African Journal of Business Management Vol. 5(17), pp. 7350-7356, 4 September, 2011
Available online at http://www.academicjournals.org/AJBM
DOI: 10.5897/AJBM10.1645
ISSN 1993-8233 ©2011 Academic Journals

Full Length Research Paper

On the exchange rates behavior by PPP: A test on Malaysian ringgit and US dollar

Farhad Pourkalbassi[1], Alireza Bahiraie[1]*, Aishah Hamzah[1] and Lee Chin[2]

[1]Institute of Mathematical Sciences, Faculty of Science, University of Malaya, 50603 Kuala Lumpur, Malaysia.
[2]Faculty of Economics and Management, University Putra Malaysia, 43400, Selangor, Malaysia.

Accepted 27 May, 2011

Exchange rates are important to innumerable economic activities and the exchange rate behavior has long been at the top of the list of research agenda in international finance. This article is another test of the Relative Purchasing Power Parity (RPPP) to explain exchange rate behavior in short terms. The study examine the relative form of Purchasing Power Parity theory with recent monthly exchange rate data of US Dollar and Malaysian Ringgit starting from year 2005, which was the time Malaysia's currency went back to floating system after a few years pegging to US dollar since 1997 Asian Financial Crisis (AFC). Within this study, correlation and Ordinary Least Square (OLS) methods were applied to test the proposed RPPP model. Both the statistical and the observational results show significance power of Relative PPP on explaining exchange rate behavior of the chosen currencies.

Key words: Exchange rate, purchasing power parity (PPP), Malaysian ringgit, US dollar.

INTRODUCTION

Exchange rate predication is one of the most challenging and critical decisions in international finance area. Its challenging aspect is due to its direct effect on one of the most important goals of any firm, doing international trade, which is exchange risk hedging. Nowadays, restricted in current monetary system, any firm who involves with import and export activities outside of its home country borders will encounter a major risk called exchange rate risk that can be a major determinant for successfulness of business. Hence, finding and evaluating various theories that may help and facilitate future exchange rate prediction is toward the benefits of any global trader and investor and has made busy a lot of economic and financial academicians so far.

One of the major theories that explain exchange rate determination is Purchasing Power Parity (PPP), which in its absolute and relative forms, has been numerously studied before. Despite all the studies that have been done in different markets to evaluate persistency of Purchasing Power Parity in different time horizons and to evaluate it as a determinant factor for exchange rate, the results are contradictory. It is amazing to see contradictory results independent of applied statistical methods for both absolute and relative type of PPP. But, as the studies shows, it may trust more on relative PPP as a tool for short term exchange rate prediction probably along with some other financial tools and theories. As it can ignore the actual levels of exchange rate and prices in relative forms of PPP, it can be said that being exempt of strong assumptions; it is much easier to hold relative PPP than absolute PPP. It should be considered that absolute PPP is much broader than relative PPP in a sense. Therefore, when absolute PPP holds, relative PPP should also hold; however, absolute PPP does not necessarily holds if relative PPP holds.

There are various questions that can be asked on this issue in context of Malaysia. Knowing that most of the studies regards PPP has been done in Malaysian market before Asian Crisis on 1997, and considering that Malaysia's currency system is switched back to floating system after 2005, how is the validity of PPP since 2005 for Malaysian ringgit? How significant is the relation between price and exchange rate for Malaysia in deal with its major trading partner US based on relative form of PPP? How does the validity of this relation prove to be useful for exchange rate forecasting?

*Corresponding author. E-mail: alireza.bahiraie@yahoo.com.

In this study, relative form of PPP theory with monthly data from 2005 to 2009, as Malaysia's currency went back to floating system in 2005 after a few years re-peg to US dollar experience since 1997 Asian Financial Crisis (AFC) was examined. In the period of 1997 to 1998, Malaysia experienced financial crisis that affected the whole ASEAN region and the country started controlling the capital movement, inflation, and interest rate movement. To prevent more reduction in value of ringgit, government switched from floating system of currency to fixed system. The ringgit of Malaysia was pegged to US dollar since then, till July 2005.

