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Abstract

This study aims to investigate the validity of the PPP hypothesis in Jordan over the periods (1980-2017), using the exchange rate for Jordanian dinar in terms of the US dollar. To carry out the objective of this study graphical approach, stationary test and Cointegration test are used. The empirical results of the these tests reject the PPP for Jordanian economy. These results affected by the trade obstacles, transaction costs and the price differences between countries.

Keywords: Cointegration Test, Jordan, Purchasing Power Parity, Stationary Tests, Trade.

Introduction

The Purchasing Power Parity (PPP) hypothesis is considered as one of the old hypothesis in the international economy fields, which was later used in many theories of the international economy. The PPP hypothesis was introduced firstly by the Swedish economist (Gustan Cassel) in 1918, he is using it as a basis for evaluating official exchange rates for countries at the end of the First World War. Thereafter, the PPP hypothesis has become widely used by central banks and policymakers as an indicator to evaluate currency when it deviates from their equilibrium values (Shapiro, 2006).

The purchasing power parity hypothesis states on that the prices of identical goods in different countries will tend to be equal in the long term, since the exchange rate will be adjusted to eliminate the profit opportunity that can be achieved by purchasing a good from a particular country and then selling it in high priced country.

Therefore, the PPP hypothesis is considered as an extension of the one price law when it applied on the level of the economy as a whole. Where the one price law states on that the

identical goods tend to be sold at the same price in any two separate markets when there are no transport costs, different taxes between the two markets or any type of trade barriers. In contrast to that, if different prices prevail in the markets, there will be opportunities to make profits by buying the commodity from low-priced markets and selling it in high-priced markets. As the buying and selling process continues, prices will tend to be equated through the supply and demand forces.

Due to the difficulty of eliminating trade barriers, the PPP hypothesis remained subject of many applied research in international economic studies, especially after the collapse of the Bretton Woods system in 1973 and the transition to the floating exchange rate system. Most of these studies indicated that the PPP hypothesis failed to be hold in the short term and in the long term there is no definitive result (Nusair, 2003).

However, the PPP hypothesis remained a theoretical basis for determining the exchange rate and considered as a tool for making comparisons between the countries. Therefore, the importance of this study is related to the importance of PPP hypothesis which considered as an important indicator for central banks and policymakers to evaluate the currencies.

Furthermore, Holmes (2001) sees that the PPP hypothesis has a potential interest to policymakers in less developed countries (LDCs) for two reasons: first, the PPP hypothesis is a method to evaluate the exchange rate and determining the overvaluation or undervaluation of currencies. second, most theories that focus on the determinants of exchange rate used some notion of the PPP hypothesis in their structure.

This study aims to examine the validity of the PPP hypothesis in Jordan. In order to achieve this objective, the study used a set of econometric tests which applied to the annual data for Jordanian economy over the period (1980-2017) that extracted from international financial statistics.

Finally, this study consists of five sections. After reviewing the first section of the study, which included the introduction and the importance of the study, the second section shows the theoretical framework and some previous literature that dealt with the purchasing power parity hypothesis. The third section presents an overview of the methodology and standard methods that used to achieve the objective of the study, the empirical results are presented in the fourth section and the last section report the conclusion of this study.

Literature Review

The general formula of the purchasing power parity hypothesis states that the cost of identical goods and services in different countries will tend to be equal in the long run. This hypothesis can be expressed in two forms: absolute purchasing power parity and relative purchasing power parity. Where the absolute purchasing power parity hypothesis suggests that the exchange rate between any two countries will equal the relative prices between them, as in the following formula:

$$e_t = \frac{P_t}{P_t^*} \dots\dots\dots (1)$$

Where: e_t : The exchange rate in period t, P_t : The domestic prices level in period t and P_t^* : The foreign prices level in period t.

This formula includes that the rise or fall in domestic price level relative to foreign price level will lead to the appreciation or devaluation of the domestic currency in relative to foreign currency. But under this assumption of integrated goods and markets (Al-Zyoud, 2015). This assumption is not achieved in the real world, therefore the possibility of the absolute PPP hypothesis to valid is difficult. This problem leads to relative form of the PPP hypothesis.

