

ON PURCHASING POWER PARITY BETWEEN PAKISTAN AND OTHER ASIAN COUNTRIES

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ABSTRACT

This paper focuses on long-run purchasing power parity (PPP) for Pak-Rupee exchange rates vis-à-vis Asian currencies – Indian rupee, Indonesian rupiah, Japanese yen, Korean won, Philippines peso, Singapore dollar, “Siri Lankan” rupee and Thai baht over the period 1982:1-1998:4. Results obtained by employing the Johansen (1988) maximum likelihood technique of cointegration and coefficient restrictions tests are supportive of PPP for five out of eight exchange rates, while those obtained from the Engle-Granger (1987) and Phillips-Ouliaris (1990) residual-based” cointegration tests are supportive of PPP for five out of eight exchange rates, while those obtained from the Engle-Granger (1987) and Phillips-Ouliaris (1990) residual-based - cointegration tests are not. One conclusion that emerges from these results is that goods and foreign exchange markets in Pakistan seem to have achieved high degree of integration with those of the South East Asian countries.

I. INTRODUCTION

The purchasing power parity (PPP) hypothesis, which postulates an equilibrium relationship between the ratio of the current to base period exchange rate, the ratio of the current to base period domestic price level and the ratio of the current to base period foreign price level, was originally put forward by Cassel (1916). This is the first, earliest explanation of exchange rate determination postulating that, under floating exchange rate regime, if disturbances are of purely monetary nature and if they overshadow the real disturbances, then equi-proportionate changes which occur in commodity prices following monetary expansions across countries ultimately keep the nominal exchange rate between the currencies in line with the ratio of the domestic to foreign price index and the real exchange rate unchanged over time.² In essence, it is the inflation differential (indicating an average rate of change in the ratio of the general level of prices measured by domestic and foreign price indices), and not the absolute price levels, that determines the exchange rate. The empirical validity of PPP has the following important implications. First, its validity under flexible exchange rates implies that the flexible exchange rate regime can help insulate

²PPP is such a useful hypothesis as having relevance to both flexible and fixed exchange rate regimes. While PPP is a theory of exchange rate determination under a flexible exchange rate regime, it is a theory of the transmission of world inflation under a fixed exchange rate regime. Under fixed exchange rates it implies that inflation rates, subject to certain reservations, must be equal in all countries of an integrated world economy (see, for example, Genberg, 1978).

economies from foreign shocks by stabilising real exchange rates of their currencies over time; intervene in foreign exchange markets to manage exchange rates of their currencies (Frenkel, 1981; p. 145). Second, if the real exchange rate turns out to be unchanged (mean reverting) over time, then national governments around the world will be unable to run monetary policies independently, and devaluation will not work to improve a country's external competitiveness (Shapiro, 1983; p.297). Third, the validity of PPP also implies the degree of integration between goods and foreign exchange markets around the world (Moosa and Bhatti, 1997; p.1); consequently, the nominal exchange rate between two national currencies will adjust to offset the excess of domestic over foreign inflation, keeping the real exchange rate constant over time.³

Enormous empirical work has been conducted to examine the validity of the PPP hypothesis for a large number of currencies under both fixed and flexible exchange rates around the world. This work can be divided into six main directions.⁴ First, a number of studies carried out, *inter alia*, by Frenkel (1978), Krugman (1978), Taylor and McMahon (1988), Ardeni and Lubian (1989), Ahking (1990), Phylaktis (1990, 1992), Taylor (1992) and Bleany (1992, 1993) who examined the PPP hypothesis for a number of currencies over the floating exchange rates of the 1920s, documenting evidence that is generally supportive of the hypothesis for almost all exchange rates, except for those involving the U.S. dollar. Second, the majority of researchers, including Frenkel (1981), Taylor (1988), Patel (1990), Layton and Stark (1990), Nachane and Chrissanthaki (1991), Crowder (1992), Sarantis and Stewart (1993), MacDonald (1993), Cheung and Lai (1993), Cooper (1994), Moosa and Bhatti (1996)

³ PPP can be used to serve other purposes as well. For a brief review see Bhatti (1996; p. 671).

