Iranian Journal of Economic Studies, 8(2) 2019, 441-462

Iranian Journal of Economic Studies

Journal homepage: ijes.shirazu.ac.ir

The Managed Floating Exchange Rate Regime and Policy Evaluation in Iran

Kiomars Sohaili[a*], Alireza Erfani[b], Yousef Hayati[b],

a. Department of Economics, Razi University, Kermanshah, Iran.

b. Department of Economics, Semnan University , Semnan, Iran.

Article History

Received date: 18 June 2019
Revised date: 23 February 2020
Accepted date: 26 February 2020
Available online: 24 June 2020

JEL Classification:
E27
E32
E37
E52

Keywords:
Exchange Rate Regimes
DSGE Models
Bayesian Method
Conditional Forecasts
Iran

Abstract

Exchange rate fluctuations have a major role in business cycles. Thus, this study aimed to analyze the effects of a managed floating exchange rate regime on the dynamics of some macroeconomic variables in Iran. To this end, a dynamic stochastic general equilibrium (DSGE) model was designed for Iran. Then, the structural parameters of the model were estimated using quarterly data from 1989 to 2016 and the Bayesian method. Conditional forecasts were obtained and the results showed that a managed floating exchange rate regime, compared with a fixed regime, could lead to more economic growth and, at the same time, less speculative activities in stock and exchange markets. Moreover, the results of variance decomposition revealed that exchange rate shocks were the most important shock in driving business cycles and fluctuations in other variables. Based on these findings, policymakers are recommended to choose a managed floating exchange rate regime as the policy rule.

1. Introduction

Although many fundamental shocks may play a substantial role in economic dynamics, exchange rate restrictions may play the most significant role in developing economies. This assumption seems reasonable given that developing economies usually have difficulties in securing their needed amount of foreign currency and/or credit and that in these economies, the output of all firms, the real balances of every agent, and the stability of financial markets crucially depend on exchange rate volatilities. Therefore, exchange rate volatilities are likely to play a more pivotal role than other sources of variation in economic dynamics.

Some empirical studies have supported the abovementioned facts. For example, due to the strong correlation between foreign sector variables, such as

∗ ksohaili@razi.ac.ir
DOI: 10.22099/ijes.2020.33990.1583

terms of trade, and output in developing countries, it can be expected that the output growth will be exposed to major fluctuations in times of exchange rate uncertainties (Agenor et al., 2000). Moreover, due to the negative relationship between the real interest rate and net exports, one can expect investment fluctuations in times of exchange rate crises (Neumeyer & Perri, 2005). These findings highlight the importance of exchange rate shocks in developing and implementing policies in developing countries.

Policymakers implement monetary and fiscal policies via a set of specified rules (Canzoneri et al., 2001); these rules are a combination of instruments and long-run targets that ensure policymakers achieve their final goals (Taylor, 1993). A developing country that is subject to unexpected changes in the nominal exchange rate is restricted to a given set of monetary, fiscal, and exchange policies. If a country finds that controlling the exchange rate leads to the stability of the rest of the economy, it will focus on the optimal exchange rate policy and abandon those monetary and fiscal rules that are in conflict with that policy. Accordingly, some studies encourage policymakers to adopt an active exchange rate policy (Curdia & Woodford, 2008).

It is worth noting that nominal effective exchange rate is a major part of the monetary transmission mechanism; thus, analyzing the size and effect of this indicator is necessary due to its impact on the general price level, inflation, and output growth (Hahn, 2003; Stulz, 2007). Thus, the implemented exchange rate policy has far-reaching implications for fiscal and monetary policy, which pursues inflation targeting policies and trade facilitation. There are two channels through which the exchange rate affects prices and output. A direct channel works through the import price index, in which the import prices are affected by the exchange rate. The changes in the import price index will alter the costs of production and consumer buying power, leading to changes in economic equilibrium. The second channel refers to the degree of competitiveness of domestic goods in the international markets; through this channel, a country's total exports can be determined.

During the past decades, Iran has experienced several periods of exchange rate crisis, which had lasting effects on the economy due to the fact that the Iranian economy is strongly dependent on exchange rates and fluctuations in it. The experienced fluctuations have obliged policymakers to take various steps, from using a pegged exchange rate to adopting a managed floating exchange rate policy, to intervene in the exchange market. Each policy certainty has its specific impact on the economy; thus, comparing the outcomes following each policy is a useful index in determining the most appropriate policy rule. This study was aimed to analyze the effects of a managed floating exchange rate policy on the macro variables using a DSGE model.

This study is different from earlier studies conducted in Iran in at least three ways: (1) the exchange rate policy rules were analyzed based on reaction function rather than the loss function, (2) this study proposed a rule for the exchange rate, and (3) a different and more coherent set of exchange rate policy rules were followed, which led to more distinct results.

In addition, the present study differs from previous international studies in that the method used to introduce the policy-controlled interest rate was not related to the domestic or foreign interest rates; rather, it was based on the variations in Iran’s economy.

The rest of this article is structured as follows: In Section 2, a review of the literature review is given. The third section is devoted to the designed DSGE model. The model parameters are estimated and the policy rules are analyzed in Section 4. Finally, some conclusions are offered in the fifth section.

2. Literature Review

2.1 Theoretical Background of the Study

For years, adopting a proper exchange rate regime has been one of the main macroeconomic policies. The central banks around the world have to grapple with the question of whether they should fix the exchange rate. Despite its overriding importance, there is no agreement on a fixed exchange rate policy. The relationship between nominal exchange rate dynamics and macroeconomics will answer the question. Some studies have supported the notion that exchange rate dynamics have positive effects on economic growth (Edwards & Levy-Yeyati, 2005). Other studies, however, have shown the negative effects of exchange rate volatility on macroeconomic variables (Demir, 2010).

Introduced by Friedman (1953) and Mundell (1961, 1963), exchange rate regimes are key in analyzing economic efficiency. The proponents of flexible exchange rate regimes believe that variations facilitate the adjustment of an economy to shocks (Edwards & Levy-Yeyati, 2005). In other words, when a shock occurs, if prices and wages are rigid, flexible exchange rates can adjust the international relative prices and, thus, offset production losses (Mundell, 1961).

However, the benefits cited for a managed exchange rate regime, including adjustment to external shocks and monetary policy autonomy, may lead to fluctuations in the domestic currency. Indeed, an economy with a floating exchange regime may be affected by variations in the market which can lead to macroeconomic instability and harm economic growth. Exchange rate fluctuations can also affect output growth by having an impact on the leading indicators, such as trade flows, investment, and employment. In this regard, several studies have shown that exchange rate variability often leads to a reduction in the volume of international trade (Hooper & Kohlhagen, 1978; Pozo, 1992). Many empirical studies have also shown the impact of exchange rate fluctuations on output growth. Dollar (1992) examined the relationship between exchange rate volatility and economic growth in 95 developing countries over the period of 1976-1985 and reported a negative relationship between the two variables. Bosworth et al. (1995) studied the determinants of economic growth in 88 developed and industrial countries during 1960-1992 and concluded that exchange rate volatility could negatively affect output growth.

