Purchasing Power Parity in Developing Countries

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Abstract

This article evaluates the long-term foreign exchange rate on the Purchasing Power Parity model in development countries. The tests were applied to seven countries in the Americas, eight countries in Africa, five in Asia, and five in the Middle East, using the United States as the reference country. To test the model, we used the consumer price index, the implicit GDP deflator, the wholesale price index, and the producer price index; the exchange rates were period-ending rates, for the period from 1965 to 2015, with annual frequency. We applied the Vector Error-Correction Model as a mechanism for correcting errors of the co-integration vectors, using STATA-14 software. Of the projections thereby produced, only four combinations corroborated the theory, therefore it is possible to say that we were unable to corroborate PPP.

Introduction

Exchange rate is one of the most important and longest-lasting macroeconomic variables in the economy, according to Soofi (1998) and Edwards (2006), because it affects inflation, exports, imports and economic activity of a country and between countries. Cassel (1916) says that the exchange rate between two countries is determined by the ratio between the general price levels in both countries.

Copeland (2005) says that one of the most widely studied long-term exchange rate models in the economy is Purchasing Power Parity (PPP), which shows ambiguous results, because in most of the tests, the theory is not corroborated. Dornbusch (1982) claims that PPP-oriented exchange rate policies have been widely adopted among developing countries as a way of assessing the foreign trade sector, although it is also applied in developed countries.

Aggarwal *et al.* (2000) evaluated PPP in real exchange rates between Japan and Indonesia, Korea, Malaysia, the Philippines, Singapore, Sri Lanka, Thailand, Germany, the US, and Australia. They considered the consumer price index (CPI) and producer price index (PPI) for the period from 1974 to 1997, using quarterly data. Aggarwal et al. (2000) concluded that PPP is maintained for Asian countries; however, the theory is not confirmed for non-Asian countries.

Endres; Chumrusphonlert (2004) evaluated PPP with average nominal exchange rates and CPI, using monthly data, for Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore and Thailand, using Japan and the US as reference countries, for the period from 1973.1 to 2001.7, with the Philippines with data up to 2001.6; Malaysia with data up to 2001.4; Indonesia with data up to 2000.12 and Hong Kong with data up to 2001.6. Endres;

Chumrusphonlert (2004) found evidence of PPP between Japan and Indonesia, Korea, Malaysia, Philippines and Thailand; and with the US as a reference, PPP is valid for all of the countries except Japan.

Baharumshaha; Tze-Haw; Fountas (2008), observing two sub-periods, from 1976.1 to 1997.6 and 1997.7 to 2002.9, studied PPP using nominal exchange rates and CPI, considering Japan and the US as reference countries, in order to assess parity with South Korea, Thailand, Indonesia, Malaysia, Singapore and the Philippines; no sufficient evidence was found to support PPP (BAHARUMSHAHA; TZE-HAW; FOUNTAS, 2008).

To test absolute PPP for the US, Japan, Canada, Mexico and the United Kingdom, Hong; Phillips (2010) used nominal exchange rates, with CPI, PPI and WPI (wholesale price index), with monthly frequency, from 1971.1 to 2004.12, except the PPI series for Mexico, which begins in January 1981. Applying the Augmented Dickey-Fuller (ADF) test, they found that US-Canada and US-Japan were not co-integrated for CPI and PPI, but are significant for US–Mexico and US–UK; with the KPSS test, there is a linear co-integration for the entire sample period (HONG; PHILLIPS, 2010).

Soofi (1998) analyzed PPP for several members of the Organization of Petroleum Exporting Countries, and the Geweke and Porter-Hudak (GPH) test results suggest that PPP models for Algeria, Ecuador, Saudi Arabia and Venezuela were co-integrated, but the ADF test shows the opposite (Soofi, 1998). Frenkel (1981) concluded that the exchange rate of the G-7 countries during 1970 did not support the forecast of the PPP theory. Liu (1992) tested PPP for nine countries in Latin America compared to the US, and concludes that the theory is corroborated in the cases studied. Xu (2003) tested PPP between the US and Canada, France, Germany, Italy, Japan, Korea, the Netherlands and UK, the first quarter of 1974 to the last quarter of 1997, using CPI, WPI and the traded goods price index (TPI), and rejected all of the hypotheses.

Theoretical reference

Purchasing Power Parity (PPP) was developed as an alternative to the gold standard using elements of the Quantity Theory of Money and considering the Law of One Price (LOOP) (CASSEL, 1918).

