Iranian Journal of Economic Studies, 12(1) 2023, 89-104

Shiraz University

Iranian Journal of Economic Studies

Journal homepage: ijes.shiraz.ac.ir

Investigating the Effect of Oil Price and Stock Market Shocks on Profitability of Banking System: Application of RDCGE Model

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Article History

Received date: 12 January 2023
Revised date: 08 May 2024
Accepted date: 13 September 2024
Available online: 30 October 2024

JEL Classification
C68
D60
E40
F31
G12
H50

Keyword
Banking System Profitability
Crude Oil Price
Exchange Rate
Government Budget
RDCGE Model.
Total Stock Price Index

Abstract

The role and importance of the banking system as the primary source of financing for businesses is necessary to investigate the factors affecting the profitability of this sector. Therefore, this research uses a computable general equilibrium model (RDCGE), the effect of exchange rate shock, crude oil price, stock price index, and government budget on Iran's banking system profitability. For this purpose, the social accounting matrix (SAM) of 2011 and the Input-Output table of 2016 were used to analyze the twelve design scenarios and the profitability of the banking system in response to shocks 2, 5, and 10 percent in the exchange rate, crude oil price, stock price index, and government budget are evaluated. The findings reveal that the exchange rate and crude oil prices negatively affect banking system profitability, while the total stock price index and government budget have positive effects. The funding comparison shows that in different scenarios, the shocks of the exchange rate, oil price, stock market, and government budget, respectively have the most effect on bank profitability. Thus, appropriate use of the national development fund and government support for the stock market are effective for reducing exchange rate shock and crude oil prices and controlling the consequences of these shocks.

Highlights

- We Investigate the Effect of Oil Prices, Stock Market, and government budget Shocks on the Profitability of the Banking System in Iran.
- We use Recursive Dynamic Computable General Equilibrium (RDCGE) model
- Results show positive shocks in crude oil prices and exchange rate lead to a decrease in the profitability of the banking system.
- Government budget and stock price index shocks will increase the banking system's profitability.

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DOI: 10.22099/ijes.2024.46513.1887

1. Introduction

The significance of the banking industry in fostering enduring, sustainable, and continuous economic growth is paramount. As a vital financial institution, the banking sector actively contributes to a nation's economic development (Pirahmadi et al., 2019). It exerts considerable influence on both industrial growth and stability (Mansouri & Sadeghi Amroabadi, 2021). The banking sector serves as a crucial economic facilitator, with Islamic banking gaining widespread recognition in numerous countries (Esmaeil et al., 2020). Furthermore, the financial sector has charted a course for the expansion and progress of the global economy. In light of globalization and financial integration, ensuring the stability and sustainability of the financial system has become a priority at both national and international levels. The resilience of a country's domestic financial system and its ability to absorb shocks while safeguarding investors are critical determinants of capital movement. (Hafidh & Burhan, 2021). In Iran, commercial banks have had to adopt a more profit-oriented approach as a result of heightened domestic and international competition, which is essential for maintaining the stability of the financial system. Research by Ali & Puah (2018) indicates that countries with a strong and profitable banking sector are better equipped to endure financial crises, recover swiftly, and mitigate the adverse effects on their economies. Consequently, it is essential to examine the factors contributing to banking system instability, such as fluctuations in crude oil prices and stock market shocks. Additionally, crude oil plays a critical role in the production process, and its price volatility has significant repercussions for the real economy. Given the reliance of oil-exporting nations on these exports, the relationship between oil prices and banking performance, along with its implications for systemic stability, is of utmost importance for policymakers (Narayan & Gupta, 2015). Oil prices are a significant factor in economic activity.; thus, an increase in oil revenue enhances government expenditure, which in turn fosters ample liquidity within the banking system and bolsters private sector confidence. This dynamic leads to an increase in both deposits and credit, facilitating the growth of the non-oil sector. Furthermore, there exists a well-documented correlation between a bank's profitability and economic growth through the development of the financial sector. Additionally, advancements in the stock market have an important role in the accumulation of capital, productivity, and the expansion of the banking sector. The interrelationship between banking and capital markets is notable, as the development of one can occur at the expense of the other. A bank's stock value has a direct impact on its profit, and a decline in stock value presents significant challenges for the institution (Aayale et al., 2022). Given the critical nature of these factors, it is imperative to assess the impact of shocks in exogenous variables, such as crude oil prices and stock market fluctuations, to safeguard the banking system from adverse volatility. Consequently, this study aims to examine the effects of the shocks of the stock market, oil prices, exchange rates, and government budgets on the profitability of the national banking system through the application of a general equilibrium model.

