Iranian Journal of Economic Studies

Shiraz University

Investigating the Effect of Economic Sanctions on the Balance of Foreign payments of the Islamic Republic in Iran: The Application of Dynamic Systems

Saeed Iranmanesh[a]*[iD], Reza Etesami[b], Reza Ashraf Ganjoei[c]

a. Department of Economics and Accounting, faculty of Management, Economics and Accounting, University Of Hormozgan, Bandar Abbas, Iran
b. Department of Statistics, Faculty of Mathematics and Computer, Shahid Bahonar University of Kerman, Kerman, Iran
c. Economics Department, Faculty of Economics and Management, University of Sistan and Baluchestan, Zahedan, Iran.

Article History **JEL Classification:** **Keyword**	**Abstract** Since the revolution, Western countries such as the United States of America, the European Union, and the United Nations Security Council have consistently implemented a variety of extensive sanctions on the Islamic Republic of Iran. These sanctions have had a significant impact on Iran's foreign balance of payments, particularly in the area of foreign trade. To analyses the effects of these sanctions, a dynamic systems approach was used to simulate Iran's foreign trade pattern. Additionally, the opinions of 15 economics experts were collected through fuzzy questionnaires and analyses using the fuzzy logic method to determine the variable index of sanctions. The research period covered 1979-2021, and four scenarios were examined to assess the economic effects of sanctions on Iran's foreign trade model. The results revealed that sanctions on Iran's exports pose the greatest risk to the country's foreign balance, highlighting the importance of focusing on export development to mitigate the impact of economic sanctions. Furthermore, the study suggests that leveraging trade agreements and strategic partnerships with regional countries can help mitigate the economic consequences of sanctions.

Highlights

- The use of a dynamic systems approach to simulate Iran's foreign trade pattern in order to analyze the effects of economic sanctions on the country's balance of foreign payments.
- The identification of sanctions on Iran's exports as posing the greatest risk to the country's foreign balance, emphasizing the need to focus on export development to mitigate the impact of economic sanctions.
- The identification of sanctions on Iran's exports as posing the greatest risk to the country's foreign balance, emphasizing the need to focus on export development to mitigate the impact of economic sanctions.

1. Introduction

The economy's globalization has made foreign trade a vital component of any country's economy, serving as a means to acquire goods at the lowest cost and in accordance with government welfare objectives. In many developing countries, the foreign trade sector is seen as the primary driver of economic growth and development, and the impact of sanctions on its structure is considerable (Korhonen et al.,2018). Economic sanctions have become a prevalent form of political dispute between nations, as well as a tool for achieving foreign policy goals and interests. The earliest known instance of sanctions occurred in 432 BC, when Athens imposed a trade embargo on the city of Megara as a punitive measure. Since then, sanctions have been utilized for centuries and have reached their height in modern times (Ankudinov et al., 2017).

Applying sanctions is a tool to achieve political goals and objectives (Allen et al., 2020; Cunningha & Erin, 2020; Elin et al., 2020; Gutmann et al., 2021). Economic sanctions are usually divided into two groups, negative and positive, so that negative economic sanctions are used as the best economic tool with the aim of economic impact on one or more countries, and positive economic sanctions are incentives. It is intended for intergovernmental cooperation. Meanwhile, negative economic sanctions are more important due to the consequences they bring to the sanctioned countries (such as reducing the degree of integration with the global economy). In another framework, economic sanctions can be viewed in terms of the number of countries that impose sanctions. Based on this, economic sanctions are divided into unilateral and multilateral sanctions (Gutmann et al., 2021; Morgan et al., 2023; Gaur et al., 2023; Nguyen & Ahmed, 2023; Sajadi et al., 2023). In recent decades, economic sanctions have been cited as a superior policy or as a substitute for lower-cost military tools (war) (Eyler, 2007). Countries employ economic sanctions as a means to accomplish their political objectives, such as bringing about regime change or altering the political conduct of specific nations (Katzman, 2015). In the current international system, in order to dictate political goals and force the target country to change policies, sanctions have become a common tool (Aghaei et al., 2018). During a embargo, the embargoing country, in order to achieve its intended goals, tries to impose costs on the target country by imposing trade sanctions (export and import restrictions and financial sanctions) (Hufbauer et al., 2007). These sanctions, due to distorting the natural course of international economic exchanges, not only reduce trade between the target and imposing countries, but also affect other countries (Lamotte & Olivier, 2012). The extent of the impact of sanctions strongly depends on the parameters that determine the economic characteristics of the sanctioned country, such as trade and economic relations and the intensity of the need for strategic goods, such as oil and the like (Moret & Erica, 2014).