PURCHASING POWER PARITY (PPP) THEORY

The theory of purchasing power parity (PPP) is a result of Cassel (1916) research in which he states that in ideally efficient market; identical goods should have only one price. Based on this idea, purchasing power parity (PPP) is a theory of exchange rate determination and a way to compare the average costs of goods and services between countries.

Purchasing power parity (PPP) states that there is a proportional relationship between the prices - peroxide by a representative basket of goods - in one country, relative to that of another when expressed in the same base currency. Although, there are a number of PPP specifications, the concept that has been the focus of recent empirical studies is long run PPP that permits short run deviations. The concept has been the subject of much debate both in the theoretical and econometric literature. Dornbusch (1976) commented that most macroeconomists have a deep-seated belief that a variant of PPP is justified in some sense. Since it forms a cornerstone of many macroeconomic models of trade and of exchange rate determination, failure to support this parity empirically, would somewhat undermine the basis for such models.

Different literatures have investigated the empirical validity of the PPP using different econometric methods and using data from developed as well as developing countries. These empirical investigations have also expanded to emerging markets and ASEN economics. It is interesting to know that these various empirical tests results do not all approve or reject this theory together. Frenkel (1981) by using standard 2SLS and GLS showed that PPP failed to hold during 1970's, but in another study conducted by Davutyan and Pippinger (1985), they concluded that indeed, it held not only during the 1920's, but also during the 1970's. More amazing is even after recent developments in econometric techniques, result of studies that have used these advanced methods are still not toward one direction. Unit root tests and cointegration analysis, is one of these new techniques that after its introduction has widely adopted to test PPP in most of recent studies.

Debates on validity of PPP theory among different economics based on their level of advancement, has created a rationale on conducting some of PPP tests. In context of Malaysia, to the best of our knowledge, previous related researches that focus solely on Malaysia has been done only by Gan (1991), Khoon and Mithani (2000). Gan (1991) finds no relationship between real effective exchange rate and relative price of tradable goods. Similar conclusion is arrived in a later study by Khoon and Mithani (2000) who found that Malaysian's real exchange rate follow a random walk implying the invalidity of PPP. Others studies in a multi-countries context with the inclusion of Malaysia are also limited. Among others, Manzur (1995) finds that PPP holds poorly in the short run but quite well in the long run in Malaysia and four other selected South East Asian countries. Bahmani-Oskooee (1993) and Baharumshah et al (1997) also obtain, among other countries, a weak evidence of long-run PPP in Malaysia. Their results are in contrary to Kim (1993) who rejects the PPP hypothesis in Malaysia and Singapore using the Johansen and Juselius (1990) method.

Recently, Razzaghipour et al. (2001) use statistical analysis to study the mean-reversion to PPP in the Asian currencies including Malaysian Ringgit and obtain empirical support for PPP, although not statistically significant. Meanwhile, Azali et al. (2001) are able to provide support for PPP between South East Asian countries (including Malaysia) and the Japan using the panel unit root and cointegration approach.

Kim et al (2009) in a recent study, use a time-varying coefficient cointegration model to test for purchasing power parity (PPP) of Southeast Asian currencies and to track changes in purchasing power relationships over time. From one of their main empirical findings, the stability of the relationship between exchange rates and price differentials is strongly rejected.

EMPIRICAL METHODOLOGY

A fundamental concept of PPP is the relation between domestic and foreign prices. The purchasing power parity is written as:

$$P_d = S \times P_f$$

which says that the domestic price level is equal to the foreign price level multiplied by the exchange rate. Of course, the exchange rate is defined as direct quotation. The expression can be rewritten to say that the exchange rate should be equal to the price ratio:

$$S = P_d \div P_f$$

Under fixed exchange rates, the first expression could be used to determine domestic prices. The second expression gives us the 'equilibrium' exchange rate under floating rates.