Cassel (1916), Dornbusch (1987), Batiz; Batiz (1994), Macdonald *et al.* (1992, 1994, 2007), Rogoff (1996), Sarno; Taylor (2001), Visser (2004), Moosa (2005) and Rossi (2013) argue that in the long term, the nominal exchange rate should reflect the relative prices of two currencies, because according to Cassel (1916, 1918, 1921, 1925a, 1928a, 1928b, 1930, 1932b, 1933, 1967), Houthakker (1978), Dornbusch (1987), Edwards (1989), Macdonald (1994, 2007), Rogoff (1996), Mccallum (1996), Famá e*t al.* (2001), Sarno; Taylor (2001), Xu (2003), Marçal e*t al*. (2003, 2011), Visser (2004), Copeland (2005), Felmingham (2007), Hong; Phillips (2010) and Rossi (2013), PPP shows that the price level in one country, converted into the currency of a second country by the nominal exchange rate, should be equal to the price level of the second country, for a unit of currency in the first country to have the same purchasing power as the second country, as follows:

$$e = P \,/\, P^* \qquad (1)$$

$$P = e \,.\, P^* \qquad (2)$$

Where $P$and P^* are the tradable goods price indices in different countries and e is the nominal exchange rate, which is the amount of local currency needed to buy a unit of foreign currency (DORNBUSCH, 1987 and BATIZ; BATIZ, 1994). However, when the nominal

exchange rate is adjusted due to changes in price levels, Strauss (1996) says that the real exchange rate is obtained; for Batiz; Batiz (1994), this is an indicator of relative competitiveness between two or more countries, which compares the price of foreign goods in terms of domestic goods.

Hence, for Dornbusch (1987), Batiz; Batiz (1994), and Vasconcelos (2004), the real exchange rate (θ) between two countries can be formally represented by the nominal exchange rate adjusted by the ratio of relative prices:

$$\theta = \frac{e\,.\,P*}{P} \tag{3}$$

$$\theta = \hat{e} + \hat{P}^* - \hat{P} \tag{4}$$

In PPP, any change in the relative purchasing power between two currencies, which comes from an initial position of equilibrium, causes a fluctuation in the exchange rate (CASSEL, 1918, 1921, 1925a, 1928a; 1932b). Changes in domestic purchasing power of a currency have a greater influence on exchange rates than any other type of changes in the actual conditions in which international trade is developed (CASSEL, 1932b). In the Quantity Theory of Money, variations in the quantity of currency in circulation produce changes in the purchasing power of that currency, which reflect domestic prices and alter the exchange rate (CASSEL, 1967), although Keynes (1923), Angell (1926) Samuelson (1948), and Balassa (1964) say that there are channels of reciprocal causality between price index and exchange rate.

To empirically develop the PPP, Cassel (1918) distinguished the Absolute PPP (APPP) from the Relative PPP (RPPP); in the APPP, the nominal exchange rate of a country is determined by the relationship between the general price levels of two countries (CASSEL, 1916; HOUTHAKKER, 1978; SOOFI, 1998; MACDONALD, 1994, 2007; ROGOFF, 1996; SARNO; TAYLOR, 2001; PAPELL; PODRAN, 2003 and COPELAND, 2005).

Soofi (1998), MacDonald *et al.* (1992, 1994, 2007), and Batiz; Batiz (1994) state that in absolute PPP, the ratio of consumer goods prices to any country approaches the equilibrium exchange rate. Hence, when verifying the APPP and RPPP, Batiz; Batiz (1994) show that the real exchange rate (θ) will be constant and equal, reflecting identical competitive capabilities between the countries at any point in time.

Therefore, Edwards (1989), Soofi (1998), MacDonald (1994, 2007), Sarno; Taylor (2001), and Marcal (2003) show that at time *t*, the real exchange rate (θ)is:

$$\theta_t = e_t - p_t + p_t^* = 0 \tag{5}$$

Where e_t is the nominal exchange rate, p_t and p_t^* are the price levels of the country of origin and the foreign country and at time *t*. Thus, APPP supports the assertion that monetary factors, measured by the ratio of price level to the exchange rate at any moment t (MACDONALD, 1994, 2007). However, it is difficult to determine according to MacDonald (1994, 2007), Rogoff (1996) and Sarno; Taylor (2001) whether the same basket of goods is available in different countries, and it is more common to test the RPPP, as it sustains changes in the percentage of the exchange rate over a particular period, offsetting the difference in inflation rates in the countries evaluated in the same period of time.

