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Original Research Article

Choosing Base Year in Relative Purchasing Power Parity Theory to Determine the Long-Run Trend of Exchange Rate in Iran

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The theory of relative purchasing power parity to determine the long-run trend of the exchange rate in Iran is quite sensitive to the base year selection. So, by changing the base year, trends with a level difference of several hundred percent are obtained. It means that the long-run trend of the real exchange rate is not at a constant level. In other words, contrary to the PPP theory, the real exchange rate trend is not stationary. Empirical studies consider the non-stationary change in terms of trade resulting from the changes in the real oil price as one of the reasons. This study examines the nexus between the real exchange rate and terms of trade in Iran from 1960 to 2020, using the autoregressive distributed lag approach to cointegration as the estimation method. We find that higher terms of trade lead to a decline in the actual exchange rate and vice versa. The results indicate a long-run relationship, which means that the condition needed to estimate the long-term trend of the exchange rate in Iran is to have the same terms of trade in the base year.

Keywords: Exchange rate determination, Terms of trade, Oil price, Bound test.
JEL Classification*:* F31, Q43

1 Introduction

The literature on exchange rate determination originates in the discussions on the reconstruction of the international monetary system after the First World War. Most of the countries were under the Gold Standard during 1868-1914. The countries involved in the war used seigniorage to finance their expenditures. The growth of the money supply and subsequent expectations

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about the devaluation of the currency in some countries caused these countries not to adhere to the Gold Standard. After the war's end in 1918, there was a challenge to determine the exchange rate because there were different experiences of printing money concerning gold stock and, therefore, different inflation rates (Rogoff, 1996). Cassel (1921, 1922) introduced the Purchasing Power Parity (PPP) theory to deal with the value of money in terms of gold. Five decades later, another basic theory, the Monetary Theory of the Exchange Rate Determination, was developed (see Bilson, 1978; Dornbusch, 1976; Frankel, 1979; Frenkel, 1976; Johnson, 1972; Mussa, 1976). The PPP theory and the monetary model consider the difference in price index growth and the difference in the growth rate of money supply and demand as the main factors determining the exchange rate in the long term.

Due to the high share of oil exports in the supply side of the foreign exchange market in oil-exporting countries such as Iran and the government's crucial role in its supply, determining the exchange rate is particularly important. For example, 72% of Iran's exports between 1992 and 2021 are related to oil exports. The increase in the price of oil and the consequent increase in the supply of foreign exchange in the 2000s caused the growth of the exchange rate to decrease from 20 to 3 percent. At the same time, this reduction was not proportional to inflation and money supply growth. The divergence of the exchange rate from what the monetary model and PPP theory imply in the short and even the long run has raised doubts about these theories. However, empirical evidence suggests that PPP theory reasonably explains the long run in countries with high inflation rates (Caves, Frankel, & Jones, 2007, p. 380; Salvatore, 2013, p. 470).

After the Iranian currency crisis in 2018, the theoretical exchange rate became a fundamental question for policymakers. According to the PPP theory, some believe that the exchange rate is higher than what the fundamental economic variables indicate. On the other hand, some believe that the increase in the exchange rate is in accordance with the fundamental economic variables, relying on this theory. Some experts have also doubted the explanatory power of this theory in Iran, relying on the significant effect of the base year change in the exchange rate resulting from PPP. Because of the significant allocation of petrodollars on the supply side and the government's control over them, some economic experts also do not consider PPP a good theoretical framework to determine the exchange rate. This difference of view regarding the validity of the PPP theory has been the source of essential differences of opinion in politics. Therefore, stabilization of the

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official exchange rate and having a multi-rate system is sometimes introduced as the optimal policy.

In empirical studies, relative PPP is used to determine the exchange rate in the long run due to the difference in the baskets of goods and services and the base year in computing the price index. If the consumer price index is used, the relative PPP implies that the exchange rate in period t is as follows:

$$Ex_t = Ex_0 \frac{P_t/P_0}{P_t^*/P_0^*} = Ex_0 \frac{CPI_t/CPI_0}{CPI_t^*/CPI_0^*} \quad (1)$$

In which Ex is the nominal exchange rate, 0 and * imply base year and US quantities, respectively. CPI stands for consumer price index. Figure 1 shows the trend of unofficial exchange rate and exchange rate obtained from PPP in two base years, 1971 and 1991.

