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Purchasing Power Parity: Further Evidence from African Countries

Mutiu Abimbola Oyinlola*, Oluwatosin Adeniyi and Festus O. Egwaikhide

Department of Economics, University of Ibadan, Ibadan, Nigeria

Abstract: In this paper we pursue an empirical enquiry into the validity of an equilibrium absolute purchasing power parity (PPP) for a sample of 26 economies in Africa. Using univariate as well as panel unit root tests on yearly observations spanning 1973 to 2008, we uncover evidence that the PPP notion holds in just a little over one-third of the countries selected and breaks down on average when the latter class of tests are employed. In sum, non-linear modelling of exchange rate convergence to its PPP trajectory could foster understanding on the subject.

Keywords: Real Exchange Rates, Purchasing Power Parity, Univariate Unit Root Test, Panel Unit Root Test

JEL classification Number: C22, C23, F31

1. Introduction

The purpose of this paper is to empirically re-examine the relationship between the equilibrium exchange rate and relative national price levels in African countries. This Purchasing Power Parity (PPP) doctrine states that the change in exchange rates between two currencies is a function of the relative prices of the two countries.[1]

The absolute PPP, which is the earlier tributary of the mainstream thinking on exchange rates and relative national prices, has been the subject of myriads of empirical studies with no clear consensus as yet. Some attempts in the vast literature on the subject have argued in favour of the possibility of a PPP relation in the long-run (for instance, see Abauf and Jorion 1990; Bahmani-Oskooee and Barry 1997; Chortareas and Kapetanios 2004, among others). However, there are also a handful of rejections documented in the studies of Corbae and Ouliaris (1991) and Bahmani-Oskooee (1995).[2]

* Corresponding author. Email: mutiu_oyinlola@yahoo.com

[1] There are, however, two major variants of this hypothesis. First, is the absolute PPP which posits that, on average, the purchasing power of a unit of domestic currency should be the same in the foreign economy when converted, at the market exchange rate, into foreign currency. Second, that the relative PPP remains valid when there is equality in purchasing power parity across both countries.

[2] Rogoff (1996) presents a detailed chronology on not only theoretical but also empirical developments in the literature on the purchasing power parity debate. Excellent surveys of the literature may also be found in Taylor and Taylor (2004) and the relevant references therein.

The mixed nature of empirical evidence has inspired further empirical studies in search of answers aimed at resolving the inconclusiveness. Earlier enquiries tested the theory by regressing the nominal exchange rate on relative national price levels. PPP was then ascertained if the estimate obtained for relative prices is close to one. Studies of newer vintage differ in their use of more refined statistical approaches, the most notable being testing for unit roots in the real exchange rate.[3] Specifically, most of the data sets used have hardly been Africa-specific[4]. Thus, the primary aim of the present study is to provide an empirical assessment of the PPP theory using an Africa-specific dataset together with unit root tests with desirable power properties.

To shed additional light on this debate, this study empirically investigates the PPP using a large sample of African countries, especially over the post-Bretton Woods era using more robust panel unit root approaches which have not been used in related studies[5] in addition to the standard univariate time series unit root tests.

Since we refrain from a review of the literature[6] on the basis of ubiquity, the rest of the article is organised in two broad sections: Section 2, which is further bifurcated, deals in part with the data scope, span, definition, sources as well as construction of the real exchange rate series for the selected countries. The other bit reports and discusses the empirical results of both the standard univariate as well as the panel mean-reversion tests. The third and final section presents the conclusion and points a way to future research.

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[3] The intuition behind this is that a test of the existence of a cointegration (long-run) relationship between the nominal exchange rate and relative national prices should be equivalent to a test of the stationarity of the real exchange rate. Recall that $r_{it} = \left(\frac{e_{it} P_{*t}}{P_{it}} \right)$, where P_{it} is the price level in country i in period t with i=1,2,…,N and t=1,2,…,T. P_{*t} is the base country price level and e_{it} is the nominal exchange rate of country i. r_{it} represents the real exchange rate constructed from the other variables.

[4] The studies by Holmes (2000) and Kargbo (2003) are insightful examples which are Africa-oriented. However, both studies tested the relative version of the hypothesis using time series cointegration and simple panel unit root approaches in that order.

[5] We made use of panel stationarity methods on the real exchange rate of the sample countries to gauge the existence of the PPP phenomenon rather than a specific focus on cointegration tests as typical in most studies on Africa (see, for instance, Odedokun 2000; and Kargbo 2003).

[6] Studies on PPP hypothesis have been documented in the literature (For an insightful survey, see Taylor and Taylor 2004 for instance)

2. Data and Empirical Results

The 26 African countries covered are Algeria, Botswana, Burkina Faso, Burundi, Cameroon, Cote d' Ivoire, Egypt, Ethiopia, Gabon, Gambia The, Ghana, Kenya, Lesotho, Libya, Mauritius, Madagascar, Morocco, Niger, Nigeria, Rwanda, South Africa, Senegal, Seychelles, Swaziland, Tanzania and Togo. Annual data covering the period from 1973 to 2008[7], for a total of 28 observations per country, was used. The nominal exchange rates and Consumer Price Indices (CPIs) of the selected countries were obtained online from database of the World Bank. The US CPI is however collected from the IMF's *International Financial Statistics* CD-ROM. Exchange rates are the spot rates in terms of the US dollar (the numeraire currency), while price data are derived from the CPI of each country. The real exchange rate series for the cross-section of countries was calculated using the expression in footnote 3.

