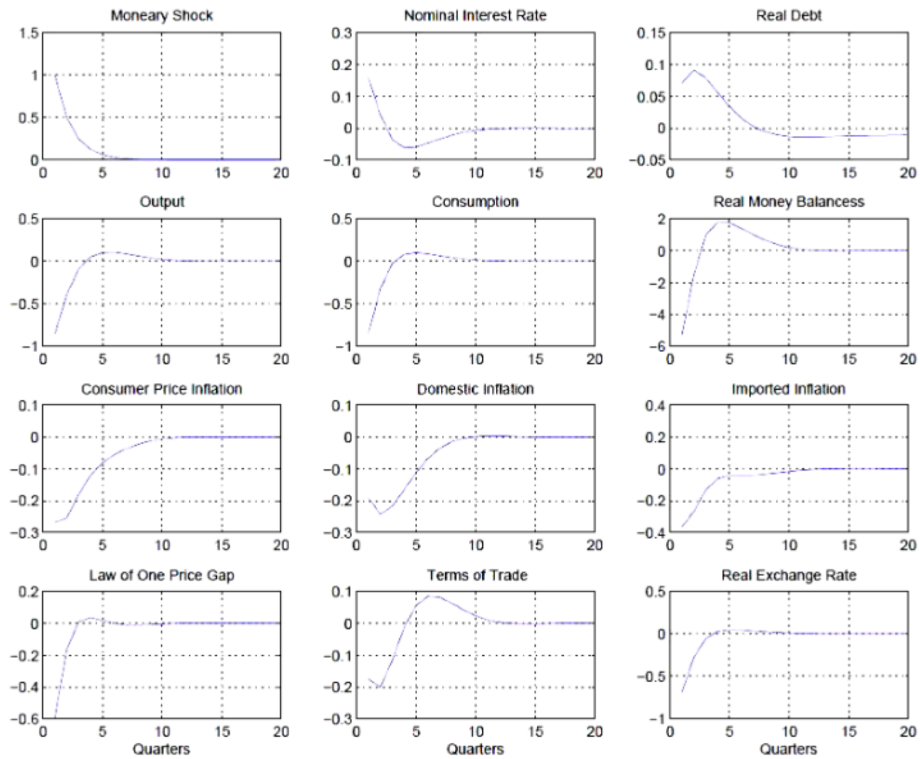
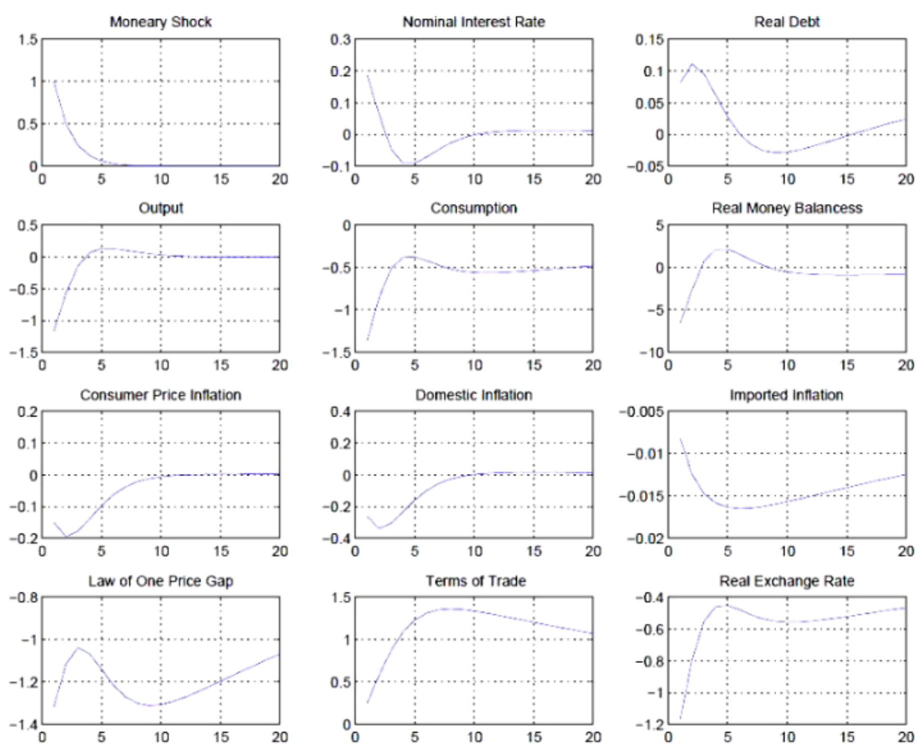


Figure 4.3: Monetary shock and incomplete exchange-rate pass-through ($\tau_F = 0.99$): CIT Policy Regime



