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The Impact of Economic Sanctions on Real Exchange Rate Misalignment in Iran

Mahdi Hemmati, Ebrahim Hadian*, Ali Hussein Samadi, Ahmad Sadraei Javaheri

Department of Economics, Shiraz University, Shiraz, Iran

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Abstract

Exchange rate misalignment has involved many world countries. It has profoundly affected the internal and external sectors of the economy. Hence, disclosing the emergence and formation causes of the misalignments is a requisite. Studies on the Iranian economy have mostly evaluated the sanctions' efficacy on macroeconomic variables, involving the economic growth, domestic production, liquidity, exports, imports, oil price, oil revenues, etc. Few studies have evaluated the sanctions' impact on the foreign exchange market. There is no research work assessing the sanctions' impact on exchange rate misalignment in Iran. The main purpose of this paper is to estimate the impact of economic sanctions on real effective exchange rate (REER) misalignment in the context of the Iranian economy during the period 1996:1 - 2019:4. In doing so, at first we apply the model designed by Edwards (1989) and Cottani et al. (1990) and using smooth transition regression (STR) to estimate the REER equilibrium and its misalignment. Moreover, factor analysis is used to estimate the sanction indices. Then to analyze the impact of economic sanctions on the REER misalignment a nonlinear autoregressive distributed lag (NARDL) model is employed. The time path of estimated REER misalignment indicates a lot of volatilities during the period of study. The estimated results also show that sanctions significantly affect these volatilities in the short run and long run and thereby increase REER disequilibrium in the Iranian economy.

Highlights

- The REER volatility and misalignment from equilibrium values and their association with economic variables are crucial in issues related to exchange rate.
- The real exchange rate misalignment meaning continuous isolation of the real exchange rate from its equilibrium values is approved by many economists.
- Sanctions can influence the economy of countries that are dependent on the foreign exchange revenues from natural resources and oil through two channels:
- During the economic embargoes, exchange transactions were disrupted and oil exports became limited, disrupting in the exchange market.
- Presuming 0 and 1 for a certain variable, especially the economic penalties imposed against Iran, is not desired because of its broadness, diversity, and volatility.

* ehadian@rose.shirazu.ac.ir
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1. Introduction

The following structural weaknesses exist in the economy of Iran: foreign exchange reserves are highly dependent on foreign exchange inflows by oil sales; the Central Bank of Iran lacks an independent status; there exist multiple exchange rate systems, budget deficit and the balance of payments, hyperinflation, and the monopoly of foreign exchange income and market by the government. These factors have made Iran easily influenced by sanctions; the sanctioning countries have taken advantages from these economic drawbacks to access their goals and threaten Iran's economy. Economic sanctions against Iranian economy unavoidably affect the value of national currency and international capital flows. Since equilibrium in the foreign exchange market is ensued through the interactions of the internal markets and the systems of currency, economic sanctions consciously disrupt the exchange market via negative impulsive forces on oil exports, financial transactions (disrupting the monetary transactions), and having an impact on the government budget. Studies on Iran have mostly evaluated the sanctions' efficacy on macroeconomic variables, involving the economic growth, domestic production, liquidity, exports, imports, oil price, oil revenues, etc. Few studies have evaluated the sanctions' impact on the exchange rate. There is no research work assessing the sanctions' impact on exchange rate misalignment. However, Nademi et al. (2016) investigated the economic sanctions' effect through two studies on the gap between the official and market exchange rate using the autoregressive moving average model (ARMA).

The present study set to assess the efficacy of economic sanctions on the seasonal misalignment of real effective exchange rate (REER) in Iran from 1996 to 2019, applying the nonlinear autoregressive distributed lag (NARDL) model. The estimation of REER misalignment is presented after the introduction section and theoretical review. At first, the REER equilibrium was calculated by means of smooth transition regression (STR). Afterwards, the REER misalignment was obtained using the REER time-series data. The sanctions indices were achieved by the exploratory factor analysis. Ultimately, the sanctions index influence on the REER misalignment was examined using the NARDL model.

2. A Review of the Related Literature

The real exchange rate misalignment refers a continuous departure of the actual real exchange rate from its equilibrium value. Two forms of the exchange rate misalignment can take place in the economy, over-valuation or under-valuation of the national currency. Both of them (over-valuation/under-valuation) imposing negative consequences. Such a disequilibrium caused by temporary alterations in nominal or non-fundamental variables. International sanctions are one of these variables which can highly create volatilities in the foreign exchange market and unavoidably lead to misalignment.

Sanctions can influence the economy of any country that is dependent on the foreign exchange revenues from natural resources through two channels: 1) if we assume the foreign exchange market' demand as constant, the foreign currency supply declines due to the restriction created in the foreign exchange receipts of natural resources. Indeed, an unanticipated, intensive reduction in the foreign currency supply in the foreign exchange market causes excess demand, ultimately resulting in an abrupt increase in the exchange rate. Moreover, embargoed banks, specifically the central bank, causes disruption in the monetary transactions of a country and troubles the commercial activities, even the oil exports, as receiving the foreign exports exchange payments is not possible. Also, the demand is created by the domestic requisite for the goods imports, carried out by importers, leading to a profound increase in the foreign exchange value despite the shortage of foreign exchange reserves. (Xiong & Tian, 2015; Butuzov, 2016), 2) the second channel also raises the exchange rate over time with sanctions' expansion, i.e. the sanctions augment negative expectations and traders' demand, and speculators enter the exchange market to earn more profit with increase in the exchange rate swings. Thus, abundant liquidity enters this market, sharply increasing the exchange rate and bringing about inflationary expectations in the exchange market (Prilepskiy & Gurvich, 2015; Sadat Akhavi & Husseini, 2017).

To assess the misalignments of real exchange rate, first, the equilibrium exchange rate should be estimated. A conventional method for the calculation and experimental evaluation of the real exchange rate misalignment is the equilibrium REER method. It consists of three main stages: 1) the long run relation between REER and the institutional factors is calculated by cross-sectional regression. Then, the equilibrium exchange rates are calculated as a function of the medium-term and long-term levels. Finally, the exchange rate equilibrium that can restore the economy back to equilibrium is calculated directly as the percentage difference between the REER and the defined equilibrium value at stage two.

To calculate the REER misalignment index, the models of Edwards (1989) and Cottani et al. (1990) were used. Edwards states that the economy's real variables or institutional factors determinate the path of equilibrium real exchange rate and crucially affect the internal and external equilibrium of the economy. Although these variables are large in number, two broad classes of these factors can be distinguished in analytical discussions: external institutional factors (world prices, foreign aids, and global real interest rates) and internal institutional factors (variables influenced by economic policy makings involving imports tariffs, import quota, export tax, exchange and capital monitoring, other subsidies and taxes, and combining government expenditures and independent variables such as technological advances.

Considering the structural features of the economy of Iran, variables that explain the real exchange rate behavior consist of oil income, government expenditure, trade limitations, term of trade, and economic openness (Khataie & Gharabali Moghadam, 2002; Tahmasbi et al., 2012).

The linear model is the most commonly used model for estimating the equilibrium real exchange rate in most research works using the institutional variables. However, the linear model is the adequate model to estimate the equilibrium exchange rate in developed countries. Using a non-linear model is suggested for estimating the equilibrium exchange rate in the developed countries assuming the interventions and monetary policies applied in the foreign exchange market, exchange costs in foreign exchange transactions, and abrupt reactions because of trade impulses in the foreign exchange markets of developing countries (Bereau et al., 2008). Azizi & Hadian (2012) stated that the non-linear model is better for evaluating the impact of variables on the real exchange rate in Iran' economy. They employed conventional linear methods to estimate the real exchange rate, resulting in incorrect research results.1 Moreover, a primary problem in anticipating economic variables, particularly in Iran, is the periodic failures and regime alterations in the time-series of the target variable and long durability of previous impulses in its current and future behavior. Thus, models resistant against failure must be used to increase the prediction precision. The privileges of the STR model are resistance against failure, accurately determining the number of regimes, two variables' relationship, and possessing several regimes.

