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PURCHASING POWER PARITY HYPOTHESIS IN THE SELECTED AFRICAN COUNTRIES

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This paper explore the long-run absolute purchasing power parity (PPP) hypothesis for a sample of 26 African countries, using both the univariate and the panel unit root tests on annual data for the period 1973-2008. The conventional unit root tests essentially failed to reject the null hypothesis of a unit root in the real exchange rates of the countries which were investigated. Evidence, in favour of PPP for only 7 countries was found. Consequently, a volley of panel unit root tests was employed. The results demonstrated that the null of mean-reversion in the real exchange rates of all countries in the sample could not be rejected, implying a breakdown of the PPP in these countries. Therefore, it could be insightful to consider non-linear assessments of adjustment of the exchange rate towards its PPP trajectory. This threshold-type of analysis may convey information useful for policy making.

I. Introduction

A plethora of existing studies have empirically examined the relationship between the equilibrium exchange rate and the relative national price levels. This Purchasing Power Parity (PPP) doctrine states that change in exchange rates between the two currencies is a function of their relative prices. There are, however, two major variants of this hypothesis. First, 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. Second, the relative PPP remains valid when there is equality in purchasing power parity across both countries. However, the core of subsequent discussion in this paper is steered towards the former tributary of the mainstream thinking on exchange rates and relative national prices. Absolute PPP has been the subject of myriads of empirical studies with no clear consensus. In the vast literature some attempts on the subject have argued in favour of the possibility of a PPP relation in the long-run [e.g., see Abauf and Jorion (1990), Kim (1990), Glen (1992), Pippenger (1993), Lothian and Taylor (1996), Bahmani-Oskoee and Barry (1997), Taylor et al. (2001), Chortareas and Kapetanios (2004)]. However, there are (also) a handful of rejections documented in the studies of Kravis and Lipsey (1978), Baillie and Selover (1987),

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Corbae and Ouliaris (1991) and Bahmani-Oskoee (1995)[1]. 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.[2] However, most of the data sets used have hardly been Africa-specific.[3] 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 the unit root tests with the desirable power properties.

A number of reasons distinguish this attempt. First, we are aware that this is a pioneer effort at an empirical investigation of the PPP using a large sample of African countries, especially over the post-Bretton Woods era. Also, since univariate time series unit root tests have more recently been criticized for their low power with respect to rejecting the null hypothesis of non-stationarity, we imply more robust panel unit root approaches which have not been used in the earlier studies. Finally, rather than a specific focus on cointegration tests as in most studies on Africa [see, Nagayasu (1998), Krichene (1998), Odedokun (2000), and Kargbo (2003)], the use of panel stationarity methods on the real exchange rate of the sample countries is used in this study, to gauge the existence of the PPP phenomenon.

This paper examines the long-run absolute purchasing power parity (PPP) hypothesis using both univariate and panel unit root tests on annual data covering the period 1973-2008 for a sample of 26 African countries.[4] Using the conventional unit root tests, evidence is seen in favour of PPP for only 7 out of the 26 countries selected for this study. However, when panel unit root tests are used, the results shows a breakdown of the PPP in these countries.

The rest of the paper is organised in five sections: Section II is an overview of the movements in exchange rate and the general price level across the selected countries. Section III contains a brief account of some issues within the purchasing power parity literature with specific emphasis on empirical arguments. The empirical model and methodology are presented in Section IV, while results of both the standard univariate and the panel stationarity tests are reported in Section V. Section VI presents the concluding remarks.

[1] Rogoff (1996) presents a detailed chronology in the literature on both theoretical and as well as empirical development on purchasing power parity debate. Excellent survey of the literature is also available in Taylor (2003) and Taylor and Taylor (2004), and the relevant references therein.

[2] The intuition behind this was 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, which recalls 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.

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

[4] These 26 African countries are Algeria, Botswana, Burkina Faso, Burundi, Cameroon, Cote d' Ivoire, Egypt, Ethiopia, Gabon, Gambia, Ghana, Kenya, Lesotho, Libya, Mauritius, Madagascar, Morocco, Niger, Nigeria, Rwanda, South Africa, Senegal, Seychelles, Swaziland, Tanzania and Togo.

