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PURCHASING POWER PARITY AND ITS VALIDITY IN THE SOUTH ASIAN COUNTRIES

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PURCHASING POWER PARITY AND ITS VALIDITY IN THE SOUTH ASIAN COUNTRIES

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Abstract

This paper examines the validity of Purchasing Power Parity (PPP) in the context of South Asian countries namely India, Sri Lanka and Pakistan. The study verifies the PPP hypothesis that it is more pronounced either in developed countries as a group or developing countries but not between developed and developing countries. The study uses the Cointegration technique and concludes that PPP is quite feasible among the South Asian countries with India as a base country.

Introduction

Purchasing Power Parity (PPP) is one of the solid foundations of exchange rate determination in an open economy. Humphrey and Keleher (1982) documented that the roots of the PPP extended back more than two centuries and Bernholz (1982) traced it back more than four centuries. The modern origin of PPP, however, was structured in the hands of Gustav Cassel in 1916. In a series of highly influential articles, Cassel (1921, 1922) promoted PPP as a means of setting relative gold parities. Using post World War inflation of some of the countries, he calculated the exchange rate in order to maintain PPP. Thereafter, the basic premise of Cassel has been debated extensively in economic literature, especially after the collapse of the Bretton Woods system in 1973. The persistent volatility of foreign exchange rates, with varying high rate inflation during the post-1973 period became the central issue in order to calculate an accurate equilibrium exchange rate and maintain its stability. Though the PPP theory is considered to be one of a traditional exchange rate determination, still it possesses great importance in the present literature along with modern theories of exchange rate determination, such as

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portfolio approach and monetary approach to exchange rate determination. In fact, the portfolio approach emphasized that assets play a key role in exchange rate determination (Branson, 1977). However, this approach is only suitable for a short period to explain the exchange rate behaviour. The monetary approach, an advanced version of 'Quantity Theory of Money', explains the long-run behaviour of exchange rate (Johnson, 1972; Frenkel and Johnson, 1978). In fact, this approach considers that PPP plays a decisive role in its whole analysis. Nevertheless, in order to analyze the long-run behaviour, national price level plays a key role in determining both interest rate and the relative prices at which countries are traded. It is the PPP theory, which concern the importance of national price levels interaction with exchange rates (Krugman et al, 1991). Further, the notion of PPP plays a pertinent role in real exchange rate determination to explain the international competitiveness of a country. In this context, Edwards et al (1999) notes that in the recent period, much importance has been given to PPP to assess the long-run behaviour of the real exchange rate, at least in the case of developed countries. Thus, PPP is considered a pertinent tool in international economics research, which has been evidenced in the existing literature. However, the empirical evidence of the PPP doctrine is mixed in literature. Studies such as that of Alder and Lehman (1983), Huang (1987), Meese and Rogoff (1988) failed to find any evidence of the doctrine and other studies like that of Officer (1978), Hakkio (1984), Rush and Husted (1985), Edison (1987) supported it. Indeed, the controversy surrounding PPP is evident in the comprehensive survey by Officer (1976), Humphrey and Keleher (1982), in the entire issue of the *Journal of International Economics* (May 1978) and in Edwards et al (1999).

In the recent literature, many studies quite emphatically focused on the validity of PPP with respect to variance of time. Most of the studies in developed countries discarded its validity in the short run as these studies basically assume it as a long-run phenomenon, which deals with the co-variation between price levels and exchange rates (Dornbusch (1982); and Darby (1983)). In this context, the question arises whether PPP will hold in the long run or not? In fact, a set of studies concludes PPP as a long-run phenomenon in the developed countries (Gailliot (1970), Officer (1980), Hakkio (1982, 1984), Rush and Husted (1985) and Johnson (1990)). Though the findings of the Gailiot (1970) and Officer (1980) support PPP a long-run phenomenon with using different methodology but they tested it by assuming a base year in which PPP holds. In contrast to this assumption, the study by Rush and Husted (1985) examined the same issue without such assumption in the context of seven developed countries. Further, the study also decomposes the data for wage and consumer price index (CPI) into a low-frequency trend (or long-run) component and a high-frequency noise component. Using the distributed lag regressions, it finds that PPP holds for all developed countries.

