Print ISSN: 2008-448X
Online ISSN: 2538-3310
International Journal of Business and Development Studies
University of Sistan and Baluchestan
Homepage: https://ijbds.usb.ac.ir

Evaluating the Inflationary Rule of Exchange Rate Determination Based on the Resistive Economy Strategy (Case Study: Iran)[1]

Behnam Ebrahimi[1] **Mohammad Vaez Barzani[2]**

[1.] Post-Doc. Researcher, Department of Economics, Faculty of Administrative Sciences and Economics, University of Isfahan, Esfahan, Iran. (Corresponding Author) Email: bizbehnam@yahoo.com.
[2.] Associate Professor, Department of Economics, Faculty of Administrative Sciences and Economics, University of Isfahan, Esfahan, Iran. Email: m.vaez@ase.ui.ac.ir.

ARTICLE INFO

Article type:
Research

Article history
Received: 12.08.2024
Received: 18.02.2025
Accepted: 11.04.2025
Published: 07.05.2025

Keywords:
Inflationary Rule of Exchange Rate Determination (IR-ERD), Discretionary Approach to Exchange Rate Determination (DA-ERD), Economic Sanctions, and Resistive Economy Strategy (RES).

Abstract:

The exchange rate is a critical variable that impacts the economy in the international environment. Therefore, selecting an appropriate exchange rate regime and policy rules for managing the exchange rate is vital. This is particularly important for the Iranian economy, which has been affected by nuclear sanctions and the resulting exchange rate fluctuations, leading to a number of negative consequences. The purpose of this study is to evaluate and compare the two approaches to exchange rate determination outlined in the Law on Permanent Decrees of the Country's Development Programs under economic sanctions. The analysis involves a theoretical discussion of a set of mathematical equations and software results, obtained from the algebraic and numerical solving of a simulated version of a dynamic stochastic general equilibrium model in the context of the international economy for a small open economy. The model is calibrated using the structural parameters of the Iranian economy. The criterion for evaluating the rule and comparing it with other policy options is the "stability" of macroeconomic variables, a key aspect of the Resistive Economy Strategy as the obliging basic document in economic policy-making and planning. The stability is quantified using the "Variance" index. Based on the results of this study, the adoption of the rule-based inflationary exchange rate determination approach, compared with the contingency approach to exchange rate determination, on the one hand, offers the possibility of achieving lower inflation rates and exchange rate growth pace. On the other hand, it will reduce the instability of selected macroeconomic variables, which is desirable from the perspective of the overall policies of the resistance economy strategy. Therefore, it is recommended that, in the presence of foreign economic sanctions, the economic authority should implement inflationary rule of exchange rate determination based on the current inflation rate.

[1] This article is taken from the post-doctoral project entitled "Exchange Rate Targeting Rule-Making in context of Resilient Economy", supported by Iran National Science Foundation and University of Isfahan.

Cite this article: B. Ebrahimi and M. Vaez Barzani (2025). Evaluating the Inflationary Rule of Exchange Rate Determination Based on the Resistive Economy Strategy (Case Study: Iran). *International Journal Of Business and Development Studies*, 17 (1), 237-274. DOI: 10.22111/ijbds.2025.50506.2179.

© The Author(s).
Publisher: University of Sistan and Baluchestan

1. Introduction

Exchange rate fluctuations caused by domestic and foreign shocks pose a significant challenge to many developing economies due to its impact on macroeconomic variables. Thus, researchers and policymakers in these economies have sought to adopt sound exchange rate management rules and policies to optimally manage the exchange rate system and minimize the impact of external shocks on macroeconomic variables. This is in particular important for Iran's economy, given the ongoing international political conditions, shocks caused by various sanctions, and its status as a small open economy. Therefore, various policy recommendations were proposed by economic policymakers and theorists to address the negative impacts of sanctions and other external shocks; among which, the concept of the "Resistive Economy Strategy" was endorsed by the Supreme Leader of Iran in 2012. The Resistive Economy Strategy (RES) is defined as a country's strategy for economic growth amid significant shocks, primarily of external origin. The RES aims to prevent the economy from being affected by external shocks and in case that the economy is affected, it should experience minimal negative consequences and quickly return to its pre-shock state. The RES is based on various arrangements or sub-arrangements, including those required for technology management, budgeting, government finance, and foreign trade.

One of the most important arrangements discussed in RES is the exchange rate regime and its rules. In general, three types of exchange rate regimes have been considered in modern economics: fixed exchange rate, floating exchange rate, and managed floating exchange rate, with the managed floating exchange rate system being used by many developing countries[1]. Once the managed floating exchange rate system has been selected, the economic authority should instantly address the exchange rate determination approach[2]. If the approach to exchange rate management is not discretionary[3], it must be rule-based, i.e. the target exchange rate should be set according to a predetermined rule. The official stance of Iranian authorities on the exchange rate regime and the approach to exchange rate determination is outlined in the following three documents:

1- It is mentioned in clause "c", of Article 81 of the Fifth Economic, Social and Cultural Developments Program (ESCDP) and clause "t", of Article 20 of the

[1] Refer to The International Monetary Fund (2014).

[2] Exchange rate determination has been addressed in detail in theoretical literature in various studies. According to the theory, one of the most important economic parameters used in determination of the exchange rate target, is the inflation rate.

[3] Under pure discretion, the settings for the instruments of policy are determined from scratch each period with no attempt to follow a reasonably well-defined contingency plan for the future. A precise analytical distinction between policy rules and discretion can be drawn from the time-consistency literature. In three of the major contributions -Kydland and Prescott (1977), Barro and Gordon (1983), or Blanchard and Fischer (1989) - a policy rule is referred to as the “optimal,” the “rules,” or the “pre-committed” solution, respectively, to a dynamic optimization problem. Discretionary policy is referred to as the “inconsistent,” the “cheating,” or the “shortsighted” solution, respectively. (Taylor, 1993).

Law on Permanent Decrees of the Country's Development Programs (LPDCDP)[1] as below:

"…The country's exchange rate regime is a "managed floating exchange rate system". The range (of acceptable fluctuations) of the exchange rate is determined by maintaining competitiveness in foreign trade and taking into account domestic and global inflation, as well as macroeconomic conditions, including ensuring a desirable level of foreign exchange reserves.[2]"

Two points need clarifications regarding this decree. The first point is that, according to the phrase "... the country's exchange rate regime..." as well as the objective "... maintaining competitiveness in foreign trade...", the legislator's objective in enacting this decree was not to determine the monetary policy regime, but the ultimate objective of the legislator is the management of the country's foreign trade sector. The second point is that the parameters forming basis for the decisions of the exchange rate system authority are defined in such a way that makes it seems like the legislator is trying to establish a predetermined rule for policymakers. In this case, the rule of periodic adjustment of the exchange rate was established on the basis of the difference between the domestic and foreign inflation rates, which in this study will be referred to as the "Inflationary Rule of Exchange Rate Determination (IR-ERD)".

2- In paragraph "b" of Article 11 of the seventh ESCDP, the exchange rate system is explained as below:

"The decisions and legal actions of the Central Bank, taken on the basis of the authorizations of the Monetary and Credit Council to manage exchange rate fluctuations, in order to intervene in the gold and foreign exchange markets, both officially and unofficially, are binding."

As can be seen from this clause, the legislator has declared and recognized a Discretionary Approach to Exchange Rate Determination (DA-ERD) in the seventh ESCDP bill, taking into account the extreme exchange rate volatility due to economic sanctions and the failure of the economic authority to manage the foreign exchange market. Accordingly, the legislator seems to have adopted two different and even contradictory approaches in the two laws in force.

The purpose of this study is not to criticize or violate the exchange rate determination rule derived from the theory of purchasing power parity in principle, but rather to evaluate the effects of adopting this approach in the context of the Dynamic Stochastic General Equilibrium (DSGE) model, compared to the DA-ERD (as a counter-alternative proposal) under the conditions of the imposition of foreign economic sanctions.

[1] The Law was passed in 2017.

[2] In paragraph "t", of Article 20 of the LPDCDP, this phrase is preceded by the phrase: "To implement the general policies of the Resistive Economy, including making the financial resources productive and reforming and strengthening of the country's financial system.

The comparison of the performance of the two approaches, is done in two steps. In the first, the equilibrium value of selected macroeconomic variables are compared and in the second step, the "stability" of the variables are compared. The stability criterion has been proposed as the first and one of the most important criteria considered for the RES (Akhbari & Gholizadeh, 2015). Since the RES has been formulated and communicated as a basic document for all economic policies, especially in the context of the imposition of international sanctions, it is obligatory and its rules and criteria should necessarily be observed in any policy package. Moreover, this criterion has been used in many similar studies in the economic literature, such as Briguglio et al. (2009), Mayes and Riches (1996) and Aguir and Smida (2015). It is worth noting that the selected variables examined include per capita consumption, per capita production, per capita capital stock, per capita imports (balance of trade), per capita real wage, real interest rate and general price level.

The present study is organized as the following: 1) introduction, 2) literature review and research background, 3) model and methodology, 4) model solution and data analysis, and 5) conclusion and suggestions.

2. Literature review and research background

This section is divided into three parts. The first section presents theoretical notes. The second section provides a detailed review of the RES literature. Finally, the third part discusses the research background in order to clarify the situation of the present study.

2.1. Foreign exchange regulation

In a free economic system, it is assumed that the market operates without the intervention of the economic authority and that any intervention by the authority in economic system is exceptional and contrary to principle and must therefore be justified. Thus, as long as the markets are regulated by the system of supply and demand, the interventionist presence of the economic authority and the use of coercive instruments such as administrative laws and regulations are not acceptable. In some circumstances, however, the market may not be efficient enough to perform all economic functions on its own and intervention by the authority may be necessary. In such an environment, the economic authority is only a complement to the market, not a substitute for it. The economic authority seeks only to address the shortcomings of the market and to complement the accepted economic mechanisms. Therefore, the economic authority uses regulation to eliminate the temporal inconsistency of economic policy, and in this way, it helps to eliminate the shortcomings of the market, improve equality and prevent harm to citizens. Accordingly, regulation in the economy can be seen as policy-making and even as the establishment of long-term strategies. It is worth noting that regulation in an economy is undertaken with different objectives and is based on a number of criteria, including efficiency, optimality, equity, justice

and sustainability. The same applies to the foreign exchange market. It may be necessary for the foreign exchange authority or the central bank to intervene in the market to correct short-term market deviations from its optimal allocation mandates and to set rules or implement policies. Accordingly, special attention has been paid to exchange rate regulation in Iran in recent years. To this end, this study attempts to evaluate the IR-ERD, as the only predetermined rule in the LPDCDP framework for exchange rate regulation, based on the criteria of the RES and to propose the necessary reforms to improve the rule's performance.

2.2. Resistive Economy Strategy and foreign exchange determination

Iran's economy has to select an appropriate exchange rate system or regime to achieve its economic objectives. The underdevelopment of financial markets and the lack of diversity in the production and trade sectors, in conjunction with the country's reliance on oil, are some of the most important characteristics of oil-rich developing economies. The foreign pressure and economic sanctions imposed by foreign governments have further complicated the task of establishing an appropriate exchange rate system for Iran. To this end, the Resistive Economy Strategy (RES) has been adopted by the Iranian authorities to address this issue. The RES aims to achieve economic growth even in the face of major external disturbances by strengthening and consolidating the nation's economic foundations.

