The Pakistan Development Review
35 : 4 Part II (Winter 1996) pp. 671—682

A Correct Test of Purchasing Power Parity: The Case of Pak-Rupee Exchange Rates

RAZZAQUE H. BHATTI

This paper presents some empirical evidence on long-run purchasing power parity (PPP) for eight Pak-rupee exchange rates over the period 1982:1–1994:4. Results obtained from testing for cointegration and coefficient restrictions using the Johansen (1988, 1991) procedure are supportive of PPP in almost all cases. These results are also supported by those obtained from testing for mean reversion in the real exchange rate using the Sims (1988) Bayesian test. One of the conclusions that emerge from these results is that devaluation of Pak-rupee *vis-à-vis* major industrial currencies under investigation may be unlikely to improve the country's external competitiveness and, consequently, the deficit in its trade balance.

1. INTRODUCTION

The purchasing power parity (PPP) theory of exchange, which was originally put forward by Cassel (1916), postulates that under a system of floating exchange rates in which trade is free and transportation costs, capital flows and speculative expectations are absent, the nominal exchange rate cannot deviate significantly from its PPP level and the real exchange rate from its mean value. The empirical validity of this theory has two important implications. First, the PPP theory is relevant for assessing whether the flexible exchange rate system insulates national economies from foreign shocks by stabilising the real exchange rate over time: therefore, the failure of PPP provides justification for national governments to manage the exchange rates of their currencies [Frenkel (1981), p. 145]. Second, if the real exchange rate turns out to be mean reverting over time, then national governments are not able to run monetary policies independently, and devaluation does not work to improve a country's external competitiveness [Shapiro (1983), p. 297].[1]

Razzaque H. Bhatti is Assistant Professor, Kashmir Institute of Development Studies, University of Azad Jammu & Kashmir, Muzaffarabad.

[1]PPP can be used to serve other purposes as well. First, McKinnon (1986) and McKinnon and Ohno (1989) suggested using PPP for stabilising and eventually fixing exchange rates among industrial countries. The fixing of exchange rates is used to stimulate a common monetary standard—as if the world has a single currency area—and to stabilise the global prices of traded goods. It is believed that the real adjustment can be done more smoothly under fixed exchange rates than under floating exchange rates, by letting non-traded goods prices diverge while keeping the common traded goods prices constant. Second, Dryden *et al.* (1987) and Glude and Schultze-Ghattas (1993) used PPP to compare various types of economic data, such as real levels of gross domestic product, personal consumption, government expenditures and gross fixed capital formation, among countries without using market exchange rates to convert data into a common currency. Finally, PPP constitutes one of the important building blocks in modelling exchange rate determination. While the flexible price monetary model of exchange developed by Mussa (1976); Frenkel (1976) and Bilson (1978) presumes that PPP holds continuously, the Dornbusch (1976) sticky-price and the Frankel (1979) real interest rate differential models assume that PPP holds in the long run only. The poor performance of these models requires their underlying components, including PPP, to be tested for validity.

However, most of the empirical studies carried out, *inter alia*, by Taylor (1988); Giovannetti (1989); Patel (1990); Nachane and Chrissanthaki (1991); Crowder (1992); Sarantis and Stewart (1993); MacDonald (1993); Cooper (1994) and Moosa and Bhatti (1996) investigating the validity of the PPP theory during the current system of flexible exchange rates have documented evidence that usually indicates the failure of the theory.[2] One reason for the failure of PPP is that most of the above studies employed residual-based cointegration tests[3] which are criticised for having low power to reject the null of no cointegration between exchange rates and relative prices.[4] The objective of this paper is to re-examine PPP for Pakistan *vis-à-vis* its eight trading partners from the industrial world by employing the [Johansen (1988, 1991)] maximum likelihood technique of cointegration, which has a relatively higher power to reject the null of no cointegration than the Engle-Granger (1987) residual-based cointegration test. The remainder of this paper is organised as follows. Section 2 dispels some popular misconceptions about the theory and empirical testing of PPP by proposing a correct test of PPP which is compatible not only with the explicit but also with the implicit prediction of the theory. Section 3 presents empirical results and their interpretations, while the concluding remarks are given in the final section.

