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Analyzing the Effect of Economic Sanctions on Monetary Variables of the Iranian Economy Using the Structural Vector Autoregressive (SVAR) Model

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ABSTRACT

The Islamic Republic of Iran is one of the countries that has suffered the most and most extensive sanctions in the last three decades. Explaining the economics of sanctions is a global need that can play a role in the conditions of world political and economic equations. Accordingly, the present study has analyzed the effect of economic sanctions on monetary variables in the Iranian economy. In this regard, the structural autoregressive model has been used for the years 1979 to 2021. Based on the results of the SVAR model estimation, a shock from economic sanctions (assuming that other factors remain constant) causes an increase in inflation and interest rates. Based on the estimation results of the SVAR model, a shock from economic sanctions (assuming that other factors remain constant) causes an increase in inflation and interest rates by 78 and 83 percent, respectively. The models were implemented in the Eviews version 10 software, and after examining the variables, the optimal lag of the VAR model was determined and then the final research model was created. Using two main diagnostic tests, which are the use of instantaneous response functions (IRF) and variance analysis, the output results of the models were analyzed and interpreted. Interpretation of the model results and findings indicate the impact of sanctions on the research variables, and as a result of the positive shock, the sanctions variable responded positively and increased, and after a few periods, the trend decreased again and the effect of the shock was eliminated. This situation arises due to the stationarity of the research variables, but the way it occurs is different for monetary and financial variables, and in addition, financial variables succeed in eliminating the effect of sanctions over a longer period.

Keywords: Economic Sanctions, Monetary Variables of The Economy, Interest Rate, Inflation, Structural Vector Autoregressive Model (SVAR)

1. Introduction

Sanctions are broad or narrow economic and trade restrictions, penalties, and sanctions used by one country against another as an economic weapon in a non-military arena (Eyler, 2007; Rodríguez, 2024). In this case, a large country with influence in the world of politics and economics will be able to impose economic and political costs on the smaller country by imposing restrictions on a smaller economy with less influence than itself (Drezner, 2024). Economic sanctions have various forms, including, but not limited to, imposing tariffs, creating trade barriers, and restricting or quotas on imports or exports (Ghironi et al, 2024, RezaeeDaryakenari et al, 2025). The process of sanctions is very dynamic, and the simultaneous imposition of economic sanctions, along with various factors such as the country's management, the potential capabilities of economic institutions, etc., can have different effects on the economy (Avetisyan & Lektzian, 2024). This makes it impossible to clearly assess the net effect of an economic sanction. For example, a given economic sanction does not have the same effect in different economic conditions. The political, economic, social and international effects of economic sanctions are also complex and do not have the same direction (Farzanegan & Batmanghelidj, 2024). The relationship between time and the consequences of an economic sanction is also a noteworthy point. An economic sanction may have limited consequences in the short term, but its consequences in the long term can be very significant, or vice versa (Mohabati, 2018).

In the years following the Islamic Revolution, Iran has been continuously under trade sanctions and other types of sanctions, and in recent years, the sanctions have become more severe and have caused significant losses and damages to the country's economy (Farzanegan & Batmanghelidj, 2024). However, there is not enough research in the country on the effects of sanctions on the country's economy, and only a few studies have mentioned the destructive effect of sanctions, and a detailed examination of the situation created by trade sanctions on the country's economy is not found among the studies. In other words, research has not yet accurately examined the impact of trade sanctions on the country's economy, and it has not been determined to what extent the imposed trade sanctions have caused economic damage to the country, and in addition, what impact they have had on each of the monetary variables of the Iranian economy.

It is very clear that in the economic field, having accurate data on the damages caused can provide a better understanding of the effects of trade sanctions on the country's economy. On the other hand, in the countries issuing sanctions, a lot of research is being conducted on the effects and effectiveness of sanctions, and they are trying to accurately determine the effectiveness of the sanctions imposed, in order to ensure the effectiveness of these sanctions. Determining the extent of the adverse effects and damages of sanctions can determine the true dimensions of sanctions on the country's economy, and thus, unrealistic projections that further deepen the damages caused by sanctions can be prevented. By relying on existing data from monetary variables, the damages of sanctions can be determined in a documented manner. With a correct understanding of the costs incurred for the country's economy, steps can be taken to plan and provide compensatory solutions and manage the crises caused by the imposed sanctions, in order to reduce the consequences of sanctions on the country's economy as much as possible.

Therefore, in this study, the main goal is to present a model of trade sanctions on the monetary variables of the Iranian economy, and the results of this study will lead to a correct understanding of the effects of sanctions on the Iranian economy, which is the first step in confronting and dealing with the effects of such sanctions on the country's economy. The aim is to examine the effects of trade sanctions on the Iranian economy using the monetary variables of the Iranian economy (interest rate and inflation) based on the economic data officially published by the Central Bank of the Islamic Republic of Iran.

