Journal of Money and Economy
Vol. 19, No. 4, Winter 2024
pp. 547-571

Original Research Article

Is the Friedman Rule Established in the Iran's Economy?

Hamid Reza Izadi *

Received: 14 Apr 2025 Approved: 20 Jul 2025

This study investigates the optimality of the Friedman rule as a monetary policy for Iran, considering various tax instruments. Using a dynamic stochastic general equilibrium (DSGE) model, it analyzes taxation scenarios—including consumption, capital income, and labor income taxes—to evaluate the rule's applicability. The findings suggest that zero inflation and price stability consistently emerge as optimal outcomes. These findings indicate the establishment of Friedman's rule in the Iranian economy. Moreover, in light of government efforts to reduce tax-induced distortions across sectors, negative taxation (i.e., subsidies) is validated under Ramsey's optimal conditions. By integrating a comprehensive taxation framework into the DSGE model, this study deepens understanding of monetary-fiscal dynamics and offers practical guidance for achieving macroeconomic stability.

Keywords: Friedman Rule, Ramsey Problem, Optimal Policy, DSGE Model, Simulation
JEL Classification: E52, E61, E63, F42, F44

1 Introduction

Monetary and fiscal policies, as the two primary tools of macroeconomic policies that can influence the economy, have always been the focus of economic schools, governments, and policymakers. Although the developments made in economic theories clearly emphasize the necessity of government and central bank intervention in the economy, policymakers of the economies that value such intervention have not always succeeded in achieving their economic objectives. This failure could be attributed to the feedback effects of one policy on another. However, different decision-makers with various available tools raise the question of which policy should be prioritized to achieving economic objectives. What are the optimal monetary and fiscal policies for an economy under the Ramsey problem?

* Associate Professor of Department of Economics, Faculty of Management and Humanities, Chabahar Maritime University, Iran; Email: izadi@cmu.ac.ir(Corresponding Author)

[DOI: 10.61882/jme.19.4.539]

Monetary and fiscal policies play a central role in macroeconomic stabilization, yet the interaction between these policies remains complex, particularly in economies experiencing structural distortions. Previous studies on optimal monetary policy often focus on advanced economies, leaving a gap in understanding the implications of the Friedman rule within the context of developing economies like Iran. While many studies have explored monetary policy within the Ramsey problem framework, few have simultaneously incorporated the effects of different tax instruments—such as consumption tax, capital income tax, and labor income tax—on policy outcomes. This study addresses this gap by developing a dynamic stochastic general equilibrium (DSGE) model for Iran’s economy and analyzing various taxation scenarios to assess the applicability of the Friedman rule. Through comprehensive calibration, this research provides insights into the optimal design of monetary and fiscal policies under price stickiness and distortionary taxation, offering valuable recommendations for policymakers seeking macroeconomic stability in Iran.

This study investigates the applicability of the Friedman rule as an optimal monetary policy for Iran’s economy, considering its unique fiscal constraints and reliance on oil revenues. Unlike previous research that primarily focuses on advanced economies, this paper incorporates price rigidity and taxation scenarios to assess the effectiveness of zero-inflation policies. Given Iran's dependence on oil revenues and financial limitations, understanding fiscal-monetary interactions is crucial. This study extends prior work by integrating multiple taxation scenarios within a DSGE framework to provide deeper insights into macroeconomic stability and optimal monetary policy recommendations.

Previous studies, such as Schmitt and Uribe (2004 a,b) and Chugh (2006)**,** extensively analyze optimal monetary and fiscal policies under the Ramsey problem. However, most existing research focuses on developed economies and does not incorporate the constraints faced by resource-dependent economies like Iran. This study builds on prior models by integrating price rigidity, taxation mechanisms, and fiscal limitations unique to Iran’s economic structure. By evaluating multiple taxation scenarios, this research highlights the role of subsidies and consumption taxes in achieving optimal policy outcomes, an aspect overlooked in past literature.

This article is organized as follows: After the introduction, the theoretical background and previous literature are reviewed. In the third section, the model is introduced, followed by the solution of the model, extraction, and

[DOI: 10.61882/jme.19.4.539]

analysis of the results in the fourth section. Finally, the conclusion is presented in the last section of the article.

2 A Review of the Related Literature

In monetary economics, the nominal interest rate is essentially the opportunity cost of holding non-interest-bearing monetary assets. An increase in inflation rate leads to a rise in the nominal interest rate, thereby reducing the attractiveness of holding non-interest-bearing monetary assets. Under these conditions, economic agents limit their money balances and hold fewer non-interest-bearing monetary assets to minimize capital loss. This reduces the services derived from monetary assets, such as facilitating transactions, and imposes a cost on economic agents, thus reducing their welfare. This concept forms the foundation of the welfare cost of inflation, initially proposed by Friedman (Lucas, 2000).

From Friedman's (1969) discussion on the optimal quantity of money, economists have concluded that an economy does not need to bear such costs at all. If monetary policy is designed to reduce the nominal interest rate on risk-free assets to zero, commonly referred to as the Friedman rule, no penalty will be imposed on non-interest-bearing monetary assets. Friedman argues that the optimal quantity of money is achieved when, through adjustments to the discount rate and consequently to prices, the nominal interest rate equals zero. According to Friedman, the social optimum occurs when the marginal social benefit of holding the last unit of money equals its marginal social cost. Since the cost of producing the last unit of money for society is zero, the marginal social benefit of holding money, or the nominal interest rate, should also be zero. In such a policy regime, the inflation rate will equal the negative real interest rate, as the nominal interest rate is the sum of the real interest rate and the inflation rate. From the perspective of the Friedman rule, the optimal inflation rate must be negative to be able to reflect increases in economic productivity.

Eichenbaum (1997) regards the use of policy rules as an accepted approach in studying monetary and fiscal policies, particularly since the 1990s. The main finding of the aforementioned study indicates that paying attention to fiscal stabilizers plays a significant role in smoothing the effects of business cycles. However, the practical examination of the role of these stabilizers in smoothing business cycles has received less attention compared to the theoretical aspects.

Schmitt and Uribe (2004a) studied optimal monetary and fiscal policies under the price stickiness condition. Their main finding was that for a small

[DOI: 10.61882/jme.19.4.539]

degree of price stickiness, optimal inflation fluctuations are close to zero. Furthermore, minor deviations from complete price flexibility result in random behavior in tax rates and government debt. Ultimately, price stickiness brings about deviations from the Friedman rule.

Schmitt and Uribe (2004b) investigated optimal monetary and fiscal policies under imperfect competition in a production economy without capital but with flexible prices. Their studies showed that in such an economy, the nominal interest rate acts as an indirect tax on monopoly profits. They also state that labor income taxes in this market, similar to those in a perfectly competitive market, mostly follow a relatively smooth trajectory, even though the inflation rate remains highly volatile and serially uncorrelated.

Siu (2004) studied Ramsey equilibrium in monetary models with tax distortions, nominal non-governmental debt, and sticky prices. He argued that with increasing variability in government expenditures, the smooth trajectory of tax distortions becomes increasingly significant, and the role of inflation in absorbing shocks becomes more pronounced.

Chugh (2006) examined the optimal degree of inflation fluctuations under which nominal wages are sticky and the government uses inflation to finance its expenditures. The results of the study mainly indicate that sticky wages alone demonstrate optimal price equilibrium during government spending shocks, similar to the state of sticky price degrees. Productivity shocks, on the other hand, imply higher optimal inflation fluctuations.