Furthermore, the data necessary for APPP are collected sporadically (ROGOFF, 1996). MacDonald (1994, 2007) adds that in order to construct the APPP, general price levels of goods are used, but to test PPP, indices are used instead of levels. Accordingly, for Cassel

(1921, 1925a, 1932b), Soofi (1998), Batiz; Batiz (1994), and Holland *et al.* (2008), the RPPP is:

$$\hat{P} = \hat{e} + \hat{P}^* \quad (6)$$

$$\hat{e} = \hat{P} - \hat{P}^* \quad (7)$$

MacDonald (1994, 2007) and Marcal (2003) mention that in RPPP there are two price indices (internal P or p and external P^*or p^*) composed of tradable goods and with a structure of weights and goods, demonstrated by the following equation:

$$\Delta e_t = \Delta p_t - \Delta p_t^* \quad (8)$$

Where Δ represents the first difference operator. In MacDonald's view (1994, 2007), RPPP indicates that countries with relatively high inflation will experience a depreciation in the currency, so, compared to APPP, relative PPP is incontestable. Although absolute PPP often appears in theoretical models, only relative PPP can actually be tested (COPELAND, 2005).

In RPPP, the entire variation in the relation of purchasing powers between two currencies, starting from a position of equilibrium, will bring about a change in the exchange rate (MACDONALD, 1992, 1994, 2007 and BATIZ; BATIZ, 1994). Papell *et al*. (2003) and Copeland (2005), state that RPPP is emphasized by arbitration over time, because the exchange rate is adjusted to compensate for inflation differentials between countries.

Price Indices

As explained earlier by MacDonald (1994, 2007) and Sarno; Taylor (2001), the literature has focused on RPPP tests, considering that changes in relative price levels are balanced by changes in exchange rates.

Frenkel (1978), who tested the two versions of PPP, using different price indices, noted that for RPPP, indices are independent, but in APPP the type of measure of prices changed the findings for some of the exchange rates evaluated.

Thus, Cassel (1967) and Samuelson (1964) say that supply and demand in the economy of exchanging productivity factors exerts a key influence on prices, therefore it is important to evaluate the different price indices applicable to PPP.

The theoretical perspectives differ on the bases for price index: in the marginalist theory, prices seek to maximize profits; in Marxist theory they derive from the quantity of labor required to produce them; for Keynes (1923), prices are derived from applying margins on production costs; in the Sraffian theory, prices stem from a theory of surplus production, measured in terms of a standard commodity, without the need for value of labor theory.

Cassel (1928b) and Yeager (1958) believe that PPP refers to the domestic value of the currencies involved and the changes in the value thereof can only be measured by a general price index that represents the set of goods marketed in the country.

For Officer (1976), the prices of productivity factors substitute the prices of goods, as well as the unit cost of labor in industry and wage rate. According to Artus (1978), this is an advantage, because the price structure on the market of factors in a country tends to change more slowly than the price structure on the market of goods.

For Balassa (1964), Samuelson (1964) and Sarno; Taylor (2001), the index that is most widely used for PPP is the CPI, because it covers changes in competitiveness and includes a wide range of goods, in addition to periodic publication of reliable data in almost all countries, but Edwards (1989), Soofi (1998), Sarno; Taylor (2001), and Xu (2003) believe

that CPI is a poor proxy because its calculation involves large amounts of non-tradeable goods and different baskets of goods in different countries, which leads to misleading empirical results (XU, 2003).

The most appropriate indices for Copeland (2005) are the Retail (or Consumer) Price Index (RPI, supplied by the CPI), which is based on a sample of prices at stores and other retail establishments, and the Wholesale (or Producer) Price Index (WPI, in some countries replaced by the PPI), which measures prices in transactions between companies.

Felmingham (2007) uses the ratio of the export price index to the import price index, and Edwards (1989) calculates the ratio of the CPI and WPI; however, Edwards himself (1989) and Xu (2003) stress that these are not entirely appropriate, since these three price indices use disparate weights between countries and the CPI retains large amount of non-tradable goods. Xu (2003), when comparing CPI, WPI and Traded Goods Price Index (TGPI), the latter seems to be a more appropriate price index for both PPP tests.

Edwards (1989) and Sarno; Taylor (2001) believe that the GDP deflator is a real aggregate production price index because it provides a good indicator of changes in the degree of productivity competitiveness, while the CPI and WPI are consumption price indices; however, Edwards (1989) asserts that the GDP deflator, for most developing countries, is only available on an annual basis.