II. Facts on Exchange Rates and Prices

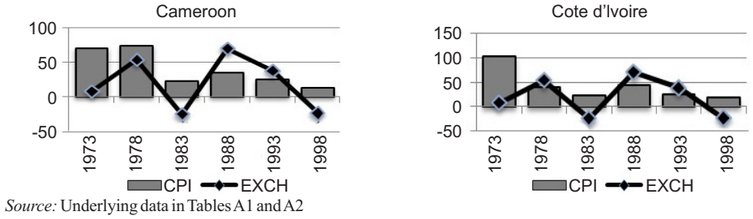
A fleeting perspective of exchange rate and domestic price across the twenty six sample countries unveils significant differences from country to country and over time, though, still unclear as presented in Tables A-1 and A-2 in Appendix–B. On a more staidly glance, a constellated pattern appears when the growth rate of variables is examined. For ease of description this pattern has been categorized, based on three criterion: Francophone countries, Oil-producing countries and Regional blocs. For the same reason, the years have also been grouped into six periods, mostly on a quinquennial basis.

1. Francophone Countries

The seven Francophone countries[5] in the sample have similar characteristics. The average consumer price index (CPI) during 1973-1977 period (Table A-1) differs but not significantly across these countries. For instance, between 1973 and 1977 the average value of CPI for Togo, Senegal and Cameroon is 19.7, 23.1, and 15.2, respectively. In the period 2003-2008, Togo's CPI moved to 100.8, while CPI of Senegal increased to 103.5. Cameroon has not differed from this trend with an average value which stands at 103.1. The exchange rate of these countries is tied to the French francs, thereby treading the same path. For example, the average exchange rate for these countries between 1973 and 1977 was 232.5, and depreciated to an average of 514.5 by 2003-2008 (see Table A-2). The movements are evident in the values of the growth rate of these variables. Figure 1 represents this group of countries and shows similar trend.

Two countries, Cameroon and Cote d'Ivoire, (in Figure 1), have been chosen to represent the first group of countries with similar trend. Consumer price indices for both countries show a consistent decline over time. Between 1988-1992 and 2003-2008, the CPI fell persistently, lending credence to the price stability goal pursued in these countries. Exchange rate movement, over the periods under consideration, remained consistent across the countries. For example, exchange rate in Cameroon rose between the first and second period before the trough in the third period. These changes depict era of adjustment of exchange rate in these countries. Exchange rate continued to dip between 2003 and 2008, an indication of exchange rate appreciation.

Figure 1
CPI and Exchange rate in Francophone Countries



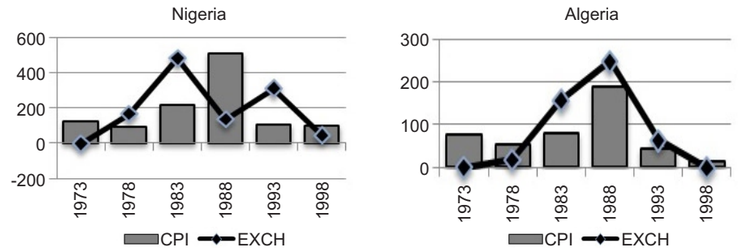
Source: Underlying data in Tables A1 and A2

[5] Burkina Faso, Cameroon, Cote d'Ivoire, Gabon, Niger, Senegal, and Togo.

2. *Oil-Producing Countries*

Countries (Algeria, Nigeria, Libya and Gabon) known for their oil resources are grouped together to observe the growth rates of their exchange rate and consumer price indices. For conciseness, two countries (Nigeria and Algeria) represent this group in our analysis. Beginning from the first period, the growth rate of exchange rate increased up to the growth between the periods 1983-1987 and 1988-1992, when the inter-periodic growth rate was highest for Nigeria. This period coincided with the era of change in regime with respect to exchange rate administration – the country moved to a managed floating exchange rate regime. The rate of increase in exchange rate however took a dip between 1988-1992 and 1993-1997, coinciding with the time when the growth rate of consumer price index reached its peak following periods of continued growing prices in the country. A similar trend in CPI growth is observed for Algeria which also reached its peak in the same period. The annual growth in exchange rate declined in both countries in the latter periods. However, while CPI stabilized in Nigeria, it increased at a decreasing rate in Algeria.

