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The Effect of External Shocks on Employment in Different Exchange Rate Regimes Assuming Price and Wage rigidity: A DSGE Approach

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Abstract:

According to the macroeconomic literature, the choice of exchange rate regime influences how various policies affect macroeconomic variables. In this study, we examine the effects of external shocks—including oil price shocks, foreign inflation shocks, and exchange rate shocks—on employment under three types of exchange rate regimes: floating, fixed, and managed floating. The analysis is conducted using a Dynamic Stochastic General Equilibrium (DSGE) model that incorporates households, firms, the government, monetary policymakers, and the external sector. The results of the impulse response functions (IRFs) indicate that oil shocks have a positive impact on employment across all three exchange rate regimes, leading to higher employment levels. The positive effect of foreign inflation shocks on employment is stronger under the fixed exchange rate regime compared to the floating and managed floating regimes. Moreover, while exchange rate shocks under the fixed regime increase employment, they exert a negative effect under the managed floating and fully floating regimes, reducing employment.

1- Introduction

The Iranian labor market has been confronted with persistent structural challenges in recent years, most notably low labor force participation, high

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unemployment, and weak labor demand. Addressing these issues has therefore become a central priority for economic policymakers. A prerequisite for formulating effective labor market policies is a comprehensive understanding of the functioning of the labor market and its interconnections with other segments of the economy—such as the goods market, financial markets, and external sectors. Insufficient knowledge or misperceptions regarding these linkages may lead to the implementation of ineffective or even counterproductive policies, thereby deepening existing imbalances (Keshavarz et al., 2016; Mohammadzadeh et al., 2019). Hence, developing policies that foster equilibrium and stability in the labor market necessitates an integrated analysis of both intra-market dynamics and cross-market interactions. In particular, understanding the transmission of various shocks—such as product market disturbances and external shocks—to the labor market is vital for designing stabilization mechanisms capable of mitigating employment volatility. Within the broader framework of international macroeconomics, the selection of an appropriate exchange rate regime constitutes a critical policy decision. Different exchange rate arrangements influence the transmission and effectiveness of macroeconomic policies and shocks across markets. As emphasized by Mundell (1971), the exchange rate regime plays a pivotal role in shaping policy outcomes. In the presence of nominal rigidities such as price and wage stickiness, resource allocation becomes inefficient, thereby amplifying the importance of the chosen exchange rate framework (Engel, 2011). An improperly managed exchange rate under such conditions can lead to suboptimal outcomes, including reduced output and employment levels (Kazerooni et al., 2019). Consequently, examining how economic policies and external shocks propagate through the economy under alternative exchange rate regimes is particularly relevant for oil-dependent economies such as Iran.

The principal objective of this study is to investigate the effects of external shocks on labor market variables in Iran within a Dynamic Stochastic General Equilibrium (DSGE) framework. The study contributes to the existing literature by examining how different types of external shocks—namely oil price shocks, foreign inflation shocks, and exchange rate shocks—affect employment under three alternative exchange rate regimes: fixed, floating, and managed floating. The analysis explicitly incorporates both price and wage stickiness, providing a more realistic representation of the Iranian economy.

The remainder of this paper is structured as follows. Section 2 reviews the relevant theoretical and empirical literature. Section 3 outlines the methodological framework and model specifications. Section 4 presents the simulation results and empirical findings. Finally, Section 5 offers concluding remarks and policy implications.

2- literature review

2-1- literature review

One of the central topics in the field of international economics concerns the selection of an appropriate exchange rate regime and the analysis of how different regimes affect macroeconomic performance. Exchange rate dynamics vary across regimes, and the transmission of economic shocks can differ substantially depending on the adopted framework. Exchange rate instability and excessive volatility can significantly influence macroeconomic variables such as foreign investment, trade flows, and overall economic stability (Ashfag, 2010). Moreover, the effectiveness of macroeconomic policies—whether fiscal, monetary, or structural—depends on the prevailing exchange rate system, which in turn shapes the behavior of key aggregates such as output, investment, and inflation.

Empirical and theoretical studies have frequently highlighted the close relationship between fixed exchange rate regimes and lower inflation levels. A fixed exchange rate system provides policy coordination that constrains inflationary pressures. On one hand, the peg stabilizes the domestic currency against foreign currencies, promoting policy credibility and investor confidence (Ostovar, 1992). On the other hand, by serving as a nominal anchor, a fixed regime disciplines monetary and fiscal authorities, thereby reducing the inflationary effects of excessive monetary expansion (Gash et al., 1995).

However, the choice of an inappropriate exchange rate regime may amplify the adverse effects of both internal and external shocks. Exchange rate shocks under an ill-suited regime can heighten volatility in relative prices, which in turn destabilizes key macroeconomic indicators such as inflation, output, and employment (Komeijani & Ebrahimi, 2013). Similarly, the impact of oil revenue shocks can vary across exchange rate systems. In a managed exchange rate regime, a positive oil revenue shock increases the inflow of foreign currency, leading to monetary expansion and a rise in the domestic money supply (Samadi et al., 2009). By contrast, under a floating regime, a positive oil revenue shock tends to appreciate the domestic currency, thereby influencing the country's export competitiveness (Samadi et al., 2009). Furthermore, increased oil revenues often stimulate public spending, generating a substitution effect that crowds out private investment and exerts a negative impact on employment and output (Cologni & Manera, 2013).

The literature also emphasizes that the choice of exchange rate regime is shaped by a range of economic and political factors. The performance of any exchange rate system depends on country-specific characteristics such as inflation dynamics, financial market depth, production structure, and the degree of trade openness. Hence, there is no universal regime suitable for all economies; the optimal choice depends on each country's economic and institutional conditions, and may even evolve over time. According to Mundell (1963), under a floating exchange rate system, output adjusts more gradually and less erratically to external shocks than under a fixed regime. He argued that the appropriate exchange rate framework should be determined in light of a country's trade openness and the nature of its trade relationships with other economies, particularly those to which its currency may be pegged.

Each exchange rate regime entails its own advantages and disadvantages, mainly reflected in the way different shocks are transmitted to the economy and how macroeconomic variables adjust to domestic and external disturbances. In general, the appropriateness of an exchange rate regime depends on the degree to which it aligns with macroeconomic conditions and policy priorities given resource and balance-of-payments constraints. In many economies, achieving low inflation and stable output levels is a key objective in determining exchange rate policy. Developing and resource-dependent countries often prioritize output growth; however, by adopting a fixed exchange rate below the equilibrium level, they may inadvertently encourage imports while undermining domestic production and exports. Consequently, policymakers in such economies may resort to expansionary policies or tolerate higher inflation to offset the decline in output and exports (Rakoff, 1985).

2-2 research review

A considerable number of studies have investigated the effects of foreign and domestic shocks on macroeconomic variables under different exchange rate regimes.

Mojtahed and Ahmadian (2007) examined the effects of exchange rate policies on welfare in Iran during the period 1968–2004 and found that a managed floating regime provided greater stability in both welfare and consumer prices compared to alternative regimes. Similarly, Mohammadi and Gholami (2008), employing a vector autoregression (VAR) framework, analyzed the effects of exchange rate unification on inflation, unemployment, and output. Their findings indicated that unification exerted a positive and significant impact on commodity prices.

Tavakolian and Afzali Abarghooei (2016) utilized a Dynamic Stochastic General Equilibrium (DSGE) model to assess the effects of various shocks—such as oil and productivity shocks—across three exchange rate regimes: fixed, managed floating, and floating. Their results revealed that inflation exhibited the least volatility under a fixed regime but the highest under exchange rate shocks. In another DSGE-based study, Keshavarz (2019) explored labor market dynamics and found that a positive monetary policy shock increased employment, although it had only a marginal impact on the unemployment rate. Mohammadi et al. (2019), applying a structural vector error correction model (SVECM) for the period 1974–2016, found that productivity and supply shocks had direct positive effects on unemployment in the short run; however, in the long run, productivity shocks reduced unemployment, while positive labor supply shocks raised it.