For Angell (1922), Xu (2003) and Baharumshaha; Tze-haw; Fountas (2008), general price indices, especially the GDP deflator, can skew PPP, because the ratio of prices of tradable and non-tradable goods move in different ways over time, due to different growth rates of productivity when estimating long-term equilibrium exchange rate. However, Edwards (1989) and Sarno; Taylor (2001) state that none of these price indices are perfect and all of them have some advantages and disadvantages. Keynes (1923) and Frenkel (1978) show that PPP is a certainty if one is restricted to the use of tradable goods price index, thereby satisfying the LOOP. PPP is seen as an extension of the LOOP, and it is possible to use different price indices, according to Samuelson (1964), Edwards (1989), Soofi (1998) and Aggarwal; Montañes; Ponz (2000).

Thus, the most widely used general price indices used are the CPI or RPI, PPI or WPI, and the implicit deflator of the Gross Domestic Product (GDP), which are used in this research because according to Keynes (1923), Balassa (1964), Samuelson (1964), Frenkel (1978), Edwards (1989), Sarno; Taylor (2001) and Copeland (2005), these are the general price indices that are most widely used in the literature.

Method

The long-term stability between macroeconomic variables is estimated by techniques of econometric co-integration, and if the series are co-integrated, the linear constraints on the co-integrating vector are tested; if the constraints are appropriate, the error correction mechanism is valid and active. Asteriou; Hall (2007) assert that by combining series, it is possible to eliminate the non-stationarity, Engle; Granger (1987) and Johansen (1991) add that it is therefore possible to affirm that there is a stationarity transformation vector that eliminates the problem of spurious regressions.

The most widely used co-integration techniques, according to Gregory *et al.* (2004) are the Augmented Dickey Fuller (ADF) test (ENGLE; GRANGER, 1987), the $Z\alpha$, the trace test (TR), and the maximum eigenvalue or maximum likelihood (MAX) (JOHANSEN, 1988, 1991) and test of Reinsel and Ahn. Vector Error Correction Models (VECM) are used, which represent a part of the imbalance between the series of variables in a period, corrected in the following period (ENGLE; GRANGER, 1987).

Specific tests are required for using univariate and multivariate models, which identify non-random patterns in the time series variables of interest; if such tests and adjustments are not made, the results are inconsistent and useless for any analysis. For this study, we investigated the properties of Johansen (1988, 1990, 1991, 1995) for the maximum eigenvalue and trace test, assessing the existence of co-integration for situations empirically relevant to country pairs.

The co-integration of Johansen (1988) analyzes structural links between two or more variables, determining whether or not they have a long-term balance; if they are co-integrated, it is necessary to note the order of integration of each one, using the unit root test. First the existence of co-integration is tested for each pair of countries, then constraints are imposed on the co-integration vector, with chi-square distribution with degrees of freedom given by the number of constraints (JOHANSEN, 1988, 1990, 1991, 1995). We applied, in the co-integration relationship with proportionate constraint on the coefficients, β with values [1 -1] and number of lags equal to two, for the systems.

Database and variables

We observed the theory of RPPP for developing countries, considering the classification of the degree of economic and social development of the International Monetary Fund (IMF), testing the hypothesis of PPP for 25 countries: seven countries in the Americas (Brazil, Colombia, Costa Rica, Mexico, Panama, Peru, Uruguay); eight countries in Africa (Central African Republic, Congo Republic, Egypt, Morocco, South Africa, Trinidad and Tobago, Tunisia, and Zambia); five countries in Asia (India, Indonesia, Malaysia, Sri Lanka, Thailand), and five Middle Eastern countries (Iran Islamic Republic, Kuwait, Pakistan, Saudi Arabia, Turkey), using the US currency as a reference.

To test the PPP, four price indices were used for each of the 25 countries, namely the CPI, GDP deflator, WPI and PPI, since these are the price indices most frequently shown in the literature; in addition to the price indices, we used the period-end exchange rates of each of the 25 countries, producing 100 possible combinations. The selected developing countries are those with the longest time series collected in the data base of the IMF and the World Bank, from 1965 to 2015, with annual data.

Assessment of the results

Observing the pairs of countries, always the US and one of the 25 countries, we evaluated in the first stage the co-integration tests between the exchange rate and CPI; exchange rate and WPI; exchange rate and GDP deflator, and exchange rate and PPI.