Figures 4.2 and 4.3 illustrate how a monetary shock impacts the economy when we allow for different degrees of incomplete exchange-rate pass-through. Here the nominal interest rate rises immediately and output, consumption and real money balances all decrease. This contraction on the economy leads to a decrease in domestic and foreign inflation and therefore a fall in CPI inflation. But with $\tau_F = 0.5$, incomplete pass-through results in a higher volatility in the terms of trade and the real exchange rate (relative to the perfect pass-through benchmark). For higher degrees of imperfect pass-through result in a fall in the law of one price gap and the real exchange rate appreciates, but contrary to the perfect pass-through benchmark this causes a depreciation in the terms of trade. Therefore, the overall conclusion is that the degree of exchange-rate pass-through plays an important role in the transmission of monetary shocks.

4.1 Propagation of the Monetary Under Alternative Monetary Policy Rule Specifications

This section undertakes an impulse-response analysis under alternative specifications for the interest-rate feedback rule. As outlined in section 3, we consider a domestic inflation targeting (DIT) monetary regime where the interest rate responds to domestic price inflation and output, and a managed oat (MF) policy where the real exchange rate also enters into the feedback rule. The purpose of this section is examine the robustness of the previous results obtained under a CPI Inflation Targeting (CIT) policy rule. Analogously, to the CIT case, the impulse response analysis is conducted for three alternative values for the degree of exchange-rate pass-through: τ_F = 0,0.5 and 0.99.

As discussed in Ouchen and Ziky (2015), monetary policies that stabilize output sacrifice stability in terms of exchange rate volatility causing higher inflation volatility. Moreover, with imperfect degrees of exchange-rate pass-through, the trade-o between output volatility and inflation volatility is almost negligible. Therefore, a flexible exchange rate policy can achieve output stabilization without high inflation volatility.

To complete the analysis for risk premium shocks, Figures 4.8 and 4.9 show an increase in the real exchange rate with a high degree of incomplete pass-through τ_F = 0.99. In this setting, we observe that the sign of the impulses responses remains the same, but this degree of pass-through increase the level of volatility in each one with small differences among the regimes.

We can observe that under the DIT regime, the volatility in the terms of trade was higher, which was beneficial to imported inflation and CPI inflation. In contrast, under the MF regime, the increase in imported inflation was less pronounced, with less volatility in the deviations on the law of one price gap, and a higher response in the real exchange rate.

Figures 4.4 and 4.5 plot the impulse responses under DIT and MF, respectively, with perfect pass-through. We can observe that this negative shock increases the nominal interest rate under DIT, whereas under MF there is a lag of two periods similar to the CIT regime. The fact that the increase of nominal exchange rate is larger under DIT causes a relatively large increase in real debt in comparison with CIT and MF. There is also a bigger negative effect on output, consumption and real money balances. Unsurprisingly, we find that the dynamics of domestic inflation, imported inflation and overall inflation are quite similar, in percentage and movement, for all three policy regimes.

Figures 4.6 (under DIT) and 4.7 (under MF) depict how a monetary shock impacts the economy with incomplete exchange-rate pass-through $\tau_H = 0.5$. Similar to a CIT policy rule, the impulse response analysis finds no significant differences under both DIT or MF. A contractionary monetary policy that increase the nominal interest rate is followed by an increase in real debt (at least for the first periods), and a fall in output, consumption and real money balances. This contraction leads to a decrease in domestic and foreign inflation and therefore a fall in CPI inflation. But with a pass-through of 0.5, the volatility of the law of one price causes an appreciation in the terms of trade and the real exchange rate.

Finally, we examine the case of a negative monetary shock setting . Under the three monetary policy regimes a negative monetary shock raises the nominal interest rate by the same amount. Moreover, real debt follow a different pattern under CIT and DIT: while real debt increases in both policy regimes, after a few periods it quickly returns to zero. This is not the case under MF where real debt is still increasing after 20 periods. Output, consumption and real money balances all fall in the same proportion and the same trajectories. Under the CIT and DIT regimes,

Imported inflation is relatively lower in comparison with MF. Domestic and overall inflation also decrease

Figure 4.4: Monetary shock and perfect exchange-rate pass-through ($\tau_F = 0$), DIT Policy Regime