2.2 Empirical Studies

Salavitabar and Jalali-Naeini (2014) evaluated the efficiency of different exchange rate regimes based on Iran central bank's proposed loss function. By using a DSGE model, they showed that the managed exchange rate policy, compared to other policy rules, could result in the minimum loss.

Dilmaghani and Tehranchian (2015) analyzed the impact of monetary policies on the exchange rate of some selected developing countries during the period of 2001-2010. The results showed that the coefficient of liquidity, as an indicator of monetary policy, was positive and significant. Moreover, GDP, inflation, and exports of goods and services had negative, positive, and negative effects on the exchange rate, respectively.

Yazdani and Gheshlaghi (2016) used a structural vector autoregressive (SVAR) model to examine the effects of exchange rate variations on inflation in Iran. The results of their study indicated that exchange rate fluctuations had a significant effect on the inflation rate. Therefore, they concluded that exchange rate policies led to inertial inflation in Iran's economy.

Batini et al. (2010) developed a two-block model for an emerging open economy (India) interacting with the rest of the world (the US as the proxy of the world). They employed the developed model to compares two monetary regimes for domestic-based inflation targeting; the monetary regimes included a floating exchange rate regime and a managed exchange rate. The results revealed that simultaneous binding to a simple inflation rate and exchange rate targeting rule could lead to a significant welfare loss whereas implementing an optimal rule with a fixed exchange rate regime could result in a relatively small welfare loss.

Shambaugh (2004) investigated the effects of a fixed exchange rate on monetary policy rules using the interest rate as a policy tool. In his study, he focused on actual behavior, rather than the declared status, to classify regimes. Moreover, he used different currencies other than the dollar and examined the impact of capital controls as a tool implemented in fixed exchange rate policy regimes. The main result of his study was that countries with fixed exchange rate regimes followed the monetary policy of the base country more closely than did the countries with floating exchange rate regimes. More specifically, the study showed that fixed exchange rates involved a loss of monetary policy autonomy.

3. Model

This study was structured on the standard features of an open economy DSGE model, in which each agent was introduced by its own objectives and constraints. The agents included households, firms, and the monetary authority. All households are assumed Ricardian and homogeneous who generally seek maximum lifetime utility over consumption, leisure, and asset holdings. Firms acquire inputs from a competitive market and proceed to sell their output in a monopolistic competition market to obtain maximum profit.

Since our model was based on a small open economy, agents benefit from consuming both goods and services which are produced domestically and those which are imported; therefore, the bundle of goods were divided into tradable and non-tradable. Due to this categorization, the overall inflation rate was a weighted sum of three sectorial inflation rates.

In this study, we assumed that the central bank was not committed to any specified Taylor-rule at all times. This means that the central bank of Iran did not follow any kind of (modernized) Taylor rule and interfered only to balance the government budget constraint over time. However, in line with the literature, the central bank activity regarding the exchange rate market can be reflected in the form of managed or fixed exchange rate regimes. Both of these different kinds of policies are considered in the present study and the effects of each regime on the dynamic path of macroeconomic variables are discussed.

3.1 Households

Since the households were assumed to be Ricardian, the analysis was based on a representative household with the following utility function:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{\tilde{C}_t^{1-\sigma}}{1-\sigma} + \frac{m_t^{1+\varsigma}}{1+\varsigma} - \frac{N_t^{1+\psi}}{1+\psi} \right) \quad (1)$$

This utility function is a version of the money-in-the-utility function (MIU) (Walsh, 2010). In this function, $\tilde{C}_t$ is the consumption bundle, m_t the real money balances, and N_t the labor supply. Moreover, σ is the inverse of the intertemporal elasticity of substitution, ς the inverse of the elasticity of money holdings, and ψ the inverse elasticity of labor supply. For the utility function to have important implications for business cycles, we also considered the concept of habit persistence by defining $\tilde{C}_t$ as follows (Fuhrer, 2000):

$$\tilde{C}_t = C_t - hC_{t-1} \quad (2)$$

Where h is the habit persistence parameter and C_t is the consumption bundle, which is a weighted sum of both tradable and non-tradable goods. Labor supplied by households was divided between two domestic producing sectors, i.e. tradable and non-tradable:

$$N_t = N_{h,t} + N_{N,t} \quad (3)$$

In (3), the subscripts of h and N refer to tradable and non-tradable sectors, respectively. Each household faces the following budget constraint:

$$P_t C_t + M_t + E_t(Q_{t+1} D_{t+1}) \leq D_t + W_t N_t + M_{t-1} + T_t \quad (4)$$

Where P_t is the price index, M_t the nominal money balances, D_{t+1} the nominal rate of return for a portfolio in t at t+1, Q_{t+1} the subjective discount rate, W_t the nominal wage, and T_t the lump-sum tax. As mentioned before, consumption index (C_t) is a combination of tradable ($C_{T,t}$) and non-tradable ($C_{N,t}$) goods:

$$C_t = ((1-\lambda)^{\frac{1}{\upsilon}} C_{T,t}^{\frac{\upsilon-1}{\upsilon}} + \lambda^{1/\upsilon} C_{N,t}^{\frac{\upsilon-1}{\upsilon}})^{\frac{\upsilon}{\upsilon-1}} \quad (5)$$

Where λ is the share of non-tradable goods in the consumption bundle and υ is the intertemporal elasticity of substitution between tradable and non-tradable goods. Considering (5), the demand for tradable and non-tradable goods can be presented, respectively, as follows:

$$C_{T,t} = (1-\lambda)(\frac{P_{T,t}}{P_t})^{-\upsilon} C_t \quad (6)$$

$$C_{N,t} = \lambda(\frac{P_{N,t}}{P_t})^{-\upsilon} C_t \quad (7)$$

Where $P_{T,t}$ and $P_{N,t}$ are tradable and non-tradable price indices, respectively, and P_t is the general price level. The basket of tradable goods is a combination of domestic and imported tradable goods:

$$C_{T,t} = ((1-\alpha)^{\frac{1}{\eta}} C_{H,t}^{\frac{\eta-1}{\eta}} + \alpha^{1/\eta} C_{F,t}^{\frac{\eta-1}{\eta}})^{\frac{\eta}{\eta-1}} \quad (8)$$

Where $C_{H,t}$ and $C_{F,t}$ are the consumption bundle of domestic and imported tradable goods, α is the share of imported goods in the consumption index, and η is the intertemporal elasticity of substitution between domestic and imported tradable goods. Considering (8), the demand functions for domestically produced and imported tradable goods can be written, respectively, as follows:

$$C_{H,t} = (1-\alpha)\left(\frac{P_{H,t}}{P_{T,t}}\right)^{-\eta} C_{T,t} \quad (9)$$

$$C_{F,t} = \alpha\left(\frac{P_{F,t}}{P_{T,t}}\right)^{-\eta} C_{T,t} \quad (10)$$