Literature Review

Economic sanctions on Iran

Although economic sanctions have a long history in human life, their dimensions have expanded and their number has increased in the modern century. In the modern era, Iran was first sanctioned by England in the 1950s due to the "oil industry nationalization movement." After the victory of the Islamic Revolution, it has been continuously sanctioned by the United States due to the seizure of the American

embassy. However, a new round of economic sanctions against Iran began in the mid-2000s and reached its peak in 2011 under the pretext of nuclear and human rights. Economic sanctions have various consequences (Sadat Akhavi, 2017). After the Islamic Revolution, Western and global powers have used various tools against Iran to change Iran's behavior in accordance with their interests. These measures and tools include the attack on Tabas, the tanker war, diplomacy (such as nuclear negotiations), media portrayal, and blackening Iran's image. Perhaps one of the most important aspects of these measures is the impact on Iran's economy through sanctions. According to Ganji (2006), the most important tool of the powers to influence Iran's behavior in the last three decades has been sanctions (Shariatini and Tohidi, 2014). In the years after the revolution, economic sanctions against Iran have also intensified, and with the seizure of the US embassy in 1979, a new trend in sanctions against Iran was formed, and Iran officially faced trade and economic sanctions from the US and its European allies. Of course, almost all sanctions against Iran in the years after the Islamic Revolution were imposed by the US or were instigated by the US, and therefore, it will be important to consider the goals and views of the US regarding economic sanctions. In recent years, under the pretext of uranium enrichment and the flow of nuclear energy, the United States has been able to find allies among other European countries for financial and trade sanctions against Iran, and has also increased the severity of past sanctions. This has led to recent economic problems being attributed to economic sanctions at home, and criticism of the government's public and international policies.

Impact of Sanctions on Macroeconomic Variables

Sanctions have a wide range of effects on the macroeconomic variables and financial structures of the target country. Studies show that sanctions lead to reduced investment, increased inflation, and reduced economic growth. Mohabati (2018) states that financial sanctions particularly affect development projects and impose additional costs on the country. Hofbauer et al. (2007) also point out that economic sanctions may directly or indirectly affect the exchange rate and the general price level, which in turn affects inflation and interest rates.

Main Economic Variables and Their Role in Macroeconomics

Economic variables such as inflation, interest rates, production, and consumption are used as indicators to analyze the economic situation of a country. The Institute of Consultants (2022) states that these variables help policymakers to make better financial and economic plans for economic progress. In macroeconomics, these variables indicate the macroeconomic performance of the country and can help in policy decisions at various levels. Sharif (2018) emphasizes that understanding these variables helps in analyzing economic issues and predicting future changes.

A review of the literature and background shows that various studies have been conducted to understand the concept of economic sanctions, but few studies have examined the impact of this variable on monetary policies.

The most important research conducted in this field is reviewed in Table 1.

Table 1: Studies Conducted on Economic Sanctions

Researcher and Year	Findings
Lotadi et al (2022)	In a research report titled, Identifying the Effects of Sanctions on the Iranian Economy. they stated that the collected data shows that there is no doubt that sanctions have had a negative impact on the Iranian economy and have played a role in low growth, high inflation, and increased volatility. However, not all crises and poor performance in the indicators under study can be clearly attributed to sanctions, and over the past few decades, weak internal management has also been influential in high inflation, currency crises, and lower-than-expected growth in the country's production.
Corbet et al, (2025)	To counter the growing threat of direct conflict with the rogue state, the use of sanctions packages has become a tactical response. With this, it is targeted, but now there is a significant increase in attention that can be generated. With the sanctions packages on air transport resulting from the Russia- Ukraine war in 2022 in various regions around the world, the results show that There are more spillovers to major airlines than to other aviation-related companies.
Ezati et al (2019)	In order to examine the effect of economic sanctions on employment in the service sector, in the first step of

Researcher and Year	Findings
	this study, an attempt was made to use an index for sanctions in economic modeling using the factor analysis method. Then, the estimation of the effect of economic sanctions on the growth of production and employment in the service sector was investigated using the simultaneous equation system method during the years 1979-2015. The results indicate that economic sanctions have had a negative effect on employment in the service sector by reducing economic growth in the service sector.
Mohabati (2018)	This research aims are to examine the impact of sanctions as a dummy variable on the Iranian economy. In the first step to study the impact of sanctions on the economy, it is necessary to analyze and examine the impact of economic sanctions on trade flows. Therefore, in this historical research, the impact of economic sanctions on the economy of Iran has been examined.
RezaeeDaryakenari et al, (2025)	While politicians often argue that economic sanctions can induce policy changes in targeted countries by undermining elite and public support for the ruling government, the effectiveness of these measures, especially against undemocratic regimes, is debatable. However, this change in support and its magnitude can vary across political factions and depend on the nature of the sanctions. To empirically test our theoretical expectations, we use supervised machine learning to scrutinize nearly 2 million tweets from over 1,000 Iranian influencers and assess their responses to comprehensive and targeted sanctions during the presidency of Trump. The analysis shows that comprehensive sanctions generally improve sentiment toward the Iranian government, even among its moderate opponents, and make them more aligned with the government's position.
Nakhli et al (2020)	The aim of this paper is to analyze the simultaneous effects of oil sanctions and financial sanctions on Iran's macroeconomic variables in a small open economy within the framework of dynamic stochastic general equilibrium (DSGE). A DSGE model with a new Keynesian approach is designed for the above purpose, considering the household, manufacturing, trade, oil, government, and central bank sectors. All parameters were calibrated using the geometric mean of macroeconomic variables in 2004-2017 as the steady-state values of the variables in the static model. The intensification of oil sanctions causes a decrease in oil production due to a decrease in investment, technology, and oil exports, and a decrease in the ratio of the central bank's foreign exchange reserves to the monetary base, which leads to an increase in the exchange rate.
Zamani et al (2021)	This study specifically focuses on the fluctuations of Iran's exchange rate during the years 1985 to 2021 and, considering political factors and sanctions, attempts to provide an accurate model of the direct effects of sanctions as well as the indirect effects of inflation on the exchange rate. The findings indicate that the probability of remaining in a low exchange rate system is higher than that of remaining in a high exchange rate system. Also, sanctions have a positive and small effect on the exchange rate, and in addition, the effect of inflation on the exchange rate is also positive.
Majidi & Zarouni (2022)	This study, titled "The Impact of Sanctions on the Iranian Economy," analyzes the macroeconomic effects of sanctions on the Iranian economy. In this study, a descriptive-analytical method was used to examine the effects of sanctions, and the results show that sanctions have hit large parts of the Iranian economy. Restrictions on access to financial resources and foreign exchange, reduced investment, increased unemployment and inflation rates, and slow economic growth are among the negative effects of sanctions. However, Majidi and Zarrouni (2022) point out that sanctions have also created opportunities; including reducing dependence on oil, strengthening domestic production capacity, and reducing the vulnerability of the Iranian economy to external factors. This study, by showing the positive and negative effects of sanctions, has comprehensively examined the effects of these restrictions on the Iranian economy.