Intertemporal models are based on the assumption of optimal growth theory, in which it is assumed that economic factors have full predictability, which is not true in many developing countries (Decaluwe et al., 2013). Therefore, according to the above, in this research, the recursive dynamic computable general equilibrium model (RDCGE) approach is used to investigate the response of the profitability of Iran's banking to exchange rate, oil price, stock market, and government budget shocks. To do so, section 2 provides, the literature review, materials, and method present in section 3, and the results and concluding remarks are provided in sections 4 and 5, respectively.

2. Theoretical Framework

2.1 Mechanism of Oil Price fluctuations influence Banking system performance

Considering Iran's dependence on oil export revenues, there seems to be a correlation between oil price fluctuations and the performance and stability of banks during boom-and-bust cycles. Iran is one of the countries whose economy is based on the production and export of crude oil. On the other hand, financing in Iran is bank-oriented, so about 90% of the financing of companies is done by the banking system. There will be a higher income for the governments and consequently higher expenses if the price of oil increases. This, in turn, will strengthen the performance of companies, stock prices, and banks' balance sheets. This relationship between the macro level of oil price and financial performance shows that during the period of oil price increase, the quality of bank assets increases (Falahpor et al., 2022). Also, in the Iranian economy, there is a close relationship between the financial markets and the oil industry. So that the country's economy has always had the maximum exploitation of oil revenues in the creation and completion of the country's infrastructure, and oil price fluctuations have not only caused instability and ups and downs in construction projects but also affected the country's economy and the monetary and banking system. Therefore, in many cases, the decrease in the price of oil has caused the government to borrow from the banking system and lose its ability to pay its debt to the bank, causing huge losses to the banking sector and as a result it has reduced the profitability of the banking network (Mansouri & Sadeghi Amroabadi, 2021).

2.2 Mechanism of Stock Market Influence on Banking System Performance

Keynesians and monetarists hold differing views regarding the type of financial asset that individuals substitute with money when there is an increase in the money supply. Keynesians typically perceive the mechanism of impact in such a manner that they regard fixed-income assets, such as bonds and treasury securities, as effective substitutes for money. In the Keynesian framework, the returns on all assets, including equities, are treated as equivalent and devoid of risk. The mechanism operates such that an increase in the money supply, facilitated by a reduction in interest rates, leads to heightened demand for financial assets, including stocks, which subsequently drives up their prices. Conversely,

monetarists contend that an increase in the money supply will have a direct and unmediated effect on expenditure flows and asset prices. They argue that a rise in the money supply disrupts the equilibrium between actual and desired money balances, prompting excess demand across a broad spectrum of goods, services, and financial assets to rectify the surplus. Furthermore, monetarists assert that the assets substituting for the money supply are highly varied, encompassing a range of financial instruments with differing risk profiles, such as treasury bonds, mortgages, and equities, as well as tangible assets like real estate and durable goods. According to monetarist theory, an increase in demand for financial assets, including stocks, results in a direct escalation of their prices. On the other hand, the money market and the stock market are competitors and complement each other in the long run, and there is a meaningful and inverse relationship between these two markets. So with the increase in bank profits, a part of the shareholders with a higher degree of risk aversion withdraws their capital from the stock market and they prefer to invest in the bank and earn risk-free profit over the risk-free profit through buying and selling shares. This issue has led to the withdrawal of liquidity from the stock market and a decrease in market value, and the more the bank interest rate increases, the risk-free deposit interest market will become more attractive, and the sharper increase in the bank interest rate will even attract risk-taking people. The increase in bank profit through the attraction of funds causes a decrease in the efficiency and the growth rate of the volume of stock market transactions (Katırcıoglu et al, 2020).

2.3 Mechanism of exchange rate influence on banking system performance

In conducting foreign exchange banking operations, the exchange rate is one of the most important variables and factors that, in addition to influencing macroeconomic variables, affect the foreign exchange profits and losses of banks and their performance in the foreign exchange market. In this way, accurate and correct analysis of the effects of exchange rates on foreign exchange profitability can be the basis for making appropriate decisions in the field of attracting foreign exchange resources and allocating foreign exchange facilities by bank managers. Hence, examining the s short- and long-term effects of exchange rates on banks' profitability provides an essential tool for managing banks' foreign exchange reserves (Ma and Zhang, 2021). Lu et al. (2021) investigated the impact of pound exchange rate fluctuations on banks' profitability after the United Kingdom's exit from the European Union. Part of the results of their study showed that there is a significant relationship between exchange rate fluctuations and banks' profitability. The short- and long-term effects of exchange rate changes on banks' foreign exchange profitability were investigated by Babazadeh et al. Their study revealed that exchange rate changes and changes in the exchange rate situation have a negative effect on banks' foreign exchange profitability.

