Strong and Weak Form of Purchasing Power Parity: The Case of Jordan and its Major Trading Partners

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Abstract

The aim of this paper is to test two forms of purchasing power parity (PPP), specifically the strong form of PPP and the weak form of PPP between Jordan and its major trading partners namely, Japan, United Kingdom, Turkey, and United State, based on data covering the period of 2000M1-2012M12. First, this paper examines the strong form of PPP to test the stationarity of the real exchange rate. The results show that the real exchange rate in each country is nonstationary. This implied that the long-run PPP fails to hold for all countries. In the second stage, the Johansen cointegration test employed to test the weak form of PPP. The results of cointegration tests showed that there exists a cointegrating relationship for all the countries between exchange rate, domestic and foreign price levels. We conclude that the evidence of weak PPP is found between Jordan and its major trading partners. The unit-root tests of real exchange rates imposed proportionality and symmetry restrictions that nominal exchange rates and aggregate prices move together in a one-to-one fashion. The weak form of the PPP states that the nominal exchange rate and aggregate price ratios may move together in equilibrium, but the relationship need not necessarily be one-to-one. This paper found evidence for weak PPP but not for strong PPP, hence, the conditions of proportionality and symmetry restrictions may be one of the reasons that PPP not hold when being tested empirically.

Keywords: Purchasing power parity, strong and weak form of PPP, cointegration, Jordan

1. Introduction

Small open economies like Jordan often face the problem of fluctuations in exchange rate. Foreign exchange rate is pervasive and singularly important price in an open economy, influencing consumer prices, business and investment decisions. Uncertain future values of the exchange rate may have effect on the value of a foreign-currency-dominated obligation, receipt, asset or liability. The exchange rate influences a vast array of participants and business decisions. Tourists, trades and foreign direct investment between countries required a stable exchange rate and trusted currencies. Hence, exchange rate prediction is one of the most challenging and critical decisions for those who are involved in international finance. One of the major theories that explain exchange rate determination is Purchasing Power Parity (PPP). PPP is the simplest tool for global trader, investor, economist, policy makers and academicians to predict exchange rate. Besides exchange rate prediction, PPP is commonly used as a first step in making inter-country comparisons based in real terms of gross domestic product (GDP) and its component expenditures. GDP is commonly used as an economic indicator for size, growth, and health of a nation. PPP allows countries to be viewed through a common reference point. Although in 1995 Dinar has been pegged to the U.S. Dollar but Dinar against other currencies kept fluctuates according to market forces. We are here interested in analyzing the behavior of the Dinar versus other major currencies during its managed float. We are aware of only one study that directly examines the strong form PPP in Jordan.

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In particular, Abumustafa, (2006) tests the validity of PPP in Jordan over the period 1976-2000 using Germany, Japan, and USA as base countries applying unit root tests for the strong form of PPP in the real exchange rate. Abumustafa (2006) argues that the validity of PPP for Jordan is sensitive to the choice of the type of unit root tests. However, it is documented by many authors that, one implication of unit root is that the restrictive conditions of proportionality and symmetry restrictions are satisfied in PPP that is nominal exchange rates and aggregate prices move together in a one-to-one fashion in the long run. However, transportation cost, proportionality and symmetry in PPP, leading to the looser definition of so-called weak PPP (Taylor, 1988; Cheung and Lai, 1993; and Pippenger, 1993). The weak version of the PPP hypothesis states that the nominal exchange rate and aggregate price ratios may move together in equilibrium, but the relationship need not necessarily be one-to-one. Therefore, this paper aims to examine the validity of PPP between Jordan and its major trading partners in two ways, first, the strong form of PPP in the real exchange rate. Second, the weak form of PPP between the nominal exchange rate and the relative price levels. The results show that, the real exchange rate in each country is not stationary. This implies that the long-run PPP fails to hold for all countries. There are many possible reasons for the failure of PPP. The unit-root tests of real exchange rates impose the proportional restriction among exchange rates and prices; the lack power of the tests and short span of data could be a possible reason and transportation cost could be another possible reason. The rest of the paper is organized as follows. Section 2 discusses the PPP theory and literature review. The third section is a review on the literature review and the methodology and data employed in Section four. The empirical results of this paper in section five and finally section six provides some conclusions.

2. Theory of PPP

PPP stated that, the exchange rate between two currencies are in equilibrium when their purchasing power is the same in each of the two countries that is 'the law of one price', that identical goods should sell for identical prices in different countries' markets. That means the exchange rate between countries should be equal to the ratio of the countries' price levels of a fixed basket of goods and services. When the country's domestic price level is getting increased more rapidly than its major trading partner that tell us a country experiencing inflation, that country's exchange rate must depreciate in order to return to purchasing power parity. There are two types of purchasing power parity theory, absolute and relative purchasing power parity. Absolute purchasing power parity theory states that the exchange rate between the currencies of two countries should equal the ratio of the price levels of the two countries and the basket of goods should be the same domestically and abroad if the goods prices are converted into a common currency, in other words, absolute purchasing power parity theory postulates that the purchasing power of money should be equal between countries.

$$S = P/P^* \qquad (1)$$

Where S is the nominal exchange rate measured in units of domestic currency per unit of foreign currency, P is the domestic price level and P* is the foreign price level. The relative PPP hypothesis, on the other hand, states that the exchange rate should be proportionate to the ratio of the price level and does not compare domestic and foreign levels of purchasing power, but rather focuses on changes in this purchasing power. Relative purchasing power parity theory, therefore, states that the inflation rate differentials between two countries are offset through inverse changes in the nominal exchange rate so that the purchasing power ratio between the two remains constant (Suranovic, 1999).

$$S = k (P/P^*) \qquad (2)$$

Where k is a constant parameter, since information on national price levels normally is available in the form of price indices rather than absolute price levels, absolute PPP may be difficult to test empirically. This paper extends and improves the work of Abumustafa, (2006) in these ways, first, instead of testing the strong form of PPP in the real exchange rate, this paper also testing the weak form of PPP using the technique of cointegration. The advantage of cointegration test for PPP is that it relaxes the restriction of proportionality and symmetry imposed by unit root tests of real exchange rates (Drine and Rault, 2008; and Sarno and Taylor, 2002).

3. Literature Review

Over the past decade, there has been a renewed interest in the economic literature on one of the most important theories in international economics - the purchasing power parity. This theory states that national price levels expressed in a common currency should be equal. The underlying intuition is the law of one price according to which international arbitrage equalizes prices across countries.

The PPP doctrine has been variously viewed as a theory of exchange rate determination, as a long-run equilibrium condition of exchange rate and as an efficient arbitrage condition in either goods or asset markets (Froot and Rogoff, 1995; and Rogoff, 1996). The empirical validity of the PPP theory has witnessed a long history. Two directions of research have mainly been followed recently, unit root tests of real exchange rates and cointegration approach. Prior studies on long run PPP have most often used time-series data to test the stationarity of real exchange rate employing different econometric techniques. Many of them were based on short time-series, often consisting of post-1973 observations for a few major industrialized countries (e.g. Adler and Lehmann 1983, Darby 1980, Taylor and McMahon 1988). These studies have failed to find favorable evidence suggesting that PPP deviations are governed by stationary process during the post-Bretton Woods period. For example, Darby, (1980) and Adler and Lehmann, (1983) have suggested that deviations from PPP follow martingale behavior and hence PPP cannot hold in the short and in the long runs. Taylor and McMahon, (1988) have shown that nominal exchange rates and relative prices are not cointegrated, suggesting that these variables tend to drift apart without bound. The symmetry and proportionality conditions on PPP (strong version of PPP) have also been the object of a considerable research. Indeed, these restrictions on PPP suppose a possible unique cointegration vector, and a unit root test on PPP is sufficient to check its validity. Consequently, the failure of unit root tests to validate the PPP doctrine can be due to the imposition of the symmetry and proportionality restrictions (Cheung and Lai, 1993b). However, the literature has often doubt on the PPP empirical validity. Indeed, most of the empirical works have focused on testing PPP in developed countries and found mixed results see for example, O'Connel (1998), Pedroni (1997a) and Papell (1997). However, little work has been done on developing countries (Frankel and Rose 1996, Nagayassa 1998, Sarno 2000, Drine et al 2003, Kargbo 2003).