The overall price level and the price index of tradable goods are represented, respectively, in the following formulas:

$$P_{T,t} = ((1-\alpha)P_{H,t}^{1-\eta} + \alpha P_{F,t}^{1-\eta})^{\frac{1}{1-\eta}} \quad (11)$$

$$P_t = ((1-\lambda)P_{T,t}^{1-\upsilon} + \lambda P_{N,t}^{1-\upsilon})^{\frac{1}{1-\upsilon}} \quad (12)$$

The total demand for domestically produced tradable goods is the sum of private domestic, foreign, and government demands for goods:

$$Y_{H,t}^d = C_{T,t} + C_{H,t}^* + G_{H,t} \quad (13)$$

Where $C_{H,t}^*$ is the foreign demand for domestic goods. The total demand for non-tradable goods equals the private domestic and government demands for goods:

$$Y_{N,t}^d = C_{N,t} + G_{N,t} \quad (14)$$

Where $Y_{N,t}^d$ is the total demand for non-tradable goods. Moreover, in this model, we assumed that the government only demanded domestically produced goods and services:

$$G_t = G_{H,t} + G_{N,t} \quad (15)$$

Where government spending follows an AR(1) process:

$$G_t = \rho_g G_{t-1} + \varepsilon_{g,t} \quad (16)$$

In these relations, $\varepsilon_{g,t}$ has a normal distribution with zero mean and σ_g^2 variance. By maximizing the utility function in (1) with respect to the budget constraint (4), the first order-conditions of the household problem can be measured as follows:

$$\tilde{C}_t^{\sigma} N_t^{\psi} = \frac{W_t}{P_t} \tag{17}$$

$$\beta \left(\frac{\tilde{C}_{t+1}}{\tilde{C}_t}\right)^{-\sigma} \left(\frac{P_t}{P_{t+1}}\right) = Q_{t,t+1} \tag{18}$$

$$\beta R_t E_t \left(\frac{\tilde{C}_{t+1}}{\tilde{C}_t}\right)^{-\sigma} \left(\frac{P_t}{P_{t+1}}\right) = 1 \tag{19}$$

In equation (19), $R_t^{-1} = E_t\{Q_{t,t+1}\}$; therefore, R_t is the interest rate on bonds. The following linear system was derived from the first-order conditions using a toolkit for the analysis of nonlinear systems (Uhlig, 1999):

$$\sigma \tilde{c}_t + \psi n_t = w_t - p_t \tag{20}$$

$$\tilde{c}_t = E_t \tilde{c}_{t+1} - \frac{1}{\sigma}(r_t - E_t \pi_{t+1}) \tag{21}$$

$$\tilde{c}_t = \frac{c_t - h c_{t-1}}{1-h} \tag{22}$$

Where small letters denote the log-deviations of variables around a steady-state. By combining (21) and (22), we obtained the total private consumption:

$$c_t = \frac{h}{1+h} c_{t-1} + \frac{1}{1+h} E_t c_{t+1} - \frac{1-h}{\sigma(1+h)}(r_t - E_t \pi_{t+1}) \tag{23}$$

and the demand for real money balances as follows:

$$m_t = \frac{\sigma}{\varsigma}\left(\frac{1}{1-h} C_t - \frac{h}{1-h} C_{t-1}\right) - \frac{1}{\varsigma} \bar{R} r_t \tag{24}$$

3.2 Firms

The firms in the developed model were divided into two groups: domestic firms and importer firms. Moreover, domestic firms included tradable and non-tradable firms.

3.2.1 Firms in the Tradable Sector

By assuming that firms used similar production technology, we could focus on a representative firm and approximate the behavior of the whole economy. The production function of a representative firm was assumed as follows:

$$Y_{H,t} = A_{H,t} N_{H,t} \tag{25}$$

Where $Y_{H,t}$ and $A_{H,t}$ are production and productivity, respectively. The log-linearized version of this function is presented below:

$$y_{H,t} = a_{H,t} + n_{H,t} \tag{26}$$

The optimal conditional firm-level labor demand was determined by minimizing the real cost of production:

$$\begin{aligned} & min \frac{W_t}{P_{H,t}} N_{H,t} \\ & S.t\ Y_{H,t} = A_{H,t} N_{H,t} \end{aligned} \tag{27}$$

By solving this problem and log-linearizing the resulted solution around a steady-state, the optimal condition can be determined by the following equation:

$$w_t - p_{H,t} = mc_{H,t} + a_{H,t} \tag{28}$$

Moreover, we assumed that productivity ($a_{H,t}$) followed an AR (1) process:

$$a_{H,t} = \rho_H a_{H,t-1} + \varepsilon_{H,t} \quad (29)$$

Where $\varepsilon_{H,t}$ has a normal distribution function with zero mean and $\sigma_{\varepsilon H}$ variance. At the process of price setting, we assumed that firms with probability θ_H followed rules of thumb when changing their prices with respect to past inflation and those firms with probability $1-\theta_H$ determined a new optimal price $P^*_{H,t}$ (Gali & Gertler, 1999). Under this modeling approach, the price index of domestically produced non-tradable goods can be written as:

$$P_{H,t} = \theta_H P^p_{H,t} + (1-\theta_H)P^*_{H,t} \quad (30)$$

Where $P^p_{H,t}$ is the price index of those firms that adjusted their price at time t to the inflation rate related to the previous period:

$$P^p_{H,t} = (1+\pi_{H,t-1})^{\omega_h} P^p_{H,t-1} \quad (31)$$

Where ω_h is the indexation parameter with respect to the inflation rate. The new optimal price was set according to the following equation:

$$p^f_{H,t} = (1-\beta\theta_H)\sum_{k=0}^{\infty}(\beta\theta_H)^k E_t\{mc^n_{H,t+k}\} \quad (32)$$

Combining the optimizing and backward-looking behavior of firms led to the following Phillips curve equation for domestic tradable goods:

$$\pi_{H,t} = \lambda_H mc_{H,t} + \gamma_{f,h} E_t(\pi_{H,t+1}) + \gamma_{b,H}\pi_{H,t-1} \quad (33)$$

Where structural parameters are defined as:

$$\lambda_H = \frac{(1-\theta_H)(1-\beta\theta_H)}{(1+\beta)\theta_H} \ , \quad \gamma_{f,H} = \frac{\beta}{1+\beta} \ , \quad \gamma_{b,H} = \frac{1}{1+\beta} \quad (34)$$

3.2.2 Firms in the Non-Tradable Sector

Non-tradable firms are similar to tradable firms in terms of the technology of production and have pricing power. In order to obtain the optimal decision for this sector, we assumed the following production equation for each firm in this sector:

$$Y_{N,t} = A_{N,t} N_{N,t} \quad (35)$$

Where $Y_{N,t}$ is the level of production and $A_{N,t}$ is the productivity. The conditional firm-level labor-demand was determined using the following minimization cost equation:

$$\begin{aligned} &min \frac{W_t}{P_{N,t}} N_{N,t} \\ &S.t. \quad Y_{N,t} = A_{N,t} N_{N,t} \end{aligned} \quad (36)$$

Log-linearizing the resulted first order conditions yielded the following:

$$w_t - p_{N,t} = mc_{N,t} + a_{N,t} \quad (37)$$

Moreover, we assumed that the technology parameter ($a_{N,t}$) evolved according to the following AR(1) process:

$$a_{N,t} = \rho_N a_{N,t-1} + \varepsilon_{N,t} \quad (38)$$

Where $\varepsilon_{N,t}$ has a normal distribution function with zero mean and $\sigma_{\varepsilon N}$ variance.