It is often convenient to write PPP in logarithmic form, to get, in this case, a linear expression for the exchange rate:

$$\ln S = \ln P_d - \ln P_f$$

Or, using small letters for logs;

$$s = p_d - p_f$$

The basic assumption is that goods arbitrage will equalize the prices of domestic and foreign goods. PPP comes in different forms. Going to the extreme, the study has the law of one price. To get to the law-of one price for all goods it need:

All goods (includes services) should be tradable
No tariffs or transportation costs
Taxes should be the same
Tastes must be the same, leading to identical domestic and foreign consumption baskets
The productivity level and growth should be the same.

If these conditions hold, the study talks about absolute PPP (APPP). These are of course, extreme assumptions. The study might assume that the deviations are given once and for all. A constant deviation can be represented with a constant term (a). In addition, it can assume stochastic stationary deviations (ε). The PPP equation for explaining the exchange rate becomes:

$$\ln S = a + \ln P_d - \ln P_f + \varepsilon$$

where (ε) is a stochastic term with mean zero, $E(\varepsilon) = 0$. The study differs between APPP, PPP (the more general form) and later relative PPP.

Over the years, people have tried a number of different price indexes. Here is a list: CPI, WSP (whole sale prices), export over import prices (=Terms of Trade), unit labor costs, indexes consisting of only tradables, indexes consisting of only non-tradables. The Economist even publishes a Big-Mac index.

A version of PPP is relative PPP, which builds on comparing inflation rates and rates of depreciations instead:

$$\Delta \ln S = \Delta \ln P_d - \Delta \ln P_f$$

If the domestic inflation increases faster than the foreign one, the outcome is depreciation of the exchange rate. Making the same assumptions as for PPP regarding constant and stochastic deviations the relation becomes:

$$\Delta \ln S = a + \Delta \ln P_d - \Delta \ln P_f + \varepsilon$$

The main difference between PPP and relative PPP is that the former assumes that price levels tend to move together in the long run. Under relative PPP, the price levels can move independent of each other in the long run, and only the inflation rates are assumed to move together. Absolute PPP does not hold empirically unless there is a study for long periods (20 years) or augment the equation with other variables like the interest rate differentials and oil-prices. Still, it will be a long run relation (of course the study has to allow for a constant term and dummies for tax changes). Relative PPP holds often among fixed exchange rates in the sense that these countries have the similar inflation rates. Countries with fixed exchange rates cannot have different inflation rates for a long time. For floating exchange rates, the relationship is mostly weak.

Hence, in the study , th e last equation to test whether relative PPP holds on span of data was used. To test the validity of relative Purchasing Power Parity as a prediction tool in short time, the study calculates the amount of PPP-implied for the time series. Based on relative PPP theory, the study found that:

$$\Delta \ln S = \Delta \ln P_d - \Delta \ln P_f$$

This formula in simple form based on inflation data and can be expressed as:

$$\Delta S = I_d - I_f$$

The formula explains that expected percentage change in exchange rate should be equal to inflation difference between domestic (home) country and foreign country if relative PPP holds:

$$\Delta S = I_d - I_f \quad \rightarrow \quad \frac{S_t - S_{t-1}}{S_{t-1}} \times 100 = I_d - I_f$$

$$\rightarrow \quad S_t = S_{t-1} + \frac{S_{t-1}}{100} \times (I_d - I_f)$$

To apply above formula, the study need to figure out inflation rates from the time series data of price levels. The inflation equation based on price level is:

$$Inflation = \frac{CPI_t - CPI_{t-1}}{CPI_{t-1}} \times 100$$

By applying this equation, the study figures out monthly inflation rates for Malaysia and US on our span of data (to calculate inflation of each month, each month's CPI should be deducted by CPI of previous year at same month). Then by applying relative PPP equation and determined inflation rates, the study estimate PPP-implied exchange rates for Malaysia and US.