The main concern of these empirical studies is to find any possible common stochastic co-movement between exchange rates and relative consumer prices by using a number of different panel unit root and cointegration tests. However, the econometric findings have been mixed and often conflicting. Frankel and Rose, (1996) have examined deviations from the PPP using a panel of 150 countries and 45 annual observations post World War II. The estimation of three panel equations (equation with no fixed effects, equation with country-specific intercepts and equation with year specific intercepts) allows these authors to show strong evidence support for PPP theory with a half-life of around four years. Drine et al (2003) used Im, Pesaran and Shin test to determine whether the real exchange rate is stationary or not by supposing that the symmetry and the proportionality conditions are valid a priori. They have found that the strong PPP is invalid for Africa, Latin America, Asia and PECO while the PPP in its weak form has been verified for MENA. According to Drine et al (2003), the strong version of PPP cannot be used as a benchmark to determine the long run evolution of the real exchange rate for the developing countries. Nagayassa, (1998) applied cointegration test of Pedroni, (1997a) and confirmed the semi-strong form of the PPP for 17 African countries by using annual data during the period 1981-1994.7 More strong support for PPP in thirty African countries covering 1960-1997 has been shown by Kargbo, (2003) by using Johansen cointegration test and error correction model. Using panel unit root tests on different periods and different panels, Alba et al (2005) have shown limited support for PPP. Unlike these empirical results, the unit root test of Im et al (2003) performed on quarterly data over 1973-1990 does not allow Holmes, (2000) to provide support for strong PPP in the case of thirty less developed countries with high inflation for the different panel of countries under consideration. This result is not in line with a styled fact explaining that the PPP is in general verified in developing countries with a high inflation (Sarno, 2000; and Alba et al 2005).As far as the empirical validity of the symmetry and the proportionality conditions on PPP are concerned, Cerrato and Saranti, (2003) have used the Johansen likelihood ratio test and found that the joint symmetry/proportionality restriction imposed on the PPP is strongly rejected in the case of OCDE countries. Using the Bayesian econometrics, Kai (1998) has also rejected the symmetry/proportionality conditions based on the data of these developed countries over 23 years. Johansen and Juselius, (1992) have confirmed these two restrictions for the United Kingdom. Within the enlarged monetary model, Edisson, (1987) has found support for the symmetry and proportionality conditions in the dollar/pound exchange rate (1890-1978). They are many methods used to tests the validity of PPP but the most common used tests are unit root tests in the strong form of PPP which is necessary and sufficient and cointegration in the weak form of PPP which is necessary condition.

4. Methodology and Data

Under strong form of PPP, the cointegration coefficient between the nominal exchange rate and the relative price levels is equal to one, strong PPP can be investigated by testing whether the real exchange rate is stationary or not, the presence of a unit root implies that PPP does not hold in the long run. While under weak form of PPP the two variables are cointegrated but the cointegrating vector can differ from unity. Testing for weak form of PPP is typically facilitated by the technique of cointegration, weak PPP holds if the nominal exchange rate and the relative price levels are cointegrated. The advantage of the cointegration test for PPP is that it relaxes the restriction of proportionality and symmetry imposed by unit root tests of real exchange rates (Drine and Rault, 2008; and Sarno and Taylor, 2002).

4.1 Model Specification for Strong Form of PPP

A strong version of the PPP theory has as its foundation the law of one price. Abstracting from complicating factors such as transportation costs, taxes, and tariffs, the law of one price states that any good that is traded on world markets will sell for the same price in every country engaged in trade, when prices are expressed in a common currency (Michael, P. and Patricia, P. 2003). To illustrate the law of one price, let p_i and p_i^* be the domestic and foreign currency prices of commodity (a good or service) and e the exchange rate (expressed as the Jordanian Dinar/ Foreign exchange rate). Thus, the law of one price implies that:

$$p_i = e\, p_i^* \qquad\qquad (1)$$

Using the intuition built by the law of one price for a good or service, one can apply the principle across an aggregate of products and prices. Or put another way, one can imagine a common basket of goods that can be traded and prices compared across two countries- this is also known as the consumer price index. By using price indices, one can rewrite equation (1) to make a relative comparison of overall price levels between domestic and foreign countries, p and p* :

$$p = e\, p^* \quad \text{or} \quad e = p/p^* \qquad\qquad (2)$$

As a theory of exchange rate determination, PPP, given by equation (3), predicts that the exchange rate will adjust to equalize price levels. Note that this absolute PPP assumes that the real exchange rate - the nominal exchange rate adjusted for differences in national price levels - is constant:

$$\frac{ep^*}{p} = 1 \qquad\qquad (3)$$

Let q be the real exchange rate, then equation (3) can be rewrite as:

$$q = \frac{ep^*}{p} = 1 \qquad\qquad (4)$$

(Robert Lafrance and Lawrence Schembri, 2002).

PPP suggest that real exchange rate series should be stationary. If real exchange rate is stationary, this exhibit that any percentage changes in the price level between two countries would be offset by an equal depreciation/appreciation of the nominal exchange rate. The empirically testable form for real exchange rates involves testing for unit roots in real exchange rates. Rejection of the unit root hypothesis indicates stationary in real exchange rates. If there is a unit root in the real exchange rate this implies that shocks to the real exchange rate are permanent and PPP does not exist between two countries (Kalyoncu and Kalyoncu, 2008).

In logarithmic form, the real exchange rate, q can be calculated as:

$$\log (q) = \log (e) + \log (p^*) - \log (p) \qquad\qquad (5)$$

Where q is the real exchange rate, e is the nominal Jordanian Dinar/trading partners exchange rate; p is the domestic price index and P* is the price index of the trading partners. This unit root test is performed on the level of real exchange rate. At first, the model without trend is adopted in the empirical analysis because an inclusion of linear time trend would be theoretically inconsistent with long run PPP proposition and, as suggested by most empirical studies, time trend in real exchange rate is not consistent with the PPP hypothesis Zhang and Lowinger, (2006) and Acaravci and Acaravci, (2007).

In addition, Alba and Papell, (2007), Alba and Park, (2003), Holmes, (2001), Culver and Papell, (1999), Papell, (2002) and Al-Rabbaie and Hunt, (2004) had tested the validity of PPP in the real exchange rate excluding a time trend from the test.