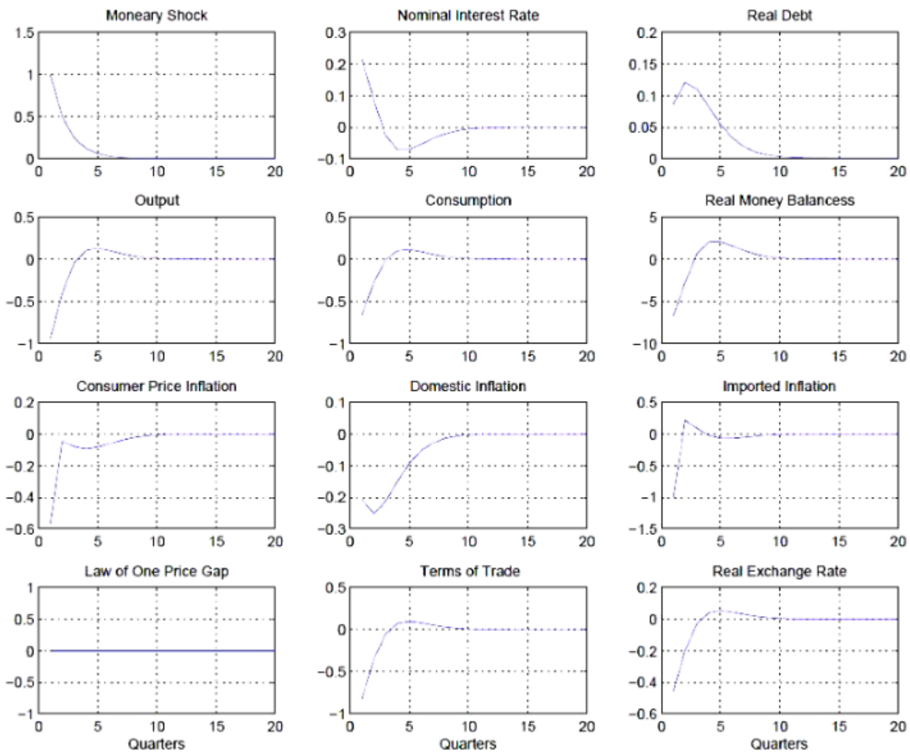


Figure 4.5: Monetary shock and perfect exchange-rate pass-through ($\tau_F = 0$), MF Policy Regime

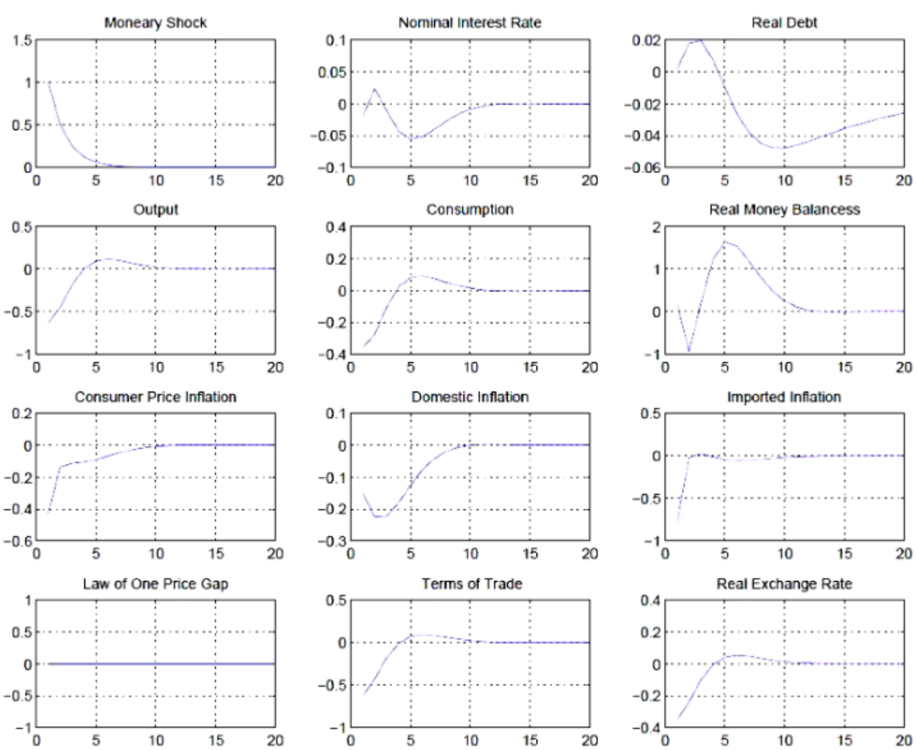


Figure 4.6: Monetary shock and incomplete exchange-rate pass-through $\tau_F = 0.5$: DIT Policy Regime

