

TESTING CONVENTIONAL AND EX ANTE PURCHASING POWER PARITY: THE CASE OF THREE CIS CURRENCIES

Razzaque H.Bhatti

Bang College of Business KIMEP University

2 Abai Avenue Office #349, Dostyk Building Almaty 050010, Kazakhstan

Tel: +7(727) 2-70-44-40 Ext. 2114; Fax: +7(727) 2704 463

M.Mujibul Haque

Bang College of Business, KIMEP University

ABSTRACT

This paper tests whether conventional or ex ante purchasing power parity holds for the exchange rates of the three CIS currencies – Kazakh tenge, Kyrgyz som and Russian Ruble – vis-à-vis the US dollar and for the exchange rates of Kazakh tenge and Kyrgyz som vis-à-vis the Russian Ruble over the period 1995m1-2010m6. Results obtained by employing two residual-based cointegration tests of Engle and Granger (1987) and Phillips and Ouliaris (1990) and coefficient restrictions tests based on the West (1988) corrected t-statistic lend strong support to ex ante PPP against conventional one. These results suggest that the real exchange rate for the underlying currency combinations is not stationary; rather it follows a random walk. This also implies that PPP does not hold for the three CIS currencies even in the long run.

Key Words: *Ex ante* PPP, Exchange rate, International financial markets

JEL Classification: E31, F31, G15

INTRODUCTION

Since Cassel (1916) presented it formally as an operational theory of foreign exchange¹, the tremendous amount of work has appeared on both theoretical and empirical aspects of purchasing power parity (PPP). The PPP theory of exchange postulates that in countries operating under a system of flexible exchange rates in which there are no such frictions as trade barriers, transportation costs, and speculators' expectations, the nominal exchange rate between two currencies adjusts fully to absorb the excess of domestic over foreign inflation (measured in terms the ratio of the domestic price index to the foreign price index), forcing the real exchange rate to be constant as well as independent of the ratio of the domestic price index to the foreign price index over time. In essence, there are two main predictions that underlie PPP: one explicit and the other implicit. The explicit prediction is that the nominal exchange rate is determined by the ratio of the domestic price index to the foreign price index, whereas the implicit prediction is that the real exchange rate is mean reverting over time.

Despite its wide acceptance, PPP is still highly controversial topic in the literature on international finance and exchange rates, both from theoretical and empirical perspectives². Most studies investigating the empirical validity of PPP for the current floating exchange rates have documented evidence that usually indicates the failure of the theory³. One reason for the failure of PPP over the current floating exchange rates that has been put forward by Bhatti and Bhatti (1994) is that PPP neglects the role of speculators' expectations in determining exchange rates. It is argued that in efficient markets for goods and capital assets, competition among speculators tends to establish PPP on *ex ante* basis⁴, so that the rate of change in the real exchange rate, and not the real exchange rate itself, is serially uncorrelated over time. This implies that the real exchange rate follows a random walk. This view of PPP differs from the conventional view in the explicit treatment of uncertainty. It is based on the proposition that in efficient markets the net returns to speculators engaging in intertemporal arbitrage on goods in a foreign country is anticipated to be zero. Employing this view of PPP, Bhatti (1994) and Moosa derives a model specification implying that in efficient markets in which speculators are engaged in intertemporal arbitrage on goods, the nominal exchange rate is determined not only by current relative prices but also by the expected real exchange rate.

The objective of this paper is to investigate whether conventional or *ex ante* PPP holds in three countries – Kazakhstan, Kyrgyzstan and Russia – of the Commonwealth of Independent States (CIS) vis-à-vis the United State and in Kazakhstan and Kyrgyzstan vis-à-vis Russian Republic over the period 1995-2010. This is done by employing the Engle-Granger (1987) and the Phillips-Ouliaris (1990) procedures for cointegration. The rest of the paper is structured as follows. Section 2 provides a brief account of the theory underlying conventional and *ex ante* PPP. Section 3 reviews the existing evidence on the underlying theories of exchange rates in transition countries including the CIS countries, while Section 4 deals with data, methodology and empirical results. The final Section concludes and deals with policy implications.