We reached the following Phillips curve for the non-tradable sector using the price-setting modeling similar to what was proposed by Christiano et al. (2005):

$$\pi_{N,t} = \lambda_N mc_{N,t} + \gamma_{f,N} E_t(\pi_{N,t+1}) + \gamma_{b,N}\pi_{N,t-1}$$
$$\lambda_N = (1-\omega_N)(1-\theta_N)(1-\beta\theta_N)\phi_N^{-1} \ , \quad \gamma_{f,N} = \beta\theta_N\phi_N^{-1} \tag{39}$$
$$\phi_N = \theta_N + \omega_N(1-\theta_N(1-\beta)) \ , \ \gamma_{b,N} = \omega_N\phi_N^{-1}$$

Where ω_N is the indexation parameter with respect to the past inflation rate and θ_N is the percentage of those firms that set their prices optimally in each period.

3.2.3 Importer Firms

Importer firms have no factors of production and just provide goods and services by buying foreign currency at a non-official rate. As a result, the average cost of importing goods and services is equal to the exchange rate. Moreover, importers face some degree of stickiness in price-setting procedures and this characteristic generates a certain kind of Phillips curve. In modeling the price-setting of importer firms, we mainly focused on the law of one price gap.

Importer firms have the power of setting prices in their market; thus, the price of imported goods in a foreign market is lower than that in a domestic market, leading to the violation of the law of one price, as described by Gali and Monacelli (2005). Following Gali and Monacelli (2005), the following specification was considered for the Phillips curve for imported goods:

$$\pi_{f,t} = \beta(1-\theta_f)\pi_{f,t-1} + \theta_f E\pi_{f,t+1} + \omega_f glo_t \tag{40}$$

Where $\pi_{f,t}$ is the imported inflation rate and glo_t is the gap in the law of one price. Moreover, θ_f is the import-price stickiness and ω_f is the markup weight assigned to the gap in the law of one price.

3.3 Exchange Rate and Inflation Rates Dynamics

Since our model was based on an open economy, foreign sector variables could impact the dynamics of model variables. We first started with the overall inflation rate, which can be written as follows:

$$\pi_t = (1-\lambda)\pi_{T,t} + \lambda\pi_{N,t} \tag{41}$$

The inflation rate in the tradable sector is a combination of the inflation rate for the imported and domestically produced tradable goods:

$$\pi_{T,t} = (1-\alpha)\pi_{H,t} + \alpha\pi_{F,t} \tag{42}$$

Where $\pi_{H,t}$ is the inflation rate of the domestic tradable goods and $\pi_{F,t}$ is the inflation rate of the imported tradable goods. It should be noted that since foreign economy is approximately closed, the price of imported goods at foreign countries is equal to the foreign price index: $P_{F,t}^* = P_t^*$. Moreover, in equation (42), α is the share of the consumption of imported goods in the total consumption bundle. Domestic inflation is equal to the average of the inflation rate for both tradable and non-tradable goods produced domestically:

$$\pi_t^d = (1-\lambda)\pi_{H,t} + \lambda\pi_{N,t} \tag{43}$$

In an open economy, one important variable that exhibits the export power of the country is the terms of trade that are defined as:

$$S_t = \frac{P_{H,t}}{P_{F,t}} \quad (44)$$

Where S_t is terms of trade. Log-linearizing this equation around a steady-state yielded the following:

$$s_t = p_{H,t} - p_{F,t} \quad (45)$$

Therefore, its first difference can be written as:

$$\Delta s_t = \pi_{H,t} - \pi_{F,t} \quad (46)$$

The second variable related to an open economy is the real exchange rate, which is defined below:

$$Q_t = \frac{\xi_t P_t^*}{P_t} \quad (47)$$

Where ξ_t is the nominal exchange rate and P^* is the foreign price index. Log-linearizing (47) yielded the following:

$$q_t = e_t + p_t^* - p_t \quad (48)$$

The following captures the first-order lag:

$$\Delta q_t = \Delta e_t + \pi_t^* - \pi_t \quad (49)$$

Where e_t is the log-linearized nominal exchange rate. The linearized relation between the domestic and foreign prices can be determined in the following equation:

$$p_{F,t} = e_t + p_{F,t}^* \quad (50)$$

By differencing the first lag of (48) from (48) and using $p_{F,t}^* = p_t^*$, following equation for foreign inflation rate will derive:

$$\pi_{F,t}^* = \pi_t^* = \pi_{F,t} - \Delta e_t \quad (51)$$

From (42) we can write:

$$\pi_{T,t} = \pi_{H,t} - \alpha(\pi_{H,t} - \pi_{F,t}) = \pi_{H,t} - \alpha \Delta s_t \quad (52)$$

Thereby, the overall inflation rate will be as follow:

$$\pi_t = (1-\lambda)(\pi_{H,t} - \alpha \Delta s_t) + \lambda \pi_{N,t} \quad (53)$$

By inserting this equation at the real exchange rate, we will have:

$$q_t = p_{F,t} - p_t = p_{F,t} - (1-\lambda)(p_{H,t} - \alpha s_t) - \lambda p_{N,t} = -(1-\alpha(1-\lambda))s_t \quad (54)$$

Based on the definition of the real exchange rate, the first difference in the nominal exchange rate could be defined as:

$$\Delta e_t = \pi_t - \pi_t^* + \Delta q_t \quad (55)$$

Similarly, for the terms of trade, we can have the following:

$$\Delta s_t = e_t + \pi_{H,t} - \pi_t^* + \varepsilon_{s,t} \quad (56)$$

Where $\varepsilon_{s,t}$ is the measurement error. By definition, the uncovered interest rate parity (UIP) states that:

$$E_t \left\{ Q_{t,t+1} \left(R_t - R_t^* \left(\frac{\xi_{t+1}}{\xi_t} \right) \right) \right\} = 0 \quad (57)$$

As mentioned before, $Q_{t,t+1}$ is the stochastic discount factor and R_t is the interest rate. However, it should be noted that due to some degree of restrictions on capital mobility, Equation (57) may not hold perfectly for Iran. By log-linearizing Equation (57) around a steady-state, we reached the following:

$$r_t - r_t^* = E_t \Delta e_{t+1} + \varepsilon_{uip,t} \quad (58)$$

Where $\varepsilon_{uip,t}$ is the shock to the UIP and shows the deviations from this rule. Since a foreign economy was exogenous for Iran, we considered AR (1) processes for these variables:

$$y_t^* = \rho_{y^*} y_{t-1}^* + \varepsilon_{y^*,t} \quad (59)$$

$$\pi_t^* = \rho_{\pi^*} \pi_{t-1}^* + \varepsilon_{\pi^*,t} \quad (60)$$

$$r_t^* = \rho_{r^*} r_{t-1}^* + \varepsilon_{r^*,t} \quad (61)$$

Where $\varepsilon_{i,t}: i = y^*, r^*, \pi^*$ has a normal distribution with zero mean and $\sigma_{i,t}^2$ variance.