4.1.1 Unit Root Tests

EViews provides a variety of powerful tools for testing a series (or first or second difference of the series) for the presence of a unit root. In addition to the existing Augmented Dickey-Fuller, (1979) and Phillips-Perron, (1988) tests, EViews now allows you to compute the GLS-detrended Dickey-Fuller (Elliot, Rothenberg, and Stock, 1996), Kwiatkowski, Phillips, Schmidt, and Shin (KPSS, 1992), Elliott, Rothenberg, and Stock Point Optimal (ERS, 1996), and Ng and Perron, (NP, 2001) unit root tests. All of these tests are available as a view of a series.

By using EViews software the following discussion outlines the basic features of ADF unit root tests. Consider a simple AR (1) process:

$$y_t = p y_{t-1} + x_t{}'\delta + \varepsilon_t \tag{6}$$

Where x_t are optional exogenous regressors which may consist of constant, or a constant and trend, p and δ are parameters to be estimated, and the ε_t are assumed to be white noise. If $[p] \geq 1$, y is a nonstationary series and the variance of y increases with time and approaches infinity, if $[p] < 1$, y is a (trend-) stationary series, thus, the hypothesis of (trend-) stationarity can be evaluated by testing whether the absolute value of p is strictly less than one. The unit root tests that EViews provides generally test the null hypothesis $H0: p = 1$ against the one-sided alternative $H_1 : p < 1$.

The Augmented Dickey-Fuller (ADF) Test

The standard DF test is carried out by estimating Equation (6) after subtracting y_{t-1} from both sides of the equation

$$\Delta y_t = \alpha y_{t-1} + x_t{}'\delta + \varepsilon_t \tag{7}$$

Where $\alpha = p - 1$, the null and alternative hypotheses may be written as,

$$H_0 : \alpha = 0 \tag{8}$$

$$H_1 : \alpha < 0 \tag{9}$$

And evaluated using the conventional t-ratio for α :

$$t_\alpha = \hat{\alpha}/(se(\hat{\alpha})) \tag{10}$$

Where $\hat{\alpha}$ is the estimate of α, and $se(\hat{\alpha})$ is the coefficient standard error

If the t_α statistics value is greater than the critical values tabulated in MacKinnon, (1996) one does not reject the null. Dickey and Fuller, (1979) show that under the null hypothesis of a unit root, this statistic does not follow the conventional Student's t-distribution, and they derive asymptotic results and simulate critical values for various test and sample sizes, more recently, MacKinnon, (1991, 1996) implements a much larger set of simulations than those tabulated by Dickey and Fuller. In addition, MacKinnon estimates response surfaces for the simulation results, permitting the calculation of Dickey-Fuller critical values and P values for arbitrary sample sizes. The more recent MacKinnon critical value calculations are used by EViews in constructing test output. The simple Dickey-Fuller unit root test described above is valid only if the series is an AR (1) process. If the series is correlated at higher order lags, the assumption of white noise disturbances ε_t is violated.

The Augmented Dickey-Fuller (ADF) test constructs a parametric correction for higher-order correlation by assuming that the y series follows an AR (P) process and adding lagged difference terms of the dependent variable y to the right-hand side of the test regression:

$$\Delta y_t = \alpha y_{t-1} + xt'\delta + \beta_1 \Delta y_{t-1} + \beta_2 \Delta y_{t-2} + ...\beta_p \Delta y_{t-p} + v_t \qquad (11)$$

This augmented specification is then used to test (3.8-3.9) using the -ratio (11). An important result obtained by Fuller is that the asymptotic distribution of the -ratio for is independent of the number of lagged first differences included in the ADF regression. Moreover, while the assumption that y follows an autoregressive (AR) process may seem restrictive, Said and Dickey, (1984) demonstrate that the ADF test is asymptotically valid in the presence of a moving average (MA) component, provided that sufficient lagged difference terms are included in the test regression. To specify the number of lagged difference terms (which will term the "lag length") to be added to the test regression (0 yields the standard DF test; integers greater than 0 correspond to ADF tests). The usual (though not particularly useful) advice is to include a number of lags sufficient to remove serial correlation in the residuals.

4.1.2 The Phillips-Perron (PP) Test

Phillips and Perron, (1988) propose an alternative (nonparametric) method of controlling for serial correlation when testing for a unit root. The PP method estimates the non-augmented DF test equation (6), and modifies the -ratio of the coefficient so that serial correlation does not affect the asymptotic distribution of the test statistic. The PP test is based on the statistic:

$$\bar{t}_\alpha = t_\alpha \left(\frac{\gamma 0}{f 0}\right)^{\frac{1}{2}} - \frac{T(f_0 - \gamma_0)(se(\hat{\alpha}))}{2 f_0^{\frac{1}{2}s}} \qquad (12)$$

Where $\hat{\alpha}$ is the estimate, and t_0 the t-ratio of α, $se(\hat{\alpha})$ is coefficient standard error, and δ is the standard error of the test regression. In addition, γ_0 is a consistent estimate of the error variance (calculated as $(T-K)s^2/T$, where k is the number of regressors). The remaining term, f_0 is an estimator of the residual spectrum at frequency zero. The asymptotic distribution of the PP modified -ratio is the same as that of the ADF statistic. EViews reports MacKinnon lower-tail critical and p-values for this test. Based on the critical values, if the value of t_α Statistic is greater than the critical values, one does not reject the null of unit root.

4.1.3 The Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) Test

The KPSS (1992) test differs from the other unit root tests described here in that the series y_t is assumed to be (trend-) stationary under the null. The KPSS statistic is based on the residuals from the OLS regression of y_t on the exogenous variables x_t:

$$y_t = x_t^-\delta + \varepsilon_t \qquad (13)$$

The LM statistic is being defined as:

$$LM = \sum_t S(t)^2 /(T^2 f_0) \qquad (14)$$

Where f_0, is an estimator of the residual spectrum at frequency zero and where $S(t)$ a cumulative residual function is?

$$S(t) = \sum_{r=1}^{t} \hat{\mu}_r \qquad (15)$$

EViews reports the critical values at the 1%, 5% and 10% levels. If the value of LM Statistic is greater than the critical values, one can reject the null of stationary.

4.2 Model Specification for Weak Form PPP

The test of weak PPP consists in testing the existence of a cointegration relationship between the nominal exchange rate and the price ratio. Let,

E=k (P/P*)   (16)

Where k is a constant parameter
Rewrite equation 17 in log form

$$\log e_t = \beta 1 \log p_t - \beta 2 \log p^*$$ (17)

Estimation cointegration regression

$$\log e_t = c + \beta 1 \log p_t - \beta 2 \log p^* + \varepsilon_t$$ (18)

$$\log e_t - c - \beta 1 \log p_t + \beta 2 \log p_t^* = \varepsilon_t$$ (19)

Where e_t, p and p^* are the exchange rate, the domestic price, and the foreign price respectively, t denoted for time subscript and c is constant, ε_t is the error term, if ε_t is a stationary process with zero mean then PPP holds in the long run. However, if ε_t is non stationary implying that deviation from PPP are cumulative and not ultimately self-reversing, then PPP fails in the long run. Let $Xt = (e_t, p_t, p_t^*)$. If all components in Xt are integrated of order 1, (I(1)), if the cointegration vector satisfies the restriction of proportionality, i.e., α =(1,-1,1). Hence, testing the cointegration among e_t, p and p^* examining the proportional restriction of the cointegration vector are ways of testing the validity of PPP. Then, the test of cointegration between the nominal exchange rate and the national price levels by estimating the following regression:

$$\log e_t - c - \beta 1 \log p_t + \beta 2 \log p_t^* = \varepsilon_t$$ (20)

Where e is the nominal exchange rate, P, P* the domestic price, and the foreign price respectively and c=constant, β1, β2 = coefficient. εt = error term. For strong PPP to be valid β1 should be positive and equal to one, β2 should be negative and equal to one in order for PPP to hold. For relative PPP β1 and β2 does not need to be equal to 1.