Hence, it is crucial to comprehensively evaluate the impact and expenses of economic sanctions, particularly on a strategically positioned country like Iran. Thus far, only a small number of specialists have delved into the dimensions of sanctions and their repercussions, leaving significant matters unexplored

(Lamotte & Olivier, 2012). A similar situation was observed in connection with the sanctions imposed on the Iranian economy. Looking at the history of sanctions against Iran over the past few decades, we can see the extent of sanctions against the Islamic Republic of Iran. The accession of the European Union to sanctions against Iran in recent years, the expansion of aspects of sanctions against Iran and their use as a tool of foreign policy created conditions for the government to act constructively and make macro changes. policies to support domestic production (Mahdiloo et al., 2019). It should be noted that the effects of sanctions and the costs they impose on the economy of the target country are not observable and measurable, so conventional methods can not be used to estimate the risks of sanctions and it is necessary to use other methods such as Fuzzy logic that has a lot of ability to measure invisible and ambiguous variables.

Economic sanctions against a country will have different effects on the economy of the country and the countries of the region and the world. The deep economic connection between countries and economic enterprises, the existence of advanced communication facilities and tools to control commercial, financial, and monetary exchanges and the possibility of using various tools to exert pressure on economic enterprises are among the factors that, on the one hand, in the effectiveness of economic sanctions against A country is effective and increases its level of success, and on the other hand, it is effective on the ineffectiveness of sanctions, and on the other hand, it is effective on the ineffectiveness of sanctions. Therefore, this dependence and the extent of trade relations can lead to sanctions can be effective and at the same time (through informal trade relations) it can lead to the ineffectiveness of sanctions (Ghironi et al., 2022). In order to systematically and comprehensively study the impact of economic sanctions on the foreign trade of the Islamic Republic of Iran, it is necessary to first extract a suitable indicator to quantify the effect of economic sanctions. Similar studies have been conducted in this field, using only the dummy variable, have introduced sanctions into the study model and studied the effects and consequences of economic sanctions. For this purpose, in the present study, based on the broad effects of economic sanctions on macroeconomic variables in Iran, an attempt was made to extract appropriate indicators using the fuzzy method for these sanctions. For this purpose, first, an extensive study was conducted on important variables such as GDP, inflation rate and unemployment rate. The breakpoints that occurred in each of these variables were then extracted. Then, by compiling a questionnaire and relying on the opinions of economic experts, the sanctions index was extracted and quantified using the fuzzy method. This index is a powerful analysis tool to study the economic effects of sanctions on foreign trade in the Islamic Republic of Iran. In the next step, in order to study the effect of economic sanctions on the foreign trade of the Islamic Republic of Iran and relying on the balance of foreign payments, the foreign trade model of the Islamic Republic of Iran was designed. This study is conducted to achieve the following objectives: quantification and extraction of indicators for economic sanctions and explain the pattern of foreign trade and observe the effect of sanctions on the

foreign sector of the Iranian economy. . This article has been compiled in several sections. After the introduction section and in the theoretical foundations and research methods section, the theoretical foundations related to economic sanctions and the balance of foreign payments were mentioned. In addition, dynamic systems and fuzzy logic were introduced as research methods. After presenting the experimental results and analysis of the model, the conclusion was expressed and finally all the sources used in this study were presented.

2. Theoretical Foundations
2.1 Economic Sanctions

Economic sanctions are the reduction, suspension or threat of cessation of normal economic, trade and financial relations with the target country by the government of the sanctioning country. Conventional relations in this definition mean relations in a state without sanctions. In fact, sanctions are an economic weapon in the field of civilian struggle that transcends diplomacy into dialogue (Eyler, 2007). Hoffbauer, Scott, and Elliott also see economic sanctions as the intentional cessation or threat of cessation of normal business or financial relations. According to Holstie's definition, in trade sanctions, the import of certain goods into the target country or all export products of the sanctioned country is prohibited (Mahdiloo et al., 2019). Various approaches have been employed in numerous studies to analyze and assess the impact of economic sanctions on the overall economy, trade, and economic growth. The most notable of these methods include the consumer surplus model, attraction model, trade-off curve method, game theory model, and public choice model (smart sanctions). Similarly, the Iranian economy has also been subject to sanctions in recent years, with a history of sanctions against the Islamic Republic of Iran dating back several decades. The European Union's participation in imposing sanctions against Iran has led to an expansion of the scope of sanctions, turning them into a foreign policy tool. This has prompted the government to take constructive measures and make macro policy changes to bolster domestic production (Kazeruni et al.,2017).

A) Consumer surplus model: In this model, using the concept of consumer surplus and social welfare, the impact of taxes on exports and imports is examined. Such a method has been used by Hofbauer and Scott (1985) to estimate the cost of economic sanctions. Of course, there is a slight difference between financial and trade sanctions. Trade sanctions (such as sanctions on exports to the target country or sanctions on imports from the target country) directly change production, and affect and reduce economic growth by restricting the sales market or restricting the purchase market. But financial sanctions target the flow of funds and capital into the country, and by restricting it in the capital market, it makes it more difficult to finance domestic enterprises and increases real interest rates. This, in addition to reducing production (due to reduced foreign investment and loans), reduces production due to reduced investment due to increased investment costs (interest rates). Therefore, its analysis is slightly different and is usually taken into account when analyzing (Katzman, 2015).