The closest concept to the RES in the economic literature is that of the resilient economy. The concept of a resilient economy emerged in 2009 following the negative impact of economic disturbances (primarily financial crises) on economies that were not the source of the disturbances. A resilient economy can quickly and easily remove the effects of exogenous economic shocks or adapt to their negative consequences (Sondermann, 2016). A resilient economy is characterized by its ability to withstand and recover from external pressures and economic sanctions, thereby promoting national economic development. The RES, however, is primarily addressing self-sufficiency and economic independence. Resisting foreign sanctions can contribute to self-sufficiency and economic independence and thereby to improve domestic production and the indigeneity of the economy.

The RES has multiple dimensions, but current research only examines the exchange rate determination rule outlined in the LPDCDP. According to main guidelines of the RES, it is essential for the country's economic system to seize opportunities arising from external shocks, particularly those related to foreign exchange, and to strengthen and manage the economy in times of challenges. Therefore, the exchange rate system should be adapted to the framework of the RES in such a way that turn the threats into opportunities. This is referred to as foreign exchange regulation under the RES. In essence, the foreign exchange rules and Foreign Exchange Market (FXM) must be regulated according to the

specifications and structure of the country's economy, while taking into account both internal and external disturbances.

The primary objective of the RES, is to protect Iran’s exchange rate system against potential risks. In other words, it is essential to adjust the exchange rate system in order to minimize damage to the Iranian economy in the event of multiple risks. Mitigating the negative effects of external shocks depends on achieving economic stability and improving public welfare. Any action taken in the exchange rate system that leads to economic instability and reduces social welfare will hinder the country’s ability to achieve RES and increase economic risks.

The RES, as conceptualized, has four basic characteristics: it is Knowledge-Based (KB); it has an Endogenous/International-Looking Approach (EI); it is People-Oriented (PO); and it is Justice-Oriented (JO). If these four pillars are properly managed, the RES will be formed and the country will have the ability to withstand any risks.

Paying attention to promoting technology in the manufacturing sector and raising the level of skills and capabilities of human resources, and empowering the young educated population will reduce problems such as unemployment and increase economic resilience. (Malek Alipour and Purpir, 2012). Moreover, the endogenous/international-looking approach, which is achieved through activities such as supporting national production, leads to economic growth, creating jobs and reducing in unemployment, increasing national income, increasing international trade, developing industries, and eventually increasing the resistance of the economy (Rajabi Kelvani et al., 2012). In addition, raising people's awareness of the state of the national economy and increasing their participation in the economic planning and management through utilizing their insights, ideas, and solutions will reduce the vulnerability of the national economy to external shocks, and encourage families to actively support the development of the national economy.

The exchange rate regime is one of the most effective factors in this regard and can affect it in a number of different ways. Figure 1 depicts the relationship between the RES and the impact of an appropriate exchange rate regime on the economy.

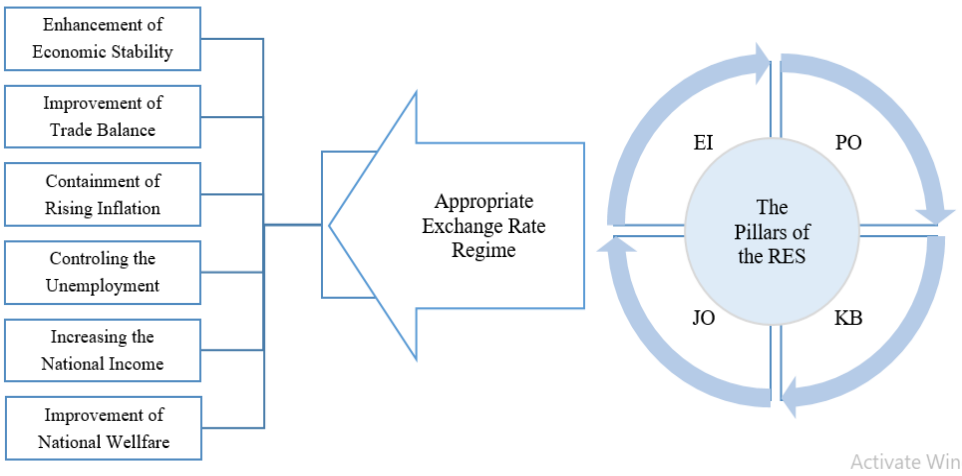


Figure 1: The relationship between the RES and the exchange rate system

An appropriate exchange rate system conducted in accordance with the RES pillars could enhance economic stability by improving economic resilience, improve the trade balance by restricting imports, increase national income by increasing domestic production, reduce unemployment by creating more jobs, prevent raising inflation by mitigating the negative effects of foreign shocks, and ultimately it could increase national welfare by promoting justice. This would lead to the institutionalization of RES itself.

Conversely, if the exchange rate regime is not properly formed and managed, importing becomes more profitable, leading to an increase in the propensity to import. As a result, domestic production loses its market share, and consequently employment falls. This leads to an increase in unemployment, a decrease in social welfare and overall, it will hinder the establishment of RES. Therefore, the performance of the exchange rate system is one of the most crucial factors influencing the success of the RES.

2.3. Research background

Economists have made numerous efforts to explain the factors influencing exchange rate dynamics. Some traditional theories, such as Mundell (1960), Fleming (1962) and Cassel (1918), consider exchange rate fluctuations as a function of the real variable of trade, while others, such as Lucas (1982) or Obstfeld and Stockman (1985), emphasize the role of productivity shocks. More recent theories, such as Obstfeld and Rogoff (1995), emphasize the role of nominal variables such as price stickiness or market inefficiency. In these models, especially after the introduction of floating exchange rates, the role of asset markets and capital flows in explaining exchange rate fluctuations is more

emphasized. The new models can be divided into two generations of monetary models, such as Frenkel (1976) and Dornbusch (1976), and portfolio balance models, such as Kouri (1976) and Branson (1977). In monetary models, the national currency and foreign currency are considered as asset. Therefore the exchange rate is not only affected by exogenous factors influencing the supply and demand of financial assets, but also by future expectations of these factors which will also affect the exchange rate fluctuations.

The disruptive factors in the international economic environment and their impact on the exchange rate is also the subject of another part of economic studies. A significant part of these studies examines the impact of economic sanctions on exchange rate movements and fluctuations. These studies can be categorized in different ways. In terms of the types of sanctions studied, these studies fall into several groups, including economic sanctions, import sanctions, export sanctions, financial system sanctions, trade sanctions, and freezing of assets of the target economy. For example, Lorenzoni and Werning (2022) focus on import sanctions. Drygalla (2022), Cerra (2016) or Moeeni et al. (2021) study the effects of export embargoes. Pourshahabi and Dahmardeh (2015), Rahmati et al. (2021) have studied the impact of trade sanctions. Heydarian et al. (2021) have studied the effects of financial sanctions. Tyll et al. (2017), Hemmati et al. (2022), and Wang et al. (2019) have studied the effects of economic sanctions. Some of these studies also examine the impact of multiple categories of sanctions, for example, we can mention Eichengreen et al. (2023), Nakhli et al. (2020), Onour (2020), Rasolyar et al. (2015), or Itskhoki and Mukhin (2022).

In terms of economies, the most frequently addressed case studies include Iran, Russia, Venezuela, Syria, Sudan, Cuba, and North Korea. For instance, Nakhli et al. (2020), Hemmati et al. (2022), Moeeni et al. (2021), Rahmati et al. (2021), Heydarian et al. (2021) or Pourshahabi and Dahmardeh (2015) examined the impact of sanctions on the Iranian economy. Lorenzoni and Werning (2022), Itskhoki and Mukhin (2022), Drygalla (2022) and Tyll et al. (2017) studied the impact of sanctions on the Russian economy. Cerra (2016) studied the impact of economic sanctions on the Venezuelan economy while Onour (2020) focused on the effects of sanctions on Sudan and Iran. Rasolyar et al. (2015) selected the data used in their study from a sample of 6 countries. Eichengreen et al. (2023) also conducted their study using a sample of the sanctions experience of 22 countries and Wang et al. (2019) used a sample of 23 countries.

In terms of research methodology, these studies can be divided into two general categories. The research methodology of the first category is based on statistical methods, including Eichengreen et al. (2023), Drygalla (2022), Wang et al. (2019), Heydarian et al. (2021), Rasolyar et al. (2015), Tyll et al. (2017), Hemmati et al. (2022), and Pourshahabi and Dahmardeh (2015). Among these studies Moeeni et al. (2021), stands out as they used Google search index data as an indicator of Iranian consumers' expectations and applied the ARDL method.

The method used in the second group is based on the DSGE approach, including Nakhli et al. (2020), Rahmati et al. (2021), Itskhoki and Mukhin (2022), Cerra (2016), Onour (2020), and Lorenzoni and Werning (2022).

In terms of scope, these studies fall into two groups. The aim of the first group is simply to identify the impact of sanctions on different sectors of the economy. For example, Eichengreen et al. (2023), Tyll et al. (2017), Moeeni et al. (2021), Wang et al. (2019), and Rasolyar et al. (2015) have studied the impact of different sanctions on exchange rate changes or fluctuations. Hemmati et al. (2022) have studied the effect of economic sanctions on the deviation of the real exchange rate. Rahmati et al. (2021) have studied the effects of oil and non-oil sectors exports embargoes, on national production and income, as well as the psychological effects of sanctions on the occurrence of the currency crisis, inflation, and real sector production. Lorenzoni and Werning (2022) explain the impact of sanctions on the exchange rate and social welfare, while Pourshahabi and Dahmardeh (2015) study the impact of trade sanctions on the occurrence of currency crises. Heydarian et al. (2021) have investigated the impact of financial sanctions on Iran's economic growth. Sara (2016) has explained the impact of oil sanctions and the reduction in foreign exchange revenues and currency rationing on the exchange rate and inflation. Nakhli et al. (2020) investigated the effects of the oil export embargo on aggregate consumption and investment, innovation, exports, exchange rates, monetary variables, public finance methods, and public expenditure. Onour (2020) or Itskhoki and Mukhin (2022) studied the impact of sanctions on exchange rate fluctuations. Rahmati et al. (2021) have studied the effects of imposing trade sanctions on a wide range of macroeconomic variables.

In contrast, the second group, not only explains the effects of sanctions, but also evaluates the tools and policies to address the effects of economic sanctions, in particular, monetary and fiscal policies, as well as foreign exchange policies. Nakhli et al. (2020), Drygalla (2022), and Rahmati et al. (2021) belong to this group. Nakhli et al. (2020), used a neo-Keynesian DSGE model, calibrated with the parameters of the Iranian economy, to study the effects of oil and financial sanctions on macroeconomic variables. According to the results of the study, the imposition of oil and financial sanctions will reduce innovation, investment, and production in the oil sector as well as production and exports in the non-oil sector. In addition, sanctions would cause an increase in the exchange rate and the inflation rate, which can lead to stagflation. On the other hand, the imposition of sanctions will increase the government budget deficit resulting in an increase in the sales of government bonds. In addition, the researchers evaluated and compared performance of two types of monetary regimes in managing the negative effects of the foreign economic sanctions. The two monetary regimes include current approach of monetary targeting regime and proposed approach of inflation targeting regime; both of which are compared using the inflation rates of

the producer price index (PPI) and the consumer price index (CPI). If the policymaker prefers to maintain the level of production in the targeted equilibrium path, the inflation rate based on the Producer Price Index (PPI) is used, and if the the policymaker's objective is to maintain the purchasing power of households, the inflation rate based on the Consumer Price Index (CPI) is used. The results indicate that when the monetary targeting approach is implemented, the price index used to calculate the inflation rate has no effect on the negative effects of sanctions. On the other hand, when the inflation targeting approach is implemented, the use of the PPI reduces the negative effects of sanctions more than in other cases, and accordingly it is preferable to them.