⁴ Many researchers have also focused on rationalising the failure of PPP. First, Balassa (1964) argues that productivity growth tends to be higher in traded goods sectors than in non-traded goods sectors, so that the price of traded goods will tend to fall relative to the price of non-traded goods. Therefore, if PPP is applied only to traded goods, then an increase (a decrease) in the relative price of non-traded goods will lead to over-valuation (under-valuation) of the domestic currency relative to the PPP value, causing a systematic bias in the PPP relationship. While studies using cross sectional data (e.g. Clague and Tanzi, 1972; Officer, 1976; and Clague, 1988) generally rejected the Balassa hypothesis, those using time series data (e.g. Hsieh, 1982; Bahmani-Oskooee, 1992; and Moosa, 1994) did not generally. Second, it is argued that PPP is likely to fare well in case it is tested in combination with uncovered interest parity. Testing the PPP equation by incorporating the interest rate differential as an additional explanatory variable, Johansen and Juselius (1992) found results supportive of PPP. These results were supported by Hunter (1992), while those obtained by Edison and Melick (1992) were in direct contrast with them. Third, Bhatti and Moosa (1994) argue that conventional PPP fails to fare well over the current flexible exchange rate regime because it neglects the role of uncertainty and expectations in exchange rate determination. Based on *ex ante* PPP, they put forward a new view of exchange rate determination which postulates that in efficient markets in which there is presence of uncertainty and expectations about the future, the exchange rate is determined not only by current relative prices but also by the expected real exchange rate. They tested this view for 10 industrial currencies over the period 1972:1-1993:7 and obtained results which were highly supportive in all cases. These were strongly supported by Bhatti (1997) who tested the view for Pak-rupee exchange rates.

and Bhatti (1996), tested the PPP hypothesis for the Post-Bretton Woods flexible exchange rates producing evidence that is generally un-supportive of the hypothesis.⁵ While all such studies investigated the performance of PPP at the macro level by employing data on national price indices, studies conducted, *inter alia*, by Isard (1977), Richardson (1978), Brenton and Parikh (1987), Goodwin *et al* (1990) and Fraser *et al* (1991) focused on investigating its performance at the micro level by employing data on dis-aggregated price levels.⁶ Third, a number of researchers, among others, Gubitz (1988), Karfakis and Moschos (1989), Nachane and Chrissanthaki (1991), Fisher and Park (1991), Bleany (1991), Kugler and Lenz (1993) and Dockery and Georgellis (1994) tested the hypothesis for EMS and non-EMS currencies⁷ producing evidence indicating that the validity of PPP cannot be rejected for some EMS and non-EMS currencies. Fourth, studies conducted, for example, by McNown and Wallace (1989), Liu (1992), Conejo and Shields (1993) and Mahadavi and Zhou (1994) examined PPP for the countries experiencing hyperinflation and produced evidence which was strongly supportive of the hypothesis. Fifth, many researchers, *inter alia*, Lothian (1990), Ardeni and Lubian (1991), Tronzano (1992) and Moosa (1994) tested PPP using low frequency (annual) data stretching over a century or more than a century, ignoring changes in exchange rate regimes, and produced evidence supporting the hypothesis. Sixth, many studies conducted, among others, by Huizinga (1987), Kaminsky (1987), Abuaf and Jorion (1990) and Whitt (1992) tested the hypothesis if the real exchange rate is mean-reverting over time;

⁵ The exceptions are MacDonald (1993), Cheung and Lai (1993), Bhatti (1996) and Moosa and Bhatti (1996), of which the former three studies produced results supportive of PPP by employing the Johansen (1988) maximum likelihood technique of cointegration, the latter by employing the Stock-Watson (1993) dynamic ordinary least squares estimator. Moreover, the results obtained by Bhatti (1996) and Moosa and Bhatti (1996) also lent support to mean reversion in the real exchange rate by employing the Sims (1988) Bayesian and the variance ratio (Cochrane, 1988; and Malliaris and Umitia, 1990) unit root tests, which are more powerful than the conventional tests developed by Dickey-Fuller (1979,1981).