Kazerooni et al. (2019) examined the effects of monetary shocks on employment across exchange rate regimes in Iran (1982–1995) using a DSGE framework. Their findings showed that the employment response to monetary shocks depended on the stability of the regime: under an unstable regime, monetary shocks decreased employment, whereas under a stable regime, they increased employment in the short run. In a related DSGE study, Boroumand et al. (2019) analyzed the impact of foreign shocks on Iran's macroeconomic variables and found that a positive oil price shock led to an increase in both GDP and non-oil output.

More recent DSGE-based analyses have extended this line of inquiry. Zubaidi et al. (2021) examined labor market dynamics in Iran and found that both expansionary monetary policy and positive technological shocks widened the gender gap in employment outcomes. Sighlani and Jalali Naeini (2013) analyzed foreign shocks, cost pressures, and stagflation in the Iranian economy, concluding that international sanctions caused a structural shift in inflation performance between the decades 2001–2011 and 2012–2022. Likewise, Al-Baji et al. (2023) explored Iran's macroeconomic response to monetary and exchange rate policies using a DSGE model and demonstrated that a managed exchange rate system performed best in minimizing central bank losses and reducing macroeconomic volatility relative to other regimes.

Several international studies have also addressed similar questions. Berger (2006) investigated the optimal exchange rate regime for small economies within a DSGE framework and concluded that when domestic money supply shocks are strong, switching from a floating to a fixed regime can improve consumption, though a stable monetary policy under a fixed regime does not necessarily enhance welfare. Feldman (2011) analyzed exchange rate fluctuations and unemployment using VAR and GARCH models across 17 industrialized countries over the period 1982–2003, finding that greater exchange rate volatility was associated with higher unemployment. Shing and Wang (2014), using a DSGE model for Australia (1993–2007), found that technology shocks accounted for short-run labor market fluctuations, whereas preference shocks better explained wage variations. They also reported that demand-side shocks had a larger positive impact on output compared to supply-side shocks.

In the context of oil-exporting economies, Al-Abri (2014) studied the optimal exchange rate regime for a small open economy subject to monetary and productivity shocks. His results suggested that household welfare was higher under a floating regime than under a fixed regime. Lukyanenko and Oliskovich (2015) analyzed the Ukrainian labor market over 2002–2014, showing that technology and supply shocks reduced unemployment in the long run, while temporary labor demand shocks had persistent effects, indicating a high degree of labor market rigidity. Gerke et al. (2018) examined the German labor market during economic stagnation periods and found that shocks played a major role in shaping employment dynamics.

More recently, Zhao et al. (2020) employed a DSGE model incorporating habit formation, capital adjustment costs, and news shocks to study aggregate labor market volatility. Their results revealed strong comovement between aggregate labor demand and supply in response to news shocks. Gaina and Elia (2021) explored technology shocks and sectoral labor market spillovers in the United States (1992–2019) using a multi-sector VAR model, finding that employment rose following technology shocks but declined in response to investment shocks. Finally, Bertinelli (2022) analyzed labor market fluctuations in OECD countries (1970–2013) and showed that technology stocks led to labor reallocation toward non-tradable sectors, increasing working hours in those industries.

3- Methodology

The model employed in this study for the household and firm sectors is based on the Calvo (1983) price stickiness framework, while the government and central bank sectors follow the New Keynesian model developed by Skudeh (2012) and Tavakolian (2016). The economy consists of a representative household, firms producing final goods, firms producing intermediate goods, the government–central bank sector, and the foreign sector.

The representative household derives utility from consuming goods and services as well as from holding real money balances, while experiencing disutility from labor supply. Firms producing final goods operate under monopolistic competition and set prices according to the Calvo pricing mechanism. Government revenues consist of bond issuance, tax receipts, and oil revenues, which are used to finance public expenditures.

3.1. Households

The model assumes a representative household composed of a continuum of identical members. The household derives utility from consumption and real money holdings and incurs disutility from supplying labor. Accordingly, the household's utility function is specified as in Equation (1).

$$u\left(c_t, \frac{M_t}{P_t}, L_t\right) = \left(\frac{c_t^{1-\eta}}{1-\eta} + \frac{\gamma}{1-b_m} {m_t}^{1-b_m} - \Phi \frac{L_t^{1+es}}{1+es}\right) \quad (1)$$

In this equation, η denotes the inverse of the intertemporal elasticity of substitution in consumption. The parameter b_m represents the inverse of the elasticity of demand for real money balances, while e_s is the inverse of the elasticity of labor supply. Φ and γ are constant parameters. Accordingly, the objective of the representative household in this model is to maximize its expected lifetime utility, as specified in Equation (2).

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u\left(c_t, \frac{M_t}{P_t}, L_t\right) \tag{2}$$

In this relation, β denotes the subjective discount factor, and Pt represents the aggregate price level. In period t, the household has multiple sources of income, including labor income from supplying labor, w_t^n, capital rental income, Rt, corporate profits, Π_t, government transfers (subsidies), TRt, real money balances, m_t, and interest income from bonds purchased in the previous period, r_t^b . The household allocates its income by saving in the form of bonds, Bt, and Tt paying lump-sum taxes, accordingly. The household budget constraint is given by Equation (3).

$$c_t + i_t + \frac{M_{t+1}}{P_t} + \frac{B_{t+1}}{P_{t_t}} \leq \frac{W_t^n}{P_t} L_t + r_t k_t + \frac{M_t}{P_t} + \Pi_t - \frac{T_t}{P_t} + \frac{TR_t}{P_t} + \left(1 + r_t^b\right)\frac{B_t}{P_t} \tag{3}$$

Based on the amount of household investment and the existence of depreciation (δ), the capital movement equation of the economy will be in the form of equation (4).

$$\mathrm{K}_{t+1} = (1 - \delta)\mathrm{K}_t + \mathrm{I}_t \tag{4}$$

According to the maximization of the household utility function with respect to the budget constraint, the equations for the demand of money, capital, and bonds are obtained in the form of equations (5) to (7), respectively.

$$\mathrm{C}_t^{-\eta} = \gamma \mathrm{m}_t^{-\mathrm{b_m}} + \beta \mathbb{E}_t\left[\frac{\mathrm{C}_{t+1}^{-\eta}}{P_{t+1}}\right] \tag{5}$$

$$\mathrm{C}_t^{-\eta} = \beta \mathbb{E}_t\left[C_{t+1}^{-\eta}\left(R_{t+1} + (1 - \delta)\right)\right] \tag{6}$$

$$C_t^{-\eta} = \beta\left(1 + r_t^b\right)\mathbb{E}_t\left[\frac{\mathrm{C}_{t+1}^{-\eta}}{P_{t+1}}\right] \tag{7}$$

In the proposed model, households are the exclusive suppliers of differentiated labor to firms producing intermediate goods. The wage rate set by households depends on the degree of substitution among labor and is determined by the coefficient τ. Once the wage rate is set, the labor supply will also be determined (Cristiano et al. 2005).