Drygalla (2022), studied the impact of oil price fluctuations and private sector capital outflows caused by economic sanctions on Russian macroeconomic variables using a DSGE model. The model incorporates structural equations of oil price changes and the specific structure of the Russian currency market. According to the findings of the study, capital outflows and oil price changes have a significant effect on Russian macroeconomic variables, including inflation rate, production, and exchange rate. The study also compares the performance of five monetary policy regimes in mitigating the adverse effects of the sanctions shocks. The first monetary regime is the "inflation targeting", where the policymaker uses interest rate tool to mitigate the deviation of the inflation rate from the target. The second policy regime is the "strict inflation targeting", in which the policymaker sets the coefficient (respective parameter) of the inflation rate deviation to infinity, resulting in a much more severe reaction to the inflation rate deviation compared to the first case. In the third case, the "hybrid inflation targeting" regime is studied, in which the policymaker takes into account the deviation of real GDP from its target value in addition to inflation rate deviation when setting the interest rate. In the fourth case, the "fixed exchange rate" regime is studied in which the exchange rate is managed through government intervention in the foreign exchange market using foreign exchange reserves. In the fifth scenario, the policy regime of "ruble price of oil targeting" is studied. In this case, the central bank adjusts the growth rate of the exchange rate in line with the oil price inflation rate in the world markets. The comparison is made using the "stability" criterion and the "analysis of variance of the prediction error" index. Based on the results of comparing the performance of policy regimes, the hybrid inflation targeting regime reduces the economy's vulnerability to external shocks. It is worth mentioning that the fixed exchange rate regime or ruble price of oil targeting regime are inferior to all types of inflation targeting regimes. Although in the event of a shock to the flow of capital, the fixed exchange rate regime is more efficient due to its full compensation of the effects of the shock, but in the case of shock to the price of oil, this policy is less efficient.

Rahmati et al. (2021) used a DSGE model that incorporates a speculative attack on the foreign exchange market in its structural relationships to study the impact of trade sanctions on macroeconomic variables. The model was calibrated using data on the Iranian economy for the period 1990-2013. The results of the study imply that the medium and long term effects of oil and non-oil trade sanctions take in the form of a decline in the production of non-oil goods and aggregate income. Also, the news outbreak of trade sanctions will spark speculative currency attacks, leading to an increase in the exchange rate, the occurrence of a currency crisis, and a profound impact on inflation and production. In addition, the researchers have evaluated the performance of fiscal and foreign exchange rate policies in managing the negative effects of sanctions. In evaluating fiscal policies, the key assumption of the study is that there is no fiscal dominance i.e. the central bank has independence in controlling the budget deficit and inflation.
In other words, it is assumed that the government is able to adjust budget size or the tax rate in order to keep the liquidity growth rate and the inflation rate stable. Therefore, it is recommended that during sanctions period, when the government's oil revenues shrinks, the tax rate should be increased or the size of the government should be reduced in order to avoid a sharp increase in inflation and its adverse effects. It is also assumed that just two periods ahead of the imposition of sanctions, when households are informed of imminent imposition of sanctions, the government increases the supply of foreign exchange from foreign exchange reserves in order to maintain the fixed exchange rate system. The simulation results show that this policy is effective in controlling the real exchange rate against trade sanctions in the short term only.
The review of the research background reveals that most of the studies have focused on explaining the effects of different types of economic sanctions on different macroeconomic sectors and variables. Only three of the studies have analyzed and evaluated the performance of the economic policies to address sanctions. Furthermore, none of these three researches has studied the IR-ERD as a foreign exchange regime. Instead, the main purpose has been to study the effect of monetary and fiscal tools in managing the effects of sanctions, or other kinds of shocks to fundamental variables of the international economy. In addition, some of the mentioned policy regimes are not prevalent in developing economies such as Iran, so the results of these studies will not be applicable to policymakers in these economies. Therefore, the necessity of conducting the present study to analyze the IR-ERD and compare it to DA-ERD is of vital importance.

3. Methodology and the Research Model Specification

The research methodology involves theoretical analysis based on mathematical solution and extraction of structural relationships of the economic model, as well as numerical solution of the calibrated version of the model. The theoretical

foundations and literature are derived from library resources and internet databases. The numerical parameters required for simulation are obtained from the official sources of the Iranian economy (such as the Iranian Central Bank or the Statistical Center of Iran), the findings of other applied researches and the data generated by appropriate computer software. In particular, the structural parameters of Iran's economy (e.g. time preference rate or capital production elasticity) are taken from the previous researches, macro-statistical variables (e.g. the population growth rate) are obtained from official sources of economic data, and the set of exogenous shocks introduced into the economy, is generated using appropriate computer software.

The study model provides a theoretical framework for identifying and understanding the impact of the implementing of the IR-ERD. The construction of the model is based on the simple principles and framework. However, as the numerical solution of the calibrated version of the model is done using parameters of the Iranian economy, the behavior of the model and its basic variables reflect the behavior of the Iranian economy and similar developing economies. Therefore the results of this research are used to understand the behavior of the basic macroeconomic variables, including capital stock, per capita consumption, exchange rate, production, volume of money and credit, exchange rate, interest rate, trade balance, and may be used in policymaking.

The research model is based on DSGE framework and reflects the settings of a small open economy[1] in the international economic environment. International DSGE models have been used, in particular, to study the dynamics of economy under different exchange rate systems, especially the fixed exchange rate system, and the effects of different trade policies. These models, in contrast to the Keynesian models, are based on the micro-foundations, i.e. the macroeconomic behavior of different sectors of the economy is explained by the collective decisions of individual rational agents under conditions of certainty and all markets clearing. In these models, the short-run equilibrium of economy is assumed and the long-run behavior, the steady state, is extracted by taking into account all the available events and information. The different sectors of the economy and the underlying assumptions are explained below:

3.1. Consumption-Capital goods

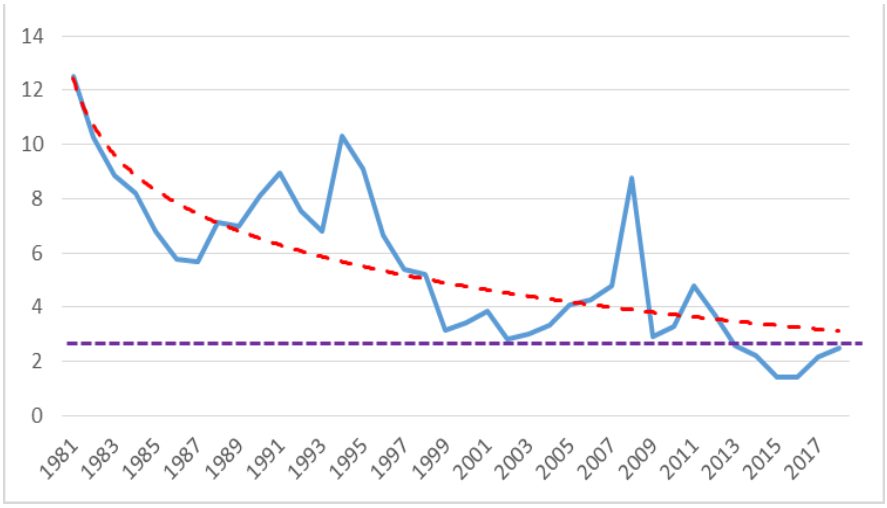
There is only one homogenized commodity[2] that can be consumed, saved, or invested. This commodity can be produced by domestic firms or foreign sector

[1] The stylized facts (taken from the statistics of the International Monetary Fund and the World Bank) supporting this assumption are as follows: 1) Iran's share of the global GDP (1%) or global trade (0.378%) is insignificant, which confirms that Iran economy may considered as small. 2) The ratio of Iran’s foreign trade to GDP is close to the global average (close to 50%), which confirms the openness of the Iranian economy.

[2] A homogenized good actually consists of a wide range of various tradable and non-tradable goods, which are aggregated and considered as a single good for analytical simplicity.

firms. The initial stock of this commodity in the national economy is equivalent to K_0, which belongs equally to all households. This initial balance is referred to as the capital reserve of the first period.

According to the following diagram (Figure 2), the dynamics of the inflation rate of the homogenized commodity in global market, in terms of foreign currency, are assumed to be exogenous and a function of a stochastic process that converges to a constant value:



Source: World Bank

Figure 2: Global inflation rate variations

Therefore, in order to specify the price dynamics of homogenized goods in the global market, in terms of foreign currency, the following equation is used:

$$P_t^R = \left(1 + \overline{\delta^R} + \varepsilon_t^R\right) P_{t-1}^R \approx \left(1 + \overline{\delta^R}\right) P_{t-1}^R + \varepsilon_t^R \qquad (1)$$

$$\varepsilon_t^R \sim iid(0, \sigma^R)$$

In which P_t^R is the price of goods in the world markets in terms of foreign currency, $\overline{\delta^R}$ is the inflation rate in the world market, and ε_t^R is the random component with normal distribution and given parameters.

Accordingly, the effect of all exogenous factors influencing the current nominal price of homogenized goods in the international market would be reflected in the random component of ε_t^R. Therefore, the international price dynamics of homogenized goods will be determined by the functional form mentioned above

and will be entirely exogenous. In other words, it is assumed that the mathematical expectation of the global inflation rate is fixed at 2.5% and that the price of goods in the world market grows at this specific rate, unless unforeseen events cause the realized inflation rate to deviate from the expected rate. The standard deviation of the stochastic process of the random component of the nominal current price is equal to σ^R.

3.2. Production-trade enterprises

The production sector[1] consists of a large number of firms that operate under conditions of perfect competition. Production is a function of capital and labor (population). The Production function has a constant returns on scale, and the growth rate of technology is constant and exogenous. The production function is assumed to be the Cobb-Douglas function:

$$Y_t = F(K_t, N_t) = A_t K_t^{\alpha} N_t^{1-\alpha} \qquad (2)$$

Where, α is the elasticity of production function with respect to capital, A_t is the (exogenous) index of technology or total factor productivity, Y_t is the gross output and K_t is the capital stock.

In this model, firms have a dual production-trading role: in the trade sector, firms either export a portion of their output or import goods from the foreign sector, depending on the level of households demand. Accordingly, only manufacturing firms and the government are in contact with the foreign sector. It is also assumed that firms rely on bank loans to finance the payment of capital rent and wages, and that the payment of these funds is obligatory at the beginning of the period.

3.3. Foreign sector and exchange

The foreign sector consists of all economies that are related to the national economy. Taking into account the number and size of the economies in the foreign sector, it is assumed that the behavior of the domestic economy has no effect on the foreign sector. In other words, it is assumed that the domestic economy is price taker in the international market and the size of exports and imports of the national economy has no effect on the relative international prices.