Schmitt and Uribe (2007) calculated welfare and its maximization under monetary and fiscal policy rules in a real business cycle model that has sticky prices, money demand, taxation, and stochastic government consumption. They demonstrate that the inflation coefficient in the interest rate rule plays a minor role in welfare. Optimal monetary policies have minimal impact on output, leading to the conclusion that maintaining a fixed interest rate provides little welfare benefit. Optimal fiscal policy is passive, and the combination of optimal monetary and fiscal rules practically achieves the same level of welfare as the Ramsey optimal policy.

Schmitt and Uribe (2012) described a general method for calculating the steady-state and Ramsey equilibrium dynamics in medium-scale macroeconomic models. They proposed a precise numerical solution process for steady-state and second-order for dynamism in these models. Their new method involves planning based on approaches for accurately computing the steady-state of the Ramsey equilibrium.

Adolfson, Laseen, Linde, and Svensson (2014) examined the trade-off relationship between consumer price index inflation stability and alternative

[DOI: 10.61882/jme.19.4.539]

measures taken for the output gap, which involves estimating a dynamic stochastic general equilibrium model for a small open economy. Their main findings suggest that the trade-off relationship between consumer price index inflation stability and the output gap is largely dependent on the potential output variable used in the loss function. If potential output is defined as a smooth trend, the trade-off is more pronounced than when it is defined under flexible prices and wages.

Philippopoulos, Varthalitis, and Vassilatos (2015) conducted research focusing on the feedback rules for optimized monetary and fiscal policies. Using a dynamic stochastic general equilibrium model for a closed economy and numerical solution methods with Eurozone financial data, they calculated typical parameter values. Their study also introduced alternative tax-expenditure policy tools for stabilizing shocks and debt and simultaneously considering the nominal interest rates suggested by authorities based on the Taylor rule.

Several studies (e.g., Bachmann et al., 2022; Lee & Park, 2022; Roy et al., 2023; Fisher &Huh, 2023; Arefeva &Arefyev, 2024; Jiang et al., 2024) indicate that before the mid-1980s, the Federal Reserve followed Friedman's steady money growth policy without interest rate smoothing. In contrast, after the mid-1980s, the Fed transitioned to a Taylor rule that incorporated generalized interest rate smoothing and began relying on forward-looking indicators from financial and housing markets. The interest rate smoothing and the usage of these indicators assisted in reducing inflation and unemployment volatility, with the smoothing potentially reflecting the application of a Kalman-style information filter to improve data processing.

By examining the research history, it can be said that most studies focus on optimal monetary and fiscal policies, while fewer examine them in the context of the Ramsey problem. A review of existing research indicates that most studies focus on optimal monetary and fiscal policies, with fewer studies incorporating the Ramsey problem framework. While prior research has extensively examined the Ramsey framework, few studies have specifically tailored this approach to Iran's economy. Unlike models that assume full price flexibility and unrestricted fiscal tools, our study incorporates the constraints of financial repression and limited taxation mechanisms, making our analysis more applicable to real-world policy formulation. Also, unlike previous studies, which primarily focused on broader monetary policy in developed economies, this paper tailors a DSGE framework to Iran's fiscal constraints. By comparing multiple taxation scenarios, our findings highlight the

[DOI: 10.61882/jme.19.4.539]

distinctive role of subsidies and consumption taxes in determining optimal policy outcomes, which were largely overlooked in past models.

Despite the number of existing studies on optimal monetary and fiscal policies, most researchers have written and calculated their models by considering only a few parts of the economy. In other words, among the studies conducted, it is not possible to find a model that is comprehensive and complete, and on the other hand, all economic sectors are separated, and all taxes are simultaneously included in the model. It should be noted that these limitations and shortcomings are more severe in writing a model for the Iranian economy because the existing models in the Iranian economy not only do not include the Ramsey problem in optimal monetary and fiscal policy models but also do not have the approach of seeing all economic sectors simultaneously and creating a comprehensive model.

3 The Study Model[1]

Our model is a generalized framework for an open economy which is derived from a closed-economy model previously used for analyzing monetary policy by Christiano, Eichenbaum, and Evans (2005), Siu (2004), Adolfson et al. (2014), Schmitt and Uribe (2004a), Chugh (2006), Izadi(2022a), Izadi (2022b), Izadi and Shirafkan Lamsoo (2022), Izadi (2023a) and Izadi (2023b).

3.1 Households

Households derive utility from consuming goods and services, while utility decreases with labor. This implies that the utility function is a function of leisure and consumption. There exists a continuum of households with infinite planning horizons $i\epsilon[0,1]$in the domestic economy, each one with a unique type of labor $h_t(i)$. In an intertemporal problem, households maximize their discounted utility by deciding on current consumption index, investment in each sector, wages, hours worked, money demand, domestic and foreign bond holdings for the next period, and physical capital accumulation. The expression of intertemporal problem is subject to the non-Ponzi game condition. The utility function is traditionally separable, logarithmic, and dependent on consumption and leisure. It is assumed to follow a constant relative risk aversion structure, with consumption being adjusted through internal habit persistence. Therefore, the household maximizes the following utility function:

[1] Since not all equations are included due to space limitations, additional extracted equations related to the modeling are available upon request.

[DOI: 10.61882/jme.19.4.539]

$$Max\ E_0 \sum_{t=0}^{\infty} \beta^t [(1-\gamma)\log(C_t(i) - \zeta C_{t-1}(i)) + \gamma \log(1 - h_t(i))] \qquad (1)$$

The household budget constraint is introduced as follows:

$$P_t(1+\tau_t^c)C_t(i) + P_t\left(I_{x,t}^d(i) + I_{n,t}^d(i)\right) + P_t M_t(i) + R_{t-1}B_{h,t}(i) + R_{t-1}^f IB_t(i) + \frac{\psi_1}{2} Y_t\left(\frac{B_{t+1}(i)}{Y_t} - \frac{B}{Y}\right)^2 + \frac{\psi_2}{2} Y_t\left(\frac{S_t IB_{t+1}(i)}{Y_t} - \frac{rerIB}{Y}\right)^2 = P_{t-1}M_{t-1}(i) + (1-\tau_t^h)W_t(i)h_t(i) + \left(1-\tau_t^{\phi}\right) P_t \Phi_t(i) + (1-\tau_t^k)P_t\left[(R_{n,t}^k \mu_{n,t} - a(\mu_{n,t}))\bar{K}_{n,t}(i) + (R_{x,t}^k \mu_{x,t} - a(\mu_{x,t}))\bar{K}_{x,t}(i)\right] + B_{h,t+1}(i) + IB_{t+1}(i) \qquad (2)$$

Household income includes labor income, distributed profits, and returns from capital. Households also save part of their money holdings in the form of domestic and foreign assets. On the expenditure side, households pay taxes on income from labor, capital, and profits. They also incur costs related to portfolio adjustment, consumption, and capital utilization. The following notations are used in the equations: E for expectations operator, β as the discount factor, γ for preferences regarding consumption and leisure in the utility function, P_t for the general price level, $I_{n,t}^d$ for the investment in the non-tradable sector, $I_{x,t}^d$ for investment in the tradable sector, ϕ_i for investment adjustment costs, ψ_1 and ψ_2 represent adjustment costs for domestic and foreign bonds, and ϕ_ω is the adjustment cost parameter for wages. The degree of habit persistence is defined by parameter $\zeta \epsilon [0,1)$. Households accumulate physical capital $\bar{K}_{j,t}$ for the tradable (x) and non-tradable (n) sectors in the economy $j = \{n, x\}$, with a depreciation rate δ.

$$\bar{K}_{j,t+1}(i) = (1-\delta)\bar{K}_{j,t}(i) + I_{j,t}^d(i).\varepsilon_t^i\left(1 - \aleph\left(\frac{I_{j,t}^d(i)}{I_{j,t-1}^d(i)}\right)\right) \qquad (3)$$

$$\aleph\left(\frac{I_{j,t}^d}{I_{j,t-1}^d}\right) = \frac{\phi_i}{2}\left(\frac{I_{j,t}^d}{I_{j,t-1}^d} - \mu^I\right)^2 \quad j = \{x, n\} \qquad (4)$$

Following studies by Christiano, Eichenbaum, and Evans (2005), and Schmitt and Uribe (2004a), investment is associated with adjustment costs and subject to an adjustment cost function $\aleph(.)$ and μ^I denotes the growth rate of steady-state investment.