In a comparative study, Frenkel (1981) examined the validity of PPP in both the 1920s and 1970s. The study tested the doctrine under two different conditions. First, using bilateral exchange and price level between European countries (UK, France and Germany) and US and second among the European countries. Using the two-stage least square method, the study found that in the first case PPP holds well in 1920s than 1970s. However, in the second case it got just an opposite result of the first. The study argued that the reason for the failure of PPP in the first case may be due to different factors such as: wide presence of transport costs between European countries and US and changes of commercial policies and non-tariff barriers among these countries.

In contrast to the findings of the studies that PPP does not hold during 1970s, the study by Hakkio (1984) stated that PPP holds in 1970s. The study examined PPP in the context of four developed countries during 1920s and 1970s. It tested both single and multi-equational forms of PPP to compare and contrast the results during the two different periods. Using the time-series - cross section estimation procedure with the help of a single equation, the study found that PPP holds neither in 1920s nor in 1970s. However, in case of multi-equation, the study found that PPP holds in both the periods. The study stated that such findings due to use of cross section-time series procedure, which increases the power of the test.

A study by Johnson (1990) tested the long-run validity of PPP in the context of Canada and US by using cointegration technique and error-correction mechanism. The results of the study evidenced that PPP as a long-run phenomenon where equilibrium relationship exists between Canadian prices, US prices, and the Canadian dollar and US dollar. This type of results may be due to two reasons. First the study uses long period data, which is important in considering the properties of the real exchange rate and maintenance of PPP. Second the study uses error-correction mechanisms for exchange rate change and domestic price change, which varies by choice of exchange rate regime.

A study by Fisher and Park (1991) examined the long-run validity of PPP in the context of G-10 industrial countries. The study tests PPP under the null hypothesis that exchange rates and prices are cointegrated, which is in contrast to the usual Engle-Granger two steps cointegrated technique assumption (Park, 1990). The study analyzes a wide range of cross-section data of exchange rate and prices of each country under only the flexible exchange rate (1973-88) system. The findings of the study evidenced that PPP holds in the long run.

In contrast to studies used by the bivariate approach of PPP using Engle-Granger two step technique, the study by Kugler and Lenz (1993) test the trivariate approach of PPP in the long run by using

Johansen's multivariate cointegration methodology in the context of fifteen industrial countries. Findings also suggest that PPP hold in the long run.

In case of developing countries, especially from South Asia, most of the studies examined the validity of the PPP as a long-run phenomenon. A study by Qureshi (1993) examined the validity of PPP in the context of Pakistan under both fixed (1973-81) and flexible exchange rate (1982-90) systems. It considers U.S. as the base country for empirical verification. Applying the OLS method, the study concluded that PPP is quite feasible under both fixed and flexible exchange rate systems. A recent study by Chaudhuri (1998) verified the long-run validity of PPP in the context of five South Asian countries (India, Pakistan, Sri Lanka, Nepal and Bangladesh) by using the time series techniques such as unit root and cointegration. The US and India as the separate base country for empirical analysis of this study. The results of the study evidenced that the validity of PPP is feeble in the case of US as a base country, whereas in India as a base country, PPP shows its validity in almost all cases. Another study by Doganlar (1998) examined the feasibility of PPP in the long run for five developing countries (India, Indonesia, Pakistan, Philippines and Turkey) under the flexible exchange rate system. The study considers only US as a base country for empirical verification. Using the cointgration technique (both Engle-Granger and Johansen), the study found that PPP does not hold in all cases except Turkey.

It is important to note that though there are many studies on the PPP doctrine in the context of developed countries, there is no rigorous attention paid in the case of developing countries. Most of the studies conclude that the PPP doctrine is more pronounced either in developed countries as a group or developing countries but not between developed and developing countries. The existing literature in developing countries suggest that except Chaudhuri (1998), none of the study concerned the debate that PPP is more feasible among the developing countries taken as a separate group than between developing and developed countries. However, the same study does not examine the more advanced version of PPP (tri-variate), which has much importance in the present literature. Thus, the present study examines the validity of the PPP doctrine in the context of three newly emerging developing South Asian countries such as India, Sri Lanka and Pakistan, by considering US and India as two separate base countries in order to verify the PPP doctrine.

An Overview of PPP Doctrine

The PPP doctrine comprises two versions, namely absolute and relative. The absolute version of the PPP, based on the assumption of 'Law of one price', states that the exchange rate is simply the ratio of price levels between two countries, that is

$$E = P / P^* \ldots \quad (1)$$

or in logs

$$\ln E = \ln P - \ln P^* \ldots \quad (1)/$$

where P = the domestic price level

P* = the foreign price level

E = exchange rate (expressed as units of domestic currency per unit of foreign currency).