Considering the policy-making behavior of the Iranian economy (research case) it is assumed that the exchange rate system of the national economy is the managed floating exchange rate. In addition, as mentioned in previous sections, it is assumed that the exchange rate system authority should use two approaches to manage the exchange rate, including the DA-ERD and the IR-ERD. In the discretionary approach, the exchange rate system authority determines the growth rate of the exchange rate based on the discretion of current socio-political economic conditions and the growth rate of the foreign currency is ensured by

[1] The production function does not include the natural resources sector (oil and other raw minerals) because this sector does not account for a significant share of national employment. Instead, the rents arising from the scarcity of these resources, constitute almost all of the earnings from foreign trade, in terms of foreign currency.

intervening in the foreign exchange market. In contrast, under the inflationary rule approach, the exchange rate system authority adjusts the inflation rate of exchange rate in accordance with the differential between the domestic and the global inflation rate. In other words, the exchange rate management authority determines the changes in the exchange so that the growth rate of exchange rate is equal to the difference between the domestic and foreign inflation rates:

$$\delta_{t+1}^{G} = \delta_t - \overline{\delta^R} \qquad (3)$$

In which, δ_t is the domestic inflation rate and) exchange rate [1]officialis the (δ_t^G growth rate.

3.4. Government and public expenditure

In the Iranian economy and in most of the similar contemporary economies, the public sector typically employs different methods to finance its activities. These methods could be broadly categorized into borrowing (debt), taxation, revenues from state-owned enterprises, and transfer of assets (such as sales of natural resources, rights, and public property). In this model, borrowing[2] and state-owned enterprises[3] are ignored and it is assumed that the government uses only the money creation[4] (funds obtained as seigniorage), and the sales of foreign exchange (funds obtained from the sales of oil and other natural resources) to finance its activities:

$$G_t = G_t^F + G_t^S \qquad (4)$$

$$G_t^F = R_t^G P_t^R Z_t$$

$$G_t^S = (M_{t+1} - M_t) = \mu_t . M_t$$

In that, G_t is the government expenditure; G_t^F is the government expenditure financed from foreign exchange sales; G_t^S is the government expenditure finance through seigniorage; Z_t is the net goods import (trade balance); R_t^G is the (official) exchange rate in period t;is the rate of $\mu_t$is the monetary base, and M_t growth of monetary base.

[1]It is assumed that the government has an exclusive power to determine the exchange rate, given its access to significant foreign exchange resources and the fact that various sectors of the economy conduct their foreign exchange transactions only with the government. This exchange rate is called the government exchange rate denoted as R_t^G. Obviously, there is no guarantee that this exchange rate is equal to the equilibrium exchange rate, based on purchasing power parity, or the market exchange rate, based on free supply and demand for currency.

[2] The reason for this assumption is that, at least for our case study and similar economies, the share of this method is negligible compared to other methods due to the lack of development of financial markets.

[3] This assumption is made because in Iran and other similar economies, state-owned enterprises typically operate at a loss and do not contribute to financing government expenditure. Therefore, it is assumed that a portion of the government subsidy is used to offset the losses of these enterprises in the production of consumer goods for households.

[4]The seigniorage is called inflationary tax in the literature.

It is assumed that the government is committed to paying a certain amount of subsidies (free transfer payments)[1] in each period and to selling foreign exchange exactly equivalent to the demand of households (for imports). It is also assumed that the government create money to finance the budget deficit i.e. the difference between expenditure and revenue from the sales of foreign exchange. This shows how the government's trade deficit affects the monetary base.

3.5. Monetary and banking sector

It is assumed that all transactions necessarily involve money and the barter is not possible. It is also assumed that holding cash[2] outside of a bank account is taxed at a rate of 100%. Therefore, due to the cost of holding cash, households always deposit all their monetary wealth in bank and use it for their payments. In other words, the economy is assumed to be pure-credit[3]. In addition, it is assumed that households are required, by law, to always keep a minimum portion of their deposits in the bank. For simplicity, the minimum amount, is assumed to be equivalent to the balance of the monetary base at the end of the period. The assumption is an analytical simplification intended to avoid inserting money into the household utility function, or other methods of treating money balances as households' savings[4]. This assumption can be explained by the following equation:

$$B_t = (1 + \mu_t)M_t \qquad (5)$$

B_t is the monetary balance at the end of period t.

According to the assumptions mentioned above, at the end of each period, households use their total available funds (including the cash subsidies and the principal and interest of their bank deposits after deducting the legal requirements) to purchase goods (domestic and foreign products) from producing and trading firms[5]. As a result, all the available funds are paid to the firms, which the firms then use it to repay the principal and interest of the loans they received, and all transactions are settled.

It is assumed that there are a large number of banks in the economy. Banks create money through fractional reserve banking practice based on the deposits they attract from households. It is also assumed that the reserve requirements ratio is equal to τ and that, in the absence of uncertainty, banks do not hold

[1]This assumption is consistent with the structure of the Iranian economy, given the significant size of the government in Iran and the difficulty of making structural adjustments to the current government budget.

[2]In other words, Clover Constraint or Cash-in-Advance are assumed to be established.

[3]In his Interest and Prices (1898), Wicksell coined the phrase for the last stage in the logical evolution of monetary systems: a state of affairs in which all money is held in interest-bearing bank deposits and in which all payments are effected by means of bookkeeping transfers in the banking system (Trautwein, 1997).

[4] This assumption ignores the possibility of accumulation of profits and debts for banks and firms, which is useful for conducting the desired analyses in this research.

[5] This is due to the adoption of the assumption that holding money for one period has no utility for economic agents and, more obviously for holding money from the end of one period to the beginning of the next period.

precautionary or operational reserves in excess of statutory reserves. Banks create money on the basis of the above conditions and lend it to entrepreneurs at an interest rate of i_t^{l} [1]. This rate is set by the monetary authority and is exogenous to banks. Banks are profit maximizers and the banking industry is assumed to be competitive. Therefore, the expected profit of banks' activities is zero. For simplicity, the operating costs of the bank are also assumed to be zero. So, the objective function of banks is as follows:

$$\max_{L_t^s} \frac{1}{N^b}\left[\left(i_t^l - i_t^h\right).L_t^s - i_t^h.M_t\right] \qquad (6)$$

The bank maximizes the above objective with respect to following constrain:

$$\left(\frac{1-\tau}{\tau}\right).L_t^s - M_t \leq 0 \qquad (7)$$

In this inequality, i_t^h is the interest rate on deposits; L_t^s is the supply of credit, and τ is the reserves requirements ratio.

3.6. Households

The population is assumed to consist of either one large household or an infinite number of infinitesimal homogeneous households with infinite lifetimes. It is also assumed that, households have a triple role, as the consumer, as the owner of capital stock, and as the labor force. The objective of households is to maximize the utility of consumption in the form of the following function[2]:

$$U = E_0 \sum_{t=0}^{\infty} (1+\beta)^{-t}.ln(C_t) \qquad (8)$$

In which β is the time preference parameter.

Households decide how much to consume and how much to save. They save by accumulating capital goods which involves the formation of physical capital stock. Saving is added to the capital stock and constitutes the physical capital balance for the next period. Therefore, the households' budget constraint will be as follows:

$$P_t.K_{t+1} + P_t.C_t + P_t.\pi.K_t + B_{t+1} = P_t.K_t + \left(1+i_t^h\right).\{r_t.K_t + W_t + G_t^F + B_t\} + G_t^S \qquad (9)$$

In this equation, C_t is the households' consumption, K_t is the capital stock at the beginning of period t, π is the depreciation rate of the capital stock, r_t is the monetary rent of unit of physical capital and W_t is the monetary wage of unit of labor.

[1] It is assumed that the monetary authority is not aware of or ignores the banks' violation of reserve requirements at the time of payment for the goods.

[2] The utility function is assumed to be of logarithmic form in per capita consumption. This functional form satisfies all assumptions regarding the structure of consumers' utility (in particular the concavity of the utility function).

In each period, households purchase a combination of domestic and imported goods for consumption and investment according to the following decision problem [1]:

$$\min_{C_t^F, C_t^D} P_t.C_t = P_t^D.C_t^D + P_t^F.C_t^F, \qquad (10)$$

$$s.t.;\ C_t = \left\{\varphi^{\frac{1}{\eta}}.C_t^{F\frac{\eta-1}{\eta}} + (1-\varphi)^{\frac{1}{\eta}}.C_t^{D\frac{\eta-1}{\eta}}\right\}^{\frac{\eta}{\eta-1}}$$

Where C_t^D and C_t^F are the consumption of domestic and imported goods, respectively; P_t^D and P_t^F are the price of domestic and imported goods, respectively (in national currency units); φ is the share of imported goods in consumption, and η is the elasticity of substitution between domestic and imported goods in consumption[2].

In the equation (10) above, the aggregated price index, P_t, is:

$$P_t \equiv \left\{\varphi.P_t^{F\,1-\eta} + (1-\varphi).P_t^{D\,1-\eta}\right\}^{\frac{1}{1-\eta}} \qquad (11)$$

Using the definition of inflation rate, one can obtain the following equation:

$$\delta_t = \frac{P_t - P_{t-1}}{P_{t-1}} = \frac{P_t}{P_{t-1}} - 1 \qquad (12)$$

It is also assumed that, in each period, households choose the optimal combination of their saving and investment, from domestically produced and imported goods, based on the following function:

$$\min_{I_t^F, I_t^D} P_t\,.I_t = P_t^D.I_t^D + P_t^F.I_t^F, \qquad (13)$$

$$s.t.;\ I_t = \left\{\varphi^{\frac{1}{\eta}}.I_t^{F\frac{\eta-1}{\eta}} + (1-\varphi)^{\frac{1}{\eta}}.I_t^{D\frac{\eta-1}{\eta}}\right\}^{\frac{\eta}{\eta-1}},$$

$$I_t = K_{t+1} - K_t \qquad (14)$$

In which, I_t^D and I_t^F are the investments from the domestic and imported goods, respectively. It should be noted that since the households purchase the homogenized goods in order to consume and investment at once, the elasticity of substitution between domestic and imported goods in investment is supposed to be the same as the elasticity of substitution for consumption.

[1] An important implicit assumption here is that the cost of exchanging goods between the domestic economy and the foreign sector is negligible.

[2] The elasticity of substitution between domestic and imported goods in consumption is called "Armington elasticity" in the international economics literature.

3.7. Price Level Setting

Based on the structural assumptions of the model, the price level of domestically produced goods is determined by the following relationship [1]:

$$P_t^D.Y_t + P_t^F.Z_t = \left(\frac{1+i_t^l}{\tau} + \mu_t\right).M_t - B_t \qquad (15)$$

4. Model solution and extracting structural relations

In order to solve the model and extract the structural equations in steady state to analyze the structural relationships of the model it is necessary to detrend all variables. To do this, real variables[2] are divided by the population level N_t, to eliminate population growth trend and obtain per capita variables. Additionally, by dividing the nominal variables[3] by $P_t^R.R_t^G$, the effect of the growth of global homogenized goods prices and the growth of the government exchange rate on the nominal variables is controlled. The detrended nominal variables are referred to as "real" or "detrended" variables as it is called in the literature. Accordingly, the structural relationships of the model are presented in equations grouped in different sections below.

4.1. Household decision on per capita consumption

Based on the later section, the objective function and the household budget constraint in terms of per capita real variables and detrended nominal variables will be as follows:

$$U = E_0 \sum_{t=0}^{\infty} (1+\beta)^{-t} ln(c_t) \qquad (16)$$

$$k_{t+1} = \frac{1}{1+v}\left\{-c_t + \left[1 + (1+i_t^h).\frac{\hat{r}_t}{\hat{P}_t} - \pi\right].k_t + (1+i_t^h).\left(\frac{\hat{w}_t}{\hat{P}_t} + \frac{\hat{g}_t^F}{\hat{P}_t} - \frac{\hat{m}_t}{\hat{P}_t}\right) + \frac{\hat{g}_t^S}{\hat{P}_t} - \frac{\hat{b}_t}{\hat{P}_t}\right\} \qquad (17)$$

Accordingly, the following equation is obtained for the dynamics of per capita consumption using the dynamic programming technique:

---

[1] Three important assumptions affect the price level of domestically produced goods in this model. 1) At the end of each period, households use their total free monetary balances to purchase goods (domestic and imported). 2) The price level of imported goods is exogenously determined. 3) Firms inelastically supply their total output to the market.