Figure 2
CPI and Exchange rate in Oil Producing Countries

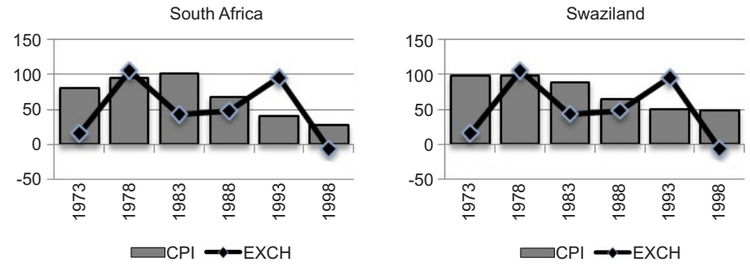


Source: Underlying data in Tables A1 and A2.

3. *Regional Blocs*

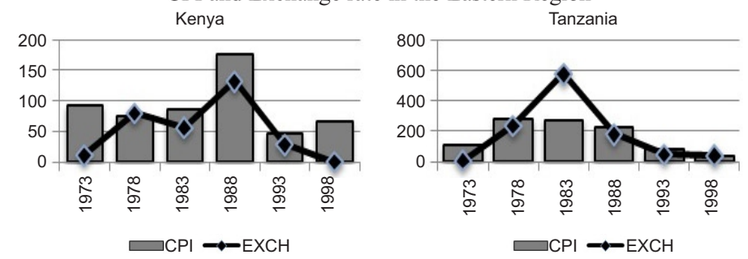
A couple of countries are observed to have common trend in the movement of variables in question as a result of their membership of specific regional blocs. Typical examples are the Swaziland-Lesotho-South Africa (Southern bloc) and Kenya-Tanzania (Eastern bloc). There is no coherent common pattern in what may be described as Western bloc (Nigeria–Togo–Ghana) possibly as a result of the separation discussed earlier under the sub-regions. Swaziland is a country in Southern Africa and so, it is no surprise that exchange rate trends tow similar path with that of South Africa (as evident in Figure 3). Between the last four periods, the annual growth in CPI fell and was not as persistent in comparison to the earlier periods. These variables (in the Eastern bloc) present a somewhat different picture when compared to their trends in the Southern bloc, especially the growth rate of CPI. Exchange rate followed the same path when the entire periods of the trend are considered. CPI presents a completely different picture indicative of varying domestic monetary policy in these countries even though there is high level of move towards further integration in the region.

Figure 3
CPI and Exchange rate in the Southern Region



Source: Underlying data in Tables A1 and A2.

Figure 4
CPI and Exchange rate in the Eastern Region



Source: Underlying data in Tables A1 and A2.

One is inclined to conclude from the foregoing that movements in consumer price indices are not tied to exchange rate dynamics. While this may seem in order for some countries, further enquiry regarding the long run relationship between these variables is desirable in order to gain a deeper insight. The long run co-movement between CPI and exchange rate in the selected countries is the preoccupation of this present investigation.

III. The Purchasing Power Parity : Previous Studies

The literature presented in this section is very brief because it has been well developed in other articles [see for instance, Taylor (2003), and Taylor and Taylor (2004)]. Only the summary of the conclusions is highlighted.

According to Rogoff (1996), scholars of the Salamanca school in the 1500's Spain were the first to conjecture that national price levels ought to be equal, once converted to the same currency. Basically, goods arbitrage, which ensures parity across individual goods, should almost naturally imply that average price should also be highly correlated across countries. Gustav Cassel's [(1918), (1922)] articles

shaped the contours of empirical knowledge on a PPP as a tool for international comparisons of not only price differentials but also income. These seminal contributions and empirical attention paid to the PPP hypothesis imperceptibly increases. For the purpose of this study, these are grouped into those using long span data, cross-country data, and panel data with each category succinctly dealt with.

First, long span studies are premised on the assertion that traditional tests usually fail to reject the random walk model of the real exchange rate due to poor power. Thus, the only way to observe mean reversion in the equilibrium real exchange rate is to use these unit root tests on data spanning several decades (a century or even more in most of the applications in this genre) if any rejection of the random walk hypothesis is to be obtained [Frankel (1986), (1990)]. The 1990s witnessed a surge in long-horizon PPP investigation. Abauf and Jorion (1990), for instance, used annual data covering 1901-1972 for eight bilateral exchange rates and found evidence in support of the PPP hypothesis. A similar outcome was reported by Diebold et al; (1991) in their study of six currencies using data for the Gold standard period.[6] A number of problems are ascribed to this category of studies; the main is their use of both the fixed and flexible exchange rate periods. Papell and Theodoridis (2001) posited that this problem mostly taints whatever conclusions reached regarding real exchange rate movements.