B) Gravity Model: The "gravity model" is used to analyze the effects of economic sanctions on the trade of the target country, not only the trade relations with the sanctioning country, but also the whole trade relations of the target country. This model is actually a modified version of Newton's law of gravity. According to Newton's law of gravitation, gravity between two objects is a function of the mass of two objects and the distance between them $\alpha_{ij} = \gamma m_i m_j d_{ij}^{-2}$. In its simplest form, the following model of gravity was first expressed by Tien Bergen in economics. Extracted from Newton's theory of gravity in equation 1. x_{ij}: Indicates the country's exports to jhY: Income of two countries, N: Population (per capita income), D: Distance, U: Disruption component, A: dummy variable Although restricting the target country's trade is not usually the primary goal of sanctions, one of the results has been achieved. The basis of the gravity model is based on the fact that economic interactions between two countries are proportional to their size and have an inverse ratio with the distance between them. These models have high empirical explanatory power. The effect of distance is large and does not diminish over time, and the system of interactions that results from these two-way relationships shape the spatial structure of the economy. This model is actually a metaphor borrowed from Newtonian mechanics, according to which the amount of gravity between two objects is directly related to their mass and inversely related to their distance. Also, different empirical approaches have been proposed to solve econometric problems related to these complex frameworks (Moret & Erica, 2014).

 c) The offer curve method in trade: The offer curve indicates a country's satisfaction with trade in terms of the exchange relationship, presented by Kempfer and Luthenberg (1994). This curve shows how much goods the country is willing to export in exchange for the different quantities of imported goods it needs. This approach examines the consequences of trade sanctions, analyzes the effects of sanctions on the exchange relationship between the target country and the sanctioning country and also shows the welfare effects of sanctions (Mahdiloo et al., 2019).

D) Game theory models: Game theory models describe the strategic choices of the parties in economic and political relations and are very insightful for analyzing economic sanctions. Expected net benefits or earnings change during the sanctions game, and decisions on both sides can change before and during the game. Also, these models provide an explanation of the results of cooperation versus the results of competition in conditions of uncertainty. The results of cooperation explain the strategic economic decisions when the strategy adopted by one party is conditional on the strategy adopted by the other party (or so-called Nash equilibrium). This context of cooperation causes the decisions of the sanctioning country to go beyond the current situation and to consider the decisions of other countries in the power of influence and coercion of the sanctioning country (Frank, 2017).

E) Models of public choice (smart sanctions): Sanctions in the world are considered as two-way diplomatic tools that potentially harm both the innocent

citizens of a country and the government of that country. In fact, innocent citizens are also fined for the political behavior of their government. The policy of economic sanctions also seeks to influence through this violation of citizens' rights in order to motivate the citizens of the target country and demand a change in government policy. Sanctions also seek to incite violent groups against the policies and leaders of their target country in the form of political processes by inciting them to do so. Kamfir and Leuenberg focus on the theory of public choice in economic policy, arguing that stakeholder states' stakeholders influence decisions about the start, continuation, and end of sanctions, as if there were a market for sanctions. This sanctions market may also exist in the target country (Ankudinov et al., 2017).

In recent years, various studies have been conducted in connection with the impact of Iran's economic sanctions. The results of these studies show that the imposition of any economic sanctions has not only caused a decrease in trade between the two countries of Iran and Afghanistan, but has also caused an increase in trade between Iran and Afghanistan in the long term. Therefore, the two countries should use the necessary solutions to reduce the effect of sanctions and develop trade (Mehrgan Nader et al., 2021). The results of estimating the impact of economic sanctions on the composition of Iran's trading partners show that extensive economic sanctions have caused a decrease in Iran's total foreign trade, which is more than in the second group of countries. While limited sanctions have not affected Iran's foreign trade. Also, extensive sanctions have reduced exports and imports; Limited sanctions have not affected exports and imports. Therefore, in order to manage the effect of economic sanctions, economic policy makers should consider the development of trade with neighboring countries (Ghaffari Fard et al., 2023). The results of the research on the effects of trade sanctions on Iran's economy show that the import embargo has more severe economic effects compared to the export embargo on the Iranian economy and causes an increase in the general level of production side prices (Wasfi Asfastani et al., 2022). Economic sanctions have a detrimental impact on Iran's health system, leading to a decrease in the availability of health services. The negative effects of sanctions on economic and social conditions have been well-documented, and they can also impede health research and education. Strategies aimed at bolstering the health system's resilience to sanctions are largely cantered around enhancing health system governance (Kelishomi & Nisticò, 2022).

