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Real effective exchange rate misalignment and currency crisis in Iran

Mohammad Hassanzadeh* and Shahla Mousavi

Abstract

This study aimed to examine real effective exchange rate (REER) misalignment in Iran and its relation to the currency crisis. The behavioral equilibrium exchange rate was employed to calculate the equilibrium exchange rate (EER), and misalignment was obtained using the exchange rate deviation from the equilibrium value. Using the autoregressive distributed lag (ARDL) method and data from 1986 to 2019, the long-run relationship between macroeconomic fundamentals and REER was estimated. The results show that trade openness, rate of productivity growth in tradable good production, net foreign assets of the central bank, oil exports, and terms of trade significantly affected the EER. Estimation of misalignment and its relationship with the currency crisis show that in the years before the crisis, there was generally a significant overvaluation in several consecutive years; hence, exchange rate misalignment serves as a leading index to predict the probability of a currency crisis.

Keywords Exchange rate misalignment, Currency crisis, Autoregressive distributed lag (ARDL) method

JEL Classification O24, H12, F31

Introduction

The exchange rate is one of the fundamental variables of macroeconomics because it determines the relative price of goods and services at home and abroad, and it influences the decisions of economic agents [26]. If the real exchange rate is not on the equilibrium level, it can result in wrong signals and economic distortions [21]. An appropriate development strategy should include policies to maintain the exchange rate at the equilibrium level. Exchange rate misalignment is defined as the deviation of the exchange rate from its equilibrium level [11, 25, 36]. It is assumed that exchange rate overvaluation reduces economic growth, while undervaluation accelerates economic growth [2, 34]. Severe and permanent misalignment indicates economic incompatibility and may lead to an economic crisis. Such misalignment may also contribute to a currency crisis [16, 17]. Many countries, such as

Mexico (1994–1995), Russia (1998), Brazil (1999), Turkey (2001), and Argentina (2002), have experienced currency crises that have created interruptions in their development path. A currency crisis occurs if there is considerably high demand for foreign currency, and a speculative attack results in a sharp depreciation in national currency value or forces monetary authorities to defend the currency by selling foreign exchange reserves [15]. Although each crisis occurs under specific circumstances, studies show that exchange rate misalignment can predict a currency crisis.

The existing views regarding the currency crisis can be divided into three groups. The first group considers weak macroeconomic fundamentals or inconsistent macroeconomic policies as the cause of the currency crisis. According to the second point of view, even if there is no weakness of macroeconomic fundamentals or inconsistency of macroeconomic policy, there is still a possibility of crisis. According to this point of view, the overvaluation of the exchange rate can ultimately cause a currency crisis. In the third point of view, the currency crisis can be occurred in connection with the banking crisis.

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Therefore, examining the relationship between exchange rate misalignment and currency crises is included in the second group of currency crisis models.

Holtemöller and Mallick [17] argued that exchange rate misalignment can predict currency crises, emphasizing different currency regimes. Glick and Hutchison [15] introduced the overvaluation index to the regression model of the currency crisis. They considered exchange rate deviation from its trend as exchange rate misalignment. Kemme and Roy [23] found that overvaluation of the exchange rate can be a prelude to a currency crisis. Jongwanich [20] concluded that real exchange rate overvaluation occurred before the currency crisis of 1997 in Thailand. Heriqbaldi et al. [16] conclude that, of the 17 crises in Indonesia, 10 have been associated with high exchange rate misalignment.

Currency crises are more likely to occur in oil-dependent economies with incompatible monetary and currency policies. In countries like Iran, where the primary source of government revenue is foreign exchange earnings from the export of raw materials such as oil, the importance of the exchange rate is much more significant. Although factors such as economic sanctions against Iran have contributed to these fluctuations, other economic factors also play a vital role in this case. Although the exchange rate issue has been one of the most important issues of Iran's economy in recent years, the currency crisis and its relationship with the exchange rate misalignment have not been given much attention. Given the high costs that currency crises impose on the Iranian economy, the main focus of this article is to determine the EER, estimate misalignment, and examine the relationship between exchange rate overvaluation and the currency crisis.