3. Estimating the exchange rate misalignment

As mentioned, to calculate the misalignment of REER, first, the equilibrium REER was modeled using Edwards (1989) and Cottani et al. (1990) models:

LREER = (LIOIL, LGCGDP, LTARIFFS, LTOT, LOPEN) (1)

Variables explaining the REER behavior in model (2) are used logarithmically. Except for the REER[2] data derived from the International Monetary Fund, other data were provided from the Central Bank. The data are seasonally and logarithmically applied in the model.

Table1 : The variables used in equation 1

Variables symbol	How to calculate the variable	Variable name
REER		Real equilibrium exchange rate
IOIL		Iran's oil revenues
GCGDP	$GCGDP = \frac{GC}{GDP}$	government consumption to gross domest product
TARIFFS	$TARIFFS = \frac{T_{im}}{IM}$	the ratio of imports tax to the total goods and service import
TOT	$TOT = \frac{P_{ex}}{P_{im}}$	terms of trade

[1] In the first stage of estimation of the STR, the model linearity is examined. It is predicted that the equilibrium process is non-linear based on the research results (Rio et al. 2008; Azizi & Hadian, 2012) and also some concurrent time period of the conduction of the current study with that of Azizi and Hadian (2012).

[2] The REER data based on 2010 data available at the IMF website affiliated with the International Monetary Fund were used. The IMF calculates the REER data based on consumer prices.

OPEN	$OPEN = \frac{EX + IM}{GDP}$	the openness degree of the economy

The STR is defined as the following:

$$Y_t = \acute{\varphi} w_t + (\acute{\theta} w_t) F(s_t, \gamma, c) + u_t \quad (2)$$

$$w_t = (1, y_{t-1}, \dots, y_{t-p_1}, x_t, x_{t-1}, \dots, x_{t-p_2})$$

$$F(s_t, \gamma, c) = \{1 + exp[-\gamma \prod_{j=1}^{j} (s_t - c_t)]\}^{-1}, \gamma > 0 \quad (3)$$

u_t is the disturbance component; it is assumed that (u_t=iid(0,σ^2)) is a sequence with 0 mean from the normal independent variables. y_t is an endogenous variable; x_t is an exogenous variable. $\acute{\theta}$ is the coefficients vector of the nonlinear part. $\acute{\varphi}$ is the coefficients vector of the linear part. s_t is the transfer variable that is very effective. If it varies, the estimation of the variable coefficient changes. $F(s_t, \gamma, c)$ is the transfer function (logistically), whose value varies from 0-1 (Azizi & Hadian, 2012).

3.1 Stationary test of variables

The augmented Dickey-Fuller, Phillips-Perron, and KPSS approaches were employed to confirm the stationary and non-stationary status of time-series variables. The stationary test results of the variables revealed that some variables are stationary and some others are non-stationary, and the unit root test showed that all the variables became stationary via differentiating once.

3.2 Co-integration tests

To assess the co-integration relation and the estimated coefficients, Johansen-Juselius and Saikkonen-Luetkephol co-integration test were used, being able to evaluate the structural break of the equations system. The tests revealed a long-term relation between the variables with 99% confidence. Hence, the association between the explanatory variables and the equilibrium real exchange rate was estimated based on the model.

Table 2. cointegration test results

p-value J	Johansen-Juselius Test statistic	p-value S&L	Saikkonen-Luetkephol Test statistic	Cointegration vector (r_0)
0.0000	229.7	0.0000	200.74	0
0.0000	138.65	0.0000	119.48	1
0.0375	78.37	0.0120	66.48	2
0.0950	50.77	0.0265	42.62	3
0.2747	27.36	0.1265	20.89	4
0.4604	11.97	0.3389	6.91	5
0.3360	4.64	0.7555	0.15	6

Source: *research results*

3.3 Estimation stage, modeling process

An STR modeling and estimation cycle pursue the following three stages: model detection, model estimation, and model evaluation. In the model detection stage, the logistic smooth transition regression (LSTR) starts by generating a linear model as the starting point for analysis and is modeled based on the vector autoregressive (VAR) model. The second part of detection involves the non-linearity test, selecting the transfer variable S_t, and making decision about choosing $LSTR_1$ or $LSTR_2$. In the VAR model, an endogenous variable, numerous explanatory variables, and their intercepts can enter. Then, the linearity vs. non-linearity tests can be performed. If the null-hypothesis based on the model linearity is not rejected, the REER variations can be explained by a linear model, and no non-linear model is required. If the null-hypothesis is rejected and the non-linearity hypothesis is accepted, the suitable form of the transfer function and the transfer variable are chosen; afterwards, the model parameters are estimated. The F-statistic values (Prob F) are provided in Table 1, demonstrating the uncertainty level when rejecting the linearity hypothesis. Columns F_2, F_3, and F_4 are related to the uncertainty levels in rejecting the H_{02}, H_{03}, and H_{04} hypotheses, respectively. The appropriate transfer variable is shown with*.

Table 3. Results of the linearity tests, transfer variable determination, and appropriate function

Models	Prob F_2	Prob F_3	Prob F_4	Prob F	Transfer variables
$LSTR_1$	$2.1559e^{-1}$	$5.9873e^{-3}$	$7.6380e^{-9}$	$1.8272e^{-9}$	LREER*(t-1)
$LSTR_1$	$3.7281e^{-1}$	$2.2034e^{-1}$	$3.9852e^{-4}$	$1.6706e^{-3}$	LGCGDP(t)
$LSTR_1$	$1.1905e^{-1}$	$1.8944e^{-1}$	$9.7906e^{-1}$	$4.1618e^{-2}$	LIOIL(t)
Linear	$1.4791e^{-1}$	$8.1825e^{-3}$	$6.6593e^{-1}$	$7.7912e^{-1}$	LOPEN(t)
Linear	$2.9958e^{-1}$	$1.7143e^{-1}$	$6.4533e^{-1}$	$3.1835e^{-1}$	LTARIFFS(t)
Linear	$4.1210e^{-1}$	$9.8695e^{-1}$	$8.7048e^{-1}$	$9.5265e^{-1}$	LTOT(t)
$LSTR_2$	$6.5295e^{-2}$	$4.6464e^{-4}$	$1.9043e^{-1}$	$5.1583e^{-4}$	TREND

Source: research results

The results (Table 1) show that in the Prob F column related to LREER(t-1) and the linearity hypothesis test of the model, the uncertainty level of LREER(t-1) is the lowest ($1.8272e^{-9}$) in comparison with other variables. Thus, the linearity hypothesis about LREER(t-1) is rejected with a higher probability. Its test statistic was lower than other variables, so LREER(t-1) is the most appropriate transfer variable. Selecting an appropriate transfer function form is dependent on the transfer variable and the uncertainty levels of F_2, F_3, and F_4 statistics of that variable. The adequate functional form suggested according to Table 1 for the transfer function is $LSTR_1$. This functional form possesses an asymmetry in the exchange rate equilibrium process regarding its threshold value in addition to being non-linear (Azizi & Hadian, 2012). The LSTR estimation owns two stages: 1) finding the start values, 2) estimating the parameters. The parameters of the STR model are estimated using a nonlinear optimization approach. The search model generates a linear network c and a linear logarithmic network in γ; the values of this parameter are presented as the start points of the algorithm giving the minimum sum of squared errors, i.e. the initial values of $\gamma=10$ and $c_1=2.3556$ are selected as the start points of the algorithm. Then, γ is set equal to the determined value, so a new estimate for c is obtained. Afterwards, c is set identical to the new estimate, and a new estimate for γ is gained. This process is carried out again and again until the final c and γ values become consistent (Anderson, 2004). The final values of $\gamma=139.5$ and $c_1=2.3619$ were determined. Equation (4) describes the entire form of the model estimated and the estimation results of Table (2). However, the $\acute{\varphi} w_t$ parameters in Equation (4) are linear and the $(\acute{\theta} w_t)F(s_t, \gamma, c)$ parameters are nonlinear:

$$LREER_t = 0.9983LREER_{t-1} + (5.6386LREER_{t-1} - 2.2165LGCGDP - 1.6559LIOIL + 1.9475LOPEN + 0.4596LTARIFFA - 1.2724LTOT)\{1 + \exp[1*(LREER_{t-1} - 2.3556)]\}^{-1} \quad (4)$$