According to Schmitt and Uribe (2005), households determine their capital holdings and the utilization rate of capital $\mu_{j,t}$, which they rent out to firms in each sector. The cost function for changing capital utilization is defined as

[DOI: 10.61882/jme.19.4.539]

$a(\mu_{j,t})$ for each sector and period, with θ_1 *and* θ_1 representing the parameters of the cost function at capital level.

$$K_{j,t} = \mu_{j,t}\overline{K}_{j,t} \tag{5}$$

$$a(\mu_{j,t}) = \theta_1(\mu_{j,t} - 1) + \frac{\theta_2}{2}(\mu_{j,t} - 1)^2 \tag{6}$$

After taxation, the return on private sector capital in each sector is specified as follows:

$$\left(1 - \tau_t^k\right)P_t\left[(R_{j,t}^k\mu_{j,t} - a(\mu_{j,t}))\overline{K}_{j,t}(i)\right] \tag{7}$$

Households supply labor according to the total wage rate determined in the economy. W_t denotes the total wage, and h_t represents the total demand for labor. As monopolistic suppliers of labor, households choose their nominal wage W(i) to supply the total demand for their labor $h_t(i)$, subject to W(i). The elasticity of substitution between labor types $h_t(i)$ is denoted by ϖ which is bigger than 1.

$$h_t(i) = \left(\frac{W_t(i)}{W_t}\right)^{-\varpi} h_t \tag{8}$$

Based on the budget constraint, households are able to allocate wealth and to purchase government bonds at a certain period $\mathrm{B}_{\mathrm{h,t+1}}(\mathrm{i})$ or to buy gross nominal interest rate bonds $IB_{t+1}(i)$ from other countries. Foreign bonds are priced in domestic currency, and households receive firm profits $\Phi_t(i)$ after setting the taxes.

3.2 Firms

It is assumed that the economy consists of four sectors, each containing a set of firms operating under monopolistic competition. Firms in the non-tradable n and tradable goods sectors (x) demand labor and capital for production. The firms in the import (m) and export (xp) sectors purchase final goods for sale in the domestic and international markets. Firms adjust their prices with probability α_i, which independent across sectors and firms, and $i = \{n, x, m, xp\}$ If firms are unable to optimize prices in period t, they index their prices based on the past inflation rate. Indexation rule means the sectors set their prices the same as the previous prices or adjust them partially according to the inflation rate.

[DOI: 10.61882/jme.19.4.539]

$$a_{n,t}(K_{n,t}(i_n))^{\theta}(z_t h_{n,t}(i_n))^{1-\theta} - z_t^{*}\chi_n \geq D_{n,t}(i_n) \tag{9}$$

$$\frac{z_{t+1}}{z_t} = \mu_{t+1}^{z} = (1-\rho_z)\mu^{z} + \rho_z\mu_t^{z} + \epsilon_{t+1}^{z} \tag{10}$$

$$log a_{n,t+1} = \rho_n log a_{n,t} + \epsilon_{t+1}^{n} \tag{11}$$

3.3 The Problem of Producers in The Tradable and Non-Tradable, Imported and Exported Goods Sector

Firms in the non-tradable sector produce consumption and investment goods using labor and capital. In this section, a Cobb-Douglas production function is employed for production, incorporating productivity shocks and labor-specific technology shocks. In each period, firms optimize prices and solve their problem by choosing labor and capital demand, given the probability $1-\alpha_i$, which indicates the firm's ability to adjust its prices. For this problem, $a_{n,t}$ represents persistent technology shocks, while z_t denotes non-persistent labor-specific technology shocks. The price-setting equation is divided into two parts, X_t^1, X_t^2, and the inflation dynamics for non-tradable goods are represented as $\tilde{p}_{n,t} = \frac{\tilde{P}_{n,t}}{P_{n,t}}$. Here, a_n denotes the Calvo stickiness parameter in the non-tradable sector, and $r_{t,t+1}$ represents the stochastic discount factor.

$$X_t^1 = Y_{n,t}(\tilde{p}_{n,t})^{-1-\eta_n} mc_{n,t} + \alpha_n\, r_{t,t+1} E_t\left(\frac{\tilde{p}_{n,t}}{\tilde{p}_{n,t+1}}\right)^{-1-\eta_n}\left(\frac{\pi_{n,t}^{\kappa_n}}{\pi_{n,t+1}^{(1+\eta_n)/\eta_n}}\right)^{-\eta_n} X_{t+1}^1 \tag{12}$$

$$X_t^2 = Y_{n,t}(\tilde{p}_{n,t})^{-\eta_n}\frac{(\eta_n-1)}{\eta_n} + \alpha_n\, r_{t,t+1} E_t\left(\frac{\tilde{p}_{n,t}}{\tilde{p}_{n,t+1}}\right)^{-\eta_n}\left(\frac{\pi_{n,t}^{\kappa_n}}{\pi_{n,t+1}^{\eta_n/(\eta_n-1)}}\right)^{1-\eta_n} X_{t+1}^2 \tag{13}$$

The producer of goods i_x $i_x \epsilon[0,1]$ uses labor and capital to determine the price-setting behavior of firms. The pricing problem for tradable goods firms is defined after defining Z_t^1, Z_t^2, and $Z_t^1 = Z_t^2$

$$Z_t^1 = (\tilde{p}_{x,t})^{-1-\eta_x} Y_{x,t} mc_{x,t} + \alpha_x\, r_{t,t+1} E_t\left(\frac{\tilde{p}_{x,t}}{\tilde{p}_{x,t+1}}\right)^{-1-\eta_x}\left(\frac{\pi_{x,t}^{\kappa_x}}{\pi_{x,t+1}^{(1+\eta_x)/\eta_x}}\right)^{-\eta_x} Z_{t+1}^1 \tag{14}$$

$$Z_t^2 = (\tilde{p}_{x,t})^{-\eta_x} Y_{x,t}\frac{(\eta_x-1)}{\eta_x} + \alpha_x\, r_{t,t+1} E_t\left(\frac{\tilde{p}_{x,t}}{\tilde{p}_{x,t+1}}\right)^{-\eta_x}\left(\frac{\pi_{x,t}^{\kappa_x}}{\pi_{x,t+1}^{\eta_x/(\eta_x-1)}}\right)^{1-\eta_x} Z_{t+1}^2 \tag{15}$$

Similarly, for imported and exported goods, price stickiness is modeled using the methodology of Lubik and Schorfheide (2005). For importing firms, price-setting is determined using Y_t^1 and Y_t^2, where $Y_t^1 = Y_t^2$.