⁶ Overall, the evidence on PPP seems to be mixed at the micro level. For a brief survey see Moosa and Bhatti (1997; pp. 216-218).

⁷ Frenkel (1981) was the first to claim that PPP is likely to fare better among the neighbouring European countries than among each of these countries and the U.S. This is because European countries have experienced strong trade linkages and exchange rate stability amongst themselves but not with the U.S. in the latter case. More specifically, arrangements such as relatively lower transportation costs, the gradual abolition of trade barriers and capital controls, and institutional agreements like the Snake and latter the European Monetary System are thought to have facilitated commodity arbitrage among European countries, leading to an environment highly favourable to PPP.

the results lent strong support to PPP when the more sophisticated and powerful unit root tests, such as the Sims Bayesian and the variance ratio tests, were used rather than when the conventional unit root tests, such as the Dickey-Fuller (1979, 1981) tests, were used.

It is worth noting that most of the above studies investigated the empirical validity of PPP for major industrial currencies *vis-a-vis* the U.S. dollar, with some attention focused on the EMS and non-EMS currencies of the European countries *vis-a-vis* the German mark. However, only little work has been carried out in order to examine the validity of PPP for Pak. rupee exchange for having low power to reject the null of no cointegration between exchange rates and relative prices. The objective of this paper is to re-examine PPP for Pakistan *vis-a-vis* its eight trading partners from the Asian world by employing the Engle-Granger (1987) and Phillips-Ouliaris (1990) residual-based cointegration tests as well as Johansen (1988)'s maximum likelihood test. The remainder of this paper is organised as follows. Section II presents PPP model specifications and discusses econometric procedures employed in testing them. Empirical results and their interpretations are presented in section III, while the concluding remarks are given in the final section.

II. Model Specification and Econometric Methodology

Cassel (1916) was the first to formally put forward the PPP theory of foreign exchange⁸ postulating that the exchange rate between two national currencies tends to be essentially determined by the relative purchasing power of these currencies between home and abroad. As for the relative purchasing power of the two national currencies, it was first stated in terms of relative money supplies and then translated into a relationship between prices via an application of the quantity theory of money.⁹ The PPP theory is, therefore, an extension of the quantity theory of money in an open economy, implying that doubling the money supply in the home country doubles its prices which in turn causes a proportionate increase in the exchange rate. Looked at in this perspective, the role of prices, in the PPP theory, seems to serve as a proxy to

⁸ Moosa and Bhatti (1999) argue that Cassel was the first to present PPP formally as an operational theory of foreign exchange in which monetary and non-monetary factors play a role in determining the exchange rate, and he also coined the term "purchasing power parity". Yet there are some popular misconceptions not only pertaining to the interpretation of the original exposition as put forward by Cassel but also to the empirical testing of the theory. The first misconception pertains to the interpretation of Cassel's theory in such a way as to have no resemblance to what he originally put forward in 1916 and continuously advocated throughout his subsequent writings. The second misconception is related to the empirical testing of the theory. It is argued that, at least for the purpose of empirical testing, the distinction between absolute and relative PPP is useless and, at best, redundant. The third misconception arises from the implication of testing PPP in first differences. It is argued testing PPP on the basis of the model using first differences of exchange rates and prices amounts to testing *ex ante* PPP, which implies that the real exchange rate follows a random walk. If this model is valid, then the results supportive of the first-difference PPP model will indicate the failure rather than the validity of PPP.