The empirical validity of PPP is tested by using univariate unit root tests. The results of the ADF and the KPSS unit root tests under different deterministic trends are presented in Table 1.[8] The results under constant deterministic trend indicate that a unit root is rejected for only Lesotho's real exchange rate at the 5 percent level of significance. Statistically, the results are not different from those of constant and trend. In addition to Lesotho, Ghana's is also found to be significant, but at the 10 percent level.

The real exchange rates for the other African countries are found to have unit roots in their levels, indicative of no evidence to support PPP in the countries. At first blush, the results of the KPSS test in Table 1 appear to be more in concert with the PPP notion than the ADF test suggests. The null hypothesis of stationarity under KPSS is rejected for all the countries in their levels, except for Seychelles under constant deterministic trend. KPSS proves to be a more powerful test, especially under constant and trend where the null hypothesis of real exchange rate stationarity of 7 countries [Burkina Faso, Cameroon, Cote d'Ivoire, Gabon, Niger, Senegal, and Togo] cannot be rejected. This implies that there is support for PPP in 7 out of 26 countries. Overall, there is no evidence to support PPP in a significant number of countries in Africa.[9,10]

[7] An up-to-date investigation could hardly be pursued since such data was not available at the point of writing this paper. However, we presume that the results would be affected in no significant way as not much has changed in the behaviour of exchange rates and relative prices (components of the real exchange rate variable used in our analysis) among the sampled countries especially over the last two quinquenniums.

[8] For the ADF test, the null hypothesis of unit root of real exchange rate is tested against the alternative hypothesis of stationarity.

[9] There is the possibility that the rejection of PPP for most of the countries in the sample with the univariate ADF and KPSS tests is an artefact of low power and the consequent increase in the likelihood of rejecting the alternative hypothesis of mean-reversion (Diebold and Nerlove 1990).

Next, are the results of the panel unit root tests. Reported in Table 1 are the outcomes of the Levin, Lin and Chu (2002), (LLC), Im, Pesaran and Shin (2003), (IPS) mean-reversion tests and two other panel data stationarity tests for PPP popularised by Maddala and Wu (1999) – the ADF- Fisher chi-square and PP- Fisher chi-square – across the 26 countries.

Table 1: Results of Panel Stationarity Tests

Panel Test	Null Hypothesis	Level		1st Difference		Decision
		Drift	Drift & trend	Drift	Drift & trend	
LLC	Unit root	9.2792	5.4703	-3.8313*	-4.7391*	I (1)
IPS	Unit root	11.2197	8.0193	-7.4192*	-9.2705*	I (1)
ADF- Fisher	Unit root	23.6162	29.6306	228.2370*	222.2350*	I (1)
PP- Fisher	Unit root	12.9489	11.0943	254.8540*	391.8592*	I (1)

Note: * denotes statistical significance at the 0.01 level. The figures in parentheses are the probability of rejection. All estimation and the computation of panel statistics were implemented in E-Views version 6.0. The LLC statistic assumes a common unit root process while in the other tests individual unit root process is the null. The probabilities for both Fisher tests are computed using an asymptotic φ^2 distribution. All other tests, however, assume asymptotic normality.

The null hypothesis, as Table 1 makes clear, of a unit root in the real exchange rates (RERs) of all the 26 countries in our sample could not be rejected at the conventional significance levels. It is therefore innocuous to conclude that PPP fails to hold for the sample of countries studied.[11] Specifically, the LLC and the IPS tests fails to reject the null of mean reversion thus implying that PPP does not hold for the selected African countries. Broadly, this conclusion seems out of tandem with the study by Holmes (2000) who found support for PPP hypothesis in 27 African countries using quarterly data over the period 1974 to 1997. Also, a number of studies on developing countries, apart from Africa, subsequently furnished evidence reinforcing Holmes's results [see, for example, Marcela et al. 2003; and Narayan 2006]. However, and this is heartening, O'Connell (1998) and more recently Alba and Papell (2007) found that the real exchange rates of African countries were non-stationary in line with our conclusion that the PPP conjecture more often than not

[10] The detailed results are available but not included here for want of space.

[11] To ensure that our findings do not pass for non sequitur, it is important to emphasize here that the stationarity of the RER has typically been used in most studies as an alternative way of ascertaining the existence or otherwise of a PPP-type reversion of the exchange rate to its long-run path. In general, where the RER series for the panel is I (0) PPP holds. Thus, with all the tests confirming our RERs for the 26 countries as stationary after differencing once, that is I (1), the suggestion of the absence of a long-run association between nominal exchange rates and relative national price levels is hardly trivial.

breaks down in entirely African samples. In their conclusion, Alba and Papell argued that country characteristics such as distance, openness and exchange rate volatility were factors that should be considered in understanding not only whether but also why PPP holds or not.

3. Conclusion

This study has examined the long-run absolute purchasing power parity using a sample of 26 African countries. Specifically, mean-reversion was tested via the use of both univariate and panel unit root tests with annual data covering the period 1973-2008. Findings, in keeping with the received wisdom, showed that the conventional unit root tests largely failed to reject the null hypothesis of a unit root in the RERs of the countries studied. Evidence in favour of PPP only in seven out of the 26 countries was reported. The low power property of the time-series stationarity tests proved to be the culprit. Arising from the foregoing, we employed the IPS, LLC, ADF-Fisher chi-square and PP-Fisher chi-square panel unit root techniques. The conclusion from these tests is that the null of mean-reversion is not rejected, suggesting that PPP breaks down in the sampled countries. Thus, like O'Connell (1998) and Alba and Papell (2007), the results obtained provide little evidence of the PPP phenomenon in entirely African Samples. Going forward, it will be insightful to consider non-linear assessments of the adjustment of the exchange rate towards its PPP trajectory. This threshold-type of analysis may convey information useful for policy.

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