Advances In Industrial Engineering And Management (AIEM)

DOI: *http://doi.org/10.7508/aiem.01.2019.15.24*

ZIBELINE INTERNATIONAL PUBLISHING

ISSN: 2222-7059 (Print)
EISSN: 2222-7067 (Online)

AIEM ADVANCES IN INDUSTRIAL ENGINEERING AND MANAGEMENT

CrossMark

REVIEW ARTICLE

DYNAMIC STOCHASTIC GENERAL EQUILIBRIUM (DSGE) AND NEWS SHOCK: A REVIEW OF REGIONAL MONETARY AFFECTIONS IN IRAN

Hossein Marzban, Alihossein Samadi, Ahmad Sadraei Javaheri, Shapoor Zarei*

Faculty of Economics, University of Shiraz, Tehran 14159, Iran
****Corresponding Author E-mail: info.mitworkshop@gmail.com***

ARTICLE DETAILS

Article History:

Received 23 November 2018
Accepted 25 December 2018
Available online 5 January 2019

ABSTRACT

This study aims to investigate the effects of news shockshmonetary policies in Iran using the Dynamic Stochastic General Equilibrium (DSGE) model. To this end, two kinds of news shocks (known as technology and consumer preferences) were defined according to Khan and Tsoukalas' approach. In order to construct and simulate the DSGE model to approaching the real conditions in Iran, consumption habits in the utility function were concerned based on the assumption of the zero-value obtained from multiplying the inflation by the real interest rate in the Fisher's equation, whereas the real interest rates in the long run were appointed as negative remark in simulating the monetary policy models. The estimation and simulation results for the research models indicated that monetary policies using the interest rate instrument identified the news shocks less frequently than monetary policies using the monetary base instrument. In regard to findings and results mentioned in this case-study research, the approximate value of the social loss function in the optimal commitment and discretionary monetary policies suggests that the optimal commitment policy is estimated to be lower in both cases. Due to value of the social loss function in optimal monetary policies with nominal interest rate instrument in the presence of news shocks, this could be claimed that monetary policy with interest rate instrument is more appropriate than the monetary policy with a monetary base instrument.

KEYWORDS

News shock, Monetary policy, DSGE model, Social loss function, Impulse responses function.

1. INTRODUCTION

The development of a monetary strategy tailored to the economic environment of countries including Iran, which are exposed to various shocks, is of paramount importance. In this regard, it is necessary to specify the structure of the economy, identify the source of shocks, and make appropriate policies in terms of the shock type. In order to achieve these goals, the general equilibrium models are common to be employed. In the new classic general equilibrium models, given the assumption that money is neutral in the economy; the behaviors of the monetary authority and monetary policies were not explained by the model and the dynamics of the economy were simply investigated with regard to the reactions of macroeconomic variables against the real shocks criticized by economists considering such models. With regard to these critiques, groups of economists were to expand and generalize the new classic general equilibrium models through maintaining the positive feature of these models, including the emphasis on rational expectations, microeconomic foundations, and optimization of the economic agents, by adding monopolistic competition structures and nominal and realistic adhesions. Thus, the impact of economic policies and the demand-side shocks could be analyzed and explained. These models are now referred to as New Keynesian Dynamic Stochastic General Equilibrium (DSGE) Models. In spite of assumptions such as incomplete competition, incomplete markets, heterogeneous work force, asymmetric information, and the lack of smooth and straightforward settlement of markets, this model contrary to the monetary theory of trade cycle believes that the expected monetary policy can even have real effects on production and employment. Hence, this study aimed to investigate the impact of news shocks on monetary policies using the DSGE in Iran's economy.

2. REVIEW OF LITERATURE

The expected shocks in economy are so-called news shocks. According to Sims (2016), the term "news shock" in the macro-economy refers to an exogenous variable that focuses on affecting factors before the variable is changed [1,2]. Offick and Wohltmann (2016) argued that the news shocks would be realized in the future [3]; however, their size and maturity time can be expected by economic factors. Cochran (1994) and Beaudry and Portier (2004) examined the idea indicating that news shocks could be a major source of fluctuations in all trade cycles [4,5]. This study and similar studies have examined the impact of news shocks on the economy in the form of real trade cycles. Recently, some studies using the new Keynesian models have been developed to analyze the impact of these types of shocks on macroeconomic variables. For example, Jinnai (2013) researched news and inflation shocks using the new Keynesian models [6]. Since the effectiveness of monetary policies is applied through Keynesian models, theoretical foundations in the form of new Keynesian models are required to investigate the impact of news shocks on the monetary policies.

3. IDENTIFYING NEWS SHOCKS

Most studies on news shocks have focused on how to identify these types of shocks. Various studies (e.g., Beaudry & Portier, 2005 and 2006; Fève et al., 2009; Fève & Jidoud, 2012; Khan & Tsoukalas, 2012; and Miyamoto & Nguyen, 2014) have been performed to identify these types of shocks, most of which rely on the structure of the VAR or SVAR models [7-12].

According to the above studies, there are two types of news shocks: Total Factor Productivity (TFP) Shock in the corporate sector and Consumer

Preferences Shocks (CP) in the household sector.

We consider the shock process as follows:

$$ln\varepsilon_t = \rho_a ln\varepsilon_{t-1} + \eta_t \tag{1}$$

Where, ρ_a is the shock continuity parameter and η_t is the disturbance component in which the news shock is defined. We divide the shock disturbance component into two separate unexpected and expected (i.e., news shock) parts so the equation can be rewritten as follows:

$$\eta_t^{news} = \sum_{h=1}^{H} \eta_{t-h}^{news,h} \quad \varsigma_t = \eta_t^{un} + \eta_t^{news} \tag{2}$$

In the above relation, $\eta_{t-h}^{news,h}$ is the news received during the period *h* by the factors created during the period *t-h*. *H* also represents the longest horizon expected by economic factors, which is usually considered to be above the shock. Another assumption is that, firstly, the components ε_t and $\eta_{t-h}^{news,h}$ are considered as white noise with normal distribution, and secondly, the above components are assumed to be independent during the period *H*.

The VAR or SVAR methods are commonly used to identify news shocks; though, VAR-based DSG models have also been used extensively. Accordingly, Smets and Wouters (2005, 2007), Beaudry and Portier (2004, 2007), Jaimovich and Rebelo (2009), Altig et al. (2011), Schmitt-Grohé and Uribe (2008, 2012) presented the DSGE models in which news shocks considerably explain the data fluctuations [13-19].

4. BASIC MODEL

To investigate the effects of news shocks on the monetary policies, the basic model considered includes the households, firms, government, and Central Bank. Furthermore, two kinds of news shocks focusing on family preferences as well as on technology or the total factor productivity of production are also concerned.