2. A CORRECT TEST OF THE PPP THEORY

Testing PPP is invariably based on the relative version, most researchers however misinterpret their findings by confusing absolute with relative PPP. The most notable example is Frenkel (1978, 1981) who tested absolute and relative PPP on the basis of the models using levels and first differences of exchange rates and prices, which are given respectively by:

$$s_t = \alpha_0 + \alpha_1 p_t - \alpha_2 \ p_t^* + u_t \qquad \ldots \qquad \ldots \qquad \ldots \qquad (1)$$

and

$$\Delta s_t = \alpha_0 + \alpha_1 \Delta p_t - \alpha_2 \Delta \ p_t^* + v_t \qquad \ldots \qquad \ldots \qquad \ldots \qquad (2)$$

where s_t is (the logarithm of) the nominal exchange rate (defined as the domestic currency price of one unit of the foreign currency) and p_t (p_t^*) is (the logarithm of) the domestic (foreign) price index. Absolute and relative PPP hold precisely well if the restriction (α_0, α_1, α_2) = (0,1–1) is not rejected. Model specifications represented by Equations (1) and (2) are evident in the bulk of econometric work

[2]For an updated survey on PPP see Bhatti (1995) and Moosa and Bhatti (1996b).

[3]The exceptions are MacDonald (1993) and Moosa and Bhatti (1996) which produced results supportive of PPP by employing the Johansen (1988) and the Stock and Watson (1993) tests respectively.

[4]See MacDonald (1993).

including, *inter alia*, MacDonald (1988); Corbae and Ouliaris (1988); Giovannetti (1989); Patel (1990); Conejo and Shields (1993); Serletis (1994) and Mahdavi and Zhou (1994). Corbae and Ouliaris (1988) note that relative PPP cannot be tested for cointegration because exchange rate changes and inflation rates are stationary. Patel (1990) also makes a similar point by arguing that it is difficult to test relative PPP because observed exchange rates and prices are difference stationary, implying that relative PPP must take a first difference form. On the other hand, Conejo and Shields (1993) and Mahdavi and Zhou (1994) wrongly classified their models into those representing absolute PPP and others representing relative PPP on the basis of the order of integration of exchange rates and prices.[5]

It is, however, argued that the distinction between absolute and relative PPP is useless, at least, for the purpose of empirical testing. Absolute and relative PPP are usually distinguished on the basis of price levels and price indices. While absolute PPP requires the equilibrium exchange rate to be equal to the ratio of the domestic to foreign price levels, relative PPP requires the ratio of the equilibrium exchange rate in a current period (t) to the equilibrium exchange rate in the base period (0) to be equal to the ratio of the domestic to foreign price indices, where both indices are measured relative to the same base period (0).[6] Therefore, if p and $p*$ were price indices, then Equation (1) would not represent absolute PPP because standard type of price indices are computed relative to some base period. By contrast, both Equations (1) and (2) represent relative PPP in levels and first differences respectively.[7] It is also worth noting that while relative PPP can be tested empirically, absolute PPP cannot, due to the nonavailability of comparable data, particularly, on price levels across countries.[8] Moreover, as long as empirical testing is based on price indices (which is invariably the case), it will amount to testing relative PPP irrespective of the model specification. Therefore, the distinction between absolute and relative PPP is useless and, at best, redundant, at least for the purpose of empirical testing.

It is also argued that a noteworthy implication of both versions of PPP is that the real exchange rate remains constant over time.[9] When viewed in this perspective,

[5]These studies suggest testing absolute PPP if $s_t \sim I(1)$, $p_t \sim I(1)$, and $p_t^* \sim I(1)$ but relative PPP if $s_t \sim I(2)$, $p_t \sim I(2)$ and $p_t^* \sim I(2)$. However, one cannot help wondering what version of PPP it would be if $s_t \sim I(1)$, $p_t \sim I(2)$, and $p_t^* \sim I(2)$, or any other possibility.