[DOI: 10.61882/jme.19.4.539]

$$Y_t^1 = \left(\tilde{p}_{m,t}\right)^{-1-\eta_m}\left(C_{m,t} + \frac{P_t}{P_{m,t}} I_{m,t})\right)\frac{mc_{m,t}}{P_{m,t}} + \alpha_m r_{t,t+1} E_t \left(\frac{\tilde{p}_{m,t}}{\tilde{p}_{m,t+1}}\right)^{-1-\eta_m}\left(\frac{\pi_{m,t}^{\kappa_m}}{\pi_{m,t+1}^{(1+\eta_m)/\eta_m}}\right)^{-\eta_m} Y_{t+1}^1 \quad (16)$$

$$Y_t^2 = \left(\tilde{p}_{m,t}\right)^{-\eta_m}\left(C_{m,t} + \frac{P_t}{P_{m,t}} I_{m,t})\right)\frac{(\eta_m - 1)}{\eta_m} + \alpha_m r_{t,t+1} E_t \left(\frac{\tilde{p}_{m,t}}{\tilde{p}_{m,t+1}}\right)^{-\eta_m}\left(\frac{\pi_{m,t}^{\kappa_m}}{\pi_{m,t+1}^{\eta_m/(\eta_m-1)}}\right)^{1-\eta_m} Y_{t+1}^2 \quad (17)$$

For exporting firms, price-setting is defined using U_t^1 and U_t^2, where $\mathrm{U}_\mathrm{t}^1 = \mathrm{U}_\mathrm{t}^2$. Here, export $\mathrm{X}_{\boldsymbol{t}}$ and the prices of domestic exported goods $\mathrm{P}_{\mathrm{x,s}}^*$ are calculated according to the external price.

$$U_t^1 = \left(\tilde{p}_{x,t}^*\right)^{-1-\eta_{xp}} X_t \frac{P_{x,t}}{P_{x,s}^*} + \alpha_{xp} r_{t,t+1} E_t \left(\frac{\tilde{p}_{x,t}^*}{\tilde{p}_{x,t+1}^*}\right)^{-1-\eta_{xp}}\left(\frac{\left(\pi_{x,t}^*\right)^{\kappa_{xp}}}{\left(\pi_{x,t+1}^*\right)^{\frac{(1+\eta_{xp})}{\eta_{xp}}}}\right)^{-\eta_{xp}} U_{t+1}^1 \quad (18)$$

$$U_t^2 = \left(\tilde{p}_{x,t}^*\right)^{-\eta_{xp}} X_t \frac{(\eta_{xp} - 1)}{\eta_{xp}} + \alpha_{xp} r_{t,t+1} E_t \left(\frac{\tilde{p}_{x,t}^*}{\tilde{p}_{x,t+1}^*}\right)^{-\eta_{xp}}\left(\frac{\left(\pi_{x,t}^*\right)^{\kappa_{xp}}}{\left(\pi_{x,t+1}^*\right)^{\frac{\eta_{xp}}{(\eta_{xp}-1)}}}\right)^{1-\eta_{xp}} U_{t+1}^2 \quad (19)$$

3.4 Central Bank

In conventional monetary policy frameworks, interest rates serve as the primary tool for inflation control and economic stabilization. However, Iran's financial structure deviates from this standard due to the presence of credit controls, state-regulated loan rates, and monetary interventions beyond simple interest rate adjustments. Nasiri et al. (2024) highlight that monetary policy credibility in Iran remains weak, with constraints on the central bank's ability to adjust interest rates independently. Although in practice, the Central Bank of Iran lacks significant independence, this study assumes central bank autonomy. The determination of interest rates is considered part of financial repression policies in Iran, and the determination of various rates in government budget notes is part of this policy. In this study, it is assumed that central bank behavior follows the Taylor rule, where the interest rate is endogenously determined within the model. The Taylor rule includes an

[DOI: 10.61882/jme.19.4.539]

autoregressive component along with deviations of inflation from the endogenous amount, output deviations from its amount in the steady state, changes in real exchange rates, the coefficient of interest rate ρ_R, α_π (inflation rate), α_y (output rate), and α_{rer} (real exchange rate). In the current study, we employ the standard Taylor rule framework:

$$log\left(\frac{R_{t+1}}{R}\right) = \rho_R log\left(\frac{R_t}{R}\right) + (1-\rho_R)\left[\alpha_\pi log\left(\frac{\pi_{t+1}}{\pi}\right) + \alpha_y log\left(\frac{y_{t+1}}{y}\right) + \alpha_{rer} log\left(\frac{rer_{t+1}}{rer}\right)\right] + \epsilon_{t+1}^R \quad (20)$$

$$\pi_{t+1} = \left(1-\rho_{\pi_t}\right)\pi \quad + \rho_{\pi_t}\pi_t \ + \epsilon_{t+1}^{\pi} \quad (21)$$

However, as suggested by Davoodi and Bastanzad (2019), non-conventional monetary tools, such as central bank credit controls and liquidity management policies, play a more significant role in Iran's economic stability. To refine our model, we propose incorporating liquidity management M_t as an additional factor in determining monetary policy outcomes:

$$R_t = f(L_t, \pi_t, C_t) + \gamma M_t$$
$$M_t = \varphi_1 L_t + \varphi_2 \Delta B_t + \varphi_3 \epsilon_t^M$$

Where R_t Nominal interest rate, L_t Liquidity level in the economy, which influences credit availability and financial stability, π_t Inflation rate, which affects the central bank's monetary policy decisions, $, C_t$ Aggregate consumption in the economy, a key determinant of demand-side pressures, M_t Liquidity management policies implemented by the central bank, including credit controls and monetary interventions, γ Coefficient representing the impact of liquidity management on the interest rate, ΔB_t accounts for bond issuance variations, and ϵ_t^M captures exogenous liquidity shocks. M_t represents liquidity interventions, which influence credit availability and inflation dynamics. This equation refines the conventional Taylor rule by explicitly incorporating liquidity management M_t as an additional factor affecting interest rate determination. Given Iran's financial structure, where direct interest rate adjustments may be constrained by state regulations, liquidity interventions M_t play a crucial role in maintaining monetary stability.

3.5 Government

In this section, two scenarios can be considered. The first scenario is: Oil revenues indirectly impact Iran's economy through money supply growth M_t

[DOI: 10.61882/jme.19.4.539]

rather than appearing explicitly in the government's budget constraint. When Iran exports oil, the revenue is received in foreign currency. The Central Bank of Iran then converts these revenues into rial, injecting liquidity into the economy. This process increases the monetary base and broad money supply, affecting inflation, exchange rates, and overall fiscal stability. Studies on Iran's monetary framework suggest that oil revenue shocks lead to fluctuations in liquidity, influencing inflation and economic cycles. Since a significant portion of government spending is financed by oil revenues, changes in global oil prices directly affect the country's monetary policy stance. Instead of explicitly listing oil revenues in the fiscal constraint, their effects are incorporated through changes in money supply and central bank interventions. Thus, in DSGE models analyzing Iran's economy, oil revenues are implicitly embedded in the monetary transmission mechanism, impacting fiscal outcomes without being directly listed in the budget constraint equation. Therefore, the government finances its exogenous expenditures ،G_t through various taxes, including consumption tax τ_t^c, labor income tax τ_t^h, capital income tax τ_t^k, and the firms' profit tax τ_t^ϕ. It also issues domestic bonds $B_{g,t}$ and controls the money supply M_t , adjusting the interest rate if necessary. The government budget constraint is defined as follows:

$$R_{t-1}B_{g,t} = P_t(T_t - G_t) + P_tM_t + B_{g,t+1} - P_{t-1}M_{t-1} \tag{22}$$

$$g_t = (1-\rho_g)g + \rho_g g_{t-1} + \epsilon_t^g \qquad \epsilon_t^g \sim \mathrm{N}(0, \sigma_g) \tag{23}$$

$$T_t = \tau_t^c C_t + \tau_t^h \widetilde{W}_t h_t + \tau_t^\phi \Phi_t + \tau_t^k\left[(R_{n,t}^k \mu_{n,t} - a(\mu_{n,t}))\overline{K}_{n,t} + (R_{x,t}^k \mu_{x,t} - a(\mu_{x,t}))\overline{K}_{x,t}\right] \tag{24}$$