5. HOUSEHOLDS

In this model, it is assumed that the typical household has an unlimited life. The households own labor and capital in the economy and they aim to maximize the expected life expectancy in line with their budget constraints. The typical household in the economy, *i*, achieves utility from using product and services and maintaining the real money holdings. By providing more labor, its productivity decreases because their leisure time is reduced. Therefore, a typical household has the following preferences:

$$E_t \sum\nolimits_{t=0}^{\infty} U\left[c_t^i.\left(\frac{M_t}{P_t}\right)^i, l_t^i\right] \tag{3}$$

Where, C_t is the household's total consumption, M_t/P_t is the real money holdings, and L_t is the work hour spent by the household. An assumption, indicating that a household obtains productivity from consumption when it is able to increase its consumption basket in the society in which it lives, makes one approach the real conditions. The formation of consumption habits is thus included in the model, following Boldrin et al. (2001) [20]. Regarding the subjective form of the utility function, which is considered as relative risk aversion, the current value of the benefits that the household earns is as mentioned in Equation (4):

$$E_t \sum\nolimits_{t=0}^{\infty} \beta^t \varepsilon_{\beta t}\left[\frac{\left(C_t^i - hC_{t-1}\right)^{1-\sigma}}{1-\sigma} + \frac{\kappa_m}{1-b_m}\left(\frac{M_t^i}{P_t}\right)^{1-b_m} - \chi\frac{\left(L_t^i\right)^{1+\eta}}{1+\eta}\right] \tag{4}$$

In the above equation, *E* is the expectation operator and β and *h* are the parameters of time discounting and the stability degree of habits. σ, b_m, and η represent the inverse elasticity of inter-temporal consumption substitution, the inverse elasticity of the real money holdings relative to the interest rate, and the inverse elasticity of the labor supply to the actual wage, respectively. $\varepsilon_{\beta t}$ also reflects the consumer preferences shock. κ_m and χ respectively indicate the parameters of the money preferences and the lack of labor supply preferences in the utility function.

The capital stock of economy is periodically adjusted as follows:

$$k_t = (1-\delta)k_{t-1} + i_t \tag{5}$$

In Equation 5, δ is the investment depreciation rate and i_t is the gross investment

The typical household starts the period *t* with $M_{(t-1)}$ units of money and $(1+r_{t-1})B_{t-1}$ units of bonds, which is left from the operation of the previous period. In addition, $K_{(t-1)}$ is the unit of capital and L_t stands for available hours of labor. During the period *t*, the households begin to supply the production factors (i.e., labor and capital) to the manufacturing firms that produce the mediatory product and earn revenues from the place of supply. Furthermore, the households are also assumed to be corporation owners and receive dividends, D_t, distributed in each period. It is also assumed that they receive the whole subsidy of TA_t from the government.

With regard to the above considerations, the typical household is exposed to the following budget constraint to maximize its productivity function:

$$c_t^i + i_t + \frac{M_t}{P_t} + \frac{B_t}{P_t} + T_t = w_t l_t + R_t k_{t-1} + \frac{M_{t-1}}{P_t} + \frac{(1+r_{t-1})B_{t-1}}{P_t} + TA_t + D_t \tag{6}$$

Where, w_t is the actual wage of the labor force, R_t is the actual rental rate of the capital, r_{t-1} is the nominal interest rate, and P_t is the total price index. If $m_t = \frac{M_t}{P_t}$ is the true balance of the money and $b_t = \frac{B_t}{P_t}$ is real bonds, then the gross inflation rate will be determined as follows (Ireland, 2002) [21]: $\pi_t = \frac{P_t}{P_{t-1}}$

Then, we have:

$$c_t^i + i_t + m_t + b_t + T_t = w_t l_t + R_t k_{t-1} + \frac{m_{t-1}}{\pi_t} + \frac{(1+r_{t-1})b_{t-1}}{\pi_t} + TA_t + D_t \tag{7}$$

Following conditional optimization by the households and forming the Lagrange equation using the coefficient λ_t, the first-order conditions of household optimization, compared to c_t^i, l_t, m_t, b_t and k_t, will be:

$$\left(c_t^i - hc_{t-1}\right)^{-ó} - \lambda_t = 0 \tag{8}$$

$$-\chi l_t^{\eta} + w_t\lambda_t = 0 \tag{9}$$

$$\kappa_m m_t^{-b_m} - \lambda_t - \beta E_t\frac{\varepsilon_{\beta t+1}\lambda_{t+1}}{\pi_{t+1}} = 0 \tag{10}$$

$$-\lambda_t + \beta E_t\frac{\varepsilon_{\beta t+1}\lambda_{t+1}(1+r_t)}{\pi_{t+1}} = 0 \tag{11}$$

$$-\lambda_t + \beta E_t\left[R_{t+1} + (1-\delta)\right] = 0 \tag{12}$$

The following economic concepts are derived from combining equations (8) to (12):

Supply of labor force

$$\frac{\chi l_t^{\eta}}{\left(c_t^i - hc_{t-1}\right)^{-\sigma}} = w_t = \frac{W_t}{P_t} \tag{13}$$

Demand for money

$$\frac{\kappa_m m_t^{-b_m}}{\left(c_t^i - hc_{t-1}\right)^{-\sigma}} = \frac{r_t}{1+r_t} \tag{14}$$

Fisher's Equation

$$E_t \frac{(1+r_t)}{\pi_{t+1}} = E_t\left[R_{t+1} + (1-\delta)\right] \tag{15}$$

Euler's equation

$$\left(c_t^i - hc_{t-1}\right)^{-\sigma} = \beta E_t \frac{\varepsilon_{\beta t+1}(1+r_t)\left(c_{t+1}^i - hc_t\right)^{-\sigma}}{\pi_{t+1}} \tag{16}$$

6. FIRMS

Price stickiness is a key premise in new Keynesian models and is of paramount importance to understand the response of critical macroeconomic variables to monetary shocks. To check the price stickiness, two types of firms, i.e., final producer and intermediary firms, are considered.

6.1 Final manufacturing corporation

As Ireland Suggested [21], the sample corporation is the producer of final product from the units of mediatory product Y_{jt}, in which $j \in [0,1]$ is purchased at the nominal price of P_{jt} and the final product Y_t is produced. According to Equation (17), which, according to Dixit and Stigkutz (1997) [22], is a collector, one can write:

$$Y_t = \left[\int_0^1 Y_{jt}^{(\theta-1)/\theta} dj\right]^{\theta/(\theta-1)} \tag{17}$$

In the above equation, θ> 1 and mediatory product are distinguished and imperfect substitutes of each other and there is steady θ-substitution elasticity among them. During the period *t = 0,1,2, ...*, the sample corporation manufacturing the final product selects Y_{jt}, for all *j*∈[0,1] in a way to maximize its profit:

$$Max\left\{P_t Y_t - \int_0^1 P_{jt} Y_{jt} dj\right\} \tag{18}$$

According to (18), the first-order condition of the above optimization, the demand function for a distinct manufactured product for the corporation *j*, will be in the following form (19):

$$Y_{jt} = \left[\frac{P_{jt}}{P_t}\right]^{-\theta} Y_t \tag{19}$$

Where, θ shows the price elasticity of the demand for the mediatory product *j*. On the other hand, as it can be seen, the demand for the product *j* is a function of the relative price (the proportion of the price for the product j to that for the final product) and the production of the final product.