This paper is structured as follows. “[Exchange rate policies in Iran](#)” section presents a review of the exchange rate policies of Iran. “[Methods](#)” section is devoted to methods for measuring the EER and its misalignment. The Estimation of equilibrium exchange rates and misalignment results are presented in “[Estimation of equilibrium exchange rates and misalignment](#)” section. “[Exchange rate misalignment and currency crisis](#)” section investigates the relationship between real exchange rate misalignment and the currency crisis. The final section presents the “[Conclusions](#)”.

Exchange rate policies in Iran

Before 1990, there was a multiple exchange rate system in place in Iran and, at different times, special regulations governing import control and the exchange rate system. In 1990, primary attempts were made to equalize the exchange rate. However, these efforts remained unsuccessful for various reasons. On 21 July 1991, there was a reduction in the number of official exchange rates

from seven to three. Oil exports, basic goods imports, and repayment of formal debts were based on the basic official rate stabilized for special drawing rights (SDR), which equaled 92.3 rials (Iran's currency). The competitive rate was another official rate in which one US (United States) dollar was stabilized for 600 rials. The competitive rate was used for intermediate and capital goods that were not classified into basic goods imports. Floating exchange rates were used in other transactions. The free non-bank market rate was used to determine this rate. The free non-bank market exchange rate is set by exchange traders [35].

On 21 March 1993, the three official rates were equalized, and one US dollar stabilized for 1500 rials. Moreover, currency regulations became more flexible, currency allocation through foreign exchange funds was stopped, and the exchange rate was determined based on the daily rate of the central bank within the managed floating system that was considered a free non-bank exchange rate. However, factors such as expansionary fiscal policies and a decline in oil price interrupted exchange rate unification and intensified the pressure of rising exchange rates and depreciating the national currency. On 21 December 1993, the exchange rate was stabilized for 1750 rials per dollar, and the free non-bank market rate was no longer used to determine the official exchange rate. The competitive rate was introduced on 4 May 1994 to expand exports.

High inflation and the imposition of unilateral sanctions by the US again pushed up the free non-bank exchange rate and increased pressure on the devaluation of the national currency and the rise of the official exchange rate. In parallel markets outside Iran, the value of Iran's currency fell against the US dollar. Some rules were formulated to liberalize the trade and currency system to stimulate exports in 1996. Although many policies were established to control the declining national currency value, the policies failed as a result of high inflation [35].

Strict policies that were created in relation to macroeconomics led to the relative stabilization of the exchange rate in 1998–1999. Simultaneously, there was minimal government interference in the stock exchange market (market of currency transaction), which paved the way to unify the exchange rate and increase the value of the national currency.

The currency unification policy was implemented successfully in 2002, and the interbank exchange rate market was established in line with the unification strategy. Success was achieved by mitigating import constraints, liberalizing the capital account, using managed floating rates, and reducing fiscal system dependence on the dollar. Further, increased oil prices, an oil stabilization fund,

and market exchange rate experience in the Tehran Stock Exchange enabled successful currency unification. At this stage, unification was achieved under appropriate conditions and from a position of strength [19].

In 2004, a currency trading license was issued for currency exchange. There was a relatively stable exchange rate with little difference between the official and non-official exchange rates (about 0.3%) (CBI, various years). After the exchange rate was stabilized, some factors, including sanctions on the oil sector, reduced disposable foreign exchange earnings and limited currency transactions. This led to a lower value of the national currency, which remained until 2013.

In 2013, with the change in political conditions as a result of the Iranian presidential elections and the Geneva Accord between G5 + 1 countries and Iran, relative stability prevailed in the foreign exchange market. Thus, the declining value of the rial stopped, and the central bank was able to manage the exchange rate. Nuclear negotiations continued in 2014, and some fiscal sanctions were lifted, followed by the release of some frozen assets as a result of the Geneva Agreement. The relative gap between the exchange rate in the official and non-official markets was narrowed, and there was a relatively stable exchange rate at that time.

Since 2016, concerns about the US's adherence to its commitments to the Joint Comprehensive Plan of Action have negatively affected the currency market. This, in turn, has led to an increasing non-official exchange rate. The exchange rate was stabilized at 42,000 rials for all economic activity in April 2018, which accelerated the foreign exchange demand. In August 2018, the exchange rate of 42,000 was allocated to essential goods and medicines. The Management Integrated System (NIMA) also obliged non-oil exporters to enter 95% of the currency earnings from exports to the NIMA system based on an agreed rate of imports. The US's withdrawal from the Joint Comprehensive Plan of Action on 8 May 2018 led to a more severe rise in the exchange rate, which widened the gap between the official and market rates. In 2019, the average market rate reached 129,185 rials, significantly higher than the official rate (42,000 rials); this rate reached more than 220,000 rials in 2020 (CBI, various years).