CONVENTIONAL AND EX ANTE PPP

Conventional PPP postulates that the real exchange rate is equal to the nominal exchange rate adjusted by the quotient between domestic and foreign inflation (measured in terms of the ratio of the domestic price index to the foreign price index). This is given as follows:

$$Q_t = S_t / (P_t / P_t^*) \quad (1)$$

where $S_t(Q_t)$ is the nominal (real) exchange rate (defined as the domestic currency price of a unit of the foreign currency) and $P_t(P_t^*)$ is the domestic (foreign) price index. The main force keeping the nominal exchange underlying equation (1) in line with the ratio of the domestic price index to the foreign price index is the casual chain running from money supply to prices (via the quantity theory of money) to exchange rates (via PPP). Thus conventional PPP is an extension of the quantity theory of money in an open economy. Taking logarithm on its both sides and using the lower case letters to represent the logarithmic values of the underlying variables, equation (1) can be rewritten as

$$q_t = p_t^* + s_t - p_t \quad (2)$$

Conventional PPP posits that the nominal exchange rate in Equation (2) adjusts continuously to offset the excess of the domestic price index over the foreign price index, eventually forcing the real exchange to remain constant over time. If the real exchange rate is equal to a constant value a and fluctuates randomly rate over time t around its constant value, a , the behavior of the real exchange rate can modeled as follows

$$q_t = a + u_t \quad (3)$$

Substituting Equation (3) into (2), solving the resulting equation for the nominal exchange rate and then rewriting the same in a general empirically testable stochastic regression form we obtain

$$s_t = \beta_0 + \beta_1(p - p^*)_t + w_t \quad (4)$$

where $\beta_0 = a$, $w_t = u_t + v_t$ where v_t is an error term incorporating all effects on the nominal exchange rate unexplained by current relative prices. For conventional PPP to hold precisely well, both of its explicit and implicit predictions must be supported by the data. For the explicit prediction to hold the hypothesis $(\beta_0, \beta_1) = (0, 1)$ should not be rejected. On the other hand, for the implicit prediction to be valid the real exchange rate must be stationary, i.e. $q_t = s - p_t + p_t^* \sim I(0)$ ⁵.

Clearly, if conventional PPP, as represented by equation (4), holds both in the short and long run, then the PPP deviations (or the real exchange rate) should be serially uncorrelated with a mean zero over time. However, if conventional PPP does not hold in the short run, these deviations which may persist and cumulate are expected to return to parity over time in the presence of such economic forces as international commodity arbitrage and the price-specie-flow mechanism creating a countervailing tendency in the system (Gailliot, 1970; and Hodgson and Phelps, 1975)⁶. If true, then the real exchange rate will eventually revert to unity, though over long and variable lag levels.

Ex ante PPP differs from conventional PPP in its prediction concerning the behavior of percentage changes in the real exchange rate. Roll (1979) demonstrated that the PPP deviations are permanent and persistent, and developed the efficient market version of PPP to show that

these deviations are consistent with martingale behavior, a stochastic process in which changes in real exchange rates are serially independent. Testing conventional and efficient market versions of PPP for 23 exchange rates, he found results supportive of the latter version in most cases. These findings were supported strongly by subsequent studies conducted, *inter alia*, by Darby (1980), Adler and Lehman (1983) and Giovannetti (1989)⁷.

An important assumption underlying *ex ante* PPP is that economic agents are not certain about future movements in prices and exchange rates, and, as a result, they are concerned about the expected purchasing power of their return on domestic and foreign investment. Therefore, if the future inflation rate is expected to be higher at home than abroad, then speculators in the domestic country will be motivated to convert their current balances into foreign currency in an anticipation of gains from expected depreciation of the domestic currency. However, efficiency in commodity markets at home and abroad will force the net return anticipated by speculators engaging in intertemporal speculation on goods to be zero. Unlike conventional PPP, which stipulates a relationship between the current nominal exchange rate and relative prices, *ex ante* PPP stipulates a relationship between expected nominal exchange rate changes and inflation differentials. This is given by

$$\Delta s_{t+1}^e = \Delta p_{t+1}^e - \Delta p_{t+1}^{*e} \quad (5)$$

where the superscript *e* indicates that the value of the underlying variable expected at time *t* to prevail at time *t+1*. Assuming rational expectations and risk neutrality, equality must hold between the expected return on buying a bundle of goods in the domestic and foreign markets. The former expected return can be proxied by expected domestic inflation and the latter by the sum of expected foreign inflation and the expected change in the nominal exchange rate.