In competitive markets, the profit obtained for the corporation producing the final product is equal to zero and the zero-profit condition, P_t, is defined as follows:

$$P_t = \left[\int_0^1 P_{jt}^{(1-\theta)} dj\right]^{\frac{1}{(1-\theta)}} \quad t = 0,1,2, \ \ldots \tag{20}$$

6.2 Intermediary manufacturing firms

Based on the conventional method of including stickiness in random dynamic equilibrium models, the economy is composed of a chain of exclusive competitive firms in the manufacturing sector of mediatory product. Each of the firms produces a distinct product, which is eventually purchased (consumed) by households after being combined by the firms producing the final product.

The corporation *j* manufacturing the mediatory product rent labor force l_{jt} and capital k_{jt-1} from the typical household. It should be noted that the household, with respect to the actual wage rate w_t, supplies (j∈ [0,1]) l_{jt} labor force to the j[th] intermediary producer. The total labor force supplied to intermediary producers by the selected household in each period is equal to:

$$l_t = \int_0^1 l_{jt} dj \tag{21}$$

Also, the selected household offers its capital stock at the real rental rate of R_t as much as (j∈ [0,1]) k ($_{jt-1}$) unit of capital to the j[th] intermediary producer:

$$k_{t-1} = \int_0^1 k_{jt-1} dj \tag{22}$$

According to the above points regarding the mediatory product, the corporation *j* during the period *t* produces Y_{jt} unit of product:

$$Y_{jt} = A_t k_{jt-1}^{\alpha} l_{jt}^{1-\alpha} \tag{23}$$

In (23), α∈ (0, 1) represents the share of capital in the production of mediatory product. A_t stands for the technology (productivity) common to all firms producing mediatory product and follows the first-order regression process. The technology shock is defined here.

The optimization problem for the j[th] corporation is to minimize its costs with respect to a given amount of production. The Lagrange equation of minimization problem for the intermediary corporation *j* is as follows:

$$\mathcal{L} = w_t l_{jt} + R_t k_{jt-1} + \varphi_t\left[Y_{jt} - A_t k_{jt-1}^{\alpha} l_{jt}^{1-\alpha}\right] \tag{24}$$

The first-order conditions of minimization problem for firms are as follows:

$$w_t - \varphi_t A_t (1-\alpha) k_{jt-1}^{\alpha} l_{jt}^{-\alpha} = 0 \tag{25}$$

$$R_t - \varphi_t A_t \alpha k_{jt-1}^{\alpha-1} l_{jt}^{1-\alpha} = 0 \tag{26}$$

By simplifying the above equations, two equations would be obtained for l_{jt} and k_{jt-1}, which indicate the demand for labor and capital.

$$l_{jt} = (1-\alpha)\frac{\varphi_t}{w_t} Y_{jt} \tag{27}$$

$$k_{jt-1} = \alpha \frac{\varphi_t}{R_t} Y_{jt} \tag{28}$$

To observe Walras' Law for the DSGE models, an equation is written for l_{jt} and k_{jt-1}. Due to the fact that the Lagrange coefficient (φ_t) in the F.O.C. relations indicates the concept of final cost (mc_t) and that the Phillips curve is an equation of final cost, we need to have an equation for the final cost.

An equation for labor and capital will be obtained by dividing Equation 27 by Equation 28:

$$l_{jt} = \left(\frac{1-\alpha}{\alpha}\right)\frac{R_t}{w_t} k_{jt-1} \tag{29}$$

The final cost will be obtained as follows through the combination of equations 25 and 26:

$$mc_t = \varphi_t = \frac{1}{A_t}\left(\frac{1}{-\alpha}\right)^{1-\alpha} (w_t)^{1-\alpha} \left(\frac{1}{\alpha}\right)^{\alpha} R_t^{\alpha} \tag{30}$$

The intermediary corporation manufacturing the mediatory product sells its product in the exclusive competition market. Therefore, the sample corporation manufacturing the mediatory product *j* specifies the price P_{jt} during the period *t*. Calvo's method (1983) is assumed in this research to be used for the process of pricing so that ω percent of firms in each period cannot adjust their prices and (1-ω) percent of firms [23], which determine the prices in the current period optimally, can adjust their prices. In other words, a corporation with a probability percentage of ω in each period cannot adjust its price; however, the probability of (1-ω) percent makes it possible. It is also assumed that firms not being able to adjust their prices basically adjust prices based on former prices using Sahuc's formula (2006) [24]:

$$P_{jt} = \left(\pi_{t-1}\right)^{\tau} P_{jt-1} \tag{31}$$

In this equation, the parameter τ shows the degree of price indexation.

According to the above assumptions, the combined New Keynesian Phillips curve, similar to that of Christiano et al. (2005) [25], is obtained as follows:

$$\hat{\pi}_t = \tau\phi^{-1}\pi_{t-1} + \beta\phi^{-1}E_t\pi_{t+1} + (1-\omega)(1-\beta\omega)\omega^{-1}\phi^{-1}\widehat{mc}_t \tag{32}$$

In the above equation, $\varphi = 1 + \beta\tau$. Now, if τ = 0, the pure forward-looking NKPC will then be obtained.

7. GOVERNMENT

It is assumed that the government during the period *t* pays as much g_t on product and services. It also pays as much as $\left(1+r_{t-1}\right)\frac{B_{t-1}}{P_t}$ as the main and secondary part of the bonds of the last period, and ultimately transfers TA_t to the household. Within the same period, the government receives tax T_t and $\frac{B_t}{P_t}$ from people and the right to print money as much as $\frac{M_t - M_{t-1}}{P_t}$ from the Central Bank. Accordingly, the budget constraints are as follows:

$$g_t + \left(1+r_{t-1}\right)\frac{B_{t-1}}{P_t} + TA_t = T_t + \frac{B_t}{P_t} + \frac{M_t - M_{t-1}}{P_t} \tag{33}$$

The financial policy is also supposed to be exogenous in the following form with respects to the first-order regression process:

$$g_t = g^{1-\rho_g}\left(g_{t-1}\right)^{\rho_t}\exp\left(\varepsilon_{gt}\right),\ \varepsilon_{gt} \sim i.i.d.N\left(0,\sigma_g^2\right) \tag{34}$$

8. CENTRAL BANK OR MONETARY POLICYMAKING AUTHORITY

The common monetary policy theory was developed over the past two decades based on the New Keynesian approach, which considers the price stickiness in firms operating in monopolistic competition markets. Accordingly, the monetary policy is worthy to be included and has impacts on short-term production and commercial cycles. Therefore, there are two basic approaches to design monetary policy to examine its impact: An instrument-based approach and a goal-setting approach.