[2] The real variables of the model are: production, capital stock, net import and consumption, gained through dividing them by N_t in the model relations, real variables' per capita values, and per capita values' relations. Small Latin letters stand for per capita variables.

[3] The nominal variables consist of monetary balances, deposit balances at the end-period, credit volume, wages, rent of capital rate, price level, and government expenditure. The nominal variables are divided by $R_t^G.P_t^R$ to obtain detrended values. The detrended variables, are noted using "$\hat{}$" symbol.

$$c_t = \left[\frac{1+\left(1+i_t^h\right).\frac{\hat{r}_t}{\hat{P}_t}-\pi}{1+\beta}\right].c_{t-1} \qquad (18)$$

This equation illustrates the transitional dynamics of per capita consumption. Using this equation, the steady state condition can be obtained as follows[1]:

$$\frac{\hat{r}_{ss}}{\hat{P}_{ss}}.(1+i_{ss}^h)=\beta+\pi \qquad (19)$$

In which, the time index of "ss" represents the value of the variables in steady state.

Therefore, if the capital stock and the status of monetary variables are such that the ratio of $\frac{\hat{r}_{ss}}{\hat{P}_{ss}}$ is equal to the ratio of $\frac{\beta+\pi}{1+i_{ss}^h}$, the steady state will be established. In this situation, the per capita consumption, per capita capital stock, real rent of capital, real wage of labor, per capita product, real deposits balances, real loan balances, real value of subsidies, per capita imports (trade balance), and real per capita monetary balance remain unchanged.

In addition, by using algebraic operations, one could obtain the real exchange rate equation as shown below:

$$RER_{ss}=\frac{\beta+\pi}{\hat{r}_{ss}.(1+i_{ss}^h)} \qquad (20)$$

RER_t is the real exchange rate.

Accordingly, in steady state, the real exchange rate is a direct function of the time preference parameter and real capital depreciation rate and an inverse function of the real rent of capital and the nominal interest rate.

On the other hand, by solving the household's decision problem regarding the optimal combination of consumption and investment of domestic and imported goods, the following equation will be obtained:

$$\frac{z_t}{y_t}=\frac{c_t^F}{c_t^D}=\frac{i_t^F}{i_t^D}=\frac{\varphi}{1-\varphi}.\left(\frac{\hat{P}_t^F}{\hat{P}_t^D}\right)^{-\eta} \qquad (21)$$

Therefore, the ratio of imported goods to domestic goods (demand for consumption or investment) is an inverse function of the ratio of the prices of imported goods to domestic goods (in national currency units in the domestic market). In other words, the higher the price of imported goods, the less its share in consumption and investment.

[1] Definition and the method of obtaining steady state follows the literature centered by of solow (1956) and swan (1956).

4.2. Enterprises' decision

Since the economy is supposed to be decentralized, two competitive markets are considered for the factors of production. In these markets, firms acquire the labor services and physical capital they need from households, at the nominal wage of w_t and nominal rent of r_t, respectively. In addition, it is assumed that households supply labor services and the total stock of physical capital (capital goods) to the production sector inelastically[1] at the beginning of each period. Therefore the first-order profit maximization conditions of firms are as follows:

$$\frac{\partial F}{\partial K_t} = 0;\ \frac{A_t.\alpha}{{k_t}^{1-\alpha}} = \left(1 + i_t^l\right).\frac{r_t}{P_t^D} = \left(1 + i_t^l\right).\frac{\hat{r}_t}{\hat{P}_t^D} \tag{22}$$

$$\frac{\partial F}{\partial N_t} = 0;\ A_t.(1-\alpha).{k_t}^{\alpha} = (1 + i_t^l).\frac{w_t}{P_t^D} = (1 + i_t^l).\frac{\widehat{w}_t}{\hat{P}_t^D} \tag{23}$$

Algebraic operations and detrending the variables will provide the following equations in the factors markets:

$$\hat{r}_t = \frac{A_t.\alpha}{(1 + i_t^l).{k_t}^{1-\alpha}}.\hat{P}_t^D \tag{24}$$

$$\widehat{w}_t = \frac{A_t.(1-\alpha)}{(1 + i_t^l).{k_t}^{-\alpha}}.\hat{P}_t^D \tag{25}$$

One can divide both sides of the above equations to eliminate the domestic product price:

$$\frac{\hat{r}_t}{\widehat{w}_t} = \frac{\alpha}{(1-\alpha).k_t} \tag{26}$$

Therefore, the factors' wage ratio (capital rent to labor wage) is an inverse function of the abundance of capital and a direct function of the capital productivity index[2]. In other words, the more abundant capital or the lower its productivity, the cheaper it is, compared to labor.

On the other hand, the firm's profit maximization problem for imported goods in a perfectly competitive market implies the following result:

$$\frac{\partial F}{\partial Z_t} = 0;\ P_t^F = \left(1 + i_t^l\right).R_t^G.P_t^R \tag{27}$$

$$\hat{P}_t^F = 1 + i_t^l \tag{28}$$

---

[1] In other words, having decided on the next period's investment on the basis of the marginal return on capital, the household realizes its decision by dividing the product between consumption and savings and invests its entire savings.

[2] The capital productivity index is the α parameter and is simply shown as $\frac{\partial}{\partial \alpha}\left(\frac{r_t}{w_t}\right) > 0$.

The relationship above is an extended (monetary) form of the law of one price. The law states that, the price of a unit of imported homogeneous goods is obtained by multiplying three factors. The first factor, $1 + i^l$, is the bank interest rate, which has entered the price structure because the economy is a pure credit economy, and the price level is directly related to it. The second factor, R_t^G, is the official exchange rate, which is determined exogenously by the exchange rate system authority (based on either the IR-ERD or the DA-ERD). The third factor, P_t^R, is the price of goods on the world markets in foreign currency units, which is also determined exogenously at the global level. By the way, according to equation (28) above, the detrended price level is equal to ($1 + i_t^l$). This implies that the origin of any trend in the nominal variables in the model lies in the values of P_t^R and R_t^G. Therefore, any internal trend in nominal variables must be taken into account in the determination of R_t^G, which is a vital policy rule.

4.3. Banks' decision to maximize interest

In the credit market, the profit maximization of banks in a perfect competitive market leads to the following equations for the equilibrium nominal interest rate on loans and the balance of credit:

$$\hat{l}_t = \left(\frac{1-\tau}{\tau}\right).\hat{m}_t \qquad (29)$$

$$i_t^h = (1-\tau).i_t^l \qquad (30)$$

$\hat{l}_t$ is the equilibrium balance of credit.

Accordingly, banks supply credit in each period in proportion to the monetary base which firms then use to finance their purchases of the resources needed for production or import. The interest rate paid on deposits is also a function of the interest rate on the loan.

4.4. Full set of equations of the Model

By solving the decision problems of economic agents in different sectors, the set of structural relationships of the comprehensive model is obtained as follows, which must be solved simultaneously to obtain an equilibrium solution:

$$c_t = \left[\frac{1+(1+i_t^h).\frac{\hat{r}_t}{\hat{P}_t}-\pi}{1+\beta}\right].c_{t-1} \qquad (31)$$

$$k_{t+1} = \frac{1}{1+v}\left\{-c_t + \left[1+(1+i_t^h).\frac{\hat{r}_t}{\hat{P}_t}-\pi\right].k_t + (1+i_t^h).\left(\frac{\hat{w}_t}{\hat{P}_t}+\frac{\hat{g}_t^F}{\hat{P}_t}+\frac{\hat{m}_t}{\hat{P}_t}\right)+\frac{\hat{g}_t^S}{\hat{P}_t}-\frac{\hat{b}_t}{\hat{P}_t}\right\} \qquad (32)$$

$$y_t = {k_t}^{\alpha} \qquad (33)$$

$$\hat{r}_t = \frac{A_t.\alpha}{(1+i_t^l).{k_t}^{1-\alpha}}.\hat{P}_t^D \quad (34)$$

$$\hat{w}_t = \frac{A_t.(1-\alpha)}{(1+i_t^l).{k_t}^{-\alpha}}.\hat{P}_t^D \quad (35)$$

$$\frac{z_t}{y_t} = \left(\frac{\varphi}{1-\varphi}\right).\left(\frac{\hat{P}_t^F}{\hat{P}_t^D}\right)^{-\eta} \quad (36)$$

$$\hat{g}_t^F = z_t \quad (37)$$

$$\hat{g}_t^S = \mu_t.\hat{m}_t \quad (38)$$

$$\hat{g}_t = \hat{g}_t^F + \hat{g}_t^S \quad (39)$$

$$\hat{P}_t^F = 1 + i_t^l \quad (40)$$

$$\hat{P}_t^D.y_t + \hat{P}_t^F.z_t = \left(\frac{1+i_t^l}{\tau} + \mu_t\right).\hat{m}_t - \hat{b}_t \quad (41)$$

$$\hat{P}_t \equiv \left\{\varphi.{\hat{P}_t^F}^{1-\eta} + (1-\varphi).{\hat{P}_t^D}^{1-\eta}\right\}^{\frac{1}{1-\eta}} \quad (42)$$

$$(1+\delta_t).\hat{P}_{t-1} = (1+\delta_t^G).\left(1+\overline{\delta^R}\right).\hat{P}_t \quad (43)$$

$$i_t^h = (1-\tau).i_t^l \quad (44)$$

$$\hat{l}_t = \left(\frac{1-\tau}{\tau}\right).\hat{m}_t \quad (45)$$

$$\hat{b}_t = (1+\mu_t)\hat{m}_t \quad (46)$$

$$\left[(1+\nu).(1+\delta_t^G).\left(1+\overline{\delta^R}\right)\right].\hat{m}_t = (1+\mu_{t-1}).\hat{m}_{t-1} \quad (47)$$

The above set of relationships is a system of multiple equations that is very complex to solve and analyze mathematically. Therefore, the numerical solution method of the calibrated version of the model should be used with the help of computer software. In this case, it is also possible to carry out sensitivity analysis and visual observation of the model behavior, which provides a better understanding of the results of the implementation of the approaches. Accordingly, in the next section, the solution of the calibrated version of the model is carried out using the basic parameters of the Iranian economy with the help of the DYNARE software.