2.4 Mechanism of government budget influence on banking system performance

There are two views regarding the role and manner of the government's presence in the direction of government spending (financial policy) and its effect on the financial markets, especially the functioning of the banking system and lending to the private sector. The development perspective proposed by Lewis (1950) and Gerschenkron (1962) believes that governments usually intervene in the financial markets to eliminate market deficiencies and the goals of economic growth and development through their expenses. They try to reduce costs or increase the granting of subsidies to production companies and increase access to financial resources. This point of view is especially emphasized in developing countries, and the government's excessive ownership of financial authorities is considered to be derived from this point of view. In this view, with the increase of the government's share in the economy, the financial system is also expanded, and the indicators of financial development show improvement (Cooray, 2011). The second point of view, which is called the political point of view and entered into this literature by Kornai (1979) and Shleifer and Vishny (1994), believes that the government pursuing its desired goals, especially in countries with weak private ownership can lead to a decrease in efficiency through an increase in overhead costs (Chen et al, 2019). In this view, one of the important aspects of financial policies, especially during the adoption of fiscal expansionary policies (the policy of increasing government spending) is its adverse effect on financial markets and the occurrence of contractionary conditions in these markets. In other words, in this perspective, unlike traditional macroeconomics, which is based on Keynes's economic views, according to the type of financial adjustments, the initial level of public debt, and the structure of the labor market in the economy, any of the results of contraction or expansion in the economy can be considered. This point of view states that most likely, the emergence of contractionary results in the banking system, which is the consequence of the government's expansionary policies, will be visible in countries with low financial depth. That is, in such economies, an increase in government spending drives out private investment, and through the deterioration of the quality of a country's assets (decreasing the valuation and liquidity of these assets), it causes the emergence of contractionary conditions in the financial markets (Esmaeil et al., 2020).

3. A Review of the Related Literature

Majok (2015) analyzed the impact of exchange rate fluctuations on the financial performance of commercial banks in Kenya. The study focused on a population of all 43 commercial banks that were operational in Kenya as of December 2014. The findings revealed a positive correlation between fluctuations in foreign exchange rates and the financial performance of banks, as indicated by the returns on assets ratio. Sayari and Shamk (2016) explored the connection between the profitability of commercial banks and developments in the stock market in Jordan. Utilizing two multiple regression models, the researchers

examined these relationships for 13 Jordanian commercial banks over the period from 2009 to 2013. The results indicated that the market capitalization variable had a negative and significant impact on ROA, while it positively influenced ROE. Additionally, trading volume exhibited a strong positive correlation with both return on equity(ROE) and return on asset(ROA), suggesting that trading volume is a key determinant of profitability. Furthermore, ROE was found to be a superior measure of profitability compared to ROA. Alharbi (2017) conducted a study on the factors influencing the profitability of Islamic banks, utilizing longitudinal data from 1992 to 2008, which encompassed nearly all Islamic banks globally. The results demonstrated that factors such as capital ratio, other operating income, GDP per capita, bank size, concentration, and oil prices had a positive effect on the profitability of Islamic banks. Conversely, insurance schemes, foreign ownership, and real GDP growth were found to negatively impact their profitability. Brahmaiah (2018) investigated the determinants of profitability among Indian commercial banks. The findings revealed that the robustness of equity capital, operational efficiency, and the ratio of banking sector deposits to GDP exert a significantly positive impact on bank profitability. Conversely, factors such as credit risk, cost of funds, the ratio of non-performing assets (NPA), and inflation negatively affect profitability. Additionally, bank size and the ratio of priority loans to total loans do not influence profitability. The relationship between GDP growth and inflation is negatively correlated with return on assets (ROA), while inflation positively affects return on equity (ROE). Alaagam (2019) examined the connection between profitability and stock prices within the Saudi banking sector. To elucidate this relationship for investors' decision-making, quarterly profitability data of selected banks and stock price information from 2011 to 2018 were analyzed. According to the results, stock prices have no relationship with profitability in the long term; however, a significant positive correlation between ROA and stock prices was observed in the short term. Katırcıoglu et al. (2020) explored the long-term equilibrium relationship between the profitability of the banking sector and its internal and external determinants, including inflation, growth, and oil prices in Turkey. The findings of the study indicate that fluctuations in oil prices have a significant indirect impact on the profitability of the Turkish banking sector, primarily through inflationary channels. Additionally, it has been determined that bank profitability is directly and negatively influenced by oil prices due to a reduction in oil-related business lending. Shaiban et al. (2021) explored the effects of oil price shocks on the banking sector's equity performance. To achieve their research goals, they utilized a sample comprising both developed and emerging economies for comparative analysis. The application of the Toda and Yamamoto causality test aims to examine the time-varying relationship between oil prices and banking indices, thereby assessing how oil price shocks influence the performance of banking industries in specific countries. The results differ across the economies included in the sample; however, the impact of oil prices is notably significant in the United States, the United Kingdom, Canada, Japan, Mexico, and Brazil.