Table 4. Estimates of the equilibrium real exchange rate model ($LSTR_1$)

Variables	P-value	Coefficient	P-value	Coefficient
	Non-linear part of the model		Linear part of the model	
CONST	0.2858	-7.3831	0.8280	-0.0193
LREER(t-1)	0.0000	5.6386	0.0000	0.9983
LGCGDP(t)	0.0003	-2.2165	0.6957	0.0234
LIOIL (t)	0.0000	-1.6559	0.9695	0.0021
LOPEN(t)	0.0203	1.9475	0.3184	-0.0600
LTARIFFS(t)	0.0985	0.4596	0.4494	-0.0175
LTOT(t)	0.0123	-1.2724	0.5512	0.0116
GAMMA	0.0327	10		
C1	0.0000	2.3556		
	AIC	SC	HQ	R2
	-6.26	-5.83	-6.087	95.93

Source: *research results*

The results of various diagnostic tests to detect functional specification, serial correlation, heteroscedasticity and etc. show that the overall performance of the model is satisfactory.

In the linear part, only the first-order lag of LREER is significant, the increase of which raises the equilibrium REER. In the non-linear part, all variables' coefficients are significant, and the increase of the first-order lag of LREER, LOPEN, and LTARIFFS increments the equilibrium REER, and the increase in LGCGDP, LIOIL, and LTOT reduces the equilibrium REER.

The model estimation coefficients and comparing them with previous studies approve the non-linear association between the explanatory variables and the real exchange rate. Azizi & Hadian (2012) also discussed about it. However, the points to be considered are the variables that were not significant, except for the first-order lag variable of the REER in the linear part, and the other is the difference between the present study and previous researches' results carried out by means of the linear method. Differences may be due to differences in the study periods because the variables' effect can alter over time assuming the ruling system's terms (Azizi & Hadian, 2012). Thus, there is no comprehensive agreement with respect to the variables' effect on the real exchange rate.

3.4 Estimation of the REER misalignment

The exchange rate misalignments are derived based on the percentage difference of the REER from the equilibrium REER via calculation of the equilibrium REER values in each period. This variable is called REER misalignment or disequilibrium. The model proposed by Kamin (2001) and Hiri (2014) is applied according to the formula below:

MIS=((REER-PEER)/PEER)*100 (5)

MIS is the REER misalignment; REER is the real effective exchange rate, and PEER is the (permanent) equilibrium REER. Figure 1 depicts the misalignment of REER.

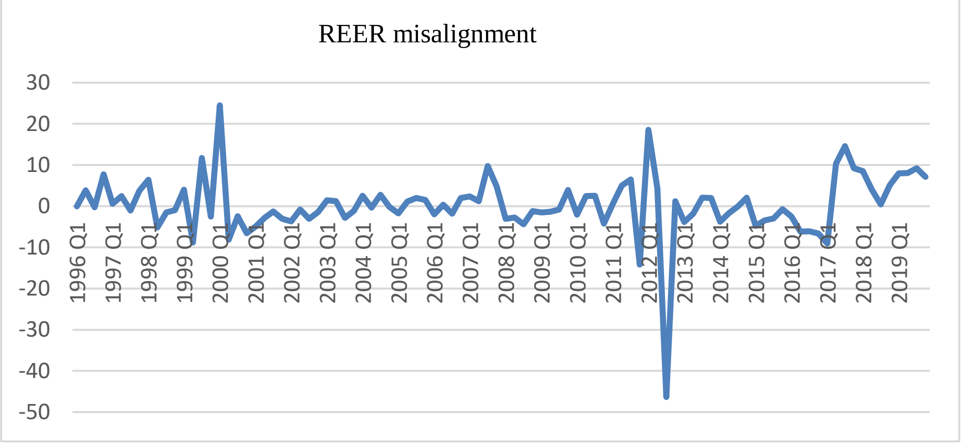

Figure 1. The misalignment of REER

Source: *research results*

The results showed that the level of misalignment has had many volatilities from the beginning of the period to the end. When the curve is above the horizontal axis (disequilibrium is positive), it shows that the REER is greater than the equilibrium REER or it manifests the overvaluation of the national currency; vice versa, when the curve is below the horizontal axis (disequilibrium is negative), it shows that the REER is less than the equilibrium REER or it indicates undervaluation of the national currency. If the research period is classified into five periods, the features of every period are as below:

Time period of 1996-2001: This time period was coincident with the following incidences: oil prices' decline in 1998, the government's requirement to save the foreign exchange income's excess in case of oil price rise in the foreign exchange reserves, the resentful failure of the exchange rate unification policy, and the government's effort to manage the foreign exchange market through various exchange rates including official exchange rate, exports rate, the deposit certificate rate, and the free market exchange rate. In this period, the government could control the exchange market inflation and make the economy ready for the second unification of exchange rate since the early 2000s. These widespread reforms could somehow decrease the real exchange rate volatility; however, the misalignments in the REER are considered from the equilibrium level point of view (Azizi & Hadian, 2012; Mozayani & Ghorbani, 2015).

Time period of 2002-2005: This time period was coincident with the successful execution of the second round of exchange rate unification policy as a managed float regime of exchange rate. Throughout this period, the economy benefited from relative stability in the foreign exchange reserves flow and exchange expenditures so that no severe disequilibrium was observed in the REERE (Mozayani & Ghorbani, 2015).

Time period of 2006-2012: This time period was coincident with the government change, the incremental flow of oil revenues, and the government's attempt to fix the nominal exchange rate via increasing the foreign exchange reserves' injection into the market. The government's excessive insistence on fixed nominal exchange rate and also severe increase of liquidity and inflation triggered a period of real exchange rate overvaluation. The drastic consumption of foreign exchange reserves, increase in imports inflow (official and unofficial), foreign exchange outflow, and the disruption of tradable vs. non-tradable goods' relative prices were the unavoidable effects of fixed nominal exchange rate (Manzoor & Mostafapour, 2013; Mozayani & Ghorbani, 2015).

Time period of 2013-2015: This time period was coincident with the inauguration of the new government and the international sanctions' intensification, such as coercive measures on oil sales and embargoing precious metals' and gold transactions, sanctioning the Central Bank, freezing the funds, and severe exchange restrictions so that the government could not pursue the policy of fixed nominal exchange rate via the injection of foreign exchange reserves to the economy. Accordingly, some temporary disruptions took place in the foreign exchange market (despite the government's measures, e.g. establishing a center for foreign exchange transactions), and the nominal exchange rate rose with numerous volatilities, deviating the REER from equilibrium (Iranmanesh et al., 2021).

Time period of 2016-2019: This time period was coincident with the United States withdrawal from the Joint Comprehensive Plan of Action (JCPOA), limitations of the foreign exchange reserves, international challenges in financial and banking interactions, hence, disabling policymakers in fixing the nominal exchange rate, increasing of national currency overvaluation, and intensifying the REER disequilibrium (Landler, 2018).