3. Methodology and Data
3.1 Fuzzy Logic
The exploration and development of fuzzy logic originated in the 1920s, with the term "fuzzy logic" being coined by Professor Lotfi Asgarzadeh (1921-2017) in 1965 at Berkeley University. He observed that digital devices, governed by binary logic, lack the capacity to emulate the nuanced and flexible nature of human thought processes, which involve degrees of correctness or fallibility in decision-making, unlike the binary "true" and "false" states employed in digital

logic (Diamond, 2019). The fuzzy logic approach can be conceived in such a way that instead of considering two situations, such as black or white, it replaces a spectrum of gray that is limited to white on one side and black on the other. Fuzzy logic finds applications in diverse fields including "artificial intelligence" and "control theory." Consequently, its utilization in these domains enables computers to perform calculations and make decisions based on uncertain and implicit data [13]. The advantages of the fuzzy logic method include the following:

- Flexible implementation and simplicity of algorithms in "machine learning" methods
- The possibility of simulating human logic and thinking
- The possibility of creating two solutions or answers for a problem
- Suitable for solving problems with approximate answers
- A processual approach to inference along with the use of flexible adverbs and conditionals in fuzzy logic
- Ability to create non-linear functions with arbitrary complexity

    Fuzzy logic has four main parts, which are introduced below. The Figure 1 also shows how these sections relate well.
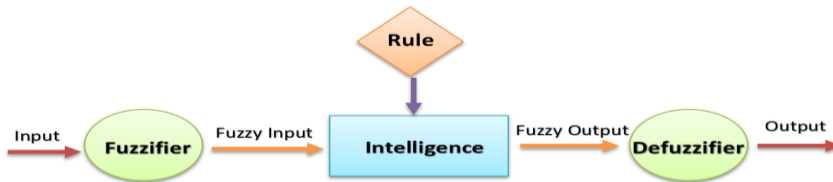

Figure 1. fuzzy logic System

3.2 Dynamic systems

    Dynamic systems models or dynamic systems (System Dynamics) are continuous simulation models that are built using hypothetical relationships between activities and processes. This modeling method was developed by Mr. Forrester in 1961. This method has different names such as simulation of dynamic systems, modeling of dynamic systems, modeling of dynamic systems or modeling of dynamic systems. The dynamic systems method includes the following (Diamond, 2019):

- When defining a problem using graphs that have a time axis as the horizontal axis, it is important to do so in a dynamic or changing manner.
- Attempting to gain a deeper understanding of the internal behavior of a system and concentrating on the characteristics of the system.
- Considering all the ideas within the actual system as interconnected continuous values, influenced by feedback and causality loops.
- Recognizing the quantities of stocks present in the system and determining the pace at which they are being inputted and outputted.

- Creating a self-replicating behavior model is a key focus. This model, typically presented as computer simulation, often takes the form of nonlinear equations. Alternatively, it may be depicted qualitatively, using a diagram to illustrate the cumulative feedback structure and the flow of causal feedback within the system.
- Grasping the implementation principles and strategies derived from the model's outcomes.
- Implementation of the changes obtained from the findings and understanding of the model

Feedback is an essential component in dynamic systems methodology. By utilizing feedback loops and causality loops, one can visualize the structure of a complex system and link observations derived from the model. A feedback loop occurs when information from an action circulates throughout a system in a circular manner and eventually returns to the point of origin. If the loop reinforces the initial action, it is termed a positive feedback loop or a reinforcing loop. In this case, if a variable increases (decreases), it will increase (decrease) again after a delay. Conversely, if the loop opposes the initial action, it is referred to as a negative feedback or balancing loop. In this scenario, if the variable decreases, it will increase, and if it increases, it will decrease. The sign of the loop is known as "polarity." Balancing loops exhibit harmony and stability, while amplifying loops are discordant and unstable. The amalgamation of these two loops can generate various dynamic patterns (Bostani et al., 2017).

3.3 Data

This article utilized the fuzzy logic method to create a sanctions index for examining the impact of foreign sanctions on the balance of foreign payments in the Islamic Republic of Iran. Sanctions imposed against the Islamic Republic of Iran in the period of 1979-2021 were identified according to the year of sanctions and the institution that applied them. After that, a fuzzy questionnaire was designed based on the triangular membership function, in which the experts were asked to rate the impact of the sanctions imposed by the United States of America, the European Union, and the United Nations Security Council on macro variables every year. Determine Iran's economy. After that, using the verbal-fuzzy relationships of the questionnaires, the opinions of the experts were quantified by the fuzzy logic method and the index of economic sanctions was obtained. This index is in the form of table 1. In order to collect data, the time series bank of the Central Bank and the World Data Bank have been used. In order to extract fuzzy data, the opinions of economic experts have been used. The time domain of this research is the years 1979-2021 and its geographical domain is the Islamic Republic of Iran. In the present study, the sampling method is non-probability-judgmental and purposeful, and the studied population consists of experts and senior experts in the field of economics. In the current study, an expert is a person who has the following characteristics has a specialized doctorate in the field of economics and has managerial and executive experience in the field related to

economics. After collecting the fuzzy questionnaires, each verbal statement was equated with a triangular fuzzy number. Subsequently, a fuzzy system comprising three inputs and one output was devised. The fuzzy input values were then fed into the system, and the resulting output fuzzy values for the economic sanctions index were obtained.