3.4 Market Clearing Condition

The market clearing condition for domestic tradable goods is represented in the following equation:

$$Y_{H,t} = C_{H,t} + C_{H,t}^* + G_{H,t} \quad (62)$$

Where $C_{H,t}$ is calculated by combining Equations (6) and (9). $C_{H,t}^*$ is obtained through the following equation:

$$C_{H,t}^* = \left(\frac{P_{H,t}}{P_t}\right)^{-\eta} \left(\frac{1}{Q_t}\right)^{-\eta} C_t^* \quad (63)$$

The log-linearized equations for $C_{H,t}$ and $C_{H,t}^*$ are presented, respectively, below:

$$c_{H,t} = -\eta\left(p_{H,t} - P_{T,t}\right) - \nu\left(P_{T,t} - p_t\right) + c_t \quad (64)$$

$$c_{H,t}^* = \eta \lambda_{pn,t} - \eta(1-\lambda)\alpha s_t + c_t^* + \eta q_t \quad (65)$$

By substituting (64) and (65) in (62), we reached the following:

$$y_{H,t} = \alpha\big((1-\alpha)\upsilon - \eta\big)s_t + +(1-\alpha)c_t + \alpha c_t^* + g_{H,t} \quad (66)$$

The market clearing condition in a non-tradable sector can be determined by the following equation:

$$y_{N,t} = c_{N,t} + g_{N,t} \quad (67)$$

$$c_{N,t} = -\nu\left(p_{N,t} - p_t\right) + c_t = -\nu(1-\lambda)\alpha s_t - \upsilon(1-\lambda)p_{N,t} + c_t \quad (68)$$

Thereby, we can write the market clearing condition in a non-tradable sector as:

$$y_{N,t} = -\nu(1-\lambda)\alpha s_t - \upsilon(1-\lambda)p_{N,t} + c_t + g_{N,t} \quad (69)$$

Finally, the market clearing condition for the whole economy is formulated below:

$$y_t = (1-\lambda)y_{H,t} + \lambda y_{N,t} \quad (70)$$

3.5 Marginal Cost Functions

In order to obtain the log-linearized marginal cost functions in tradable and non-tradable sectors, we used the production function which yielded the following equations:

$$mc_{H,t} = \sigma(c_t - hc_{t-1}) + \psi\big(y_t - a_{H,t}\big) - a_{N,t} \quad (71)$$

$$mc_{N,t} = \sigma(c_t - hc_{t-1}) + \psi(y_t - a_t) - a_{N,t} \quad (72)$$

Where:

$$n_t = (1-\lambda)n_{H,t} + \lambda n_{N,t} \tag{73}$$
$$a_t = (1-\lambda)a_{H,t} + \lambda a_{N,t} \tag{74}$$

3.6 Exchange Rate Policies

Generally, the central bank of Iran does not follow a known policy rule and its past behavior shows that it intervenes in the exchange market by injecting foreign reserves to control or stabilize the nominal exchange rate around a targeted level. This targeted level may have two distinct forms: a constant number or a flexible interval. The former is known as the fixed exchange rate policy and the latter is known as the managed floating exchange rate policy. Thus, depending on the policymakers' attitude toward the exchange market, one of the abovementioned policies is implemented.

In what follows, both of these exchange rate policies are formulated. Our modeling is similar to that utilized by Batini et al. (2010) but there is a major distinction between their model and ours. Since we assumed that the central bank had no rule in setting the interest rate, we could not evaluate exchange rate policies via interest rate rules. As a result, to examine the exchange rate policies, we had to impose a mathematical formula that defined the exchange rate based on some macroeconomic variables. Therefore, the fixed and managed floating exchange rate policies were specified by the following equations, respectively:

$$\begin{cases} e_t = e_{t-1} + \varepsilon_t^e \\ e_t = \rho_e e_{t-1} + \rho_\pi \pi_t + \varepsilon_t^e \end{cases} \tag{75}$$

Where ε_t^e is the shock to the exchange rate. The first equation in the pair of equations in (75) shows a fixed exchange rate regime, in which the current nominal exchange rate equals the lagged nominal exchange rate plus a disturbance term. In other words, in each period, the central bank sets a nominal interest rate unless a permanent (transitory) shock imposes a long-run (short-run) deviation.

The second equation represents a managed floating exchange rate, in which the central bank simultaneously considers the previous nominal exchange rate and the inflation rate fluctuations.

3.7 Dynamics of Other Variables

Without a banking system, the real balances held by households, in equilibrium, should equal the monetary base. The currency held by households is in the liability side of the central bank balance sheet. To produce equilibrium, the asset side of the central bank balance sheet should be determined, as captured in the following equation:

$$M_t = F_t + GD_t \tag{76}$$

Where F_t is the central bank foreign exchange reserves and GD_t is the government debt to the central bank. The change in the foreign exchange reserves over time can be measured by the following equation:

$$F_t = \left(1 + r_{f,t-1}\right)F_{t-1} + C_t^* - impo_t \tag{77}$$

Where $r_{f,t-1}$ is the interest on foreign exchange reserves and $impo_t$ is the level of imported goods and services. The government debt evolves according to an AR (1) process, as shown below:

$$GD_t = (1 - \rho_{GD})(GD_t - \overline{GD}) + \varepsilon_t^{GD} \quad (78)$$

Where $\overline{GD}$ is the steady-state of government debt, ε_t^{GD} is the shock to the government debt, and p_{GD} $0 < \rho_{GD} < 1$.

At each point in time, the government must regulate its revenues and expenditures to balance the budget constraint:

$$G_t + R_{t-1}B_{t-1} = T_t + B_t + (M_t - M_{t-1}) \quad (79)$$

Where B_t is the bond issued by the government and sold to the households.

3.8 Stylized Facts

During the past 30 years, Iran's economy has experienced four humps in the nominal exchange rates. The first one was an increase in the nominal exchange rate from 1500 rials per dollar to about 5000 rials in the mid-1990s. In that period, the government decided to divide goods and services into basic and non-basic. The official rate (1500 R) was allocated to supply the first group, i.e. basic, of goods, and the market rate (5000 R) to supply the second group, i.e. non-basic, of goods. This categorization generated a channel for speculative activities that finally offset the effects of the official rate. The speculative activities increased in the exchange market and infiltrated other markets, especially the money market, and left no meaningful positive effect on output. This phenomenon was observed in the late 1990s, when the official rate increased from below 2000 rials to about 8000 rials. In the early 2010s, the official rate was raised from 10000 rials to about 30000 rials and, recently, in 2018 from about 40000 rials to 120000 rials, on average. During the last three exchange crises, the government has tried to set a fixed nominal exchange rate, at least for some part of the economy, but, these measures have led to a rise in commodity prices and a decrease in output, on the one hand, and gradually narrowed the gap between the official and non-official rates, on the other hand, resulting in decreased speculative activities.