3.5 Economic sanctions' indexing

Scholars who have conducted studies on economic sanctions have employed different methods to estimate an index or select a decent variable reflecting the sanctions, including selection of 0 or 1 virtual variable instead of sanctions, inconsistency index[1], fuzzy logic[2], and factor analysis[3]. The economic sanctions against Iran are broad and have been imposed by different organizations and countries with varying amounts. Also, these sanctions are imposed against different individuals, institutions, and activities. Furthermore, there are different economic sanctions' durations against Iran. Presuming 0 and 1 for a certain variable, especially the economic sanctions imposed against Iran, is not desired because of its broadness, diversity, and volatility. Thus, an index reflecting some part of the so-called items is required. Some scholars could reach more comprehensive and real data about sanctions referring to the sanctions' targets to solve the problem of evaluating the variables that are affected by sanctions. There are a variety of data analyses that can solve the problem above (quantification of the sanctions' impact); however, factor analysis is the most desired method used to simplify complicated data sets with a lot of variables (Kalantari, 2013). This method can detect variables or basic factors to explain the correlation between the variables observed. Simultaneously, it crucially affects the detection of the hidden variables or factors through the variables observed (Momeni & Ghuyoni, 2007:191).

To estimate the sanctions index, first, the variables affected by sanctions are detected; to obtain a desired outcome, variables that are highly sensitive to the economic sanctions are selected[4]. The evaluated variables are: imports price (PX) and exports price (PM), terms of trade (TOT), foreign direct investment stock (FDIS), the United States' share in the foreign trade of Iran (USIRTTR), the ratio of Iran's oil production with respect to the world production of crude oil (OLSPS), the ratio of Iran's oil exports with respect to crude oil exports (OLSEXS), premium in the exchange rate[5] (PEREX), the exchange rate variance[6] (VAREX),

[1] Mahmoudi et al. (2018) and Fadyi and Derakhshan (2013) used this method.

[2] Iranmanesh et al. (2021) used fuzzy logic to develop the sanctions index.

[3] Garshasbi and& Yousefi (2015), Nademi et al. (2018), Ezzati et al. (2018), Nademi and Sedaqat Kalmazai (2018), and Nademi and Hassanvand (2018) employed this method.

These variables are often accounted by the imposers of sanctions as the major origins [4] of the effectiveness of sanctions on the key variables of economy (Ezzati et al. 2020).

[5] The ratio of the difference of official exchange rate from the non-official exchange rate to the official exchange rate

[6] Official and non-official exchange rate variance based on seasonal exchange rate data

the ratio of balance of non-oil trade to gross domestic product (TDNOIL), Iran's share of air shipment in the world (ASAIR) (Yousfi & Garshasbi, 2016; Ezzati et al., 2020), the amount of emissions of air pollutant and greenhouse gases (POLL) (Mustafavi et al., 2014; Fahimi Fard, 2020), the ratio of liquidity to gross domestic product (LIQUD) (Sadat Akhavi & Husseini, 2017), the ratio of foreign debt to gross domestic product (EXDE) (Torbat, 2005), the inflation rate (INFA) (Sadat Akhavi & Husseini, 2017; Sadeghi & Tayibi, 2018), and the unemployment rate (UNEM) (Nademi & Sedaghat Kalmazi, 2019; Ezzati et al., 2020).

Prior to factor analysis, first, sampling adequacy must be confirmed[1], i.e. can the available data be used for analysis? To put in other words, are the number of available data good for factor analysis or not? (Shirkond & Jokar, 2012). So, the KMO[2] index and Bartlett's[3] test was employed (Table 3); the test results of these two indices are as described in Table 3.

Table 5. Sphericity test and the KMO index for sample adequacy

KMO statistic		0.683
Bartlett's Test of Sphericity	Correlation coefficient	1740.790
	Degree of freedom (dg)	120
	Significance level (sig)	0.0000

Source: *research results*

Table 3 shows that the KMO index is 0.683, indicating that the data are appropriate for factor analysis. To make sure that the correlation matrix is specified and is not 0, Bartlett's Test of Sphericity should be used. Table 3 provides the Bartlett's test results that are approximations of the Chi-square statistic. The significance level of the Bartlett's test is lower than 5% (0.000), indicating that factor analysis is desirable for detection of the structure of the factor analysis model.

In exploratory factor analysis, a researcher must primarily determine the number of factors that should be extracted. Although the aim of exploratory factor analysis is to extract the minimum number of factors via explaining the most data variations to elucidate the issue under study, selecting the correct number of factors is very important (Zebardast, 2017). Comrey (1986) argued that the desired factor structure should be assumed based on the theoretical framework of the study prior to performing factor analysis to ensure the analysis results.

The country imposing sanctions attempts to pursue the following measures through imposing costs on the target country to achieve its intended objectives s: 1) trade embargo and 2) financial sanction. Thus, to narrowly evaluate the

[1] The more the number of samples, the more reliable the factor analysis

[2] This index assesses the negligent correlation between the variables and indicates whether the research variables' variance is affected by the common variance of the factor or not, which is 0 - 1. If the index's value is close to 1 (at least 0.6), the data are appropriate for factor analysis.

[3] This test appraises when the correlation matrix is identified (the unit and identity matrix mathematically), so it is not suitable for identifying the structure (factor model).

economic sanctions' impact on the misalignment of REER in the exploratory factor analysis, two factors were selected.

Table 4 presents the variables' contribution in the factors after rotation. Every variable is set in a factor having a significant high correlation with.

Table 6. Rotated factor matrix and variables coefficients

Variables	Coefficients of variables in the factor (component)		Contribution of variables in the factor (component)	
	F_1(SANC)	F_2(SANM)	F_1	F_2
PX	-0.075	0.191	-0.610	0.746
PM	-0.047	0.203	-0.464	0.764
TOT	0.052	-0.163	-0.143	-0.529
OILPS	0.134	-0.033	0.798	-0.244
OILEXS	0.164	0.008	0930	-0.129
FDIS	0.048	0.121	0.158	0.383
USIRTTR	0.019	0.008	0.103	0.011
PEREX	0.136	0.185	0.605	0.525
VAREX	-0.017	0.197	-0.287	0.715
TDNOIL	-0.152	0.012	-0.880	0.188
PASAIR	0.140	-0.227	-0.587	-0.670
LIQUD	-0.004	-0.159	0.130	-0.561
POLL	-0.166	0.001	-0.952	0.161
EXDE	0.154	0.034	-0.851	-0.026
INFA	-0.002	0.151	-0.135	0.534
UNEM	0.106	0.036	-0.586	0.025

Source: *research results (SPSS output)*

3.6 Estimating the sanctions indices

In factor analysis, the sanctions index is a factor (component), and the factor is a new variable estimated from the linear combination of the major values of the variables observed as Equation (5):

$$F = \sum_{i=1}^{p} w_i x_i \tag{5}$$

In Equation (6), x_i represents the ith variable; w_i is the factor score of the ith variable; p is the number of variables, and F is the factor. Table 4 shows the coefficients of each variable related to the corresponding factor, so the sanctions index equations are estimated as Equations (6) and (7).

$$SANC = 0.134OILPS + 0.164OILEXS + 0.019USIRTTR + 0.136PEREX - 0.152TDNOIL - 0.166POLL + 0.154EXDE + 0.540106UNEM \tag{6}$$