The relative PPP hypothesis states on that the percentage change in the exchange rate between two countries during any time period is equal to the difference between the percentage change in price levels between the two countries during the same period of time (Lafrance and Scembri, 2002). The relative formula of the PPP writes as the following:

$$\frac{e_t - e_{t-1}}{e_{t-1}} = \frac{P_t - P_{t-1}}{P_{t-1}} - \frac{P_t^* - P_{t-1}^*}{P_{t-1}^*} \quad \dots\dots\dots (2) \quad \text{Since there is no definitive result about the}$$

long-term purchasing power parity (PPP) hypothesis, many applied studies have examined the validity of the PPP hypothesis in its absolute and relative form in order to evaluate the value of the exchange rate, especially during the instability times. Some of these studies accepted the PPP hypothesis and others rejected this hypothesis. Therefore, the PPP hypothesis remains an open question, in spite of its importance to central banks and policymakers.

Previous studies used different techniques to test the validity of the PPP hypothesis in the short run and in the long run. Also, these studies differed in the objective of the study, some of this concern on the absolute form while other concerns on the relative form of the PPP hypothesis. Anyway, the following part of this study present overview of some of this study.

In order to measure the impact of base country and test type on the accepting or rejecting the purchasing power parity hypothesis, Abumustafa (2006) tested the PPP hypothesis in Jordan using more than one unit root test and with three different base countries. He found that the acceptance or rejection of the purchasing power parity hypothesis in Jordan was influenced by the type of test. On the other side, he indicated that PPP in Jordan is not sensitive to the choice of base country.

Choong et al. (2006) examined the validity of the PPP hypothesis in absolute and relative form using a set of econometric techniques applied to a group of Asian countries during the period (1983-2002). The results of this study indicate that the absolute PPP hypothesis was not hold for the selected countries, while the results indicate the validity of the relative PPP hypothesis.

In order to include some structural changes during the study period, Ocal (2013) used the Zivot-Andrews stability test which applied to the Romanian economy using annual data during (1991-2012). The results of this study reached to reject the PPP hypothesis.

Al-Gasaymeh and Kasem (2015) tested the strong and weak forms of the purchasing power parity hypothesis between Jordan and its major trading partners, based on monthly data covering the period (2000-2012). The results of this study show that. the real exchange rate in each country is nonstationary, which means the long-run PPP fails to hold for all countries. Also, the Johansen cointegration test that used to test the weak form of PPP, showed that there exists a cointegrating relationship between exchange rate, domestic and foreign price levels for all the countries. This result is evidence on the weak form of the PPP between Jordan and its major trading partners.

Al-Zyoud (2015) used the Engle-Granger cointegration test to investigate the long-term movement between the Canadian dollar and the US dollar using monthly data for the period (1995-2008). The results of this study show that the absolute form of the purchasing power parity (PPP) does not hold. Also, The result shows that there is no cointegration between actual exchange rate and PPP rate, suggesting that there is no long run relationship between the Canadian dollar and the US dollar exchange rates.

Merza (2017) tested the purchasing power parity (PPP) hypothesis during (2006-2015) using monthly data of Kuwaiti economy. The results of the stationary tests indicated a rejection of the purchasing power parity hypothesis for the Kuwaiti economy. Also, after referring to the components of the real exchange rate, the researcher pointed that price level in both Kuwait and America not move in a such way that ensure the stationary of the real exchange rate. The researcher explained this results by the huge increase in the prices of the housing and food sectors in Kuwait during the study period.

Yilanci et al. (2017), investigated the validity of the PPP hypothesis for 14 African countries during the period (1980-2015) using monthly time series. The results of this study indicate that the unit root test failed to provide evidence of that, the real exchange rates for these 14 countries have mean-reverting tendencies. On the other side, the cointegration test detects a long-term stable relationship between the nominal exchange rate and the relative price level for 8 countries.

Data and Methodology

To test the validity of the purchasing power parity hypothesis for the Jordanian economy, this study used data from the international financial statistics. the data consists of data on the Jordanian consumer price index (P^J) and the US consumer price index (P^U) after converting the base year into 2006. Also, the data include data on the exchange rate between the Jordanian dinar and the US dollar, which is expressed in the terms of the amount of the Jordanian dinar that needed to purchase one unit of the US dollar (S^{JU}). These data were used to calculate the real exchange rate (RS^{JU}) using the following formula:

$$RS^{JU} = S^{JU} \frac{P^U}{P^J} \dots\dots\dots (3)$$

The previous studies used several econometric techniques to test the validity of the PPP hypothesis. In this study two techniques employed to examine the validity of the PPP hypothesis for the Jordanian economy, the first: the graphical approach, and the second: the econometric tests.