Second, apart from extending coverage in terms of number of years, another approach that has been adopted in the literature is the use of cross-country data. This is opined to improve the power of unit root tests via increase the amount of information available across exchange rates [Rogoff (1996)]. Abauf and Jorion (1990) used real exchange rate data for ten countries covering the period from 1973 to 1987. Their findings suggest a slight rejection of non-stationarity, an outcome interpreted as evidence in support of equilibrium PPP. However, cross-sectional approaches, by their design, usually fail to dealt with potential biases arising from heterogeneity due to country specificities particularly in terms of economic structure [Quah (1994) and Casselli et al. (1996)].

Third, panel data techniques have flourished in terms of PPP applications from around the mid-1990s. Frankel and Rose (1995) employed data for one hundred and fifty countries (1948-1992) and reported the existence of PPP not only for the entire sample period but even for the post-Bretton Woods sub-period. There are, however, sample bias criticisms against such results as they appear to hold true when high inflation countries are included in the regressions.[7,8]

A few studies, specific to Africa, used a variant of the panel methodology.[9] Specifically, Holmes (2000) conducted a test of long-run PPP using a sample of

[6] Their sample typically ranged between 74 and 123 annual observations depending on specific regressions. Other studies (with a long time dimension) include, Edison (1987) Glen (1992), Lothian and Taylor (1996), Cheung and Lai (1994), Froot and Rogoff (1995) and Taylor (2002) but are not limited.

[7] There are quite interesting arguments, for instance in Rogoff (1996) and Taylor (2002), relating to the predominance of monetary shocks in high inflation countries but that is not the concern of the present study. Also, the interested reader could see Holmes (2000) includes a definition of "high inflation countries" in his sample in order to address the concerns with respect to differential inflation experiences across countries.

[8] Wei and Parsley (1995), Pedroni (1995) and Higgins and Zakrajsek (1999) are additional studies that have exploited the additional information offered by this cross-section-time series approach.

[9] It is pertinent to note that Kargbo's (2003) paper is also well cited in the literature. However, it used both Johansen cointegration and error correction modelling approaches on the black market, rather than nominal, exchange rates and national price levels of thirty African countries. Bahmani-Oskoee and Tankui (2008) in a more recent study investigates the adjustment process towards long-run PPP using both the official and parallel market exchange rates of twenty African countries.

twenty seven African countries with quarterly data over the period 1974-1997. The study found that, PPP was generally rejected by the individual specific unit root tests while the panel t-bar test supported PPP. Four preliminary, although arguable, conclusions are evident:

- There appears to be no consensus in the empirical literature on the existence of PPP,
- This seems true even for samples specific to Africa,
- Low test power has often been blamed for the failure to ascertain PPP; hence, the use of more powerful panel unit root tests have almost become the norm,
- Forth, such tests are yet to be used to test the PPP hypothesis for Africa.

Therefore, in the current study an attempt is made to test this hypothesis with a large and entirely African sample; with details on these stationarity tests being the subject of what follows.[10]

IV. The Model and Data Sources

This section is preoccupied with two key themes. Firstly, is the explanation of both the individual time series mean-reversion tests and the more powerful panel unit root tests used in the subsequent empirical analysis. Secondly, detail on the data to be used in terms of its coverage – across both time and space – and the transformations conducted. However, with respect to the first part, brevity precludes a description of the Augmented Dickey and Fuller [ADF (1979), (1981)] and the Kwiatkowski-Phillip-Schmidt-Shin [KPSS (1992)] methodologies. The issue is discussed on the Levin and Chu (2002) as well as the Im-Pesaran and Shin (2003), panel unit root tests.