[6]See, for example, Officer (1978, p. 562).

[7]Junge (1984) was the first to draw attention to this confusion which was more formally treated later by Pippenger (1993) and Bhatti (1995).

[8]Even the use of comparable data on price levels, if available across countries, is likely to produce results that may not differ significantly from those obtained by testing relative PPP using price indices.

[9]See, for example, Giovannetti (1992) and Hakkio (1992).

the model specification using first differences of exchange rates and prices, as implied by Equation (2), does not seem to constitute a correct test of PPP. It has recently been argued by Bhatti (1995) that testing the first-difference PPP model amounts to testing *ex ante* PPP and that the empirical validity of this model indicates the failure, rather than the validity, of (conventional) PPP. The logic behind this argument is that a correct test of PPP needs to be based on a model specification that is compatible not only with the explicit prediction of the theory that the nominal exchange rate tends to be equal to the ratio of the domestic price index to the foreign price index but also with its implicit prediction that the real exchange rate is mean reverting over time. Clearly, conventional PPP holds precisely well, if the real exchange rate, and not the change in the real exchange rate, turns out to be a zero mean stationary process.[10] Therefore, it is erroneous to test PPP on the basis of the model using first differences of exchange rates and prices because, unlike the level model, it implicitly presumes that the past changes in the real exchange ($v_t = \Delta s - \Delta p + \Delta p*$) are a zero mean stationary process. Moreover, if the past changes in the real exchange rate also turn out to be serially uncorrelated, then first-difference PPP will become consistent with *ex ante* PPP which predicts that the change in the real exchange rate derived from the rationally expected changes in nominal exchange rates and relative prices is a zero mean serially uncorrelated process ($\varepsilon_{t+1} = \Delta s_{t+1} - \Delta p_{t+1} + \Delta p^*_{t+1}$).[11] This implies that the first-difference PPP model does not constitute a correct test of PPP because its empirical validity indicates that the real exchange is not mean reverting over time and, therefore, conventional PPP is rejected rather than supported empirically.

Finally, it is argued that the PPP theory of exchange that is generally attributed to Cassel is not the theory which he originally put forward in 1916 and continuously advocated throughout his subsequent writings. In particular, a clear-cut distinction between the absolute and relative PPP versions, which are usually derived from the law of one price and are based on commodity arbitrage, cannot be found in Cassel's writings. In fact, Cassel's original PPP theory of exchange postulates 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

[10]If s_t, p_t *and* p^*_t in Equation (1) are integrated with a cointegrating vector $(0,1,-1)$ then the real exchange rate, which is by $u_t = s_t - p_t + p^*_t$, will turn out be a zero mean stationary process.

[11]For the derivation of the change in the real exchange rate from the *ex ante* PPP equation, $\Delta s^e_{t+1} - \Delta p^e_{t+1} - \Delta p^{*e}_{t+1}$, see Bhatti and Moosa (1994).

[12]See Cassel (1916).

money.[12] Thus, the PPP theory is in fact 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 lead to a proportionate increase in 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 clearly postulates that the ratio of the equilibrium exchange rate in the current period, S_t, to the exchange rate in some base period, S_0, tends to be equal to the ratio of the domestic price index, P_t, to the foreign price index, p_t^*. Therefore, the PPP relationship is represented by

$$S_t = S_0\left(\frac{P_t}{P_t^*}\right) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

Obviously, the process of exchange rate determination underlying Equation (4) does not seem to rely, directly or indirectly, on the operation of arbitrage in goods, but it relies mainly on the causal chain running from monetary disturbances to price levels to exchange rates. Indeed, the PPP theory postulates that if disturbances are purely of monetary nature and they overshadow the real ones, then equi-proportionate changes which occur in commodity prices following the monetary growth across countries ultimately keep the nominal exchange rate in line with its PPP level and the real exchange rate unchanged over time. This is what may be referred to as a monetary view of PPP, which stipulates that if the relative price structure (real factors) remains unchanged then the exchange rate between two national currencies is primarily determined by monetary factors, which was originally advocated by Cassel (1916), (1918), (1921), (1922), (1928).[13]