⁹ See Cassel (1916:p.63).

capture the effects of the underlying monetary conditions on the exchange rate. Cassel (1921; p.37) argues that if two currencies are inflated, then the actual exchange rate will be equal to the old rate multiplied by the quotient between the degrees of inflation of both countries. This view of PPP, therefore, requires the ratio of the equilibrium exchange rate in the current period, s_t to the exchange rate in some base period, S_0 , to be equal to the ratio of the domestic price index, P_t to the foreign price index, P_t^* , and as such the PPP relationship boils down to the following equation

$$S_t = S_0 (P/P^*)_t \quad (1)$$

in which case the process of exchange rate determination does not seem to rely, directly or indirectly, on commodity arbitrage but on the causal chain running from monetary disturbances to prices to exchange rates. This implies that if disturbances occurring across countries are of purely monetary nature and they overshadow the real disturbances, then the exchange rate between two countries tends to be essentially determined by their inflation differentials and the real exchange rate to be mean reverting over time.

In an empirically testable form equation (1) can be written as

$$S_t = \beta_0 + \beta_1 (p - p^*)_t + \xi_t \quad (2)$$

where lower-case letters denote the natural logarithms of the variables and β_0 is the logarithm of the exchange rate observed in the base period, S_0 . PPP holds precisely well if the restriction $(\beta_0, \beta_1) = (0, 1)$ is not rejected.

Alternatively, PPP can be tested by using a univariate model given by

$$q_t = s_t - P_t + P_t^* \quad (3)$$

where q_t is the real exchange rate reflecting deviations of the nominal exchange rate from the PPP level. Looked at in cointegration perspective, if both the variables underlying the PPP equation (2), the nominal exchange rate and the ratio of the domestic to foreign price index, are integrated of the same order ($S_t \sim I(1)$ and $(p - p^*)_t \sim I(1)$), then long-run PPP holds precisely well if the linear combination of them turns out to be stationary (i.e. $\xi_t \sim I(0)$) and the restriction $\beta_0, \beta_1 = (0, 1)$ is not rejected.¹⁰ However, this is a necessary but a sufficient condition for long-run PPP to hold precisely well, the sufficient condition being that there is one-to-one correspondence between the nominal

¹⁰However, if $\beta_0 \neq 0$ and $\beta_1 = \beta_0$, PPP will still hold precisely well and in which case non-zero value of the intercept term (β_0) will reflect the presence of transaction or transportation costs. Taylor (1988) also demonstrates that in the presence of transportation costs and/or measurement errors, even the coefficient on the relative prices (β_1) may not necessarily be equal to unity. Therefore, long-run PPP cannot be rejected if $\beta_1 > 0$

exchange rate and relative prices. In this case, empirical testing is concerned with the property of mean reversion in the real exchange rate as implied by equation (3). In the jargon of cointegration analysis, this specification implies the imposition of the restriction of (1,-1,1) on the cointegrating vector (S_t, P_t, P_t^*) . Hence it is the real exchange rate, not the residuals of the unrestricted cointegrating vector, that is tested for stationarity, i.e. $q_t \sim I(0)$.¹¹

The methodology employed in testing the PPP relationship will be cointegration analysis, which seems to be tailor-made for testing long-run relationships while allowing for short-run deviations from equilibrium. Testing for a long-run relationship between the exchange rate and the ratio of the domestic to foreign price index is carried out on the basis of three cointegration tests: two residual-based, the Engle-Granger (1987) and the Phillips-Ouliaris (1990), tests as well as Johansen's (1988) maximum likelihood test.¹² Two test statistics are used in conjunction with each test: *ADF* and *CRDW* with the Engle-Granger test, Z_α and Z_t , with the Phillips-Ouliaris and *Max* and *Trace* with the Johansen test. One problem with the residual-based cointegration tests is that the conventional standard errors and *t* ratios cannot be employed for making inference about the numerical values of the estimated coefficients because they do not have the limiting standard distribution.¹³ However, this problem may be overcome by using the corrected standard errors and *t* statistic as suggested by West (1988). The corrected *t* statistics are asymptotically normal which means that it is possible to make