Equation (5) can be derived from the behavior of speculators in an efficient market. Efficiency in international commodity markets obtains when current and future prices of domestic and foreign goods reflect fully all available relevant information and the expected return to speculators engaged in intertemporal speculation on commodities is equal to zero. Assuming that there are no transaction costs and that market agents are certain about domestic and foreign prices, then the return to speculators engaged in temporal speculation on goods is given by

$$\pi_t = p_t^* + s_t - p_t \quad (6)$$

where π (representing the real exchange rate) is the profit made by speculators by engaging themselves in temporal arbitrage on domestic and foreign goods. On the other hand, the profit made by speculators in intertemporal arbitrage on goods is given by

$$\pi_{t+1}^e = p_{t+1}^{*e} + s_{t+1}^e - p_{t+1}^e \quad (7)$$

where π_{t+1}^e also represents the expected real exchange rate. Thus, the net return from temporal and intertemporal speculation on goods is given by

$$\pi_{t+1}^e - \pi_t = (s_{t+1}^e - s_t) - (p_{t+1}^e - p_t) + (p_{t+1}^{*e} - p_t) \quad (8)$$

If markets are efficient in Fama's (1970) sense, then current prices must reflect all information available to agents, so that current prices are the best forecast of future prices. Thus Equation

(8) reduces to (5) provided that the expected return to speculators, $\pi_{t+1}^e - \pi_t = \nu_t$, is completely random, displaying no pattern over time.

Bhatti and Moosa (1994) argue that if the market's expected rate of change of the nominal exchange rate between two currencies, domestic and foreign, tends to be equal to the expected differential in inflation rates between home and foreign, then the equilibrium nominal exchange rate will be determined not only by current relative prices but also by the expected real exchange rate. Typically, this view of exchange rate can be derived by solving *ex ante* PPP, as represented by Equation (5), in levels, and writing the resulting expression in a general stochastic regression form as follows

$$s_t = \beta_0 + \beta_1(p - p^*)_t + \beta_2 q_{t+1}^e + u_t \quad (9)$$

where $q_{t+1}^e = s_{t+1}^e - p_{t+1}^e + p_{t+1}^{*e}$ is the real exchange expected to prevail at time $t+1$ and $u_t = \nu_t + \eta_t$. Thus, Equation (9) implies that the nominal exchange rate is determined not only by current relative prices but also by the expected real exchange rate, indicating that the omission of the latter makes conventional PPP miss-specified.

Under the assumption that economic agents are rational and that they efficiently process all available information contained in the information set Ω_t , the real exchange rate realized at time $t+1$ will differ from the expected real exchange rate by a zero mean, serially uncorrelated error term. Formally, this is given by

$$q_{t+1} = q_{t+1}^e + \varepsilon_{t+1} \quad (10)$$

such that $E(\varepsilon_{t+1} | \Omega_t) = 0$ and $E(\varepsilon_{t+1} \varepsilon_{t+1-i}) = 0 \forall_i \neq 0$. Substituting Equation (10) into (9), we obtain

$$s_t = \beta_0 + \beta_1(p - p^*)_t + \beta_2 q_{t+1} + \omega_t \quad (11)$$

where $q_{t+1} = s_{t+1} - p_{t+1} + p_{t+1}^*$ is the real exchange realized at time $t+1$ and $\omega_t = u_t - \beta_2 \varepsilon_{t+1}$. If conventional PPP holds, then the nominal exchange rate should not be influenced by the expected real exchange rate, which means that the restriction $\beta_2 = 0$ should not be rejected. This implies that there will be no role for speculation in PPP with regard to exchange rate determination. On the other hand, if the restriction $\beta_2 = 0$ is rejected significantly, then there will be an explicit role for speculation in exchange rate determination and as such evidence in favour of *ex ante* PPP against conventional one. If *ex ante* PPP holds, then it will also be interesting to see whether a one-to-one proportionality exists between the nominal exchange rate and relative prices and the nominal exchange and expected real exchange rate, that is whether or not the restrictions $\beta_1 = 1$ and $\beta_2 = 1$ are rejected.