EMPIRICAL RESULTS AND ANALYSIS

Data set

In order to have enough sample observation to validate the relative PPP in short term, the study use monthly data. Therefore, it selects forty five samples of observations starting from year 2005 on the pair of currencies. Data for this study are obtained from various sources. For inflation rate, that is, percentage change in Consumer Price Index (CPI), it extracts the required data from International Financial statistics (IFS) CD- ROM. Also, for price level or price index data, the study use same database from IFS. For actual monthly exchange rate, it obtains required data from PACIFIC Exchange Rate Service which offers a trustable database service for academic research and teaching purposes. For the purpose of this study, the three macroeconomic data: a) CPI (Consumer Price Index) percentage changes as the

Table 1. Estimated PPP-implied exchange rate.

No.	Date	Actual MYR/USD	Inf MY	Inf US	PPP-Impl MYR/USD	No.	Date	Actual MYR/USD	Inf MY	Inf US	PPP-Impl MYR/USD
1	Jul-05	3.7866	2.93	3.17	3.79	24	Jun-07	3.4457	1.45	2.69	3.36
2	Aug-05	3.7601	3.65	3.64	3.79	25	Jul-07	3.4406	1.63	2.36	3.42
3	Sep-05	3.7691	3.47	4.69	3.71	26	Aug-07	3.4846	1.92	1.97	3.44
4	Oct-05	3.773	3.09	4.35	3.72	27	Sep-07	3.471	1.83	2.76	3.45
5	Nov-05	3.7784	3.31	3.46	3.77	28	Oct-07	3.3736	1.92	3.54	3.41
6	Dec-05	3.7792	3.22	3.42	3.77	29	Nov-07	3.357	2.3	4.31	3.31
7	Jan-06	3.7514	3.25	3.99	3.75	30	Dec-07	3.334	2.39	4.08	3.30
8	Feb-06	3.7266	3.24	3.60	3.74	31	Jan-08	3.2674	2.28	4.28	3.27
9	Mar-06	3.7034	4.76	3.36	3.78	32	Feb-08	3.2238	2.66	4.03	3.22
10	Apr-06	3.6613	4.55	3.55	3.74	33	Mar-08	3.1865	2.76	3.98	3.18
11	May-06	3.6105	3.91	4.17	3.65	34	Apr-08	3.1624	3.05	3.94	3.16
12	Jun-06	3.6652	3.90	4.32	3.60	35	May-08	3.2155	3.81	4.18	3.15
13	Jul-06	3.6687	4.1	4.15	3.66	36	Jun-08	3.2577	7.69	5.02	3.30
14	Aug-06	3.6754	3.28	3.82	3.65	37	Jul-08	3.2499	8.51	5.6	3.35
15	Sep-06	3.673	3.27	2.06	3.72	38	Aug-08	3.3323	8.5	5.37	3.35
16	Oct-06	3.6779	3.07	1.31	3.74	39	Sep-08	3.4447	8.21	4.94	3.44
17	Nov-06	3.6434	2.96	1.97	3.71	40	Oct-08	3.5225	7.63	3.66	3.58
18	Dec-06	3.5502	3.05	2.54	3.66	41	Nov-08	3.5883	5.71	1.07	3.69
19	Jan-07	3.5076	3.24	2.08	3.59	42	Dec-08	3.5539	4.39	0.09	3.74
20	Feb-07	3.4959	3.14	2.42	3.53	43	Jan-09	3.5732	3.91	0.03	3.69
21	Mar-07	3.49	1.55	2.78	3.45	44	Feb-09	3.6356	3.71	0.24	3.70
22	Apr-07	3.4371	1.55	2.57	3.45	45	Mar-09	3.6749	3.52	-0.38	3.78
23	May-07	3.4031	1.45	2.69	3.39						

indicator of the inflation rate for each country. b) Price level or Index that is the same Consumer Price Index but not in percentage or differential format. c) Actual exchange rate for each country, was chosen.