As is seen in Figure 1, choosing different base years results in entirely different trends in the PPP exchange rate. For example, the PPP exchange rate in 2021 is 78000 IRR for the base year 1971 and 262000 IRR for the base year 1991. At the same time, the unofficial exchange rate was 260000 IRR. The PPP exchange rate trend with the base year 1971 is consistent with the unofficial exchange rate trend from 1960 to 1972. That is, by choosing these years as the base year, there is no change in the trend. This argument is also reasonable for the sub-period 1980-2000 and sub-period 2018-2021 for the PPP exchange rate trend with the base year 1991. In the 2000s, when oil prices increased, the unofficial exchange rate diverged from the PPP exchange rate with the base year 1991. This gap disappeared after oil exports decreased in the exchange crisis in 2018. It is clear that choosing the 2000s as the base year results in different PPP exchange rates. For example, it yields a PPP exchange rate of about 160000 IRR for 2021 by choosing 2011 as the base year, which is 100000 IRR lower than the unofficial exchange rate for that year.

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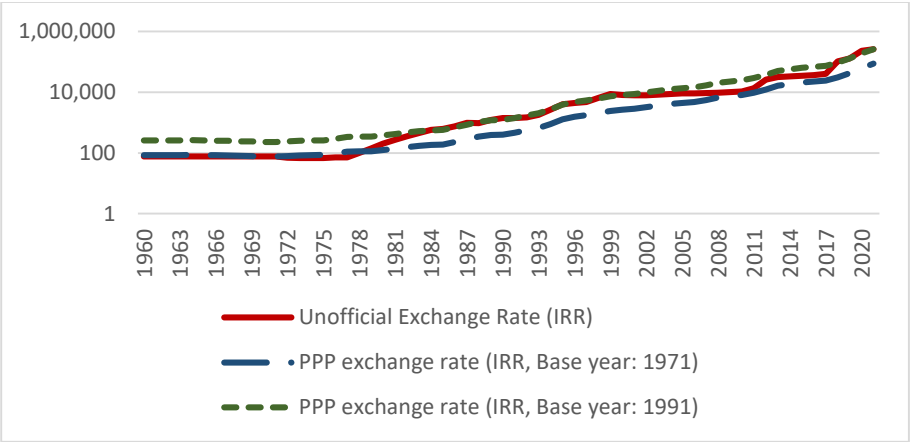

Figure 1. Unofficial exchange rate and PPP exchange rate (in logarithms) in Iran, 1960-2021, by using 1971 and 1991 as the base year. The data is from the Central Bank of the Islamic Republic of Iran and the World Bank.
Source: Research Findings

A change in the PPP exchange rate trend with a change in the base year means a change in the level of the real exchange rate trend and its non-stationary nature. As Figure 2 shows, the real exchange rate level has changed in different sub-periods[1]. The difference in PPP exchange rate trends is reflected in Figure *1*ure 2 as the distance between the real exchange rate level in 1971 and 1991. Therefore, knowing the cause of the change in the real exchange rate can help to choose the appropriate base year.

[1] The calculation of the real exchange rate is explained in the third section.

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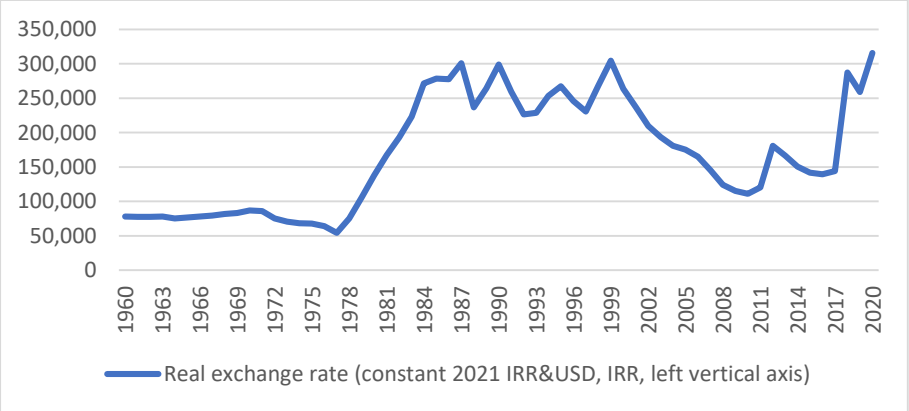

Figure 2. The real exchange rate in Iran. Real exchange rate is calculated from the data of the Central Bank of the Islamic Republic of Iran and the World Bank.
Source: Research Findings