The labor supplied by households will be converted into the total labor supply of the economy using the Dixit-Stiglitz (1972) aggregator as follows:

$$L_t = \left(\int_0^1 L_t^{\frac{1}{\tau}}(j)dj\right)^{\tau} \quad (8)$$

Labor maximizes its profit according to equation (8) with respect to the wage level (W_t):

$$\max_{L_{t(j)}} w_t L_t - \int_0^1 w_{j,t} L_t(j) dj \quad (9)$$

From maximizing this Eq., the demand for labor of household j is obtained as follows:

$$L_t(j) = \left(\frac{w_{j,t}}{w_t}\right)^{\frac{\tau}{\tau-1}} L_t \quad (10)$$

By substituting equation (10) into (8), we will have:

$$w_t = \left(\int_0^1 w_{j,t}^{\frac{1}{1-\tau}} dj\right)^{1-\tau} \quad (11)$$

According to the Calvo method, in each period a proportion of households $(1-\theta_w)$ set their wages optimally ($\widehat{w}_t$) and the rest of the households cannot change their wages and their wages increase to some extent with the inflation rate. The extent of this indexation is determined by the coefficient $\chi_w \in [0,1]$.

$$w_{j,t} = \pi_{t-1}^{\chi_w} w_{j,t-1} \quad (12)$$

From the maximization of the household problem, the optimal wage rate is obtained as eq., (13):

$$\widehat{w}_t = \left(\frac{\tau}{\tau-1}\right) \frac{E_t \sum_{s=0}^{\infty} (\beta\theta_w)^s (\psi L_{t+s}^{1+\gamma}(j))}{E_t \sum_{s=0}^{\infty} (\beta\theta_w)^s (\lambda_{t+s} \prod_{h=1}^{s} (\pi_{t+h-1})^{\chi_w} L_{t+s}(j))} \quad (13)$$

Using equation (13) and wage indexation (12), the law of motion of real wages is obtained as follows:

$$w_t^{1-\tau} = \theta_w (w_{t-1}\pi_{t-1})^{1-\tau} + (1-\theta_w)(\widehat{w}_t)^{1-\tau} \quad (14)$$

In this study, households are assumed to consume two types of goods: domestically produced goods and foreign-produced (imported) goods. Consequently, total household consumption is defined as the aggregate of domestic and foreign consumption. Accordingly, the household's total consumption is given by Equation (15).

$$C_t \equiv \left[(\alpha_c)^{\frac{1}{\eta_c}} (C_t^d)^{\frac{\eta_c-1}{\eta_c}} + (1 - \alpha_c)^{\frac{1}{\eta_c}} (C_t^m)^{\frac{\eta_c-1}{\eta_c}}\right]^{\frac{\eta_c}{\eta_c-1}} \quad (15)$$

In this equation, α_c denotes the share of domestically produced goods in total household consumption, and η_c is the elasticity of substitution between domestic and imported (foreign) goods. C_t^d and C_t^m represent consumption of domestic and imported goods, respectively. The representative household maximizes the consumption aggregator in Equation (15), subject to the budget constraint given in Equation (16), in order to obtain the optimal allocation of expenditures between domestic and imported goods.

$$P_t C_t = P_t^d C_t^d + P_t^m C_t^m \tag{16}$$

In this equation, Pt denotes the consumer price index (CPI), P_t^d is the price index of domestically produced goods, and P_t^m represents the price index of imported goods. The price index for foreign goods is defined in Equation (17).

$$\mathrm{P_t^m = s_t P_t^*} \tag{17}$$

Based on minimizing equation (16), the optimal amount of consumption of domestic and foreign goods is obtained as equations (18) and (19).

$$C_t^d = \alpha_c \left(\frac{P_t^d}{P_t}\right)^{-\eta_c} C_t \tag{18}$$

$$C_t^m = (1-\alpha_c)\left(\frac{P_t^m}{P_t}\right)^{-\eta_c} C_t \tag{19}$$

$$\gamma_t^m = \frac{P_t^m}{P_t} = \frac{S_t P_t^*}{P_t} = er_t \tag{20}$$

Equation (20) defines the real exchange rate. As shown in this equation, the real exchange rate is obtained by multiplying the nominal exchange rate by the foreign price level and dividing it by the domestic price level.

Using Equations (18) and (19) together with the budget constraint in Equation (16), the consumer price index is derived as Equation (21).

$$P_t \equiv [\alpha_c (P_t^d)^{1-\eta_c} + (1-\alpha_c)(P_t^m)^{1-\eta_c}]^{\frac{1}{1-\eta_c}} \tag{21}$$

Household investment in each period depends on the composition of investment in domestic and foreign (imported) capital goods. Accordingly, using a CES aggregation, the total amount of new capital goods in each period is represented by Equation (22).

$$I_t \equiv \left[(\alpha_i)^{\frac{1}{\eta_i}}(I_t^d)^{\frac{\eta_i-1}{\eta_i}} + (1-\alpha_i)^{\frac{1}{\eta_i}}(I_t^m)^{\frac{\eta_i-1}{\eta_i}}\right]^{\frac{\eta_i}{\eta_i-1}} \tag{22}$$

In the above equation, (I_t^d) denotes domestic capital goods, while (I_t^m) represents imported capital goods. η_i is the elasticity of substitution between domestic and foreign capital goods, and α_i is the share of imported capital goods in total investment Households allocate a portion of their income to the purchase of capital goods The optimal allocation of household expenditure between domestic and imported capital goods is determined by Equation (23).

$$P_t I_t = P_t^d I_t^d + P_t^m I_t^m \tag{23}$$

In the above relation, P_t^m , P_t^d, and P_t denote the price index of imported capital goods, the price index of domestically produced capital goods, and the aggregate price index of capital goods, respectively. By optimizing Equation (22) subject to the constraint in Equation (23), the demand functions for domestic and imported capital goods are derived as Equations (24) and (25).

$$I_t^d = (\alpha_i)\left(\frac{P_t^d}{P_t^I}\right)^{-\eta_i} I_t \tag{24}$$

$$I_t^m = (1-\alpha_i)\left(\frac{P_t^m}{P_t^I}\right)^{-\eta_i} I_t \tag{25}$$

By substituting Equations (24) and (25) into Equation (23), the price index of capital goods, $(P_t^I)$is obtained as shown in Equation (26).

$$P_t^I \equiv \left[(\alpha_i){P_t^d}^{1-\eta_i} + (1-\alpha_i){P_t^m}^{1-\eta_i}\right]^{\frac{1}{1-\eta_i}} \tag{26}$$

3-2- Firms producing final goods

In this study, it is assumed that there is a large number of intermediate goods–producing firms, each producing $y_t(i)$ units of output. These intermediate goods are then aggregated into Y_t units of final goods by the representative final goods producer. The production technology of the final goods producer, exhibiting constant returns to scale and incorporating productivity, is specified in Equation (27).

$$Y_{d,t} = \left[\int_0^1 y_{d,t}(i)^{\frac{\varepsilon-1}{\varepsilon}} di\right]^{\frac{\varepsilon}{\varepsilon-1}} \tag{27}$$

In this relation, ε denotes the elasticity of substitution between domestically produced goods. The final goods producer operates in a perfectly competitive market and maximizes profits given the production level specified in Equation (27).

$$max\ P_{d,t}Y_{d,t} - \int_0^1 P_{d,t}(i) y_{d,t}(i) di \tag{28}$$

By solving this optimization problem, the demand for the output of the firm producing the i*th* intermediate good is obtained, as shown in Equation (29).

$$y_{d,t}(i) = \left(\frac{p_{d,t}(i)}{p_{d,t}}\right)^{-\varepsilon} Y_{d,t} \tag{29}$$

After determining the demand in Equation (29), the domestic price index is derived as shown in Equation (30).

$$P_{d,t} = \left(\int_0^1 P_{d,t}^{1-\varepsilon}(i)di\right)^{\frac{1}{1-\varepsilon}} \tag{30}$$

3-3- Intermediate goods producing firms

Each intermediate goods–producing firm utilizes capital and labor according to a Cobb-Douglas production function. Operating in a monopolistically competitive market, the firm sells its output at the price p^w.

$$y_t(i) = z_t(k_{i,t})^{\varphi}(L_{i,t})^{1-\varphi} \tag{31}$$

$$logz_t = \rho_z logz_{t-1} + \varepsilon_t^z \qquad \varepsilon_t^z \sim i.i.d\ N(0,\sigma_z^2) \tag{32}$$

In Equation (31), LLL denotes the amount of labor employed by the firms, and K represents the amount of capital demanded. Equation (32) captures the technology shock affecting production.