Results via correlation testing and observation

The study calculates the PPP-implied exchange rate on the span of data by applying the proposed relative PPP equation.

Table 1 shows the actual value of exchange rate along with the PPP-implied exchange rate. It shows the comparison of differences in the inflation rate of home country (Malaysia) and foreign country (USA), which is assumed to be equal to the percentage change in exchange rates, and the actual percent change in the exchange rate.

Same result has been shown in Figure 1 to reveal the relation between actual and PPP-implied exchange rates observably. According to Figure 1, it seems that the study have satisfactory results for supporting relative PPP, even though it notices some deviations. To have a deeper analysis on deviations, the study goes through equations further presented to figure out percent deviation of actual exchange rate from the theoretically calculated PPP-implied exchange rate:

$$\text{Arithmetic Mean} = \frac{\sum_{i=1}^{n} \text{data points}}{\text{number of data points (n)}}$$

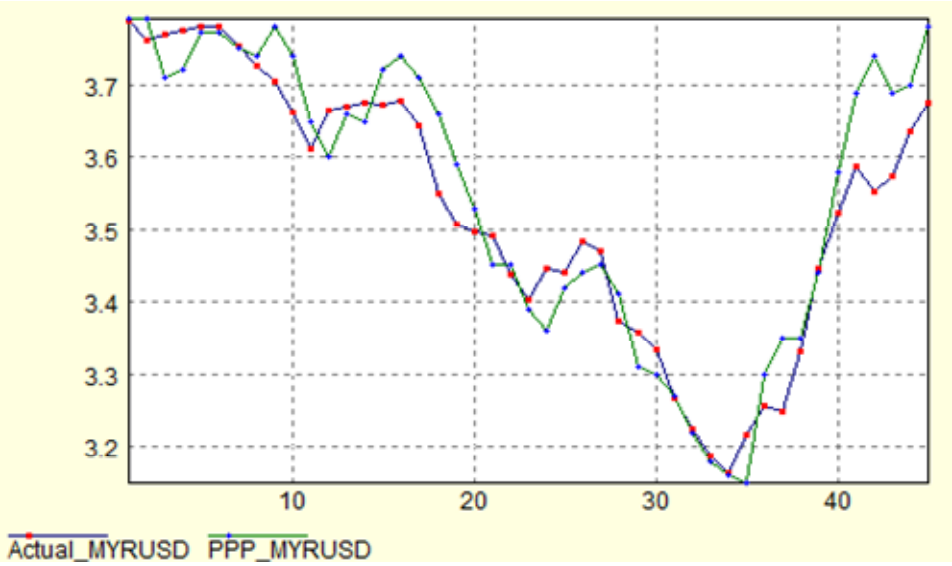

Figure 1. Actual exchange rate vs. estimated PPP-implied rate.

Table 2. Percent deviation and percent error of PPP-implied exchange rate.

Date	% Deviation	% Error	Date	% Deviation	% Error	Date	% Deviation	% Error
Jul-05	6.24	0.09	Oct-06	3.42	1.66	Jan-08	8.64	0.08
Aug-05	5.54	0.79	Nov-06	2.52	1.8	Feb-08	10.13	0.12
Sep-05	5.91	1.59	Dec-06	0.01	3	Mar-08	11.43	0.2
Oct-05	5.99	1.42	Jan-07	1.18	2.3	Apr-08	12.27	0.08
Nov-05	6.06	0.22	Feb-07	1.53	0.97	May-08	10.62	2.08
Dec-05	6.08	0.24	Mar-07	1.74	1.16	Jun-08	8.86	1.28
Jan-06	5.37	0.04	Apr-07	3.27	0.37	Jul-08	8.96	2.99
Feb-06	4.72	0.36	May-07	4.33	0.39	Aug-08	6.5	0.53
Mar-06	4.06	2.03	Jun-07	3.1	2.55	Sep-08	3.06	0.14
Apr-06	2.98	2.1	Jul-07	3.2	0.6	Oct-08	0.77	1.61
May-06	1.66	1.08	Aug-07	1.9	1.3	Nov-08	1.04	2.76
Jun-06	3.2	1.81	Sep-07	2.29	0.61	Dec-08	0.1	4.98
Jul-06	3.24	0.24	Oct-07	5.17	1.07	Jan-09	0.63	3.17
Aug-06	3.44	0.7	Nov-07	5.83	1.42	Feb-09	2.31	1.74
Sep-06	3.31	1.26	Dec-07	6.55	1.03	Mar-09	3.3	2.78