In the series that were co-integrated, two series were used in one vector error-correction model (VECM) with linear constraints on β; in the ones in which there was evidence of error correction, the system of variables was classified as valid. Of the 100 possible combinations, only four had evidence of co-integration and valid linear constraints for the co-integration vector. The projected results, in Table 1 (APPENDIX A) were compared with observed values, with the following result:

For the consumer price index (CPI): the theory is corroborated for country pairs Sir Lanka – United States and Egypt – United States; For the implicit GDP deflator: only the Saudi Arabia – United States country pair confirms the theory; For the wholesale price index (WPI): only the Trinidad and Tobago – United States country pair corroborates the theory; For the producer price index (PPI): no two countries confirm the theory.

Conclusion

This paper aimed to verify whether relative PPP is maintained over time for 25 developing countries, having the United States as the reference country, with annual data from 1965 to 2015, using four price indices and period-end exchange rates.

We used co-integration tests to analyze whether or not the variables have a long-term equilibrium relationship, imposing constraints on the vectors, with chi-square distribution with degrees of freedom given by the number of constraints. In systems with significant results, a co-integration relationship was imposed, with proportionate constraint on the coefficients and number of lags equal to two.

The hypothesis was tested using the VECM, to examine the effects of individual shocks on the dynamics of the system, and adjustments were made in relation to the variance-covariance matrix of the residuals; regressions were made with the rolling regression process, taking the first half of the data as the sample space. A series was generated with the squared errors for each VECM projection, in STATA-14 software.

Of the 100 projections, the theory was not corroborated for any pair of countries with PPI; however, for the CPI, it was corroborated for two country pairs (Sir Lanka – United States, Egypt – United States); for the implicit GDP deflator, only one country pair was corroborated (Saudi Arabia – United States), and for WPI, one country pair (Trinidad and Tobago – United States) corroborates the theory. Ratifying the majority of published studies, PPP is not corroborated because the confirmed combinations are small countries with foreign trade flow that is too low to validate the proposed theory. Therefore, more studies are needed, that seek to explain why PPP is not corroborated or even to add variables to improve the explanatory power of the theory.

References

Aggarwal, R., Montañés, A. and Ponz, M., (2000), "Evidence of long-run purchasing power parity: analysis of real asian exchange rates in terms of the Japanese yen", *Japan and the World Economy*, No. 12, pp: 351-361.

Angell, J.W., (1922), "International Trade Under Inconvertible Paper", *The Quarterly Journal of Economics*. Vol. 36, No. 3, pp: 359-412.

Artus, J. (1978), "Methods of assessing the long-run equilibrium value of an exchange rate", *The Journal of International Economics*, Vol. 8, pp: 277-299.

Baharumshah, A. Z., Haw, C. T. and Foutna, S., (2008), "Re-examining purchasing power parity for East-Asian currencies: 1976–2002", *Applied Financial Economics*, Vol. 18, pp: 75–85.

Balassa, B., (1964), "The Purchasing-Power Parity Doctrine: A Reappraisal", *The Journal of Political Economy*, Vol. 72, No. 6, pp. 584 - 596.

Batiz, F. L. R.; Batiz, L. A. R., (1994), *"International finance and open economy macroeconomics"*, Prentice Hall, 2ª Edition.

Cassel, G., (1916), "The present situation of the foreign exchanges", *The Economic Journal*, Vol. 26, No. 101, pp: 62-65.