The second scenario is: The Iranian economy heavily relies on oil revenues as a primary source of government funding. However, the current model does not include oil revenues in the government budget constraint, which may lead to incomplete policy conclusions. Studies such as Eskandari et al. (2024), Davoodi and Bastanzad (2019) and Tavakolian (2014) demonstrate that fiscal and monetary policies in Iran are significantly affected by fluctuations in oil revenues. The omission of this variable can result in an overestimation on the role of direct taxes in financing government expenditures and underestimating the impact of external economic shocks. To adjust for this oversight, we incorporate government oil revenues ROR_t directly into the budget constraint as follows:

[DOI: 10.61882/jme.19.4.539]

$$R_{t-1}B_{g,t} = P_t(T_t - G_t) + P_tM_t + B_{g,t+1} - P_{t-1}M_{t-1} + ROR_t$$

Following Schmitt and Uribe (2005), after defining the government's total real debt L_t and using the government's net debt, the budget constraint is rewritten as follows:

$$L_{t-1} \equiv M_{t-1} + \frac{R_{t-1}}{P_{t-1}}B_{g,t} \quad (25)$$

$$L_t = \frac{R_t}{\pi_t}L_{t-1} + R_t(G_t - T_t) - (R_t - 1)M_t \quad (26)$$

Additionally, the government is assumed to employ a fiscal policy rule to determine the labor income tax rate: ψ_{li} is the coefficient of the debt-to-output ratio, ψ_y is the output coefficient, and $\left(\frac{l}{y}\right)^{tar}$ represents the target debt-to-output ratio in the fiscal rule.

$$\tau_t^h - \tau^h = \psi_{li}\left(\frac{L_t}{Y_t} - \left(\frac{l}{y}\right)^{tar}\right) + \psi_y(y_t - y) + \epsilon_t^{\tau} \quad (27)$$

$$\tau_t^k = (1 - \rho_{\tau k})\tau^k + \rho_{\tau k}\tau_{t-1}^k + \epsilon_t^{\tau k} \quad (28)$$

$$\tau_t^c = (1 - \rho_{\tau c})\tau^c + \rho_{\tau c}\tau_{t-1}^c + \epsilon_t^{\tau c} \quad (29)$$

3.6 International Financial Markets

In order to model the transmission of shocks from international financial markets, the approach proposed by Schmitt and Uribe (2003) is used to determine and estimate the risk premium of bonds issued in each country as a function of the net foreign asset position. Consequently, the international interest rate is defined as follows:

$$R_t^f = R_t^* f(\xi_t, IB_{t+1}) \quad (30)$$

R_t^* represents the nominal risk-free interest rate on bonds traded in international markets, and ξ_t is an exogenous shock to the risk premium, where the foreign interest rate is an increasing function of the risk premium and a decreasing function of real foreign bond holdings. This paper, similar to the study by Schmitt and Uribe (2003), uses a function based on the net foreign asset position of an economy to determine and estimate the risk premium of bonds issued by each country**.** The international interest rate is defined as:

[DOI: 10.61882/jme.19.4.539]

$$R_t^f = R_t^*(1+\xi_t)^{k_1}\left(\frac{S_t IB_{t+1}}{P_t Y_t} / \frac{IB}{Y}\right)^{k_2} \tag{31}$$

Where R_t^* is the nominal risk-free interest rate of bonds traded in international markets, ξ_t is an independent shock to the risk premium, along with the overall risk level of the global economy, with an expected value equal to the long-term risk premium demanded by the domestic economy ξ^*, The last term represents the gap between the total external debt of the domestic economy and its long-term level. This formulation captures country-specific risk and deviations from long-term external debt levels, making it a useful framework for understanding risk premiums in open economies. Additionally, the demand equation of households in other parts of the world for tradable goods produced domestically is defined as follows, where y_t^* denotes global output and z_t^* is the external technology shock:

$$X_t = \left(\frac{P_{x,t}^*}{P_t^*}\right)^{-\eta^*} z_t^* y_t^* \tag{32}$$

Finally, gross domestic product (GDP), market-clearing conditions, and profits are defined as follows:

$$Y_t = C_t + G_t + I_t + \frac{P_{x,t}}{P_t} X_t - \frac{P_{m,t}}{P_t} D_{m,t} + \frac{\psi_1}{2} Y_t \left(\frac{B_{t+1}}{Y_t} - \frac{B}{Y}\right)^2 + \frac{\psi_2}{2} Y_t \left(\frac{S_t IB_{t+1}}{Y_t} - \frac{rerIB}{Y}\right)^2 \tag{33}$$

Here, S_t denotes the nominal exchange rate, $D_{m,t}$ represents imports, and X_t denotes exports.

$$rer_t = \frac{S_t P_t^*}{P_t} \tag{34}$$

The equation (34) in the paper defines the real exchange rate. This equation indicates that the real exchange rate the function of the nominal exchange rate S_t, the global price level P_t^*, and the domestic price level P_t. An increase in the nominal exchange rate (currency depreciation) raises the real exchange rate, meaning domestic purchasing power decreases relative to global prices. A decrease in the nominal exchange rate (currency appreciation) lowers the real exchange rate, indicating stronger domestic currency. Higher domestic prices reduce the real exchange rate, making exports less competitive in global markets. Lower domestic prices increase the real exchange rate, potentially boosting exports. Rising international prices increase the real exchange rate, indicating a relative increase in international prices compared to domestic ones. Lower global prices decrease the real exchange rate, affecting trade balances.

3.7 Ramsey Problem

By definition, the problem of determining the optimal tax structure to finance a specific level of expenditures is referred to as the Ramsey problem. In representative-agent models, the Ramsey problem involves setting taxes to maximize the representative agent's utility subject to the government's revenue requirements. Ramsey equilibrium, is the evaluation from a timeless perspective, as described by Woodford (2003), and assumes that the government implements its commitment policy over a long horizon. Based on the literature on the Ramsey problem, studies such as Schmitt and Uribe (2004), Siu (2004), Chugh (2006), Lucas and Stokey (1983), Chari et al. (1999), Marzban et al. (2016) and Marzban et al. (2018) have shown that the Ramsey planner's problem involves maximizing household utility, subject to the constraints of households in the equilibrium state and resource constraints.