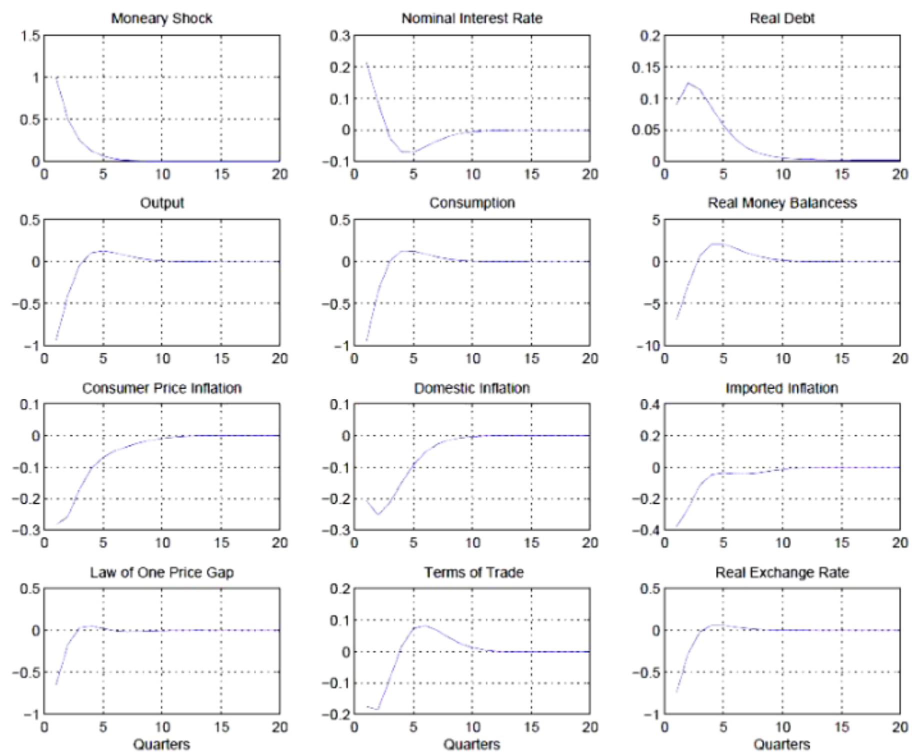


Figure 4.7: Monetary shock and incomplete exchange-rate pass-through ($\tau_F = 0.5$): MF Policy Regime

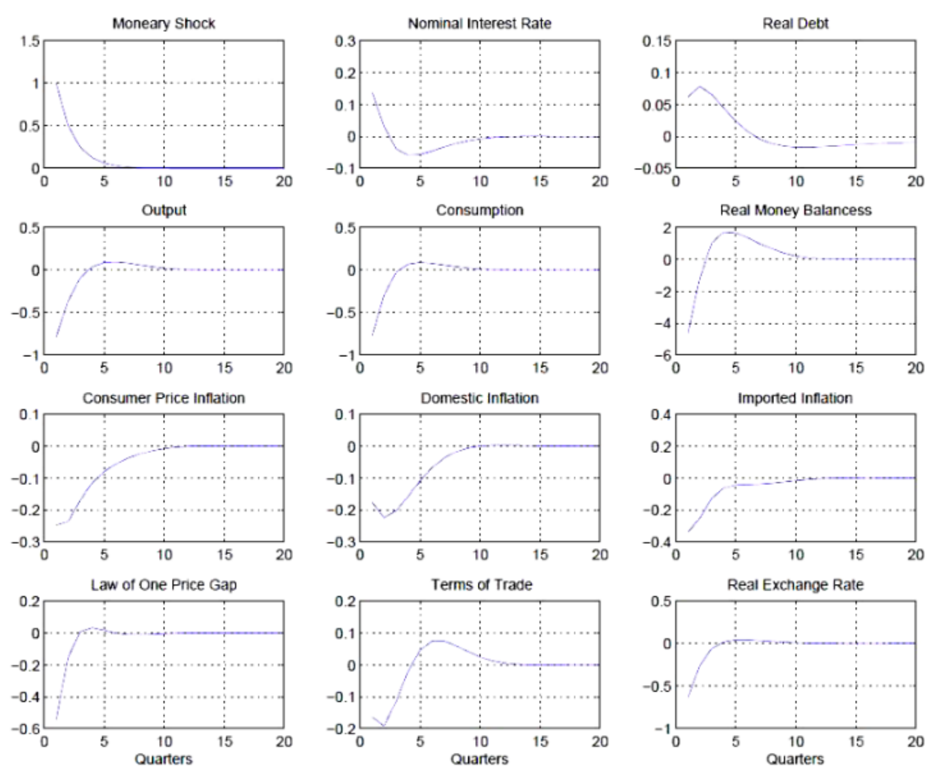


Figure 4.8: Monetary shock and incomplete exchange-rate pass-through ($\tau_F = 0.99$), DIT Policy Regime