_____., (1918), "Abnormal deviations in international exchanges", *The Economic Journal*, Vol. 28, No.112, pp: 413-415.

_____., (1921), "The World's Monetary Problems", New York.

_____., (1925a), "Rates of exchange and PPP", *Skandinaviska Kreditaktiebolaget, Quarterly Report*, pp: 17-21.

_____., (1928a), "Foreign Investments", *University of Chicago Press*, Chicago.

_____., (1928b), "Post War Monetary Stabilization", *Columbia University Press*, New York.

_____., Gregory, T. E., Kuczynsky R. E. and Norton, H. K., (1930), “Foreign Investments”, *The Economic Journal*, Vol. 40, No. 157, pp: 120-122.
CASSEL, G., (1932b), “The Crisis in the World’s Monetary System”, *Oxford: Oxford University Press*.
_____., (1933, 1967), “The Theory of Social Economy”, *Harcourt, Brace & Co*. New York.
Copeland L.S., (2005), “Exchange Rates and International Finance”, *Prentice Hall*, Fourth Edition, England.
Dornbusch, R., (1982), “PPP exchange rate rules and macroeconomic stability”, *The Journal of Political Economy*, Vol. 90, No. 1, pp: 158-165.
_____., (1987), “Exchange Rates and Prices”, *The American Economic Review*, Vol. 77, No. 1, pp: 93-106.
Edwards, S., (1989), “Real Exchange Rates in the Developing Countries: Concepts and Measurement”, *National Bureau of Economics Research*, Working Paper No. 2950.
ENGLE, R.F.; GRANGER, C.W.J. Cointegration and error correction: representation, estimation and testing. *Econometrica*, v. 55, p. 251-276, 1987.
Enders, W. And Chumrusphonlert, K., (2004), “Threshold cointegration and purchasing power parity in the pacific nations”, *Applied Economics*, No. 36, pp: 889–896.
Famá, R. and Chaia, A. J., (2001), “Teorias da Previsão da taxa de Câmbio: Um Teste de Eficiência no Brasil, Chile e México na Segunda Metade dos anos 90”, *Caderno de Pesquisa em Administração*, São Paulo, Vol. 08, No. 2.
Flemingham, B. S. and Wadsley, A. G. W., (2007), “The Purchasing Power Parity Puzzle: The Dependent Economy Solution”, *Proceedings of the Australian Conference of Economists*, Hobart, Tasmania, Session 2, Paper 2, pp: 1-42.
Frenkel, J. A., (1978), “Purchasing power parity: doctrinal perspective and evidence from the 1920’s”, *Journal of International Economics*, Vol. 8, pp: 169-191.
———., (1981), “Flexible exchange rates, prices and the role of `news’: Lessons from the 1970’s”, *Journal of Political Economy*, 89, pp: 665 - 705.
Holland, M., Luncinda, C.; Gala, P., (2008), “Desalinhamento Cambial no Brasil: uma primeira aproximação”, *Centro de Macroeconomia Aplicada*, São Paulo.
Hong, S. H. And Phillips, P. C. B., (2010), “Testing Linearity in Cointegrating Relations With an Application to Purchasing Power Parity”, *American Statistical* Association, *Journal of Business & Economic Statistics*, Vol. 28, No. 1.
Houthakker, H. S., (1978), “Purchasing Power Parity as an Approximation to the Equilibrium Exchange Ratio”, *Economics Letters 1, North-Holland Publishing Company*, Department of Economics, Harvard University, Cambridge, pp: 27-31.
International Monetary Fund - http://www.imf.org/external/index.htm
Johansen, S., (1988), “Statistical analysis of cointegration vectors”, *Journal of economics dynamics and control*, Vol. 12, pp: 231-254.
———., (1991), “Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models”, *Econometrica*, Vol. 59, No. 6, pp: 1551–1580.
———., (1995), “Likelihood-Based Inference in Cointegrated Vector Autoregressive Models”, *Oxford University Press*, New York.
——— and Juselius, K., (1990), “Maximum Likelihood Estimation and Inference on Cointegration–with Applications to the Demand for Money”, *Oxford Bulletin of Economics and Statistics*. Vol. 52, No.. 2, pp: 169–210.
Keynes, J. M., (1923), “A Tract on Monetary Reform”, *Macmillan and Co. London*.
Liu, P. C., (1992), “Purchasing power parity in Latin America: a cointegration analysis”, Weltwirtschaftliches Archiv, *Band 128*, Heft4, pp: 662-680.

