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RESEARCH PAPER

Investigating the Effect of Financial and Monetary Policy on the Iranian Stock Market by Using DSGE Model

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Abstract
This paper uses a dynamic stochastic general equilibrium model to investigate the effect of fiscal and monetary policy on the stock market in Iran. Results show that a positive money shock leads to a rise in output, stock price index, and inflation. In addition, the response of the stock demand to money supply shock is negative. We found that a positive government expenditure shock led to a rise in output and inflation. The response of stock demand and stock price index to the government expenditure shocks are negative. Furthermore, results show that a stock market shock leads to a rise in output and inflation.
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Introduction

This paper aims to examine the effects of fiscal and monetary policy on the stock market in Iran. During the last decade, the Stock market has played a more important role in the Iranian economy than in the past. This market has experienced an unstable stock price index (Bashiri et al., 2016). Given the fledgling capital market in Iran as well as the bank-centric financing system, we need to investigate further the effects of monetary and fiscal policies on the financial system and capital market in Iran. In the Iranian economy, whenever investment risks change due to the volatility of the economic variables, it can drastically change investment options. Empirical evidence in the Iranian economy shows that equity in the stock market responds quickly to macroeconomic changes.

A look at the securities market in Iran in recent years, the Iranian stock market has been subject to increasing and decreasing stock price volatility. The stock price index and the current market value of stocks, which is one of the published indexes, have also had major fluctuations. It can be argued that the importance of the capital market sector in the economy as a whole is increasing, and has the potential to have a major impact on the economy as one of the most important channels of financing and resource allocation in the future. Therefore, policymakers need to be aware of how this market can affect the economy and avoid financial instability and consequently economic instability by using appropriate policies.

Increasing the importance of the stock market in Iran has not only the relative efficiency reasons but also there are other reasons such as government attention to the stock market as a tool to simplify privatization of state-owned companies that have significant effects on the stock market's growth and development (Khodaparasti, 2014).

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Considerable researches have studied the relationship between monetary policy and stock market performance (see Bjornland and Leitemo, 2009; Giorgio and Nistico, 2005; Nistico, 2009; 2012; 2014; Castelnuovo and Nistico, 2010; Castelnuovo, 2013; Ravn, 2013; Gali and Gertler, 2007), but only a few have investigated the effect of fiscal policy on stock markets (e.g. Afonso and Sousa, 2011; 2012; Agnello and Sousa, 2010; Darrat, 1988; Jansen et al., 2008).

Monetary policy officials in their effort to maintain low inflation, mainly influence the interest rate. Given this, it is argued that stances of monetary policy can influence the stock market return through five possible channels: (i) the interest rate channel, (ii) the credit channel, (iii) the wealth effect, (iv) the exchange rate channel, and (v) the monetary channel (Chatziantoniou et al., 2013). While monetary policy is designed to affect macroeconomic, those policies, as monetary shocks, also affect the stock market indirectly. Moreover, these effects on the stock market are significantly different during various periods and market cycles (Guo et al., 2013).

Also, fiscal policy stances can influence the stock market performance. Whether the government fiscal deficit affects the stock market activity has been a matter of concern among financial economists. While some argue that fiscal policy actions do not affect the stock market activity due to the efficiency of stock markets, others disagree and insist that fiscal deficits may affect the stock market activity through changes in the interest rate that triggers a portfolio revaluation by investors. The classical economic theory focuses on the crowding-out effects of fiscal policy in the market for loanable funds and the productive sectors of the economy. Hence, fiscal policy can potentially drive the stock prices to lower through the crowding out of private sector activity (Chatziantoniou et al., 2013).

The remainder of this paper is organized as follows. Section 2 presents the DSGE model with nominal and real rigidities. Section 3 describes the results of calibration and impulse responses. Section 4 contains concluding remarks.

The Model

This model's basic structure is inspired by Giorgio and Nistico (2005), Nistico (2009, 2012, 2014), Castelnuovo and Nistico (2010), Castelnuovo (2013), and Ravn (2013). It is assumed that the economy is populated by a representative household, a representative final-good-producing firm, a continuum of intermediate-good-producing firms indexed by $\mathrm{J}\epsilon(0.1)$, the government, and the central bank.

Household

Following Ireland (1997) and Kim (2000), the representative household derives utility from consumption (c_t), real money balances ($\frac{M_t}{P_t}$), and labor (l_t), and thus, we assume that all individuals have the same portfolio of risky assets and homothetic preferences (unitary income elasticity for all goods, unitary wealth elasticity for all assets, and same human characteristics such as envy, jealousy, and altruism). As all households are identical, the household's preferences are described by the expected utility function:

$$E_0 \sum_{t=0}^{\infty} \beta^t U\left(c_t . \frac{M_t}{P_t} . l_t\right) \tag{1}$$

where $0 < \beta < 1$ is the discount factor. It is assumed that the single-period utility function is specified as:

$$U\left(c_t.\frac{M_t}{P_t}.l_t\right) = \frac{c_{it}^{1-\sigma}-1}{1-\sigma} + \frac{1}{1-b}\left(\left(\frac{M_{it}}{P_t}\right)^{1-b} - 1\right) - \frac{1}{1+\nu}(l_{it}^{1+\nu} - 1) \tag{2}$$

where σ is the inverse of the intertemporal elasticity of substitution, b is the inverse of the wage elasticity of labor supply, and ν is the inverse of the money demand elasticity. The single utility function, U, is supposed to be strictly concave, strictly increasing in c_t and m_t, and strictly decreasing in L_t. Since all households are identical, they shall solve the following utility maximization problem:

$$\max U = E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{c_{it}^{1-\sigma}-1}{1-\sigma} + \frac{1}{1-b}\left(\left(\frac{M_{it}}{P_t}\right)^{1-b} - 1\right) - \frac{1}{1+\nu}(l_{it}^{1+\nu} - 1)\right] \tag{3}$$

subject to the relevant budget constraint.