EXISTING EVIDENCE IN THE CIS COUNTRIES

A number of studies have been conducted on conventional PPP and *ex ante* PPP in the transition economies including those of the CIS countries. An important finding that emerges

from these studies is that while *ex ante* PPP holds in the CIS countries, conventional PPP does not. Doganlar (2006) tested the validity of conventional PPP for three CIS countries (Azerbaijan, Kazakhstan and Kyrgyzstan) by employing four cointegration tests: Engle-Granger (E-G) (1987) test, fully modified OLS (FM-OLS) procedure proposed by, Phillips and Hansen (1990), autoregressive distributed lag (ARDL) approach developed by Pesaran and Shin (1999), and Johansen (1988, 1991) multivariate cointegration technique. The results obtained show that nominal exchange rates, domestic prices and foreign prices are not cointegrated in all the three CIS countries when four different types of cointegration tests were applied. He also tested the proposition implied by PPP that the real exchange rate does not follow a random walk. In reality, this test amounts to testing *ex ante* PPP presuming that if PPP holds on the basis of expectations, then the real exchange rate should follow a random walk. Consequently, the failure to reject the null hypothesis that the real exchange rate follows a random walk implies that *ex ante* PPP holds against conventional PPP. Employing three tests – Kwiatkowski, Phillips, Schmidt and Shin (KPSS), Phillips-Perron (P-P) and ADF, Doganlar (2006) obtains results indicating that the real exchange rate follows a random walk in the three CIS countries and confirming that PPP does not hold even in the long run. Similar results were obtained by Korhonen and Wachtel (2006) who tested the degree of exchange rate pass-through in the CIS countries. Failure to find that there is a long-run relationship between nominal exchange rates and current relative prices in these countries (including Ukraine) and that the real exchange rate for the underlying CIS currencies is stationary, they employed *ex ante* changes in exchange rates and prices (and hence *ex ante* PPP) to assess the degree of exchange rate pass-through and produced results showing that the degree of exchange rate pass-through is reasonably high in all CIS countries, except for Georgia. However, results were obtained somewhat in contrast with these findings by Sideris (2006) and Solakoglu (2006). Sideris (2006) employed the Johansen cointegration methodology to test PPP for 17 transition economies including the five CIS countries of Belarus, Georgia, Moldova, Russia and Ukraine and produced results which although did not reject PPP in the long-run in majority of the cases⁸, the estimated coefficients of the cointegrating vectors were not consistent with the symmetry and proportionality hypothesis suggested by PPP in all cases. Solakoglu (2006) tested PPP for cointegration in a panel framework for 21 transition countries including the eight CIS countries of Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia and Ukraine and found results supportive of PPP. Solakoglu (2006) also compares the convergence rates for ‘less open’ and ‘more open’ transition countries and finds that ‘more open’ transition economies converge faster than ‘less open’ transition economies.

DATA DESCRIPTION AND EMPIRICAL RESULTS

Conventional PPP and *ex ante* PPP, as represented by equations (4) and (11), are tested for three currencies of the CIS countries – Kazakhstan, Kyrgyzstan and Russia – vis-à-vis the US dollar and for Kazakh tenge and Kyrgyz som vis-à-vis the Russian ruble. Monthly data were obtained from the IMF CD-ROM on both consumer and wholesale prices and exchange rates of the three CIS currencies against the US dollar⁹. The sample covers the period 1995m1-2010m6. s is the end period nominal exchange rate (currency/dollar), p^c (p^w) is the domestic consumer (wholesale) price index, p^{*c} (p^{*w}) is the foreign consumer (wholesale) price index and q_{t+1}^c (q_{t+1}^w) is the ex post value of the real exchange realized at time t+1 based on the consumer (wholesale) price index.

The methodology employed in testing conventional and *ex ante* PPP is cointegration analysis. Prior to testing the underlying PPP relationships for cointegration, tests are conducted to

determine if the variables underlying both the relationships are integrated of the same order. Testing for a unit root (the order of integration) in the times series underling equations (4) and (11) is conducted on the basis of the Dickey-Fuller (1979) ADF and the Phillips-Perron (1988) PP tests. The results, as shown in Table 1, are consistent in indicating that all the variables are I(1) in levels and I(0) in first differences.