Macdonald, R. and Taylor, M. P., (1992), “The International Library of Critical Writigns in Economics 16”, Exchange Rate Economics: Volume I, *Aschgate Publishing Company*, Vermont.
———., (1994), “The International Library of Critical Writings in Economics 16”, Exchange Rate Economics: Volume I, *Aschgate Publishing Company*, Vermont.
Macdonald, R., (2007), “Exchange Rate Economics: Theories and evidence”, *Routledge*. First Published. New York.
Marçal, E. F., Pereira, P.L.V. and Santos Filho, O.C., (2003), “Paridade do poder de compra - Testando dados brasileiros”, *Revista Brasileira de Economia*, Vol. 57, No.1, pp: 159–90.
Marçal, E. F., (2011), “Estimando o desalinhamento cambial brasileiro a partir de modelos multivariados com cointegração”, *Instituto de Pesquisa Econômica Aplicada – IPEA*, Rio de Janeiro.
Mccallum, B., (1996), “International Monetary Economics”, *Oxford University Press.*
Moosa, I. A., (2005), “Exchange Rate Regimes: Fixed, flexible or something in-between?”, *Palgrave Macmillan, Printed and bound in Great Britain by Antony Rowe Ltd*, Chippenham and Eastbourne.
Officer, L., (1976), “The purchasing power parity theory of exchange rates: A review article”, I*MF Staff Papers*, Vol. 23, pp: 1-60.
Papell, D. H., and Podran, R., (2003), “Long Run Purchasing Power Parity: Cassel or Balassa-Samuelson?” ,University of Houston..
Rogoff, K., (1996), “The Purchasing Power Parity Puzzle”, *The Journal of Economic Literature*, Vol. 34, No. 2, pp: 647-668.
Rossi, B., (2013), “Exchange Rate Predictability”, *Journal of economic literature*, Barcelona GSE Working Paper Series, Working Paper No. 690, pp: 1063-1119.
Samuelson, P.A., (1948), “International Trade and the Equalization of Factor Prices”, *The Economic Journal*. Vol. 58, No. 230, pp: 163-184.
Samuelson, P., (1964), “Theoretical Notes on Trade Problems”, *The Review of Economics and Statistics*, Vol. 46, No. 2, pp: 145 - 154.
Sarno, L. and Taylor, M. P., (2001), “Purchasing Power Parity and the Real Exchange Rate”, *International M*acroeconomics, London, Discussion Paper No. 2913.
SOOFI, A. S., (1998), “A fractional cointegration test of purchasing power parity: the case of selected members of OPEC”, *Applied Financial Economics*, No. 8, pp: 559-566.
STRAUSS, J., (1996), “The cointegrating relationship between productivity, real exchange rates and PPP”, *Journal of Macroeconomics*. Vol. 18, No. 2, pp. 299-313.
VASCONCELOS, C. R. F., (2004), “O efeito Balassa-Samuelson e a Paridade do Poder de Compra na Economia Brasileira”, *Análise Econômica*, Ano 22, v. 41.
VISSER, H. A., (2004), “Guide to International Monetary Economics: Exchange Rate Theories, Systems and Policies”, Third Edition, Cheltenham, UK, *Edward Elgar Publishing*.
World Bank - http://www.worldbank.org/
XU, Z. (2003), “Purchasing power parity, price indices, and exchange rate forcasts. *Journal of International Money and Finance*, No. 22, pp: 105–130.
YEAGER, L. (1958), “A rehabilitation of PPP. *Journal of Political Economy*”, Vol. 66, No. 6, pp: 516-530.