Table 1. Sanction Index Data for Iran

Sanction Index Data

Year	Sanction Index	Year	Sanction Index	Year	Sanction Index
1979	3.211614	1994	4.595396	2009	7.865674
1980	2.9383	1995	5.123305	2010	7.947141
1981	2.664987	1996	5.391473	2011	7.988276
1982	3.271227	1997	4.374773	2012	8.029411
1983	3.877467	1998	4.292395	2013	7.864564
1984	5.089946	1999	4.210017	2014	6.393815
1985	4.241109	2000	4.127639	2015	6.658696
1986	3.392271	2001	4.045261	2016	6.923576
1987	1.694595	2002	4.017983	2017	7.188457
1988	1.991207	2003	3.990706	2018	7.453338
1989	2.287818	2004	3.977067	2019	7.277496
1990	2.881041	2005	3.963429	2020	7.395674
1991	3.474263	2006	3.936151	2021	7.435674
1992	4.067486	2007	5.860179		
1993	4.331441	2008	7.784207		

4. Experimental results and analysis

In this stage and after extracting the data related to the number of sanctions, using these data, the effect of economic sanctions against the Islamic Republic of Iran on the structure of foreign trade was investigated. The main relationships used in the above model are presented in table 2:

Table 2. Sanction Index Data for Iran

Current account = export-import
Capital account = capital inflow-capital outflow
External payment balance = current account + capital account
Government Revenue = Tariff Revenues + Income Tax + Foreign Exchange Revenues of Oil Exports

Change in government spending = government spending + export incentives
Government debt to the central bank = a proportion of the government budget deficit
Budget deficit = government expenditure - government revenue
Exchange rate changes = a function of currency demand and currency supply
Change in central bank assets = exports - imports

:

In this model, the main focus of the study is the balance of foreign payments, which consists of two major accounts, the current account and the capital account. In order to form the equations related to the current account, the government has entered the model as the main actor in the field of exports. Government revenues are calculated in two parts: tax revenues and revenues from oil exports. In addition, it has been tried to determine the role of export incentives and import tariffs in this model. Therefore, tariff revenues as a part of government revenues and export incentives as government expenditures have entered the model. A part of foreign exchange income from oil exports is deposited into the foreign exchange reserve fund, and the central bank is included in the model as a monetary authority in the model. The exchange rate system that governs the model is the managed floating exchange rate system, and currency supply and demand affect the currency price. After that, by entering the sanctions index extracted from fuzzy logic, and creating scenarios in line with the extent and manner of the sanctions' effect from different channels, the effect of sanctions on the international trade of the Islamic Republic of Iran can be model. The pattern of foreign trade of the Islamic Republic of Iran is according to Figure 2.
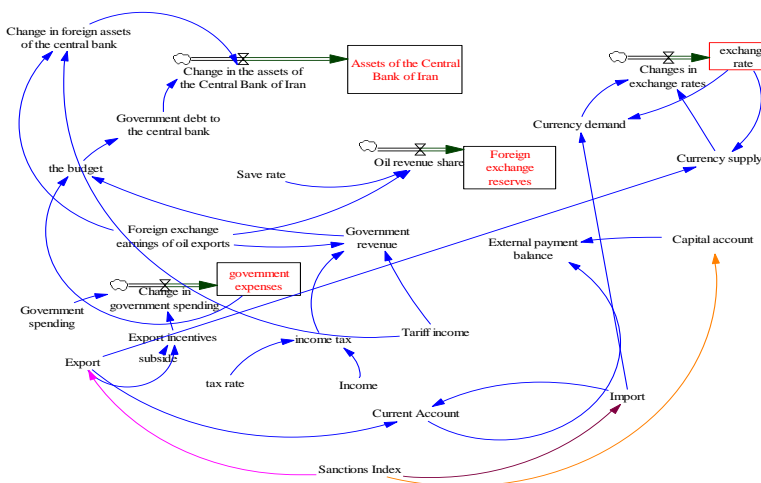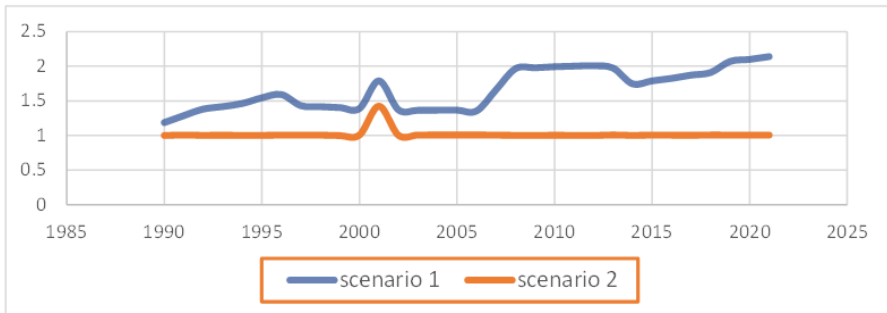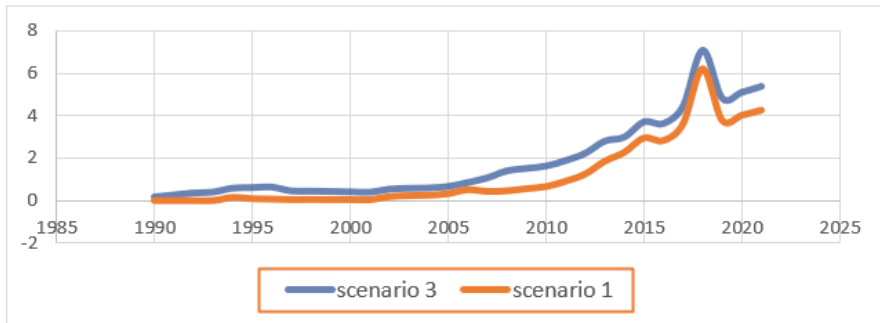