Abdulazeez et al. (2021) investigated the effects of oil and gas price shocks on bank performance in the major oil and gas exporting countries of the Gulf Cooperation Council (GCC), utilizing data from 2000 to 2017. Their findings revealed that increases in oil and gas prices directly affect bank performance through the mechanism of price-induced bank deposits and associated lending to business activities. Falahpour et al. (2022) examined the influence of oil price shocks and Western sanctions on the liquidity creation of banks. Their results showed that negative oil price shocks adversely affect both on-balance sheet liquidity creation and the overall liquidity creation of large banks while having a positive effect on smaller banks. Conversely, the effects of positive oil price shocks are only significantly observed in the off-balance sheet liquidity creation of larger banks. Aayale et al. (2022) analyzed the correlation between equity prices and bank returns, alongside indicators of solvency, liquidity, asset quality, and profitability. A multiple linear regression analysis was conducted on panel data utilizing the financial information of commercial banks listed on the Casablanca Stock Exchange from 2011 to 2020. The findings indicated that stock prices are unaffected by liquidity levels, asset quality, and profitability metrics, which raises significant questions regarding the efficiency of the Moroccan stock market. Conversely, additional tests reveal a correlation between the profitability of banks, as measured by Return on Assets (ROA), and the aforementioned indicators.

4. Materials and Methods

This study employs the Recursive Dynamic Computable General Equilibrium (RDCGE) model to examine the influence of stock market fluctuations and oil price shocks on the profitability of Iran's banking sector. The computable general equilibrium (CGE) model utilizes actual data that reflects economic activities to analyze how economic systems respond to changes in policy and technology. It incorporates essential mathematical representations of the economy, encompassing the production, supply, and consumption functions, as well as governments, investors, and exporters' behavioral functions. Each participant operates based on specific underlying behaviors that guide their decision-making processes (Robson & Dixit, 2017). Notably, a key advantage of the dynamic CGE model is its capacity for cross-period analysis, thereby broadening the scope of research, and making it an essential tool for policy evaluation. Moreover, the CGE approach is increasingly utilized for long-term assessments of national economic policies, as well as for local policy analysis. The CGE model has emerged as a leading method for evaluating local economic support policies. The proposed CGE model illustrates the effects of government policies and market price combinations. Additionally, Iran's social accounting matrix is categorized into four sectors: agriculture, industry, services, and oil. The activities and commodities are designated as sets M and N, respectively, where $m \in M$, $n \in N$, and $m, n = 1, 2, \ldots, 4$. The principal relevant formulas are outlined below (for a comprehensive model, refer to Zhang (2010)). Price module:

$$PAm \cdot Am = PVAm \cdot VAm + PINTAm \cdot INTAm \quad (1)$$

Where *A*, *VA*, and *INTA* represent the levels of quantity, the quantity of value-added, and the quantity of aggregate intermediate input, respectively. Similarly, *P* denotes the corresponding prices. Equation (1) indicates that the income generated from each activity is entirely utilized for payments related to value-added and intermediate inputs.