The above discussion leaves us with this question that when there is a jump in the exchange rate, what policy the government should adopt to reduce speculative activities in the money and other markets and, at the same time, stimulate economic growth.

4. Estimation Results

4.1 Bayesian Estimation of the Model Parameters

There are different approaches, such as GMM, MLE, MDE, etc., to estimate the parameters of a DSGE model, but not all of them may produce reliable results. Among these methods, Bayesian inference is an efficient method for parameter estimation because it uses all available information[1]. Bayesian

[1]See Tavakolian and Sarem (2017) for more details on Bayesian estimation.

estimation is derived from a familiar formula in statistics which is known as Bayes rule. Bayes rule enables us to compute the conditional probability of a stochastic variable using the information of a known joint distribution function. This is the starting point of Bayesian estimation, followed by the prior and posterior distribution functions.

The prior distribution function is available to the researchers beforehand and the posterior distribution function is obtained by multiplying the probability of data by the prior distribution function. The probability of data is referred to as the likelihood function. Based on the Bayes rule, the posterior distribution function is proportional to the prior density multiplied by the likelihood function. This multiplication produces a multiple integral that cannot be solved by ordinary methods. Therefore, in Bayesian inference, the Metropolis-Hastings algorithm is employed to solve this integral. Moreover, the model required random sampling from probability distribution functions, and we applied the Bayesian Monte Carlo Markov Chain (MCMC) sampling approach, which is an algorithm-based method to produce a Markov Chain with desired characteristics.

This study used quarterly data from 1989:01 to 2016:04[1]. After specifying initial values for the model parameters and prior distribution function, the data set was formed from the available data on consumption, nominal exchange rate, monetary base growth rate, money base, government spending, and export volume. Furthermore, Monte Carlo optimization was used with 600000 iterations in two blocks. The estimated results are reported in Table 1.

Table 1. Estimation results

Parameter	Prior Mean	Prior d.f	Posterior Mode	Posterior Standard Deviation
$\boldsymbol{h}$	0.5	Beta	0.49	0.2
$\boldsymbol{\sigma}$	1.5	Gamma	1.53	0.2
$\boldsymbol{\varsigma}$	2.5	Gamma	2.49	0.2
$\boldsymbol{\theta_H}$	0.75	Beta	0.74	0.1
$\boldsymbol{\beta}$	0.97	Beta	0.97	0.02
$\boldsymbol{\psi}$	2	Gamma	2.1	0.5
$\boldsymbol{\omega_N}$	0.5	Beta	0.51	0.15
$\boldsymbol{\theta_N}$	0.75	Beta	0.69	0.15
$\boldsymbol{\omega_f}$	0.45	Beta	0.43	0.1
$\boldsymbol{\theta_f}$	0.6	Beta	0.59	0.1
$\boldsymbol{\lambda}$	0.5	Beta	0.45	0.1
$\boldsymbol{\alpha}$	0.3	Beta	0.29	0.02
$\boldsymbol{\rho_e}$	0.7	Beta	0.7	0.2
$\boldsymbol{\rho_\pi}$	1.25	Beta	1.24	0.1

In order to evaluate the impact of a managed floating exchange rate policy on the model dynamics, a set of policy analysis was utilized that comprised two parts: the first one was conditional predictions of variables and the second was

[1]Data were extracted from the Economic Time Series Database of the central bank of Iran (tsd.cbi.ir).

variance decomposition of the model variables, which revealed the effect of shocks on the fluctuations of each variable.

4.2 Conditional Predictions

The conditional predictions were incorporated in the policy analysis due to the fact that in a managed floating exchange regime, policymakers allow the exchange rate to fluctuate merely within predetermined bounds; as a result, the information on the exchange rate is released sooner than other types of information are made public. This means that the future path of variables will depend on the expected path of the nominal exchange rate. Therefore, the effects of this policy on macroeconomic variables, when the economy experiences different situations, can be understood through conditional forecasting. In what follows, first, an outline of conditional forecasting is provided; then, the effects of a managed floating exchange rate policy on macroeconomic variables are analyzed in various economic situations.

A linearized DSGE model comprises a vector of endogenous variables (Z_t), a vector of parameters (θ), and a vector of exogenous variables (X_t):

$$E[Z_t, X_t, \theta] = 0 \tag{80}$$

The reduced form of this equation has a state-space representation of the form:

$$Z_t = A(\theta)Z_{t-1} + B(\theta)X_t \tag{81}$$

Where A and B are matrices of structural parameters. Equation (81) shows that a vector of endogenous variables (Z_t) has a normal distribution function with a mean of $\bar{Z}$ and a matrix of variance-covariance of Φ. Now, suppose that the whole or some of the arguments of Z_t are given the following restriction:

$$DZ_t \sim TN(\bar{Z}_{TN}, \Omega, [L, H]) \tag{82}$$

Where D is a vector of deterministic elements, TN the truncated multivariate normal distribution function, $\bar{Z}_{TN}$ the mean, Ω covariance matrix of this distribution, L the lower bound, and H the upper bound. Due to the nature of endogenous variables in general equilibrium models, any restriction on endogenous variables means a restriction on exogenous variables (shocks), as shown by the following distribution function:

$$RX_t \sim TN(\bar{Z}_{TN} - D\bar{Z}, \Omega, [L - D\bar{Z}, H - D\bar{Z}]) \tag{83}$$

Where the matrix R is defined as DΦ.

Considering the feature of distribution mentioned in (82), it can be stated that in a managed floating exchange rate regime, establishing bounds on a nominal exchange rate will lead to a truncated distribution for endogenous variables and their future paths. In addition, it must be added that controlling the nominal exchange rate is only possible by imposing restrictions on those shocks that directly affect the nominal exchange rate[1]. Therefore, what is presented in

[1]It should be noted that in this structure, shocks are divide into two categories: controlled and uncontrolled. Here, imposing restrictions means those shocks that are controlled by policymakers.

this section is based on this assumption that the nominal exchange rate shock is controlled by policymakers. In line with this assumption, the path which macroeconomic variables are expected to take in the face of each variation in the economy is examined and discussed below.

4.2.1 Inflation Shock

In this scenario, it is assumed that under a managed floating regime, the inflation rate rises to about 10% for one year. Figure (1) shows the effects of this inflationary event on some real variables.