Intermediate goods–producing firms face a two-stage optimization problem. In the first stage, to minimize costs given input prices (w_t, and r_t) and the constraint in Equation (31), the firms choose the optimal levels of labor $L_{i,t}$ and capital $K_{i,t}$.

$$\min_{L_{i,t},K_{i,t}} w_t L_{i,t} + r_t K_{i,t} \tag{33}$$

By minimizing the firm's costs subject to the production function constraint, the labor demand function is derived from the first-order conditions, and the firm's final real cost is obtained as follows:

$$P_t^w \frac{dy_t(i)}{dl_t(i)} = w_t \tag{34}$$

$$mc_t = \left(\frac{1}{1-\varphi}\right)^{1-\varphi}\left(\frac{1}{\varphi}\right)^{\varphi}\frac{w_t^{1-\varphi}r_t^{\varphi}}{z_t} \tag{35}$$

In the second stage, intermediate goods–producing firms set prices to maximize their discounted real profits, following the Calvo pricing mechanism. Under this approach, in period t, only a fraction $1-\theta_H$ of firms can optimally adjust their prices, while the remaining θ_H cannot. Firms that are unable to reset their prices are assumed to index them to the previous period's inflation, as described in Equation (36).

$$P_{d,t}(i) = (\pi_{d,t-1})^{\chi_H} P_{d,t-1}(i) \tag{36}$$

In this equation, the coefficient χ_H represents the degree of indexation. A value of $\chi_H = 0$ indicates no indexation, while $\chi_H = 1$ corresponds to full indexation. With probability $s = 1,2, \ldots\ \theta_H^s$ denotes the likelihood that a firm will be unable to adjust its prices for the next s periods. Consequently, the price in period t+s is determined according to Equation (37).

$$P_{d,t+s}(i) = P_{d,t} \prod_{h=1}^{s} \left(\pi_{d,t+d-1}\right)^{\chi H} \tag{37}$$

Therefore, the objective is to determine the price that maximizes the discounted profit of the producing firm, as specified in Equation (38), subject to the constraint in Equation (39).

$$\max_{\tilde{P}_{d,t}} E_t \sum_{s=0}^{\infty} (\beta\theta_H)^s \lambda_{t+s} \left[y_{t+s}(i) \left(\prod_{d=1}^{s} \left(\pi_{d,t+d-1}\right)^{\chi_H} \frac{P_{d,t}}{P_{d,t+s}} - mc_{t+s} \right) \right] \tag{38}$$

$$y_{d,t+s}(i) = \left(\prod_{d=1}^{s} \pi_{d,t+d-1}^{\chi_H} \frac{P_{d,t}}{P_{d,t+s}} \right)^{-\varepsilon} Y_{t+s} \tag{39}$$

Accordingly, the optimal price is derived as shown in Equation (40).

$$P_t = \left(\frac{\eta}{\eta - 1}\right) \frac{E_t \sum_{s=0}^{\infty} (\beta\theta_H)^s \lambda_{t+s} p_{d,t+s} mc_{t+s} y_{d,t+s}(i)}{E_t \sum_{s=0}^{\infty} (\beta\theta_H)^s \lambda_{t+s} \prod_{h=1}^{s} \pi_{t+h-1}^{\chi_H} y_{d,t+s}(i)} \tag{40}$$

3-4- Importing companies

In this study, importing firms are assumed to import two types of goods: foreign consumer goods (C_m) and capital goods (I_m). These firms purchase the goods from world markets at the price P_{it}^* and supply them to the domestic market as final consumer and capital goods. Importing firms operate in a monopolistic market, and domestic prices are subject to stickiness.

Imported final goods (IM_t) are an aggregation of j distinct imported goods supplied by importing firms. The production technology of these firms is specified in Equation (41).

$$IM_t = \left[\int_0^1 IM_t^{\frac{\eta_m - 1}{\eta_m}} (j)\, di \right]^{\frac{\eta_m}{\eta_m - 1}} \tag{41}$$

By solving the optimization problem of the imported goods producers, the demand functions for imported consumer and capital goods are derived as Equations (42) and (43).

$$C_{m,t}(j) = \left(\frac{P_{m,t}(j)}{P_{m,t}} \right)^{-\eta_m} C_{m,t} \tag{42}$$

$$I_{m,t}(j) = \left(\frac{P^{i}_{m,t}(j)}{P^{i}_{m,t}}\right)^{-\eta_m} I_{m,t} \tag{43}$$

By substituting the demand functions in Equations (42) and (43) into Equation (41), the price indices of imported consumer and capital goods are obtained as specified in Equations (44) and (45), respectively.

$$P^{c}_{m,t} = \left(\int_0^1 \left(P^{c}_{m,t}\right)^{1-\eta_m}(j)dj\right)^{\frac{1}{1-\eta_m}} \tag{44}$$

$$P^{i}_{m,t} = \left(\int_0^1 \left(P^{i}_{m,t}\right)^{1-\eta_m}(j)dj\right)^{\frac{1}{1-\eta_m}} \tag{45}$$

Importing firms set their prices to maximize discounted real profits, following the Calvo pricing mechanism. In each period, a fraction $(1-\theta_m)$ of firms importing consumer or capital goods can optimally adjust their prices, while the remaining firms index their prices to the previous period's inflation.

$$P^{c}_{m,t}(j) = \left(\pi_{m,t-1}\right)^{\chi^{c}_{m}} P^{c}_{m,t-1}(j) \tag{46}$$

$$P^{i}_{m,t}(j) = \left(\pi^{i}_{m,t-1}\right)^{\chi^{i}_{m}} P^{i}_{m,t-1}(j) \tag{47}$$

The degree of indexation for these firms is determined by the coefficient $\chi_m \epsilon\ [0,1]$. A value of $\chi_m = 0$ indicates no indexation, in which case prices remain equal to those of the previous period, whereas $\chi_m = 1$ corresponds to full indexation. The importing firm sets $P_{m,t}$ to maximize its expected real profit over time:

$$\max_{P_{m,t}} E_t \sum_{s=0}^{\infty} (\beta\theta_m)^s \lambda_{t+s} \left[C_{t+s}(j)\left(\prod_{d=1}^{s}\left(\pi_{m,t+d-1}\right)^{\chi_F} \frac{P_{m,t}}{P_{m,t+s}} - \psi^{m}_{t+s}\right)\right] \tag{48}$$

According to Equation (49):

$$C_{t+s}(j) = \left(\prod_{d=1}^{s} \pi^{\chi_m}_{m,t+d-1} \frac{P_{m,t}}{P_{m,t+s}}\right)^{-\eta_m} C_{t+s} \tag{49}$$

To determine the optimal price set by importing firms, solving the pricing problem in Equation (44) subject to the constraint in Equation (46) yields the following relationship.