The relative version of PPP asserts that the percentage change in the exchange rate equals the difference between the percentage change in the domestic and foreign price levels. It is expressed as:

$$\Delta E = \Delta \ln P - \Delta \ln P^* \ldots \quad (2)$$

In recent literature, many studies like Kim (1990), Choudhry et al (1991), MacDonald (1993, 1995), Mohsin and Kamaiah (1993), Lothian and Taylor (1996), Doganlar (1998) applied time series techniques to evaluate the above two versions of the PPP doctrine in the long run. Out of these studies, some examined the random walk nature of the real exchange rate (RER), few analyzed the long-run equilibrium relationship between exchange rate and relative prices and some others examined both the cases. In general, there are three specific models of PPP existing in the literature. The first one is the univariate specification, which requires that the real exchange rate should be stationary for a long-run relationship between exchange rate and relative price level. It is expressed as follows:

$$\ln (RER) = \ln E + \ln P - \ln P^* \ldots \quad (3)$$

The random walk hypothesis of equation (3) can be written as:

$$RER_t = \alpha + \beta\, RER_{t-1} + u_t \ldots \quad (4)$$

In literature, equation (4) was tested by different studies like Alder and Leheman (1983), Mark (1990), Gan (1994), Calvo et al (1995) and Coes (1995). The results of these studies show a contradictory conclusion.

The second one is the bivariate model of PPP doctrine, which is expressed as:

$$\ln E_t = \alpha_0 + \beta_0 \ln (P / P^*)_t + u_t \ldots \qquad (5)$$

Equation (5) states that for relative version to hold, β_0 should be equal to 1 and for absolute version α_0 should be zero with $\beta_0 = 1$. There are a number of studies like Taylor (1988) and Kim (1990), Gan (1994) and Seabra (1995) which tested the above model.

The third and more advanced type of PPP model is expressed in the trivariate form as:

$$\ln E_t = \alpha_1 + \beta_1 \ln P_t - \beta_2 \ln P_t^* + u_t \ldots \qquad (6)$$

The present study adopts the advanced tri-variate model and tested it by applying cointegration technique in order to find out long-run equilibrium relationship among the variables. The present study does not impose symmetry and proportionality restrictions, believing on the lines of MacDonald (1993), who argued that if transactions and trade restrictions are important, the constraints of symmetry and proportionality should not impose the coefficient of price variable. In order to estimate equation 6, this study uses the Johansen Multi-variate Cointegrating Technique, which uses maximum likelihood procedures to determine the number of cointegrating vectors of the time series. Hence, equation 6 could be re-written in the following way:

Let X_t be a vector of p potentially endogenous variables with k-lags and can be written in VAR form as:

$$X_t = \Pi_1 X_{t-1} + \Pi_2 X_{t-2} + \ldots + \Pi_2 X_{t-k} + u_t \ldots \qquad (7)$$

$$\Delta X_t = \sum_{j=1}^{k-1} \Gamma_j \Delta X_{t-j} + \Pi_2 X_{t-k} + u_t \ldots \qquad (8)$$

where $\Gamma_j = -I + \Pi_1 + \Pi_2 + \ldots + \Pi_j$

and $\Pi = -I - \Pi_1 - \Pi_2 - \ldots - \Pi_k$

The study uses 3 time series endogenous variables (p) such as exchange rate (E), domestic price (P) and foreign price (P*). The matrix Π is the long-run impact matrix. The rank r of the matrix Π in equation (8) determines the number of cointegrating vectors in the VAR. If r = 0 then there is no cointegrating vector. The Johansen approach is developed to determine the number of cointegrating vectors r in VAR. The details of

the procedure can be found in Johansen (1988) and Johansen and Juselius (1990). There are two types of likelihood ratio tests in order to determine the value of r. These are maximum eigen value (λ_{max}) and trace (λ_{trace}) tests. The related statistics are as follows:

$$\lambda_{max} = -2 \text{ In } (Q) = - T \text{ In } (1 - \lambda_{r+1}) \ldots \quad (9)$$

$$\lambda_{trace} = -2 \text{ In } (Q) = - T \sum_{j=r+1}^{3} \text{In } (1 - \lambda_j) \ldots \quad (10)$$