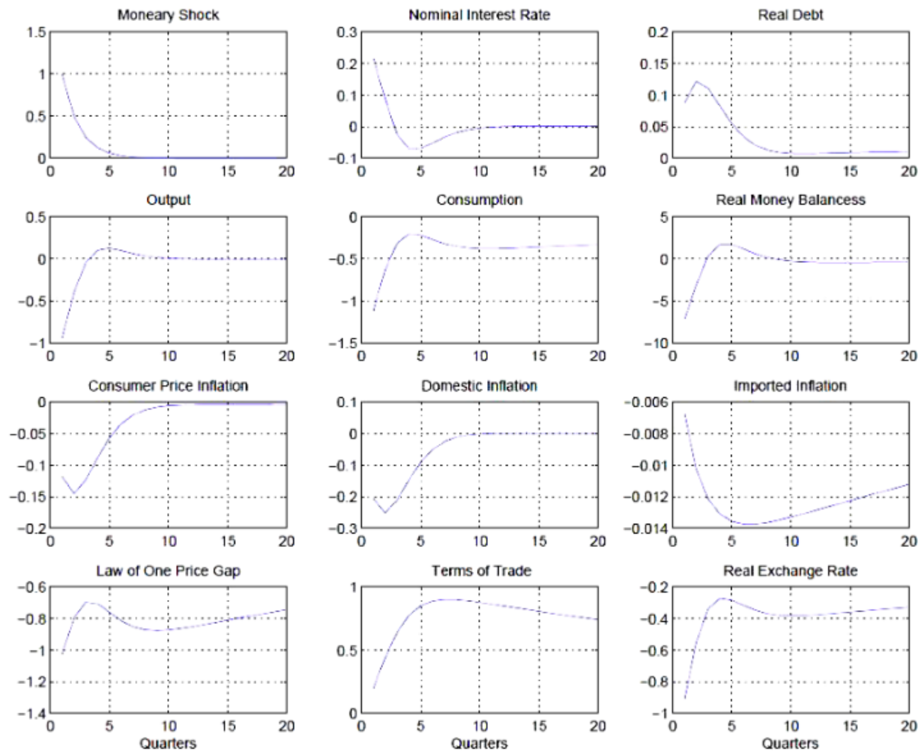
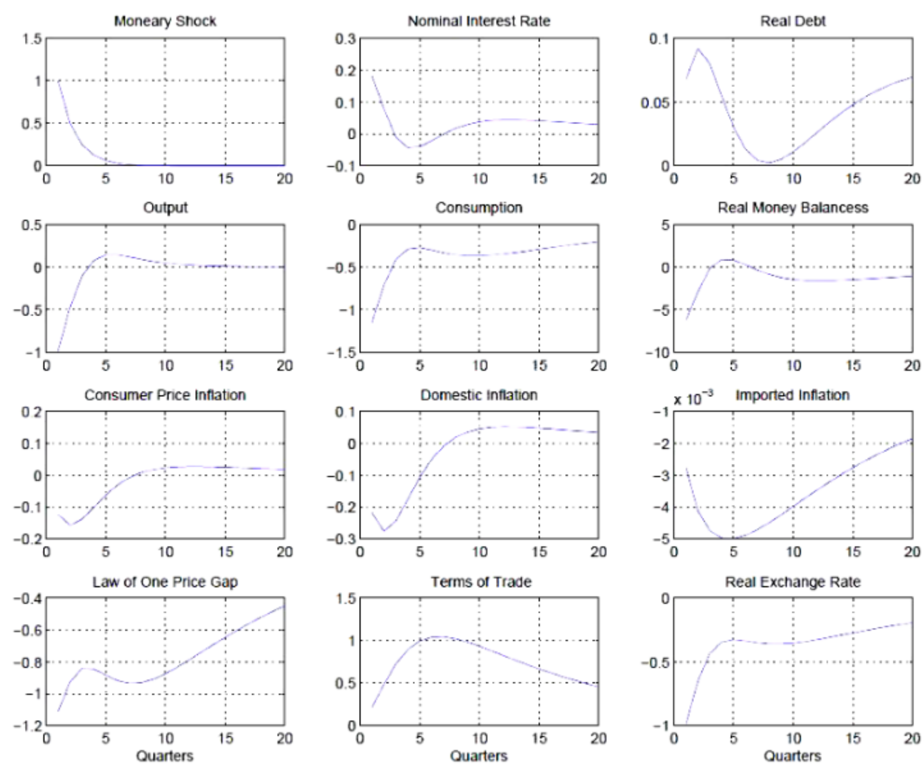


Figure 4.9: Monetary shock and incomplete exchange-rate pass-through ($\tau_F = 0.99$): MF Policy Regime



with the same pattern for the three regimes. Finally, we observe the same volatility in the law of one price gap under CIT and DIT, but it is magnified under MF. Thus, the terms of trade depreciates more in CIT and DIT than MF. The volatility in law of one price gap is also reflected in the magnitude of appreciation of real exchange rate that is greater under the CIT and DIT monetary policy regimes.