$$P^{c}_{m,t} = \left(\frac{\eta_m}{\eta_m - 1}\right) \frac{E_t \sum_{s=0}^{\infty} (\beta\theta_m)^s \lambda_{t+s} p_{m,t+s} \psi_{m,t+s} C_{t+s}(j)}{E_t \sum_{s=0}^{\infty} (\beta\theta_m)^s \lambda_{t+s} \prod_{d=1}^{s} \pi^{\chi_m}_{t+d-1} C_{t+s}(j)} \tag{50}$$

Based on this, the price dynamics of imported goods are obtained as shown in Equation (51).

$$\left(P_{m,t}^{c}\right)^{1-\eta_m} = \theta_m\left(\left(\pi_{m,t-1}\right)^{\chi_m} P_{m,t-1}^{c}\right)^{1-\eta_m} + \left(1-\theta_m\right)\left(P_{m,t}^{c}\right)^{1-\eta_m} \quad (51)$$

Similarly, the price of imported capital goods is determined based on Equations (52) and (53).

$$P_{m,t}^{I} = \left(\frac{\eta_m^I}{\eta_m^I - 1}\right)\frac{E_t\sum_{s=0}^{\infty}(\beta\theta_m^I)^s\lambda_{t+s}p_{m,t+s}^{I}\psi_{m,t+s}^{I}I_{t+s}(j)}{E_t\sum_{s=0}^{\infty}(\beta\theta_m^I)^s\lambda_{t+s}\prod_{h=1}^{s}\pi_{t+d-1}^{\chi_m^I}I_{t+s}(j)} \quad (52)$$

$$\left(P_{m,t}^{I}\right)^{1-\eta_m} = \theta_F^I\left(\left(\pi_{F,t-1}^{I}\right)^{\chi_F^I} P_{F,t-1}^{I}\right)^{1-\eta_m^I} + \left(1-\theta_F^I\right)\left(P_{F,t}^{I}\right)^{1-\eta_m^I} \quad (53)$$

3-5-Export goods companies

In this study, exports are categorized into two types: oil exports (OX) and non-oil exports (NOX). In the non-oil export sector, it is assumed that there are multiple exporting firms that purchase domestically produced goods from final goods producers at the price level P_t^d and sell them abroad as differentiated products at the export price level $P_t^x(j)$. The demand function for non-oil export goods of firm j, at the export price P_t^x, is given by Equation (54).

$$NOX_t(j) = \left(\frac{P_t^x(j)}{P_t^*}\right)^{-\eta_x} y_t^* \quad (54)$$

In the above equation, π_t^* represents global inflation, and y_t^* denotes foreign income. Both are assumed to follow an AR (1) process, specified as follows.

$$\log\pi_t^* = \rho_0\log\pi_{t-1}^* + \varepsilon_t^{P^*} \qquad \varepsilon_t^{P^*} \sim i.i.d\ N\left(0,\sigma_{P^*}^2\right) \quad (55)$$

$$\log y_t^* = \rho_0\log y_{t-1}^* + \varepsilon_t^{y^*} \qquad \varepsilon_t^{y^*} \sim i.i.d\ N\left(0,\sigma_{y^*}^2\right) \quad (56)$$

Exporting firms set their prices to maximize discounted real profits, following the Calvo pricing mechanism. In each period, a fraction $1-\theta_x$ of firms can optimally adjust their prices, while the remaining firms index their prices to the previous period’s inflation.

$$P_t^x(j) = (\pi_{t-1}^x)^{\chi_x} P_{t-1}^x(j) \quad (57)$$

In the above relation, $\chi_x \in [0,1]$ represents the degree of indexation. A value of $\chi_x = 1$ corresponds to full indexation, while $\chi_x = 0$ indicates no indexation.

Exporting firms set their prices to maximize expected real profits over time. Accordingly, P_t^x denotes the optimal price chosen by all adjusting firms in period t, and the dynamics of export prices are determined based on Equations (58) and (59).

$$P_t^x = \left(\frac{\eta_x}{\eta_x - 1}\right) \frac{E_t \sum_{s=0}^{\infty} (\beta\theta_x)^s \lambda_{t+s} p_{t+s}^x \psi_{t+s}^x NOX_{t+s}(j)}{E_t \sum_{s=0}^{\infty} (\beta\theta_x)^s \lambda_{t+s} \prod_{d=1}^{s} \pi_{t+d-1}^{\chi_x} NOX_{t+s}(j)} \tag{58}$$

$$(P_t^x)^{1-\eta_x} = \theta_x \left((\pi_{t-1}^x)^{\chi_x} P_{t-1}^x\right)^{1-\eta_x} + (1-\theta_x)(P_t^x)^{1-\eta_x} \tag{59}$$

3-6-Oil sector

In this study, it is assumed that, in each period, a state-owned enterprise produces Y_t^{oil} units of oil. Total output comprises both oil and non-oil production, whereη_0 denotes the elasticity of substitution between oil and non-oil outputs, and α_0 represents the share of oil production in total output.

$$Y_t = \left[(\alpha_0)^{\frac{1}{\eta_0}} (Y_t^{oil})^{\frac{\eta_0 - 1}{\eta_0}} + (1-\alpha_0)^{\frac{1}{\eta_i}} (Y_t^{n0il})^{\frac{\eta_0 - 1}{\eta_0}}\right]^{\frac{\eta_0}{\eta_0 - 1}} \tag{60}$$

In this equation, Y_t^{0il} represents the value added of the oil sector, which is assumed to follow an AR (1) process, specified as follows.

$$logY_t^{oil} = \rho_0 logY_{t-1}^{oil} + \varepsilon_t^{Y^{oil}} \qquad \varepsilon_t^{Y^{oil}} \sim i.i.d\ N\left(0, \sigma_{Y^{oil}}^2\right) \tag{61}$$

3-7-Government and Central Bank

In this model, the government finances its expenditures through tax collection, bond issuance, and oil revenues. When the government budget is balanced, the central bank conducts monetary policy independently of the government's budget constraint. However, if a budget deficit arises despite these revenue sources, the government covers the deficit by borrowing from the central bank or by drawing down its deposits held at the central bank. Mathematically, the government budget constraint is represented as in Equation (62).

$$\frac{G_t}{P_t} + (1 + r_{t-1}^b)\frac{B_{t-1}}{P_t} + \frac{TR_t}{P_t} = \frac{T_t}{P_t} + \frac{B_t}{P_t} + \left(\frac{M_t - M_{t-1}}{P_t}\right) \tag{62}$$

Here, G_t denotes government spending, $\left(1+r_{t-1}^{b}\right)\frac{B_{t-1}}{P_t}$ represents interest payments on government bonds, TR_t is subsidies, T_t denotes taxes, B_t is bond issuance, and $\frac{M_t-M_{t-1}}{P_t}$ captures changes in the monetary base. The monetary base corresponds to the central bank's balance sheet, specified in Equation (63), with its dynamics determined by Equation (64).

$$M_t = DC_t + er_t FR_t \tag{63}$$

$$M_t - M_{t-1} = DC_t - DC_{t-1} + er_t(FR_t - FR_{t-1}) + fr_t(er_t - er_{t-1}) \tag{64}$$

In this equation, DC_t denotes domestic credit, er_t is the nominal exchange rate, and FR_t represents foreign reserves, i.e., the central bank's net foreign assets converted into domestic currency using the exchange rate er_t. Expressing Equation (64) in real terms yields Equation (65).

$$m_t = dc_t + er_t fr_t \tag{65}$$

Here, m_t and dc_t are adjusted by the domestic price index P_t, while fr_t is adjusted by the foreign price index P_t^*. It is assumed that the accumulation of foreign assets by the central bank follows the process specified in Equation (66).

$$FR_t = FR_{t-1} + P_t^*(OX_t + NOX_t - IM_t) \tag{66}$$

By adjusting this equation for the foreign price index P_t^*, the accumulation of real foreign reserves is expressed as in Equation (67).