Household financial assets consist of money, bonds, and stocks. Bonds have interest-bearing s with an interest rate of r_t^d, and stocks have dividend profit shares and return on equity due to the price changes. Therefore, the sample household at the beginning of period t has a M_{t-1} unit of money that has been transferred from the previous period, and on the other hand has revenues from the supply of labor, capital and debt securities, and stocks. It is assumed that the household has a basket of shares of N_t (j) issued by the j-intermediary firm, and that the market price of each share in the period t is equal to $P_t^s(j)$, and its dividend is worth $DV_t(j)$. Therefore, at the beginning of each period, household income sources include the net rental of capital, wages, and collections of financial assets of the previous period. To model the stock assets in this paper, Nistico studies will be used. Therefore, the stock of the j household from the previous period is defined as follows:

$$\Omega_{t-1}^{*j} = \int_0^1 \left(P_t^s(j) + DV_t(j)\right) N_{i(t-1)}(j)dj \tag{4}$$

So, the budget constraint household of real prices will be:

$$\begin{aligned} c_t + i_t + \frac{M_t}{P_t} + \frac{B_t}{P_t} + \frac{1}{P_t}\int_0^1 \frac{P_t^s(j)N_t(j)}{\omega_t^s}dj + \frac{T_t}{P_t} \\ = \left(\frac{W_t}{P_t}\right)l_t + \left(\frac{R_t}{P_t}\right)k_t + \frac{M_{t-1}}{P_t} + \frac{(r_{t-1}^d)B_{t-1}}{P_t} + \frac{1}{P_t}\Omega_{t-1}^{*j} \end{aligned} \tag{5}$$

ω_t^s is the stock price shock as defined as follows:

$$\ln\omega_t^s = \rho_s \ln\omega_{t-1}^s + \varepsilon_{st} \tag{6}$$

ω_t^s is normalized to one at steady-state. The firm's capital stock evolves according to Equation 7:

$$K_{t+1} = (1-\delta)K_t + i_t \tag{7}$$

where δ is the capital depreciation rate.

The solution gives the following first-order conditions:

$$c_t^{-\sigma} = \beta(1 + r_t^d)E_t\left(\frac{c_{t+1}^{-\sigma}}{\pi_{t+1}}\right) \tag{8}$$

$$c_t^{-\sigma} - \lambda_t = 0 \tag{9}$$

$$m_t^{-b} = c_t^{-\sigma}\left(\frac{r_t^d}{1 + r_t^d}\right) \tag{10}$$

$$l_t^{\nu} = c_t^{-\sigma}\left(\frac{W_t}{P_t}\right) \tag{11}$$

$$\gamma_{st} = \omega_{st}E_t\left(\frac{\pi_{t+1}}{1 + r_t^d}(\gamma_{st+1} + dv_{t+1})\right) \tag{12}$$

$$\frac{\gamma_{st}}{\gamma_{st-1}} = \frac{\pi_{st}}{\pi_t} \tag{13}$$

$$E_t\left(\frac{1 + r_t^d}{\pi_{t+1}}\right) = E_t\big((1-\delta) + r_{t+1}\big) \tag{14}$$

$$K_{t+1} - (1-\delta)K_t - i_t = 0 \tag{15}$$

$$ln\omega_t^s = \rho_s ln\omega_{t-1}^s + \varepsilon_{st} \tag{16}$$

where $\pi_t = \frac{P_t}{P_{t-1}}$ and $\gamma_{st} = \frac{P_{st}}{P_t}$.

Final Goods Firms

The representative final-good-producing firm sells its output (yt) on a perfectly competitive market at the price pt. On the other hand, each intermediate-good-producing firm produces a distinct, perishable intermediate good (yjt) that sells in the monopolistically competitive market at the price pjt. The intermediate-good producing firm pays two distinct finite costs when it adjusts its nominal price and labor input. There is a chain of final good producers operating under perfect competition. The firm produces the final good by continuum, combining retail goods and using CES technology:

$$\left[\int_0^0 Y_t(j)^{\frac{\mu-1}{\mu}} dj\right]^{\frac{\mu}{\mu-1}} \geq Y_t \tag{17}$$

where μ governs the degree of substitution between types of goods. The representative firm takes the price of final goods P_t and the price of retail goods $P_t(j)$ as given. Profit maximization leads to the following first-order condition:

$$Y_t(j) = \left(\frac{P_t(J)}{P_t}\right)^{-\mu} Y_t \tag{18}$$

The Intermediate-Good-Producing Firm

Intermediate-good-producing firm j hires k_{jt} units of capital and l_{jt} units of labor to produce output according to the following constant returns to scale technology:

$$Y_t(j) \le A_t K_t^{\alpha}(j) L_t(j)^{1-\alpha} .0 < \alpha < 1 \tag{19}$$

where A_t is a technology shock that is common to all intermediate-good-producing firms. The technology shock (A_t) is assumed to follow the autoregressive process:

$$lnA_t = \rho_A lnA_{t-1} + \varepsilon_{At} \tag{20}$$

where $\rho_A \epsilon(-1.1)$, and ε_{At} is a serially uncorrelated shock that is normally distributed with zero mean and standard deviation σ_A. It is well-known that money is super neutral in a monopolistic competition framework unless some form of nominal friction is added to the model (e.g. Rotemberg, 1982). Here, nominal rigidity is introduced by the price-adjustment costs. It is assumed that the intermediate-good-producing firm faces a quadratic cost of adjusting its nominal price given by the following function:

$$C_t(j) = \frac{\phi_p}{2}\left(\frac{P_t(j)}{P_{t-1}(j)} - 1\right)^2 Y_t \tag{21}$$

where $\phi_p > 0$ is the price-adjustment cost parameter.