5. Conclusions

In this work we developed a small open-economy model that incorporates several important features for a developing economy with the purpose to calibrate the model for Mexico. Following Justiniano and Preston (2010), the model incorporates incomplete asset market, inflation indexation, and imperfect exchange-rate pass-through. Differently to Justiniano and Preston (2010), we allow for real money balances, as in McKnight and Mihailov (2015) and we consider four exogenous shocks: productivity, cost-push, risk-premium and monetary shocks. Following Ouchen and Ziky (2015), our analysis also considers three popular specifications for the interest rate rule the consumer price inflation, the domestic price inflation rate and the real exchange rate.

To solve the model economy, the equilibrium conditions of the model are log-linearized around a zero-inflation steady-state. Following the seminal studies of Galí (2008) and Galí and Monacelli (2004), the shocks follow independent AR(1) processes with a relatively high value for the persistence term. To derive conclusions for the Mexican economy, we calibrate the deep parameters of model for Mexico. Using Dynare, an impulse response analysis was performed for each shock under different values for the degree of exchange-rate pass-through.

Our results are consistent with the previous literature. A technology shock that leads to an improvement in productivity, reduces real marginal cost and increases output and consumption. This shock resulted in a decrease in the domestic inflation rate and, therefore, a decrease in overall inflation. A novel finding is that the degree of imperfect exchange-rate pass-through plays an important role for the magnitude of the shock.

The next shock we analyzed was a risk premium shock that resulted in an immediate in-crease in the nominal interest rate, real debt and a depreciation of the terms of trade and the real exchange rate. Under imperfect pass-through this shock caused an increase in output, although domestic consumption did not increase. On the other hand, this shock resulted in a fall in domestic inflation, but this was outweighed by an increase in imported inflation causing also an increase in aggregate inflation.

We also examined a cost-push shock, as one may expect this shock had a negative impact on the economy and the transmission of the shock was in the opposite direction to the productivity shock causing output, consumption and real money balances to all decrease. Domestic inflation, imported in ation and overall CPI inflation all increased and the rise in the nominal interest rate while the terms of trade and real exchange rate both appreciated.

Finally, we considered a monetary shock in the spirit of Galí (2008) that generated some of the most important and interesting results from the analysis. A contractionary monetary shock increased the nominal interest rate and decreased output and consumption. This contraction in the economy exerted negative pressure on prices causing a fall in domestic, imported and overall inflation. However, the degree of imperfect exchange-rate pass-through, increased the volatility of the shock and lead to different results for the dynamics of the terms of trade. For the case of perfect pass-through, the monetary shock have a positive effect on terms of trade which became negative if the degree of imperfect pass-through was sufficiently large.

Our results or some interesting insights for policymakers. To start with, the degree of exchange-rate pass-through is very important for the assessment of monetary policy. In a low pass-through environment, the policymaker can simultaneously strictly target CPI inflation, but still allow high volatility in the nominal exchange rate to stabilize the real economy in face of the shocks. This results emerges because the low-pass-through eliminates the trade-o between output volatility and inflation volatility.

We have also found that the degree of exchange-rate pass-through can play an important role in the propagation of shocks in the open economy, particularly in the case of monetary shocks. This suggests that for inflation targeting countries like Mexico that have a high degree of incomplete exchange-rate pass-through, monetary shocks are likely to play a more important role in driving the business cycle.

We conclude from the analysis and focused only in the monetary shock and setting the exchange rate pass-through equal to 0.99, (which is consistent with the estimated value of exchange rate pass-through in Mexico (Ramos-Francia 2011)), that given the volatility on consumer inflation, domestic inflation and imported inflation it is desirable to is optimal for Mexico assume a flexible exchange-rate regime. Moreover, in terms of Real Debt is most costly adopt a Domestic Inflation Targeting than a Consumer Inflation targeting, therefore, for Mexico it is optimal to adopt Consumer Inflation Targeting.