In an empirically testable form Equation (4) can be rewritten in logarithms as

$$s_t = \beta_0 + \beta_1(p - p^*)_t + \varepsilon_t \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

where 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. The PPP model specification, as represented by Equation (5), imposes one-to-one proportionality between nominal exchange rates and relative prices, a restriction which although holds in theory seems to be inappropriate and unrealistic in practice when transportation costs and/or measurement errors are allowed for Taylor (1988), pp. 1371-72 demonstrates that in the presence of transportation cost/or measurement errors, proportionality may still hold but it will not necessarily be equal to unity (i.e. $\beta_1 \neq 1$).

[13]For a detailed discussion on Cassel's original PPP theory of exchange, see Moosa and Bhatti (1996b).

3. DATA, METHODOLOGY, AND EMPIRICAL RESULTS

The PPP relationship is tested for Pak-rupee (PR) exchange rates *vis-à-vis* eight industrial currencies—Austrian schilling (AS), British pound (BP), Canadian dollar (CD), German mark (GM), Japanese yen (JY), the Netherlands guilder (NG), Swedish krone and the U.S. dollar (UD)—on the basis of Equation (5). The sample data consists of quarterly observations on exchange rates and wholesale prices covering the flexible exchange rate period 1982:1–1994:4. The data were obtained from the IMF's *International Financial Statistics* as reported by *Datastream*.

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. For a pair of variables s_t and $(p - p^*)_t$ underlying Equation (5) to form a cointegrating (long-run) relationship a necessary but not a sufficient condition is that both of the variables are integrated of the same order (i.e. the same order of differencing is required to produce stationarity). If s_t and $(p - p^*)_t$ are $I(1)$, then the sufficient condition requires the linear combination thereof to be integrated of order zero (i.e. $\varepsilon_t \sim I(0)$. Therefore, prior to testing for cointegration, unit root testing is carried out to determine the order of integration of the variables underlying Equation (5). For this purpose, the Phillips-

Table 1

Testing for Unit Root

Country Combination	Variable	Level		First Difference	
		$\hat{Z}_\alpha$	$\hat{Z}_t$	$\hat{Z}_\alpha$	$\hat{Z}_t$
Pakistan/Australia	s_t	–0.457	–0.496	–57.336*	–7.572*
	$(p - p^*)_t$	0.857	0.779	–42.311*	–6.686*
Pakistan/Canada	s_t	–0.845	–1.175	–37.343*	–5.695*
	$(p - p^*)_t$	1.205	2.656	–41.107*	–5.884*
Pakistan/Germany	s_t	–0.411	–0.443	–54.801*	–7.507*
	$(p - p^*)_t$	1.142	2.475	–39.979*	–5.516*
Pakistan/Japan	s_t	–0.349	–0.476	–56.894*	–7.451*
	$(p - p^*)_t$	0.701	1.653	–30.509*	–4.603*
Pakistan/Netherlands	s_t	–0.372	–0.394	–39.595*	–5.061*
	$(p - p^*)_t$	1.131	2.439	–36.766*	–5.279*
Pakistan/Sweden	s_t	–0.824	–0.607	–42.814*	–6.234*
	$(p - p^*)_t$	2.096	2.345	–33.344*	–5.166*
Pakistan/U.K.	s_t	–0.312	–0.283	–42.870*	–6.880*
	$(p - p^*)_t$	2.658	3.348	–37.123*	–5.296*
Pakistan/U.S.	s_t	–0.397	–0.730	–32.998*	–5.949*
	$(p - p^*)_t$	1.139	2.416	–47.494*	–6.381*

*Significant at the 5 percent level.