Empirical Analysis

The study uses the cointegration technique to examine the long-run relationship among the variables underlying the trivariate specification (Equation 6) of the doctrine. It is important to note that this study chooses the period from 1982 to 1998, considering only the flexible exchange rate system. The year 1982 has been chosen as starting period of flexible exchange rate system for all the South Asian countries. It is reported in the existing literature that the Indian Rupee floated since September 1975, Pakistan Rupee since January 1982, and Sri Lankan Rupee since November 1977 (Qureshi 1993, Doganlar 1998, Hossain et al 1999). The data used are monthly frequency for nominal exchange rate (currency of each South Asian country per U.S. dollar, and currency of Sri Lanka and Pakistan per Indian Rupee) and consumer price index of each country. It has been argued that the CPI is the better proxy for domestic and foreign price level to calculate real exchange rate than WPI as it gives the equal weightage to both traded and non-traded goods (McKinnon, 1971). Further, Rush and Husted (1985) also argued that CPI is a better proxy for price than other indices because it not only contains prices of second-hand goods but also currently produced goods. All data are collected from various issues of IMF's International Financial Statistics (IFS).

The unit root test is conducted in order to check the stationary properties of data as well as to check the order of integration before applying the cointegration test. The present study uses two unit root tests, namely Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) for the same purpose. Table 1 through Table 4 shows the results of unit root tests for both India and US as base country. In the first case, the results of variables at various levels are reported in Table 1, thereby indicating that the null hypothesis of unit root cannot be rejected even at 10 per cent level. However, the null hypothesis is rejected for all the variables in their first difference (Table 3). Thus, all the relevant variables

are stationary in their first difference and are integrated of order one, that is I (1). Using India as a base country, the results also confirm the same conclusion. Table 2 shows that all variables have unit root in their level. However, all are stationary in their first difference (Table 4).

Confirming that all variables are integrated at the same order, which is most suitable for the application of cointegration technique, the present study employs the Johansen maximum likelihood test to find out the long-run equilibrium relationship among the variables. The results of the cointegration test for the US as a base country are reported in Table 5. The results show that trace statistics with null hypothesis of variables are not cointegrated ($r = 0$) against the alternative of one or more cointegrating vectors ($r > 0$), which is rejected only in case of Sri Lanka. It is also evident that the null hypothesis of $r \leq 1$ against the alternative of $r > 1$ is rejected at 5 per cent significance level in the case of the same country. The λ_{max} statistics shows the presence of two cointegrating vectors in the case of Sri Lanka but not even a single cointegrating vector for India and Pakistan. In the case of India as a base country, the results of trace statistics illustrate that the null hypothesis of variables are not cointegrated ($r = 0$) against the alternative of one or more cointegrating vectors ($r > 0$) and are rejected in the case of both the countries at 10 per cent significance level (Table 6). The λ_{max} statistics also confirm the same conclusion in both the cases. Thus, the results demonstrate that there is a single cointegrating vector for both Sri Lanka and Pakistan.

The presence of a cointegrating vector shows that there exists a long-run relationship among the concerned variables. However, the results differ widely from one case to another. In the case of US as a base country, the study found that PPP holds true only in case of Sri Lanka, whereas in case of India as a base country, the doctrine posits its validity among all the three South Asian countries. The weak result evidenced only in the first case may be attributed due to the significant differences in inflation rate, productivity differentials due to different kinds of technology used in the production process, consumer preferences and significant trade barriers that existed between developing and developed countries.

Conclusion

The present study re-examines the validity of Purchasing Power Parity (PPP) in the long run in the context of three South Asian countries, namely India, Sri Lanka and Pakistan. Considering the broad conclusion that PPP is more pronounced either in developed countries as a group or developing countries rather than between developed and developing countries, the present study assumed that U.S. and India are two separate base countries to verify it. The study concludes from the cointegration results that PPP is quite feasible among the South Asian countries with India as a base

country. However, in the first case (i.e. U.S.) it does not find any strong evidence of PPP. The reasons may be due to significant differences in inflation rate, productivity differentials due to different kinds of technology used in the production process, consumer preferences and significant trade barriers that existed between the US and South Asian countries.