Methods

Researchers have proposed different methods for estimating the EER. The Behavioral Equilibrium Exchange Rate (BEER) method was used in this research, as well as in studies conducted by Burkart and Coudert [8], Clark and MacDonald [9], MacDonald and Dias [27], Nouria et al. [31], and Burkart and Coudert [8]. The BEER approach evaluates the real effective exchange rate

(REER) directly by estimating the long-run relationship between the REER and macroeconomic fundamentals [1]. In this method, the long-run relationship between the REER and macroeconomic variables is estimated. Then, using the estimated coefficients and the stable value of macroeconomic variables, the value of the EER is calculated. After calculating the EER, the gap between the EER and the REER is calculated. This gap is defined as REER misalignment. The Hodrick–Prescott filter is used to obtain a permanent value of the macroeconomic fundamental variables. The short-term fluctuations of time series and time series trend are distinguished in this approach. The BEER is then estimated by multiplying the estimated coefficient by the permanent values of the variables [10, 30].

In this paper, macroeconomic variables affecting the effective exchange rate have been selected based on previous studies. Table 1 identifies the variables used in this article and the studies that used these variables.

The REER is calculated using the International Monetary Fund methodology as [6]:

$$E_i = \prod_{i \neq j} \left[\frac{P_i R_i}{P_j R_j} \right]^{W_{ij}}$$

where i and j refer to Iran and trade partners, respectively, P 's are CPIs, and R 's are bilateral nominal exchange rates against the US dollar (measured in U.S. dollar per local currency). For Iran, market exchange rate is used as nominal exchange rate. W_{ij} , representing effective trade weights and sum to unity. Data were collected from World Development Indicators (World Bank), United Nations Comtrade database, and Economic Time Series Database of Central Bank of Iran.

Estimation of equilibrium exchange rates and misalignment

We use the ARDL cointegration method to extract the long-term relationship between macroeconomic variables and REER. In this method, it is possible to use the variables that are $I(0)$ and/or $I(1)$. First, it is necessary to check the existence of cointegration between the variables using the ARDL Bounds Testing methodology of [33]. Anyway, in this method, none of the variables should be $I(2)$; otherwise, the results will be invalid. The Phillips–Perron unit root test is used to determine the order of integration. The test results are shown in Table 2.

The optimal lag structure is determined by Schwarz–Bayesian criterion (SBC).

According to the unit root test results, the variables had the stationary combination of $I(0)$ and $I(1)$ and none of the variables are $I(2)$. The Akaike information criterion (AIC), Schwarz–Bayesian criterion (SBC), and

Table 1 Equilibrium exchange rate model variables and sources

Variables	Definition	References
OX	Oil export as a share of GDP	Mozayani and Parvizi [29]
OPEN	Trade openness Total exports and imports as a share of GDP	Dağdeviren et al. [13] Jongwanich [20] Nouira and Sekkat [32] Hossfeld et al. [18]
TOT	Terms of trade	Nouira and Sekkat [32] Hossfeld et al. [18] Giannellis and Papadopoulos [14] Baak [4] Jongwanich [20]
NFA	Net foreign assets as a share of GDP	Baak [4] Kim and Korhonen [24] Hossfeld et al. [18]
GOV	Government expenditure as a share of GDP	Kim and Korhonen [24] Hossfeld et al. [18] Cuestas et al. [12] Ajevskis et al. [1]
PRO	Productivity differential Real GDP per capita relative to main trading partner	Zardad et al. [38] Toulaboe [37] Banerjee and Goyal [5]

Table 2 Phillips–Perron unit root test

Variables	Level		1st difference		Level of integration
	Phillips–Perron test statistic	P value	Phillips–Perron test statistic	P value	
REER	− 2.887	0.1794	− 10.019***	0.000	I(1)
OX	− 1.867	0.6488	− 5.454***	0.0005	I(1)
OPEN	− 2.651	0.2615	− 5.432***	0.0004	I(1)
TOT	− 4.658***	0.0030	–	–	I(0)
NFA	8.053	1.000	− 4.692***	0.0036	I(1)
GOV	− 1.940	0.6149	− 6.944***	0.0000	I(1)
PRO	− 5.095***	0.0009	–	–	I(0)

***Significance at the 1% levels

the Hannan–Quinn information criterion (HQC) Criteria can be used to determine the optimal number of lags in the model. Because of the limited sample size, the SBC was used. The selected model is ARDL (2, 0, 1, 0, 0, 2, 1), which shows the optimal lag lengths of the variables REER, OX, OPEN, TOT, NFA, respectively.