In the instrument-based approach, two types of instruments are more concerned by the monetary policy maker: Nominal interest rates and growth rate of monetary base. Taylor's rule is used in policymaking based on interest rate. In policymaking based on growth rate of monetary base, a rule similar to Taylors', in which the growth rate of monetary base is used instead of the interest rate, is employed. In goal-setting approach, the Central Bank adopts an optimal monetary policy based on an optimal response to the economic situation using an available instrument (such as nominal interest rate and monetary base). In this approach, the optimal monetary policy is obtained based on an objective function, which is usually defined based on terminating and decreasing the gap between production and inflation, with paying attention to the economy structure. In this approach, there are two policymaking approaches: Commitment Policymaking and Discretionary Policymaking. In the first approach, the monetary authority minimizes the inter-temporal loss function; even though, the monetary authority in the discretionary approach minimizes the loss function for each period individually. In other words, if the optimal policy is adjusted in each period, nominal interest rate is selected based on this approach, and the policy commitments set aside do not impose a constraint on the policymaking in the current period, this will be a discretionary process. On the other hand, the Central Bank extracts a policy-based approach using an inter-temporal approach and makes itself committed.

To sum, four types of monetary policies investigated and compared in this study to measuring the effects of news shocks as:

8.1 Monetary policy based on Taylor's rule

According to the Keynesian theory, monetary policy options were relevant based on the exchange rate between the unemployment rate and inflation (Philips curve); however, the general acceptance of the theory of rational expectations decreased the reliance of policymakers on the Philips curve as an instrument for policy options. Taylor (1979) offered an alternative to monetary policy [26]. Contrary to the Philips curve, this is consistent with the forward-looking expectations approach in macroeconomics.

In monetary policymaking based on Taylor's law, it is supposed that the Central Bank determines the nominal interest rate in response to production and inflation as follows:

$$r_t = r_{t-1}^{\rho_r}\left[\left(\frac{\pi_t}{\pi}\right)^{\psi_\pi}\left(\frac{Y_t}{Y}\right)^{\psi_y}\right]^{1-\rho_r}\exp\left(\varepsilon_{rt}\right), \varepsilon_{rt} \sim i.i.d.N\left(0,\sigma_r^2\right) \tag{35}$$

Under the above Taylor's rule, π and Y are the values of the stable status of inflation and production. ε_{rt} is the exogenous shock of monetary policy in Taylor's rule, which is considered to be white noise.

8.2 Monetary policy based on the growth rate of the monetary base

One can rewrite Taylor's rule, as the most popular monetary policy rule, in a way that the growth rate of the monetary base is used an instrument instead of the interest rate. To this end, the response function of monetary policymaking is assumed as follows:

$$\dot{M}_t = \dot{M}_{t-1}^{\rho_m}\left[\left(\frac{\pi_t - \pi_t^*}{\pi}\right)^{\psi_\pi}\left(\frac{Y_t}{Y}\right)^{\psi_y}\right]^{1-\rho_m}\exp\left(\varepsilon_{mt}\right), \tag{36}$$
$$\varepsilon_{mt} \sim i.i.d.N\left(0,\sigma_m^2\right)$$

In the above equation, $\hat{\pi}_t^*$ is the implied inflation rate targeted by the Central Bank, which follows a first-order auto-regression process. ε_{mt} is an exogenous shock of monetary policy and white noise.

In this policy situation, two other equations are added to the DSGE model, one of which is the equation for the nominal growth of the monetary base and its relation to the real volume of money and inflation. Another one is associated with inflation policy of implied target.

$$\dot{M}_t = \frac{\frac{M_t}{P_t}}{\frac{M_{t-1}}{P_{t-1}}} \tag{37}$$

$$\hat{\pi}_t^* = \rho_\pi\pi_{t-1}^* + \grave{o}_{\pi t},\ \grave{o}_{\pi t} \sim i\ i\ d\ N\left(0,\ \sigma_\pi^2\right) \tag{38}$$

9. REAL ASSUMPTIONS OF IRAN'S ECONOMY

The results of the economic model can be used in policy making when the real assumptions of the economy are included more closely. For this purpose, two real assumptions on Iran's economy have considered in the development and simulation of the DSGE model. The first assumption is relevant to the multiplication of the nominal interest rate at the inflation rate, which is not considered zero with respect to Iran's economy data as taken into account in the Fisher's curve. The second assumption is about real interest rate. Since the long-run value of real interest rates in Iran's economy is negative, it is considered negatively in simulating monetary policy models based on interest rates. In order to compare the results with the ideal conditions, the model simulation in the optimal commitment monetary policy using the interest rate considers two scenarios (namely negative real interest rate and positive real interest rate).

10. CALIBRATING AND ESTIMATING OF PARAMETERS

The conventional method to estimate the parameters of the DSGE models is the maximum likelihood method. This method is sensitive to the initial values considered for the parameters; however, he initial values for the parameters in the Bayesian method are considered as primary information. If such information is precise, the Bayesian method will be converted to calibration. If not, the Bayesian method will be converted to the maximum likelihood method and the parameters will be estimated (Hamilton, 1994) [27]. Then, the estimated parameters are considered in the models and the models are solved. Then, the direct impulse response functions of the endogenous variables are studied and the moments of the sequences produced by simulation are compared with the moments of the real economy data.

The results of the calibration and estimation of the research models parameters in the two models along with a description of the parameters are presented in Tables 1 and 2. The estimation results of the Bayesian parameters and their standard deviations (including mean and standard deviation of the former distribution) are conventional for the two models of monetary policy based on Taylor rule and nominal growth of monetary base. Hence, the estimated results are reliable (The results of the former and later distributions are shown in Appendix A.).

Variance decompositions of news shocks

In order to evaluate the significance of news shock in comparison to the unexpected amount of preference and technology shocks quantitatively, the variance decomposition of shocks used after model estimation and simulation. The results of variance decomposition are presented in Table 3.

As it could be observed, the news shock of preferences in the rule-based monetary policies has been less known. This indicates the ineffectiveness of household expectations against news shocks imposed on consumers' preferences in rule-based monetary policymaking. The technology shock is less identified in the Taylor's model and more recognized in the monetary base model. Therefore, Taylor's monetary policy is appropriate if the target is to control the technology shock. On the other hand, the share of news shocks in all optimal monetary policies was higher than that of the unexpected shocks. When the monetary authority acts optimally in

Table 1: Calibration and estimates of model parameters in monetary policy model based on Taylor rule.