$$fr_t = \frac{fr_{t-1}}{P_t^*} + (OX_t + NOX_t - IM_t) \tag{67}$$

According to Manzoor and Taghipour (2015), government tax revenue comprises value-added tax T_t^{vat} and other taxes T_t^{d}. The value-added tax is modeled as a function of total final consumption (both government and private), while other taxes depend on total national income. Therefore,

$$logT_t^{vat} = \tau^{vat}\log(c + g + x - Im) \tag{68}$$

$$logT_t^{d} = \tau^{vat} logy \tag{69}$$

$$T = T_t^{d} + T_t^{vat} \tag{70}$$

3-8-Monetary and exchange rate policies

In this study, the central bank (monetary authority) is assumed to pursue three objectives: controlling the inflation rate, stabilizing output, and maintaining the real exchange rate. To achieve these objectives, the central bank employs two instruments: managing the foreign exchange market (through nominal exchange rate growth) and controlling the growth rate of the monetary base. Since the interest rate in Iran is administratively set, it cannot serve as a policy instrument. The monetary authority determines the growth rate of the monetary base so as to minimize deviations from its targets: the deviation of output from its steady-state level, the deviation of inflation from the target rate, and the deviation of the real exchange rate from its steady-state value. Although the Central Bank of Iran does not formally adopt an inflation-targeting framework, it maintains a reference level of inflation in each period, effectively implementing an implicit form of inflation targeting. Accordingly, the target inflation is assumed to follow a first-order autoregressive process, as specified in Equations (71) and (72), with the coefficient ρ^{π^T} close to one. Here, $d\dot{c}_t$ denotes the domestic credit growth rate, π_t is the actual inflation rate, π_t^T is the target inflation, Y_t is output, and e_t is the real exchange rate. Y and e_r represent the steady-state values of output and the real exchange rate, respectively.

$$\frac{d\dot{c}_t}{d\dot{c}} = \left(\frac{d\dot{c}_{t-1}}{d\dot{c}}\right)^{h_0} \left(\frac{\pi_t}{\pi_t^T}\right)^{h_1} \left(\frac{Y_t}{Y}\right)^{h_2} \left(\frac{er_t}{er}\right)^{h_3} \quad (71)$$

$$log\pi_t^T = \rho^{\pi^T} log\pi_{t-1}^T + \varepsilon_t^{\pi^T} \qquad \varepsilon_t^{\pi^T} \sim i.i.d\ N\left(0, \sigma^2{}_{\pi^T}\right) \quad (72)$$

In this context, h_0, h_1, h_2,and h_3 represent the central bank's sensitivities, respectively, to maintaining a stable growth rate of the monetary base, targeting inflation, minimizing deviations of output from its equilibrium level, and stabilizing the real exchange rate. Under a managed floating exchange rate regime, the central bank can employ two policy instruments—monetary base growth and nominal exchange rate adjustments—through systematic and legally authorized interventions in the domestic money and foreign exchange markets. In the foreign exchange market, the central bank responds to deviations of inflation from its target, output from its equilibrium level, and the real exchange rate from its steady-state value. This policy reaction is formalized through the behavioral rules specified in Equations (73) and (74).

$$d_t = \frac{s_t}{s_{t-1}} \quad (73)$$

$$\frac{\dot{d}_t}{\dot{d}} = \left(\frac{\dot{d}_{t-1}}{\dot{d}}\right)^{k_0} \left(\frac{\pi_t}{\pi_t^T}\right)^{k_1} \left(\frac{Y_t}{Y}\right)^{k_2} \left(\frac{er_t}{er}\right)^{h_3} \left(\frac{er_t fr_t}{Y_t}\right)^{k_4} \quad (74)$$

Here, d_1 represents the growth rate of the nominal exchange rate S_t. The coefficients K_0, K_1, K_2, K_3 and K_4 capture the central bank's sensitivities, respectively, to changes in the nominal exchange rate from the previous period, the target inflation rate, deviations of output from its long-run equilibrium, stabilization of the real exchange rate, and maintaining a constant ratio of foreign exchange reserves to GDP. Under a floating exchange rate regime, the central bank does not intervene in the foreign exchange market, and the balance of payments remains in equilibrium. Consequently, foreign reserves are constant across periods, exchange rate policy is removed from the model, and $fr_t = fr_{t-1}$ is substituted. In a fixed exchange rate regime, the central bank intervenes in the foreign exchange market to stabilize the nominal exchange rate, and monetary policy based on the nominal growth of the money supply is deactivated. Accordingly, $d_t = d_{t-1}$ is imposed in the model. In this regime, the central bank reacts only to exchange rate fluctuations and cannot actively target output or inflation, rendering monetary policy passive. In a managed floating exchange rate regime, the central bank intervenes in the bond market, the money market, and the foreign exchange market. As a result, both policy reaction functions are incorporated into the model.

3-9-Market equilibrium condition

In the market equilibrium, aggregate supply equals aggregate demand. By combining the consumer and government budget constraints with the central bank's balance sheet, the market clearing condition is expressed as in Equation (75).

$$Y_t = C_t + I_t + G_t + X_t - IM_t \tag{75}$$

4-Analysis of results

4-1-Estimation of model

The parameters of the model are determined using a calibration approach. Three types of parameters are considered in this study:

1. Parameters derived from official statistics: These are obtained from the Statistical Center of Iran.
2. Parameters from previous studies: These include values reported in the literature relevant to the Iranian economy or similar economies.
3. Parameters based on moment matching: These parameters are selected to ensure that the model reproduces key statistical properties (moments) of macroeconomic variables observed in the real economy.

The analysis is conducted using quarterly data on Gross Domestic Product (GDP at 2016 constant prices), consumption, and investment. The data are obtained from the Central Bank of the Islamic Republic of Iran for the period 2014–2022 (corresponding to Iranian calendar years 1393–1401).

To prepare the data for model estimation, the logarithm of each series was taken, followed by detrending using the Hodrick-Prescott (HP) filter. Before analyzing the dynamic responses of the model, ratios that do not require estimation are examined. Table 1 presents the calibrated ratios and parameter values used in the computations.

Table (1): Calibrated data of the model based on Iranian economic data

Amount	Variable	Amount	Variable	Amount	Variable
0.32	$\frac{\bar{I}}{\bar{y}}$	0.23	$\frac{\bar{x}}{\bar{y}}$	0.7	$\frac{\overline{cm}}{\overline{im}}$
0.48	$\frac{\bar{c}}{\bar{y}}$	0.18	$\frac{\bar{g}}{\bar{y}}$	0.18	$\frac{\overline{im}}{\bar{y}}$
0.7	$\frac{\overline{xo}}{\bar{x}}$	1.7	$\frac{\overline{xo}}{\overline{fr}}$	1.5	$\frac{\overline{im}}{\overline{fr}}$
0.3	$\frac{\overline{Im}}{\overline{im}}$	0.3	$\frac{\overline{xno}}{\bar{x}}$	0.3	$\frac{\overline{xno}}{\overline{fr}}$
0.41	$\frac{\overline{dc}}{\bar{m}}$	0.69	$\overline{\gamma^{Im}}$	1.28	$\overline{\gamma^{m}}$
0.59	$\frac{\overline{erfr}}{\bar{m}}$	0.89	$\overline{\gamma^{Id}}$	0.97	$\overline{\gamma^{d}}$

Source: Research calculations

Table (2) shows the calibrated parameters.