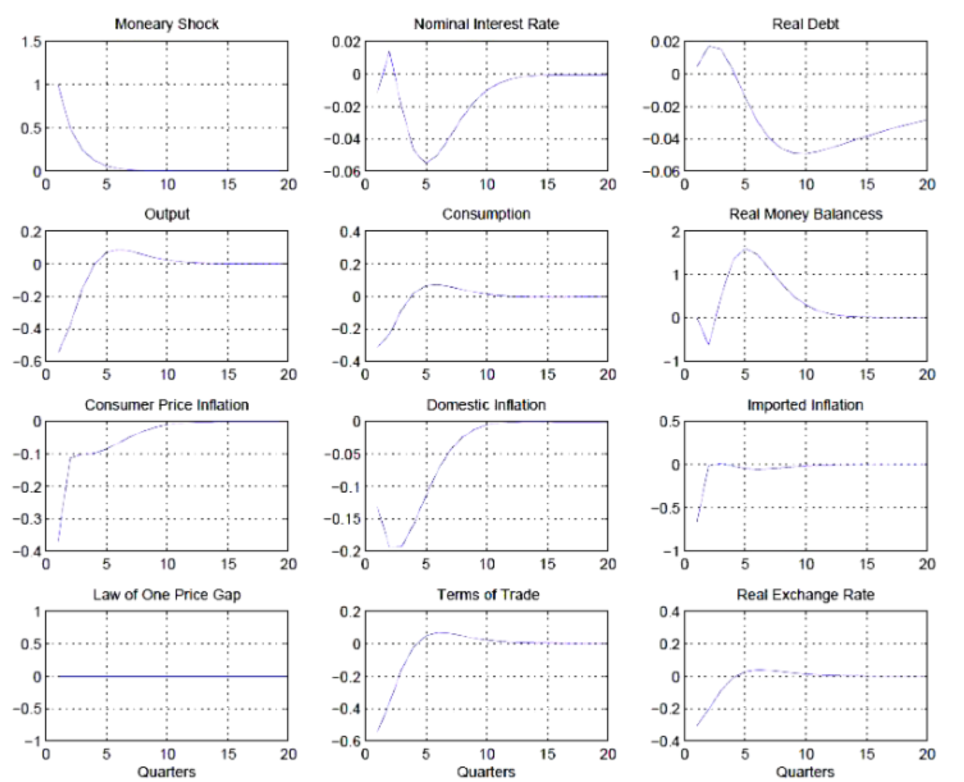
For further research, it might be interesting to replicate the analysis of Justiniano and Preston (2010), which explores optimal policy design within an structural model. that estimate the parameters of the model and calculate a objective function and the losses associated with the later, but using data for Mexico. It might also be important to determine whether policies in a class of generalized Taylor rules optimally responds to exchange rate variations as predicted by theory .

6. Appendix

Recent studies by Ball and Reyes (2004) for Mexico and Nogueira (2009) for Brazil, Mexico and South Korea, have investigated the empirical implications for emerging countries that have adopted an explicit inflation targeting regime. Even under inflation targeting, these studies find that there are still strong incentives for central banks in the sample countries to respond to exchange rate deviations from their targeting level. The main reason is that even under inflation targeting, exchange rate shocks are expected to pass-through into domestic inflation.

This active response of the central bank to changes in the exchange rate targeting, can be explicitly modelled under a Managed Float regime. In section 5, we analyzed the impulse responses for the economy under MF setting $\beta_3 = 0.14$. In this appendix we would like to compare these results against a higher coefficient value of $\beta_3 = 0.55$, as suggested by Ball and Reyes (2004). To maintain

Figure 6.1: Monetary shock and complete exchange-rate pass-through ($\tau_F = 0$) : MF Policy Regime and ($\beta_3 = 0.55$)



consistency with our previous analysis, we rst present the case of perfect exchange rate pass-through, followed by an intermediate degree of imperfect exchange-rate pass-through $\tau_F = 0$, 0.5 and finally the case of a full degree of imperfect rate pass-through $\tau_F = 0.99$.

Figure 6.1 considers the complete exchange-rate pass-through case. By inspection of Figure 6.1, the impact of a monetary shock under MF with $\beta_3 = 0.55$, affects the economy in a different way from the baseline results using. With $\beta_3 = 0.55$, the path of nominal interest rate is more volatile, output falls more, domestic inflation is slightly greater, and there are small gains in the terms of trade. The other variables of the economy remain on the same path.

Figure 6.2 depicts the results under imperfect pass-through setting $\tau_F = 0.5$. In this case we do not find any significant differences either in the path or volatility of the main variables of the model, compared to the baseline $\beta_3 = 0.14$ case.

Finally, Figure 6.3 consider the case for $\tau_F = 0.99$. (i.e., no pass-through). Here we find that a higher coefficient for is β_3 costly for the economy since it induces a higher response for CPI in inflation and less gains in terms $\beta_3 = 0.14$ of the appreciation of real exchange rate.

With these results in mind, we can conclude that the results presented in Section 5 are robust. The Mexican Central Bank, should not set a higher weight in the stabilization of the real exchange rate. In the hypothetical case of perfect exchange rate pass-through, the only gain that we found was a small gain in the terms of trade. For the case of imperfect pass-through $\tau_F = 0.5$, we do not find any changes in the path or volatility of the main variables of the model. Finally, for the case of $\tau_F = 0.99$, a higher coefficient for β_3 is more costly for the economy since it induces higher CPI inflation and less gains from the appreciation of the real exchange rate.