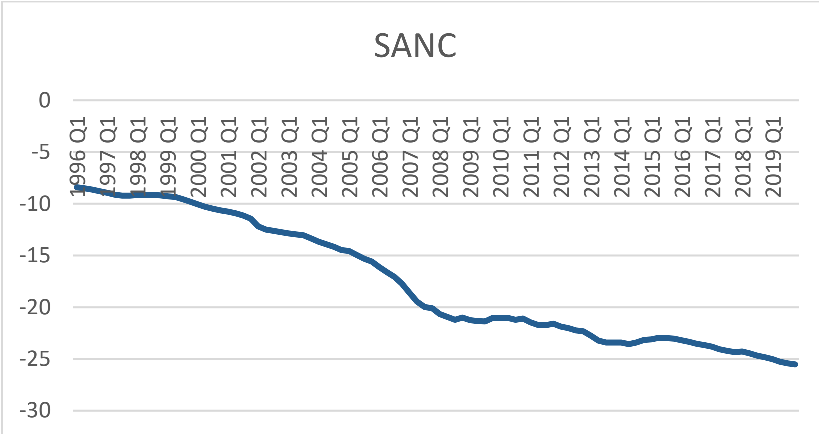

Figure 2. F_1(SANC) sanctions index
Source: *research results*

$$SANM = 0.191PX + 0.203PM - 0.163TOT + 0.121FDIS + 0.197VAREX - 0.227PASAIR - 0.159LIQUD + 0.151INFA \quad (7)$$

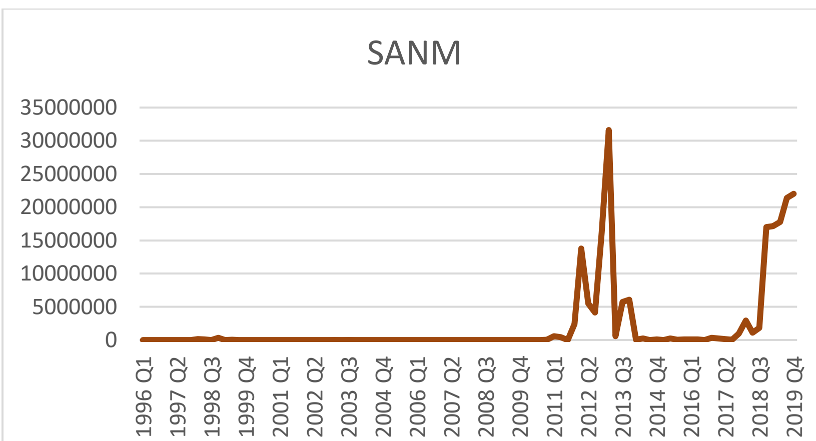

Figure 3. F_2(SANM) sanctions index
Source: *research results*

The economy of Iran has suffered economic embargoes for four decades. The sanctions were intensified from the late 2010s, i.e. restriction of financial transfers approved in 2010, the Central Bank' sanction imposed in 2011 and 2012 by the European Union and the United States, the intensification of sanctions on oil sale and the transaction of precious metals and gold, funds freezing approved by the European Union in the late 2012 and the United States Congress in the early 2013 (Manzur & Mostafapoor, 2012), and the withdrawal plan from the

JCPOA at the end of September 2017 (Landler, 2018). On October 2017, withdrawal from the JCPOA was seriously taken into consideration by the United States' government; on May 8, 2017, the United States withdrew from the JCPOA. Figures 4 and 5 are plotted by the estimation of sanctions' indices, confirming the above evidences.

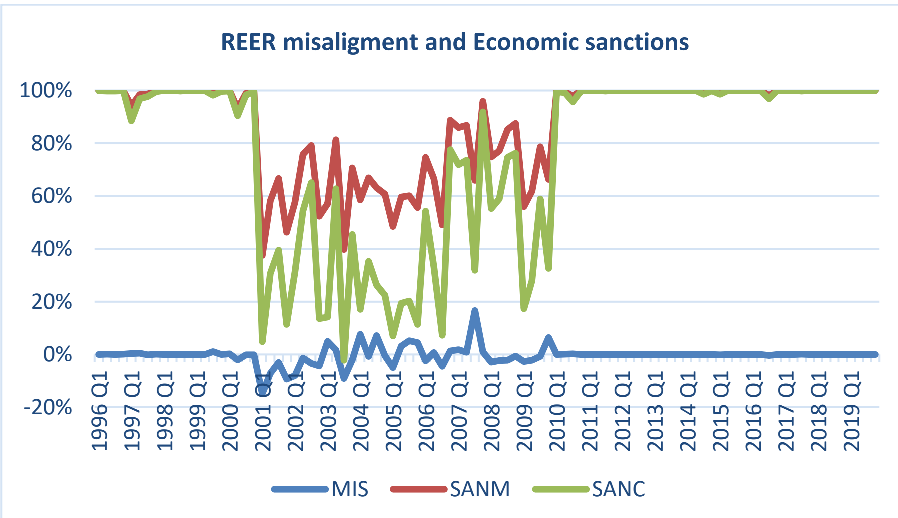

Figure 4. The misalignment of REER and sanctions index

Source: *research results*

What follows from figure 5 is that in the time when the sanctions (SANM , SANC) have been changed , the amount of the real effective exchange rate misalignment has also been changed.

4. Evaluation of the sanctions' impact on the REER misalignment using the NARDL model

So far, the sanctions' index was estimated using the factor analysis, and the equilibrium REER and the REER misalignment were obtained using the STR. To better perceive the economic sanctions' complicated nature on the exchange rate misalignment, the NARDL[1] was used to analyze the positive and negative impulses' effects of sanctions on the exchange rate misalignment in the short- and

[1] In addition to having all ARDL model features (except linearity), the NARDL model can identify and assess asymmetric impacts, so the NARDL is classified into two symmetric and asymmetric models. In case of symmetry, it is assumed that the impacts of increase and decrease in the independent variable on the dependent variable are identical, so the model presented by Pesaran et al. (2001) can be applied. In contrast, when the influences of increase or decrease in the independent variable on the dependent variable are not identical, i.e. in case of asymmetric impacts on the increase or decrease of the variables, Shin et al.' model (2014) has to be used (Kirimi Petanlar et al., 2019).

long-run and identify the number of equilibrium periods from the short run to the long run.

4.1 Model variables

Hatami et al. (2014), Asgharpoor et al. (2014), Mozayeni & Ghorbani (2015), and Bordbar et al. (2019) elaborated the significant and profound effects of government expenditure and the liquidity volume on the prices' level on the exchange rate. To analyze how economic sanctions' index affects the REER misalignment, the effects of the nominal government expenditure (GC), liquidity volume (LIQ), and inflation rate (INFA) were assessed in addition to the SANM[1] and SANC[2] economic sanctions. The terms of the use of the NARDL model are variables with stationary degree of less than two. Therefore, using stationary tests is required prior to the model estimation. Hence, to monitor the variables' stationary status, augmented Dickey-Fuller and Phillips-Perron tests were used. The unit root test results showed that some of the model variables were non stationary, but they become stationary with differentiating once.

4.2 Structural breaks, Zivot-Andrews test

Structural breaks in economic time series are prevalent due to impulses such as war, sanctions, climatic fluctuations, etc. Zivot and Andrews presented a procedure to accurately understand stationary status, assuming structural breaks. The null hypothesis in the Zivot-Andrews test is a unit root for the variables in the y-intercept status, the trend status, or the combined statuses of y-intercept and the trend. According to Zivot-Andrews test results, the variables are stationary.