APPENDIX A

Table 1 – Johansen Co-integration Tests

		Exchange rate and CPI			GDP deflator exchange rate			Exchange rate and PPI			Exchange rate and WPI		
	Critical value 5%	Test statistic	Constraints on Beta Chi2(1)	Prob > Chi2	Test statistic	Constraints on Beta Chi2(1)	Prob > Chi2	Test statistic	Constraints on Beta Chi2(1)	Prob > Chi2	Test statistic	Constraints on Beta Chi2(1)	Prob > Chi2
BRAZIL													
H_0: r=0 vs H_1: re 1	15.41	13.7108			7.7021			7.8566			7.8567		
H_0: rd1 vs H_1: re2	3.46	4.5246			2.3017			2.2140			2.2140		
CENTRAL AFRICAN REPUBLIC													
H_0: r=0 vs H_1: re 1	15.41	9.0132			8.1144								
H_0: rd1 vs H_1: re2	3.46	2.3944			2.1388								
COLOMBIA													
H_0: r=0 vs H_1: re 1	15.41	9.1121			10.3578			9.9996			10.0010		
H_0: rd1 vs H_1: re2	3.46	1.9956			2.5498			1.9268			1.9286		
CONGO, REP.													
H_0: r=0 vs H_1: re 1	15.41				4.7052			10.8869			10.8869		
H_0: rd1 vs H_1: re2	3.46				0.4038			0.0797			0.0797		
COSTA RICA													
H_0: r=0 vs H_1: re 1	15.41	11.3652			11.5616			4.0381			4.0365		
H_0: rd1 vs H_1: re2	3.46	0.9325			0.0089			0.9158			0.9131		
EGYPT													
H_0: r=0 vs H_1: re 1	15.41	15.5834	6.195	0.013	14.3367			14.4465			14.4465		
H_0: rd1 vs H_1: re2	3.46	0.2368			1.5016			0.0255			0.0255		
INDIA													
H_0: r=0 vs H_1: re 1	15.41	2.7097			3.3789			7.3941			7.3850		
H_0: rd1 vs H_1: re2	3.46	0.5456			0.0533			0.2006			0.2000		
INDONESIA													
H_0: r=0 vs H_1: re 1	15.41	4.0420			4.2297			7.8645			7.8645		
H_0: rd1 vs H_1: re2	3.46	0.6309			0.6842			0.9613			0.9613		
IRAN, ISLAMIC REP.													
H_0: r=0 vs H_1: re 1	15.41	12.0355			9.3648			11.0203			11.0203		
H_0: rd1 vs H_1: re2	3.46	17934			0.5304			0.0454			0.0454		
KUWAIT													
H_0: r=0 vs H_1: re 1	15.41												
H_0: rd1 vs H_1: re2	3.46												
MALAYSIA													
H_0: r=0 vs H_1: re 1	15.41	7.1918			6.7746			5.5535			5.8993		
H_0: rd1 vs H_1: re2	3.46	2.5213			0.5922			0.7511			0.8807		
MEXICO													
H_0: r=0 vs H_1: re 1	15.41	17.9539	0.135	0.713	15.0849			36.6942	30.73	0.000	36.6945	30.730	0.000
H_0: rd1 vs H_1: re2	3.46	1.4644			0.7160			0.7763			0.7760		
MOROCCO													
H_0: r=0 vs H_1: re 1	15.41	16.3321	9.441	0.002									
H_0: rd1 vs H_1: re2	3.46	1.6400											
PAKISTAN													
H_0: r=0 vs H_1: re 1	15.41	3.4294			11.2161			5.2089			5.2086		
H_0: rd1 vs H_1: re2	3.46	0.0066			0.0001			0.1803			0.1799		
PANAMA													
H_0: r=0 vs H_1: re 1	15.41	2.3573			1.5236			1.3295			1.2197		
H_0: rd1 vs H_1: re2	3.46	0.0000			0.0000			0.0000			0.0000		
PERU													
H_0: r=0 vs H_1: re 1	15.41	14.9886			12.6319			36.3968	12.010	0.001	35.4008	11.550	0.001
H_0: rd1 vs H_1: re2	3.46	11475			14553			83327			81731		
SAUDI ARABIA													
H_0: r=0 vs H_1: re 1	15.41				19.0161	0.00113	0.973	14.0963			12.2860		
H_0: rd1 vs H_1: re2	3.46				2.2964			19011			0.8797		
SOUTH AFRICA													
H_0: r=0 vs H_1: re 1	15.41	14.7410			15.7808	4.346	0.037	13.3569			19.2961	6.603	0.010
H_0: rd1 vs H_1: re2	3.46	0.2399			0.0122			55559			54268		
SRI LANKA													
H_0: r=0 vs H_1: re 1	15.41	21.6667	0.854	0.355	17.3647	0.837	0.360	17.6840	5.316	0.021	17.6840	5.316	0.021
H_0: rd1 vs H_1: re2	3.46	1.2594			1.0944			1.1893			1.1893		
THAILAND													
H_0: r=0 vs H_1: re 1	15.41	12.7319			8.0429			6.1067			6.1126		
H_0: rd1 vs H_1: re2	3.46	0.6672			0.1947			0.0925			0.0930		
TRINIDAD AND TOBAGO													
H_0: r=0 vs H_1: re 1	15.41	4.2777			5.1095			31.7547	2.557	0.110	31.7547	2.557	0.110
H_0: rd1 vs H_1: re2	3.46	0.9446			0.5868			126601			12.6601		
TUNISIA													
H_0: r=0 vs H_1: re 1	15.41	13.4773			8.1165			15.1305			15.1305		
H_0: rd1 vs H_1: re2	3.46	0.0676			0.0060			0.1448			0.1448		
TURKEY													
H_0: r=0 vs H_1: re 1	15.41	11.1774			9.9082			10.1568			10.1551		
H_0: rd1 vs H_1: re2	3.46	15574			0.9985			44934			4.4942		
URUGUAY													
H_0: r=0 vs H_1: re 1	15.41	9.9223			9.6734			8.6273			8.6295		
H_0: rd1 vs H_1: re2	3.46	39258			42659			39671			3.9678		
ZAMBIA													
H_0: r=0 vs H_1: re 1	15.41	21.5099	5.498	0.019	7.3517			13.1044			13.1044		
H_0: rd1 vs H_1: re2	3.46	61696			0.3202			36976			3.6976		