Coudert and Mignon (2016) argue that some economic factors, such as the Balassa-Samuelson effect, the terms of trade (see e. g. Coudert et al., 2011) and net foreign assets can cause changes in the real exchange rate in the long run. The oil price can drive significant changes in both the latter factors because of the critical position of oil in international trade (Coudert & Mignon, 2016). Caves et al. (2007) introduce the constant change in the terms of trade as one of the violations of PPP. They consider oil prices as one of the most critical factors in terms of trade; Increasing (decreasing) oil prices increases (decreases) the terms of trade of oil exporting countries. As is apparent in Figure 3, the trend of the terms of trade has had a high correlation with oil exports. The increase in the terms of trade implies that a country can import more without the increase in the volume of exports. As Caves et al. (2007) suggest, this relative increase in a country's purchasing power causes the real exchange rate to increase. Of course, other structural changes, such as the Bretton Woods breakdown, could also bring about changes in terms of trade. For this reason, Salvatore (2013, p. 470) does not consider PPP appropriate for structural changes.

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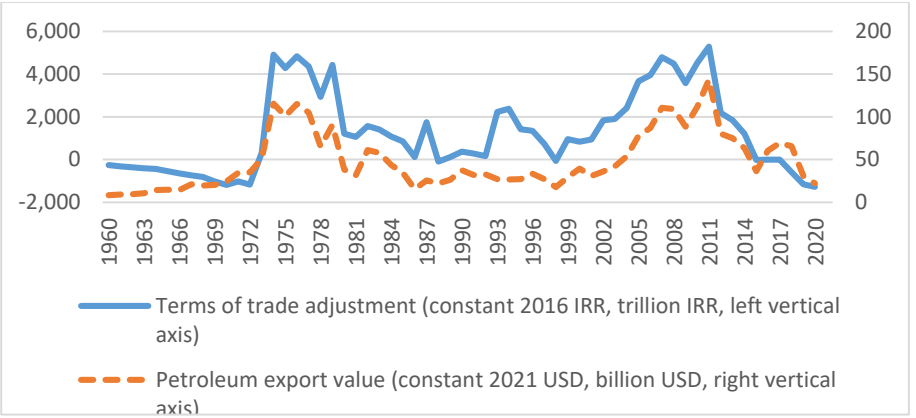

Figure 3. Terms of trade adjustment and the real value of oil exports for Iran. The data on the nominal value of oil exports are from the Central Bank of the Islamic Republic of Iran, which is converted to real value using the US CPI (from the World Bank). The data on the terms of trade adjustment is from the World Bank.
Source: Research Findings

The empirical study of Amano and van Norden (1998b) on the relationship between real exchange rate and oil price is the beginning of extensive literature regarding the relationship between exchange rate and oil prices. According to them, oil prices affect the real exchange rate by changing the terms of trade. After their study, broad literature was formed regarding the relationship between oil prices and real exchange rates.

Regarding the real exchange rate in Iran, it is expected to have a long-run relationship with the terms of trade, which means that changes in the PPP exchange rate trend with changes in the base year are caused by changes in the terms of trade. This study examines the hypothesis that there is a relationship between the terms of trade and the real exchange rate in Iran. To do this, we examine the long-run nexus between terms of trade and real exchange rates using the autoregressive distributed lag (ARDL)-bounds testing approach.

The following section reviews the literature. The third section is a theoretical framework, and the fourth section presents empirical findings. The fifth section discusses the findings.

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2 Review of Literature

There was a surge in the empirical studies investigating the Purchasing Power Parity theory after the breakdown of the Bretton Woods system in 1973. The findings imply that, unlike the long run, PPP does not explain exchange rate changes in the mid-run and short-run. Also, PPP has a better explanation in countries with higher growth rates of money supply and inflation (Salvatore, 2013, p. 470). Because of less rigidity in prices, price adjustment in these countries is quicker than in other countries. In other words, the long-run is shorter in these countries (Caves et al., 2007, p. 380).