4.2.1 Cointegration Test

In this paper, cointegration procedure developed by Johhansen, (1988) and Johansen-Juselius, (1990) is employed to examine long-term relationship between the different models within economics, as proposed in the coming parts. Cointegration refers to the possibility that non-stationary variables can be a linear combination that is stationary. From a statistical perspective, a long-term relationship means that the balance variables move together in time, so that any short-term deviations from long-term trend will be corrected. These series are said to be cointegrated and therefore a common root stochastic trend. Johansen-Juselius, procedure again, in the n-variable first order given by VAR.

$$\Delta X_t = A_1 X_{t-1} + \varepsilon_t$$ (21)

By subtracting X_{t-1} from each side of the equation, equation (21) can be rewritten as:

$$\Delta X_t = A_1 X_{t-1} + X_{t-1} + \varepsilon_t$$ (22)

$$= (A_1 - I)X_{t-1} + \varepsilon_t$$

$$= \pi X_{t-1} + \varepsilon_t$$

Where X_{t-1} and ε_t are (n x 1) vectors; A is an (n x n) matrix of parameters; I is an (n x n) identity matrix; and π is defined as $(A_1 - I)$. The rank of π equals to the number of cointegration vectors, also, the model in equation (4.23) can be generalized to allow for a higher-order autoregressive process. Which is?

$$\Delta X_t = \sum_{i=1}^{m-1} \pi_i \Delta X_{t-i} + \pi i X_{t-m} + \varepsilon_{\varepsilon t} \qquad (23)$$

And the most important function is still the grade as equal to the number of independent cointegration vectors. As we know that the rank of a matrix is equal to the number of its characteristics which are different from zero, so the number of individual cointegration vectors in this model may be determined by checking whether the significance of the characteristic roots π. The test for the number of cointegration vectors can be accomplished with the help of two like hood ratios (LR) test on the track of statistics and maximum eigenvalue statistics as shown below:

Trace Test $\qquad : L_{trace(r)} = -T \sum L_n (1 - \lambda_i) \qquad (24)$

Maximum eigenvalue test $\qquad : L_{\max(r,r+1)} = -TL_n (1 - \lambda_{r+1}) \qquad (25)$

Where λ_I the estimated eigenvalues and T is the number of valid observations, the null hypothesis of traces of statistical tests that the number of individual cointegration vector is smaller than or equal to r against a general alternative which gives the result of not more than r cointegrating vectors the last λ max statistical tests the null hypothesis that there is vectors r cointegrating against the alternative of r +1 cointegrating vectors. In general λ max statistics is more preferable, because it represents the result of exactly r cointegrating vectors. Critical values for both tests are in a table Osterwald-Lenum, (1992).

4.3 Lag Length Selection

An important practical issue for the implementation of the unit root test is the specification of the lag length p. If p is too small then the remaining serial correlation in the errors will bias the test. If p is too large then the power of the test will suffer. The idea is to include enough lagged dependent variables to rid the residuals of serial correlation. There are several ways of choosing how many lags need to be added. First, we can use the testing down strategy, which starts with a reasonably large number of lags and test down until they are all significant. This is one of the lag selection criteria that EViews automatically calculate (Lavan Mahadeva & Paul Robinson, 2004). The second test, tests the residuals each time to see whether they contain any serial correlation. Choose a p that renders the residuals serial uncorrelation. Another way is to start with a reasonably large number of lags and test down, choose p (less than the specified maximum) to minimize one of the following criteria: Akaike information criterion, Schwartz Bayesian information criterion, etc. For ADF, this paper will use whether they contain any serial correlation, choose a p that renders the residuals serial uncorrelation. For PP and KPSS the lag length was chosen based on the lowest AIC criteria. To perform the Johansen test, we have to decide the lag length (k) in the vector autoregressive (VAR) model, and to examine the appropriateness of including a time trend in the model. We started from a general lag system where the lag has to pass all the diagnostic tests.

5. Results and Discussion

The aim of this paper is to test two forms of PPP between Jordan and its major trading partners namely, Japan, United Kingdom, Turkey and United State. Section 5.1 will report the result for strong form of PPP, while section 5.2 presents the result for weak form of PPP and section 6 conclusions.

5.1 Strong form of PPP

Results and Discussion of Unit Root Tests in the Real Exchange Rate

The strong form of PPP translates that the real exchange rate should be constant. A popular way of interpreting the PPP doctrine is that real exchange rates should be mean-reverting. That is, in response to any shock or disturbance, the real exchange rate must eventually return to its' PPP-defined level. This is a useful interpretation because it is empirically testable. The baseline test involves testing for unit roots in real exchange rates. Rejection of the unit root hypothesis indicates mean reversion in real exchange rates (Alba and Park 2003). The optimal lag length for ADF is chosen by tested residual is free from serial correlation and the optimal lag length for PP and KPSS is chosen by the lowest AIC criteria.

The results of ADF and PP test with intercept for real exchange rate are organized by countries pair. Table 1 and 2 show that, the hypothesis of nonstationary real exchange rate in each country cannot be rejected; this implies that the long-run PPP fails for all countries

Table: 1: ADF Results in the Real Exchange Rates (q)

No	Variables	t-Statistics	P-value
1	q Jordan/Japan	-1.335 (3)	0.464
2	q Jordan/ UK	0.459 (1)	0.812
3	q Jordan/ Turkey	1.149 (4)	0.835
4	q Jordan/ United State	2.087 (9)	0.246

Note: The selection of lag length is based on the residuals of the regression that do not
exhibit serial correlation.
All series are log transformed
The null hypothesis is that the series contain unit root.
Figures in parenthesis after t-statistics are lag length.
For constant without trend, the critical values for rejection are -3.46, -2.87 and
-2.57 at 1%, 5% and 10%, respectively.

Table: 2: PP Results in the Real Exchange Rates (q)

No	Variables	t-Statistics	P-value
1	q Jordan/Japan	-1.476 (7)	0.677
2	q Jordan/ UK	0.488 (8)	0.822
3	q Jordan/ Turkey	-0.578 (6)	0.971
4	q Jordan/ United State	-1.576 (9)	0.546

Note: The selection of lag length is based on the lowest AIC criteria
All series are log transformed
The null hypothesis is that the series contain unit root.
Figures in parenthesis after t-statistics are lag length.
For constant without trend, the critical values for rejection are -3.46, -2.87 and
-2.57 at 1%, 5% and 10%, respectively.

The results for the KPSS test in Table 3 could show that the null hypothesis for stationary or no unit root can be rejected, when all variables are tested at level. Therefore, we conclude the real exchange rate in the strong form of PPP between Jordan and its trading partners is not stationary at level, leading us to conclude that all the series are I (1) process.

Table: 3: KPSS Results in the Real Exchange Rates (q)

No	Variables	LM-Statistics
1	q Jordan/Japan	0.796 (10)
2	q Jordan/ UK	1.225 (10)
3	q Jordan/ Turkey	1.366 (10)
4	q Jordan/ United State	0.759 (10)

Note: The selection of lag length is based on the lowest AIC
All series are log transformed
The null hypothesis is that RER is stationary.
Figures in parenthesis after t-statistics are lag length.
For constant without trend, the critical values for rejection are 0.7390, 0.4630
and 0.3470 at 1%, 5% and 10%, respectively.