5. The Effects of Implementing the IR-ERD using the current Inflation Rate

In this section, the dynamics of the selected variables are simulated using data from the case study's economy. For this purpose, it is necessary to define the structural relationships of the model in DYNARE software and set the values of the structural parameters. The data and parameter values of Iran's economy[1] have been extracted from official statistical data sources and past studies and are presented in the following table:

Table 1: Structural parameters of the model

Source	Value	Parameters	
Statistical Center of Iran	0.015	Population growth rate (η)	1
Research results	0.025	Global inflation rate (δ^{R})	2
Rezaei and Molabahrami (2017)	0.08	Time preference rate (β)	3
Central Bank of Iran	0.15	Legal reserve ratio (τ)	4
Model assumption	1	Technology index (A)	5
Rezaei and Molabahrami (2017)	0.54	Product elasticity of capital (α)	6
Hajbar Kiani and Naqibi (2013)	0.05	Capital depreciation rate (π)	7
Statistical Center of Iran (Computational)	0.42	Share of consumption imported products (φ)	8
Rezaei and Molabahrami (2017)	0.5	Consumption elasticity of substitution between domestic and imported products (η)	9
Turki and Mazaheri (2022)	0.75	Mid-period transition coefficient of the shocks effect (ρ)	10
Research results	20.55%	Average rate of Exchange rate growth	11

Source: research results based on previous studies and data available in different databases

It is worth mentioning that some fundamental variables of the model, such as the minimum wage of labor, are supposed to be determined exogenously by the policy maker. Thus, to ensure the establishment of steady state, it is assumed that the relevant economic authority behaves rationally in determining these values i.e. it determines values based on the model. In other words, any deviation in setting appropriate values for key variables such as labor wages, interest rates, exchange rates, public expenditure, real money balances, and the growth rate of the monetary base will lead to significant monetary and financial imbalances that will make the achieving of steady state impossible. Therefore, it is assumed that the economic policy maker will act rationally in determining the relevant economic policies. In particular, the labor wage is determined endogenously to ensure that this purpose is met[2].

[1] The simulation process attempts to create conditions that are as close as possible to the characteristics of the economy being studied. The aim is to provide a reliable framework for policy analysis and decision making.

[2] Another solution is to obtain the policy values of the variables from another different version of the model in which the values of the mentioned variables are defined as endogenous. These values can then be used in this model as exogenous or predetermined variables.

Accordingly, and using the structural relationships of the model and the parameters of the above table, the behavior and dynamics of the Iranian economy are simulated in two cases and the performance of the inflationary exchange rate rule is evaluated accordingly.

In the first case, the simulation is carried out assuming the implementation of the IR-ERD according to LPDCDP. It seems that the legislator's intention in these decrees is rather to use the current inflation rate. Therefore, in the first case, the implementation of the IR-ERD is carried out using the current inflation rate. In the second case, the behavior of the Iranian economy is simulated based on the DA-ERD, in accordance with the prevailing practices of the Iranian monetary and economic authorities in recent years, as well as the 7th ESCDP. In the latter case, it is assumed that the economic policymaker, taking into account political and social concerns, stabilizes the growth rate of the nominal exchange rate in order to control inflation. Accordingly, the dynamics of the model are explained in the following two cases.

5.1. The First Case: Simulation based on the IR-ERD

In this case, assuming the use of the current inflation rate, the equilibrium values of the model variables are estimated as shown in the following table.

Table 2: The results of the model dynamics simulation in IR-ERD case

Model Estimation results based on the IR-ERD[1]	Variable	
5.0377	Consumption	1
11.814	Capital	2
3.7941	Production	3
1.9716	Import (trade balance)	4
0.7042	Real money balance	5
3.9907	Real volume of facilities	6
0.7327	Real balance of deposits	7
0.0923	Capital rental	8
0.9288	Wage rate	9
0.8306	Price	10
0.6386	Domestic product’s price	11
1.2000	Imported product’s price	12
0.0404	Growth rate of money volume	13
0.0284	Seigniorage	14
1.9716	Foreign exchange sale income	15
0.1700	Deposits’ interest rate	16
0.0250	Domestic inflation rate	17
0.0000	Exchange rate’s price growth	18

Source: research results

[1] All estimated/simulated values of variables are in terms of the homogenized product units.

It should be noted that the quantities presented in the table above represent the equilibrium values of the substantial economic variables in the steady state. These quantities represent the real values of the variables. To obtain the nominal values, it is necessary to apply inverse transformations to the real variables. For example, the relationship between the dynamics of the different price levels is as follows:

$$P_t^D = 0.6386\ P_t^R.R_t^G \quad (48)$$

$$P_t^F = 1.2000\ P_t^R.R_t^G \quad (49)$$

$$P_t = 0.8306\ P_t^R.R_t^G \quad (50)$$

The existence of a solution to the model as shown in the table above implies that when IR-ERD is implemented using the urrent inflation rate, it is possible to achieve the steady state in the economy. Moreover, since the rank condition is verified, the uniqueness of the equilibrium values is guaranteed[1].

```
EIGENVALUES:
         Modulus              Real         Imaginary

       2.291e-16        2.291e-16                 0
       3.381e-16        3.381e-16                 0
         0.03538          0.03538                 0
            0.75             0.75                 0
          0.8556           0.8556                 0
           1.021            1.021                 0
           1.281            1.281                 0
           1.609           -1.609                 0
       5.946e+17        5.946e+17                 0
       1.838e+19        1.838e+19                 0
             Inf              Inf                 0


There are 6 eigenvalue(s) larger than 1 in modulus
for 6 forward-looking variable(s)

The rank condition is verified.
```

Figure 3: The rank condition verification output in IR-ERD case

In addition to ensuring the existence and uniqueness of the solution, it is necessary to check the stability of the unique equilibrium solution. This is done by applying a temporary shock to the right side of the IR-ERD relationship (5-24):

[1] The rank condition (Blanchard Kahn conditions) indicates that the number of forward-looking variables and the eigenvalues of the matrix of coefficients of structural equations of the model are equal, ensuring the solution uniqueness.

$$\delta_{G,t+1} = \delta_t - \bar{\delta}_R + er_t \qquad (51)$$

The following diagrams depict the output of the software, showing the transition path of the selected variables, in the case of a temporary shock to the inflation rate determined under the IR-ERD:

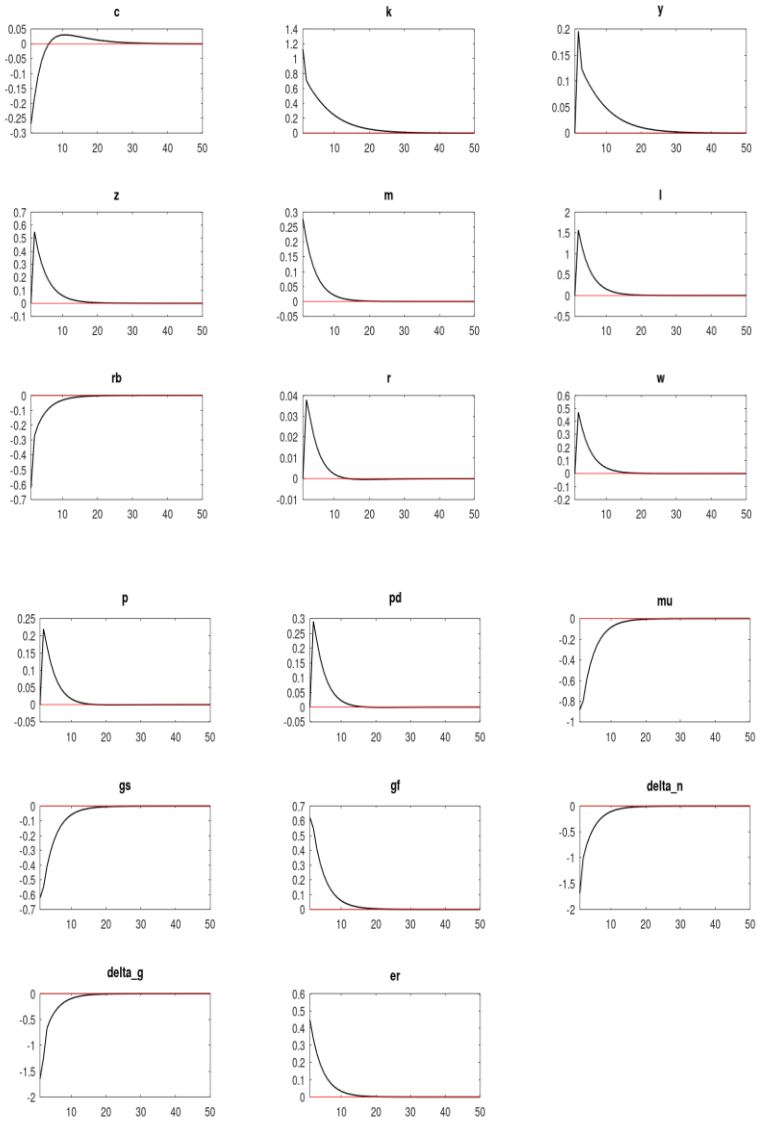


Figure 4: The effects of a temporary positive shock on the targeted inflation rate

According to the above diagrams, when a temporary shock occurs, all of the selected variables deviate from their equilibrium path. Then, after the shock is removed, all of the variables return to their previous equilibrium values, over a certain period of time. This ensures the stability of the equilibrium solution of the model. Therefore, the implementation of the IR-ERD using the current inflation rate will make it possible to achieve a long-run equilibrium situation.

5.2. The Second Case: Simulation based on the DA-ERD

In this case, it is assumed that the policymaker determines the exchange rate in each period as an instrumental variable or an intermediate operational objective based on macroeconomic fundamentals, and adjusts it through the growth rate of the exchange rate, i.e. through changes in the determined growth rate of the exchange rate (Benes et al., 2014). The following table represents the estimated values of the variables in the case of implementing the DA-ERD (hypothetical growth rate of 20.55% for the exchange rate[1]):

Table 3: The results of the model dynamics simulation in DA-ERD case

Model Estimation results based on the DA-ERD	Variable	
5.0200	Consumption	1
11.068	Capital	2
3.6627	Production	3
1.8363	Import (trade balance)	4
0.6442	Real money balance	5
3.6505	Real volume of facilities	6
0.8080	Real balance of deposits	7
0.0885	Capital rental	8
0.8346	Wage rate	9
0.7966	Price	10
0.5944	Domestic product's price	11
1.2000	Imported product's price	12
0.2542	Growth rate of money volume	13
0.1637	Seigniorage	14
1.8363	Foreign exchange sale income	15
5.0200	Deposits' interest rate	16
11.068	Domestic inflation rate	17
3.6627	Exchange rate's price growth	18

Source: research results

[1] The growth rate of 20.55%, is the average growth rate of exchange rate during the period of discretionary approach of exchange rate authority in Iranian economy.