The empirical findings of Frenkel (1978, 1981), Kravis & Lipsey (1978), McKinnon (1979), Levich (1985), and Dornbusch (1987) show that PPP does not hold in the short-run. For example, Frenkel (1981), by using monthly data for the inflationary period of the 1920s, shows that PPP holds in the long-run. Frankel (1986, 1990) suggests using PPP is appropriate for long-run data. He shows that PPP has good long-term explanatory power by examining pound-dollar parity from 1869 to 1984. Nevertheless, he shows that the decrease in the deviation of PPP is slight; that is, the deviation of PPP is reduced by 15% per year. Lothian & Taylor (1996), using the data for pound/dollar and pound/frank parity over the time period 1790-1990, show that the parity rate reverts to PPP. Other empirical studies confirm these results. Frankel & Rose (1995) by using the data for 150 countries over the time period 1948-1992; MacDonald (1999) by using the data for dollar/mark parity over the time period 1960-1996; Taylor (2002) by using the data for 20 countries over the time period 1882-1996; Cashin & McDermott (2006) by using the data for the effective exchange rate in 20 industrial countries over the time period 1973-2002, have obtained five years period to half the deviation of the exchange rate from PPP. Taylor & Taylor (2004) confirmed the above studies' findings. Cashin & McDermott (2006), using the data for 90 developed and developing countries over the time period 1973-2002, have shown that the time period for halving the deviation from PPP is less in developed countries and countries with floating exchange rates.

As mentioned, empirical studies imply better explanatory power for PPP in countries with higher inflation rates and money supply growth. For example, McNown & Wallace (1989), show that PPP holds by examining the relationship between the producer price index and exchange rate for four countries with high inflation during the 1970s and 1980s. Mahdavi & Zhou (1994), also show that PPP holds in the long-run by using the data for 13 high-inflation countries. Caves et al. (2007) attribute the better explanatory power

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of PPP for the exchange rate in high inflationary periods to more flexibility of prices.

Caves et al. (2007) suggest the change in terms of trade resulting from the changes in oil prices as one of the main determinants of the changes in the real exchange rate. Empirical studies on the relationship between exchange rates and oil prices align with this contention. After the oil prices hike in the 2000s, there has been a significant increase in the empirical studies on the relationship between oil prices and the exchange rate. One of the common findings of these empirical studies is the long-run relationship between real exchange rates and oil prices (Beckmann et al., 2020).

Krugman (1980, 1983) and Golub (1983) describe how oil prices theoretically affect exchange rates by analyzing the balance of payments in oil-exporting and oil-importing countries. Their findings show that the increase in oil prices causes the oil-exporting countries to experience an appreciation of their currency. Amano & van Norden (1998a, 1998b) show that the real values of the dollar, Japanese yen, and German mark have a long-run relationship with real oil prices: "The results presented above show that the US real exchange rate appears to be cointegrated with the real price of oil, which suggests that oil prices may have been the dominant source of persistent real shocks over the post-Bretton Woods period." According to them, a change in the real price of oil changes the real exchange rate by affecting terms of trade. Chaudhuri & Daniel (1998) examined the experience of OECD countries after Bretton Woods. They found that non-stationary real oil price brings about the non-stationary real exchange rate of the US.

In similar studies, by using time series methods, the long-run relationship between exchange rate and oil prices has been obtained (see Beckmann & Czudaj, 2013; Bénassy-Quéré et al., 2007; Coudert et al. 2008). Some other studies using panel data methods have examined the long-run relationship between exchange rates and oil prices. For example, Camarero & Tamarit (2002) examined this relationship for Spain using panel co-integration. Chen & Chen (2007), using monthly data for G7, have found the long-run relationship between oil prices and exchange rates and showed that the most crucial determinant affecting the real exchange rate is the oil price, which increases the predictive power of the exchange rate model. Other studies like Habib & Kalamova (2007) for Norway, Saudi Arabia, and Russia; Al-mulali (2010) for Norway; Yang et al. (2018) for Japan, Canada, Britain, and Euro region; Huang & Guo (2007) for China; Habib et al. (2016) for 48 oil exporting and oil importing countries; Beckmann & Czudaj (2013) for ten oil exporting and oil importing countries, have found similar results.

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In sum, two significant results related to the subject of the study can be mentioned from empirical studies. In countries like Iran, which has experienced high inflation in the long term, the PPP theory is expected to provide a suitable explanation of the exchange rate trend. The long-term trend of the real exchange rate is expected to be at a constant level unless the terms of trade level change due to the fluctuation of the real price of oil.

3 Theoretical Framework

If PPP holds in the long-run, there must be a constant real exchange rate. In the long run, the real exchange rate level change means that different PPP exchange rate trends are obtained by choosing different base years. Figure 4 shows the real exchange rate in the unofficial market and terms of trade for Iran. The real exchange rate is computed as follows:

$$rer_t = Ex_t(P_t^*/P_t)(P_{1400}/P_{1400}^*) \quad (2)$$

In which rer_t, Ex_t, P^* and P are the real exchange rate, nominal exchange rate, the US CPI, and Iran's CPI, respectively. Figure 4 shows that the real exchange rate level in the 1980s and 1990s differ from the 1960s and 1970s. Except for the periods under the Bretton Woods system and years 2014-2017, in which the real interest rate was very high, the trend of the real exchange rate has been proportionate to the terms of trade. As is seen in Figure *3*4, the trend of terms of trade is also proportionate to the real value of oil exports. The long-run relationship between the real exchange rate and terms of trade implies that using PPP to calculate the exchange rate in a given year requires using a base year with a similar value for the terms of trade. For example, to calculate the exchange rate by using PPP for years 2018-2021, it is not appropriate to use a base year in the 1970s in which the value of the terms of trade was quite different from 2018-2021.