Ouliaris (1990) $\hat{Z}_\alpha$ and $\hat{Z}_t$ test statistics are used. These test statistics, which were originally 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 and $(p - p^*)_t$ are $I(1)$ in level and $I(0)$ in first differences. As for testing for cointegration, it is carried out on the basis of the Johansen (1988, 1991) maximum likelihood test. The results of cointegration and coefficient restrictions tests, which are shown in Table 2, indicate that PPP holds reasonably well in all but one case (the U.K.) only. One implication of the PPP theory is that the real exchange rate should be mean reverting over time.[14] Testing for mean reversion in the real exchange rate is carried out on the basis of the Sims (1988) Bayesian test, which is more powerful than conventional tests, such as the Dickey-Fuller (1979) and the Phillips-Ouliaris (1990) tests, in discriminating between a true and a near random walk. For this purpose two test statistics γ and $1-\alpha^*$ are used: the null hypothesis that the real exchange rate follows a random walk is rejected if $\gamma < 0$, while this rejection becomes stronger if the value of $(1-\alpha^*)$ is close to 1 and weaker if it is close to zero.[15] The results of testing for mean reversion in the real exchange rate, which are shown in Table 3, lend strong support to PPP because the null hypothesis that the real exchange rate follows a random walk is rejected in all cases by both the test statistics γ and $1-\alpha^*$.

4. CONCLUSION

This paper has presented empirical evidence on both the explicit prediction of PPP that the nominal exchange rate tends to be equal to the ratio of the dometic price index to the foreign price index and the implicit prediction that the real exchange rate is mean reverting over time. Results obtained from testing for cointegration and

coefficient restrictions between the nominal exchange rate and relative prices by employing the Johansen maximum likelihood test are supportive of the PPP theory. These results are also supported by those obtained from testing for mean reversion in the real exchange rate by employing the Sims Bayesian test. One of the conclusions that emerge from these results is that devaluation of Pak-rupee *vis-à-vis* major industrial currencies under investigation may be unlikely to improve the country's external competitiveness and, consequently, to reduce deficit in its trade balance. Moreover, the monetary authorities in Pakistan may not be able to run monetary policy independently.

[14]In order to test this implication, the PPP relationship is expressed in terms of the real exchange rate which is given by

$$q_t = s_t - p_t + p_t^*$$

in which case testing mean reversion boils down to testing for unit root in the real exchange rate, i.e., $q_t \sim I(0)$.

[15]For a detailed discussion on this test see Moosa and Bhatti (1996a).

Table 2

Testing for Cointegration and Coefficient Restrictions

$(s_t = \beta_0 + \beta_1 \ (p - p^*)_t \ + \varepsilon_t)$

	PR/AS	PR/BP	PR/CD	PR/DK	PR/GM	PR/JY	PR/NG	PR/UD
Max								
$r = 0$	22.45*	17.58*	22.21*	24.19*	22.68*	15.74*	21.51*	22.46*
$r \leq 1$	2.13	2.53	4.67	16.32	2.39	3.78	2.37	6.17
Trace								
$r = 0$	24.58*	20.11*	26.87*	40.51*	25.08*	19.52*	23.88*	28.63*
$r \leq 1$	2.13	2.53	4.67	16.32*	2.39	3.78	2.37	6.17
β_0	0.035	9.514	2.495	0.379	1.600	–3.274	1.600	3.514
β_1	1.400	25.350	0.995	0.675	1.048	0.880	1.175	1.634
$\chi^2_{(\beta_0, \beta_1) = (0, 1)}$	2.488	6.357*	3.554	3.506	1.896	3.532	1.692	5.177

*Significant at the 5 percent level.

Table 3

Testing for Mean Reversion in the Real Exchange Rate

Real Exchange Rates	1–α*	γ
PR/AS	0.618	–3.739
PR/CD	0.805	–5.613
PR/GM	0.572	–3.355
PR/JY	0.618	–3.733
PR/NG	0.544	–3.128
PR/SK	0.578	–3.399
PR/BP	0.571	–3.348
PR/UD	0.968	–9.566

*Significant at the 5 percent level.

REFERENCES

Bhatti, R. H., and I. A. Moosa (1994) A New Approach to Testing *Ex Ante* Purchasing Power Parity. *Applied Economics Letters* 1:148–151.

Bhatti, R. H. (1995) International Parity Conditions: An Empirical Investigation. Unpublished Ph. D. Thesis: Sheffield University Management School.