Price- and employment-adjustment costs make the representative intermediate-good-producing firm's problem dynamic. The problem of firm j is to choose contingency plans for $l_{jt}; k_{jt};\ y_{jt}$ and $p_{jt}, t\ = 0, \dots, \infty$ that maximize its expectation of the discounted sum of its profit flows conditional on the information available at time 0:

$$\max_{K_t(j).L_t(j).p_t(j)} E_0\left(\sum_{t=0}^{\infty} \beta^t \lambda_t \left(\frac{DV_t(j)}{P_t}\right)\right) \tag{22}$$

where the instantaneous profit function is given by:

$$DV_t(j) = P_t(j)Y_t(j) - R_t K_t(j) - W_t L_t(j) - P_t C_t(j) \tag{23}$$

subject to constraints 18 and 19, to which the Lagrangian multiplier $\Lambda_t > 0$ is associated. The firm's discount factor is given by the stochastic process $\beta^t \lambda_t$, where λ_t denotes the marginal utility of real wealth. In equilibrium, this factor represents a pricing kernel for contingent claims. The solution gives the following first order conditions:

$$-r_t + \alpha \Lambda_t \frac{Y_t(j)}{K_t(j)} = 0 \tag{24}$$

$$\lambda_t \phi_p \frac{P_t}{P_{t-1}(j)}\left(\frac{P_t(j)}{P_{t-1}(j)} - 1\right) - \lambda_t(1-\mu)\left(\frac{P_t(J)}{P_t}\right)^{-\mu} - \Lambda_t \lambda_t \mu \left(\frac{P_t(j)}{P_t}\right)^{-\mu-1} - \beta \phi_p E_t \lambda_{t+1} \frac{P_{t+1}(j) P_t}{P_t^2(j)}\left(\frac{P_{t+1}(j)}{P_t(j)} - 1\right)\frac{Y_{t+1}}{Y_t} = ٠ \tag{25}$$

$$-\lambda_t \frac{W_t}{P_t} + (1-\alpha)\Lambda_t \frac{Y_t(j)}{l_t(j)} = 0 \tag{26}$$

$$\left(\frac{P_t(j)}{P_t}\right)^{-\mu} Y_t - A_t K_t^{\alpha}(j)\left(\xi^t L_t(j)\right)^{1-\alpha} = 0 \tag{27}$$

Government and Monetary Authority

It is assumed that government is in charge of both monetary and fiscal policies. The real government budget constraint is defined as Equation 28:

$$\frac{G_t}{P_t} + \frac{\left(r_{t-1}^d\right)B_{t-1}}{P_t} = \frac{T_t}{P_t} + \frac{M_t - M_{t-1}}{P_t} + \frac{B_t}{P_t} \tag{28}$$

where G_t is the government expenditure, and T_t is the lump sum tax revenue. It is assumed that the government real expenditures $g_t = \frac{G_t}{P_t}$ follow an AR (1) process:

$$\ln g_t = \rho_g \ln g_{t-1} + \left(1-\rho_g\right)\ln \bar{g} + \varepsilon_{g_t} \tag{29}$$

where $|\rho g| < 1$, ε_{g_t} is a white noise process with zero means, and g□ is the steady level of government expenditures.

In the present model, the monetary base (m_t) is a function of the net government deposit, dc_t and foreign reserves, fr_t of the central bank. It is also assumed that the foreign reserves of the central bank are a function of their interruptions and the proceeds from the sale of oil, oil_t.

$$m_t = -dc_t + fr_t \tag{30}$$

$$fr_t = \frac{fr_{t-1}}{\pi_t} + oil_t \tag{31}$$

Oil production has not been modeled as a separate productive sector, because oil revenue is exogenous and a function of the exogenous changes in oil prices. The oil revenue shock follows an AR (1) process as follows:

$$\ln oil_t = \rho_{oil} \ln oil_{t-1} + (1-\rho_{oil}) \ln \overline{oil} + \varepsilon_{oil_t} \tag{32}$$

We assume that $|\rho_{oil}| < 1$, because this AR(1) process is stationary if $|\rho_{oil}| < 1$. ε_{oil_t} is a white noise process with zero mean and σ_{oil}^2 variance. Moreover, $\overline{oil}$ is the steady-state value of the oil revenues and oil_t is the real flow of oil revenues.