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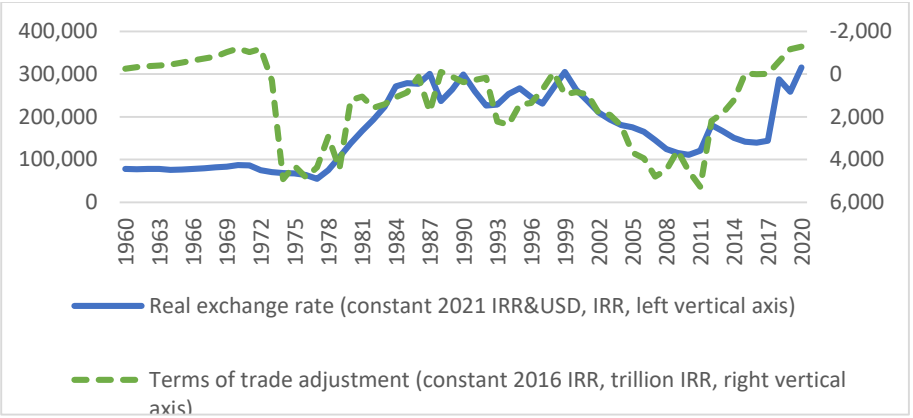

Figure 4. The real exchange rate and terms of trade adjustment in Iran. Real exchange rate is calculated from the data of the Central Bank of the Islamic Republic of Iran and the World Bank.
Source: Research Findings

In the two periods of 1973-1960 and 2017-2014, there is a disconnection between the real exchange rate and terms of trade. The first period is related to Bretton Woods, and the second period coincides with a significant increase in the real deposit interest rate.

Under the Bretton Woods system, most countries adjusted their balance of payments based on the dollar. The US committed to repurchase dollar-denominated assets of the countries with a parity of 35 for an ounce of gold. A decrease in the credibility of the US ability to exchange gold for dollars caused the gold reserves to decrease from 14.6 thousand tons in 1960 to 9.5 thousand tons in 1970. The decrease in trust could be attributed to the increase in the money supply growth rate and inflation in the 1960s. The continued demand to exchange dollars for gold led US President Nixon to unilaterally stop the conversion of dollars to gold on August 15, which is known as the Nixon Shock. As the dollar depreciated against gold, Japan and the European Economic Community began to adopt a floating exchange rate system in 1973, marking the beginning of the collapse of the Bretton Woods system. The sharp fall in the dollar's value relative to gold from $35 per ounce in 1973 to $600 per ounce in 1980 indicated the validity of countries' expectations that the dollar was overvalued. This change in the international monetary system is considered a structural break, which Salvatore (2013, p. 470) suggests is a factor in the unreliability of PPP. In addition to the decrease in the dollar value,

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the decrease in the terms of trade of the US after Nixon's Shock is also notable. As is seen in Figure 5, the terms of trade in the US decreased by about 40 percent between 1970 and 1980. The decrease in the US terms of trade intensified after the sharp increase in oil prices from 1973 to 1981. Since the exchange rate is the ratio between two national currencies, the level of terms of trade in both countries will be essential for calculating the PPP exchange rate. Therefore, to obtain the PPP exchange rate in recent years, the years related to Bretton Woods should not be used as the base year because US terms of trade during the Bretton Woods period is significantly different from its value in the last four decades.