Parameter	Description	Distribution	Value	Based on estimation or calibration
ó	Inter-temporal inverse substitution elasticity	Gamma	1.8455	Research findings
â	Discount rate	Beta	0.9614	Research findings
á	Capital share of production	Beta	0.3872	Research findings
ù	Degree of price stickiness	Beta	0.4396	Research findings
ç	Inverse elasticity of labor supply	Gamma	2.17	Taei (2006) [28]
h	Consumption stability degree	Beta	0.2958	Research findings
ä	Depreciation rate	Beta	0.0141	Research findings
ô	price indexation degree	Beta	0.1932	Research findings
c_y	Consumption expenditure to production ratio	Beta	0.55	Based on Iran's seasonal data
i_y	Investment expenditure to production ratio	Beta	0.30	Based on Iran's seasonal data
g_y	government expenditure to production ratio	Beta	0.15	Based on Iran's seasonal data
$\bar{r}$	Interest rate (profit) in steady state	normal	1.02	Fakhr Hosseini (2012) [29]
$\bar{R}$	Real interest rate in steady state	normal	-0.03	Based on Iran's calibration data and Fakhr Hosseini's study (2012) [29]
ψ_y	weight of production in monetary policy	normal	0.4070	Research findings
ψ_π	weight of inflation in monetary policy	normal	1.4270	Research findings
ρ_g	Auto-regression coefficient of financial policy	Beta	0.7844	Research findings
ρ_r	Auto-regression coefficient of monetary policy	Beta	0.0727	Research findings
ρ_a	Auto-regression coefficient of productivity	Beta	0.6	Selective
ρ_h	Auto-regression coefficient of Preference Shock	Beta	0.2259	Research findings
ρ_f	Auto-regression coefficient of productivity shock	Beta	0.0669	Research findings
ρ_{er}	Auto-regression coefficient of monetary policy shock	Beta	0.1654	Research findings
ρ_θ	Auto-regression coefficient of markup shock	Beta	0.7	Selective

Source: Research Estimates by Dynare Software

Table 2: Calibration and estimates of model parameters in monetary policy model based on growth rate of monetary base.

Parameter	Description	Distribution	Value	Based on estimated or calibrated
ó	Inter-temporal inverse substitution elasticity	Gamma	1.2602	Research findings
â	Discount rate	Beta	0.9627	Research findings
á	Capital share of production	Beta	0.6269	Research findings
ù	price stickiness degree	Beta	0.2808	Research findings
ç	Inverse elasticity of labor supply	Gamma	2.17	TAI (1385)
h	Consumption stability degree	Beta	0.2923	Research findings
ä	Depreciation rate	Beta	0.0030	Research findings
ô	price indexation degree	Beta	0.2923	Research findings
b_m	Inverse elasticity of money demand	Gamma	1.5286	Research findings
c_y	Consumption expenditure to production ratio	Beta	0.55	Based on Iran's seasonal data
i_y	Investment expenditure to production ratio	Beta	0.30	Based on Iran's seasonal data
g_y	government expenditure to production ratio	Beta	0.15	Based on Iran's seasonal data
$\bar{r}$	Interest rate (profit) in steady state	Beta	0.8133	Research findings
$\bar{R}$	Real interest rate in steady state	normal	0.0595	Research findings
ψ_y	weight of production in monetary policy	normal	-2.1937	Research findings
ψ_π	weight of inflation in monetary policy	normal	-0.3733	Research findings
ρ_g	Auto-regression coefficient of financial policy	Beta	0.8472	Research findings
ρ_m	Auto-regression coefficient of monetary policy	Beta	0.0422	Research findings
ρ_a	Auto-regression coefficient of technology	Beta	0.5733	Research findings
ρ_h	Auto-regression coefficient of preference shock	Beta	0.3544	Research findings
ρ_f	Auto-regression coefficient of technology shock	Beta	0.6777	Research findings
ρ_{pi}	Auto-regression coefficient of monetary policy shock	Beta	0.2739	Research findings
ρ_{epi}	Auto-regression coefficient of implied objective function shock	Beta	0.6	Selective
ρ_θ	Auto-regression coefficient of markup-up shock	Beta	0.6	Selective

Source: Research Estimates by Dynare Software

Table 3: Identifying news shocks in different monetary policy models.

Total of control line	Percentage of unexpected Shock	Percentage of news Shock	Monetary policy model and imposed shock
99.97	94.47	5.50	Taylor's Model - Preferences Shock
100.03	73.75	26.27	Taylor's Model - Technology Shock
100.07	94.37	5.70	Monetary base model - Preferences shock
100.04	6.91	93.13	Monetary base model - technology shock
99.89	19.99	79.90	First case of optimal commitment model- interest rate - preferences shock
100.4	23.40	76.64	First case of optimal commitment model- interest rate - Technology shock
99.89	19.99	79.90	Second case of optimal commitment model- interest rate - Preferences shock
100.04	23.40	76.64	Second case of optimal commitment model- interest rate - technology shock
99.88	19.99	79.89	Optimal Discretionary Model - Interest Rate - Preferences Shock
100.05	23.41	76.64	Optimal Discretionary Model - Interest Rate - Technology Shock

100.00	17.64	82.36	Optimal discretionary Model - Monetary Base - Preferences Shock
100.01	13.09	86.92	Optimal discretional Model - Monetary Base - Technology Shock
100.17	17.67	82.50	Optimal discretionary model - Monetary base - Preferences Shock
99.90	12.94	86.97	Optimal discretionary Model - Monetary Base - Technology Shock

Resource: Research Findings

policymaking, the share of news shocks might be greater than the total shock. Since the role of economic factors is highlighted in determining monetary policy, the role of expectations and, consequently, news shocks will be enhanced in the monetary policies.

11. IMPULSE RESPONSE FUNCTIONS (IRF) OF NEWS SHOCKS

In this section, the behavior of the IRFs of production and inflation variables in each of the research models against the news shock of productivity and preferences are investigated and the results of each scenario is compared and analyzed with other ones with regard to each rule as well as with competitive model scenarios. The behavior of the impulse reaction functions of the variables against the imposed shocks must be in line with the evidence from the real world economy of Iran, theoretical foundations and the researcher's scientific expectations (Appendix B).

11.1 News shock of technology

In the face of unexpected technology shock and increased productivity of production factors, the total supply curve is transmitted to the right so that investment and production increases and inflation decreases. Since the expected shocks affect the expectations of economic factors and lead to a change in the economy, inflation would be decreased and production response would be interrupted in the face of a news shock in a monetary policy based on the interest rate. On the other hand, production and inflation caused by a news shock will be accompanied with an interruption in the monetary policy based on the monetary base.

11.2 News shock of preferences

The shock of demand-side consumer preferences influences the economy and reduces both production and inflation simultaneously. Since the stability of household habits is considered, the production and inflation response to this type of shock, compared to the technology shock, will be small.