We assume that monetary policy evolves according to the rule:

$$\eta_t = \rho_\eta \eta_{t-1} + \left(1-\rho_\eta\right)\bar{\eta}_{t-1} + \rho_{\eta oil}\varepsilon_{oil_t} + \rho_S \varepsilon_{s_t} + \varepsilon_{\eta_t} \tag{33}$$

where $\eta_t = \frac{M_t}{M_{t-1}} = \pi_t \frac{m_t}{m_{t-1}}$ is the gross growth rate of money in period t, $\rho_\eta \epsilon(-1.1)$, and $\varepsilon_\eta$is a serially uncorrelated money supply shock that is normally distributed with zero mean and standard deviation. The money supply shock is uncorrelated with the stock market shocks as well as oil shocks at all leads and lags. In the event that $\rho_{\eta oil} = \rho_a = \rho_S = 0$, the monetary policy becomes purely exogenous.

Market Clearing Conditions

Finally, we introduce the market-clearing conditions as follows:

$$dv_t = Y_t - r_t K_t - w_t L_t - \left[\frac{\phi_p}{2}(\pi_t - 1)^2 Y_t\right] \tag{34}$$

$$Y_t + oil_t = c_t + i_t + g_t + \frac{\phi_p}{2}(\pi_t - 1)^2 Y_t \tag{35}$$

Symmetric Equilibrium and Resolution

In a symmetric equilibrium, all intermediate-good-producing firms are identical. They make the same decisions, so that $P_t(j) = P_t \,.\, Y_t(j) = Y_i \,.\, L_t(j) = L_t \,.\, K_t(j) = K_t \,, DV_t(J) = DV_t \,.\, C_t(j) = C_t \,.\, M_t(j) = M_t . P_{st}(j) = P_{st}$.

After identifying the model's assumptions, the first-order equilibrium conditions have to be derived. In addition to the structural equations, they build a system of stochastic difference equations. This system in two models is non-linear, so in the next step, approximation methods lead to a linear system whose solution approximates the solution of interest. So we use Uhlig (1999) method to linear approximation equation system. The equations are log-linearized around the steady-state values of each variable and stacked into a system of linear expectational difference equations. In addition, we specify a deterministic steady state for the models. The following equations are that of log-linearized model:

$$\tilde{c}_t = \tilde{c}_{t+1} - \tfrac{1}{\sigma}(\tilde{r}_{dt} - \tilde{\pi}_{t+1}) \tag{36}$$

$$\sigma \tilde{c}_t + \tilde{\lambda}_t = 0 \tag{37}$$

$$b\widetilde{m}_t = \sigma \tilde{c}_t - \frac{1}{r_d^*}\tilde{r}_{d\,t} \tag{38}$$

$$\nu \tilde{l}_t = -\sigma \tilde{c}_t + \widetilde{w}_t \tag{39}$$

$$\tilde{\gamma}_{st} = \omega_{st} + \tilde{\pi}_{t+1} - \tilde{r}_{dt} + \frac{1}{1 + r_d^*}\tilde{\gamma}_{s+1} + \frac{r_d^*}{1 + r_d^*}\widetilde{dv}_{t+1} \tag{40}$$

$$\tilde{\gamma}_{st} - \tilde{\gamma}_{st-1} = \tilde{\pi}_{st} - \tilde{\pi}_t \tag{41}$$

$$\widetilde{\omega}_{st} = \rho_s \widetilde{\omega}_{st-1} + \varepsilon_{st} \tag{42}$$

$$\tilde{r}_{dt} - \tilde{\pi}_{t+1} = \frac{r^*}{1 - \delta + r^*}\tilde{r}_{t+1} \tag{43}$$

$$\widetilde{K}_{t+1} = (1 - \delta)\,\widetilde{K}_t + \delta \tilde{\imath}_t \tag{44}$$

$$\tilde{A}_t = \rho_A \tilde{A}_{t-1} + \varepsilon_{At} \tag{45}$$

$$\tilde{\lambda}_t + \tilde{r}_{t+1} = \tilde{\Lambda}_t + \tilde{Y}_t + \widetilde{K}_t \tag{46}$$

$$\tilde{\lambda}_t + \widetilde{w}_t = \tilde{\Lambda}_t + \tilde{Y}_t + \tilde{l}_t \tag{47}$$

$$\tilde{Y}_t = \tilde{A}_t + \alpha \widetilde{K} + (1 - \alpha)\tilde{l}_t \tag{48}$$

$$\tilde{\Lambda}_t = \frac{(\mu-1)}{\mu}\frac{\lambda^*}{\Lambda^*}\tilde{\lambda}_t + \beta\frac{1}{\mu}\phi_p\lambda^*\frac{1}{\Lambda^*}\pi^*(1-2\pi^*)\tilde{\pi}_{t+1} + \frac{1}{\mu}\phi_p\lambda^*\frac{1}{\Lambda^*}(2\pi^* - 1)\pi^*\tilde{\pi}_t + \beta\frac{1}{\mu}\phi_p\lambda^*\left(\pi^*\ (1-\pi^*)\right)\frac{1}{\Lambda^*}\tilde{y}_{t+1} - \beta\frac{1}{\mu}\phi_p\lambda^*\left(\pi^*\ (1-\pi^*)\right)\frac{1}{\Lambda^*}\tilde{y}_t \quad (49)$$

$$\tilde{g}_t = \rho_g\tilde{g}_{t-1} + \varepsilon_{g_t} \quad (50)$$

$$\widetilde{oil}_t = \rho_{oil}\widetilde{oil}_{t-1} + \varepsilon_{oil_t} \quad (51)$$

$$\tilde{\eta}_t = \rho_\eta\tilde{\eta}_{t-1} + \rho_{\eta oil}\varepsilon_{oil_t} + \rho_{\eta S}\varepsilon_{s_t} + \varepsilon_{\eta_t} \quad (52)$$