In the context of a critical summary of the research background, it can be stated that despite various studies, no comprehensive model has been presented by researchers and theorists to measure the impact of economic sanctions on monetary variables such as interest rates and inflation, and the limited studies that have been conducted have not been able to accurately measure this and identify the components of this model. Therefore, the attempt to develop a comprehensive model of the impact of economic sanctions on monetary variables, while integrating existing models, is considered an innovative aspect of this research. It is expected that by conducting this research, while explaining and presenting the position and importance of the impact of economic sanctions on monetary variables of the Iranian economy in the fields of study and science, an applicable model will be presented to the studied society and its audience.

Therefore, it is important that the first step in conducting research on the effects of trade sanctions on the country's economy is to examine the monetary variables of the Iranian economy in order to determine the effects of sanctions on the country's economy. Considering the above, this research tries to answer the important question of what components and indicators

consists of the Model of economic sanctions on the monetary variables of the Iranian economy.

Research Methodology

This research is applied in terms of purpose and causal-analytical in terms of method, and the library collection method was used to obtain scientific articles related to the research topic. After completing the library part, time series data were collected in the field of the research. After collecting the data required to evaluate the effects of trade sanctions on the monetary variables of the Iranian economy and after examining the data with appropriate statistical tests, using the structural vector Autoregressive model, the research variables that were used in the model in a logarithmic manner were entered into the model and the relevant equations, and calculations were performed through the software.

Introducing Structural Vector Autoregressive (SVAR)

Blanchard & Bernanke (1986) and Sims & Watson (1986) developed the SVAR model by considering theoretical constraints on the simultaneous effects of shocks. Then Blanchard & Kah (1986), Gali & Clarida (1994) and Ashli & Great (1996) identified instantaneous response functions by applying theoretical constraints on the long-run effects of shocks. Therefore, unlike the unconstrained VAR model in which the identification of structural shocks is implicit and arbitrary, in the SVAR structural vector autoregressive models, an explicit economic logic or the use of economic theories to impose constraints and limitations is explicitly included. The main relationship established between the summarized form and the structural form in a SVAR model is as follows:

$$A\varepsilon t = BUt \quad (1)$$

In the above relation, εt and Ut are the vectors of the form disturbance terms, respectively, and the structural disturbance terms, both of which are vectors with dimensions (K*1), respectively. A and B are matrices with dimensions (K*K). According to the studies of Blanchard (1989) and Sims (1986) the simultaneous correlation between variables can be expressed by two invertible square matrices A and B. Given that the present study examines the effect of trade (economic) sanctions on the macroeconomic variables considered in the study, which include two monetary economic variables (Inflation and interest rate), using structural vector autoregressive models, the effects of the independent variable (sanctions) on the dependent variables of the study are empirically tested, and the econometric vector autoregressive approach (SVAR model) is used. The present study aims to create a vector autoregressive model to evaluate the effects of sanctions on monetary variables. As a result, the model can be presented as follows. In the structural equation below, it is clear that the sanctions variable, as an independent variable, has an effect on other variables in the model, which are dependent variables, and is entered as the first variable in the structural equation model. In the second stage, monetary variables are entered into the model in order (first the inflation variable, then the interest rate variable), which causes the effects of inflation on the sanctions variable and the interest rate variable to be considered. In general, each of the variables that enter the model creates effects on other variables and the variable itself, which are adjusted and taken into account in the model calculations.

Statistical Sample and Time Period of the Study

The time series economic data used in this study were extracted from the Central Bank of Iran website. These data include key monetary variables, especially inflation and interest rates, and were selected to cover the period from 1979 to 2021. The criteria for selecting the data were based on their importance in the Iranian macroeconomics and their potential effects of economic sanctions. Also, data related to sanctions were considered as a dummy variable due to the inability to fully separate the types of sanctions. According to studies and available information on sanctions, the first very effective sanctions on the country's institutions and financial centers were imposed in the third quarter of 2011 against the Central Bank of Iran, and before that, most of the sanctions included restricting individuals and political institutions, and financial sanctions were mostly in the form of threats, and therefore, from 2004 to the second quarter of 2011, the sanctions variable was assigned the number zero, and then until the end of 2014, the

number one. After the negotiations in 2014, the severity of the sanctions was reduced and no new sanctions were imposed. This process continued until 2019, and after that, all US sanctions were reimposed on Iran. Therefore, in this study, to analyze the effects of sanctions, a dummy variable was used, the values of which vary between 0 and 1, indicating the presence or absence of sanctions.