To investigate the existence of a long-term relationship between the variables, the bounds test was used. The results of this test are shown in Table 3. Two lags were used in the bounds test because of the limited number of data. According to the results of the F-value reported in the table, the null hypothesis (H_0) of no long-run relationship between variables was rejected; therefore, there was a long-run relationship between the variables.

Table 3 Bounds test results

F-statistics	Lag	Bound critical values			
5.453	2	Significance level	I(0)	I(1)	
		1%	2.66	4.05	
		5%	2.04	3.24	
		10%	1.75	2.87	

Table 4 Estimated long-run coefficients based on the ARDL cointegration approach

Regressor	Coefficient	P value
OPEN	− 1.107	0.0004
NFA	73.765	0.0001
OX	4.047	0.0000
TOT	− 0.131	0.0049
GOV	1.759	0.1656
PRO	102.777	0.0284

Table 4 reports the results of the estimated long-run relationship between the REER and macroeconomic fundamentals.

$$\begin{aligned}
 \text{REER} = & - 1.107\text{OPEN} + 73.756\text{NFA} \\
 & + 4.047\text{OX} - 0.131\text{TOT} \\
 & + 1.759\text{GOV} + 102.777\text{PRO}
 \end{aligned}$$

As observed in the model, all coefficients are significant except for government expenditure. Regarding the significant negative coefficient of trade openness, a 1 unit increase in the openness index leads to a 1.107 unit decline in the REER. The reason for this relationship is the effect of trade openness on reducing the domestic price of tradable goods, thereby reducing the REER.

The coefficient of net foreign assets of the central bank was positive and significant, indicating that a 1 unit increase in the net foreign assets of the central bank leads to a 73 unit increase in the REER.

Oil exports also had a positive and significant effect on the REER, indicating that a 1 unit increase in the oil price leads to a 4.04 unit increase in the REER. Rising oil prices increase government foreign exchange earnings; as a result, the government can strengthen the value of the national currency.

Terms of trade can positively or negatively affect REER. By increasing the terms of trade, national income increases (income effect), which can increase the price of non-tradable goods. Conversely, it has a substitution effect on supply and demand. In this study, terms of trade had a negative effect on the REER, although its effect was negligible.

Government expenditure had a positive and insignificant effect on the REER, indicating that a 1 unit increase in government expenditure leads to a 1.75 unit increase in the REER. Accordingly, government expenditure mainly includes untradeable goods. Government consumption (compared with private consumption) is first allocated to non-tradable goods, and such an increase in government consumption (redistribution of earnings toward the government) increases the relative price of non-tradable goods, as well as the REER.

Of the independent variables, the productivity variable had the most significant effect on the REER. Productivity generally grows more in tradable sectors and is expected to increase the REER. The result was consistent with theoretical expectations and confirmed the Balassa–Samuelson effect.

An EER was obtained by placing a constant amount of independent variables in the equation. A long-run relationship between the REER and fundamental macroeconomic variables was used to calculate the EER. The Equilibrium Exchange Rate was calculated using the long-run relation coefficients and the permanent value of the macroeconomic variables. The permanent value of the macroeconomic variables was obtained from filtering the data using the Hodrick–Prescott filter.