TABLE 1: TESTING FOR A UNIT ROOT

Variable	ADF		PP	
	Level	First Difference	Level	First Difference
KZT/USD				
s	-1.95	-9.83*	-2.23	-9.81*
$p^w - p^{*w}$	-1.28	-7.22*	-1.47	-9.52*
$p^c - p^{*c}$	-2.73	-7.23*	-4.31*	-7.12*
q_{t+1}^w	-0.80	-7.11*	-0.66	-7.11*
q_{t+1}^c	-1.20	-9.49*	-1.13	-9.40*
KRS/USD				
s	-2.66	-6.78*	-2.39	-11.48*
$p^w - p^{*w}$	-1.97	-11.35*	-1.69	-11.71*
$p^c - p^{*c}$	0.32	-3.50*	-0.64	-3.57*
q_{t+1}^w	0.08	-15.62*	0.23	-15.69*
q_{t+1}^c	-1.12	-8.06*	-0.23	-8.11*
RUR/USD				
s	-1.91	-9.65*	-2.12	-9.90*
$p^c - p^{*c}$	-3.50*	-9.05*	-3.79*	-9.46*
q_{t+1}^c	-1.52	-8.90*	-1.40	-10.96*
KZT/RUR				
s	-1.92	-10.63*	-2.00	-10.72*
$p^c - p^{*c}$	-1.66	-4.76*	-2.25	-9.43*
q_{t+1}^c	-2.74	-10.95*	-2.54	-10.96*
KRS/USD				
s	-2.00	-11.67*	-2.09	-11.60*
$p^c - p^{*c}$	-2.12	-5.45*	-2.52	-5.29*
q_{t+1}^c	-2.94	-9.07*	-2.97	-8.80*

* Significant at the 5% level.

Testing conventional and *ex ante* PPP for cointegration is conducted using Engle-Granger (1987) and Phillips-Ouliaris (1990) tests. Two test statistics are used in conjunction each test: CRDW and ADF with the Engle-Granger and \hat{Z}_t and \hat{Z}_α with the Phillips-Ouliaris tests. The results, as reported in Table 2, lend strong support to *ex ante* PPP rather than conventional PPP, except for one exchange rate (KRS/RUR) when consumer prices are used. The expected real exchange rate is highly significant in all cases, rejecting the implication of PPP that the real

exchange rate is constant over time. The inclusion of the expected real exchange rate as an additional explanatory variable in the PPP equation reinstates the proposition of PPP that there is a one-to-one correspondence between the nominal exchange and relative prices. Moreover, the proposition of *ex ante* PPP that there is a one-to-one correspondence between the nominal exchange rate and the expected real exchange rate can be rejected in all cases, except for the two exchange rates, KZT/USD and KRS/RUR. An important conclusion that emerges from these results is that conventional PPP is misspecified since it neglects the effect of speculation (as proxied by the expected real exchange rate) on the current nominal exchange rate. These results are highly consistent with those obtained by Bhatti and Moosa (1994) who tested *ex ante* PPP for 10 major industrial countries using monthly data covering the period 1972:1-1993:7.