$$\tilde{\eta}_t = \tilde{\pi}_t + \widetilde{m}_t - \widetilde{m}_{t-1} \quad (53)$$

$$\widetilde{m}_t = -\frac{\mathrm{dc}^*}{\mathrm{m}^*}\mathrm{dc}_\mathrm{t} + \frac{\mathrm{FR}^*}{\mathrm{m}^*}\widetilde{\mathrm{fr}}_\mathrm{t} \quad (54)$$

$$\widetilde{\mathrm{fr}}_\mathrm{t} = \frac{1}{\pi^*}\widetilde{\mathrm{fr}}_{\mathrm{t}-1} - \frac{1}{\pi^*}\tilde{\pi}_\mathrm{t} + \frac{\mathrm{oil}^*}{\mathrm{FR}^*}\widetilde{\mathrm{oil}}_\mathrm{t} \quad (55)$$

$$\frac{\mathrm{dv}^*}{\mathrm{Y}^*}\ \widetilde{\mathrm{dv}}_\mathrm{t} = \tilde{\mathrm{Y}}_\mathrm{t} - \frac{\mathrm{r}^*\mathrm{K}^*}{\mathrm{Y}^*}(\tilde{\mathrm{K}}_\mathrm{t} + \tilde{\mathrm{r}}_\mathrm{t}) - \frac{\mathrm{w}^*\mathrm{l}^*}{\mathrm{Y}^*}(\tilde{\mathrm{l}}_\mathrm{t} + \tilde{\mathrm{w}}_\mathrm{t}) \quad (56)$$

$$\left(1 - \phi_\mathrm{p}(\pi^*\ - 1)^2\right)\tilde{\mathrm{Y}}_\mathrm{t} = \frac{\mathrm{c}^*}{\mathrm{Y}^*}\ \tilde{\mathrm{c}}_\mathrm{t} + \frac{\mathrm{I}^*}{\mathrm{Y}^*}\tilde{\mathrm{i}}_\mathrm{t} + \frac{\mathrm{G}^*}{\mathrm{Y}^*}\tilde{\mathrm{g}}_\mathrm{t} - \frac{\mathrm{OIL}^*}{\mathrm{Y}^*}\widetilde{\mathrm{oil}}_\mathrm{t} + \phi_\mathrm{p}\pi^*(\pi^*\ - 1)\tilde{\pi}_\mathrm{t} \quad (57)$$

Results

In this section, results are going to be discussed. First, we have explain the estimation method parameters and calibration, and then we calculate the steady-state. In the second part, we compared models. Finally, we review the results of monetary and fiscal shocks in the models by using Eviews, Dynare, and Matlab.

Calibration

Estimating the model parameters is one of the important stages of empirical measurement in general equilibrium models. The ratios for the calibration were collected from the Central Bank annual data from 1979 to 2012. In the first stage, the model parameters are either calibrated based on previous studies or computed based on the observed steady-state levels of real variables. The calibrated parameters are shown in Table 1.

In this section, the parameters influencing the deterministic steady state of the model are identified. Furthermore, we set $\frac{\mathrm{oil}^*}{\mathrm{FR}^*}.\frac{\mathrm{dc}^*}{\mathrm{m}^*}.\frac{\mathrm{G}^*}{\mathrm{Y}^*}$ and $\frac{\mathrm{OIL}^*}{\mathrm{Y}^*}$ using the data of Iran's economy from 1979 to 2012 that is the same as that of Tavakolian (2012), Shahmoradi (2010), and Mohammadi (2014). Other state ratios of variable find with the solution of the model on the steady-state. Table 2 shows the steady-state ratios of the variable. Equations 58–68 are steady-state, by which we find the state ratios of the variable:

$$r^d = \frac{\pi}{\beta} - 1 \quad (58)$$

$$r_t = \frac{1 + r^d}{\pi} - (1 - \delta) \quad (59)$$

$$\frac{i}{y} = \delta \frac{\alpha}{\frac{\lambda}{\Lambda}} \frac{1}{r} \tag{60}$$

$$\frac{rK}{Y} = \frac{\alpha}{\frac{\lambda}{\Lambda}} \tag{61}$$

$$\frac{wl}{Y} = \frac{1-\alpha}{\frac{\lambda}{\Lambda}} \tag{62}$$

$$\frac{\lambda}{\Lambda} = \frac{\mu}{\left(\phi_p \pi \, (\pi - 1)(1-\beta) - (1-\mu)\right)} \tag{63}$$

$$\eta = \pi \tag{64}$$

$$\frac{fr}{m} = \frac{dc}{m} \tag{65}$$

$$\pi = \frac{1}{1 - \frac{oil}{fr}} \tag{66}$$

$$1 + \frac{OIL}{Y} = \frac{C}{Y} + \frac{I}{Y} + \frac{G}{Y} + \frac{\phi_p}{2}(\pi - 1)^2 \tag{67}$$

$$\frac{dv}{Y} = 1 - \frac{rk}{Y} - \frac{wl}{Y} - \left[\frac{\phi_p}{2}(\pi - 1)^2\right] \tag{68}$$