Figure 2. Model of foreign trade in the Islamic Republic of Iran

In this article, following the model development, four general scenarios were outlined. Scenario 1 involves simulating the foreign trade pattern of the Islamic Republic of Iran in its basic state. In scenario 2, the impact of economic sanctions on capital inflow and outflow was eliminated. The status of the capital account according to scenario 2 of the research is depicted in figure 3.


Figure 3. Capital account within the foreign trade model of the Islamic Republic of Iran

According to the results of Figure 3, it can be said that according to scenario number 2 of the research, in which the effect of sanctions is removed from the capital account and the flow of capital inflow and outflow, and according to scenario number 1 of the research, which shows the general state of the model It can be said that in 2007-2012 and in 2015 and 2016, the main reason for the deficit in the balance of foreign payments was the embargo on capital inflow and outflow. Because according to the output of scenario model number 2 of the research, if the economic sanctions on the capital account in the Islamic Republic of Iran were ineffective, the balance of payments of the Islamic Republic of Iran faced a surplus in the mentioned years, which means a decrease The exchange rate is in the Islamic Republic of Iran. Therefore, by comparing scenario number 1 and 2 of the research, it can be stated that the sanctions imposed against the Islamic Republic of Iran, with the serious obstacles they have created on the way of capital entering the Islamic Republic of Iran, lead to a deficit in the balance of payments of the republic. have become Islamic Iran. Among these, the sanctions imposed after 2006 as well as the sanctions of 2012 are considered among the most severe of these sanctions, which have seriously affected the Iranian economy and the balance of foreign payments. In scenario 3 of the research, the effect of economic sanctions on exports in the Islamic Republic of Iran was eliminated. Iran's export situation in this scenario was presented according to figure 4.

Figure 4. Trend of exports within the foreign trade model of the Islamic Republic of Iran

By examining diagram 4 and comparing scenario 1 and 3 of the study, it can be inferred that the major obstacles imposed on the export of the Islamic Republic of Iran due to sanctions after 2006 have significantly contributed to a deficit in the balance of payments. The findings indicate that each period of economic sanctions imposed on the Islamic Republic of Iran has resulted in a notable reduction in its exports. The most significant decrease in Iran's exports occurred during the years 1994-2000-2006 and 2012, which implies that the sanctions enforced during these years were effective. Scenario 4 of the research, which eliminated the impact of economic sanctions on imports in the Islamic Republic of Iran, is represented in Figure 5.
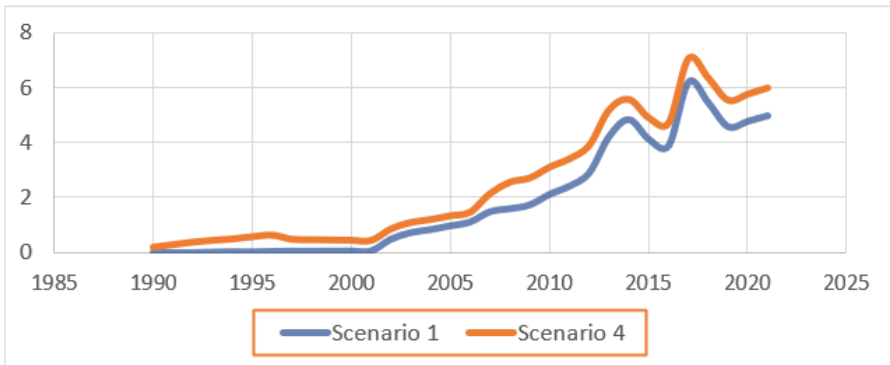
Figure 5. Trend of imports within the foreign trade model of the Islamic Republic of Iran

Based on Figure 5 and the comparison between scenarios 1 and 4 in the study, it is evident that economic sanctions have significantly decreased imports since 2002. Consequently, this has led to a reduction in the depth of the deficit in the balance of payments, indicating that economic sanctions on imports in the Islamic Republic of Iran have contributed to the improvement of the balance of payments. The model's output results also identify the most impactful economic