Validity and Reliability of the Research Method

To assess validity, the SVAR model was designed considering previous studies and theoretical limitations related to the interaction effects of variables and setting the necessary constraints in its structure. Since this model is based on a valid theoretical framework, the content and structural validity of the research is guaranteed. Also, changes in international policies in recent decades and their effects on Iran's macroeconomic variables have made the existence of structural break

inevitable. As a result, Eviews software proposes a generalized Dickey-Fuller stability test that takes structural break into account using the critical values of the Vogelsang (1993) table. The test results are as follows:

Table 2: Dickey Fuller's Statistical Results with Break

Variable	Description	The calculated value of the Dickey-Fuller statistic with break	Probability of Dickey-Fuller test with break	Reliability status
SN	Sanctions	4.947-	0.0384	stationary
IN	Inflation	5.536-	0.01	stationary
IR	Interest rate	6.848-	0.01	stationary

Source: Research Findings

As can be seen from the aggregated results of the Dickey-Fuller test along with the structural break, it can be inferred that the variables have the necessary reliability and can be used to interpret the model results over time.

Results

Descriptive Statistics

In this section, a descriptive analysis of the data used in the research will be first discussed.

To examine each variable more closely, in addition to using descriptive statistics, using a line chart can also be an effective and efficient tool for identifying the trend of changes in the variables during the period under study. For this purpose, by drawing a line chart for each variable, we have analyzed their trend of changes in the period from 1979 to 2021 to more accurately identify the patterns of changes and the status of each variable.

The line chart of the sanction's variable shows that sanctions on Iran have decreased and then increased again in several periods. However, in the last two decades, due to the intensification of various sanctions, Iran has faced a high level of economic restrictions. Only in the period from 1979 to 2021, due to the lifting of a large part of the sanctions, we have witnessed a temporary reduction of these restrictions for a short period (about three periods). However, with the rapid return of previous sanctions and the intensification of restrictions, this variable has returned to its maximum state, namely the number 1.

The line chart of inflation variable clearly shows the unfavorable and unstable inflation situation in the period under study. In addition to showing continuous inflation fluctuations, this chart indicates economic instability and continuous depreciation of the national currency. Inflation has been at a high level in most of the years under study and has intensified and peaked in several periods, then decreased in periods. This variable pattern indicates successive periods of increase and decrease in inflation that have affected the economic conditions of the country.

Table 3: Table of Results of Descriptive Statistics of Research Variables

Index	SN	IN	IR
mean	۰,۳۹۳۲٦۷	۲۱,۳۷۵۵٦	۱۲,۹۷۷۲۷
median	۰,۲۱۷۰۰۰	۱۸,٤۰۰۰۰	۱۳,۵۰۰,۰۰۰
Maximum	۱,۰۰۰,۰۰۰	٤۹,٤۰۰۰۰	۲٤,۰۰۰,۰۰۰
minimum	۰,۰۰۰۰۰۰	٦,۹۰۰,۰۰۰	۸,۰۰۰,۰۰۰
St. deviation	۰,۳٦۹۹۳۲	۱۱,۳٦۸۲۸	۳,۷۹۵۵۸۳
Skewness	۰,۸۲۵۷۵۲	۱,۰۲۲۷۷۲	۰,٦۱۳۷۰۰
kurtosis	۱,۹۰۲۵۵۰	۳,۲۰۱۹٦۰	۳,۲۷۸۸۱۵
Jarque-Bera Test	۷,۳۷۲۲۳۹	۷,۹۲۱۹۳۹	۲,۹۰٤٤۵۷

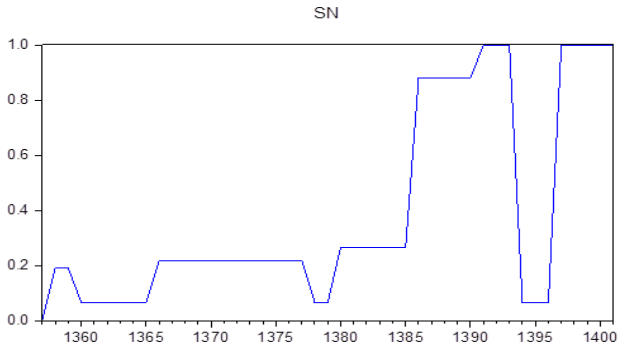

Figure 1: Line Chart of the Sanction's Variable

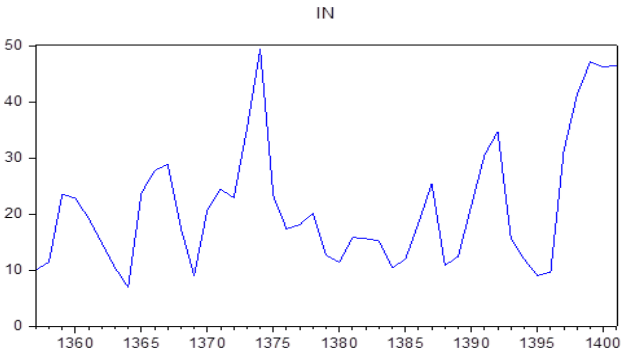

Figure 2: Line Chart of Inflation Variable

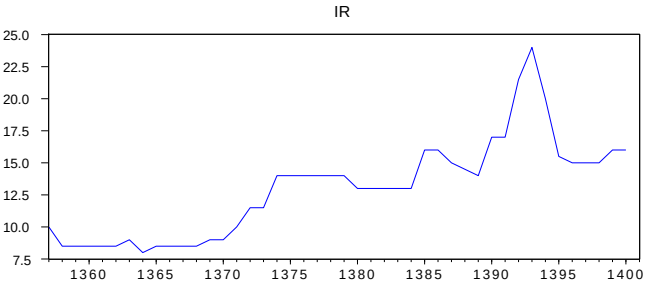

Figure 3: Line Chart of Interest Rate Variable

The line chart of interest rate variable clearly shows the increasing trend and, in some periods, its significant fluctuations during the period under study. This pattern indicates a continuous increase in interest rates during this period and shows that interest rates have not returned to their previous levels. This situation reflects the economic challenges that have accompanied the increase in interest rates during this period and have had significant effects on the country's financial conditions.