The focus here is to provide a formal, without any particular claim to detail, description of the two panel unit root tests employed in the empirical test for existence or otherwise of PPP in the selected African countries. Levin et al. (2002), (henceforth LLC) assume that the stochastic process $\{y_{it}\}$ is observed for a panel of individuals $i=1, ...,N$, each with a time dimension $t=1, ..., T$. The intuition is to ascertain if this process is integrated for each individual in the panel. In line with the conventional single time series approach, individual regressions may contain an intercept and time trend. Also, all parameters in the error process are assumed to vary across individuals, except for the first-order autocorrelation coefficients. More formally, LLC considered a sample of N cross-sectional units observed over T periods. The process y_{it} is generated by an AR (1) model thus;

$$y_{it} = (1 - \phi_i)\,\mu_i + \phi_i\, y_{i,t-1} + \varepsilon_{it},\ i=1, ..., N,\ t=1, ..., T$$

The primary concern is testing the null hypothesis of unit roots, that is $\phi_i=1$ in expression (1). Subtracting $y_{i,t-1}$ from both sides of the expression yields;

[10] The Augmented Dickey-Fuller (ADF), 1981 and the Kwiatkowski et al. (1992). KPSS tests were also conducted in our sample on the real exchange rates of the 26 countries. The details on the specification of these tests are however ubiquitous in the literature and hence familiarity dictates its exclusion in this paper.

$$\Delta y_{it} = \alpha i + \beta_i y_{i,t-1} + \varepsilon_{it}$$

where $\alpha_i = (1 - \phi_i)\,\mu_i$, $\beta_i = -(1 - \phi_i)$ *and* $\Delta y_{it} = y_{it} - y_{i,t-1}$

The null hypothesis of unit roots is then stated as:

$$H_0 : \beta_i = 0 \text{ for all } i$$

and the alternative as:

$$H_A : \beta_i < 0,\ i = 1, \ldots, N$$

This formulation of the null hypothesis only allows for homogeneity in the β's, across the groups. All individual series are assumed to have unit roots under the alternative hypothesis. Although the null is intuitive under certain conditions, this kind of alternative hypothesis may however be too restrictive, and hence uninformative, especially in empirical works [Maddala and Wu (1999)]. To better approximate reality, Im, et al. (2003), IPS from now on, relax the homogeneity assumption imposed by LLC under the alternative hypothesis. The alternative, in this case, is that;

$$H_A : \beta_i < 0,\ i = 1, \ldots, N_1,\ \beta_i = 0,\ i = N_1 + 1, N_1 + 2, \ldots, N$$

IPS developed a t-bar statistic for testing unit roots given as[11]:

$$\sqrt{N}\,\frac{(\bar{t}_{N,T} - \mu)}{\sigma} \Rightarrow N(0,1) \qquad \text{where} \qquad \bar{t}_{N,T} = \frac{1}{N}\sum_{i=1}^{N} t_{i,T}$$

Therefore, using data on 26 African real exchange rates, the t-bar statistic is calculated using the mean value of the individual ADF statistics based on each ϕ_i.[12]

For sampled African countries annual data covering the period 1973 to 2008,[13] a total of 28 observations per country, was used. The nominal exchange rates and Consumer Price Indices (CPIs) of the selected countries were obtained from online database of the World Bank. The US CPI is 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. The scope, in terms of years covered, is in consonance with other studies with investigation restricted to the post-Bretton Woods or more appositely the modern floating exchange rate regime [see, for example, Bahmani-Oskooee (1993), Mahdavi and Zhou (1994), and Holmes (2000)].

[11] Two pertinent issues are germane to note. One, the t-test for each cross-sectional unit, based on T observations, is obtainable using the mean and variance of the decision statistic which are $E(t_{i,T}) = \mu$ *and* $Var\,(t_{i,T}) = \sigma^2$ respectively. Two, the IPS testing procedure is suitable for balanced panels like the one used in this study.

[12] The t-bar is then standardized and it is shown that the standardized t-bar statistic converges to a standard normal distribution as N and $T \to \infty$.

[13] An up-to-date investigation could hardly be pursued since such data was not available at the stage 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 sample countries especially over the last two quinquenniums.

V. Estimation Results and Discussion

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. For the ADF test, the null hypothesis of unit root of real exchange rate is tested against the alternative hypothesis of stationarity. The results under constant deterministic trend indicate that a unit root is rejected for only Lesotho's real exchange rate at the 5 per cent 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 per cent 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 these countries. At first blush, 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 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 out of 26 countries there is a support for PPP in 7, mostly, CFA countries. Overall, there is no evidence to support PPP in a significant number of countries in Africa. There is, however, a 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)].