Table 1. The Calibrated Parameters

Symbol	Parameter explanation	Calibrated value	Resource
σ	Inverse elasticity of intertemporal consumption	1.571	Tavakolian (2012)
b	Inverse elasticity of money demand	2.39	Tavakolian (2012)
ν	Inverse elasticity of labor supply	2.17	Tavakolian (2012)
β	Discount factor	0.9648	Tavakolian (2012)
δ	Depreciation rate	0.042	Fakhrhosseini (2014)
α	Capital share in production	0.412	Motavaseli et al. (2011)
μ	Degree of substitution between types of goods	4.33	Motavaseli et al. (2011)
ϕ_p	Price adjustment cost parameter	4.26	Dib and Phaneuf (2001)
ρ_A	Persistence of technology shock	0.72	Kavand (2008)
ρ_η	Persistence of monetary shock	0.562	Fakhrhosseini (2014)
$\rho_{\eta OIL}$	Monetary policy reaction to the oil shock	0.08	Fakhrhosseini (2014)
$\rho_{\eta s}$	Monetary policy reaction to a stock market shock	0.118	Nistico (2010)
ρ_{oil}	Persistence of oil shock	0.60	Fakhrhosseini (2014)
ρ_g	Persistence of government expenditure shock	0.56	Mohammadi (2014)
ρ_s	Persistence stock market shock	0.84	Nistico (2009)

Table 2. The Steady-State Ratios Gained

The ratio of steady states	Calculated amount	The ratio of steady states	Calculated amount
$\frac{FR^*}{m^*}$	0.504	$\frac{oil^*}{FR^*}$	0.13
$\frac{G^*}{Y^*}$	0.22	$\frac{OIL^*}{Y^*}$	0.20
$\frac{\lambda^*}{\Lambda^*}$	1.31	r^*	0.078
π^*	1.149	$\frac{dv^*}{Y^*}$	0.189
$\frac{dc^*}{m^*}$	0.496	$\frac{c^*}{Y^*}$	0.78
$\frac{r^*K^*}{Y^*}$	0.314	$\frac{I^*}{Y^*}$	0.168
$\frac{w^*l^*}{Y^*}$	0.448	r_d^*	0.191

Source: Research finding.

Variance Decomposition

Results of the variance decomposition of variables in response to the occurrence of any shocks parameters are shown in Table 3. According to Table 5, the sentiment shock has a considerable influence on the fluctuations of aggregate variables and the stock price. Variance decomposition of the variables shows that the monetary policy shock represented about 1.54% of stock price fluctuations. In addition, about 82% of output fluctuations, 95.11% of inflation, and more than 96% of denoting stock are justified by this shock.

Also, variance decomposition of the variables indicates that the fiscal policy shock represents about 0.05% of stock price fluctuations, 0.48% of output fluctuations, 0.01% of inflation, and more than 0.25% of denoting stock that is justified by this shock.

Table 3. Variance Decomposition of Variables Relative to Structural Shocks

	Stock market shock	Technology shock	Fiscal policy shock	Oil income shock	Monetary policy shock
rd	2.21	0.00	0.01	2.59	95.19
pi	2.20	0.00	0.01	2.67	95.11
infs	93.36	0.36	0.10	0.56	5.61
gamas	98.15	0.24	0.05	0.02	1.54
dv	2.23	0.22	0.25	1.27	96.03
y	1.92	14.18	0.48	0.69	82.74

Source: Research finding.

Impulse Responses

Here, we report the effects of each shock in the model without an asymmetric policy. Figures 1 to 5 display the impulse responses of some key endogenous variables to an orthogonalized unit shock to technology, oil income, fiscal policy, monetary policy, and the stock market. These figures display that how endogenous variables react to shocks, and also present the adjustment process of shocks effects.

Figure 1 shows the impulse responses to a standard deviation technology shock computed in the model. It indicates that a positive shock leads to a rise in output, stock price, and stock demand. The output is adjusted after 20 periods, but other variables are adjusted after 10 periods. The response of inflation to technology shocks is negative and is adjusted after 10 periods. Results show that the growth rate of the stock price is higher than the inflation rate.[1]

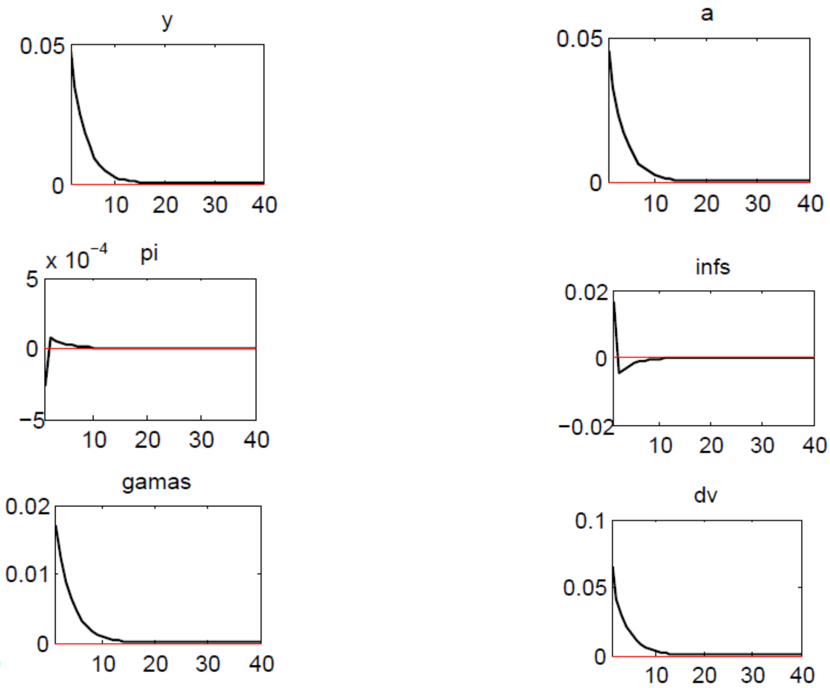

Figure 1. Effects of a Positive Technology Shock
Source: Research finding.