III. Sample Data and Empirical Results

The PPP relationship, as implied by equation (2), is tested for Pak-rupee exchange rates *vis-a-vis* eight Asian currencies: Indian rupee, Indonesian rupiah, Japanese yen, Korean won, Philippines peso, Singapore dollar, Sri Lankan rupee and Thai bath. The sample data consists of quarterly observations on exchange rates and wholesale prices covering the flexible exchange rate period 1982:1-1998:4. The data were obtained from the IMF's *International Financial Statistics*. Before testing for cointegration, unit root testing is conducted to determine the order of integration of the variable s_t and $(p-p^*)_t$ underlying equation (2). For this purpose, the Phillips-Ouliaris (1990) Z_α and Z_t test statistics are used. These test statistics, which were originally

¹¹It is, therefore, erroneous to test PPP, as implied by equation (2), in first difference form (constituting a test of the so-called relative PPP). This is because if the error term of the first difference PPP model turns out to be a mean zero serially uncorrelated, the real exchange rate follows a random walk, which means that when a deviation in relative PPP occurs, it is unlikely to be eliminated over time. Consequently, the first difference model does not constitute a correct test of PPP because it indicates the failure rather than the validity of PPP. For a detailed discussion see Bhatti (1996).

¹²For a detailed discussion on these tests see Moosa and Bhatti (1997; pp.167-179) statistical inference about the estimated coefficients. In the case of the Johansen test, the restrictions are tested by the procedure outlined in the Johansen and Juselius (1990).

¹³See Engle and Granger (1991).

proposed by Phillips (1987), are more robust to a wide variety of serial correlation, time dependent heteroscedasticity and regime changes. The results of unit root testing, which are shown in Table 1, are consistent in indicating that both the variables, s_t I(1) and $(p - p^*)_t$ are I(1) in level and I(0) in first differences in all cases. As for testing for cointegration, it is carried out on the basis of two residual-based, the Engle-Granger (1987) and the Phillips-Ouliaris (1990), cointegration tests and the Johansen (1988) maximum likelihood test. Results obtained using the residual-based cointegration tests are presented in Table 2, while those from the Johansen (1988) maximum likelihood technique in Table 3. The results from the residual-based cointegration tests are consistent in indicating the collapse of PPP in all cases, while those from the Johansen (1988) test lend strong support to PPP in five out of eight cases. These results furnish strong support to those produced by MacDonald (1993), Cheung and Lai (1993) and Bhatti (1996) and their findings that the Johansen test is more powerful in detecting cointegration between prices and exchange rates than the residual-based cointegration tests.

Table 1: Testing for Unit Root

Country	Variable	Level		First Difference	
		Z_a	Z_t	Z_a	Z_t
Pakistan/India	s_t	-3.09	-1.26	-63.68*	-7.95*
	$(P - P^*)_t$	0.09	0.46	-55.87*	-6.90*
Pakistan/Indonesi	s_t	-7.16	-1.60	-30.84*	-4.79*
	$(P - P^*)_t$	-6.39	-1.18	-38.16*	-5.03*
Pakistan/Japan	s_t	-0.90	-1.26	-75.58*	-8.54*
	$(P - P^*)_t$	0.27	0.77	-37.89*	-5.24*
Pakistan/Korea	s_t	-1.97	-1.33	-71.26*	-9.66*
	$(P - P^*)_t$	-0.28	-0.50	-47.42*	-6.56*
Pakistan/Philippin	s_t	-6.16	-1.99	-67.07*	-7.48*
	$(P - P^*)_t$	-6.12	-2.18	-27.18*	-8.98*
Pakistan/Singapor	s_t	-0.23	-0.53	-74.29*	-6.86*
	$(P - P^*)_t$	0.20	0.64	-39.99*	-9.57*
Pakistan/Sri	s_t	-4.18	-1.31	-64.49*	-6.66*
	$(P - P^*)_t$	-9.38	-2.40	-44.76*	-7.53*
Pakistan/Thailand	s_t	-1.61	-1.22	-47.68*	-5.18*
	$(P - P^*)_t$	-0.75	-1.46	-38.83*	-6.38*

* Significant at the 5% level.