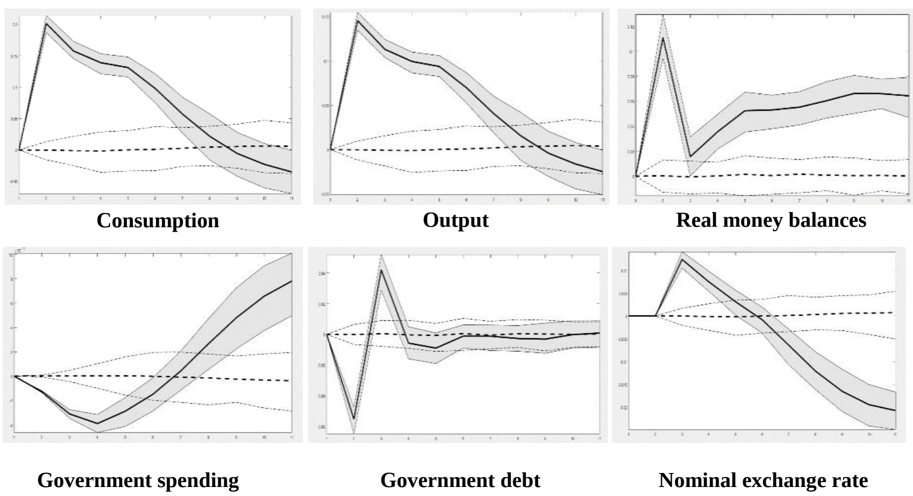


Figure 1. Conditional forecasting of a rise in the inflation rate

As Figure (1) shows, under a managed floating regime, a rise in the inflation rate will lead to an increase in the real consumption at the starting point. Then, the real consumption will decrease. In the intertemporal Euler equation, a rise in inflation will push up consumption because households know that their future purchasing power will decline and thereby purchase more. A rise in real consumption means an increase in the total demand will lead to a rise in output. An increase in the price level will reduce the real debt and the government spending but will increase the real money balances due to the assumed price stickiness in the model. The point which is worth highlighting is that although there is no volatility in the exchange rate at the beginning, there will be some volatility in the following periods.

4.2.2 Real Private Consumption

In this scenario, it was assumed that the real private consumption rose to about 10% for one year. Figure (2) shows the effects of this phenomenon on some real variables:

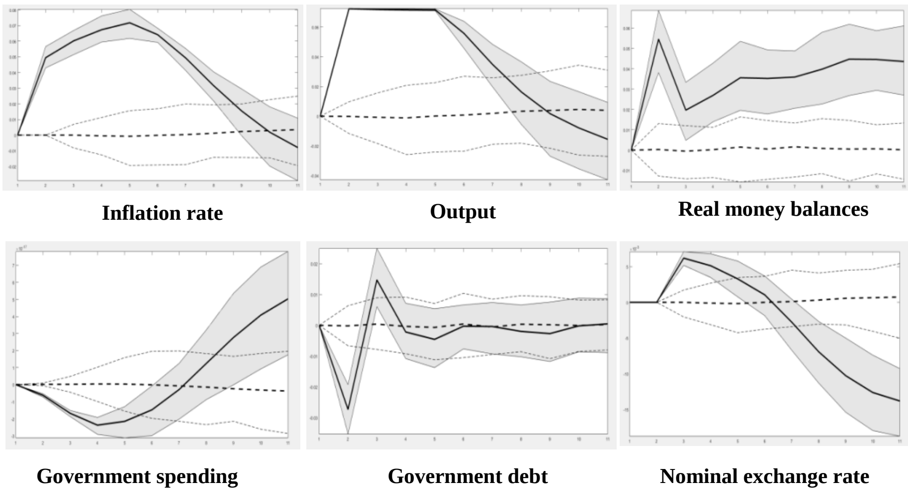


Figure 2. Conditional forecasting of a rise in the private real consumption

Since a rise in the real private consumption means a rise in the total demand, there will be an increase in both inflation rate and real output. Due to the inflationary pressure which follows a rise in the real private consumption, the real government debt and spending will decline but the real money balances will increase due to the price stickiness. As Figure (1) shows, the nominal exchange rate increases after being fixed at the beginning.

4.2.3 Real Money Balances Shock

In the third scenario, it was assumed that the real money balances rose to about 10% for one year. Figure (3) shows the real effects of this change.

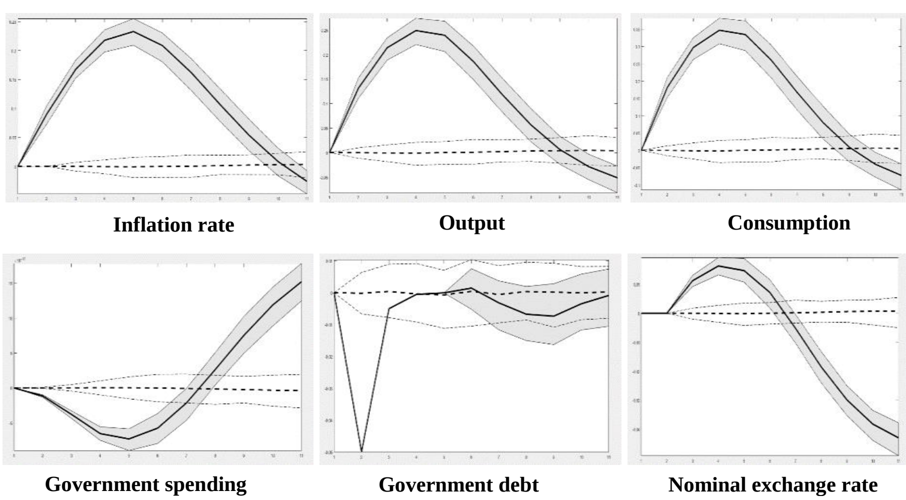
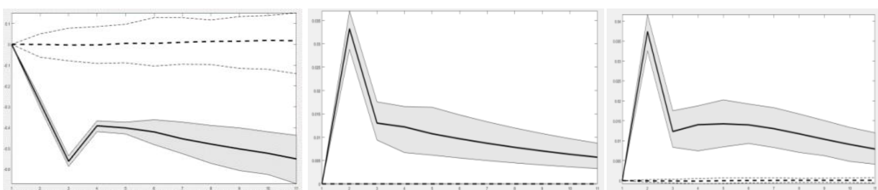


Figure 3. Conditional forecasting of a rise in the real money balances

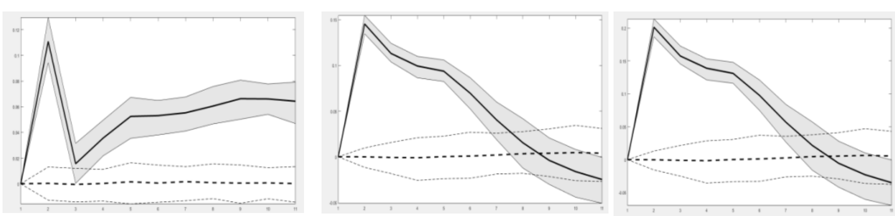
Due to price rigidity, a rise in the money supply will lead to changes in the real variables.

4.2.4 Comparing the Results with Those of a Fixed Exchange Rate

It can be inferred from Equation (72) that if the policymakers choose a fixed exchange rate regime, the dynamic paths of the model variables which resulted from the three previous scenarios under the managed exchange rate regime will be different. Since high inflation rates is one of the main problems of Iran's economy, the conditional predictions were performed with an inflation rate under 10% rise under a fixed exchange rate regime and the resulted paths were compared with those derived under a managed floating regime (Figure 4):



Real money balances under a fixed regime | **Real output under a fixed regime** | **Real consumption under a fixed regime**



Real money balances under a managed regime | **Real output under a managed regime** | **Real consumption reaction under**

Figure 4. A comparison of conditional forecasting of the effect of a rise in the inflation rate on some model Variables under fixed and managed floating regimes

It can be inferred from Figure (4) that the increase in real consumption under a fixed regime was greater than that under a managed fixed regime. Moreover, the changes in the real consumption remained positive (higher than its long-run trend) under a fixed regime, but they fell below its long-run trend after 9 periods under a managed regime. In other words, under a fixed regime, the real balances of the agents were more than those under a managed regime.