4.3 Model estimation and execution stages

To estimate the dynamic model applying the NARDL method, first, the model variables' lags should be determined based on the theoretical foundations. The maximum model lag is determined four assuming that the data are seasonal, and then the optimal model variables' lags are specified using the Schwarz-Bayesian information criterion (SBC)[3]. The non-linear ARDL method with asymmetry is equal to:

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[1] This index represents the variables affected by the embargo, including the imported and exported goods prices, terms of trade, Iran's share of direct foreign investment, the exchange rate variance, Iran's share of global air shipment, the ratio of liquidity to the gross domestic product, and the inflation rate.
[2] This index is representative of variables influenced by sanctions, like the United States' share of Iranian foreign trade, the ratio of Iran's oil production to the production of crude oil in the world, the ratio of Iran's oil exports to crude oil exports, the premium of exchange rate, the ratio of balance of non-oil trade to gross domestic product, the amount of emissions of air pollutant and greenhouse gases, and the ratio of foreign debt to gross domestic product and unemployment rate.
[3] In yearly data, the lag can be one or two, and it can be entered with more length for highly frequent data such as seasonal and monthly data, selected with the researcher' judgment (in samples lower than 100, the SBC is used so that not more degree of freedom is lost. This criterion saves on determination of lags; thus, the estimation enjoys a higher degree of freedom (Ishimo & Negalaw 2015).

$$\Delta MIS_t = \mu + \rho MIS_{t-1} + \gamma^+ SANC_{t-1}^+ + \gamma^- SANC_{t-1}^- + \lambda^+ SANM_{t-1}^+ + \lambda^- SANM_{t-1}^- + \alpha GC_{t-1} + \beta INFA_{t-1} + \theta LIQ_{t-1} + \sum_{i=1}^{p-1} \omega_i \Delta MIS_{t-i} + \sum_{i=0}^{q-1} \vartheta_i \Delta SANC_{t-1}^- + \sum_{i=0}^{q-1} \vartheta_i \Delta SANC_{t-1}^+ + \sum_{i=0}^{q-1} \vartheta_i \Delta SANM_{t-1}^- + \sum_{i=0}^{q-1} \vartheta_i \Delta SANM_{t-1}^+ + \sum_{i=0}^{q-1} \pi_i \Delta GC_{t-i} + \sum_{i=0}^{q-1} \pi_i \Delta INFA_{t-i} + \sum_{i=0}^{q-1} \pi_i \Delta LIQ_{t-i} + \varepsilon_t \quad (10)$$

In the model above, testing the asymmetric effect of economic sanctions, the impact of nominal government expenditure, liquidity volume, and inflation rate' impact on the REER misalignment are feasible in the short- and long-run. Table 5 provides the NARDL model estimations. The determination coefficient of the model is 46.20%, manifesting the explanatory capability of the model. Furthermore, the F-statistic estimate confirms that the regression is significant and the optimal model is as NARDL (2, 4, 2, 0, 0, 4, 3, 0), i.e. the exchange rate misalignment is optimized with two lags, the positive and negative impulses of economic sanctions (SANM) with four and two lags, respectively, and the positive and negative impulses of economic sanctions (SANC) with no lag, and the government expenditure and inflation, respectively, with four and three lags, and the liquidity is optimized with no lag.

Table 7. The results of NARDL model relations test

	Explanatory variables	Coefficient	t-statistic	Prob	Wald test
ARDL	CONST	-0.02406	-0.5152	0.6081	
	MIS (t-1)	-0.1401	-1.2038	0.2328	
	MIS (t-2)	0.1639	1.2519	0.2149	
	SANM+(t)	$-3.32e^{-9}$	-0.8617	0.3919	
	SANM+(t-1)	$-1.25e^{-8}$	-1.8149	0.074	F-statistic: 6.95 Effect size: $5.9e^{-9}$ Probability level: 0.000
	SANM+(t-2)	$6.02e^{-8}$	5.7556	0.0000	
	SANM+(t-3)	$-3.11e^{-8}$	-3.5581	0.0007	
	SANM+(t-4)	$-1.07e^{-8}$	-2.2208	0.0297	
	SANM-(t)	$7.73e^{-9}$	1.7796	0.0796	F-statistic: 6.08 Effect size: $1.43e^{-9}$ Probability level: 0.001
	SANM-(t-1)	$1.40e^{-8}$	2.5673	0.0098	
	SANM-(t-2)	$-2.03e^{-8}$	3.6353	0.0005	
	SANC+(t)	0.08986	2.0868	0.0407	
	SANC-(t)	-0.0068	-1.9368	0.0569	
	GC (t)	$6.61e^{-8}$	0.1447	0.8854	
	GC (t-1)	$3.66e^{-7}$	0.8455	0.4008	
	GC (t-2)	$6.74e^{-7}$	1.3807	0.1719	
	GC (t-3)	$-5.69e^{-7}$	-1.2007	0.2340	
	GC (t-4)	$-1.46e^{-6}$	-2.9490	0.0044	
	INFA (t)	0.04036	0.0087	0.0000	F-statistic: 6.89 Effect size: 0.0149 Probability level: 0.000
	INFA (t-1)	-0.09051	-4.9105	0.0000	
	INFA (t-2)	0.0651	3.5534	0.0007	
	INFA (t-3)	-0.0137	-1.6382	0.1060	

	LIQ (t)	$-1.49e^{-8}$	-1.6830	0.0970	
	R-squared	0.462	D.W	2.06	
	Error-correction factor	-0.9763	-7.3045	0.0000	
	R-squared	73.2	D.W	2.06	
	Explanatory variables	Coefficient	t-statistic	Prob	Wald test
	CONST	-0.02406	-0.5151	0.6081	
	MIS(t-1)	-0.9763	-5.5075	0.0000	
	SANM+(t-1)	$2.52e^{-9}$	0.3634	0.7174	
	SANM-(t-1)	$1.39e^{-9}$	0.2214	0.8254	
	SANC+(t)	0.08986	2.0868	0.0407	
	SANC-(t)	-0.0068	-1.9368	0.0569	
	GC(t-1)	$-9.26e^{-7}$	-3.3606	0.0013	
	INFA(t-1)	0.00123	0.4438	0.6586	
	LIQ (t)	$-1.49e^{-8}$	-1.6830	0.0013	
	D(MIS(t-1))	-0.16387	-1.2519	0.2149	
	D(SANM^{+}(t))	$-3.32e^{-9}$	-0.8617	0.3919	
Long-Run	D(SANM^{+}(t-1))	$-1.84e^{-8}$	-2.1392	0.0360	F-statistic: 1.034
	D(SANM^{+}(t-2))	$4.18e^{-8}$	4.4437	0.0000	Effect size: $3.41e^{-8}$
	D(SANM^{+}(t-3))	$1.07e^{-8}$	2.2208	0.0297	Probability level: 0.383
	D(SANM^{-}(t))	$7.73e^{-9}$	1.7796	0.0796	
	D(SANM^{-}(t-1))	$2.03e^{-8}$	3.6353	0.0005	
	D(GC(t))	$6.61e^{-8}$	0.1447	0.8854	
	D(GC(t-1))	$1.36e^{-6}$	2.0834	0.0410	
	D(GC(t-2))	$2.03e^{-6}$	2.8859	0.0052	
	D(GC(t-3))	$1.46e^{-6}$	2.9490	0.0044	
	D(INFA(t))	0.04037	4.6455	0.0000	F-statistic: 1.396
	D(INFA(t-1))	-0.05138	-4.4554	0.0000	Effect size: -0.011 Probability level: 0.255
	D(INFA(t-2))	0.0137	1.6382	0.1060	

Source: *research results*

4.4 Model assessment

To confirm the results in the model assessment, classical hypotheses including serial autocorrelation, homoscedasticity variance, and the normality of the disturbance components' distribution ought to be assessed. The classical hypotheses (detection tests) are provided. The Breusch-Godfrey test assessed the existence or lack of autocorrelation. The null hypothesis shows no autocorrelation and the alternate hypothesis indicates autocorrelation. According to the results, the null hypothesis is not rejected; hence, there is no autocorrelation. Jarque-Bera test was used to examine the residual sentences' normality, confirming their normality. To confirm heteroskedasticity variance in the model, the ARCH test was used. The results revealed no heteroskedasticity variance in the model.