Research Model and Variables

The present study aimed to create a vector autoregressive model to evaluate the effects of sanctions on monetary variables. In the structural equation below, it is clear that the sanctions variable, as an independent variable, has an effect on other variables in the model, which are dependent variables, and is entered as the first variable in the structural equation model. Next, the monetary variables are entered into the model in order (first the inflation variable, and then the interest rate variable), which allows the effects of inflation on the sanctions and interest rate variables to be examined. In general, each of the variables that enter the model creates effects on other variables and the variable itself, which are adjusted and taken into account in the model calculations.

$$\begin{bmatrix}\varepsilon_{SN}\\ \varepsilon_{IN}\\ \varepsilon_{IR}\end{bmatrix} = A(L) * \begin{bmatrix}U_{SN}\\ U_{IN}\\ U_{IR}\end{bmatrix}$$

$$\begin{bmatrix}\varepsilon_{SN}\\ \varepsilon_{IN}\\ \varepsilon_{IR}\end{bmatrix} = \begin{bmatrix}a_{11}(L) & 0 & 0\\ a_{21}(L) & a_{22}(L) & 0\\ a_{31}(L) & a_{32}(L) & a_{33}(L)\end{bmatrix} * \begin{bmatrix}U_{SN}\\ U_{IN}\\ U_{IR}\end{bmatrix} \quad (2)$$

First, the optimal model interval is determined using the Hannan-Quinn statistic, then the Bayesian vector autoregressive model is estimated using the optimal interval, and then the effect of financial sanctions on the model variables is examined. To create a comparative framework and better analyze the results of the Bayesian VAR model, the results are examined using a vector autoregressive (VAR) model, and finally, by forming an instantaneous response function for both models, the results of both BVAR and VAR models are analyzed and compared. It should be noted that Matlab 2021, Excel 16, and Eviews 12 software were used to estimate the model, analyze the results, and form the instantaneous response function.

Determining the Optimal Lag

Before running the structural vector autoregressive model, it is necessary to specify the optimal lag of the model. Considering this, in this section, an attempt has been made to determine the optimal lag for the model. Given that the number of observations is less than 100, the most appropriate criteria for selecting the optimal lag are the Schwartz Bayesian and Hannan-Quinn criteria. In the initial model, the variables used include three variables: sanctions, inflation, and interest rates. The results of the test for determining the optimal lag for the VAR model, based on the Schwartz-Baysin, Hannan-Quinn, and Akaike criteria, show that one lag is suitable as the optimal lag for this model. According to the results table, lag one has been consistently selected as the optimal lag in all the criteria examined, including Schwartz-Baysin, Hannan-Quinn, and Akaike. The Schwartz-Baysin criterion with a value of 1.730652 and the Hannan-Quinn criterion with a value of 1.407182 at lag one shows the lowest values compared to other lags, which justifies the selection of lag one as the optimal lag for this model. Therefore, using one lag in this model is a suitable choice due to the minimal values of the above criteria and can maximize the accuracy of the model in estimating the relationships between the variables of sanctions, inflation, and interest rates.

After determining the optimal lag, the VAR model is run again. The results of the optimal model are reported in Table 5.

The table for estimating the momentum coefficients has a complex analysis, given that all variables are affected by and interact with each other. To simplify this analysis, Impulse response function diagrams and variance analysis tables are used. In the software output, three Numbers of the coefficient of the variable, standard error, and t-statistic are estimated based on their own interval and the interval of other variables, respectively. The criterion for deciding whether the variables are significant is the t-statistic criterion, which is reported inside the brackets. This Number is calculated by dividing the coefficient by the standard error. In general, if the absolute value of this statistic is greater than 1.8, the coefficient of the variable, which is the same Number calculated in the

first row, is considered a significant coefficient. For example, The coefficient of SN (-1) on IN is 0.143949 and its t-statistic [1.66827] indicates a positive and weak effect of SN on IN, which is of course significant at the 90% confidence level. Also, the coefficient of SN (-1) on IR is 0.038548 and its t-statistic [2.18721] indicates that the effect of SN on IR is positive and significant, although its effect is less than that of other variables. The data in Table 5 show the results of estimating a structural vector autoregressive model of monetary variables and sanctions, which estimates a long-run equilibrium relationship for the model.

This table and analysis show that sanctions shocks have significant effects on the sanctions, inflation, and interest rate variables, while the effect of inflation shocks on interest rates and inflation is less significant. Since the instability of the SVAR model can make the results unreliable, the AR diagram is used to examine the stability of the estimated model. The AR diagram of the model, as shown in Figure 4, shows that the inverse of all characteristic roots is located inside the unit circle; therefore, the estimated SVAR model of this study satisfies the stability condition and the results obtained from the model are reliable.