$$\text{Error} = \text{PPPImplied exchange rate} - \text{Actual exchange rate}$$

$$\text{Percent Error} = \frac{|\text{Error}|}{\text{Actual Exchange Rate}} \times 100$$

$$\text{Deviation} = |\text{PPPImplied exchange rate} - \text{Arithmetic Mean}|$$

$$\text{Percent Deviation} = \frac{|\text{Deviation}|}{\text{Actual Exchange Rate}} \times 100$$

Through the stated formulas, the percent deviation and percent error in PPP-implied exchange rate and actual exchange rate are calculated and summarized in Table 2.

Regarding the deviations from PPP, there are mainly three points to be explained. First, deviations in prices can take place because of shipping costs and tariffs. Since international trade involves shipping goods across national borders, prices may differ due to shipping costs or tariffs. Second, it is because of temporary deviations, which result from the differential speed of adjustment between financial-asset markets and goods markets or real relative price changes. Relating to this factor, the

Table 3. Statistical results (Number of observations: 45).

Variable	Mean	Variance	S.D.
Actual MYR/USD	3.528493333	0.033502534	0.183036973
PPP-Implied MYR/USD	3.547777778	0.03941284	0.198526672

Correlation matrix:		
	Actual MYR/USD	**PPP-Implied MYR/USD**
Actual MYR/USD	1	0.957325 (0.0000)
PPP-Implied MYR/USD	0.957325 [0.0000]	1

different speeds in the changes of price and the exchange rate are pointed out, which are caused by some exogenous factors. Moreover, the exchange rate tends to adjust to important economic factors more promptly, while prices lag behind. It is said: 'periods with important economic news will be periods when PPP deviations are large.' Using this point, Jacob A. Frankel demonstrated 'The Collapse of Purchasing Power Parity during the 1970s' in 1981. Third, it is the appearance of deviations. They result from comparing the current exchange rates with price set in the past or using national price indexes when countries consume different baskets of goods. They reveal that there is a lag between order and delivery in international trade, and price indexes are not directly comparable internationally since tastes of consumers in different countries are different.

Test of relative PPP via statistics and hypothesis

Besides these casual observations, to have a more objective analysis, the study uses the statistical methods. Using the differentiated equation:

$$S_t = S_{t-1} + \frac{S_{t-1}}{100} \times (Inf_{MY} - Inf_{US})$$

The study defines that if PPP theory holds, the real exchange rate should be equal to PPP-implied exchange rate. However, as has already been noticed, there are deviations the relations cannot be exactly equal. By using the hypothesis testing of correlation between them, it can be decided on statistical significance of these relationships:

H_0: $\rho=0$ there is no correlation between the real rate and the PPP-implied exchange rate
H_a: $\rho\neq0$ there is no correlation between the real rate and the PPP-implied exchange rate.

If there is statistically significant correlation between the real exchange rate and the PPP-implied exchange rate, the study will reject Ho from this hypothesis.

The Table 3 shows the result of statistical test on the pair of currency with confidence level of 95%. Pearson correlation between the real exchange rate and the PPP-implied exchange rate is 0.957325 and significance (2-tailed) is 0.000 [using p = 0.05 level]

Since there is a high positive correlation between the real exchange rate and the PPP-implied exchange rate, Ho can be rejected. The risk that will be taken in rejecting Ho is very low, which is 0.000 using 0.05 level of p. Therefore, the study concludes that, there is statistically significant correlation between the actual exchange rate and the PPP-implied exchange rate on the pair of currencies.