The equilibrium exchange rate is obtained by using permanent values of macroeconomic variables and estimated long-run coefficients based on the ARDL cointegration approach ($\hat{\beta}$):

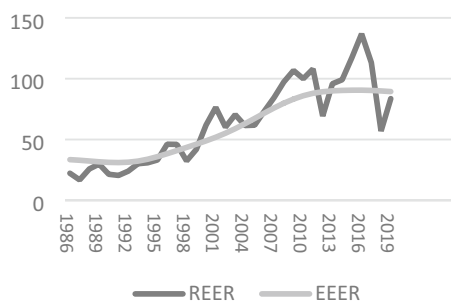


Fig. 1 Equilibrium and real effective exchange rate

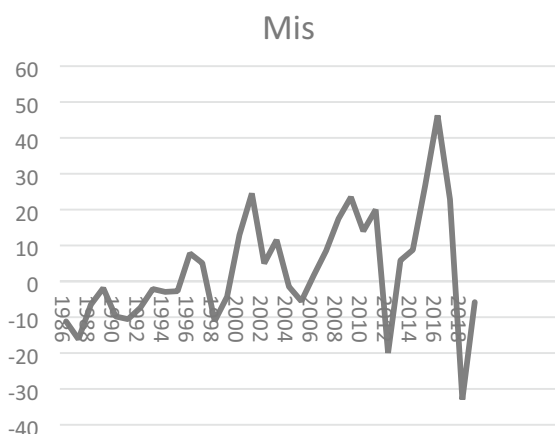


Fig. 2 Exchange rate misalignment

$$EER_t = \hat{\beta}X_t^{HP}$$

Figure 1 shows the real and equilibrium exchange rates in the period under review.

Exchange rate misalignment is defined as the gap between REER and EER.

$$MIS_t = REER_t - EER_t$$

Figure 2 illustrates the results of the exchange rate misalignment.

According to Figs. 1 and 2, the exchange rate was undervalued from 1986 to 1995, although the misalignment and undervaluation were relatively low. Between 1996 and the end of the period under review, the exchange rate was overvalued for most years. There were four significant exchange rate overvaluations during the years under investigation. The first overvaluation occurred from 1996 to 1997. The REER was higher than the EER; hence, the deviation was indicated in the form of an exchange rate overvaluation. This period lasted only two years, and the overvaluation was relatively low. The second overvaluation occurred

during 2000–2003. This period was longer than the first period, and the amount of overvaluation increased. The third period was the longest period of overvaluation from 2006 to 2011. The fourth period lasted five years (2013–2017), and the highest overvaluation occurred in this period.

Exchange rate misalignment and currency crisis

To examine the relationship between REER misalignment and currency crisis, it is first necessary to measure the currency crisis. The methods used to measure the currency crisis can be divided into two groups. In one group, devaluation is emphasized and the periods in which large devaluation happened are considered as currency crisis. In the second method, currency crisis is defined based on exchange rate pressure [15]. According to this method, it is possible for the authorities to respond successfully to speculative attacks by intervening in the currency market or increasing the interest rate. Therefore, as a result of the speculative attack, the value of the national currency may decrease, or the international reserves may decrease and/or the interest rate may increase. In other words, in this method the currency crisis is defined as a speculative attack on the value of the national currency that causes a sudden drop in the exchange rate, which can force monetary policymakers to sell foreign exchange reserves or raise interest rates [7]. Therefore, to study the currency crisis, a decrease in the exchange rate, a decrease in foreign exchange reserves, and an increase in interest rates must be considered simultaneously. The market pressure index is calculated based on the above three variables. According to studies conducted by Glick and Hutchison [15] and Ari [3], significant changes in the market pressure index are considered as currency crisis.

Exchange rate market pressure represents the weighted average rate of exchange rate changes, loss of currency reserves, and changes in the interest rate [22]. Following Ari [3], the market pressure index is calculated as:

$$MPT_T = \frac{1}{\sigma_{ER}} \left[\frac{ER_T - ER_{T-1}}{ER_{T-1}} \right] - \frac{1}{\sigma_{IR}} \left[\frac{IR_T - IR_{T-1}}{IR_{T-1}} \right] + \frac{1}{\sigma_R} R[T - R_{T-1}]$$

where ER represents the real exchange rate, IR indicates international reserves, and R represents the interest rate on short-term deposits and σ_R , σ_{IR} and σ_{ER} represent

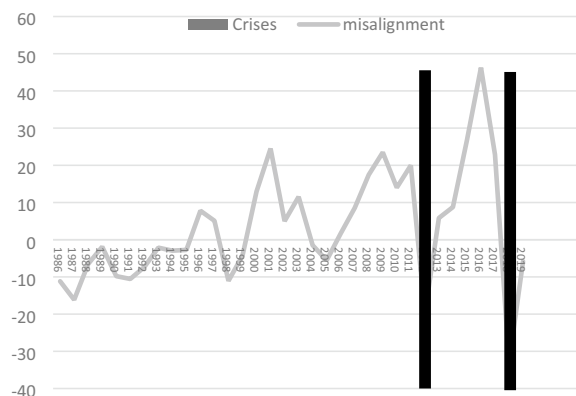


Fig. 3 Exchange rate misalignment and currency crises

Table 5 Ratio of overvaluation to exchange (percentage)