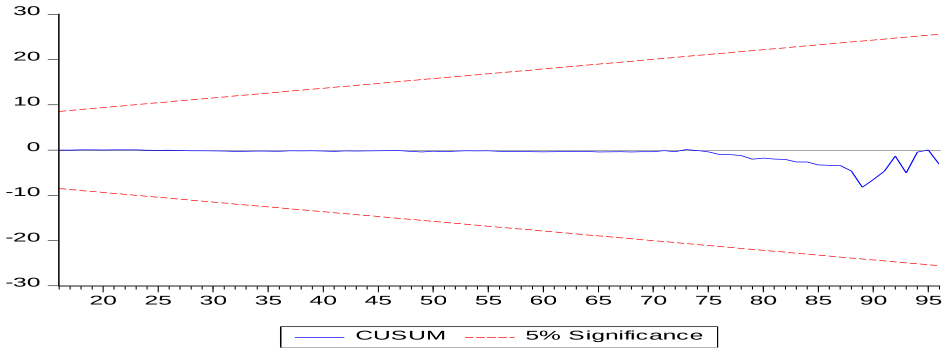

Figure 5. Graph of cusum test
Source: *research results*

The results of cusum test for stability of estimated coefficients and stability test of short – term and long – term coefficients in the study period are presented in figure 5 suggesting that the statistics are within confidence intervals of 95%, so the null hypothesis is accepted and is valid at 95% confidence level.

4.5 Analysis of short-run and long-run relations

The model estimation results in the short run indicated that:

$SANM^+$ index coefficients did not become significant in the current period. However, they became significant in the first, third, and fourth lags with a negative effect; in the second lag, the $SANM^+$ index was positively effective on misalignment. To find the effect size, Wald test was used, indicating a positive and significant impact ($5.9e^{-9}$) in the short run. The negative impulse of $SANM^-$ positively affected the misalignment in the current period and in the first lag and negatively in the second lag. The Wald's test showed the total effect size is positive and significant impact (1.43e-9) in the short run.

The $SANC^+$ index positively, and the $SANC^-$ index negatively affect misalignment.

GC: This variable's coefficients were not significant in the current period. The first-third lags were not significant. But, this variable' impact was significant in the fourth lag, and its effect was negative on misalignment.

INFA: This variable's coefficients in the current period and in the second lag positively affected misalignment but negatively affected the misalignment in the first and third lags. To find out the effect size of this variable, Wald's test was applied, indicating a positive and significant influence in the short run (0.0149).

LIQ: This variable's coefficient significantly and negatively affected misalignment in the current period (at 10%).

The long-run model estimation results revealed that:

SANM: This sanction index' impact was not significant on misalignment as positive and negative impulses in the first lag.

SANC: This sanction index' impact was significant on misalignment as positive and negative impulses in the model. The positive impulse has a positive impact on misalignment and the negative impulse has a negative and weaker impact, compared to the positive impulse.

GC: This variable's first lag coefficients affected misalignment significantly and negatively.

INFA: This variable's first lag coefficients were not significant.

LIQ: This variable's coefficient was significant in the current period, having a negative impact on misalignment.

D(MIS): The variations of exchange rate misalignment were not significant in the first lag.

D($SANM^+$): This variable's coefficients were not significant in the current period but were significant in the first to third lags. This variable negatively affected misalignment in the first lag and positively in the second and third lags. The Wald test was used to find out the effect size, revealing that this variable did not significantly affected misalignment. Its negative impulse D($SANM^-$) in the current period and the first lag was significant and positive with respect to the misalignment.

D(GC): This variable's coefficients were not significant at the probability level but were significant in the first to third lags, and its impact on misalignment was positive.

D(INFA): This variable's coefficients were significant in the current period and the first lag with positive and negative effects, respectively. But this variable's coefficient was not significant in the second lag. Wald test was used to find out the effect size, exhibiting the insignificance of the coefficients' sum in the long run.

A variable is associated with its long-run value in the error correction model of short-run volatilities. The error correction coefficient shows the percentage of the dependent variable' misalignment reaching equilibrium and approaching the long-run relation in each period. The results revealed that the numerical error correction coefficient is statistically significant, i.e. -1 – 0 ,(-0.976). A negative coefficient shows that misalignments move towards equilibrium in the long run. This coefficient' value proves 100% equilibrium in each period from the short run to the long run through the movement path. Also, this estimate' coefficient shows that over 73.2 % of the exchange rate misalignment variations are explained in the model by explanatory variables, such as economic sanctions.

5. Conclusion and recommendations

The influences of economic sanctions, inflation rate, nominal government expenditure, and liquidity volume on the REER misalignment were seasonally evaluated from 1996-2019, applying the NARDL. The LSTR model was used to estimate the REER misalignment, and the factor analysis was used to estimate the sanctions indices. The estimation results of REER misalignment indicated disequilibrium in the study period, and the leap of this disequilibrium took place through 1996 to 2001, coinciding with the oil price decline in 1998 and the failure of the exchange rate unification policy. Years 2010 to 2013 were concurrent with increases in oil revenues, liquidity, inflation, and aggregation of international sanctions.

The results of the study indicate that the effect of (SANC) economic sanctions on the REER misalignment is long and short term but effect is asymmetric so that positive shock with positive effect is much more than negative shock.however, although the effect of (SANM) economic sanctions on the REER misalignment was not significant in the long run, it was significant in the short run, and the results showed that the effect of positive shock was positive toward the negative shock of this variable and the point is that the results show that the outcome of the two shocks in this index (SANM) is positive.Taking the coefficients of other variables into account, the inflation rate coefficient did not become significant in the long run, but its effect in the short run was positively significant. The coefficients of the government's nominal expenditure and the liquidity volume were significant in the long run and negatively affected the REER misalignment. The error correction coefficient was -0.976 that is statistically significant, approving an approximate 100% speed of the short-run error equilibrium towards the long-run relation. Moreover, this estimate’s determination coefficient exhibits that more than 73.2% of the exchange rate misalignment variations are explained by explanatory variables in the model, involving the economic sanctions.

During the economic sanctions, exchange transactions were disrupted and oil exports became limited, disrupting in the exchange market. It is recommended to protect foreign exchange reserves by saving limited oil revenues and having further financial discipline through foreign exchange reserve’s fund and importing the necessary goods via clearing export goods, hence, preventing abrupt increases in the exchange rate when oil revenues decrease.

Rationally miniaturizing the government and modifying the process of allocating financial resources of government budget to increase the share of the construction expenditures versus the current expenditures and making transparent the performance of government’s foreign exchange and relevant institutions may hinder rent and corruption in Iran’s exchange market

References

Articles:

Afanasyev, D., Fedorova, E., & Ledyaeva, S. (2021). Strength of words: Donald Trump’s tweets, sanctions and Russia’s ruble. *Journal of Economic Behavior and Organization*, 184 (2021), 253–277.

Asgharpour, H., Mehdilou, A., & Esmaili, S. M. (2015). Determinants of Real Effective Exchange Rate in Iran using Fuzzy Regression. *Applied Theories of Economics*, 3(1), 25-56.

Azizi, Z., & Hadian, E. (2012). Estimating Real Exchange Rate Deviation from Equilibrium Value in Iran, using Smooth Transition Regression. *JPBUD 2012*, 17 (1), 7-27.

Baffes, J.B., Elbadawi, L.A., & O'ConneIlS, A. (1997). Single-Equation Estimation of the Equilibrium Exchange Rate, A World Bank Policy. Research Working Paper in http://www.worldbank.org/html/dec/Publications/Workpapers/WPSI800 series/wps1800/wps1800.pdf.

Barkhordari, S., & Jalili, H. (2019). Determinant Factors of Exchange Rate in Iran with Focus on Economic Sanctions" *Applied Economics Studie Iran*, 7(28), 35-58.

Bereau B., Lopez, A., & Mignon, V. (2008). Nonlinear Adjustment of the Real Exchange Rate towards its Equilibrium Value: A Panel Smooth Transition Error Correction Modelling. *Working Papers 23*. CEPII Research Center.