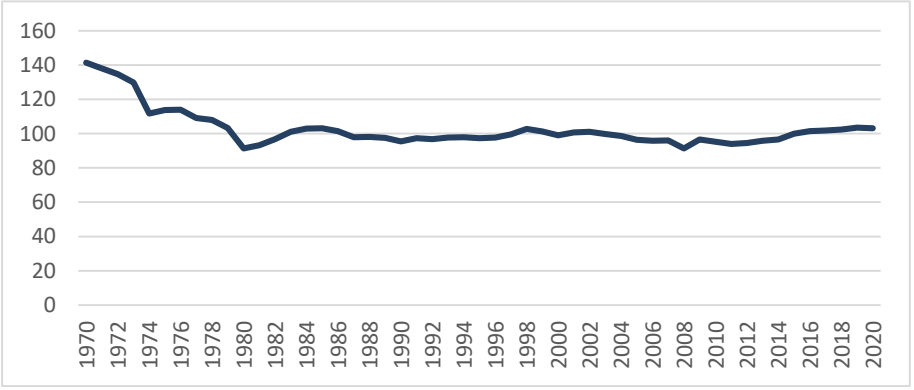

Figure 5. The US terms of trade over 1970-2020. The data is from OECD.
Source: Research Findings

The disconnection between the real exchange rate in 2017-2014 results from the real deposit interest rate. Rogoff (1996) has investigated the breakdown of the relationship of exchange rates to prices under the title of the PPP puzzle. He introduces the change in asset portfolio preferences as one of the important reasons for the exchange rate's weak adjustment in line with inflation and deviation in the real exchange rate. The high real deposit interest rate in this period can be considered as the reason for the change in asset portfolio preferences in Iran. Therefore, the sharp increase in the real interest rate has increased the demand for holding domestic assets compared to foreign ones.

Therefore, it is necessary to include the real rate of deposit interest in the long-term relationship between the real exchange rate and terms of trade. This

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study uses the following equation to examine the long-run relationship between the real exchange rate and terms of trade and interest rate:

$$rer_t = \alpha_0 + \alpha_1 tot_t + \alpha_2 rr_t + \theta_t \quad (3)$$

In which tot_t and rr_t are terms of trade and real interest rates on deposits, respectively. It is expected that the real exchange rate to have negative relationships with two explanatory variables. The effect of the Bretton Woods period and the shocks caused by the 2012 and 2018 sanctions are also included as dummy variables in the error correction form. The autoregressive distributed lag model and associated bounds testing procedure (ARDL bounds) developed by Pesaran et al. (2001) are used to examine the long-run relationship.

Compared to other methods, such as Johansen (1988), Engle & Granger (1987), and Johansen & Juselius (1990), the advantage of this method is that there is no need to differentiate the regressors I(0) and I(1). Due to the challenges of the unit root test of short series, it reduces the degree of uncertainty in the analysis (Pesaran et al., 2001). Also, when regressors are endogenous, this approach brings about appropriate estimates of the long-run model (Harris & Sollis, 2003). Philips (2017) introduces the following steps to perform this test:

1) "Ensuring the dependent variable is I(1);
2) Ensuring the independent variables are not explosive or higher orders of integration than I(1);
3) Estimating the ARDL model in error correction form, and ensuring there is no autocorrelation; and
4) Performing the bounds test for cointegration. Three possibilities are: (a) all regressors are I(1) and cointegrating, (b) all regressors are I(0) -by definition, they cannot cointegrate- or (c) indeterminate. An indeterminate result may still find cointegration among some of the independent variables, although further testing and re-specification (in Step 3) is required."

Error correction form of the ARDL model is as follows:

$$\Delta rer_t = \gamma_0 + \gamma_1 \mathrm{Dbr} + \gamma_2 \mathrm{Dsn} + \sum_{i=1}^{k} \beta_{1i} \Delta rer_{t-i} + \sum_{i=0}^{k} \beta_{2i} \Delta tot_{t-i} + \sum_{i=0}^{k} \beta_{3i} \Delta rr_{t-i} + \alpha_1 rer_{t-1} + \alpha_2 tot_{t-1} + \alpha_3 rr_{t-1} + \varepsilon_t \quad (4)$$

To examine the existence of the long-run nexus between the variables in the equation, an F-test is done for the joint significance of the coefficients of

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the lagged levels of the variables. In this set-up, the null hypothesis is the following H0: $\alpha_1 = \alpha_2 = 0$, against the alternatives H0: $\alpha_1 \neq 0, \alpha_2 \neq 0$.

4 Results

4.1 Data

The real exchange rate is defined in Eq. (5), in which CPI is the consumer price index, and Ex is the nominal unofficial exchange rate. Their data are from the Central Bank of the Islamic Republic of Iran. The US Consumer Price Index is CPI*; the data is from the World Bank.

$$rer_t = Ex_t(CPI_t^*/CPI_t) \tag{5}$$

The data for terms of trade is from the World Bank with the title terms of trade adjustment (constant LCU). The real interest rate is the difference between the nominal interest rate for one-year deposits and inflation; the data is from the Central Bank[1]. For 2016-2020, the average interbank interest rate is used because the reported interest rate on deposits differs from the realized interest rate. The dummy variable for the collapse of the Bretton Woods system is equal to 1 for the years before 1973 and equals zero after that year. The dummy variable for sanctions shocks in 2012 and 2018 equals one and equals zero for other years.