Year	Overvaluation (percentage)	Total overvaluation (percentage)	Number of years	Crisis
1996	16.9	28.0	2	No
1997	11.06			
2000	20.9			
2001	32.1	76.6	4	No
2002	8.3			
2003	16.4			
2006	2.2	78.85	6	Yes
2007	10.1			
2008	17.9			
2009	22.0	14.0		
2010	14.0			
2011	18.5			
2013	6.1	97.60	5	Yes
2014	8.8			
2015	22.8			
2016	33.8	20.2		
2017	20.2			

standard deviations of index components, respectively. The higher the pressure on the domestic currency, the higher the index of exchange market pressure will be. It is assumed that monetary authorities will increase the interest rate and/or the central bank will sell currency reserves if there is an attack on the domestic currency. In this case, international reserves will be reduced.

If this index exceeds the threshold rate (mean plus 2 times the standard deviation) in one year, it implies a crisis that is shown by 1; otherwise, it equals zero [15].

$$CCt = \begin{cases} 1 & \text{if } IMP_T > \mu_{IMP} + 2\sigma_{IMP} \\ 0 & \text{otherwise} \end{cases}$$

where CC is the index of the currency crisis; for the Iranian economy, this index is equal to 1 in 2012 and 2018, which indicates the currency crisis in these years.

Figure 3 shows the overvaluation of the exchange rate and the currency crisis simultaneously. As shown, the overvaluation of the exchange rate occurred in four periods. The first period lasted only two years, and the total overvaluation reached 28% (Table 5). In 1998, without the currency crisis, the overvaluation disappeared. The second period was longer than the first period, and the overvaluation increased, but there was no crisis in this period. The first and second periods were not followed by a crisis, but a currency crisis occurred at the end of the third and fourth periods. Table 5 shows the amount of overvaluation in each period. As shown, the third period (2006–2011) was the longest period of overvaluation. The amount of overvaluation reached 79%, and then, the currency crisis occurred. The fourth period lasted 5 years (2013–2017), and the total overvaluation reached 97%, which was the highest amount of overvaluation in the period under study. Thus, it can be concluded that, in general, an overvaluation of the exchange rate occurs before a financial crisis, and in fact, an overvaluation of the exchange rate is a prelude to a currency crisis. The results are compatible with most studies. Holtemöller and Mallick [17] states that a positive misalignment increases the probability of currency crisis. Heriqbaldi, Widodo and Ekowati [16] state that “most of the currency crisis episodes experienced by Indonesia is always preceded by an overvalued exchange rate”. Jongwanich [20] concludes that overvaluation is a basic warning variable in the currency crisis. Based on the research results by Masunda [28], the misalignment has a significant effect on the currency crisis. Also, these results are in line with Kaminsky, Lizondo and Reinhart [22], Glick and Hutchison [15] and Kemme and Roy [23].

Conclusion

Despite the very high importance of the exchange rate misalignment and its effect on the currency crisis, less attention has been paid to this issue in Iran's economy. Understanding the relationship between the macroeconomic fundamentals and the equilibrium exchange rate and also its effect on the currency crisis can be very important in policy-making to control the crisis and as a result to prevent disruptions in the path of development.

This article examined the misalignment of the exchange rate in Iran during the period 1986–2019 and its relationship with the currency crisis. For this purpose, first, the equilibrium exchange rate was calculated using the Behavioral Equilibrium Exchange Rate method.

According to the results, there is a long-term relationship between macroeconomic fundamentals (oil export, trade openness, terms of trade, net foreign assets, government expenditure and productivity differential) and real effective exchange rate. The results of the calculated misalignment showed positive misalignment values in most years, implying a higher REER than its equilibrium rate. That is, the national currency had been overvalued in most years. According to the results, four periods of overvaluation occurred in Iran during the years under study. The third period (2006–2011) was the longest period, and the fourth period (2013–2017) had the highest amount of overvaluation (97.6%).