Table (2): Calibrated parameters of the model

Symbol	Title	Amount	Source
η_c	Elasticity of substitution between imported and domestic consumer goods	0.8	Research calculations
α_c	Consumption shares of domestic goods	0.44	Balonejad (2014)
η_i	Elasticity of substitution between imported and domestic capital goods	0.8	Research calculations
α_i	Share of domestic production investment in total investment	0.68	Keshavarz (2019)
φ	Capital's share in production	0.41	Farzin Vash et al. (2015)
η	Interperiodic elasticity of consumption	1.14	Tavakolian and Afzali Abarqoei (2016)
δ	Depreciation rate	0.042	Ebrahimi (2010)
θ	Percentage of firms that cannot adjust their prices.	0.58	Komijani et al. (2012)
β	Consumer time preference rate	0.96	Tavakolian and Afzali Abarqoei (2016)
ρ_g	Government expenditure autoregressive process coefficient	0.03	Research calculations
ρ_o	Oil autoregressive process coefficient	0.8	Research calculations
ρ_d	The process of autoregression of exchange rates	0.08	Research calculations
ρ_m	Autoregressive process coefficient	0.08	Research calculations

	of money growth rate		
ρ_z	Productivity autoregressive process coefficient	0.5	Research calculations
h_2	The importance coefficient of production in the monetary policy reaction function	-2.85	Tavakolian and Afzali Abarqoei (2016)
h_3	The importance coefficient of the real exchange rate in the monetary policy response function	0.02	Tavakolian and Afzali Abarqoei (2016)
k_3	The importance coefficient of the real exchange rate in the monetary policy response function	-2.057	Tavakolian and Afzali Abarqoei (2016)
k_4	The importance coefficient of the real exchange rate in the monetary policy response function	-0.73	Tavakolian and Afzali Abarqoei (2016)

4-2- Standard deviation of the main variables of the model

In this section, the results of the model are analyzed in two ways. In the first stage, the standard deviation of the main variables of the model is examined by considering different scenarios. Then, the instantaneous response functions are analyzed and examined in three different scenarios including fixed, floating and managed floating exchange rate regimes. In Table (3), the standard deviation of important macro variables in three different scenarios was examined.

Table (3): Comparison of model-derived moments and real data moments

Variables	Real	Simulated
Production	0.06	0.05
Investment	0.17	0.20
Consumption	0.06	0.057

Source: Research calculations

4-3-Analysis of impulses response functions

After calibrating the model parameters, the next step involves examining the impact of various shocks on macroeconomic variables. Specifically, the effects of oil revenue shocks, exchange rate shocks, and foreign price shocks under three exchange rate regimes—fixed, managed floating, and floating—are analyzed on key macroeconomic indicators including output, consumption, investment, and employment.

Oil Revenue Shocks:

The impulse response functions (IRFs) of macroeconomic variables to oil revenue shocks are shown in Figure 1. The results indicate that oil shocks have a positive effect on output across all three exchange rate regimes. The impact is largest under the fixed exchange rate regime, with effects fully adjusted after approximately 15 periods. Under the managed floating exchange rate regime, the positive impact on output is adjusted after

around 11 periods. In contrast, the effect of the oil shock on output under a floating exchange rate regime is relatively small.
The mechanism behind this result can be summarized as follows:
An oil revenue shock initially increases government income, which improves the balance of payments. Consequently, the central bank’s net foreign reserves increase. The subsequent provision of foreign exchange by the central bank leads to a decrease in the nominal exchange rate. Over time, as foreign reserves are converted into domestic currency, both the money supply and the exchange rate adjust. The resulting increase in imports of capital and intermediate goods stimulates production. These findings are consistent with theoretical expectations and align with the results of Tavakolian and Afzali (2016).

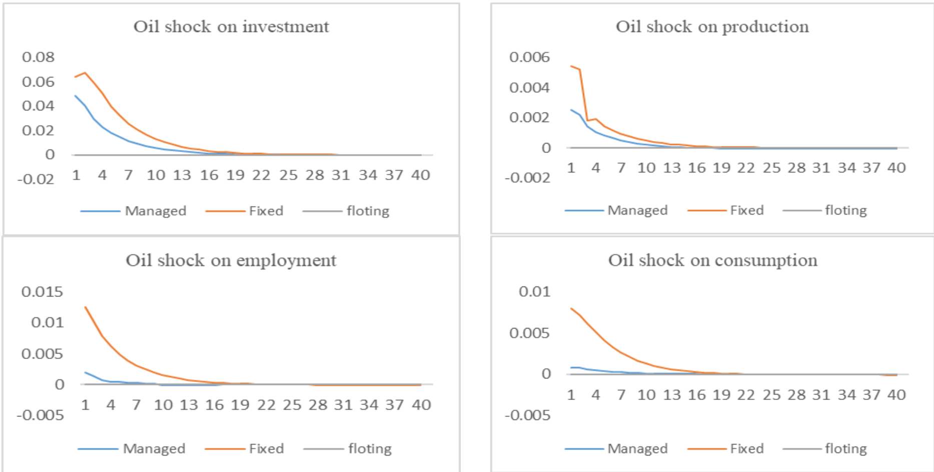

Figure (1): Instantaneous response functions of oil shock on macro variables
Source: Research calculations

Regarding investment, oil revenue shocks have a positive effect under all three regimes, although the magnitude is smallest in the floating exchange rate system. The adjustment period is longest under the fixed exchange rate regime (about 17 periods), followed by the managed floating regime (approximately 15 periods). The effect of oil shocks on employment is also positive, particularly under the fixed exchange rate regime. The increase in oil revenues stimulates enterprise production, which in turn raises employment opportunities. The employment response is largest under the fixed regime, moderate under the managed floating regime, and smallest under the floating regime. Adjustment occurs after roughly 17 periods in the fixed regime and after 6 periods in the managed floating regime.

Finally, consumption responds positively to oil revenue shocks in all three exchange rate regimes. The increase is largest under the fixed exchange rate regime, followed by the managed floating regime. This result can be explained by the rise in total national income following the oil revenue shock, which directly boosts household consumption.

The impulse response functions of the impact of the foreign inflation shock on macroeconomic variables are shown in Figure (2). The effect of the foreign inflation shock on production in all three exchange rate systems was positive and increased domestic production. In the two fixed and managed floating exchange rate systems, the effect of this shock disappeared in periods 4 and 3. However, in the floating exchange rate system, production initially increased but decreased in the next stage. The reason for this could be that initially, with the increase in foreign inflation, the demand of foreigners for domestically produced goods increased and stimulated domestic demand. In the next stage, in response to the increase in demand and in response to it, the amount of production and exports increased. However, as production and exports increased and foreign exchange entered the country, the exchange rate decreased and the volume of exports and production decreased.