5.2 Weak Form of PPP

The weak form of PPP normally tested using cointegration techniques. The prerequisite of cointegration is all series must integrated of order one. In order to determine the order of integration, the standard Augmented Dickey-Fuller (ADF) unit root test will be used for testing the null of nonstationarity. If the series are of same order, then we may proceed to test the existence of cointegrating relations between the exchange rate and its fundamentals using Johansen multivariate cointegration techniques. If we are able to reject the null hypothesis of no cointegrating vectors, this indicates the exchange rate and its monetary fundamentals have a stable long run relationship (Enders, 2004).

5.2.1 Result of ADF

Unit root tests should be performed before proceeding to cointegration tests. We apply the augmented Dickey Fuller (ADF) test to investigate the integrated order of exchange rates, price and relative prices. Table 4 summarizes results from ADF tests when all series are tested in their level while Table 5 summarizes results from ADF tests when all series are tested in their first difference. Both intercept and intercept with trend were tested.

Table: 4 ADF Results for Exchange Rate and Price Indices in Level

Variables	intercept		intercept and trend	
	t-Statistics	P-value	t-Statistics	P-value
ER Jordan/Japan	-1.734 (3)	0.415	-1.731 (5)	0.433
CPI Jordan	-0.421 (12)	0.817	-1.386 (3)	0.958
CPI Japan	-0.554 (13)	0.995	-3.151 (5)	0.174
ER Jordan/ UK	-0.718 (3)	0.762	-1.855 (4)	0.763
CPI United Kingdom	-1.830 (6)	0.314	-1.761 (3)	0.676
ER Jordan/ Turkey	-0.639 (4)	0.579	-2.231 (6)	0.565
CPI Turkey	-0.476 (5)	0.809	-2.432 (5)	0.459
ER Jordan/ United State	-1.213 (8)	0.558	-2.516 (5)	0.319
CPI United State	1.072 (10)	0.997	-2.994 (11)	0.143

Note: The selection of lag length is based on the residuals of the regression that do not exhibit serial correlation.
    All series are log transformed
    The null hypothesis is that the series contain unit root.
    Figures in parenthesis after t-statistics are lag length.
    For constant without trend, the critical values for rejection are -3.46, -2.87 and -2.57 at 1%, 5% and 10%, respectively.

Table 4 and 5 showed that the null hypothesis of the ADF unit root test was rejected when all the variables were in the level, but could not be rejected at 10% significant level when all the variables were tested in their first difference. The reason for this is that all the exchange rate variables were stationary at first difference. Hence, we can conclude that all series are I(1).

Table: 5 ADF Results for Exchange Rate and Price Indices in first Difference

Variables	1st difference		1st difference & trend	
	t-Statistics	P-value	t-Statistics	P-value
ER Jordan/Japan	-6.478 (2)	0.000	-6.471 (2)	0.000
CPI Jordan	-4.453 (8)	0.014	-4.432 (8)	0.067
CPI Japan	-4.654 (7)	0.001	-4.648 (7)	0.022
ER Jordan/ UK	-5.657 (3)	0.000	-5.643 (3)	0.000
CPI United Kingdom	-4.965 (4)	0.000	-4.376 (4)	0.000
ER Jordan/ Turkey	-3.121 (3)	0.001	-3.231 (3)	0.007
CPI Turkey	-2.651 (10)	0.058	-2.765 (10)	0.000
ER Jordan/ United State	-3.182 (6)	0.022	-3.654 (3)	0.028
CPI United State	-7.595 (1)	0.000	-7.620 (1)	0.000

Note: The selection of lag length is based on the residuals of the regression that do not exhibit serial correlation.
    All series are log transformed
    The null hypothesis is that the series contain unit root.
    Figures in parenthesis after t-statistics are lag length.
    For constant without trend, the critical values for rejection are -3.46, -2.87 and -2.57 at 1%, 5% and 10%, respectively.

5.2.2 Result of Cointegration Test

After examined the unit root test, the results show all the variables are stationary at first difference tests. All the series are I(1) process; the cointegration can be implement to examine the long-run relationship among these variables. The optimal lag length is chosen by lowest AIC. The model using this optimal lag will be further tested residual is normally distributed, free from serial correlation and homoscadesticity.

Table 6: The Johansen's Cointegration Test for Jordan-Japan

Null Hypothesis	Eigenvalue	Trace Statistic	5% Critical Value	Prob.**
None *	0.155	20.97	21.791	0.054
At most 1	0.067	7.130	10.455	0.410
At most 2	0.006	0.115	4.832	0.532
Null Hypothesis	**Eigenvalue**	**Max Eigen Statistic**	**5% Critical Value**	**Prob.****
None *	0.1338	18.821	13.161	0.065
At most 1	0.0568	7.015	18.255	0.453
At most 2	0.0016	0.112	4.741	0.754
Diagnostic Tests:			**Prob.**	
Jarque-Bera Normality (Chi-sq)			0.454	
Breusch-Godfrey Serial Correlation LM Test			0.177	
White Heteroskedasticity Test (Chi-sq)			0.358	
Note: * denotes rejection of the hypothesis at the 0.05 level The number of lag used in this model is 12 All series are log transformed. Assumption used is intercept (no trend) in cointegrating equation				

The result for Johansen cointegration test for Jordan and Japan shows in Table 4.6. If the maximum eigen statistic and trace statistic is greater than 5% critical value, we rejected the null hypothesis of no cointegrating vector. Both of the statistics indicated that the null hypothesis of zero cointegrating vectors could be rejected using 5% critical value. This implies that the variables in this model are cointegrated with one cointegrating vector. The existence of long run relationship between exchange rate of Jordan and Japan, CPI Jordan, CPI Japan implied that the theory of PPP does hold over the estimation period. The Chi-sq statisitics for JB normality test for residuals were normally distributed for Jordan- Japan was not significant, hence failed to reject the null hypothesis, and this means that the error term was normality distributed. The F test for serial correlation LM test was not significant meaning that, failed to reject the null hypothesis, hence, the residual was not auto correlated. Lastly, the null of homoscedasticity in the heteroskcedasticity White test could not be rejected, indicating that the residual was free from problems of heteroskcedasticity.