Secondly, Figure (4) shows that the rise in the output was more under a managed floating regime compared to that under a fixed regime. One explanation for this finding is that under an inflationary pressure, if the policymakers do not allow any changes in the nominal exchange rate, the real exchange rate will fall and, consequently, the imported goods will be cheaper than the goods and services produced domestically. This, in turn, will lead domestic customers to substitute domestically produced goods for imported goods, resulting in a reduction in the production of domestic goods production.

Thirdly, it can be inferred from Figure (4) that the real money balances under a managed floating regime rose over its long-run trend but fell below its trend under a fixed exchange rate. One reason for such difference is that under the former policy, i.e. the managed floating regime, the exchange rate increased in response to the inflation rate; however, under the latter regime, since the exchange rate remained fixed, a major part of the demand for domestic money shifted to the foreign currency. Therefore, the demand for domestic money fell below its trend.

4.3 Shock Decomposition

At the beginning of this study, it was claimed that the shocks to the exchange rate were probably the major and the most important shocks in driving business cycles in developing countries. One way to measure the degree of importance of the nominal exchange rate is to use the results of variance decomposition because they reveal the effect of each shock on the fluctuations in a variable. Table (2) shows the share of the nominal exchange rate fluctuations on the variances of consumption, output gap, inflation rate, and real money balances under a managed floating regime.

Table 2. The share of exchange rate shocks on variations of model variables

Regime	Consumption	Output gap	Inflation rate	Real money balances
Managed floating	97%	97%	98%	99%

Table (2) shows that the shocks to the nominal exchange rate had a significant effect on the fluctuations of consumption, output gap, inflation, and real money balances.

5. Concluding Remarks

This study aimed to analyze the effects of a managed floating exchange rate policy on the dynamics of Iran's economy. For this reason, a DSGE model was estimated for Iran's economy using quarterly data and the Bayesian estimation method. Then, the impacts of two different exchange rate regimes on model variables were estimated. Finally, some conclusions were made for policymaking in Iran using conditional forecasting and variance decomposition.

Although the fixed exchange rate policy brought more private consumption for households, it reduced output growth compared with the managed floating regime. Thereby, if policymakers have a tendency toward output gap stabilization, they are recommended to implement a managed floating regime; however, if they are inclined to improve the real money balances of households, they should follow a fixed regime. Moreover, the results indicated that a fixed exchange rate regime, by lowering the demand for domestic money, could lead to incremental demand for the exchange rate. This, in turn, will certainly impose high pressure on foreign reserves.

To measure the effects of the shock to the nominal exchange rate on the variations in the model variables, variance decomposition approach was employed and the results showed about 97% of the variation in the consumption and output, 98% in the inflation rate, and 99% in the real money balances were due to the shocks to the nominal exchange rate.

At the end, we encourage the policymakers to adopt a managed floating exchange rate regime due to the following reasons: (1) it promotes economic growth, (2) it reduces speculative activities in the exchange market by lowering the marginal profit gained by buying and selling rates, and (3) it leads to less volatility in the exchange rate by triggering a proper response to different economic dynamics.

References

Adolfson, M., Laseen, S., Linde, J., & Svensson, L. (2014), Monetary Policy Trade- offs in an Estimated Open Economy DSGE Model, *Journal of Economic Dynamics and Control*, Vol. 42, 33- 49.

Agenor, R., Prasad, E., and McDermott, C. (1999), Macroeconomic Fluctuations in Developing Countries; Some Stylized Facts, *IMF Working Papers* 99/35.

Batini, N, Gabriel, V, Levine, P, and Pearlman, J. (2010). “A Floating versus managed exchange rate regime in a DSGE model of India,*NIPE Working Papers*, 31/2010, NIPE - Universidade do Minho.

Canzoneri, M., Cumby, R., & Diba, B. (2001), Is the Price Level Determined by the Needs of Fiscal Solvency?, *American Economic Review*, Vol. 91, No. 5, 1221 – 1238.

Curdia, V., & Woodford, M. (2008), Credit Spreads and Monetary Policy, *NBER Working Paper*, 15289.

Dilmaghani, A., and Tehranchian, A. (2015), The Impact of Monetary Policies on the Exchange Rate: A GMM Approach, *Iranian Economic Review (IER*), vol. 19(2), 177-191.

Dueker, M., and Fischer, A. (1996), Inflation Targeting in a Small Open Economy: Empirical Results for Switzerland, *Journal of Monetary Economics*, 37, 89 – 103.

Fuhrer, J. (2000), Habit Formation in Consumption and Its Implications for Monetary Policy Models, *American Economic Review*, Vol. 90, No. 3, 367 – 390.

Gali, J., & Gertler, M. (1999), Inflation Dynamics: A Structural Econometric Analysis, *Journal of Monetary Economics*, Vol. 44, Issue 2, 195 – 222.

Gali, J., & Monacelli, T. (2005), Monetary Policy and Exchange Rate Volatility in a Small Open Economy, *Review of Economic Studies*, Vol. 72(3), 707-734.

Kydland, F. & Prescott, E. (1977), Rules rather than Discretion: The Inconsistency of Optimal Plans, *Journal of Political Economy*, Vol. 85, Issue 3, 473 – 91.

Lawrence, C., Martin, E., & Evans, C. (2005), Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy, *Journal of Political Economy*, vol. 113(1), 1-45.

Miah, J. (2010), Conditional Forecasts in DSGE Models, *Norges Bank Working Paper*, 2010/07.

Neumeyer, P., & Perri, F. (2005), Business Cycles in Emerging Economies: The Role of Interest Rates, *NBER Working paper*,10387.

Salavitabar, S., & Jalali-Naeini, A. (2014), Analyzing Exchange Rates Regimes in an Open Small Economy, *Budget and Planning Journal*, No. 125.

Shambaugh, J. (2004), The Effects of Fixed Exchange Rates on Monetary Policy, The Quarterly Journal of Economics, Vol. 119, Issue 1, 301 – 352.

Tavakolian, H., & Sarem, M. (2017), DSGE Model in Dynare Software, Tehran, MBRI Publication.

Taylor, J. (1993), Discretion versus Policy Rules in Practice, *Carnegie – Rochester Conference Series on Public Policy*, Vol 39, 195-214.

Uhlig, H. (1999), A Toolkit for Analyzing Non-linear Difference Equations, Memo, Tilberg University.

Walsh, C. (2010), Monetary Theory and Policy. Massachusetts, MIT Press, Third Edition.

Yazdani, M., & Gheshlaghi, S. (2016), Analyzing the Effects of Exchange Rates Shocks on the Inflation in Iran Economy, *Iran Applied Economic Studies Journal*, No. 5, 171-197.