TABLE 1

Stationarity tests of Real Exchange rate for Twenty-six African countries

	ADF		KPSS	
	Constant	Constant, trend	Constant	Constant, trend
Algeria	-1.726	-3.175	0.591**	0.133*
Botswana	2.847	1.283	0.640**	0.220***
Burkina Faso	-1.449	-1.639	0.518**	0.063
Burundi	9.595	7.222	0.559**	0.182**
Cameroon	-1.312	-1.433	0.569**	0.072
Cote d'Ivoire	-1.231	-1.342	0.575**	0.075
Egypt	2.674	-0.910	0.655**	0.197**
Ethiopia	1.983	0.955	0.660**	0.201**
Gabon	-1.717	-1.534	0.548**	0.066

(continued)

TABLE 1
(continued)

	ADF		KPSS	
	Constant	Constant, trend	Constant	Constant, trend
Gambia	2.898	-2.456	0.590**	0.167**
Ghana	-0.773	-3.402*	0.501**	0.173**
Kenya	2.608	-0.546	0.644**	0.188**
Lesotho	-3.169**	-4.358***	0.661**	0.191**
Libya	-0.061	-1.930	0.593**	0.192**
Mauritius	2.257	-0.953	0.672**	0.207**
Madagascar	0.818	1.757	0.581**	0.206**
Morocco	-1.736	-1.482	0.557**	0.167**
Niger	-1.668	-1.679	0.464**	0.058
Nigeria	2.42	-0.260	0.526**	0.174**
Rwanda	3.524	0.166	0.598**	0.188**
South Africa	0.243	-2.393	0.628**	0.165**
Senegal	-1.537	-1.602	0.525**	0.065
Seychelles	-1.179	0.717	0.221	0.143*
Swaziland	0.891	-1.409	0.629**	0.192**
Tanzania	-0.64	-0.132	0.610**	0.190**
Togo	-1.305	-1.459	0.525**	0.072

Notes: (i) *, **, *** indicate 10%, 5%, and 1% significance levels, respectively.(ii) The lag lengths for the ADF test are automatically chosen through the Schwartz Information Criterion (SIC); critical values therefore differ with lag length for the ADF test. With zero lag length at level (first difference) however, the critical values are: -2.6129 (-2.6143),-2.9484 (-2.9511), and-3.6329 (-3.6394) at 10%, 5%, and 1%, respectively (iii) Critical values for the KPSS test are from Table 1 of Kwiatowski et al. (1992) with null hypothesis of stationarity. With constant, the critical values are: 0.347, 0.463, and 0.739 at 10%, 5%, and 1%, respectively; while with constant and trend, they are: 0.119, 0.146, and 0.216 at the respective levels of significance.

The results of the panel unit root tests are reported in Table 2 showing outcomes of the LLC, 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.

The null hypothesis, of a unit root in the real exchange rates (RERs) of all 26 countries in our sample could not be rejected at the conventional significance levels (Table–2). It is therefore innocuous to conclude that PPP fails to hold for the sample of countries under studied. Specifically, the LLC test for instance, returned respectively tests statistics of 9.2792 (p-value = 1.0000) and 5.4703 (p-value = 1.0000) in the levels of the RERs when the models with a drift and a drift plus trend are applied. The same conclusion, prima facie, is reached in the case of IPS test which also 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 furnish evidence reinforcing Holmes's results [see, for example, Marcela et al. (2003), Narayan and Prasad (2005), (2006)]. However, a number of studies agree with our conclusion that the PPP conjecture more often than not breaks down in entirely African samples. For instance, O'Connell (1998) used a similar panel unit root tests and found that the real exchange rates of 13 African countries were non–stationary. Also Alba and Papell (2007) provided empirical evidence that PPP fails to hold in their sub–panel of African countries. Of the 84 countries, covering Europe, Latin America, Asia and Africa, used in their investigation, only the sub–panels with countries from the latter two regions exhibited unit roots in RERs. In concluding, Alba and Papell argued that country characteristics such as distance, openness and exchange rate volatility are factors that should be considered in understanding not only whether but also why PPP holds or not.