Next, we examined the relationship between overvaluation and the currency crisis. The exchange rate pressure index was used to identify crisis. According to this index, in the period under review, the crisis occurred in 2012 and 2018, which is the end of the third and fourth periods of overvaluation of the exchange rate. It can be concluded that the longer the overvaluation period and the higher the overvaluation, the greater the probability of a currency crisis. The above finding can be used in foreign exchange policymaking to prevent currency crises. That is, given the vital role of exchange rate overvaluation in currency crises, policymakers can avoid such crises by continuously evaluating the real exchange rate and its equilibrium value.

Abbreviations

REER	Real effective exchange rate
ARDL	Autoregressive distributed lag
EER	Equilibrium exchange rate
SDR	Special drawing rights
BEER:	Behavioral equilibrium exchange rate
AIC	Akaike information criterion
SBC	Schwarz–Bayesian criterion
HQC	Hannan–Quinn information criterion

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Author contributions

MH was a major contributor in writing the manuscript. SM performed the literature and data gathering.

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Data availability

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Competing interests

The authors declare that they have no competing interests.

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References

- Ajevskis V, Rimgailaitė R, Rutkaste U, Tkačevs O (2014) The equilibrium real exchange rate: pros and cons of different approaches with application to Latvia. *Baltic J Econ* 14(1–2):101–123. <https://doi.org/10.1080/1406099X.2014.993853>
- Akram V, Rath BN (2017) Exchange rate misalignment and economic growth in India. *J Financ Econ Policy* 9(4):414–434. <https://doi.org/10.1108/JFEP-12-2016-0093>
- Ari A (2012) Early warning systems for currency crises: The Turkish case. *Econ Syst* 36(3):391–410. <https://doi.org/10.1016/j.ecosys.2012.07.001>
- Baak SJ (2012) Measuring misalignments in the Korean exchange rate. *Jpn World Econ* 24(4):227–234. <https://doi.org/10.1016/j.japwor.2012.09.001>
- Banerjee K, Goyal A (2021) Behavioural equilibrium real exchange rates and misalignments: evidence from large emerging markets. *Econ Anal Policy* 70:414–436. <https://doi.org/10.1016/J.EAP.2021.03.004>
- Bayoumi T, Lee J, Jayanthi S (2006) New rates from new weights. In: IMF staff papers (IMF working papers, vol 53, no 2). International Monetary Fund. <https://doi.org/10.5089/9781451861181.001>
- Beck T, Claessens S, Schmukler SL (2013) Financial globalization and crises: overview. *Evid Impact Financ Global*. <https://doi.org/10.1016/B978-0-12-397874-5.00001-4>
- Burkart O, Coudert V (2002) Leading indicators of currency crises for emerging countries. *Emerg Mark Rev* 3(2):107–133. [https://doi.org/10.1016/S1566-0141\(02\)00002-X](https://doi.org/10.1016/S1566-0141(02)00002-X)
- Clark PB, MacDonald R (1999) Exchange rates and economic fundamentals: a methodological comparison of beers and feers. In: *Equilibrium exchange rates*, Springer, Cham, pp 285–322. https://doi.org/10.1007/978-94-011-4411-7_10
- Comunale M (2017) Dutch disease, real effective exchange rate misalignments and their effect on GDP growth in EU. *J Int Money Financ* 73:350–370
- Couharde C, Delatte A-L, Grekou C, Mignon V, Morvillier F (2018) EQCHANGE: a world database on actual and equilibrium effective exchange rates. *Int Econ* 156:206–230
- Cuestas JC, Mourelle E, Regis PJ (2020) Real exchange rate misalignments in CEECs: Have they hindered growth? *Empirica* 47(4):733–756. <https://doi.org/10.1007/s10663-019-09454-5>
- Dağdeviren S, Binatli AO, Sohrabji N (2012) Misalignment under different exchange rate regimes: the case of Turkey. *Int Econ* 130:81–98. [https://doi.org/10.1016/S2110-7017\(13\)60045-1](https://doi.org/10.1016/S2110-7017(13)60045-1)