The output of the software regarding the establishment of the rank condition is as follows, which also ensures the uniqueness of the answer in this case:

```
EIGENVALUES:
         Modulus              Real         Imaginary

               0                 0                 0
       4.944e-16         4.944e-16                 0
          0.5659           -0.5659                 0
            0.75              0.75                 0
          0.7912            0.7912                 0
           1.369             1.369                 0
       5.927e+48         5.927e+48                 0
             Inf               Inf                 0
             Inf              -Inf                 0


There are 4 eigenvalue(s) larger than 1 in modulus
for 4 forward-looking variable(s)

The rank condition is verified.
```

Figure 5: The rank condition verification output in DA-ERD case

To ensure the stability of the equilibrium path in this case, an exogenous shock is applied to the exchange rate. The following graphs show the dynamics of the economy in response to the
shock:

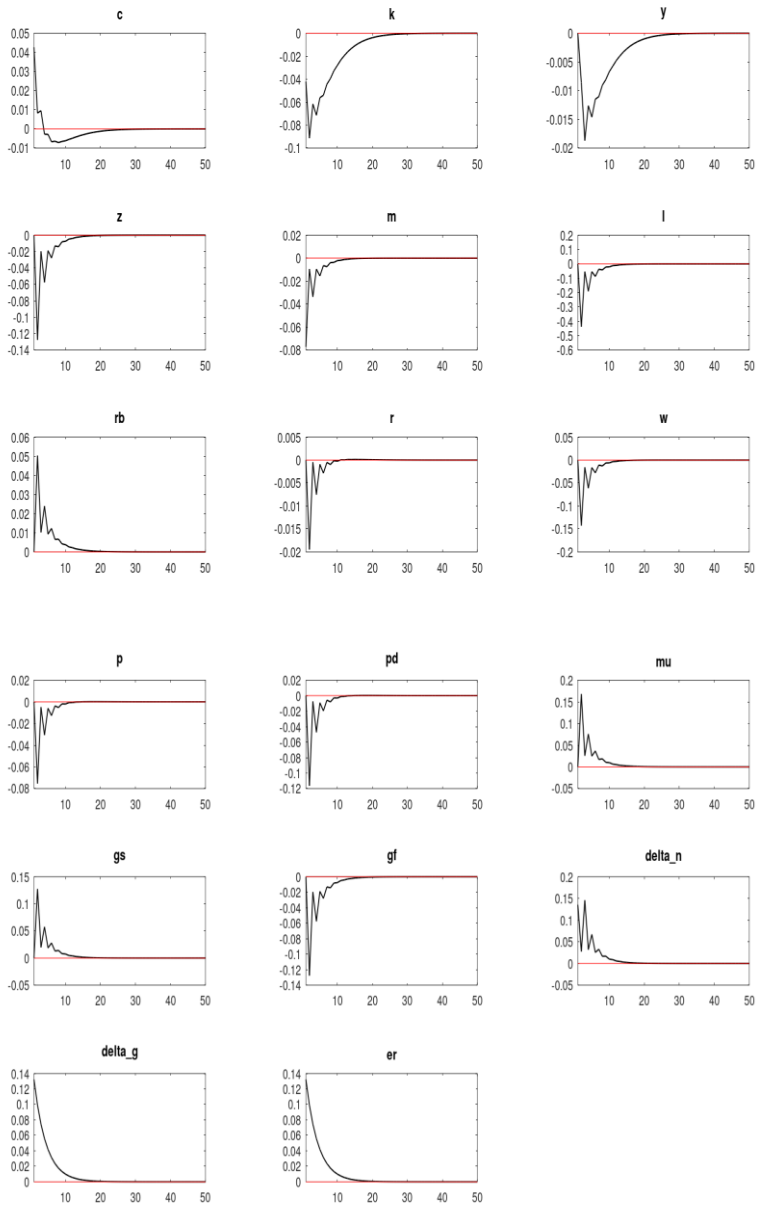


Figure 6: The effects of a temporary positive shock on the targeted exchange rate price growth

According to the above diagrams, the existence and stability of the equilibrium solution is guaranteed in the conditions of adopting DA-ERD, which is the same as the results of adopting IR-ERD, and neither of the two scenarios is superior to the other. However, the transition dynamics of mean reversion appear to be smoother for IR-ERD across all variables and it is necessary to compare the effects of the implementation of the two rules/approaches in terms of the criteria of the RES. The comparison should use quantitative indicators to determine which approach is preferable?

1.1. Comparison of the IR-ERD performance with DA-ERD

Despite the possibility of establishing steady state under two approaches, the question still remains as which of these two approaches is preferred? To answer this question, this section compares, the performance of the two approaches, based on the criteria of the RES under foreign economic sanctions.

In order to compare the performance of the two approaches, in the first part, the equilibrium values of macroeconomic variables are compared. The results of running the model under the two scenarios show that the money growth rate, the seigniorage, the domestic inflation rate and the exchange rate growth rate are significantly higher when the DA-ERD approach is used than when the IR-ERD approach is used. Therefore, using the rule-based approach of IR-ERD will effectively reduce inflation rate and exchange rate growth pace, which is an important objective and criterion of the RES. Accordingly, from the RES perspective, the use of IR-ERD is preferable to DA-ERD.

In order to answer this question, in this next section compares the dynamics of the economy in response to the shock caused by the imposition of temporary economic sanctions for the two scenarios (IR-ERD and DA-ERD) on the basis of the RES criteria. Since the main objective of developing RES is to reduce the vulnerability of the economy to external disruptive factors, the comparison is made on the basis of "economic stability"[1] as the most relevant criterion of RES. It is worth noting that this criterion has been used in many similar studies in the economic literature, such as Mayes and Riches (1996) or Aguirre and Smida (2015). Accordingly, if the implementation of the one approach improves the stability of selected macroeconomic variables, it would be endorsed by RES criteria, otherwise it would not be recommended. The selected variables include per capita consumption, per capita production, per capita capital stock, per capita imports (trade balance), per capita real wage, real interest rate, and general price level.

To quantify the economic stability criterion, the "variance" index/statistic is used. This statistic is presented in the output of DYNARE for each of the endogenous

[1] The evaluation can be based on any criterion of the RES and can be the subject of future research. However, according to the researcher's perception of the available documents, stability has proven to be the first (and perhaps the most important) criterion of the RES, and therefore this criterion has been chosen for this study.

variables after running the model. The index measures the forecast variance of each endogenous variable based on a specified variance in the distribution of exogenous shocks. The higher the value of this index for a variable, the greater the volatility of the variable due to exogenous shocks. Therefore, if the value of the predictive variance of an endogenous variable has changed significantly as a result of a change in the approach to exchange rate determination, it can be said that this change in approach has caused a significant change in the volatility of the variable. In order to test the hypothesis, the F test is used at a significance level of 5%[1], which is in accordance with the standard practice of economic studies. The sample size is assumed to be 50 observations as the Impulse Response Function (IRF) is defined for 50 periods. In addition, the same shock is applied for the two approaches with a variance of 10% of the equilibrium level of price in the world market.

Accordingly, in the next section the performance of the two approaches to exchange rate determination in response to an exogenous shock is assessed.

1.2. The Effect of Temporary Foreign Sanctions

As the Iranian and other similar economies have been exposed to various economic sanctions at different times, this section compares the impact of imposing foreign economic sanctions for the IR-ERD and DA-ERD scenarios. The imposition of foreign sanctions primarily affects the flow of foreign trade. However, since firms have the ability to trade in a variety of ways, it can be argued that the imposition of temporary sanctions simply compels trading firms to resort to more costly methods of doing business[2] in order to bypass sanctions. To be more precise, and as an analytical simplification, it is assumed that the imposition of temporary sanctions will only increase the cost of international trade. Therefore, an exogenous shock to the price level of imported goods is used to simulate the effects of temporary foreign sanctions[3].

The null hypothesis is defined as follows: The instability of the selected variables, caused by a temporary[4] shock of sanctions, will increase when using the IR-ERD approach, compared to the conditions of using the DA-ERD approach.

---

[1] It should be noted that while the nature of the change in the values of the index used in this model is not random and follows mathematical rules, but with the aim of ignoring the minor quantitative differences, the statistical approach has been used to compare the values. In other words, the aim of the statistical significance test is to disregard the small differences between the index values in the two scenarios, and to infer from significant values.

[2] This study assumes that the rise in trade costs reflects the overall impact of temporary sanctions, the theoretical foundations of which are stated in Wang et al. (2019). Also, Nakhli et al. (2020), Rahmati et al. (2021), Farzangan et al. (2016), and Khabazan et al. provided theoretical and experimental evidence.

[3] This assumption can be justified in the context of behavioral economics literature and economic agents' expectation literature.

[4] It is worth noting that the behavior of economic agents is not essentially different in response to a temporary shock, with or without a dampening effect in the following periods; in both cases a return to stable equilibrium is observed, but with a different transitional dynamic.

$$\begin{cases} H_0: \Delta_1 x < \Delta_2 x \\ H_1: \Delta_1 x \geq \Delta_2 x \end{cases} \quad (58)$$

The following table summarizes the results of the statistical test in two cases based on the variance index.

Table 4: Comparing the variables' instability in response to the foreign sanctions' shock

Variable	DA-ERD	IR-ERD	F Value	P-Value	Result ($F_{0.05} = 1.607$) ($F_{0.95} = 0.622$)
c	0.4845	0.3210	0.6625	0.077	Not Rejected[1]
y	1.4913	1.7194	1.1530	0.690	Not Rejected
k	0.0476	0.0517	1.0861	0.613	Not Rejected
z	0.2413	0.1282	0.5313	0.014	Rejected
r	0.0033	0.0008	0.2424	0.000	Rejected
w	0.2278	0.0382	0.1677	0.000	Rejected
P	0.1152	0.0351	0.3047	0.000	Rejected

Source: research results

Based on the test results summarized in the table above, at the 5% significance level, the hypothesis of an increase in volatility of the variables when using the IR-ERD cannot be rejected for real variables, but is rejected for nominal variables. According to this result, it can be inferred that, in the presence of foreign economic sanctions, changing the exchange rate management approach from the DA-ERD to the IR-ERD will not have a significant effect on per capita consumption, per capita production, and per capita capital stock. However, implementing the IR-ERD using targeted inflation rate, will significantly reduce the instability of per capita trade balance, labor wage, rent of capital, and price index compared to the condition of implementing DA-ERD.

This result is theoretically justified by the greater inertia in the real sector variables including consumption per capita, capital stock per capita and output per capita. On the other hand, the trade balance, although related to the real flow of goods and services, does not have the high inertia of other real sector variables and can be adjusted quickly. Accordingly, its results are similar to those of the nominal sector variables. For nominal variables such as the wage rate, the rent of capital and the general price level, which have a lower inertia, the volatility of the variables is significantly affected by the occurrence of temporary shocks caused by temporary sanctions. Therefore, it can be expected that the difference in the

[1] The null hypothesis is rejected in 10% significance level for trade balance and for in 25% significance level for consumption, production, and capital stock.

impact of each of the two approaches on the stability of the variables will be more apparent for the latter four variables.

Based on the comparative statistical analysis conducted, it can be argued that in conditions of occurrence of shocks resulting from the imposition of foreign economic sanctions, the use of IR-ERD will reduce the instability of selected macroeconomic variables (nominal variables). Therefore, from the perspective of the RES criteria, the IR-ERD is preferable to the DA-ERD. This result is in line with Gnabo et al. (2010) and Gersl and Holub (2006).

6. Conclusion and suggestions

Based on the results of this research, it was found that whether the DA-ERD or the IR-ERD is used, the imposition of temporary economic sanctions will cause the economy to deviate from its long-run equilibrium growth path. However when the sanctions are lifted, the economy will return to the previous long-term equilibrium path by enduring the dampening oscillation for all variables. Although, with the implementation of the IR-ERD, it is possible to achieve lower rates of inflation and exchange rate growth. The simulation of macroeconomic variables' dynamics also reveals that, on the basis of the economic stability criterion, if the exchange rate system authority uses the IR-ERD to manage the exchange rate, the negative impact of economic sanctions on trade balance and nominal variables, including labor wage, rent of capital, and price level, will be smaller than the case where the DA-ERD is used. This result is consistent with the findings of Drygalla (2022). Therefore, based on the RES criterion, in order to minimize the negative effects (instability) of the imposition of foreign economic sanctions on macroeconomic variables, it is recommended that the exchange rate system authority should implement IR-ERD based on current inflation rate to manage the exchange rate in a managed floating exchange rate system. Accordingly, it can be argued that the effectiveness of the rule outlined in the LPDCDP is confirmed in the management of the effects of foreign economic sanctions.