Table 1: Unit Root Test for US as a base country

Variables are in Level	ADF	PP
IE	-1.940(1)	-1.983(1)
SE	-2.643(1)	-3.305(1)
PE	-2.880(1)	-3.128(1)
IP	-2.985(1)	-2.737(1)
SP	-2.795(1)	-2.421(1)
PP	-1.641(1)	-1.702(1)
USP	-2.283(1)	-3.124(1)

Note: IE = exchange rate between India and US, SE = exchange rate between Sri Lanka and US, PE = exchange rate between Pakistan and US, IP = CPI of India, SP = CPI of Sri Lanka, PP = CPI of Pakistan, USP = CPI of US. Critical values for the above three tests for 204 observations are -3.99 (at 1 per cent level), -3.43 (at 5 per cent level), and -3.13 (at 10 per cent level)

Table 2: Unit Root Test for India as a base country

Variables are in Level	ADF	PP
SIE	-2.102(1)	-2.353(1)
PIE	-2.140(1)	-2.486(1)
IP	-2.985(1)	-2.737(1)
SP	-2.795(1)	-2.421(1)
PP	-1.641(1)	-1.702(1)

Note: SIE = Exchange rate between Sri Lanka and India, PIE = Exchange rate between Pakistan and India. Critical values for the above three tests for 204 observations are -3.99 (at 1 per cent level), -3.43 (at 5 per cent level), and -3.13 (at 10 per cent level)

Table 3: Unit Root Test for US as a base country

Variables are first difference	ADF	PP
DIE	-5.001(8)	-15.109(8)
DSE	-4.970(8)	-19.210(8)
DPE	-5.511(8)	-13.575(8)
DIP	-6.225(8)	-11.135(8)
DSP	-5.106(8)	-10.851(8)
DPP	-5.249(8)	-16.171(8)
DUSP	-6.773(8)	-13.888(8)

Note: IE = exchange rate between India and US, SE = exchange rate between Sri Lanka and US, PE = exchange rate between Pakistan and US, IP = CPI of India, SP = CPI of Sri Lanka, PP = CPI of Pakistan, USP = CPI of US. Critical values for the above three tests for 204 observations are -3.99 (at 1 per cent level), -3.43 (at 5 per cent level), and -3.13 (at 10 per cent level)

Table 4: Unit Root Test for India as a base country

Variables are first difference	ADF	PP
DSIE	-4.510(8)	-16.435(8)
DPIE	-4.962(8)	-19.853(8)
DIP	-6.225(8)	-11.135(8)
DSP	-5.106(8)	-10.851(8)
DPP	-5.249(8)	-16.171(8)

Note: SIE = Exchange rate between Sri Lanka and India, PIE = Exchange rate between Pakistan and India. Critical values for the above three tests for 204 observations are -3.99 (at 1 per cent level), -3.43 (at 5 per cent level), and -3.13 (at 10 per cent level)

Table 5: Cointegration test of Johansen maximum likelihood estimation US as a base country

Null Hypothesis	Alternative Hypothesis	India	Sri Lanka	Pakistan	Critical Values	
Trace Test					5%	10%
$r = 0$	$r > 0$	19.85	49.72	25.89	29.68	26.79
$r \leq 1$	$r > 1$	5.30	16.39	11.48	15.14	13.33
$r \leq 2$	$r \geq 2$	0.09	0.40	0.50	3.76	2.69
λ_{MAX} test						
$r = 0$	$r = 1$	14.55	33.33	18.01	20.97	18.60
$r = 1$	$r = 2$	5.21	15.99	9.98	14.07	12.07
$r = 2$	$r = 3$	0.09	0.40	0.50	3.76	2.69

Note: r refers to the number of cointegrating vectors.

Table 6: Cointegration test of Johansen maximum likelihood estimation India as a base country

Null Hypothesis	Alternative Hypothesis	Sri Lanka	Pakistan	Critical Values	
Trace Test				5%	10%
$r = 0$	$r > 0$	29.08	28.25	29.68	26.79
$r \leq 1$	$r > 1$	7.17	7.02	15.14	13.33
$r \leq 2$	$r \geq 2$	0.01	0.52	3.76	2.69
λ_{MAX} test					
$r = 0$	$r = 1$	21.91	19.57	20.97	18.60
$r = 1$	$r = 2$	7.16	6.01	14.07	12.07
$r = 2$	$r = 3$	0.01	0.52	3.76	2.69

Note: r refers to the number of cointegrating vectors.

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