Figure 2 shows the impulse responses for a 1% increase in the money growth rate in the estimated model. It indicates that a positive money shock leads to a rise in output, stock price, and inflation. The output is adjusted after 20 periods but other variables are adjusted after 10 periods. The response of stock demand to money supply shocks is negative and is adjusted after 5 periods. Also, results show that the growth rate of the stock price is lower than the inflation rate.

These results are in line with Namini and Tabatabaei Nasab (2016) that are based on structural vector auto-regressions (SVAR), and show that monetary policies have a positive but minor impact on the changes in the stock price index, and directly or indirectly affect the stock market.

1. y denotes the output, a is technology, pi denotes the inflation, infs denotes growth rate of stock market index, gamas denotes the ratio stock market index to consumer price index, dv denotes the stock demand, eta denotes the money growth, g denotes government expenditure, oil denotes the oil revenue, fis denotes the stock market shock.

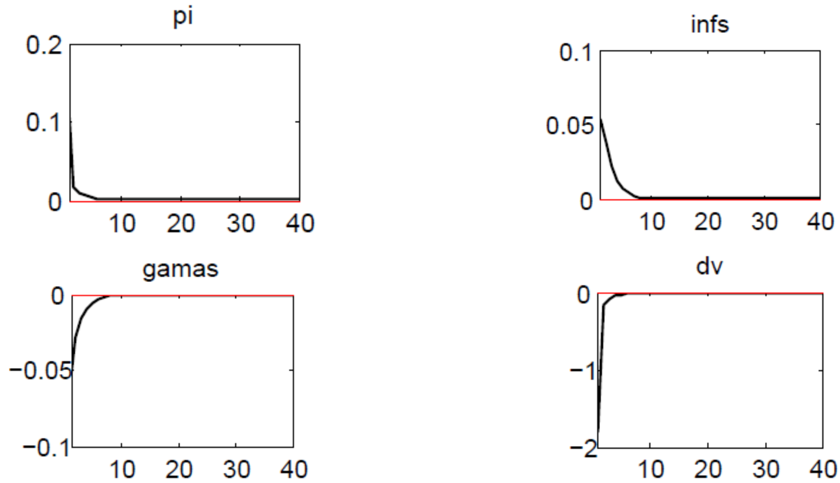

Figure 2. Effects of a Monetary Policy Shock
Source: Research finding.

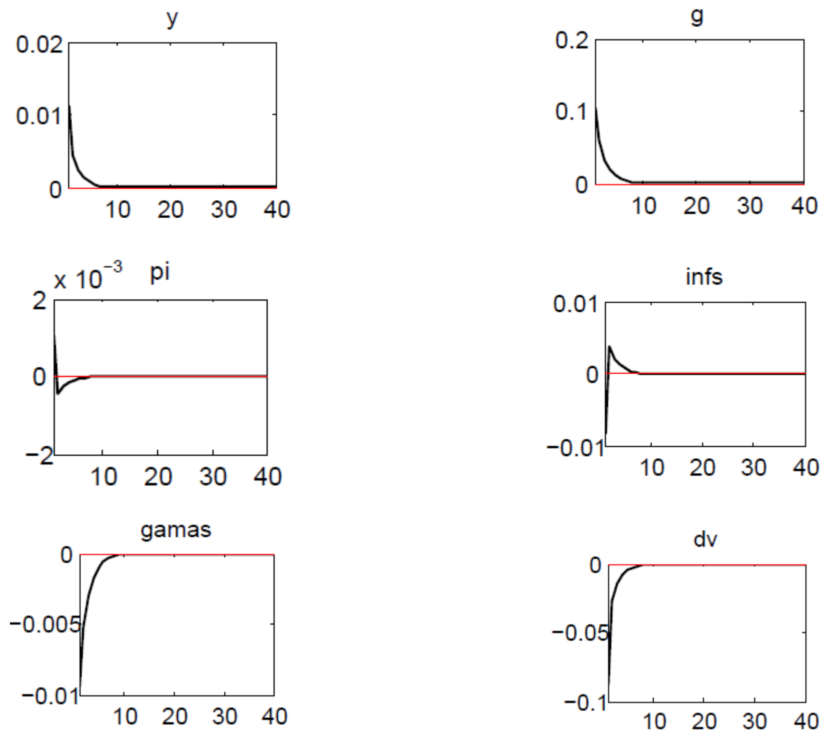

Figure 3. Effects of a Government Expenditure Shock
Source: Research finding.

Figure 3 shows the impulse responses for a 1% increase in the government expenditure in the estimated model. It indicates that a positive government expenditure leads to a rise in output and inflation. The output and inflation are adjusted after 10 periods. The response of the stock demand and the stock price to government expenditure shocks are negative and are adjusted after 10 periods.

Figure 4 shows the impulse responses for a 1% increase in the oil income in the estimated model. It indicates that a positive oil shock leads to a rise in output, inflation, and stock price. The output and inflation are adjusted after 10 periods, and the stock price is adjusted after 5 periods. The response of the stock demand to the oil shocks is negative. These results show that due to the high dependence on oil revenues, oil revenues have a considerable impact on the Iranian economy. The essential role of the oil industry in the Iranian economy has always been financial. It has been providing currency for the country without making the necessary connections with other sectors of the Iranian economy. Income oil has led to over-consumption and is expanding the oil sector rather than expanding sectors such as agriculture and industry.