12. ANOVA AND ANCOVA

To determine the impact of news shocks on monetary policies, we define the relationship between news shocks and monetary policy in the simulation. The results of the variance-covariance analysis for shocks in monetary policy using interest rate and monetary base indicate that, in both cases, the impact of technology news shock was more than doubled impact on monetary policy than the news shocks of preferences. The results also suggested that the impact of news shocks on monetary policy, in the case of monetary base instrument, is more than that in the case of political interest rate.

13. APPROXIMATE VALUE OF SOCIAL LOSS FUNCTION IN OPTIMAL MONETARY POLICIES

As stated, the Central Bank's optimal rule is derived from minimizing social loss function relative to economic constraints. This function is simulated in both the interest rate and monetary base scenarios and its results are summarized in Table 4.

Table 4: Approximate value of social loss function.

monetary policy		Approximate value of social loss function
Interest rate instrument	First case of optimal commitment policy (Negative Interest Rate)	0.075299
	First case of optimal commitment policy (Positive real interest rate)	0.14292
	Optimal Discretional Policy	0.57410951
Monetary base instrument	Optimal Commitment Policy	0.17173
	Optimal Discretional Policy	0.57929857

Source: Research findings

The results of the research is expected based on economic theories if the social loss function in the optimal commitment monetary policy was less than in the optimal discretional monetary policy. Also, the value of this function in optimal scenarios when the interest rate instrument is used is estimated to be smaller than that using the monetary base. The more important consequence of this section is that when the optimal policy is considered for the country's economic conditions, that is, the real negative interest rate, the value of social loss is estimated to be smaller. The recent finding indicated that the real economic conditions must be concerned in economic policy.

14. CONCLUSION AND DISCUSSION

In this research, the effect of news shocks on monetary policies was evaluated using the DSGE models. The results of this study could explain several aspects of this issue. In terms of identifying shocks, the result revealed that the monetary policies, in which interest rates are policy instruments, could better control the shocks in the economy. The results of the study regarding the IRF analysis indicated that monetary policy using the interest rate is of better status in terms of the elimination duration of news shocks from the economy and the effect of the news shocks on the economy, compared to the monetary policy using the monetary base instrument. On the other hand, the important result of the IRF analysis in this study was that an optimal commitment monetary policy with an interest rate instrument should be employed when there is an ideal economic status (positive real interest rate). In other words, it is concluded that the negative real interest rate was one of the signs of the trade cycle in Iran's economy. From the point of view of social loss function in the optimal policymaking, two conclusions are drawn. First, an optimal commitment monetary policy would impose lower levels of social losses on the economy, compared to the optimal discretional monetary policy. Second, if the optimal monetary policy uses a nominal interest rate instrument, it will impose lower levels of social losses on the economy than when the nominal growth of monetary base is used.

In general, it can be claimed that the best monetary policy instrument in the face of news shocks is the nominal interest rate. Of the monetary policies with interest rate instrument, the optimal discretionary monetary policy is the most appropriate one.

REFERENCES

[1] Sims E. What' S News in News? A Cautionary Note on Using A Variance Decomposition to Assess the Quantitative Importance of News Shocks. Journal of Economic Dynamics and Control (2016) 73: 41-60.

[2] Sims ER. Differences in Quarterly Utilization-Adjusted TFP By Vintage, with An Application to News Shocks (No. W22154). National Bureau of Economic Research (2016).

[3] Offick S, Wohltmann HW. Volatility Effects of News Shocks in New Keynesian Models with Optimal Monetary Policy. Economics Letters (2016) 147: 78–82.

[4] Cochrane J. Shocks. In: Carnegie-Rochester Conference Series on Public Policy (1994) 41(1): 295–364.

[5] Beaudry P, Portier F. An Exploration into Pigou's Theory of Cycles. Journal of Monetary Economics (2004) 51(6): 1183-1216.

[6] Jinnai R. News Shocks and Inflation. Economics Letters (2013) 119(2): 176-179.

[7] Beaudry P, Portier F. The "News View" of Economic Fluctuations: Evidence from Aggregate Japanese Data and Sectoral US Data. Journal of the Japanese and International Economies (2005) 19(4): 635-652.

[8] Beaudry P, Portier F. News, Stock Prices, and Economic Fluctuations. American Economic Review (2006) 96 (4): 1293–1307.

[9] Feve P, Matheron J, Sahuc JG. On the Dynamic Implications of News Shocks. Economics Letters (2009) 102(2): 96-98.

[10] Feve P, Jidoud A. Identifying News Shocks from Svars. Journal of Macroeconomics (2012) 34(4): 919-932.

[11] Khan H, Tsoukalas J. The Quantitative Importance of News Shocks in Estimated Dsge Models. Journal of Money, Credit and Banking (2012) 44(8): 1535-1561.

[12] Nguyen TL, Miyamoto W. News Shocks and Business Cycles: Evidence from Forecast Data. in 2014 Meeting Papers (No. 259). Society for Economic Dynamics (2014).

[13] Smets F, Wouters R. Comparing Shocks and Frictions in US and Euro Area Business Cycles: A Bayesian DSGE Approach. Journal of Applied Econometrics (2005) 20(2): 161-183.

[14] Smets F, Wouters R. Shocks and Frictions in US Business Cycles: A Bayesian DSGE Approach. American Economic Review (2007) 97(3): 586–606.

[15] Beaudry P, Portier F. When Can Changes in Expectations Cause Business Cycle Fluctuations in Neo-Classical Settings? Journal of Economic Theory (2007) 135 (1): 458–477.

[16] Jaimovich N, Rebelo S. Can News About the Future Drive the Business Cycle? American Economic Review (2009) 99(4): 1097–1118.

[17] Altig D, Christiano L, Eichenbaum M, Linde J. Firms -Specific Capital, Nominal Rigidities and the Business Cycle. Review of Economic Dynamics (2011) 2: 225-247.

[18] Schmitt-Grohe S, Uribe M. What's News in the Business Cycle? NBER Working Paper (2008) 14215.

[19] Schmitt-GrohÉ S, Uribe M. What's News in Business Cycles? Econometrica (2012) 80(6): 2733-2764.

[20] Boldrin M, Christiano LJ, Fisher Jonas DM. Habit Persistence, Asset Returns, and the Business Cycle. American Economic Review (2001) 1: 149–166.

[21] Ireland P. Money's Role in the Monetary Business Cycle. Journal of Money Credit & Banking (2004) 36(6):969-983.

[22] Dixit A, Stiglitz J. Monopolistic Competition and Optimum Product Diversity; American Economic Review (1977) 67: 297–300.

[23] Calvo GA. Staggered Price Setting in A Utility-Maximizing Framework; Journal of Monetary Economics (1983) 12: 383–398.

[24] Sahuc JG. Partial Indexation, Trend Inflation, and the Hybrid Phillips Curve. Economics Letters (2006) 90(1): 42-50.

[25] Christiano LJ, Eichenbaum M, Evans CL. Nominal Rigidities and the Dynamic Effects of A Shock to Monetary Policy. Journal of Political Economy (2005) 113(1): 1-45.