Production module:

$$Qa_m = \alpha_m^q [\delta_m^q VA_m^{\rho m} + (1 - \delta_m^q) INTA_m^{\rho m}]^{\frac{1}{\rho m}} \quad (2)$$

$$VA_m = \alpha_m^{va} . LD_m^{\eta m} . KD_m^{1-\eta m} \quad (3)$$

Where *LD* and *KD* represent the labor and capital, respectively, the parameters α_m^q, δ_m^q, and ρm correspond to the efficiency, share parameter, and substitution parameter of the constant elasticity of substitution (CES) function, respectively. Additionally, αva and η signify the efficiency parameter and elasticity coefficient of the Cobb–Douglas (C-D) production function, respectively. Equation (2) illustrates the activity level as a value-added CES function, while Equation (3) outlines the aggregate intermediate input, which reflects the added value through a C-D production function.

Institution module:

$$YH = WL \cdot LS + WK \cdot KS \quad (4)$$

$$YG = \sum_m [(tv_m (WL. LD_m + WK. KD_m)] + t_i . YH \quad (5)$$

Where *YH* and *YG* signify the income levels of residents and the government, respectively, LS and *KS* refer to the amounts of labor and capital supplied, respectively. WL and WK represent the average costs associated with labor and capital, respectively. The variable ti indicates the personal income tax rate, while tv_m denotes the value-added tax rate. Equations (4) and (5) outline the sources of income for both residents and the government, respectively.

System module:

$$Q_n = \sum_m INT_{mn} + H_n + INV_n + G_n \quad (6)$$

Where *Q* stands for the number of goods supplied to the market; *INV* is the quantity of fixed investment; *INT* indicates the fixed investment; *INT* refers to the quantity of commodities utilized as intermediate inputs in production activities; while *H* and *G* signify the consumption quantities for households and the government, respectively. Equation (6) establishes a balance between the quantities supplied and the demand for commodities.

Recursive dynamic module:

$$LS_m^{t+1} = LS_m^t . (1 + g_L) \quad (7)$$

$$KS_m^{t+1} = KS_m^t . (1 + g_K) \quad (8)$$

$$\alpha_{t+1}^q = \alpha_t^q . (1 + g_{tfp}) \quad (9)$$

The variables *gL*, *gK*, and gtfp denote the growth rates of labor, capital, and total factor productivity (TFP, which encompasses the overall productivity of each component within the production unit), respectively. The dynamic aspect of the CGE model serves to connect the equilibrium condition of the current period with that of the subsequent period, focusing mainly on the accumulation of productive factors and advancements in technology. Equations (7)–(9) illustrate the updates for labor, capital, and TFP in each period (Chen et al., 2019). Additionally, Table 1 presents the Social Accounting Matrix (SAM) for Iran.

Table1. Social Accounting Matrix (SAM) of Iran

Accounts	Production	Production factors	Inputs	Capital stock	Abroad	Total input
Production	3,744,722,627	0	3,641,117,074	2,202,942,295	1,906,823,247	11,495,605,243
Production factors	6,209,271,377	0	0	0	23,802,887	6,233,074,264
Inputs	129,223,564	6,212,806,622	1,085,237,746	0	4,467,266	7,431,735,199
Saving	0	0	2,699,734,860	0	0	2,699,734,860
Abroad	1,412,387,674	20,267,642	5,645,520	496,792,564	0	1,935,093,400
Total input	11,495,605,243	6,233,074,264	7,431,735,199	2,699,734,860	1,935,093,400	29,795,242,966

Source: *https://rc.majlis.ir/en (2011)*

In addition, the scenarios of the study through the effects of the exchange rate, stock market, oil price, and government budget shocks on banking system profitability (growth of bank's stock price index) are represented in Table 2.

Table2. Scenarios of the study

Shock (percent)	Scenarios												
	0	1	2	3	4	5	6	7	8	9	10	11	12
Exchange rate (EXR)	0	2	5	10	0	0	0	0	0	0	0	0	0
Total stock index (STK)	0	0	0	0	2	5	10	0	0	0	0	0	0
Oil price (OIL)	0	0	0	0	0	0	0	2	5	10	0	0	0
Government budget (BUD)	0	0	0	0	0	0	0	0	0	0	2	5	10

Source: *Research Projection*

5. Empirical Results

The method of estimating current parameters is one of the main issues in solving CGE models which applying the calibration method has been fully accepted by model makers because of its facility and lowest need for information. The calibrated quantities and parameters of the model separated by economic sectors have been presented in Table 3:

Table 3. Calibrated quantities and parameters of model separated by economic sectors