Table 4: Determining the Number of Optimal Lags

Number of lags	LR	AIC	SC	HQ
0	NA	4.096907	4.223573	4.142706
1	119.6251	1.223988	1.730652	1.407182
2	10.54262	1.354515	2.241176	1.675103
3	10.37488	1.458685	2.725345	1.916669

Table 5: Estimation of Momentum Coefficients

	SN	IN	IR
SN(-1)	0.703866	0.143949	0.038548
	(0.14845)	(0.08629)	(0.01762)
	[4.74145]	[1.66827]	[2.18721]
IN(-1)	-0.008593	0.450530	0.021334
	(0.26016)	(0.15122)	(0.03089)
	[-0.03303]	[2.97933]	[0.69072]
IR(-1)	0.255949	-0.360174	0.865205
	(0.45547)	(0.26475)	(0.05408)
	[0.56194]	[-1.36045]	[16.0000]
C	-1.006058	2.744625	0.348257
	(1.60941)	(0.93547)	(0.19107)
	[-0.62511]	[2.93394]	[1.82263]

Table 5: Estimated Long-Run Equilibrium Relationship for the Research Model

Variable	Description	Coefficient	Standard Deviation	T-Value	Significant Level
C(1)	The coefficient of sanctions impulses in the sanction's equation	0.717856	0.078325	9.165150	0.0000
C(2)	The coefficient of sanctions shocks in the inflation equation	0.157243	0.062056	2.533895	0.0113
C(3)	The coefficient of inflation impulses in the inflation equation	0.024967	0.012865	1.940649	0.0523
C(4)	The coefficient of sanctions shocks in the interest rate equation	0.386493	0.042170	9.165150	0.0000
C(5)	The coefficient of inflation impulses in the interest rate equation	0.014650	0.012472	1.174640	0.2401
C(6)	The coefficient of interest rate shocks in the interest rate equation	0.080159	0.008746	9.165150	0.0000

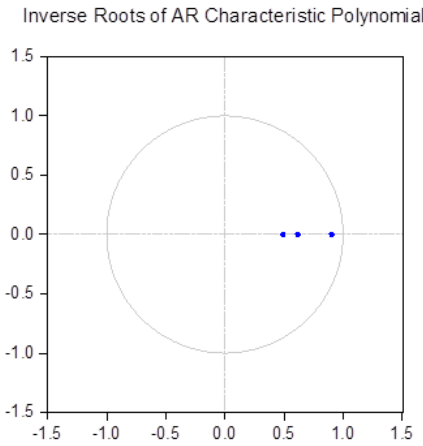

Figure 4: AR Chart

Impulse Response

Since VAR models have many parameters, examining the estimated parameters in the analysis has received less attention. One of the methods for examining the impact of a shock to a specific variable on other model variables and comparing the results is the Impulse response functions. This tool is obtained by transforming the VAR model into a moving average. Impulse response functions are a very useful tool for the dynamic analysis of model variables when an unpredictable shock occurs on the model variables. This ability is because these functions show the reaction of all variables in the system to a shock of different sizes in one of the variables. For this reason, its use to analyze the impact of structural shocks on target variables is very popular. In the following, the Impulse response functions obtained from the BVAR model and the VAR model are shown.

Estimation of Impulse Response Functions (IRF)

Two powerful tools can be used to analyze the results of the long-run equilibrium relationship in the structural vector autoregression (SVAR) model: Impulse response functions and variance decomposition. These tools help to more accurately analyze the interactions and dynamics between variables. After estimating the SVAR model, Impulse response functions are used to examine the response of the model variables to shocks, which show how each variable responds to changes in other variables over time. Also, using variance analysis, the contribution of each variable to explaining the fluctuations of other variables is analyzed. These tools allow for a more detailed analysis of the model results and its long-term equilibrium effects.

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.

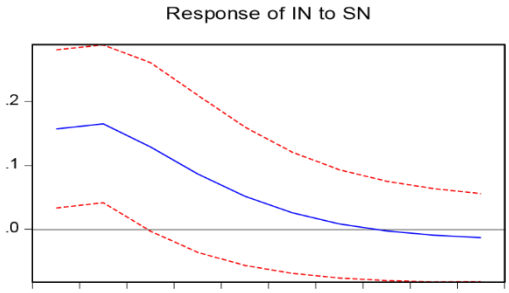

Figure 5: Impulse Reaction Flow (IRF) Graph – Response of the Inflation Variable to the Sanctions Shock

Figure 5 shows the response of the inflation variable to a positive one-standard deviation shock in the sanction's variable over ten time periods. According to this figure, if a positive sanctions shock is applied, inflation increases for two periods (an intensifying effect), then it starts to decline from the third period onwards, and finally the shock effect is completely eliminated by the seventh period. Based on this analysis, the effect of this shock on inflation in the first three periods was significant at the %95 confidence level. Therefore, it can be concluded that sanctions have an incremental effect on inflation and this effect gradually disappears after seven periods. In general, an increase in sanctions causes an increase in inflation, and after a few periods its effect gradually decreases and is eliminated.

Response to Cholesky One S.D (d.f. adjusted) innovations ± 2S.E.