TABLE 2
Results of Panel Stationarity Tests

Panel Test	Null Hypothesis	Level		1stDifference		Decision
		Drift	Drift & trend	Drift	Drift & trend	
LLC	Unit root	9.2792 (1.0000)	5.4703 (1.0000)	-3.8313 (0.0001)	-4.7391 (0.0000)	I (1)
IPS	Unit root	11.2197 (1.0000)	8.0193 (1.0000)	-7.4192* (0.0000)	-9.2705* (0.0000)	I (1)
ADF- Fisher	Unit root	23.6162 (0.9998)	29.6306 (0.9947)	228.2370* (0.0000)	222.2350* (0.0000)	I (1)
PP- Fisher	Unit root	12.9489 (1.0000)	11.0943 (1.0000)	254.8540* (0.0000)	391.8592* (0.0000)	I (1)

Notes: * 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 $\chi 2$ distribution. All other tests, however, assume asymptotic normality.

VI. Concluding Remarks

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 to 2008. The findings, in keeping with the received wisdom, shows 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 was reported only in seven out of the 26 countries. 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 null of mean-reversion is not rejected, suggestive that PPP breaks down in the sample 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. A key policy implication of findings of this study tends to suggest the need for further investigation of the underlining exchange rate policies in Africa. These exchange rate policies for each country must reflect its prevailing economic, social and political conditions. Further, it will be insightful to consider non-linear assessments of adjustment of the exchange rate towards its PPP trajectory. This threshold-type of analysis may convey information useful for the policy.