Function	Parameter/ Elasticity		Industry sector	Agriculture sector	Services sector
Consumption	Share of goods		0.184	0.231	0.585
	Households' marginal propensity to consumption		0.633	0.633	0.633
Cobb-Douglass Production	Transfer or efficiency		1.423	1.826	1.903
	Share of production factors	Labor	0.113	0.290	0.343
		Capital	0.887	0.710	0.657
Leontief final production	Share of marginal intermediates	Industry	0.288	0.067	0.119
		Agriculture	0.011	0.369	0.009
		Services	0.169	0.106	0.147
	Share of value added		0.531	0.458	0.725
Armington composite good	Elasticity of substitution		1.4	1.4	1.4
	Share of import		0.461	0.276	0.078
	Transfer		2.201	1.833	1.231
Convert function	Convert elasticity		1.2	1.2	1.2
	Share of export		0.524	0.882	0.934
	Transfer		2.003	3.342	4.476
Private loan interest rate				0.015	
Inverse elasticity of money real residual				1.284	
Substitution elasticity of urban households' consumption				1.587	
Substitution elasticity of rural households' consumption				1.150	
Inverse elasticity of labor to urban household real wage				2.941	
Inverse elasticity of labor to rural household real wage				2.142	
Share of national development fund from exporting oil revenues				0.200	

Source: *research findings and previous studies*

Results of impulse response function (IRF) of banking system profitability (BPR) growth of bank's stock price index) to scenarios of the exchange rate (EXR), the stock market (STK), oil price (OIL), and government budget (BUD) shocks represented in figures 1 to 12:

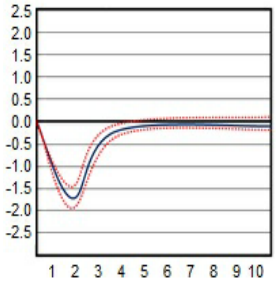

Figure 1. IRF of BPR to EXR in scenario 1
Source: *Research Estimates*

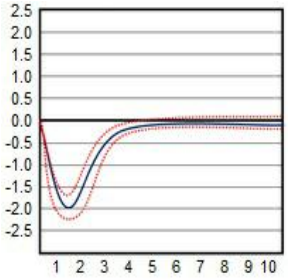

Figure 2. IRF of BPR to EXR in scenario 2
Source: *Research Estimates*

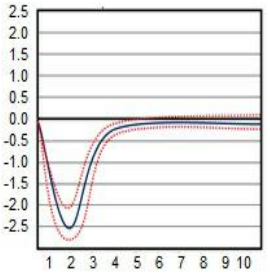

Figure 3. IRF of BPR to EXR in scenario 3
Source: *Research Estimates*

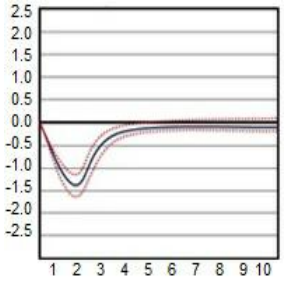

Figure 4. IRF of BPR to OIL in Scenario 1
Source: *Research Estimates*

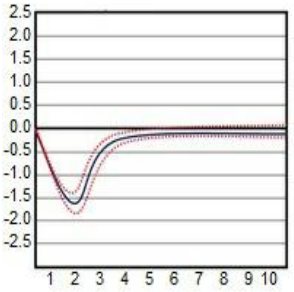

Figure 5. IRF of BPR to OIL in Scenario *2*
Source: *Research Estimates*

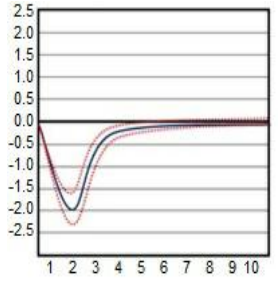

Fig6. IRF of BPR to OIL in scenario *3*
Source: *Research Estimates*

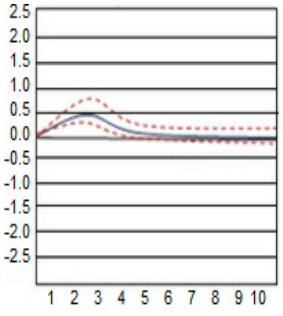

Figure 7. IRF of BPR to STK in scenario 1
Source: *Research Estimates*

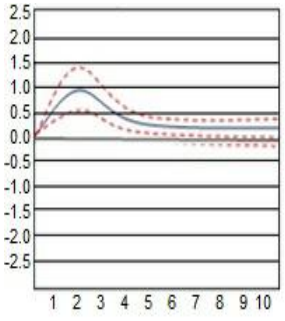

Figure 8. IRF of BPR to STK in scenario 2
Source: *Research Estimates*

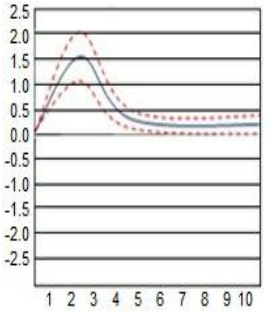

Figure 9. IRF of BPR to STK in scenario3
Source: *Research Estimates*

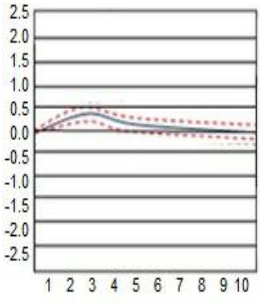

Figure 10. IRF of BPR to BUD in Scenario 1
Source: *Research Estimates*

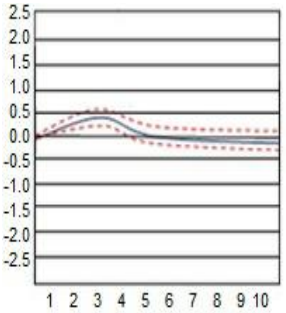

Figure 11. IRF of BPR to BUD in Scenario 2
Source: *Research Estimates*

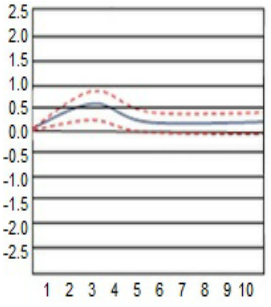

Figure 12. IRF of BPR to BUD in Scenario 3
Source: *Research Estimates*

Figures 1-3 represent the IRF of BPR to EXR in 2%, 5%, and 10% scenarios of increase in exchange rate. Results of Figure 1 indicate that according to scenario 1, if a shock equal to 2% imposes to exchange rate, BPR will decrease equal to 1.11% and 1.73% in periods 1 and 2 respectively. Then the effects of this shock will neuter and reach zero. The results of Figure 2 indicate that according to scenario 2, if a shock equal to 5% imposes to exchange rate, BPR will decrease equal to 1.14% and 2.01% in periods 1 and 2 respectively. Then the effects of this shock will neuter and reach zero. Results of Figure 3 indicate that according to scenario 2, if a shock equal to 10% imposes on the exchange rate, BPR will decrease to 1.86% and 2.57% in periods 1 and 2 respectively. Then the effects of this shock will neuter and reach zero. The shock of the exchange rate has an inverse effect on BPR because with an increase in the exchange rate, the production cost of firms due to importing moderate goods and materials will increase and therefore their solvency to bank loans will decrease.

Figures 4-6 represent the IRF of BPR to OIL in 2%, 5%, and 10% scenarios of increase in crude oil price. The results of Figure 4 indicate that according to scenario 4, if a shock equal to 2% is imposed on crude oil price, BPR will decrease to 0.86% and 1.41% in periods 1 and 2 respectively. Then the effects of this shock will neuter and reach zero. The results of Figure 5 indicate that according to scenario 5, if a shock equal to 5% is imposed on crude oil price, BPR will decrease to 1.03% and 1.63% in periods 1 and 2 respectively. Then the effects of this shock will neuter and reach zero. The results of Figure 6 indicate that according to scenario 6, if a shock equal to 10% is imposed on crude oil price, BPR will decrease to 1.45% and 2.03% in periods 1 and 2 respectively. Then the effects of this shock will neuter and reach zero. Crude oil price has an inverse effect on BPR because with an increase in crude oil price, the tendency of firms to invest in non-productive sectors due to Dutch disease will increase and therefore, their tendency to pay the banking loans will decrease.

Figures 7-9 represent the IRF of BPR to STK in 2%, 5%, and 10% scenarios of increase in total stock index. The results of Figure 7 indicate that according to scenario 7, if a shock equal to 2% is imposed on the total stock index, BPR will

decrease to 0.16% and 0.47% in periods 1 and 2 respectively. Then the effects of this shock will neuter and reach zero. The results of Figure 8 indicate that according to scenario 8, if a shock equal to 5% is imposed on the total stock index, BPR will decrease to 0.49% and 0.97% in periods 1 and 2 respectively. Then the effects of this shock will neuter and reach zero. The results of Figure 9 indicate that according to scenario 9, if a shock equal to 10% is imposed on the total stock index, BPR will decrease to 0.54% and 1.52% in periods 1 and 2 respectively. Then the effects of this shock will neuter and reach zero. The total stock index does not significant effect on BPR but, this weak positive effect shows that an increase in the total stock index represents the improvement in the firm's solvency and therefore will increase their ability to pay the banking loans.