Table 7: The Johansen's Cointegration Test for Jordan-United Kingdom

Null Hypothesis	Eigenvalue	Trace Statistic	5% Critical Value	Prob.**
None *	0.1700	31.318	31.787	0.0021
At most 1	0.0622	17.199	16.474	0.0876
At most 2	0.0174	4.081	3.6466	0.0792
Null Hypothesis	**Eigenvalue**	**Max EigenStatistic**	**5% Critical Value**	**Prob.****
None *	0.180	23.150	26.631	0.004
At most 1	0.032	15.122	17.274	0.148
At most 2	0.027	4.081	5.841	0.079
Diagnostic Tests:			**Prob.**	
Jarque-Bera Normality (Chi-sq)			0.3543	
Breusch-Godfrey Serial Correlation LM Test			0.3654	
White Heteroskedasticity Test (Chi-sq)			0.5123	
Note: * denotes rejection of the hypothesis at the 0.05 level The number of lag used in this model is 6 All series are log transformed. Assumption used is intercept (no trend) in cointegrating equation				

The Johansen's cointegration test results for Jordan and United Kingdom are shown in the Table 7. We are reminded that if the maximum eigen statistic and trace statistic are greater than 5% critical value, then we reject the null hypothesis. Both of these statistics were significant, and so the null hypothesis of zero cointegrating vectors was rejected using 5% critical value. We know from these variables in this model are cointegrated with one cointegrating vector, and the existence of a long run relationship between the exchange rate Jordan and U.K, CPI Jordan, CPI U.K implies that the theory of PPP hold good over the stipulated periods. The residual test for Jordan- United Kingdom was not significant enough to reject the null hypothesis. This means that the error term is normality distributed. The same is true of the LM test, which cannot reject the null hypothesis, because the F test is not significant hence the residual is not auto correlated. In the heteroskcedasticity test could not be rejected, and so this indicates that the residual is free from heteroskcedasticity. Table 8 displays the results for the Johansen's cointegration test. Both of these statistics indicates that the null hypothesis of the zero cointegrating vectors can be rejected using 5% critical value. This implies that the variables in the model are cointegrated, with one cointegrating vector. Consequently, the existence of a long run relationship between the exchange rates of Jordan and Turkey, CPI Jordan and CPI Turkey support the theory of PPP, indicating that it will hold over the estimated periods. The residuals tests for Jordan- Turkey were not significant on the rejection of null hypothesis. It follows that the error term had a normal distribution; the same was true for the null hypothesis for the LM test. Where the F test was not significant enough to reject the null hypothesis, and the residual was not auto correlated. In terms of the heteroskcedasticity test, and could show that the residual was free from   heteroskcedasticity problem.

Table 8: The Johansen's Cointegration Test for Jordan- Turkey

Null Hypothesis	Eigenvalue	Trace Statistic	5% Critical Value	Prob.**
None *	0.167	41.407	24.657	0.000
At most 1	0.052	12.498	17.894	0.345
At most 2	0.001	0.078	4.832	0.688
Null Hypothesis	Eigenvalue	Max-Eigen Statistic	5% Critical Value	Prob.**
None *	0.278	23.905	26.143	0.000
At most 1	0.067	14.401	16.564	0.165
At most 2	0.004	0.042	4.941	0.776
Diagnostic Tests:			Prob.	
Jarque-Bera Normality (Chi-sq)			0.323	
Breusch-Godfrey Serial Correlation LM Test			0.663	
White Heteroskedasticity Test (Chi-sq)			0.512	
Note: * denotes rejection of the hypothesis at the 0.05 level The number of lag used in this model is 6 All series are log transformed. Assumption used is intercept (no trend) in cointegrating equation				

The results for Johansen's cointegration test in Table 9: show that both these statistics showed that null hypothesis for the zero cointegrating vectors could be rejected using 5% critical value. This implies that the variables for this model are cointegrated with one cointegrating vector. Moreover, the existence of a long-run relationship between the exchange rates of Jordan and United State, CPI Jordan, CPI United State implies that the theory of PPP hold over the periods estimated. The diagnostic tests results showing that the test statistics residuals were normally distributed, there was, no serial correlation, no heteroskedasticity or misspecification problems, and as a result there was a failure to reject the null hypothesis. For the residual test for Jordan- United State was insignificant also indicating a failure to reject null hypothesis. The LM test failed to reject the null hypothesis. The F test was not significant, suggesting that, the residual was not auto correlated, while for the heteroskcedasticity test, the null hypothesis could not be rejected at 5% level, meaning that the residual was free from problems of heteroskcedasticity.

Table 9: The Johansen's Cointegration Test for Jordan- United State

Null Hypothesis	Eigenvalue	Trace Statistic	5% Critical Value	Prob.**
None *	0.132	43.927	26.497	0.008
At most 1	0.045	13.101	13.354	0.405
At most 2	3.543	0.005	3.543	0.837
Null Hypothesis	Eigenvalue	Max-Eigen Statistic	5% Critical Value	Prob.**
None *	0.121	27.654	25.119	0.014
At most 1	0.045	16.455	13.234	0.132
At most 2	3.432	0.005	3.453	0.786

Diagnostic Tests:	Prob.
Jarque-Bera Normality (Chi-sq)	0.565
Breusch-Godfrey Serial Correlation LM Test	0.243
White Heteroskedasticity Test (Chi-sq)	0.087

Note: * denotes rejection of the hypothesis at the 0.05 level
The number of lag used in this model is 12
All series are log transformed.
Assumption used is intercept (no trend) in cointegrating equation

5. Conclusion

The Middle East countries are an important economics region yet it is an under studied area. The main purpose of this paper is to examine the validity of Purchasing Power Parity between Jordan and its major trading partners namely, Japan, United Kingdom, Turkey and United State, based on data covering the period of 2000M1-2012M12. First we test the stationarity of the real exchange rate for the strong form of PPP applying ADF, PP and KPSS unit root tests. The results show that, the real exchange rate in each country is not stationary. This implies that the long-run PPP fails to hold for all countries. There are many possible reasons for the failure of PPP. The unit-root tests of real exchange rates impose the proportional restriction among exchange rates and prices; the lack power of the tests and short span of data could be a possible reason and transportation cost could be another possible reason. Another contributing factor to deviations from PPP is imperfect competition in the market. Imperfect competition may result in price discrimination. Trade barriers hinder international arbitrage is likely to influence relative prices asymmetrically and make trade expensive and consequently shows less evidence of PPP (Cheung and Lai, 2000). Second, we employs the Johansen cointegration test to test the weak form of PPP. Before proceed to cointegration test, we apply unit root test of ADF test to examine the stationarity of the data. The result of ADF test clearly shown that for all the countries the null hypothesis of unit root cannot be rejected when all the variables are in the level but can be rejected when they are tested at first difference; this means all the variables are stationary at first difference. After we confirm that all series are integrated of order one, we employ the Johansen cointegration test to examine the long-run relationship among these variables. The results of cointegration tests showed that there exists a cointegrating relationship for all the countries between exchange rate, domestic and foreign price levels. We conclude the evidence of weak PPP is found between Jordan and its major trading partners. Various diagnostic tests had been performed to ensure the robustness of the model. One implication of unit root is that the restrictive conditions of proportionality and symmetry restrictions are satisfied in PPP that is nominal exchange rates and aggregate prices move together in a one-to-one fashion in the long run. However, transportation costs, and differences in the composition of price indexes may each lead to violations of proportionality and symmetry in PPP, leading to the looser definition of so-called weak PPP (Taylor, 1988; Cheung and Lai, 1993; Pippenger, 1993). The weak version of the PPP hypothesis states that the nominal exchange rate and aggregate price ratios may move together in equilibrium, but the relationship need not necessarily be one-to-one. Last but not least, we conclude that, this paper found evidence for weak PPP but failed to find any evidence in the strong PPP. PPP is one of the simplest ways to predict exchange rate movement, the finding of the existence of a meaningful long-run relationship between exchange rate and relative prices gives policy makers, traders, investors and tourists a simple way to predict exchange rate.

Policy makers can also find some comfort in these results since predictability in the exchange rate would allow them to better gauge the value of their international reserves, their debt positions, and their competitiveness in international goods markets. However, just as any tool or method, we must be aware of the conditions for the validity of PPP and understand how we can utilize this model in a proper way. Although the existence of cointegrationg relationship allows one to forecast, one need to aware that cointegration is only necessary and not sufficient condition for forecasting. Since this paper did not use the estimated relationship to forecast and measure the forecast error, one cannot conclude on the forecasting performance of PPP.