TABLE 2: TESTING FOR COINTEGRATION

	KZT/USD		KRS/USD		RUR/USD	KZT/RUR	KRS/RUR
	WPI	CPI	WPI	CPI	CPI	CPI	CPI
Conventional PPP							
β_0	4.88	4.87	3.65	3.67	3.37	1.50	0.32
	(0.040)	(0.034)	(0.038)	(0.037)	(0.055)	(0.023)	(0.022)
β_1	0.53	0.72	0.81	1.12	1.91	0.92	0.63
	(0.077)	(0.103)	(0.066)	(0.091)	(0.062)	(0.040)	(0.043)
R^2	0.55	0.58	0.80	0.78	0.83	0.87	0.80
CRDW	0.026	0.021	0.021	0.054	0.023	0.102	0.216
ADF	-1.56	-1.32	-0.67	0.28	-1.47	-2.87	-3.08
Z_τ	-1.52	-1.17	-0.60	0.15	-1.32	-2.74	-3.27
Z_μ	-4.37	-3.01	-1.13	0.50	-3.82	-14.94	-21.88*
Ex Ante PPP							
β_0	7.65	0.017	0.004	0.025	0.031	-0.001	0.015
	(0.073)	(0.012)	(0.015)	(0.033)	(0.010)	(0.010)	(0.006)
β_1	1.20	1.001	1.001	1.002	0.99	0.99	0.00
	(0.022)	(0.002)	(0.002)	(0.005)	(0.002)	(0.001)	(0.008)
β_1	0.64	0.99	0.99	0.99	0.98	1.0001	0.95
	(0.017)	(0.002)	(0.004)	(0.010)	(0.010)	(0.003)	(0.017)
R^2	0.96	0.99	0.99	0.99	0.99	0.99	0.95
CRDW	0.61*	1.33*	2.29*	1.35*	1.56*	1.21*	1.40*
ADF	-5.80*	-9.50*	-15.98*	-8.36*	-10.79*	-8.90*	-8.42*
Z_τ	-5.84*	-9.39*	-16.17*	-8.45*	-10.81*	-8.93*	-8.45*
Z_μ	-56.72*	-115.98*	-203.94*	-156.04*	-144.59*	-112.74*	-139.09*
$t_{(\beta_2=1)}$	9.24*	2.64*	0.50	0.04	-0.26	-0.72	-1.25
$t_{(\beta_2=1)}$	21.18*	-1.20	-1.28	-0.72	-3.08	-0.15	-2.95*

*Significance of the 5% level.

CONCLUSION

This paper has presented empirical evidence on conventional and *ex ante* PPP for five combinations of the currencies of three CIS countries: Kazakhstan, Kyrgyzstan and Russia. Results based on cointegration and coefficient restrictions tests lend strong support to the *ex*

ante view of PPP against the conventional view. An important conclusion that emerges from these results is that the real exchange rate in the underlying three CIS countries follows a random walk.

End Notes

1. Some economists trace back the origin of the PPP theory more than two centuries (e.g., Humphrey and Keleher, 1982), or even four centuries (e.g., Bernholz, 1982).
2. Bhatti (1996) and Moosa and Bhatti (1999) have identified three popular misconceptions about the theory and empirical testing of PPP. The first misconception is that the Cassel's theory is interpreted in such a way as to have no relevance to what Cassel has continuously been adhered to throughout his subsequent writings. The second misconception is that the distinction between absolute and relative PPP is useless and, at best, redundant. The third misconception is that testing PPP in first differences amounts to testing *ex ante* PPP, implying that the real exchange rate follows a random walk, and as a consequence results supportive of first-difference PPP indicates the failure rather than the relevance of PPP.
3. See, among others, Frenkel (1981), Taylor (1988), Nachane and Chrinssanthaki (1991), Crowder (1992) and Cooper (1994).
4. Roll (1979) derives *ex ante* PPP by assuming efficiency in goods markets, whereas Adler and Lehman (1983) by assuming efficiency in capital markets.
5. Imposing the restriction $(\beta_0, \beta_1) = (0, 1)$ on equation (4), and solving the resulting expression for the real exchange rate we obtain $s_t - p_t + p_t^* = q_t = w_t$.
6. Gailliot (1970) investigated 5-year average of real exchange rates at 5-year intervals. Because an average real exchange rate which was observed to be unity in one period was followed by one below unity in the subsequent period, Gailliot (1970) concluded that there was a tendency for PPP deviations to revert to the equilibrium value of one.
7. Hakkio (1986) and Abuaf and Jorion (1990) were skeptical of these findings on the two grounds: (i) the use of the low-power tests, and (ii) the use of a univariate regression model based in differences in the real exchange rate, which leads to imprecise estimate because of cross-equation correlations.
8. The exceptions are Belarus and Georgia for which the null of no cointegration was not rejected.
9. The exception is Russia for which only consumer prices are used.

REFERENCES

- Abuaf, N. and Jorion, P. (1990), "Purchasing Power Parity in the Long Run", *Journal of Finance*, Vol. 45, pp. 145-174.
- Adler, M. and Lehman, B. (1983), "Deviations from Purchasing Power Parity in the Long Run", *Journal of Finance*, Vol. 38, pp. 1471-1487.
- Bernholz, P. (1982), "*Flexible Exchange Rates in Historical Perspective*", Princeton Studies in International Finance, Princeton: Princeton University Press.
- Bhatti, R. H. (1996), "A Correct Test of Purchasing Power Parity: The Case of Pak-Rupee Exchange Rates", *Pakistan Development Review*, Vol. 35, pp. 671-682.