$$Max\ E.\sum_{t=0}^{\infty}\beta^{t}\{U(C_t,h_t)+\tilde{\lambda}_{1t}(Y_t-C_t-G_t-I_t)+\tilde{\lambda}_{2t}\left(\ L_t-\frac{R_t}{\pi_t}L_{t-1}-R_t(G_t-T_t)+(R_t-1)M_t\ \right)+\tilde{\lambda}_{3t}\left(U_{h,t}-U_{c,t}\left(\left(1-\tau_t^h\right)\widetilde{W}_t\right)/(1+\tau_t^c)(1+\nu^m\left(1-\frac{1}{R_t}\right))\ (mcw_t\ )\right)+\tilde{\lambda}_{4t}\left(\left[1-\psi_1\left(\frac{B_{h,t+1}}{Y_t}-\frac{B_h}{Y}\right)\right]R_t^f\pi_{t+1}rer_{t+1}-\left[1-\psi_2\left(\frac{S_tIB_{t+1}}{Y_t}-\frac{rerIB}{Y}\right)\right]R_t\pi_{t+1}^{*}rer_t\right)+\tilde{\lambda}_{5t}\left(\tilde{\lambda}_t\tilde{q}_t-\beta E_t\left\{\tilde{\lambda}_{t+1}\left[\left(1-\tau_{t+1}^k\right)\left(\left(R_{t+1}^k\,\mu_{j,t+1}-a(\,\mu_{j,t})\right)+\tilde{q}_{t+1}(1-\delta)\right]\right\}\right)\} \tag{33}$$

4 Empirical Results

This study employs a DSGE model calibrated to Iran's economy, using macroeconomic data from [specific years, e.g., 2005–2024] extracted from the Central Bank of Iran (CBI). The estimation process follows a two-step methodology: first, steady-state calibration based on observed macroeconomic trends, and second, log-linearization of the system equations to derive impulse response functions. By comparing simulated moments with empirical data, the model provides insights into the cyclical behavior of inflation, consumption, and output under different policy regimes. To solve the model, the research framework incorporates equations derived from

[DOI: 10.61882/jme.19.4.539]

optimization conditions and existing identities in the model. The optimality conditions of the model are detrended and linearized using the logarithmic-linear method and Taylor expansion method, then utilized in the computational software. Part of the steady-state properties of the model, described by the parameters listed in Table 1, is clarified. The values of the parameters are calibrated and used in the software.

Table 1
Calibration for Steady State

Parameter	Description	Value	Source
δ	Depreciation rate	0.0139	Izadi(2023d)
θ	Capital share	0.44	Izadi(2023c)
β	Discount factor	0.9745	Izadi & Sayareh (2019)
$\eta_x = \eta_n$	Price elasticity demand domestic goods	5	Marzban et al. (2016)
η_m	Price elasticity demand imported goods	5	Izadi (2018)
η_{xp}	Price elasticity demand exported goods	5	Marzban et al. (2016)
$\alpha_x = \alpha_n$	Calvo parameter domestic goods	0.6	Izadi & Marzban (2016)
α_m	Calvo parameter imported goods	0.6	Marzban et al. (2018)
ζ	Habit persistence	0.3096	Izadi & Marzban (2016)
ϖ	Elast. subst. across labor types	21	Izadi (2021)
η^*	Elast. subst. domestic exports to ROW	1.5	Izadi (2020)
θ_2/θ_1	Adjustment of capacity utilization	2.02	Izadi & Marzban (2019)
μ_t^z	The productivity growth	1.005	Izadi & Marzban (2019)
$\left(\frac{l}{y}\right)^{tar}$	Debt to output ratio	0.47	Marzban et al. (2016)
ψ_1, ψ_2	Portfolio adj. cost	0.018	Izadi & Marzban (2019)

To evaluate the model, the moments obtained from some endogenous variables are compared with moments derived from real-world data. The following table summarizes the moments extracted from the model and those extracted from the real-world data.

To validate the robustness of the model's predictions, we compare the simulated results with real macroeconomic data from the Central Bank of Iran

[DOI: 10.61882/jme.19.4.539]

(CBI). Table 2 presents key moments extracted from the model and compares them with empirical observations, confirming that the cyclical behavior of inflation, consumption, and output aligns with historical trends. Moreover, sensitivity analysis on taxation parameters demonstrates that zero inflation remains optimal across different policy structures, reinforcing the significance of monetary stability.

Table 2
Moments of Simulated Data and Real Data

Variable	**Volatility (σ)**		$\frac{\sigma_{x_t}}{\sigma_{Y_t}}$		**Autocorrelation**	
	Real Model	**Simulation Model**	**Real Model**	**Simulation Model**	**Real Model**	**Simulation Model**
Y	1.1236	1.0913	1.0000	1.0000	0.7146	0.4288
C	2.8010	2.9488	2.4928	2.7020	0.8451	0.6099
π	0.1186	0.0706	0.1046	0.0706	0.8437	0.7755
G	2.5641	2.3254	2.2820	2.1308	0.9296	0.6000

Source: Research calculations

A comparison of the real data moments with those obtained from the software demonstrates that the research model effectively simulates the cyclical behavior and volatility of the variables.

4.1 Scenarios with the Planner's Accessible Taxes

Consider a case in which the government has access to all the financial policy tools described in the model such as consumption tax τ^c, labor income tax τ^h, capital income tax τ^k, profit tax τ^ϕ, money supply control (m), and debt issuance (b). Table 3 illustrates the optimal interest rates, optimal taxes on capital, labor, and consumption under different nominal rigidity parameters, i.e., Calvo rigidity parameter (a_i) in different scenarios.

[DOI: 10.61882/jme.19.4.539]

Table 3
Optimal Inflation and Taxes

a_n	a_m	π	R	$\%\tau^k$	$\%\tau^h$	$\%\tau^c$	Observations
The scenario with all taxes							
0.06	0.06	0.00	4.21	-17.55	100	-100	
0	0	-3.42	0.00	-17.55	100	-100	
The scenario without consumption taxes							
a_n	a_m	π	R	$\%\tau^k$	$\%\tau^h$		Observations
0.06	0.06	-0.10	3.87	-18.80	34.47		$\%\tau^c = 0$
0	0	-4.21	0.00	-17.55	36.94		
The scenario of income and consumption taxes							
a_n	a_m	π	R	$\%\tau^y$	$\%\tau^c$		Observations
0.06	0.06	0.00	4.20	-11.01	77.66		$\tau^k = \tau^\phi = \tau^h = \tau^y$
0	0	-3.65	0.33	-11.01	77.68		
The scenario of an income tax							
a_n	a_m	π	R	$\%\tau^y$			Observations
0.06	0.06	0.26	4.46	9.65			$\tau^k = \tau^\phi = \tau^h = \tau^y$
0	0	1.31	5.51	9.65			

Source: Research calculations

Scenario 1 reveals that monopolistic competition leads firms to set their prices above marginal costs, resulting in an output level below that of a perfectly competitive condition. Price stickiness, as another factor exacerbating inefficiencies, prevents rapid market clearing and causes output to deviate from its optimal level. Due to price stickiness, costs associated with price adjustments, presence of money demand, and the existing costs of trades associated with consumption, the planner must determine the optimal inflation rate by balancing the trade-off between minimizing the opportunity cost of holding money and minimizing price dispersion caused by stickiness. Two key results can be obtained in Table 3: Firstly, regardless of Calvo parameter values, price stability or the Friedman rule prevails as the optimal monetary policy. Secondly, regardless of the model main parameters, labor income is taxed at 100%, while consumption tax (subsidies) is set at the same rate.

The results of Scenario 1 indicate that if a uniform consumption tax can be imposed and the optimal policy follows the Friedman rule, full subsidies should be provided for consumption, and labor income should be taxed fully. Thus, the optimal monetary policy here involves zero or near-zero inflation. The Friedman rule refers to the optimal policy under price flexibility conditions or conditions where production loss is eliminated because of sticky prices. The planner here sets the nominal interest rate to zero and, through implementing the Friedman rule, minimizes the production loss.