Table 2: Testing for Cointegration Using Tests

$$(S_t = \beta_0 + \beta_1 (p - p^*)_t + \xi_t)$$

CONTRY COMBINATION	β_0	β_1	R^2	CRDW	ADF	Z_{α}^{\wedge}	Z_t^{\wedge}
Pakistan/India	0.15	-0.58	0.11	0.10	-1.33	-4.75	-1.56
	(0.05)	(0.61)					
Pakistan/Indonesia	-4.52	1.42	0.59	0.36	-2.73	-11.40	-2.58
	(0.07)	(0.38)					
Pakistan/Japan	-1.96	1.25	0.95	0.14	-1.66	-5.44	-1.70
	(0.06)	(0.12)					
Pakistan/Korea	-3.62	0.94	0.86	0.40	-2.58	-12.63	-2.57
	(0.04)	(0.12)					
Pakistan/Philippine	-0.12	0.75	0.65	0.29	-2.32	-9.85	-2.32
	(0.05)	(0.18)					
Pakistan/Singapore	2.41	0.98	0.98	0.39	-2.34	-11.80	-2.35
	(0.02)	(0.04)					
Pakistan/Sri Lanka	-0.56	0.33	0.15	0.24	-2.09	-6.66	-1.85
	(0.04)	(0.27)					
Pakistan/Thailand	-0.13	0.77	.095	0.63	-3.50*	-20.87*	-3.51*
	(0.15)	(0.04)					

* Significant at the 5% level. The West corrected standard errors are reported in parentheses

Table 3: Testing for Cointegration Johansen Test

$$(S_t = \beta_0 + \beta_1 (p - p^*)_t + \xi_t)$$

	<i>Pak-India</i>	<i>Pak-Indo.</i>	<i>Pak-Japan</i>	<i>Pak-Korea</i>	<i>Pak-Phill</i>	<i>Pak_Singapur</i>	<i>Pak-Sri Lanka</i>	<i>Pak-Thailand</i>
Max								
$r = 0$	3.99	33.45*	21.46*	16.91*	16.06*	34.42*	13.51	39.26*
$r \leq 0$	1.69	7.07	5.40	3.33	5.76	3.65	1.99	9.44
Trace								
$r \leq 0$	11.73	42.53*	26.86*	20.33*	21.83*	38.07*	15.49	48.70*
$r \leq 1$	1.69	7.07	5.40	3.33*	5.76	3.65	1.99	9.44
β_0	0.29	-4.38	-2.76	-4.47	-0.17	2.22	-0.72	-0.26
β_1	-0.57	0.14	0.93	0.93	1.08	0.99	1.82	0.85
$X^2 (\beta_0, \beta_1)=(0.1)$			0.68	0.68	11.06*	7.44*		33.20*
$X^2 (\beta_2=1)$			0.02	0.02	0.26	0.01		2.52

* Significant at the 5% level.

IV. Conclusion

This paper presents empirical evidence on long-run PPP for eight Pak-rupee exchange rates *vis-a-vis* Asian currencies. This is done by examining if the nominal exchange rate is in line with the ratio of the domestic to foreign price index and if one-to-one proportionality exists between the exchange rate and the ratio of the domestic to foreign price index. Results of cointegration and coefficient restrictions tests obtained using the Johansen (1988) procedure are strongly supportive of PPP in five out of eight cases, while those of Engle-Granger (1987) and Phillips-Ouliaris (1990) residual-based cointegration tests are not. Three important conclusions emerge from these results. First, devaluation of Pak-rupee *vis-a-vis* major South Asian currencies under investigation may not be likely to improve the country's external competitiveness and, consequently, to reduce deficit in its trade balance. Second, the monetary authorities in Pakistan may not be able to run monetary policy independently. Finally, the results indicate that there is presence of high degree of integration between goods and foreign exchange markets in Pakistan and those of most the South East Asian countries. However, care needs to be taken into account while interpreting these conclusions for policy purposes.

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