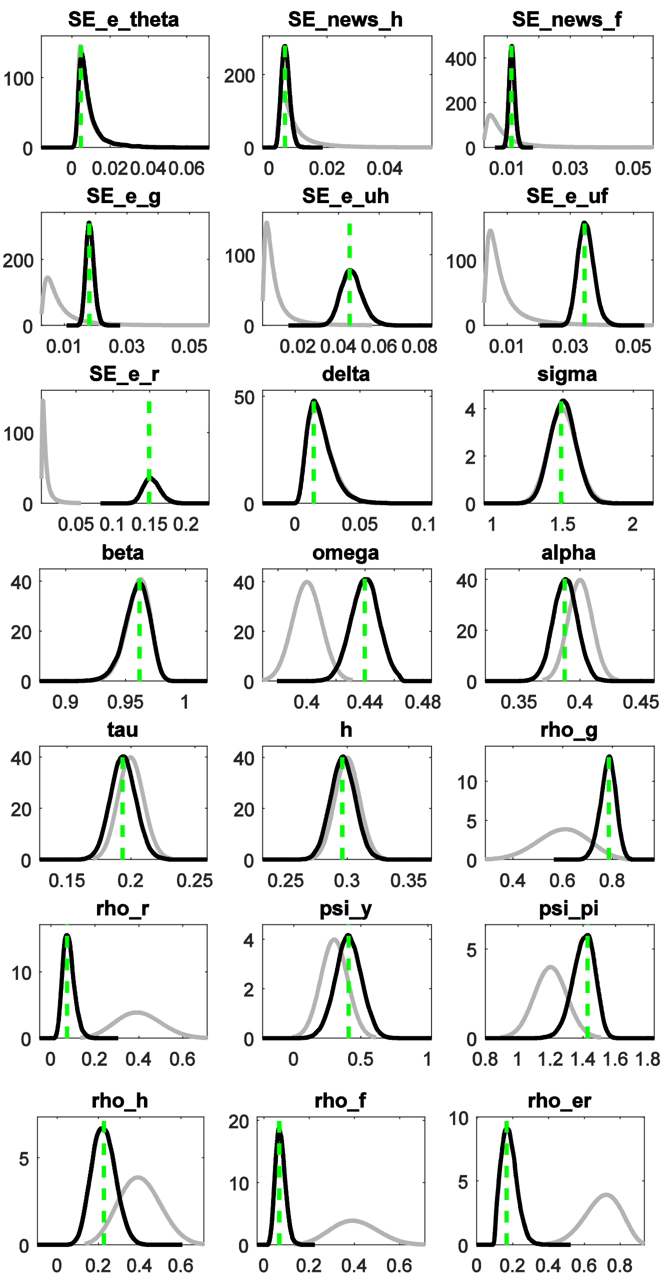
[26] Taylor J. Staggered Wage Setting in A Macro Model. American Economic Review (1979) 69(2): 108-113.

[27] Hamilton JD. Time Series Analysis (Vol. 2). Princeton: Princeton University Press. (1994).

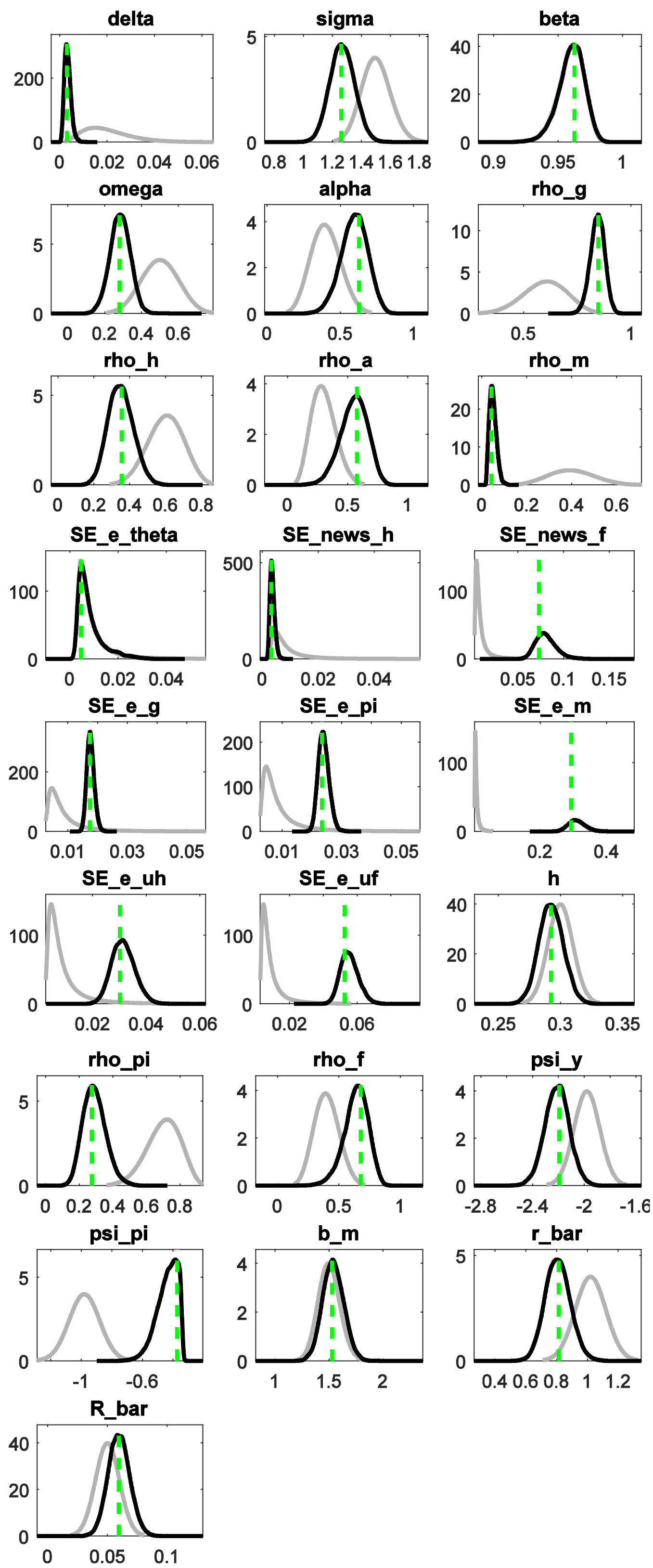
[28] Taei H. Labor Supply Function: An Analysis Based on Micro-Data, Iran's Economic Studies (2006) 29-29.

[29] Fakhr Hosseini SF. Evaluation of Monetary Policies in Iran's Economy in the Form of A Monetary Trade Cycle Model. Monetary-Banking Research (2012) 6: 14.