[DOI: 10.61882/jme.19.4.539]

Consequently, it can be said that money becomes a non-essential variable, and any liquidity level satisfies household equilibrium. Thus, the Ramsey planner eliminates the transaction costs fully by subsidizing household consumption.

The results of the model indicate negative capital taxes, implying that the monopolistic competition in the production market leads to deviations in accordance with price markups. This markup is a result of incomplete competition in intertemporal substitution in household consumption. Taxing capital income distorts investment horizons, hence altering optimal household allocations in turn. Capital income taxation, as a distortionary tax, reduces capital stock, leading to lower output and consumption.

In Scenario 2, the planner lacks access to consumption tax, faces reduced available fiscal revenue, and consequently has reduced tax income. Thus, the planner uses inflation as an indirect tax on household income sources to increase fiscal revenue. The inflation in this model results from the dissimilar amounts of price stickiness across different production sectors. Under flexible prices, the Friedman rule remains the desired outcome of the Ramsey problem, aiming, as a monetary policy, to eliminate the opportunity cost of holding money. With sticky prices, however, the costs associated with price adjustments compel the planner to choose low or near-zero inflation. Here, the planner, through creating inflation, sets an indirect tax on profits. Therefore, the optimal policy involves selecting an inflation rate close to, but not exactly, zero.

According to Scenario 3, the planner cannot differentiate different tax rates and imposes a uniform income tax on capital, labor, and profits. Meanwhile, since households pay taxes on the consumption of each unit of domestic or foreign goods, consumption taxes influence the economic exchange rules. Here, the Ramsey planner attempts to impose higher taxes on labor income compared to capital income. However, due to the constraints and the inability to differentiate labor and capital income taxes, the planner cannot achieve this. As a result, the planner relies on high consumption taxes and subsidizes capital through negative income tax policies. The results indicate that under full price flexibility, the optimal policy approaches the Friedman rule. The deviation from the Friedman rule stems from monopoly profits, which represent net income for holders of exclusive rights. Thus, the planner seeks to impose a 100% tax on such profits. However, due to constraints on setting this tax rate, the planner uses inflation rate as an indirect tax on profits.

Scenario 4 indicates that when the government has access to only one tax, inflation acts as an additional tax from the Ramsey planner’s perspective because for lower levels of price stickiness, inflation is greater than zero. On

[DOI: 10.61882/jme.19.4.539]

the other hand, price stickiness, the costs of price adjustments for firms, and the inability to differentiate tax rates force the planner to use inflation as a tax tool. In this case, the planner refrains from generating high inflation. Under the income tax regime, the planner cannot set different tax rates on all household income sources, instead indirectly taxing labor income through inflation.

Finally, the results confirm that price stability is central to Iran's economic efficiency. Policymakers should consider how consumption tax adjustments can mitigate price distortions while maintaining a zero-inflation target, reinforcing the Ramsey rule's relevance in practical applications. Also, the results confirm that price stability is central to reducing welfare losses in Iran's economy. Policymakers should consider how adjustments to labor taxation and consumption subsidies can help achieve a zero-inflation target under financial constraints. This study provides strong evidence supporting the relevance of the Friedman rule in Iran's economy. By analyzing various taxation scenarios within a DSGE model, we conclude that price stability plays a central role in reducing welfare losses. The results affirm that monetary stability through a zero-inflation policy significantly enhances economic efficiency in Iran. Policymakers should consider adjusting consumption tax rates to mitigate distortions while maintaining an inflation target close to zero. By addressing fiscal constraints through labor income taxation and targeted subsidies, governments can better navigate structural inefficiencies and ensure long-term stability.

5 Concluding Remarks

This paper examined the application of the Friedman rule as the optimal monetary policy for Iran's economy, considering the results of the Ramsey problem. The findings indicated that in this model, given nominal price stickiness, stability of the overall price level and the Friedman rule are established as optimal policies. The model's various scenarios suggested that under sticky prices, price stability emerges as the desirable outcome of the Ramsey problem. Furthermore, the provision of capital subsidies and negative taxes in the model confirms that the primary goal of the government's policy is to reduce production losses and to decrease deviation of markup prices which are due to price stickiness in monopolistic markets.

The findings of this study confirm that, under price stickiness, the Friedman rule remains an optimal monetary policy approach. However, its effectiveness depends on the fiscal policy framework and available taxation

[DOI: 10.61882/jme.19.4.539]

tools. The results highlight that reducing price dispersion and production inefficiencies should be primary policy goals.

Finally, the results of the fundamental assumptions regarding the fiscal policy framework in addressing optimal policies suggest significant changes in steady-state allocations and prices. As a result, the optimal monetary policy may deviate from the Friedman rule (zero nominal interest rates) to higher levels of inflation. This deviation depends not only on the role of model's nominal and real stickiness but also on the number of tax instruments available to the Ramsey planner. Thus, the Friedman rule can be considered an optimal policy for Iran's economy.

The planner can select the optimal inflation rate and policies to achieve their goals, considering the available financial policy tools and prevailing economic conditions. Therefore, considering whether inflation is beneficial or not for the planner in the prevailing economic conditions, he can use inflation as a tax tool. Also, considering the economic conditions, it can reduce the number of production deviations in the market and minimize the loss in welfare by imposing a negative tax (subsidy) on capital and consumption. In this case, the planner can calculate the welfare changes resulting from each scenario by by considering the tax tools available to him. Finally, by examining the dynamics resulting from the impulses in the model and their impact on macroeconomic variables, he can formulate appropriate policies for the country's economy.

This study confirms that the Friedman rule remains an optimal monetary policy choice for Iran, provided that fiscal mechanisms align effectively. The findings emphasize that eliminating consumption taxes and prioritizing labor income taxation leads to greater economic efficiency. Moreover, the interplay between monetary and fiscal policies under structural constraints highlights the need for targeted subsidies to counteract price distortions. Future research should examine the impact of external shocks, such as oil price volatility, and alternative monetary instruments like to complement inflation-targeting strategies.

6 Author Contributions

Conceptualization, methodology, validation, formal analysis, resources, writing— original draft preparation, writing—review and editing, supervision by author. Author has read and agreed to the published version of the manuscript.

[DOI: 10.61882/jme.19.4.539]

7 Funding
This research received no external funding.

8 Conflicts of Interest
The authors declare no conflict of interest.

9 Data Availability Statement
The data used in the study were taken from https://cbi.ir.

10 Acknowledgements
The author thanks the anonymous reviewers and editor for their valuable and useful contributions.

References
Adolfson, M., Laseen, S., Linde, J. & Svensson., L.E.O. (2014). Monetary policy trade-offs in an estimated open-economy DSGE Model. *Journal of Economic Dynamics and Control*, 42: 33-49.

Arefeva, A., & Arefyev, N. (2024). Playing By the Taylor Rules or Sticking to Friedman's Policy: A New Approach to Monetary Policy Identification, *Economic Modelling*, 143, ,69-76.

Bachmann, R., Gödl-Hanisch, I. & Sims, E. R. (2022). Identifying Monetary Policy Shocks Using the Central Bank's Information Set, *Journal of Economic Dynamics and Control*, 145,45-55.

Chari, V. V., & Kehoe, P. J. (1999). Optimal fiscal and monetary policy. In J. B. Taylor & M. Woodford (Eds.), *Handbook of macroeconomics* (Vol. 1, pp. 1671–1745). North-Holland..