References

Abumustafa, N. I. (2006) New Evidence of the Validity of Purchasing Power Parity from Jordan, Applied Economic Letters13, 379-383.

Acaravci S. K and Acaravci (2007), Purchasing Power Parity under the Current Float, International research Journal of finance and economics 10, 1450-2887.

Adler, M., and Lehmann, B. (1983), "Deviations from Purchasing Power in the Long Run", Journal of Finance, 38: 1471-1487.

Alba J. D. and Papell D.H (2007), Purchasing Power Parity and country Characteristics: Evidence from panel data tests, Journal of development economics 83, 240-251.

Alba, J. D and Park, D. (2003), Purchasing Power Parity in Developing Countries: Multi-Period Evidence under the Current Float, World Development, 31, 2049-2060.

Alba, J.D and Papell, D.H (2005), "Purchasing Power Parity and Countries Characteristics: Evidence from Panel Data Tests", Division of economics, Singapore, Nanyang Technological University.

Al-Rabbaie, A. and Hunt, L. (2004) Panel Unit Roots and Cointegration: Evidence for OECD Energy Demand, IAEE European conference.

Anderson, J.E. and Wincoop, E.V (2004), Trade Costs. Journal of Economic Literature.

Antweiler, W. (2005). Purchasing Power Parity, the University of British Columbia, Sander School of Business, Pacific Exchange Rate Service, Canada.

Aslan, O., and Korap, L. (2009) Are Real Exchange Rates Mean Reverting? Evidence from a Panel of OECD Countries, Applied Economics Letters, 16, 23-27.

Azali M, Habibullah, M.S and Baharumshah A. Z (2001), Does PPP Hold Between Asian and Japanese Economies? Evidence Using Panel Unit Root and Panel Cointegration Japan and the World Economy 13, 35-50.

Bashier A. and Talal, B. (2007) Forecasting Foreign Direct Investment Inflow in Jordan: Univariate ARIMA Model, Journal of Social Sciences. 3, 1-6, 1549-3652.

Central Bank of Jordan (various issues) annual report 1993, 1998, 2002, 2006).Cerrato M. and Sarantis N. (2008), Symmetry, Proportionality and the

Purchasing Power Parity: Evidence from Panel Cointegration Tests. International Review of Economics and Finance 17, 56–65.

Cheng. S. Y., Wei, J. S. and Hou, H (2008). A Cointegration Analysis of

Purchasing Power Parity and Country Risk, International Journal of Business and Economics, 7: 199-211.

Cheung Y. W and Lai K. S (1993b), Long Run Purchasing Power Parity During the Recent Float, Journal of International Economics, 34: 181-192.

Cheung, Y. and Lai, K. (1998), "Parity Reversion in Real Exchange Rates during the Post-Bretton Woods Period", Journal of International Money and Finance, 17: 597-614.

Choi, I. (2001). "Unit Root Tests for Panel Data," Journal of International Money and Finance, 20:249–272.

Cooper, J. C. B (1994), Purchasing Power Parity: A Cointegration Analysis of the Australian, New Zealand and Singaporean Currencies, Applied Economics Letters, 1, 167–171.

Culver, S. and Papell, D. (1999) Long-Run Purchasing Power Parity with Short Run Data: Evidence with a Null Hypothesis of Stationarity. Journal of International Money and Finance 18, 751–768.

Darby, M.R (1980), "Does Purchasing Power Parity Work? Working Paper, Cambridge, MA, NBER. N°607.

Dickey, D.A. and W.A. Fuller (1979). "Distribution of the Estimators for Autoregressive Time Series with a Unit Root," Journal of the American Statistical Association, 74, 427–431.

Drine, I. and Rault, C. (2008), Purchasing Power Parity for Developing and Developed Countries, What can we learn from Non-Stationary Panel Data Models? Journal of Economic Surveys 22, 752-773.

Drine, I.and Rault, C. (2003),"A re-Examination of the Purchasing Power Parity using Nonstationary Dynamic Panel Methods: a Comparative Approach for Developing and Developed Countries", Unpublished manuscript, William Davidson Institute at the University of Michigan Stephen M. Ross Business School, Working Paper, Number 570.

Drine, I.and Rault, C. Egert B., Lommatzsch K. And Rault C. (2003), The Balassa- Samuelson Effect in Central and Eastern Europe: Myth or Reality? Journal of Comparative, 31, 552-572.

Doganlar, M. (1999), Testing Long-run Validity of Purchasing Power Parity for Asian Countries, Applied Economics Letters, 6, 147-51.

Edisson, H.J. (1987), "Purchasing Power Parity in the Long-Run: A Test of the Dollar/Pound Exchange Rate, 1890-1978", Journal of Money, Credit and Banking, 19: 376-387.

Elliot, G., Rothenberg, T.J and Stock, J.H (1996), "Efficient Tests for an Autoregressive Unit Root", Econometrica, 64: 813-836.

Enders, W. (2004) Applied econometric time series. (2nd ed.). United States of America: John Wiley and Sons.

Engle, R.F. (1987). Cointegration and Error-Correction: Representation, Estimation and Testing. Econometrica 55, 251-276.

Engle, R.F. (1982). "Autoregressive Conditional Heteroskedasticity with Estimates of the Variance of U.K. Inflation," Econometrica, 50, 987–1008.

Frankel, J.A. (1978), "Purchasing Power Parity: Doctrine Perspective and Evidence from the 1920s", Journal of International Economics, 8: 169-191.

Frankel, J.A. and Rose A.K (1996), "A panel Projection Purchasing Power Parity: Mean Reversion Within and Between Countries", Journal of International Economics, 40: 209-244.

Froot, K.A and Rogoff, K. (1995), Perspective on PPP and Long Run Real Exchange Rates, In Handbook of International Economics, Vol. 3, Edited by G. Grossman   and K. Rogoff. Amsterdam: North Holland.

Godfrey, L. G. (1978). "Testing for Multiplicative Heteroscedasticity," Journal of Econometrics, 8, 227–236.

Holmes, J. (2000), "Does PPP Holds in African Less Developed Countries? Evidence from a Panel Data and Root Test", Journal of Applied Economics, 9, 63-78.

Im, K. -S., Peasaran, H. M., Shin, Y., (1997). Testing for unit roots in Heterogeneous panels, Working Paper 9526, Department of Applied Economics, University of Cambridge, forthcoming in the Journal of Econometrics.

Im, K.S, Pesaran, H.M and Shin, Y. (2003), "Testing for Unit Roots in Heterogeneous Panels", Journal of Econometrics, 115: 53-74.

Jiranyakul, K. and Batavia, B. (2009) Does Purchasing Power Parity Hold in Thailand? International Journal of Applied Economics and Econometrics.

Johansen S. and Juselius, K. (1990), Testing Structural Hypothesis in a Multivariate Cointegration Analysis of the PPP for UK, Journal of Econometrics 53: 211-244.

Johansen, S. (1988), Statistical Analysis of Cointegration Vectors, Journal of Economic dynamics and Control, 12: 231-254.

Johansen, S., Juselius, K. (1992), "Testing Structural Hypothesis in a Multivariate Cointegration Analysis of the PPP and the UIP for UK", Journal of Econometrics, 53: 211-244.

Kai, Li, (1998), "Testing Symmetry and Proportionality in PPP: A panel Data Approach", Forthcoming in Journal of Business and Economic Statistics.