Bilson, J. F. O. (1978) The Monetary Approach to the Exchange Rate: Some Empirical Evidence. *IMF Staff Papers* 25: 48–75.

Cassel, G. (1916) The Present Situation of the Foreign Exchange. *Economic Journal* 26: 62–65.

Cassel, G. (1921) *The World's Monetary Problem*. London: Constable.

Cassel, G. (1922) *Money and Foreign Exchange after 1914*. New York: Constables and Co. Limited.

Cassel, G. (1928) *Foreign Investments.* Chicago: Chicago University Press.

Conejo, C., and M. P. Shields (1993) Relative PPP and the Long-run Terms of Trade for Five Latin American Countries: A Cointegration Approach. *Applied Economics* 25: 1511–1515.

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.

Corbae, D., and S. Ouliaris (1988) Cointegration and Tests of Purchasing Power Parity. *Review of Economics and Statistics* 70: 508–511.

Crowder, W. J. (1992) Purchasing Power Parity over the Modern Float: An Application in Higher Order Cointegration. *Economics Letters* 40: 313–318.

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.

Dornbusch, R. (1976) Expectations and Exchange Rate Dynamics. *Journal of Political Economy* 84: 1161–1176.

Dryden, J., K. Reut, and B. Slater (1987) Comparison of Purchasing Power Parity between the United States and Canada. *Journal of Monthly Labour Review* 7–24.

Engle, R. F., and C. W. J. Granger (1987) Cointegration and Error Correction: Representation, Estimation and Testing. *Econometrica* 55: 251–276.

Frankel, J. A. (1979) On the Mark: A Theory of Floating Exchange Rates Based on Real Interest Differentials. *American Economic Review* 69: 601–622.

Frenkel, J. A. (1976) A Monetary Approach to the Exchange Rate: Doctrinal Aspects and Empirical Evidence. *Scandinavian Journal of Economics* 78: 200–224.

Frenkel, J. A. (1978) Purchasing Power Parity: Doctrinal Perspectives and Evidence from the 1920s. *Journal of International Economics* 8: 169–191.

Frenkel, J. A. (1981) The Collapse of Purchasing Power Parities during the 1970s. *European Economic Review* 16:145–165.

Giovannetti, G. (1989) Testing Purchasing Power Parity as a Long Run Equilibrium Condition. *Giornale degli Economisti* 46: 491–508.

Giovannetti, G. (1992) A Survey of Recent Empirical Tests of the Purchasing Power Parity Hypothesis. *BNL Quarterly Review* 180: 81–101.

Glude, A. M., and M. Schultze-Ghattas (1993) Aggregation of Economic Indicators. *IMF Staff Studies for the World Economic Outlook*.

Hakkio, C. S. (1992) Is Purchasing Power Parity a Useful Guide to the Dollar? *Economic Review*, 3rd Quarter. Federal Reserve Bank of Kansas City 37–51.

Johansen, S. (1988) Statistical Analysis of Cointegrating Vectors. *Journal of Economic Dynamics and Control* 12: 231–54.

Johansen, S. (1991) Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. *Econometrica* 59: 1551–1580.

Junge, G. (1984) Purchasing Power Parity in the 1920s and the 1970s: A Note. *European Economic Review* 26: 73–82.

MacDonald, R. (1993) Long-run Purchasing Power Parity: Is it for Real? *Review of Economics and Statistics* 75: 690–695.

Mahdavi, S., and S. Zhou (1994) Purchasing Power Parity in High-Inflation Countries: Further Evidence. *Journal of Macroeconomics* 16: 403–422.

McKinnon, R. (1986) Getting the Exchange Rate Right. *Wall Street Journal*, 12 May.

McKinnon, R., and K. Ohno (1989) Purchasing Power Parity as a Monetary Standard. In O. F. Hamoada, R. Rowley, and B. M. Wolf (eds) *The Future of the International Monetary System*. Edward Elgar.

Moosa, I. A., and R. H. Bhatti (1996) Does Purchasing Power Parity Hold between Japan and Other Asian Countries? *Journal of International Economic Studies* 10: 85–94.