Appendix A:

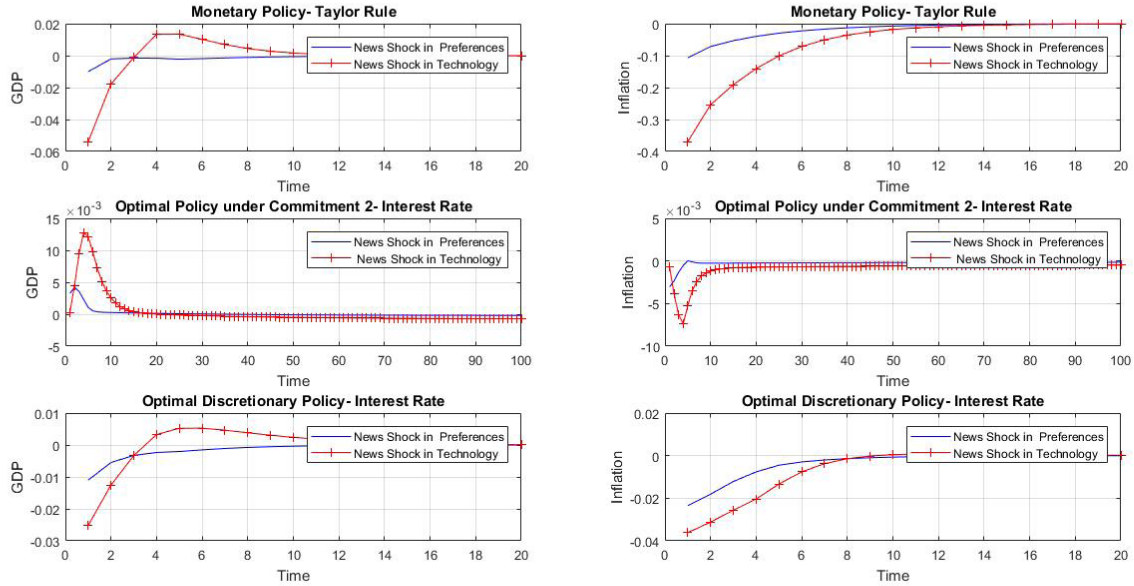


A1: Former and later distribution of Taylor's rule model parameters

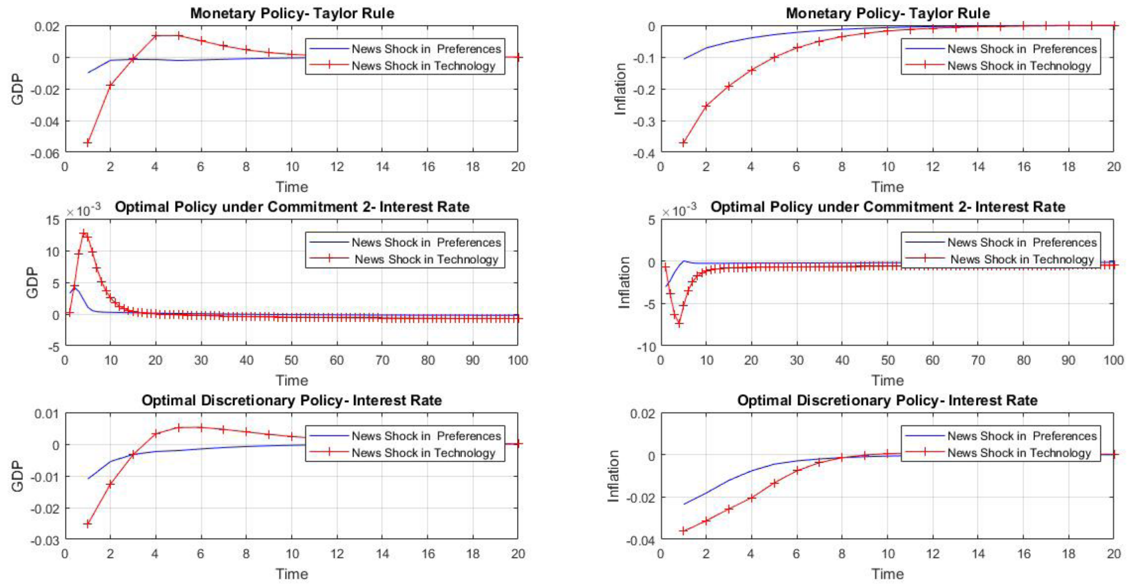


A2: Former and later distribution of model parameters in monetary base model

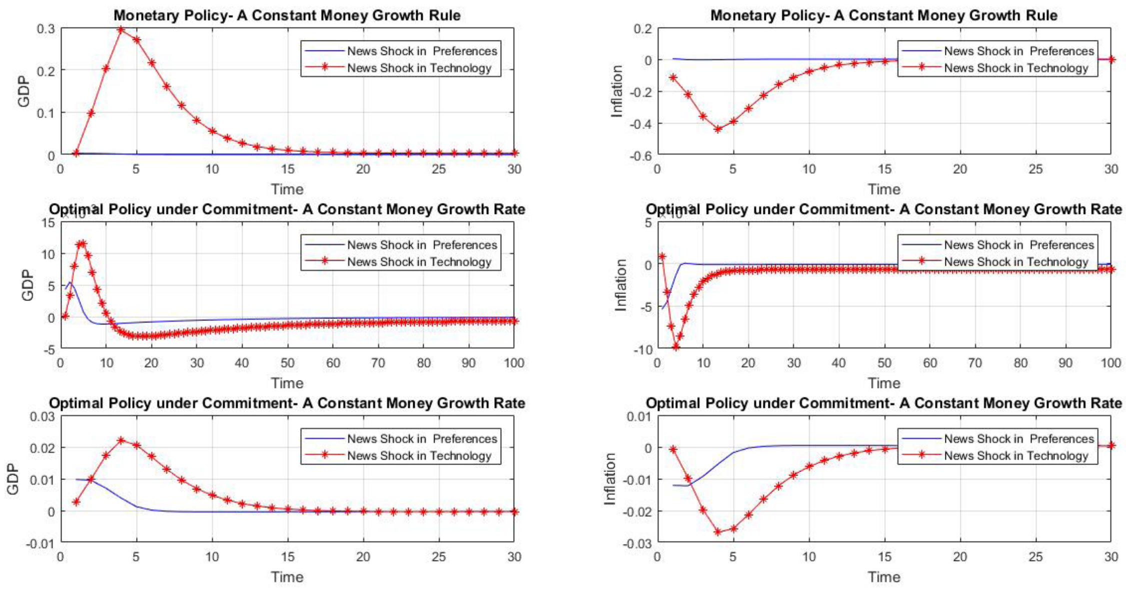
Appendix B:



B1: Impulse Response Functions (IRF) of monetary policies with nominal interest rate instrument (real negative interest rate)



B2: Impulse Response Functions (IRF) of monetary policies with nominal interest rate instrument (real positive interest rate)



B3: Impulse Response Functions (IRF) of monetary policies with nominal interest rate of monetary base