Bordbar, A., Saadat, R., Tayebi, Sk., & Mohammadi, T. (2019). An Inter-Country Approach to Analyze Effective Factors on Exchange Rate Overshooting. *Applied Economics Studies of Iran*, 8(31),95-121.

Butuzov, D. (2016). Impact of the EU and US Sanctions on the Foreign Exchange Rate of Russia. *Work Paper* ISEG Universidade De Lisboa 2016.

Cottani, J.A, Cavallo, F.D., & Khan (1990). Real Exchange Rate behavior and Economic performance in LDCS. *Economic Development and Cultural change*, 39(1990), 61-76.

Domac, I., & Shabsigh, G. (1999). Real Exchange Rate Behavior and Economic Growth Evidence from Egypt Jordan, Morocco and Tunisia.

Dreger, C., Kholodilin, K. A., Ulbricht, D., & Fidrmuc, J. (2016). Between the hammer and the anvil: the impact of economic sanctions and oil prices on Russia's ruble. *Journal Comp. Econ*., 44 (2), 295–308.

Edwards, S. (1988). Real and Monetary Determinants of Real Exchange Rate Behavior: Theory and Evidence from Developing Countries. *Journal of Development Economics*. 29, 311 -341.

Edwards, S. (1989). Real Exchange Rate Devaluation and adjustment. *London, The MIT press*, (1989).

Edwards, S. (2011). Exchange rates in emerging countries: eleven empirical regularities from Latin America and East Asia. *National Bureau of Economic Research. Working paper*, 17074.

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

Fadaee, M., & Derakhshan, M. (2015). Analysis of Short Run and Long Run Effects of Economic Sanctions on Economic Growth in Iran. *Quarterly Journal of Economic Growth and Development Research*, 18(18): 113-132.

Fahimifard, S.M. (2020). Studying the Effect of Economic Sanctions on Iran's Environmental Indexes (SVAR Approach). *Journal 0f Econometric Modelling*, 5(3), 93-119.

Faruqee, H. (1995). Long-run determinants of the real exchange rate: A stock-flow perspective. *IMF Staff Papers*, 42(1): 80-107.

Garshasbi, A.R., & Yusefi, M. (2016). Assessment of International Sanctions on Iranian Macroeconomic Variables. *Journal of Economic Modeling Research*, 7(25): 129-182.

Gurvich, E., & Prilepskiy, I. (2015). The Impact of financial sanctions on the Russian economy. *Russ. J. Econ.* 1 (4), 359–385.

Heydari, H., Ezati, M., & Moridi, P. (2021). Estimating the impacts of economic sanctions on employment in the industry, agriculture and service sectors in Iran. *The Journal of Economic Policy*, 13(25), 65-107.

Hiri, A. (2014). The real effective exchange rate misalignment: Application of Behavioral Equilibrium Exchange Rate BEER to Algeria 1980-2009. *International Journal of Economics, Finance and Management Sciences*, 2(5): 277-284.

Hufbauer, G., Jeffrey C., schott, J., Elliott, K.A. & Oegg, B. (2007). Economic Sanctions Reconsidered. *3rd Edition, Institute for International Economics*, Washington DC.

Kamin, S.B., & Klau, M. (2001). A Multi-country Comparison between Inflation and Exchange Rate Competitiveness paper prepared for the BIS workshop on Modeling Aspects of Inflation Process and the Monetary Transmission Mechanism. *Bank for International Settlements (January).*

Karimi Petanlar, S., nademi, Y., & Zobeiri, H. (2020). Government Size and Unemployment in Iran. *Journal of Economic Growth and Development Research*. 46(1), 51-64.

Kazerooni, A., Mozaffari, Z., Krimi Kandoleh, M., & Amini, M. (2016). The Effect of The Real Effective Exchange Rate Misalignment on Iranian Non-Oil Exports: The BEER approach. *Financial Knowledge of Securities Analysis*, 9(32): 95-113.

Khataie, M., & Gharbali Moghaddam, Y. (2004). Examining the Dynamic Relationship between Foreign Exchange Rate and GDP in Iran's Economy. *JPBUD*, 9 (1), 3-25.

Korotin, V., Dolgonosov, M., Popov, V., Korotina, O., & Korolkova I. (2018) The Ukrainian crisis, economic sanctions, oil shock, and commodity currency Analysis based on EMD approach. *Research in International Business and Finance*.

Lundbergh, S., Terasvita, T., & Van Dijk, D. (2003). Time-Varing Smooth Transition Autoregressive Model. *Journal of Bussiness and Economic Statisyics*, 21, 104-121.

Mehrara, M.(2006)."Long-Run and Short-Run Determinants of the Real Exchange Rate in Iran" Journal of Economic Research, 40(70): 117-158.

Montiel, P., & Hinkle, L. (1999). Exchange rate misalignment: an overview in exchange rate misalignment: concepts and measurement for developing countries. *A World Bank research publication. Washington, DC*.

Mozayani, A.H., & Ghorbani, S. (2015). Nominal Exchange Rate Misalignment in Iran's Economy. *Journal of Majlis and Rahbord*, 22(82), 199-233.

Nademi, Y., Jalili Kamjoo, S.P., & khochiany, R. (2018). Econometric Modeling the Impact of Sanctions on the Foreign Exchange Market and Its Transmission mechanism to macroeconomic variables Iran. *Journal of Econometric Modelling*, 2(2), 61-87.

Pesaran, M., & Shin, Y. (1999). An Autoregressive Distributed Lag Modeling Approach to Cointegration Analysis, in Strom, S. (Ed.), Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium. *Cambridge University Press*.

Pesaran, M.H., Shin, Y., & Smith, R.J. (2001). Bounds Testing Approaches to the Analysis of Level Relationships. *Journal of Applied Econometrics*, 16, 289-326.

Sadat Akhavi, S.M., & Hosseini, S.S. (2018).Assessment of Economics Sanction Effect on Iran' s Inflation. *Quarterly Iranian Journal of Applied Economics*,7(21), 33-50.

Samimi, A., & Ghobadi, N. (2016). Assessing the Misalignments of the Real Exchange Rate using the BEER Approach. *The Journal of Economic Policy*, 8(15), 55-76.

Tahmasbi, B., Jafari Samimi, A., & Amiry, H. (2013). The Impact of Budget Deficit on Real Exchange Rate in Iran. *Journal of Audit Science*, 12(49),25-51.

Tayebi, S.K., & Sadeghi, A. (2017). The Impacts of International Sanctions and other Factors Affecting Exchange Rate in Iran. *Journal 0f Econometric Research Tahghighat-e-Eghtesadi*, 52(3), 641-661.

Torbat, A. (2005). Impacts of the US Trade and Financial Sanctions on Iran. *The World Economy*, 28(3), 407-434.

Tyll, L., Pernica, K., & Arltova, M. (2018). The impact of economic sanctions on Russian economy and the RUB/USD exchange rate. *Journal of International Studies*, 11(1), 21-33.

Zebardast, E. (2017). Exploratory Factor Analysis in Urban and Regional Planning. *Honar-ha-ye-Ziba Memari-va-Shahrsazi*, 22(2): 5-18.

Yelena, T., & Faryal, Q. (2016). Global Oil Glut and Sanctions: The Impact on Putin's Russia. *Energy Policy*, 90, 140-151.

Wang, Y., Wang, K., & Chang, C.P. (2019). The impacts of economic sanctions on exchange rate volatility. *Journal of Economic Modelling*, 82 (2019), 58–65.

Xiong, Q., & Tian, Y. (2015). Legalization of international cooperation and effectiveness of financial sanctions: explaining the evolution of Iran's nuclear issue. *In: Asia Pacific contemporary*, 1, 98–130.