Kalyoncu H. and Kalyoncu K. (2008) Purchasing Power Parity in OECD Countries: Evidence from Panel Unit Root, Economic Modelling 25.440–445.

Kargbo Joseph, M.R (2003), "Cointegration Tests of Purchasing Power Parity in Africa", World Development, 31,1673-1685.

Krugman P. and Obstfeld, M,. (2009) International Economics: Theory and Policy, Scott, Foresman and Company.

Krugman P. and Obstfeld, M,. (1990) International Economics: Theory and Policy, 8th Edition Pearson Adisson USA 394-389.

Kwiatkowski, D.B. Phillips, P., Schmidt and Shin, Y. (1992). "Testing the Null Hypothesis of Stationary against the Alternative of a Unit Root," Journal of Econometrics, 54, 159-178.

Lavan Mahadeva, and Paul Robinson (2004) Unit Root Testing to Help Model Building, Centre for Central Banking Studies, Bank of England, London EC2R 8AH.

Lothian, J. (1997). Multi-Country Evidence on the Behavior of Purchasing Power Parity under the Current Float. Journal of International Money and Finance 16, 19–35.

MacKinnon, James G. (1991). "Critical Values for Cointegration Tests," Chapter 13 in R. F. Engle and C.W. J. Granger (eds.), Long-run Economic Relationships: Readings in Cointegration, Oxford: Oxford University Press.

MacKinnon, James G. (1996). "Numerical Distribution Functions for Unit Root and Cointegration Tests," Journal of Applied Econometrics, 11, 601-618.

Manzur, M. and Ariff, M. (1995) Purchasing Power Parity: New Methods and Extension, Applied Financial Economics, 5, 19-26.

Michael, R. Pakko, and Patricia, S. Pollard (2003), Burgernomics: A Big Mac™ Guide to Purchasing Power Parity, the Federal Reserve Bank of St. Louis.

Nagayasu, J. (1998), "Does the long-Run PPP Hypothesis Hold for Africa?

Evidence from Panel Co-Integration Study", Working Paper 98/123, International Monetary Fund, Washington, D.C.

Nasair S.A (2003). Testing the Validity of Purchasing Power Parity for Asia Countries during the Current Float, Journal of economic development 28, 2.

Nejib, H. (2008) the Purchasing Power Parity and the Symmetry, Proportionality Conditions: Panel Cointegration Evidence from Some African Countries, International Research Journal of Finance and Economics ISSN 16, 1450-2887.

Ng, S and Perron. P (2001), "Lag Length Selection and the Construction of Unit Root Tests with Good Size and Power," Econometrica, 69(6), 1519-1554.

O'Connell, P.G.J (1998), "The Overvaluation of Purchasing Power Parity", Journal of International Economics, 44: 1-19.

Oskooee, B. M (1998) Do Exchange Rates Follow a Random Walk Process in Middle Eastern Countries? Economic Letter.

Osterwald-Lenum, Michael (1992). "A Note with Quantiles of the Asymptotic Distribution of the Maximum Likelihood Cointegration Rank Test Statistics," Oxford Bulletin of Economics and Statistics, 54, 461–472.

Papell, D. (1997), "Searching for Stationarity: Purchasing Power Parity Under the Recent Float, Journal of International Economics, 43: 313-332.

Papell, D., Theodoridis, H., (2001). The Choice of Numeraire Currency in Panel Tests of Purchasing Power Parity. Journal of Money, Credit, and Banking 33, 790–803.

Papell, D.H. (2002). The Great Appreciation, the Great Depreciation, and the Purchasing Power Parity Hypothesis, Journal of International Economics, 57, 51-82.

Pedroni, P. (1997a), "Panel Cointegration: Asymptotic and Finite Sample Proprieties of Pooled Time Series with an Application to the PPP Hypothesis: New results" Working Paper, Indiana University.

Pedroni, P. (1999), "Critical Values for Cointegrating Tests in Heterogeneous Panels with Multiple Regressors", Oxford Bulletin of Economics and Statistics, 61, Supplement 653-670.

Pedroni, P. (2004), "Panel Cointegration: Asymptotic and Finite Sample Properties of Pooled Time Series Tests with an Application to the Purchasing Power Parity Hypothesis", Econometric Theory, 20, 597-625.

Phylaktis, K. and Kassimatia, Y. (1994), Does the Real Exchange Rate Follow a Random Walk, the Pacific Basin Perspective, Journal of International Money and Finance, 13, 476-495.

Phillips, P.C.B. and P. Perron (1988). "Testing for a Unit Root in Time Series Regression," Biometrika, 75,335–346.

Pippenger, M. (1993) Cointegration Tests for Purchasing Power parity: The Case of Swiss Exchange Rates, Journal of International Money and Finance, 12, 46-61.

Robert Lafrance, and Lawrence Schembri (2002), Purchasing-Power Parity: Definition, Measurement, and Interpretation, Bank of Canada Review • AUTUMN.

Rogoff, K. (1996), "The Purchasing Power Parity Puzzle", Journal of Economic literature, 647-668.

Said, Said E. and David A. Dickey (1984). "Testing for Unit Roots in Autoregressive Moving Average Models of Unknown Order," Biometrika, 71, 599–607.

Salehizadeh M. and Taylor R. (1999), a Test of Purchasing Power Parity for Emerging Economies, Journal of International Financial Markets, Institutions and Money 9.183–193.

Sarno, L. (2000), "Real Exchange Rate Behavior in High Inflation Countries: Empirical Evidence from Turkey, 1980-1997, Applied Economics Letters, 7: 285-291.

Sarno, L., & Taylor, M. P. (2002), Purchasing Power Parity and the Real Exchange Rate, IMF Staff Papers, 49, 65−105.

Sideris, D. (2006). Testing for Long-Run PPP in a System Context: Evidence for the US, Germany and Japan, Journal of International Financial Markets, Institutions and Money 16, 143–154.

Suranovic, S. (1997. Introduction to Purchasing Power Parity (PPP), Chapter 30. Taylor, M.P and Sarno L (1998), "The Behaviour of Real Exchange Rates During the post Bretton-Woods Period", Journal of International Economics, 46: 281-312.

Taylor, M.P, and McMahon, P.C. (1988), "Long-Run Purchasing Power Parity in the 1920s", European Economic Review, 32: 179-197.

Taylor, M. P. (1988) An Empirical Examination of Long Run Purchasing Power Parity Using Cointegration Techniques. Applied Economics, 20-1369-1381.

Wang, P. (2000). Testing PPP for Asian Economies during the Recent Floating Period. Applied economics letters, 7, 545-548.

White, Halbert (1980)."A Heteroskedasticity-Consistent Covariance Matrix and a Direct Test for Heteroskedasticity," Econometrica, 48, 817–838.

Wooldridge, Jeffrey M. (1990). "Quasi-Likelihood Methods for Count Data," Chapter 8 in M. Hashem Pesaran and P. Schmidt (eds.) Handbook of Applied Econometrics, Volume 2, Malden, MA: Blackwell, 352–406.

Wu, J.L. Tsai J.L. and Chen, S.L. (2004), Are Real Exchange Rates Non-Stationary? The Pacific Basin Perspective, Journal of Asian Economics, 15, 425-438.

Zhang, S., Lowinger, T.C. (2006), An Empirical Test of Purchasing Power Parity in Selected Developed Countries: A Panel Data Approach, International economic Journal 20, 79-86.