Moosa, I. A., and R. H. Bhatti (1996a) Some Evidence on Mean-Reversion in *Ex Ante* Real Interest Rates. *Scottish Journal of Political Economy* 43: 177–191.

Moosa, I. A., and R. H. Bhatti (1997) *International Parity Conditions: Theory, Econometric Testing, and Empirical Evidence*. U. K.: Macmillan Ltd.

Mussa, M. (1976) The Exchange Rate, the Balance of Payments, and the Monetary and Fiscal Policy under a Regime of Controlled Floating. *Scandinavian Journal of Economics* 78: 229–248.

Nachane, D. M., and A. Chrissanthaki (1991) Purchasing Power Parity in the Short and Long Run: A Reappraisal of the post-1973 Evidence. *Applied Economics* 23: 1257–1268.

Officer, L. H. (1978) The Relationship between Absolute and Relative Purchasing Power Parity. *Review of Economics and Statistics* 60: 562–568.

Patel, J. (1990) Purchasing Power Parity as a Long Run Relation. *Journal of Applied Econometrics* 5: 367–379.

Phillips, P. C. B. (1987) Time Series Regression with a Unit Root. *Econometrica* 55:277-301.

Phillips, P. C. B., and S. Ouliaris (1990) Asymptotic Properties of Residual Based Tests for Cointegration. *Econometrica* 58: 165–193.

Pippenger, M. K. (1993) Cointegration Tests of Purchasing Power Parity: The Case of Swiss Exchange Rates. *Journal of International Money and Finance* 12: 46–61.

Sarantis, N., and C. Stewart (1993) Seasonality, Cointegration and the Long-run Purchasing Power Parity: Evidence for Sterling Exchange Rates. *Applied Economics* 25: 243–250.

Serletis, A. (1994) Maximum Likelihood Cointegration Tests of Purchasing Power Parity: Evidence from Seventeen OECD Countries. *Weltwirtschaftliches Archiv* 130: 476–491.

Shapiro, A. C. (1983) What Does Purchasing Power Parity Mean? *Journal of International Money and Finance* 2: 295–318.

Sims, C. A. (1988) Bayesian Scepticism on Unit Root Econometrics. *Journal of Economic Dynamics and Control* 12: 463–474.

Stock, J. H., and M. W. Watson (1993) A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems. *Econometrica* 61: 783–820.

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

Comments

The paper by Dr Bhatti is very interesting and a useful contribution to the literature on exchange rate management in Pakistan.

The paper deals with testing the validity of the Purchasing Power Parity (PPP) theory. In this context, the author did a great job by providing an extensive discussion on the theoretical background of the PPP and by identifying problems relating to the empirical testing of the theory. However, I think that the PPP theory requires completely flexible exchange rate, i.e., where the rates are completely determined by the market forces. In the case of Pakistan, we have managed a floating system where the rates are partly managed by the government. Such a regime, whether the testing of PPP is appropriate or not, requires some explanation.

Now, a few minor points regarding the data, methodology, and empirical results, as the relevant section is too brief and some of the things are not clear.

First, no explanation is given about the selection of the countries and it seems that these countries were selected arbitrarily. One selection criterion could be the major trading partners of Pakistan. Second, wholesale prices were used whereas the consumer price indices could also have been used. Third, quarterly observations were used with the result that there were about fifty observations to work with, whereas the co-integration technique is meant for a large number of observations. Therefore, the use of monthly or weekly data would have been more useful. Fourth, in testing Unit Root, a little explanation regarding Z_α and Z_t is needed. I believe that this statistics differentiate the Unit Root test by including the constant or trend variable. I think that this should be explicitly mentioned in the text. Similarly, a little explanation regarding the trace-and-eigen value test in co-integration would help the readers as this procedure is not yet explained in the textbooks. Finally, the result that PPP does not hold in the case of U.K. requires some possible reasons.

Regarding the results of the paper, it seems that these are quite sensitive to the type of methodology used. Therefore, the conclusions drawn from these results must be considered with care.

Fazal Husain

Pakistan Institute of
Development Economics,
Islamabad.