sanctions affecting Iran. Additionally, the impact of each research scenario on Iran's balance of payments is presented in Figure 6.
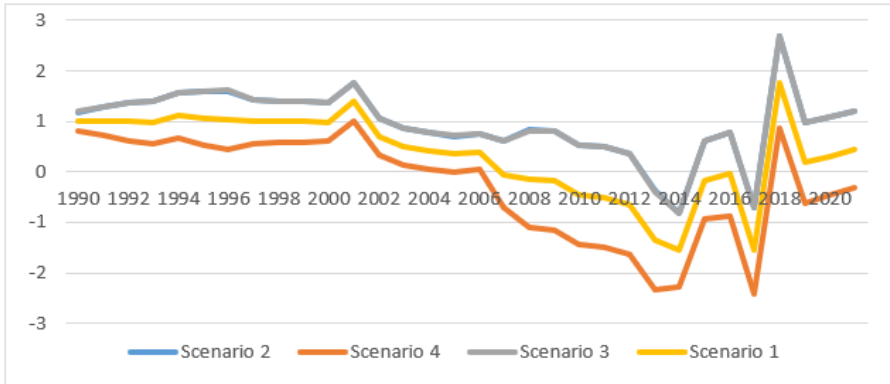
Figure 6. Balance of payments from foreign trade model in the Islamic Republic of Iran

5. Conclusions

Sanctions have long been considered a common and peaceful tool in the interaction between governments, so that since the 90s, economic sanctions have become a common political confrontation between countries and a tool to achieve goals and promote foreign policy interests. have been raised All sanctions do not have the same effects on the economy and it is not possible to adopt the same policies in the face of different sanctions. Therefore, the first step in sanctions risk management is to determine the relative importance of each type of sanctions in relation to each other. From an empirical point of view, it can be seen that the application of economic sanctions has had an effect on the balance of foreign payments in the Islamic Republic of Iran. Therefore, in this article, the impact of sanctions on the balance of foreign payments was investigated, which is one of the most important issues that officials and policymakers should pay attention to in Iran's economy.

In the course of a systematic and comprehensive examination of the impact of economic sanctions on the foreign trade of the Islamic Republic of Iran, an appropriate index was initially derived to quantify the effect of these sanctions. The study's findings indicate that, among the sanctions imposed on Iran to date, those initiated by the George Bush administration in 2001, which resulted in the prohibition of economic transactions between American citizens and Iranian companies, had a significant impact on Iran's economy. The model's results demonstrate that the 2001 sanctions could reduce Iran's foreign balance by up to 10% by restricting the flow of capital in and out of the country. Furthermore, these sanctions led to a substantial 50% reduction in Iran's imports, significantly disrupting the country's import activity. The foreign trade pattern of Iran indicates that the sanctions imposed by the George Bush administration and the United

Nations Security Council in 2006 have resulted in a persistent deficit in Iran's foreign balance of payments, primarily due to investment restrictions related to Iran's peaceful nuclear program. The research findings reveal that these sanctions led to a 30% decrease in Iran's foreign balance of payments and a 20% decline in exports. The extensive sanctions imposed by the United States and the European Union in 2012 had a profound impact on Iran's foreign balance of payments, affecting various industries such as engineering, petrochemicals, oil and natural gas, shipping, aviation, and banking. These combined sanctions had a significant adverse effect on Iran's economy. became the Islamic Republic of Iran. According to the output results of the model, the sanctions of 2012 led to a decrease of more than 40% in the foreign balance of payments of the Islamic Republic of Iran. In addition, to compensate for the balance of payments deficit in the conditions of sanctions, withdrawal from the foreign exchange reserve fund and the use of gold as a medium of exchange were presented as solutions. Therefore, it can be concluded that in order to reduce the risks caused by the economic sanctions of the Islamic Republic of Iran, it is necessary to adopt important management measures in order to overcome these conditions in a favorable way. One of the important factors in the non-expansion of the country's exports is not being a member of the FATF and the Palermo Convention. These obstacles and restrictions on export and import and the collection of foreign exchange earnings, especially export-oriented industries such as metals and petrochemicals and industries whose raw materials are imported, It will affect that they had grown significantly before with the implementation of JCPOA and the partial removal of obstacles caused by sanctions. In case of non-compliance with the standards and requirements of FATF, the name of the offending country is included in the list of countries with fundamental risk and not only that country's access to the global financial system is cut off, but also no country can have financial or commercial exchange with it. Otherwise, the cooperating country will be subject to the same penalties. Based on the results of this study, the following recommendations are given:

1. Economic sanctions have affected imports more than exports. Therefore, this situation can be a suitable opportunity to support exports and support domestic production, and in this way seriously help to improve Iran's foreign balance of payments.

2. Since the current account has a high effectiveness of economic sanctions, it is necessary to seriously deal with the import of luxury goods that have a lot of foreign exchange in the conditions of sanctions. In addition, serious attention should be paid to self-sufficiency in the production of imported products, and in order to expand exports, it is possible to influence the world markets more by increasing the variety of products.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Data Availability

All data are available in the World Bank depository, Central Bank of the Islamic Republic of Iran.

Acknowledgments

Not applicable.

References

Korhonen, I., Simola, H., & Solanko, L. (2018). Sanctions, countersanctions, and Russia: Effects on economy, trade and finance.

Ankudinov, A., Rustam, I. & Oleg, L. (2017). Sanctions and theRussian stock market. Research in International Business and Finance40: 150-162.

Eyler, R. (2007), Economic Sanctions International Policy and Political Economy at Work, Palgrave Macmillan.