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APPENDIX - A

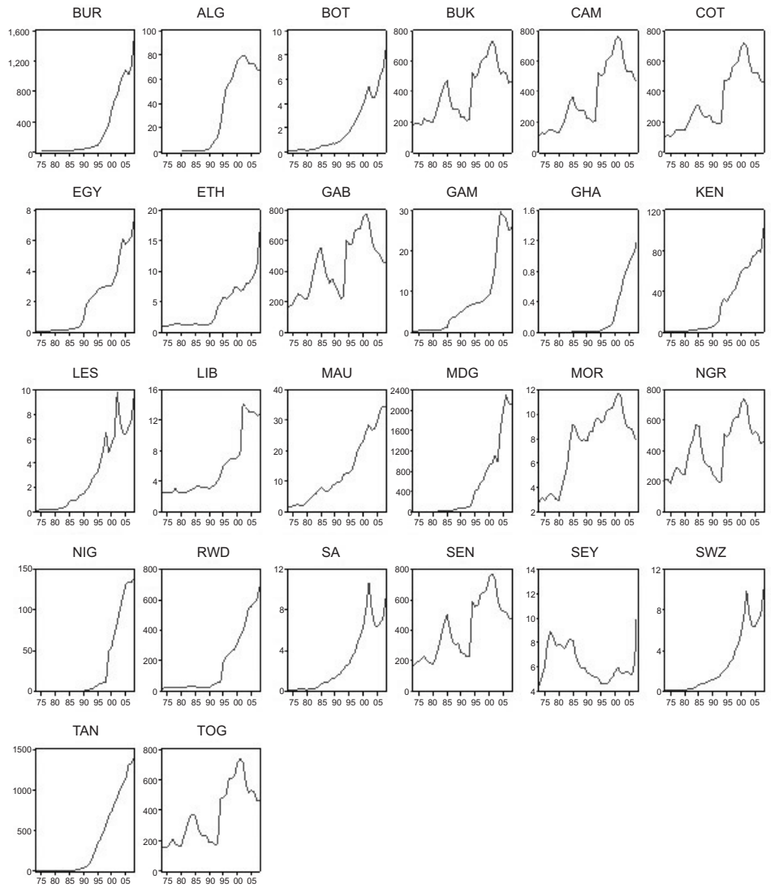

Figure A1

Real Exchange Rates of Selected African Countries, 1973-2008

TABLE A-1
Consumer Price Index for selected African Countries

	1973-1977	1978-1982	1983-1987	1988-1992	1993-1997	1998-2002	2003-2008
Algeria	4.470	7.812	12.012	21.458	62.128	88.784	102.153
Botswana	5.366	9.498	15.808	25.882	46.044	68.384	107.300
Burkina Faso	22.470	39.146	54.912	56.988	73.852	88.596	100.955
Burundi	4.026	8.260	12.372	17.022	31.352	65.048	103.353
Cameroon	15.156	25.788	44.830	54.710	73.806	91.880	103.131
Cote d'Ivoire	13.886	28.062	39.226	48.266	69.050	86.456	101.500
Egypt, Arab Rep.	3.858	6.890	14.430	33.952	61.480	77.922	107.601
Ethiopia	13.852	25.59	32.634	45.126	68.170	75.264	118.411
Gabon	23.398	43.230	67.020	67.296	83.472	95.234	101.403
Gambia, The	5.196	8.512	19.094	41.412	56.070	64.476	100.136
Ghana	0.014	0.158	1.150	3.910	14.438	42.808	106.808
Kenya	2.680	5.136	8.992	16.628	46.046	67.284	111.753
Lesotho	5.480	10.742	20.776	39.530	71.412	77.458	106.033
Libya	23.052	36.380	56.182	75.570	110.500	118.814	103.700
Madagascar	1.594	2.892	6.668	13.192	34.104	60.740	104.153
Mauritius	8.394	17.630	27.828	39.718	57.920	78.566	107.300
Morocco	19.886	32.250	49.896	64.258	83.454	93.180	102.443
Niger	26.876	51.314	66.262	57.304	72.800	89.406	99.471
Nigeria	0.312	0.692	1.330	4.178	25.450	51.524	101.366
Rwanda	6.750	12.442	16.808	20.592	48.470	72.678	106.368
Senegal	23.096	35.670	58.762	61.620	81.392	94.014	103.446
Seychelles	27.334	50.250	62.678	69.382	75.004	86.092	107.145
South Africa	5.000	9.000	17.548	35.142	58.780	82.108	104.931
Swaziland	3.994	7.874	15.574	29.260	48.180	72.136	106.501
Tanzania	0.468	0.988	3.708	13.852	44.770	80.204	105.788
Togo	19.730	33.774	45.756	46.316	70.280	89.224	100.751

TABLE A-2
Exchange Rate of selected African Countries

	1973-1977	1978-1982	1983-1987	1988-1992	1993-1997	1998-2002	2003-2008
Algeria	4.080	4.114	4.870	12.558	43.706	71.494	71.541
Botswana	0.764	0.860	1.572	1.966	2.968	5.224	5.593
Burkina Faso	232.506	250.000	382.828	287.184	486.546	669.532	514.486
Burundi	82.756	90.000	114.216	172.028	280.060	698.620	1093.563
Cameroon	232.506	250.000	382.828	287.184	486.546	669.532	514.486
Cote d'Ivoire	232.506	250.000	382.828	287.184	486.546	669.532	514.486
Egypt, Arab Rep.	0.392	0.638	0.700	1.916	3.382	3.746	5.836
Ethiopia	2.076	2.070	2.070	2.216	5.938	8.062	8.863
Gabon	232.506	250.000	382.828	287.184	486.546	669.532	514.486
Gambia, The	1.948	1.996	4.824	7.972	9.650	14.088	27.291
Ghana	0.000	0.000	0.008	0.032	0.128	0.512	0.913
Kenya	7.628	8.520	15.366	24.192	56.264	72.838	73.210
Lesotho	0.770	0.892	1.830	2.618	3.872	7.546	7.076
Libya	0.300	0.300	0.304	0.286	0.394	0.664	1.281
Madagascar	46.502	50.846	136.606	328.160	735.958	1276.526	1805.795
Mauritius	6.092	7.992	13.460	14.952	18.402	26.904	29.395
Morocco	4.290	4.640	8.688	8.438	9.058	10.470	8.675
Niger	232.506	250.000	382.828	287.184	486.546	669.532	514.486
Nigeria	0.636	0.616	1.630	9.430	21.948	89.548	127.731
Rwanda	92.426	88.492	92.922	99.880	231.094	390.862	553.073
Senegal	232.506	250.000	382.828	287.184	486.546	669.532	514.486
Seychelles	6.446	6.506	6.548	5.356	5.000	5.530	6.346
South Africa	0.770	0.892	1.830	2.618	3.872	7.546	7.076
Swaziland	0.770	0.892	1.828	2.618	3.872	7.546	7.076
Tanzania	7.638	8.338	28.172	190.920	536.352	810.566	1158.322
Togo	232.506	250.000	382.828	287.184	486.546	669.532	514.486