For using the bound test, the dependent variable must be I(1), and the degree of integration of explanatory variables should not be more than 1. As is seen in Table 1, these conditions are satisfied.

Table 1
Stationary Test with intercept and trend and intercept

	I (0)	**I (1)**
Panel A: Intercept		
$rer_t\ t(p-value)$	-1.082 (0.718)	-7.240 (0.000)
$tot_t\ t(p-value)$	-2.193 (0.211)	-8.212 (0.000)
$rr_t\ t(p-value)$	-3.814 (0.005)	-7.248 (0.000)
Panel B: Trend and intercept		
$rer_t\ t(p-value)$	-1.490 (0.822)	-7.187 (0.000)
$tot_t\ t(p-value)$	-2.011 (0.583)	-8.254 (0.000)
$rr_t\ t(p-value)$	-3.887 (0.019)	-7.218 (0.000)

Note. Numbers are t values and the numbers within prentices are p-values
Source: Research Findings

[1] The one-year deposit interest rate between 1960 and 1972 was taken from the journals of the Central Bank of the Islamic Republic of Iran.

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4.2 Estimates

The results of the co-integration test based on the bound test are reported in Table 2. F values for AIC and SBC are outside the upper bound and are significant at 1% and 5%. Therefore, the null hypothesis implying the nonexistence of a long-run relationship can be rejected. Then, the ARDL method can be used to determine short-run and long-run relationships.

Table 2
the bound test for co-integration

	AIC ARDL (1,1,2)	**SBC ARDL (1,1,0)**
F	4.93	4.02
Critical values for F-statistics		
10%	2.63	3.35
5%	3.10	3.87
2.5%	3.55	4.38
1%	4.13	5

Note. The critical bound values are from Pesaran et al. (2001).
Source: Research Findings

The long-run coefficients are reported in panel A of Table 3. As it is expected, the coefficients of terms of trade and real interest rate are negative and significant. The negative coefficient of terms of trade supports our study hypothesis; the increase in the terms of trade causes the real exchange rate to decrease.

Table 3
Full information estimate of ARDL model.

	AIC ARDL (1,1,2)	**SBC ARDL (1,1,0)**
Panel A: Estimated long-run coefficients		
tot_t	-0.311*** (0.063)	-0.330*** (0.071)
rr_t	-0.041*** (0.009)	-0.023** (0.011)
$Constant$	1.940*** (0.186)	2.091*** (0.192)
Panel B: Error correction representation for the selected ARDL		
Δtot_t	-0.019 (0.024)	-0.020 (0.024)
Δrr_t	-0.007** (0.003)	---
Δrr_{t-1}	0.007** (0.003)	---
Dbr_t	-0.370*** (0.094)	-0.386*** (0.105)
Dsn_t	0.760*** (0.141)	0.714*** (0.139)
ECM_{t-1}	-0.269*** (0.059)	-0.242*** (0.059)
Panel C: Diagnostic tests		
Serial correlation $\chi^2(2)[p-value]$	1.070 [0.586]	1.673 [0.433]
Normality $Jarque-Bera[probability]$	0.172 [0.918]	0.088 [0.957]

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Heteroskedasticity (ARCH) $\chi^2(1)[p-value]$	2.388 [0.122]	2.682 [0.102]
Ramsey RESET test $\chi^2(1)[p-value]$	0.705 [0.401]	1.017 [0.313]

Note. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively. Numbers in parentheses are SEs.
Source: Research Findings

The estimation of the error correction model is reported in panel B. As expected, the error correction coefficient is negative and significant, implying the convergence to the long-run equilibrium. This is support for the findings of co-integration obtained by the F test. As is seen in panel C, the tests on classical assumptions imply that those assumptions are fulfilled.

The existence of a co-integration relationship does not mean that the estimated coefficients are stable (Bahmani-Oskooee & Chomsisengphet, 2002). CUSUM and CUSUMSQ tests of Brown, Durbin, & Evans (1975) can be used to check this issue. Figure 6 and Figure 7 show the results of the tests for the estimates of Table 3. For AIC and SBC, the CUSUM and CUSUMSQ test values are in the confidence intervals for the 5% significance level, indicating the coefficients' stability.