Katzman, K. (2015), Iran Sanctions, Congressional Research Service.

Aghaei, Majid and Reza Gholizadeh, Mahdieh and Mohammad Rezaei, Majid (2018), "The effect of economic and trade sanctions on trade relations between Iran and major trading partners", Quarterly Journal of Strategic Studies in Public Policy, Volume 8, Number 28, Pp. 49-68.

Hufbauer, Gary Clyde, Schott, Jeffrey, J., AnnElliott, Kimberly & Oegg Barbara. (2007). Economic Sanctions Reconsidered, 3rd ed, Institute for InternationalEconomics, Washington DC.

Lamotte, Olivier. (2012). "Disentangling the Impact of Wars and Sanctions on International Trade: Evidence from Former Yugoslavia", Comparative Economic.

Moret, Erica S. (2014), Humanitarian impacts of economic sanctions on Iran and Syria, European Security.

Mahdiloo, Ali and Abolhassani, Asghar and Rezaei, Mohsen (2019), "Ranking of types of economic sanctions and estimating the risk index of sanctions using fuzzy hierarchical analysis method", Quarterly Journal of Applied Economic Theories, Volume 6, Number 2, 49-76.

Kazeruni, Seyed Alireza and Khezri, Evin (2017)," Investigating the effect of economic sanctions on the import of capital, intermediary and consumer goods of Iran during the period 1360-1392", Quarterly Journal of Parliament and Strategy, Volume 25, Number 93, 293-420.

Frank, J. (2017). The empirical consequences of trade sanctions for directly and indirectly

Diamond, J (2019), Ganglion Cells in Primate Retina Use Fuzzy Logic to Encode Complex Visual Receptive Fields, Neuron, 103(4), 549-551.

Masfaei Dolatabad, Khadijeh and Azar, Adel and Moqbel Ba, Abbas and Parvizian, Kourosh (2019), "Evaluation of Mining Process in Discovering the Model of Semi-Automatic Processes in Banking Industry", Quarterly Journal of Industrial Management Studies, Volume 17, Number 52, 1- 37.

Bustani, Mahsa and Mousavi, Farhad and Karami, Hojjat and Farzin, Saeed (2018)." Analysis of river parentheses using indicators based on turbulence theory", Iranian Water Resources Research, No. 4 (14), pp. 276-280.

Allen, Susan Hannah, Menevis Cilizoglu, David Lektzian, &Yi-Hao Su. 2020. "Essay 3: The Consequences of Economic Sanctions." International Studies Perspectives 21 (4), 438–77.

Cunningham, Erin. (2020). "Trump's Sanctions on Iran Are Helping Fuel a New Refugee Crisis—in Turkey." Washington Post, January 24, 2020.

Hellquist, Elin, & Stefano Palestini. (2020). "Regional Sanctions and the Struggle for Democracy: Introduction to the Special Issue." International Political Science Review 0192512120968109. doi: 10.1177/0192512120968109.

Gutmann, J., Neuenkirch, M., & Neumeier, F. (2021). Sanctioned to death? The impact of economic sanctions on life expectancy and its gender gap. The Journal of Development Studies, 57(1), 139-162.

Morgan, T. C., Syropoulos, C., & Yotov, Y. V. (2023). Economic sanctions: Evolution, consequences, and challenges. Journal of Economic Perspectives, 37(1), 3-29.

Gaur, A., Settles, A., & Väätänen, J. (2023). Do Economic Sanctions Work? Evidence from the Russia-Ukraine Conflict. Journal of Management Studies.

Nguyen, L. Q. T., & Ahmed, R. (2023). The impact of economic sanctions on foreign direct investment: empirical evidence from global data. Journal of Economics and Development, 25(1), 79-99.

Sajadi, H. S., Yahyaei, F., Ehsani-Chimeh, E., & Majdzadeh, R. (2023). The human cost of economic sanctions and strategies for building health system resilience: A scoping review of studies in Iran. The International Journal of Health Planning and Management.

Diamond, J (2019), Ganglion Cells in Primate Retina Use Fuzzy Logic to Encode Complex Visual Receptive Fields, Neuron, 103(4), 549-551.

Ghironi, F., Kim, D., & Ozhan, G. K. (2022). International Trade and Macroeconomic Dynamics with Sanctions.

Mehrgan Nader, Ghafari Fard Mohammad, Kazemi Morteza. (2021). The role of economic sanctions in trade between Iran and Afghanistan.

Ghaffari Fard, Mohammad, Kazemi, Nabizadeh, & Javed. (2023). The impact of economic sanctions on the composition of Iran's trading partners. Economic policies and research, 1(4), 160-191.

Wasfi Asfastani, Abolhasani Hestiani, Shaygani, Amini Milani, & Mino. (2022). Investigating the effects of trade sanctions on Iran's economy using the calculable general equilibrium method: with an emphasis on production and prices. Economic Policy and Research Quarterly, 30(103), 7-47

Kelishomi, A. M., & Nisticò, R. (2022). Employment effects of economic sanctions in Iran. World Development, 151, 105760.