Through the graphical approach, the PPP validity can be tested by drawing the trends of exchange rate and the PPP exchange rate, which can be calculated using the following formula, based on the work of Crownover et al. (1996):

$$S_t^{JU} = S_B^{JU} \frac{(P_t^J / P_B^J)}{(P_t^U / P_B^U)} \dots\dots\dots (4)$$

Where: S_t^{JU} is the hypothetical exchange rate based on the PPP hypothesis for the period t, S_B^{JU} is the actual exchange rate which is expressed in terms of the amount of the Jordanian

dinar that needed to purchase one unit of the US dollar for the base year (B), P_t^J is the Jordanian consumer price index in the period t, P_B^J is the Jordanian consumer price index for the base year, P_t^U is the US consumer price index in the period t, and P_B^U is the US consumer price index for the base year.

Based on the graphical approach, if the PPP hypothesis is hold, then the trends of exchange rate and the PPP exchange rate will move together across time. On the other side, the econometric tests that used to examine the validity of the PPP hypothesis include, firstly: the stationary test of time series to examine the stationary of the real exchange rate variable. Based on this test if the stationary of real exchange rate is failing to reject, then the PPP hypothesis is accepted. This is because the purchasing power parity hypothesis that relate to the One Price law state on that, after removing the transport costs, taxes and tariffs, the commodity will be sold in different countries for the same price (Michael and Patricia, 2003).

In order to carry out the stationary test the present study applies the Augmented Dickey-Fuller (ADF) test, which is depending on the following regression:

$$\Delta Y_t = \beta_1 + \beta_2 T + \delta Y_{t-1} + \sum_{i=1}^n \alpha_i \Delta Y_{t-i} + \varepsilon_t \quad \dots\dots\dots(5)$$

Where: Y_t : the study variable (real exchange rate), ε the error term, T the time trend and n the optimal lag which needed to eliminate the autocorrelation from estimated regression, and it determined through the Akaike Information Criteria (AIC).

If the calculated value (in absolute term) is greater than the critical value extracted from the Mackinnon table, then the null hypothesis of the non-stationary of data is rejected ($H_0: \delta = 0$), and the alternative hypothesis is accepted, which means the series is stationary at the level and integrated of degree zero (Gujarati and Porter, 2009). The acceptance of the alternative hypothesis implies that the PPP hypothesis is hold in a strong form.

The other econometric test that used to examine the validity of the PPP hypothesis in Jordan depend on the Johansen's cointegration test between the nominal exchange rate and the relative prices. This test used to test the null hypothesis that state on that: there is r or less of the cointegration vectors between the study variables (nominal exchange rate and relative prices), and to determine which vector is a statistically significant co-integration relationship, the study used the following tests:

1) Trace Test:

$$\rho_{trace} = -T \sum_{i=r+1}^k \ln(1 - \lambda_i) \quad \dots\dots\dots(6)$$

2) Maximal Eigenvalue Test:

$$\rho_{max} = -T \ln(1 - \lambda_{r+1}) \quad \dots\dots\dots(7)$$

Where: T number of observations, k number of variables, λ values of calculated Max Eigen value, and r number of cointegration vectors. On the basis of these tests, if the hypothesis

that there is no cointegration between the relative prices and the nominal exchange rate is rejected, then the PPP hypothesis is accepted in the long term.

The Empirical Results

The methodology of this study depends on several tests to examine the validity of the PPP hypothesis in Jordan. Firstly: the graphical approach which depends on the graph to show the trend of the exchange rate and the PPP exchange rate over the study period, as in the following figure:

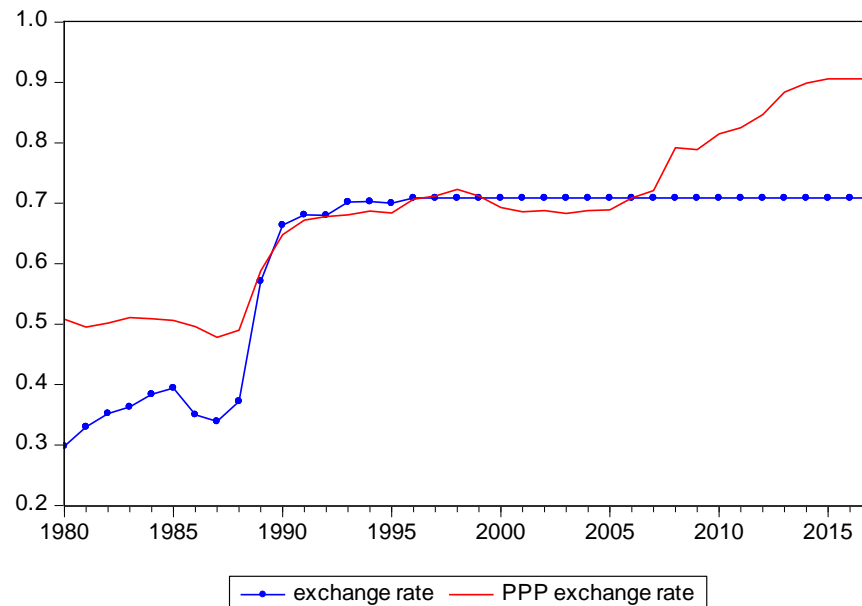


Figure (1): the exchange rate and the PPP exchange rate in Jordan over the period (1980-2017)

It is clear from the previous figure the exchange rate and the PPP exchange rate did not move together across time, especially after the stabilization of the Jordanian dinar exchange rate against the US dollar in 1995. Therefore the PPP hypothesis do not hold of the Jordanian economy.

The second test depends on the Augmented Dickey-Fuller test to examine the stationary of real exchange rate, the results of this test represented in the following table:

Table (1): stationary test for real exchange rate

With intercept			With intercept and trend	
Test	Calculated value	Critical value at 5%	Calculated value	Critical value at 5%
ADF	-1.798	-2.946	-1.57	-3.537
PP	-2.252	-2.943	-1.537	-3.537

Table (1) reports the results of the ADF tests for the real exchange rate when an intercept alone and intercept and trend are included in the ADF equation. According to this result, the real exchange rates is not stationary in all cases. Phillips-Perron (PP) test also used to test the stationary of real exchange rate, the results of this test indicate that the hypothesis of non

stationary is also accepted at the 5% level. These results support that the PPP hypothesis fails to hold for the Jordanian economy.

The final test that used in this study to examine the validity of the PPP hypothesis in Jordan is the cointegration test between the relative prices and the nominal exchange rate. The first step before applying the cointegration approach depends on the stationary test of relative prices and the nominal exchange rate as shown in the following table:

Table (2): stationary test for the relative prices and the nominal exchange rate

Variable	At level		At first difference	
	Calculated value	Critical value at 5%	Calculated value	Critical value at 5%
Relative Prices	-0.815	-2.946	-2.766*	-1.951
Exchange Rate	-2.088	-2.948	-3.826*	-1.951

* Stationary at 5% level

After testing the stationary test for the relative prices and the nominal exchange rate, the result shows that the variables are stationary at first difference. Therefore, the cointegration test can be carried out to examine the validity of the PPP hypothesis in the long run. Table (3) shows the results of cointegration test between the relative prices and the nominal exchange rate.

Table (3): Johansen's cointegration test

Hypothesis	Trace Statistics	Critical value at 5% level	Max-Eigen Statistics	Critical value at 5% level
None	6.265	15.495	6.095	14.265
At most 1	0.17	3.842	0.17	3.842

The results of trace and max-eigen value indicate that there is no cointegration between the relative prices and the nominal exchange rate at 5% level, which means the PPP hypothesis is not hold in the long run for Jordanian economy.

Conclusion

This study investigates the validity of the PPP hypothesis in Jordan over the periods (1980-2017), the exchange rate for Jordanian dinar in terms of the US dollar are used in this study. The validity of the PPP hypothesis is important for central bank and policymakers to predict the behavior of the exchange rate.

Since the econometric techniques have an impact on the results of the PPP tests this study used different techniques to test the validity of the PPP for Jordanian economy these tests includes: graphical techniques, stationary tests and cointegration test. The empirical results of the these tests reject the PPP for Jordanian economy.

In Jordan, the reason for the price difference in the last years return to that the most commodities were subsidized by government. Also, transport costs and the trade obstacles on trading some goods affect on the price level between countries. Therefore, the PPP hypothesis can't be used to predict the exchange rate in Jordan.

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