Christiano, L. J.; Eichenbaum, M. & Evans, C.L. (2005). Nominal rigidities and the dynamic effects of a shock to monetary policy. *Journal of Political Economy*, 113(1): 1-45.

Chugh, S.K. (2006). Optimal fiscal and monetary policy with sticky wages and sticky prices. *Review of Economic Dynamics*, 9(4): 683-714.

Davoudi, P., & Bastanzad, H. (2019). Monetary policy and financial stability in Iran: A DSGE approach. *Journal of Quantitative Economics*, 17(2), 43–87. [In Persian].

Eichenbaum, M. (1997). Some Thoughts on practical stabilization policy: Is there a core of practical macroeconomics that we should all believe? *American Economic Review*, 87(2): 236-239.

Eskandari, M., Memarnejad, A., & Hoseini, S. S. (2024). Analysis of the convergence of optimal monetary policies in Iran's economy and welfare. *International Journal of Nonlinear Analysis and Applications*, pp.1–12.

Fisher, L. A., & Huh, H. (2023). Systematic Monetary Policy in A SVAR For Australia, *Economic Modelling*, 128, 10-25.

[DOI: 10.61882/jme.19.4.539]

Friedman, M. (1969). *The optimum quantity of money and other essays.* Aldine Publishing Company.

Izadi, H. R. (2023a). Measuring the effects of risk aversion change on households' performance using endogenous discount factor model. *Economic Alternatives*, 2, 374-383.

Izadi, H. R. (2023b). The behavior of households using the dynamic stochastic general equilibrium model: Alternative models. *Jurnal Ekonomi Malaysia* ,57(1), 1-8.

Izadi, H. R. (2023c). The role of internalization of discount factor on households' behavior using DSGE model. *Studia Universitatis "Vasile Goldis" Arad. Economics Series*, 33(1),74-87.

Izadi, H. R. (2023d). Examining the consumption behavior of households caused by changing the utility function using the DSGE model. *Iranian Journal of Economic Studies*, 12(1), 105-121.

Izadi, H. R. (2022a). The effects of policy change regarding health expenditures on households behavior. *Evidence Based Health Policy, Management & Economics*, 6(4), 262-72.

Izadi, H. R. (2022b). Investigation of the role of change in utility function components and its effect on smooth the dynamic movement path of model variables. *Studies In Business and Economics*, 17(1), 73-84.

Izadi, H. R., & Shirafkan Lamsoo, M (2022). The role of The frisch elasticity on households' behavior using the endogenous discount factor model. *Journal Of the Faculty of Economics and Administrative Sciences*, 12(3), 221-250.

Izadi, H.R. (2021). Investigating the role of financial sanctions in utility function and their impact on household behavior. *DLSU Business & Economics Review*, 31(1), 132-141.

Izadi, H.R. (2020). Investigation and comparison of the financing costs through the financial intermediates on household behavior (DSGE Model). *Quarterly Journal of financial engineering and portfolio management Modelling*, 12(47), pp. 220-242. [In Persian]

Izadi, H. R. (2018). The role of tendency of government preference in an optimal fiscal policy model in the presence of agent heterogeneity in a DSGE framework. *Quarterly Journal of Economical Modelling*, 4(44), 73-96. [In Persian]

Izadi, H. R., & Marzban, H. (2016). Designing, investigation and comparison of the factors of stationarity of dynamic stochastic general equilibrium models in Iran economy. *Quarterly Journal of Economic Research and Policies, 24*(2), 195-216. [In Persian]

Izadi, H. R., & Marzban, H. (2019). The role of productivity growth changes in determining optimal monetary and fiscal policies from the ramsey problem. *Quarterly Journal of Quantitative Economics*, *2*(16), 31-71. [In Persian]

Izadi, H. R., & Sayareh, S. (2019). Investigating the role of labor division into internal and external sectors in the Iranian economy within the dynamic stochastic general equilibrium model framework. *Quarterly Journal of Econometric Modelling*, *4*(3), 73-96. [In Persian]

Jiang, L., Chen, Y. & Zhang, L. (2024). Monetary policy surprises and corporate investment growth in China, *Economic Modelling*, 131, 10-16.

Lee, S. & Park, J. (2022). Identifying Monetary Policy Shocks Using Economic Forecasts in Korea, *Economic Modelling*, 111, 58-69.

Lucas, R. E. (2000). Inflation and Welfare. *Econometrica*, 68(2), 247-274.

Lubik, T. A., & Schorfheide, F. (2005). A Bayesian look at the new open economy macroeconomics. *NBER macroeconomics annual, 20*, 313–366.

Lucas, R. E. J., &Stokey, N. L. (1983). Optimal fiscal and monetary policy in an economy without capital. *Monetary Econ*., 12 (1): 55-93.

Marzban, H., DehghanShabani, Z. Rostamzadeh, P. & Izadi, H.R. (2016). The Welfare Computation under Different Fiscal Policies in an Optimal Monetary and Fiscal Policy Model Framework. *Quarterly Journal of Economical Modelling*, 3 (5), pp.25-51. [In Persian]

Marzban, H., DehghanShabani, Z. Rostamzadeh, P. & Izadi, H.R. (2018). Optimal Fiscal and Monetary Policy by Applying the Ramsey Problem. *The Economic Research*, 18 (3), pp. 27-56. [In Persian]

Nasiri, S., Davoodi, P., Samsami, H., & Tavakolian, H. (2024). Optimal monetary policy and estimating the credibility of monetary policy in Iran using the DSGE approach. *Journal of Economic Research*, 23(88), 5–53.

Philippopoulos, A.; Varthalitis, P. & Vassilatos, V. (2015). Optimal fiscal and monetary policy action in a closed economy. *Economic Modelling*, 48, 175-188.

Roy, R., Bashar, O. & Bhattacharya, O.S. (2023). The Cross-Industry Effects of Monetary Policy: New Evidence from Bangladesh, Economic Modelling, 127, 64-79.

Schmitt-Grohe, S., & Uribe, M. (2004a). Optimal fiscal and monetary policy under sticky prices. *Journal of Economic Theory*, 114, 198-230.

Schmitt-Grohe, S., &Uribe, M. (2004b). Optimal fiscal and monetary policy under imperfect competition. *Journal of Macroeconomics*, 26, 183-209.

Schmitt-Grohe, S., & Uribe, M. (2007). Optimal simple and implementable monetary and fiscal rules. *Journal of Monetary Economics*, 54(6), 1702-25.

Schmitt-Grohe, S., &Uribe, M. (2012). An OLS approach to computing Ramsey equilibria in medium-scale macroeconomic models. *Economics Letters*, 115, 128-129.

Schmitt-Grohe, S., & Uribe, M. (2005). Optimal fiscal and monetary policy in a medium-scale macroeconomic model. NBER macroeconomics annual, 20, 383-462.

Schmitt-Grohe, S., &Uribe M. (2003). Closing small open economy models, *Journal of International Economics*, 61: 163-185.

Siu, H.E. (2004). Optimal fiscal and monetary policy with sticky prices. *Journal of Monetary Economics*, 51(3): 575-607.

Tavakolian, H. (2014). Estimate the degree of financial dominance and its welfare costs, DSGE model, monetary banking quarterly, 21, 329-359.

[DOI: 10.61882/jme.19.4.539]

Woodford, M. (2003). *Interest and Prices: Foundations of a Theory of Monetary Policy*. Princeton University Press.

[DOI: 10.61882/jme.19.4.539]