Figures 10-12 represent the IRF of BPR to BUD in 2%, 5%, and 10% scenarios of increase in the government budget. The results of Figure 10 indicate that according to scenario 10, if a shock equal to 2% is imposed on the government budget, BPR will decrease to 0.19%, 0.24%, and 0.38% in periods 1, 2, and 3 respectively. Then the effects of this shock will neuter and reach zero. Results of Figure 11 indicate that according to scenario 11, if a shock equal to 5% is imposed on the government budget, BPR will decrease to 0.23%, 0.26%, and 0.44% in periods 1, 2, and 3 respectively. Then the effects of this shock will neuter and reach zero. Results of Figure 12 indicate that according to scenario 12, if a shock equal to 10% is imposed on the government budget, BPR will decrease to 0.27%, 0.52%, and 0.61% in periods 1, 2, and 3 respectively. Then the effects of this shock will neuter and reach zero. The government budget has no significant effect on BPR but, this weak positive effect shows that with an increase in the government budget, the total demand and therefore demand for banking loans will increase and thus interest income and BPR will increase.

6. Concluding Remarks

The reliance of a nation's economy on its banking system as the primary source of financing for businesses underscores the critical importance of examining the factors that influence the profitability of this sector. This study examines the effect of the exchange rate, crude oil price, total stock price index, and government budget on Iran's banking system. The analysis is conducted through twelve scenarios that assess the banking system's profitability in response to shocks of 2%, 5%, and 10% in the aforementioned variables. This study utilized the Recursive Dynamic Computable General Equilibrium (RDCGE) model based on data from the social accounting matrix (SAM, 2011) and the input-output table for the year 2016. The findings reveal that the exchange rate and crude oil prices negatively affect banking system profitability, while the total stock price index and government budget have positive effects. The funding comparison shows that in different scenarios, the shocks of the exchange rate, oil price, stock market, and government budget, respectively have the most effect on bank profitability.

The results of this research are consistent with part of the findings of Babazadeh et al.'s study (2011) which examined the effect of exchange rate

fluctuations on the performance and profitability of banks in the short and long term and found that exchange rate changes and changes in the exchange rate situation have a negative effect on the profitability of banks. Also, the findings of the present study confirm part of the results of Khani et al.'s research (2019), which investigated the effect of oil price shocks on the performance of banks in Iran from 2006 to 2016 and found that oil price shocks have a significant effect on banking performance so that the increase in price of oil causes a decrease in the performance of the bank according to the Kamels model. In addition, the findings of the present study confirm part of the results of Lu et al.'s (2021) research, which investigated the effect of pound exchange rate fluctuations on bank profitability after the United Kingdom's exit from the European Union, and found that there is a significant relationship between exchange rate fluctuations and bank profitability.

Finally, the results of the research showed that the occurrence of a shock in the exchange rate decreased the profitability of the banking system due to the increase in the production costs of enterprises and consequently inability to repay the bank facilities, it is suggested that Iran's foreign currency reserve fund should be used as a shock absorber to prevent the excessive increase of the exchange rate. Furthermore, since the results showed that a positive shock to the total stock index and the government budget leads to an increase in the profitability of the banking network, it is suggested that the government support the stock market. In this way, by attracting liquidity from the private sector and providing financial resources through the transfer and sale of government shares at a high price, the government can compensate a part of its reduced income in the conditions of economic sanctions, and subsequently, pay the part of its debt to the banking network and increase the profitability of the banking system.

Author Contributions

Conceptualization, all authors; methodology, Z.E., and M.E.; formal analysis, all authors; resources, Z.E. and.; writing—original draft preparation, Z.E., and final draft M.E.; writing—review and editing, all authors; supervision, M.E, N.D, M.H.F. All authors have read and agreed to the published version of the manuscript.

Funding

This research received no external funding.

Conflicts of Interest

The authors declare no conflict of interest.

Data Availability Statement

The data used in the study were taken from https://*rc.majlis.ir/en*, https://tsd.cbi.ir/Display/Content.aspx

Acknowledgments
Not applicable

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