Figure 6 shows the response of the interest rate variable to a one-standard deviation impulse of sanctions over ten time periods. According to this chart, if a positive impulse of sanctions is applied to the interest rate, this impulse increases the interest rate for four periods (intensifying) and then becomes decreasing. The effect of this impulse has been identified at the %95 significant level for eight time

periods. Therefore, on this basis, it can be said that the effect of sanctions on the interest rate is increasing and this effect decreases after four periods. Therefore, the increase in sanctions has affected the interest rate and has caused the interest rate to increase.

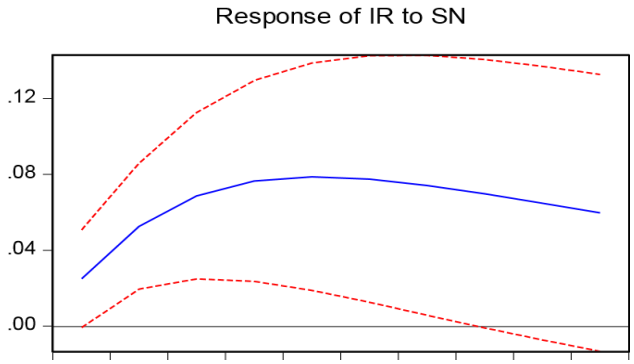

Figure 6: Impulse Reaction (IRF) Graph – Interest Rate to Sanctions

Table 6: Variance analysis table for inflation variable

Course	Forecast Error (FE)	Sanctions (%)	Inflation (%)	Interest rate (%)
1	0.000000	14.20168	85.79832	0.417256
2	0.361262	22.54197	77.09677	0.480346
3	0.813661	27.09702	72.08932	0.503276
4	1.194898	29.01946	69.78564	0.512301
5	1.477524	29.63918	68.88330	0.515674
6	1.676978	29.75090	68.57212	0.516856
7	1.815553	29.72303	68.46142	0.517318
8	1.912102	29.69199	68.39591	0.517616
9	1.980324	29.69160	68.32808	0.517916
10	2.029522	29.71915	68.25133	0.518241

Sanctions and inflation fluctuations: It is observed that the share of sanctions in explaining the fluctuations of the variables has increased over time and has reached from %14.20 in the first period to %29.72 in the tenth period. In contrast, the share of inflation has decreased from %85.80 in the first period to about %68.25 in the tenth period, indicating a relative decrease in the effect of inflation and an increase in the effect of sanctions on the model.

Interest rate stability and forecast error: The interest rate and forecast error have changed little over the periods. This indicates that interest rate changes are more stable over time and have less impact on the overall model.

Continuous increase in forecast error: The forecast error has gradually increased from the first to the tenth period, which could be due to the complexity and uncertainty of the combined effects of sanctions and inflation on the variables in the long run. These results indicate a gradual and increasing impact of sanctions on the model over time and a decrease in the relative impact of inflation, while the interest rate has a small and stable impact.

Sanctions: The contribution of sanctions to the model's Fluctuation has gradually increased, from %8.58 in the first period to %61.11 in the tenth period. This continuous increase indicates a greater and more stable impact of sanctions on the model over time.

Inflation: Inflation initially had a small contribution to the model's fluctuations and gradually changed slightly. The contribution of inflation increased from %2.95 in the first period to %3.84 in the tenth period, which indicates the relative stability of the effect of inflation on the model.

Interest rate: The share of interest rate has decreased significantly from %88.46 in the first period to %35.04 in the tenth period, indicating that the initial effect of

interest rate on the model was strong, but its effect has become weaker over time.

Forecast error: The forecast error increased from 0.085 in the first period to 0.269 in the tenth period, which may indicate an increase in the uncertainty and complexity of the effects of sanctions and interest rates on the model over longer periods. Overall, these results indicate that sanctions have gradually contributed more to the model's Fluctuation, while the effect of interest rates has decreased and inflation has a relatively constant effect on the model.

Table 7: Variance Analysis For The Interest Rate Variable

Course	Forecast Error (FE)	Sanctions (%)	Inflation (%)	Interest rate (%)
1	0.085226	8.582173	2.954714	88.46311
2	0.123616	22.20497	4.268622	73.52641
3	0.155236	33.68288	4.664316	61.65281
4	0.182031	42.17067	4.650288	53.17904
5	0.204505	48.24727	4.500579	47.25215
6	0.223125	52.60017	4.326950	43.07288
7	0.238412	55.75465	4.168392	40.07696
8	0.250894	58.07419	4.035160	37.89065
9	0.261054	59.80481	3.927078	36.26811
10	0.269312	61.11356	3.840732	35.04570

Discussion and and Suggestions

This study uses the Structural Vector Autoregressive (SVAR) model to examine the effects of sanctions on macroeconomic variables. This model allows us to analyze the structural effects of sanctions in a transparent and accurate manner by applying theoretical and economic constraints. The SVAR model in this study consists of two dependent variables, inflation rate and interest rate, and the independent variable of sanctions. In the structural equation of the model, the sanctions variable was entered as an independent variable and then its effect on inflation rate and interest rate was examined. The research findings show that despite the initial effects and shocks caused by sanctions, their effects on inflation and interest rates decrease over time and are eventually eliminated after several periods. However, the imposition of new sanctions leads to new shocks on monetary variables and prevents the complete elimination of the effects of previous sanctions. This situation causes the country's economy to continuously face the adverse effects of sanctions, because the negative effects of previous sanctions have not yet been completely eliminated, new sanctions have been imposed, and they are introducing new shocks to economic variables. The model presented in this study uses instantaneous response function (IRF) plots to show how each of the inflation and interest rate variables react to sanctions-induced shocks. According to these analyses, both variables increase significantly under the impact of sanctions shocks and gradually return to equilibrium after a few periods. This trend shows that sanctions have an incremental and negative effect on monetary variables and eventually, after several periods of time, these effects are gradually eliminated. Also, this response of variables to sanctions indicates that domestic measures to counter sanctions have been able to reduce the negative effects to some extent and neutralize the effect of sanctions over time.