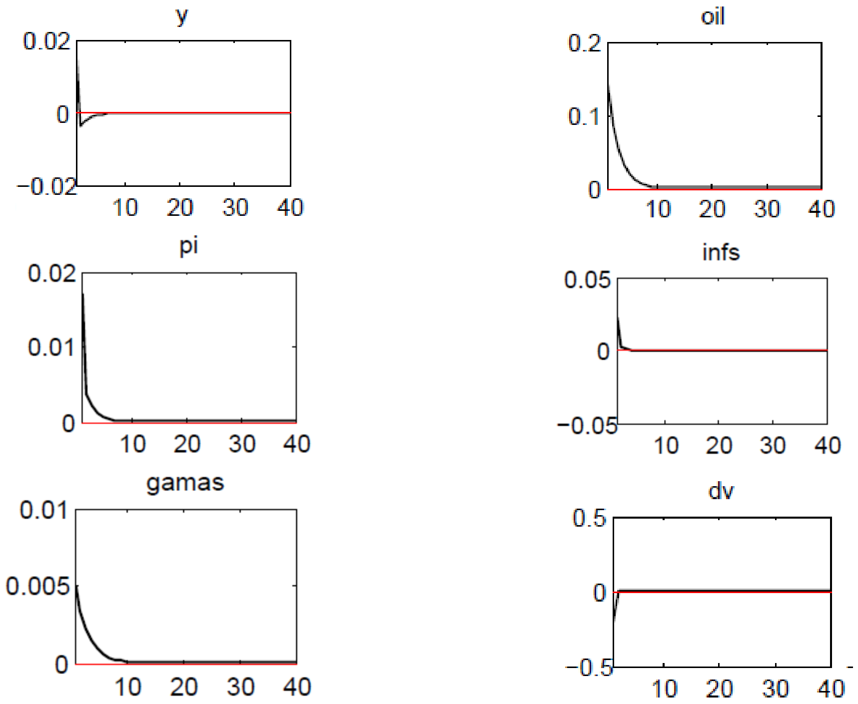

Figure 4. Effects of an Oil Shock
Source: Research finding.

Figure 5 indicates that a stock market shock leads to a rise in output, inflation, and stock price. The output and inflation are adjusted after 10 periods, and the stock price is adjusted after 5 periods. The response of stock demand to stock market shocks is negative.

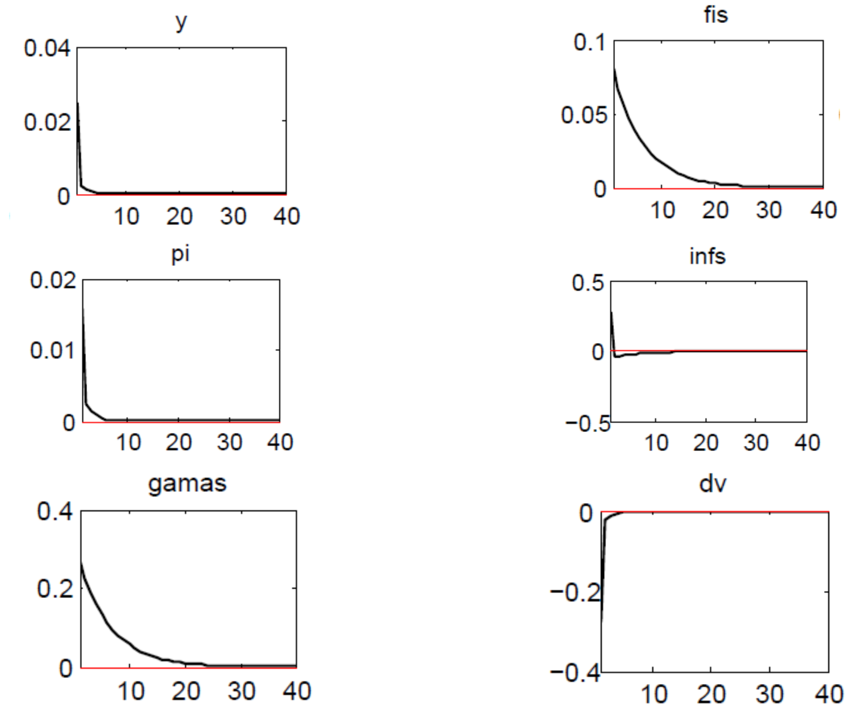

Figure 5. Effects of a Stock Market Shock
Source: Research finding.

Conclusion

In this study, we used DSGE models to answer two questions:

1. What is the effect of monetary policy on the stock market?
2. What is the effect of fiscal policy on the stock market?

We found that a positive technology shock led to a rise in output, stock price, and stock demand. In addition, a positive money shock leads to a rise in output, stock price, and inflation. The response of stock demand to money supply shocks is negative. Our results showed that a positive government expenditure shock led to a rise in output and inflation. The response of stock demand and stock price to government expenditure shocks is negative. We found that a positive oil shock led to a rise in output, inflation, and stock price. The response of stock demand to oil shocks is negative.

These results appear to contradict the realities of the Iranian economy. For example, in 2013 and 2018, despite the negative economic growth and the negative productivity growth, the stock index growth increased. Yet, it should be noted that these results indicate the variables' response to the shocks in question, and may not be studied in the model of other shocks. It may be considered in future studies, and this study could be the basis for other studies.

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