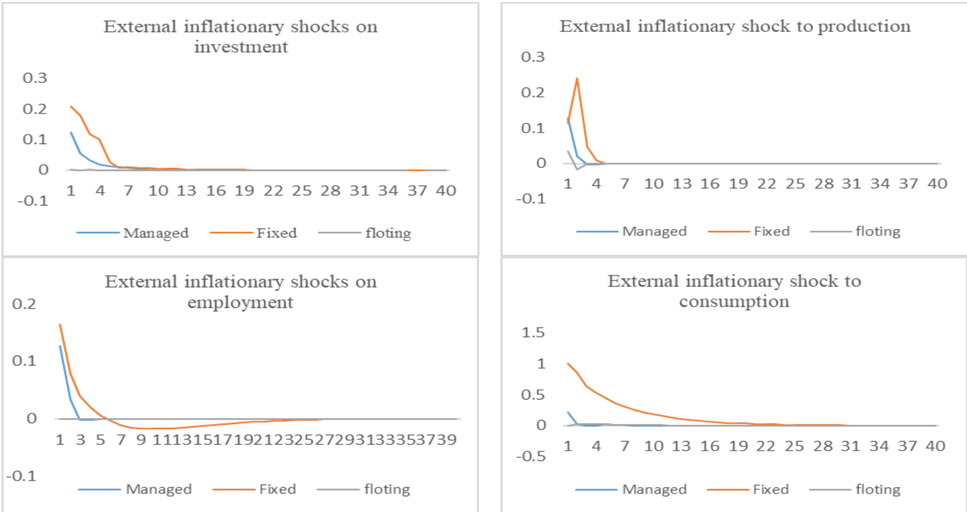

Figure (2): Impulse response functions of foreign inflation on macro variables
Source: Research calculations

The impulse response functions (IRFs) of macroeconomic variables to foreign inflation shocks indicate that such shocks have a positive effect on investment in both fixed and managed floating exchange rate regimes. In the floating exchange rate regime, the impact on investment is positive but relatively insignificant. This muted effect may be attributed to the increase in foreign prices, which raises the cost of imported capital goods needed by domestic producers, thereby limiting the expansion of investment.

Regarding employment, the foreign inflation shock leads to a positive response under the managed floating exchange rate regime, with employment increasing. The effect of the shock on employment in both the fixed and managed floating regimes stabilizes after approximately three periods. Similarly, consumption rises in response to foreign inflation shocks across all three exchange rate regimes.

The IRFs of macroeconomic variables to exchange rate shocks are presented in Figure 3. The results show that an exchange rate shock positively affects output across all three exchange rate regimes. This impact operates through both exports and imports: an exchange rate depreciation increases the cost of imported intermediate goods, initially reducing consumer and capital imports, which dampens investment. At the same time, higher competitiveness boosts exports and encourages fuller utilization of domestic production capacity, thereby increasing output. Over time, however, the positive effect diminishes due to the negative impact on capital imports and investment. The response of output is largest under a fixed exchange rate regime, followed by a managed floating regime.

The effect of exchange rate shocks on employment differs across regimes. Under the fixed exchange rate system, employment increases due to higher production and expanded utilization of existing capacities, leading to lower unemployment. Conversely, in both the managed floating and floating exchange rate regimes, the effect on employment is negative, reflecting the adverse consequences of reduced capital imports and investment. Overall, employment fluctuations are most pronounced under a fixed exchange rate regime, and smaller under managed floating and floating regimes.

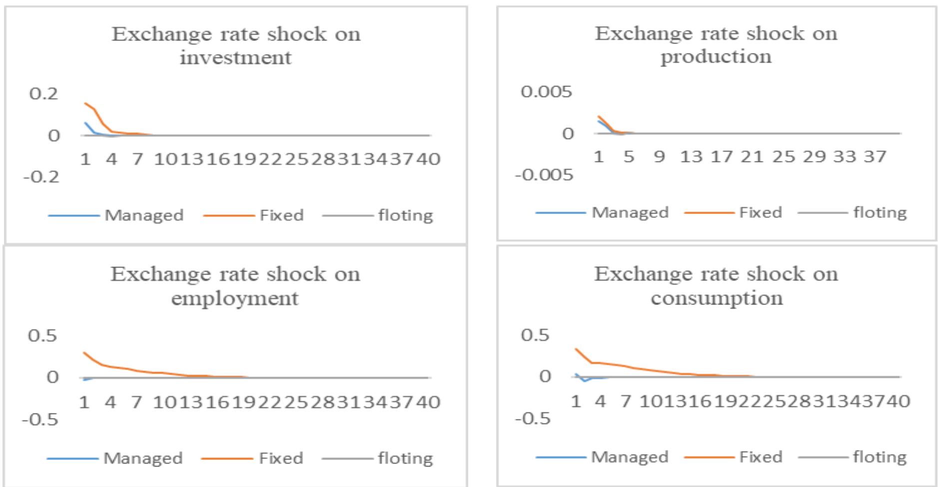

Figure (3): Impulse response functions of exchange rate shock on macro variables

Source: Research calculations

The effect of exchange rate shocks on consumption was positive in all three exchange rate regimes and has led to an increase in consumption. Exchange rate shocks initially increase exports and production, and then consumption also increases. Consumption fluctuations in a fixed exchange rate regime are greater than in a managed floating exchange rate regime. Also, these fluctuations in a managed floating exchange rate regime are greater than in a floating exchange rate regime.

5- Summary and conclusion:

This study employed a Dynamic Stochastic General Equilibrium (DSGE) model to examine the effects of foreign shocks on the labor market under different exchange rate regimes in Iran. The model equations were first optimized and log-linearized, then calibrated using real quarterly data from the Iranian economy. The analysis focused on the impulse response of key macroeconomic variables—production, investment, consumption, and employment—to three types of foreign shocks: oil revenue shocks, foreign inflation shocks, and exchange rate shocks.

The results indicate that oil revenue shocks have a positive impact on production across all three exchange rate regimes, with the largest effect observed under the fixed exchange rate system, followed by the managed floating regime, and the smallest effect under the floating regime. The impact of oil revenue shocks on employment was similarly positive, reflecting the expansion of production and job opportunities. Again, the magnitude of this effect was greatest under the fixed exchange rate regime and smallest under the floating regime.

Foreign inflation shocks also had a generally positive effect on production, investment, and employment across all regimes, although the magnitude of the response varied, with the fixed exchange rate system showing a distinct pattern compared to the other two systems. Exchange rate shocks positively influenced output and employment in all regimes. The mechanism behind this effect is through increased exports and more intensive utilization of existing production capacities, which in turn generates additional employment opportunities.

Overall, the findings suggest that the labor market in Iran responds differently to foreign shocks depending on the exchange rate regime. The fixed exchange rate system amplifies the positive effects of external shocks on both production and employment, whereas the floating regime tends to dampen these effects. The managed floating exchange rate system provides intermediate outcomes, balancing stability with responsiveness. These results highlight the importance of exchange rate policy in shaping macroeconomic and labor market responses to external shocks in an oil-dependent economy.

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اثر شوک‌های خارجی بر اشتغال در رژیم‌های مختلف ارزی با فرض چسبندگی قیمت‌ها و دستمزد

چکیده:
بر اساس ادبیات اقتصادی انتخاب رژیم های مختلف ارزی بر نحوه اثرگذاری سیاستهای مختلف موثر است. در این مطالعه اثر شوک‌های خارجی بر شامل شوک قیمت نفت، شوک تورم خارجی و شوک نرخ ارز بر اشتغال تحت سه رژیم نرخ ارز شناور، ثابت و شناور مدیریت شده مورد بررسی قرار می‌گیرد. این مطالعه از مدل تعادل عمومی پویای تصادفی (DSGE) استفاده می کند که شامل خانوارها، بنگاه‌ها، دولت سیاستگذار پولی و بخش خارجی است. نتایج توابع واکنش آنی دلالت بر این دارد که شوک نفت اثر مثبتی بر اشتغال در هر سه نوع رژیم نرخ ارز دارد و منجر به سطح اشتغال بالاتری می‌شود. اثر مثبت شوک تورم خارجی بر اشتغال در رژیم نرخ ارز ثابت قوی تر از دو رژیم شناور و شناور مدیریت شده است. بعلاوه، شوک نرخ ارز در رژیم نرخ ارز ثابت موجب افزایش اشتغال می‌شود، در حالی که در دو رژیم نرخ شناور و شناور مدیریت شده موجب کاهش اشتغال میشود.

کلمات کلیدی: شوک خارجی، اشتغال، مدل DSGE، رژیم نرخ ارز.
طبقه بندی JEL : C60, j10, j60 , F31