- Giannellis N, Papadopoulos AP (2007) Estimating the equilibrium effective exchange rate for potential EMU members. *Open Econ Rev* 18(3):307–326. <https://doi.org/10.1007/s11079-007-9040-x>
- Glick R, Hutchison M (2011) Currency crises (No. 2011–22)
- Heriqbaldi U, Widodo W, Ekowati D (2020) Real exchange rate misalignment and currency crises. *Bull Indones Econ Stud* 56(3):345–362
- Holtemöller O, Mallick S (2013) Exchange rate regime, real misalignment and currency crises. *Econ Model* 34:5–14
- Hossfeld O, Hossfeld, Oliver (2010) Equilibrium real effective exchange rates and real exchange rate misalignments: time series vs. panel estimates. <https://econpapers.repec.org/RePEc:wsr:wpaper:y:2010:i:065>
- Jbili A, Kramarenko V, Bailen J (2007) Islamic Republic of Iran: managing the transition to a market economy. <https://www.imf.org/en/Publications/IMF-Special-Issues/Issues/2016/12/31/Islamic-Republic-of-Iran-Managing-the-Transition-to-a-Market-Economy-18112>
- Jongwanich J (2008) Real exchange rate overvaluation and currency crisis: evidence from Thailand. *Appl Econ* 40(3):373–382. <https://doi.org/10.1080/00036840600570961>
- Jovanovic B (2007) Calculating the fundamental equilibrium exchange rate of the macedonian denar. Working paper. <https://ideas.repec.org/p/pra/mprapa/43161.html>
- Kaminsky G, Lizondo S, Reinhart CM (1998) Leading indicators of currency crises. *IMF Staff Pap* 45(1):1–48. <https://doi.org/10.2307/3867328>
- Kemme DM, Roy S (2006) Real exchange rate misalignment: prelude to crisis? *Econ Syst* 30(3):207–230
- Kim BY, Korhonen I (2005) Equilibrium exchange rates in transition countries: evidence from dynamic heterogeneous panel models. *Econ Syst* 29(2):144–162
- Kusumawardani D, Mubin MK (2019) The exchange rate misalignment, volatility and the export performance: evidence from Indonesia. *Iran Econ Rev* 23(3):561–591
- Libman E (2018) The effects of exchange rate regimes on real exchange rate misalignment. *Int Rev Appl Econ* 32(1):39–61
- MacDonald R, Dias P (2007) Behavioural equilibrium exchange rate estimates and implied exchange rate adjustments for ten countries. In: Working papers (No. 12). Business School—Economics, University of Glasgow. https://ideas.repec.org/p/gla/glaewp/2007_12.html
- Masunda S (2012) Real exchange rate misalignment and currency crisis in Zimbabwe. *Scholarlink Research Institute Journals*. <http://ir.msu.ac.zw:8080/xmlui/handle/11408/1622>
- Mozayani AH, Parvizi S (2016) Exchange rate misalignment in oil exporting countries (OPEC): focusing on Iran. *Iran Econ Rev* 20(2):261–276
- Musyoki D, Pokhariyal GP, Pundo M (1993) Real exchange rate equilibrium and misalignment in Kenya
- Nouira R, Plane P, Sekkat K (2011) Exchange rate undervaluation and manufactured exports: a deliberate strategy? *J Comp Econ* 39(4):584–601
- Nouira R, Sekkat K (2015) What determines the extent of real exchange rate misalignment in developing countries? *Int Econ* 141:135–151. <https://doi.org/10.1016/j.inteco.2015.02.001>
- Pesaran MH, Shin Y (1995) An autoregressive distributed lag modelling approach to cointegration analysis
- Razin O, Collins SM (2017) Real exchange rate misalignments and productivity growth. <https://papers.ssrn.com/abstract=225932>
- Sundarajan V, Michel L, Williams S (1999) Exchange rate unification, the equilibrium real exchange rate, and choice of exchange rate regime: the case of the Islamic Republic of Iran. *IMF Work Pap* 99(15):1
- Terra C, Valladares F (2010) Real exchange rate misalignments. *Int Rev Econ Financ* 19(1):119–144
- Toulaboe D (2017) Real exchange rate misalignment of Asian currencies. *Asian-Pac Econ Lit* 31(1):39–52
- Zardad A, Mohsin A, Zaman K (2013) Estimating long-run equilibrium real exchange rates: short-lived shocks with long-lived impacts on Pakistan. *Springerplus* 2(1):292. <https://doi.org/10.1186/2193-1801-2-292>

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