References

1. Aguir, A. and Smida, M. (2015). Efficiency of monetary policy under inflation targeting. Economics Bulletin, Volume 35, Issue 1. Pages 788-813.
2. Akhbari, M. and Qolizadeh, S. (2015). Macroeconomic stability in the resistive economy approach. Ravand Quarterly. 71, 55-78.
3. Barro, R.J. and Gordon, D.B. (1983). Ru1es, Discretion and Reputation in a Model of Monetary Policy. Journal of Monetary Economics, 12: 101-22.
4. Benes, J. Berg, A. Portillo, R. A. and Vavra, D. (2014). Modeling Sterilized Interventions and Balance Sheet Effects of Monetary Policy in a New-Keynesian Framework. Journal of Economies Review, 26: 81-108.
5. Blanchard, O. and Fischer, S. (1989). Lectures in Macroeconomics. Cambridge, Mass.: MIT Press.
6. Branson, W. (1977). Asset markets and relative prices in exchange rate determination. Sozialwissenschaftliche Annalen, 1(1977): 69-89.
7. Briguglio, L. Cordina, G. Farrugia, N. & Vella, S. (2009). Economic Vulnerability and Resilience: Concepts and Measurements. Oxford Development Studies, 37(3), 229–247.
8. Cassel, G. (1918). Abnormal deviations in international exchange rates. Economic Journal, 28(112): 413-415.
9. Cerra, V. (2016). Inflation and the Black Market Exchange Rate in a Repressed Market: A Model of Venezuela. IMF Working Paper No. WP/16/159.
10. Dornbusch, R. (1976). Expectations and exchange rate dynamics. Journal of Political Economy, 84(6): 1161-1176.
11. Drygalla, A. (2022). Monetary policy in an oil-dependent economy in the presence of multiple shocks. Review of World Economics. 159, 185–214
12. Eichengreen, B. Minesso, M. F. Mehl, A. Vansteenkiste, I. Vicquéry, R. (2023). Sanctions and the Exchange Rate in Time. Economic Policy. (DOI: 10.1093/epolic/eiad034).
13. Farzanegan, M. R. Khabbazan, M. M. & Sadeghi, H. (2016). Effects of oil sanctions on Iran's economy and household welfare: New evidence from a CGE model. In Economic Welfare and Inequality in Iran (pp. 185-211). Palgrave Macmillan, New York.
14. Fleming, M. J. (1962). Domestic Financial Policies under Fixed and under Floating Exchange Rates. IMF Staff Papers, 9(3): 369–380.
15. Frenkel, J. A. (1976). A monetary approach to the exchange rate: doctrinal aspects and empirical evidence. Scandinavian Journal of Economics, 78(2): 200-224.
16. Gersl, A. and Holub, T. (2006). Foreign Exchange Interventions under Inflation Targeting: The Czech Experience. Contemporary Economic Policy, 24(4); 475–491.
17. Gnabo, J. V. de Mello, L. and Moccero, D. (2010). Interdependencies between Monetary Policy and Foreign Exchange Interventions under Inflation Targeting: The Case of Brazil and the Czech Republic. International Finance, 13(2); 195–221.

18. Hemmati, M. Hadian, E. Samadi, A. H. & Sadraei Javaheri, A. (2022). The Impact of Economic Sanctions on Real Exchange Rate Misalignment in Iran. Iranian Journal of Economic Studies, 11(1), 223-245.
19. Heydarian, S. Pahlavani, M. and Mirjalili, Sd. H. (2021). Financial Sanctions and Economic Growth: An Intervention Time-series Approach. International Economic Studies, 51(1); 1-14.
20. International Monetary Fund. (2003). Classification of Exchange Rate Arrangements and Monetary Policy Frameworks. Retrieved from: https://www.imf.org/external/np/mfd/er/2003/eng/1203.htm
21. International Monetary Fund. (2014). Annual Report on Exchange Arrangements and Exchange Restrictions. Washington.
22. Itskhoki, O. Mukhin, D. (2022). Sanctions and the Exchange Rate. NBER Working Paper No 30009.
23. Jahan, S. (2014). Inflation Targeting: Holding the Line. International Monetary Funds, Finance & Development. Retrieved 28 December 2014.
24. Khabbazan, M. M. & Farzanegan, M. R. (2016). Household welfare in Iran under banking sanctions: From open economy toward autarchy. In Economic Welfare and Inequality in Iran (pp. 213-232). Palgrave Macmillan, New York.
25. Kouri, P. J. (1976). The exchange rate and the balance of payments in the short run and in the long run: a monetary approach. Scandinavian Journal of Economics, 78(2): 280-304.
26. Kydland, F. and Prescott, E.C., (1977). Rules Rather than Discretion: The Inconsistency of Optimal Plans. Journal of Political Economy, 85: 473-92.
27. Lorenzoni, G. and Werning, I. (2022). A Minimalist Model for the Ruble during the Russian Invasion of Ukraine. NBER Working Paper No. 29929.
28. Lucas, R. E. (1982). Interest rates and currency prices in a two-country world. Journal of Monetary Economics, 10(3): 335-360.
29. Malek-Alipour, G. and Pourpir, M. (2012). Comparative elaboration of resistive economy policy and other economic schools. Proceedings of the National Conference on Reviewing and Explaining Resistive Economy, Gilan University, Rasht.
30. Mayes, G. M. and Riches, B. (1996). The effectiveness of monetary policy in New Zealand. Reserve Bank Bulletin, Vol 59, No 1. Pages 5-20.
31. Moeeni, Sh. Sharifi, A. Mozafari Shamsi, H. and Mohammadi, V. (2021). The Impact of Iran Oil Sanctions on the Exchange Rates: An Analysis Using Google Search Index. Iranian Economic Review 2021, 25(3); 397-417.
32. Mundell, R. A. (1960). The Monetary Dynamics of International Adjustment under Fixed and Flexible Exchange Rates. Quarterly Journal of Economics, 74(2): 227–257.
33. Nakhli, sd. R. Rafat, M. Bakhshi Dastjerdi, R. Rafei. (2020). A DSGE Analysis of the Effects of Economic Sanctions: Evidence from the Central Bank of Iran. Iranian Journal of Economic Studies, 9(1); 35-70.
34. Obstfeld, M., & Rogoff, K. (1995). Exchange rate dynamics redux. Journal of Political Economy, 103(3): 624-660.

35. Obstfeld, M., & Stockman, A. (1985). Exchange rate dynamics. In Bilson, F. O. & Marston, R. C. Exchange Rate Theory and Practice. Chicago: University of Chicago Press.
36. Onour, I. (2020). Modelling the impact of economic sanctions on small open economy: A dynamic approach. MPRA Paper 116005, University Library of Munich, Germany.
37. Pourshahabi, F. and Dahmardeh, N. (2015). Economic sanction, speculative attacks currency crisis. Asian Economic and Financial Review, 5(2):340-355.
38. Rahmati, M. H. Ebrahimian, M. and Madanizadeh, sd. A. (2021). Dynamic effects of trade barriers with speculation on foreign currency: The case of Iran. International Economics 167 (2021) 151–173.
39. Rajabi Kalvani, P., Keshavarz Shal, F., and Aryamanesh, T. (2012). Economic sanctions and resistive economy strategies to defeat sanctions. Proceedings of the National Conference on Reviewing and Explaining Resistive Economy, Gilan University, Rasht.
40. Rasolyar, M. S. Babaei, J. and Yavari, Sh. (2015). The Effect of Sanctions on Exchange Rates through GMM Method (A Cross Country Comparison). International Journal of Review in Life Sciences, 5(3); 1202-1207.
41. Rezaei, E. and Molabahrami, A. (2016). Tax policies' impact on the dynamics of growth, capital, and consumption based on an optimal growth model; Case study: Iran and East Asian countries. Economic Research Quarterly (sustainable growth and development), 17(1), 73-94.
42. Solow, R. M. (1956). A contribution to the theory of economic growth. The quarterly journal of economics, 70(1), 65-94.
43. Sondermann, D. (2016). Towards more resilient economies; The role of well-functioning economic structures. ECB woking Paper, No. 1984.
44. Swan, T. W. (1956). Economic growth and capital accumulation. Economic record, 32(2), 334-361.
45. Taylor, J. B. (1993). Discretion versus Policy Rules in Practice. Carnegie-Rochester Conference Series on Public Policy 39, 195-214.
46. Trautwein, HM. (1997). The Uses of the Pure Credit Economy. In: Cohen, A.J., Hagemann, H., Smithin, J. (eds) Money, Financial Institutions and Macroeconomics. Recent Economic Thought Series, vol 53. Springer, Dordrecht.
47. Turki, L. and Mazaheri, B. (2022). The economic effects of financial sanctions on Iran's economy. Scientific Economic Research Quarterly (Sustainable Growth and Development), 22(4), 69-98.
48. Tyll, L. Pernica, K. & Arltová, M. (2018). The impact of economic sanctions on Russian economy and the RUB/USD exchange rate. Journal of International Studies, 11(1); 21-33.
49. Wang, Y. Wang, K. and Chang, Ch. P. (2019). The impacts of economic sanctions on exchange rate volatility. Economic Modelling, 82(2019); 58-65.

ارزیابی قاعده نرخ‌بندی تورمی ارز بر مبنای راهبرد اقتصاد مقاومتی (مطالعه موردی: اقتصاد ایران)

چکیده:

نرخ ارز از جمله مهم‌ترین متغیرهای اثرگذار بر اقتصاد در محیط بین‌الملل است؛ از این رو، انتخاب نظام ارزی و قواعد سیاستی مناسب برای مدیریت نرخ ارز، دارای اهمیت حیاتی است. برای اقتصاد ایران، با وجود تحریم‌های هسته‌ای و نوسان‌های شدید نرخ ارز و آسیب‌های اقتصادی ناشی از آن، انتخاب قواعد سیاستی مناسب در شرایط تحریمی از اهمیت به مراتب بالاتری برخوردار است. پژوهش حاضر به دنبال ارزیابی و مقایسه دو رویکرد مدیریت نرخ ارز تصریح شده در قانون احکام دائمی برنامه‌های توسعه کشور، در شرایط اعمال تحریم‌های اقتصادی است. روش پژوهش در این مطالعه، تحلیل نظری و حل عددی نسخه شبیه‌سازی شده یک الگوی تعادل عمومی پویای تصادفی در فضای اقتصاد بین‌الملل (اقتصاد کوچک باز) است که با استفاده از پارامترهای اساسی اقتصاد ایران کالیبره شده است. معیار ارزیابی و مقایسه قواعد مورد مطالعه، معیار ثبات متغیرهای اقتصاد کلان، است که از جمله معیارهای مد نظر راهبرد اقتصاد مقاومتی، به عنوان سند بالادستی لازم‌الرعایه در سیاست‌گذاری و برنامه‌ریزی‌های اقتصادی، است و با استفاده از شاخص/آماره "واریانس" کمی سازی می‌شود. بر اساس نتایج حاصل از این مطالعه، اتخاذ رویکرد قاعده‌مند نرخ‌بندی تورمی ارز، در مقایسه با رویکرد اقتضایی مدیریت نرخ ارز، از یک سو امکان دست‌یابی به نرخ‌های پایین‌تر تورم و رشد نرخ ارز را فراهم می‌کند. از سوی دیگر نیز باعث کاهش بی‌ثباتی متغیرهای منتخب اقتصاد کلان خواهد شد که از منظر سیاست‌های کلی راهبرد اقتصاد مقاومتی مطلوب است. لذا توصیه می‌شود رهیافت مقام اقتصادی در اجرای احکام برنامه‌های توسعه در بخش ارز، اتخاذ رویکرد قاعده‌مند نرخ‌بندی تورمی ارز باشد.

کلمات کلیدی: نرخ‌بندی تورمی ارز، رویکرد اقتضایی نرخ‌بندی ارز، اقتصاد مقاومتی، تحریم اقتصادی و اقتصاد کوچک باز.