SUMMARY AND CONCLUSION

Exchange rates are important to innumerable economic activities. Tourists care about the value of their home currency abroad. Investors care about the effect of exchange rate fluctuation on their international portfolios. Central banks care about the value of their international reserves and open positions in foreign currency as well as about the impact of exchange rate fluctuation on their inflation objectives. Governments care about the prices of exports and imports and the domestic currency value of debt payments. Markets care both directly and indirectly, since exchange-rate shifts can affect all sorts of other asset prices. Exchange rates often swing wildly on a daily basis for reasons that apparently have connection to economic and financial variables. In this study, a simple test of the relative Purchasing Power Parity (RPPP) to explain the exchange rate behavior in short time was run. The study concludes that, since there are high correlations between the real exchange rate and the PPP-implied exchange rate, there is statistically significant correlation between the actual exchange rate and the PPP-implied exchange rate. So, it can be said that there is a statistically significant correlation between the change in the exchange rate and the percentage change in the price level of two countries. Therefore, PPP can serve to explain the changes in the exchange rate between two countries significantly. Further, the study explained that there are many factors that cause deviations from PPP, and large deviations can be considered as invalidity of PPP. Some factors are permanently avoidable, such as, freight costs for international trade,

but some are not avoidable to a certain period such as the effect of big economic news. Considering these aspects, the study cannot deny that it has different results by using different data, periods, countries and methodlogies. However, PPP can still be used as a basis for economic policy decision, because it can bear satisfactory results for certain countries or periods.

REFERENCES

Azali M, Habibullah MS (2001). Does PPP hold between Asian and Japanese economies? Evidence using panel unit root and panel cointegration. Japan World Econ., 13: 35-50.

Baharumshah AZ, Ariff M (1997). Purchasing power parity in Southeast Asian countries economies. Asian Econ. J., 11: 141-153.

Bahmani-Oskooee M (1998). Do exchange rates follow a random walk process in Middle Eastern countries?. Econ. Letters., 58(3): 339-344.

Gan BW (1991). On the deviations from purchasing power parity: the case of the Ringgit effective exchange rate. Appl. Econ., 23: 1461-1471.

Cassel G (1916). The present situation of the foreign exchanges. Econ. J., 26: 62-65.

Davutyan N, Pippenger J (1985). Purchasing power parity did not collapse during the 1970s. Am. Econ. Rev., 75(5): 1151-1158.

Dornbusch R (1976). Expectations and Exchange Rate Dynamics. J. Pol. Econ., 84: 1161-1176.

Frenkel JA (1981). The collapse of purchasing power parities during the 1970's. Eur. Econ. Rev., 16: 145-165.

Johansen S, Juselius K (1990). Maximum likelihood estimation and inference on cointegration with application on demand for money. Oxf. Bull. Econ. Stat., 52: 169-210.

Kim BJC (1993). Test of the long-run purchasing power parity: the case of some Pacific-Rim countries. In: Pan Pacific Business Association (Eds.). Proceedings of the Pan Pacific Conference on A Business, Economic, Technological and Educational Exchange. Beijing, pp. 370-372.

Kim BH, Kim HK (2009). The purchasing power parity of Southeast Asian currencies: A time-varying coefficient approach. Econ. Model., 26: 96-106.

Khoon GS, Mithani DM (2000). Deviation from Purchasing Power Parity: Evidence from Malaysia, 1973–1997. Asian Econ. J., 14: 71-85.

Manzur M, Ariff M (1995). Purchasing power parity: new methods and extensions. Appl. Finan. Econ., 5: 19-26.

Razzaghipour A, Fleming G, Heaney R (2001). Deviations and mean reversion to purchasing power parity in the Asian currency crisis of 1997. Appl. Econ., 33: 1093-1100.