The results of the present study are consistent with the findings of Mohabati (2018) and Majidi and Zarrouni (2022), both of which have pointed to the negative and diminishing impact of sanctions on Iran's exports and macroeconomics. Also, the findings of the study show that the motivation of sanctioning countries to impose new and more severe sanctions is to counter this reduction in the effects of sanctions over time. In other words, by imposing new sanctions, sanctioning countries seek to increase the negative effects on the target country's economy again.

Based on the results of this study, the following suggestions are made for better decision-making by managers:

1) Focus on effective countermeasures: The results of this study show that domestic

countermeasures have been able to gradually reduce the negative effects of sanctions. Therefore, it is suggested that these countermeasures be strengthened and more comprehensive plans be developed and implemented to reduce dependence on foreign resources and strengthen domestic production.

2) Paying attention to reducing the negative effects of sanctions in economic policymaking: Given that sanctions have widespread negative effects on macroeconomic variables and these effects gradually decrease over several periods, it is recommended that economic policymakers pay attention to these temporary effects and anticipate economic planning to deal with possible future shocks.
3) Strengthening monitoring and modeling tools for evaluating and monitoring sanctions: The use of analytical tools such as the SVAR model and instantaneous response functions (IRF) in this research has shown that these tools can play an important role in identifying trends in the effectiveness of sanctions and their sustainability. Therefore, it is suggested that these tools be used regularly in the country's economic analyses.
4) Formulating long-term economic policies to reduce vulnerability to sanctions: Given the continuation of sanctions and the possibility of new shocks, it is suggested that long-term plans be formulated to reduce dependence on the global economy and increase economic resilience. These policies can help maintain the country's economic stability against sanctions, reduce dependence on external resources, and ensure sustainable growth and development. Overall, this study comprehensively analyzed the impact of trade sanctions on the monetary variables of the Iranian economy and showed that although sanctions have initial negative effects, these effects are gradually reduced and neutralized over time and with the use of domestic solutions. Nevertheless, policymakers should consider these results in their decision-making and be prepared to deal with possible future sanctions.
5) Sanctions by restricting Iran's banking network and central bank may hamper trade in services and also cause the cost of all goods and services in Iran to increase. Ultimately, this could severely damage the trade sector, meaning that exports and imports would suffer greatly as a result of the sanctions. The impact of such sanctions would primarily leave the government with a budget deficit, which would directly impact the inflation rate. Therefore, considering the impact of sanctions on inflation and interest rates, taking immediate action by the international community and human rights organizations to lift the severe trade, financial, oil, and banking sanctions against Iran are essential and vital issues. Also, the policy of the nominally democratic government of Iran in preserving the nuclear agreement with the other parties to the JCPOA negotiations is a logical and correct thing that can weaken the anti-JCPOA position of the United States in the international community. Although economic sanctions have a significant impact on inflation and interest rates, decision-makers can neutralize the impact of sanctions and make economic structures resistant to them through long-term planning, especially for sanctions. It is proposed that by reducing bank interest rates, which are set by decree in Iran, an additional incentive be created for investors in the private sector. Also, policymakers can reduce sudden shocks that may cause economic instability by carefully planning in all dimensions of the slowdown.

This research is highly dependent on the availability of reliable data and attempts are made to consider the maximum time period so that the models have greater computational validity. The existence of numerous and different statistics on the research variables created problems for the researcher in correcting and completing the relevant data for the final years of the time period, which ultimately led to the reliance on the Central Bank database as a reliable reference, and the inclusion of data extracted from other sources was neglected. Another limitation is the complex and inseparable nature of the effects of sanctions, which complicates the quantitative measurement and use of values for sanctions. Furthermore, it should be noted that due to the complex and mixed effects of sanctions, identifying the sphere of influence and variables affected by a specific type of sanction is fraught with

difficulties. Using the model while the independent variable (sanction variable) is the same and the dependent variables (monetary variables) are different will cause the model to focus on the effects of the independent variable on monetary variables and to ignore the effects of monetary variables on other variables. As a result, according to the econometric calculation method in vector autoregression models, the effects of monetary variables on other groups of variables are avoided and we will focus only on the effects of monetary variables on monetary variables, while the effects of the independent variable (sanction variable) on the dependent variables are calculated. As a result, in analyzing the results of the models, the unwanted effects of monetary variables on the opposite group of dependent variables are completely eliminated, and the readability of the model calculation results in the output of the EViews software will increase significantly. Although the country's macroeconomic variables can reveal the effects of sanctions on the country's economy, such an approach will not be able to assess the precise details or broader dimensions of these very destructive effects. Therefore, a valuable suggestion for future research is to pay attention to other variables affected by the imposition of sanctions, such as financial variables of the Iranian economy. The results of the present study also revealed that the effects of sanctions on the Iranian economy have gradually decreased after several periods of sanctions, and this is due to the efforts of the country's management system and the measures taken to combat sanctions. Therefore, with respect to the efforts of the country's managers in combating the negative effects of sanctions, another suggestion related to future research is to pay close attention to the country's various economic sectors and provide executive solutions to solve the problems caused by the imposition of sanctions.

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