Figure 6.2: Monetary shock and incomplete exchange-rate pass-through ($\tau_F = 0.5$) : MF Policy Regime and ($\beta_3 = 0.55$)

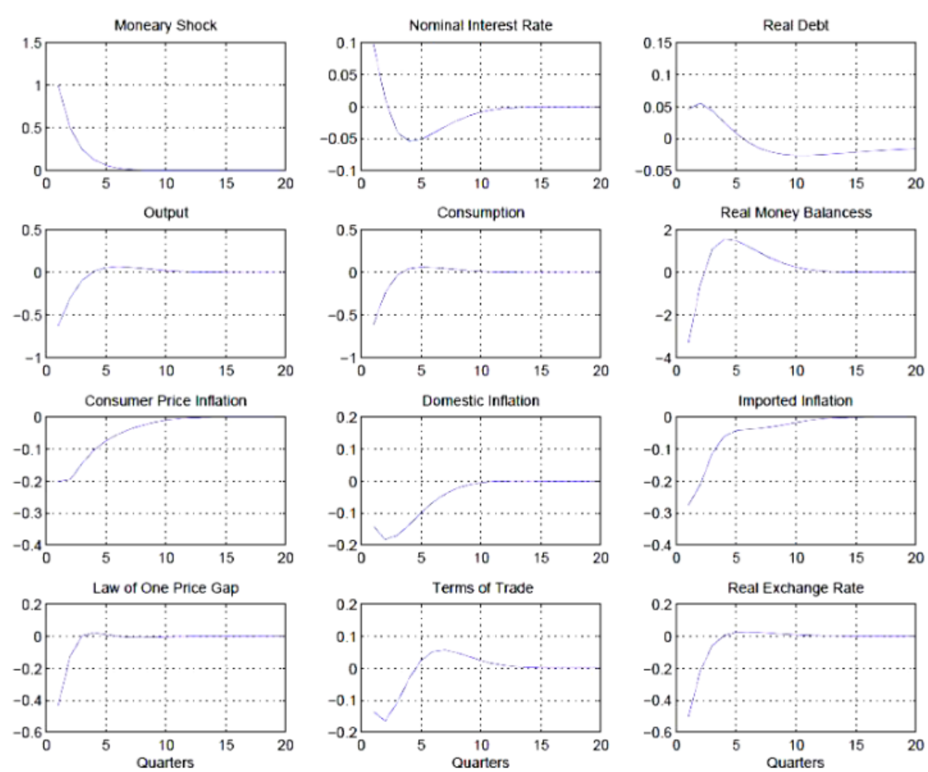
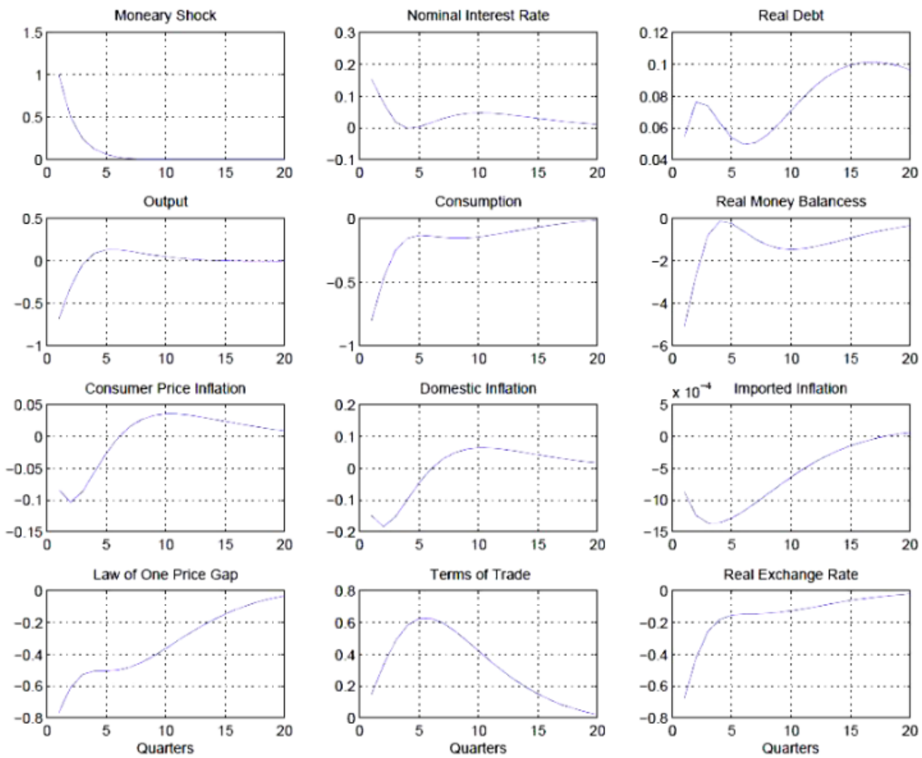


Figure 6.3: Monetary shock and incomplete exchange-rate pass-through ($\tau_F = 0.99$) : MF Policy Regime and ($\beta_3 = 0.55$)



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