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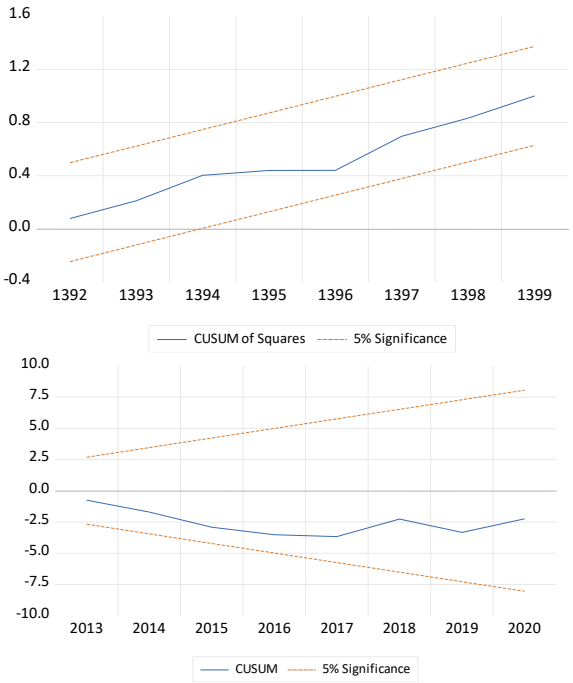

Figure 6. CUSUM and CUSUMSQ series for ARDL model and AIC.
Source: Research Findings

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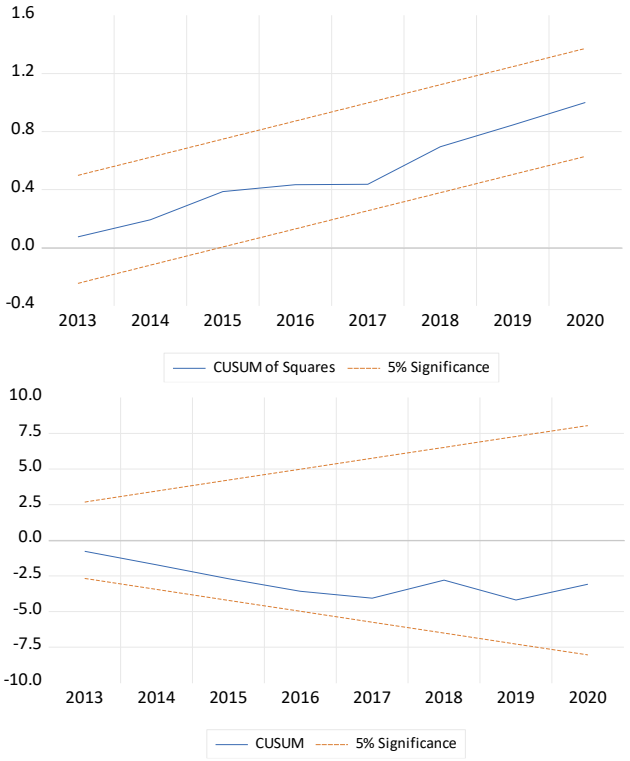

Figure 7. CUSUM and CUSUMSQ series for ARDL model and SBC
Source: Research Findings

5 Discussion

This study tries to answer the question, "Why is the exchange rate extracted from PPP theory for different base years quite different?" To answer this question, we have examined the relationship between real exchange rates and terms of trade. The long-run change in the real exchange rate means that the exchange rate calculated from PPP for different base years will change. For example, the different levels of the real exchange rate trend over 1960-1980 compared to 1980-2000 imply that choosing a base year in the first-period results in a different PPP exchange rate than choosing a base year in the second period. Empirical studies show that changes in terms of trade and structural break can bring about this situation. Examining the hypothesis that the real exchange rate has a long-run relationship with terms of trade in Iran shows that the change in terms of trade is the factor behind the change in the PPP exchange rate by changing the base year.

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The bound test implies the existence of the long-run relationship between the real exchange rate and terms of trade. This finding means that the necessary condition for an appropriate estimation of the PPP exchange rate for a specific period is to choose a base year in which the terms of trade are the same as that specific period. For example, because of the different terms of trade, it is not appropriate to use a base year in the 1970s to obtain the PPP exchange rate for 2018-2021. Otherwise, the PPP exchange rate will be underestimated. On the other hand, the 1960s were not an appropriate base year for estimating the PPP exchange rate for the period after the collapse of the Bretton Woods system.

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