- Bhatti, R. H. and Moosa, I. A. (1994), "A New Approach to Testing Ex Ante Purchasing Power Parity", *Applied Economics Letters*, Vol. 1, pp. 148-149.
- Bhatti, R. H. and Moosa, I. A., (1999), "Some Popular Misconceptions about the Theory and Empirical Testing of Purchasing Power Parity", *Journal of International Economic Studies*, Vol. 13, pp. 147-161.
- Cassel, G. (1916), "The Present Situation of the Foreign Exchange", *Economic Journal*, Vol. 26, pp. 62-65.
- Cooper, J. C. B. (1994), "Purchasing Power Parity: A Co integration Analysis of the Australian, New Zealand, and Singaporean Currencies", *Applied Economics Letters*, Vol. 1, pp. 167-171.
- Crowder, W. J. (1992), "Purchasing Power over the Modern Float: An Application in Higher Order Cointegration", *Economics Letters*, Vol. 40, pp. 313-318.
- Darby, M. R. (1980), "Does Purchasing Power Parity?", NBER Working Paper No. 607, pp. 1-29.
- Dickey, D. A. and Fuller, W. A. (1979), "Distribution of the Estimators for Autoregressive Time Series with a Unit Root", *Journal of the American Statistical Association*, Vol. 74, pp. 427-431.
- Doganlar, M. (2006), "Long-run validity of Purchasing Power Parity and Cointegration Analysis for Central Asian Countries", *Applied Economics Letters*, 13, 457-461.
- Engle, R. F. and Granger, C. W. J. (1987), "Co integration and Error Correction: Representation, Estimation and Testing", *Econometrica*, Vol. 55, pp. 251-276.
- Frenkel, J. A. (1981), "The Collapse of Purchasing Power Parity During the 1970s", *European Economic Review*, Vol. 16, pp. 145-165.
- Gailliot, H. J. (1970), "Testing Purchasing Power Parity as an Explanation of Long-term Changes in Exchange Rates", *Journal of Money, Credit and Banking*, Vol. 2, pp. 384-357.
- Giovannetti, G. (1989), "Testing Purchasing Power as a Long Run Equilibrium Condition", *Giornale, degli Economisiti*, Vol. pp. 46, 491-508.
- Hakkio, C. S. (1988), "Is Purchasing Power a Useful Guide to the Dollar?", *Economic Review*, 3rd Quarter Federal Reserve Bank of Kansas City, pp. 37-51.
- Hodgson, J. S. and Phelps, P. (1975), "The Distributed Impact of Price Level Variation on Floating Exchange Rates", *Review of Economics and Statistics*, Vol. 57, pp. 58-64.
- Humphrey, T. and Keleher, R, (1982), *The Monetary Approach to the Balance of Payments, Exchange Rates, and World Inflation*: New York, Praeger.
- Nachane, D. M. and Chrissanthaki, A. (1991), "Purchasing Power in the Short and Long Run: A Reappraisal of the Post-1973 Evidence", *Applied Economics*, Vol.23, pp. 1257-1268.
- Phillips, P. C. B. and Ouliaris, S. (1990), "Asymptotic Properties of Residual Based Tests for Co integration", *Econometrica*, Vol 58, pp. 165-193.

Sideris, D. (2006, "Purchasing Power Parity in Economies in Transition: Evidence from Central and East European Countries", *Applied Financial Economics*, 16, 135-143.

Solakoglu. E. G. (2006), "Testing Purchasing Power Parity Hypothesis for Transition Economies", *Applied Financial Economics*, 16, 561-568.

Taylor, M. P., "An Empirical Examination of Long-run Purchasing Power Parity Using Co integration Techniques", *Applied Economics*, Vol. pp. 1369-1381.

West, K. D. (1988), "Asymptotic Normality When Regressors Have a Unit Root", *Econometrica*, Vol. 56, pp. 1397-1418.