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# Tests of International Parity Conditions Validity in the Proposed 'Ecozone': Implications for Monetary Integration

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## **Abstract**

*In a proposed monetary integration, the 15-member Economic Community of West African States (ECOWAS) resolved to evolve and adopt a single currency, 'eco' across the African sub-continent by January 2020. This proposed monetary region is consequently styled by this author as 'proposed Ecozone'. This paper appraised the international parity conditions in the proposed monetary union with specific focus on purchasing power parity (PPP), international Fisher Effect (IFE) and uncovered interest parity (UIP). The examination of simultaneous validity of these postulations and theories in the cases of the 15-countries were performed through the investigation of directions of bilateral relationship of the countries of the Ecozone. Monthly, quarterly and annual data spanning averagely over a period of 28 years between 1990 and 2017 were employed in this study. Residual-based cointegration test methods of Engle-Granger, Philip-Ouliaris and Park's Added Variable and the Johansen cointegration tests were applied in evaluating these parity conditions. Results generated by various empirical estimations generally revealed that the international parity theoretical propositions of absolute PPP, relative PPP, international Fisher Effects and the uncovered interest parity are hugely not valid across the proposed 'Ecozone'. However, the cointegration of real exchange rate, based on the possible anchor country for the proposed monetary union, Nigeria, holds, thus implying positive implications for the proposed monetary integration of the West African sub-continent as there are evidences to conclude that there are long run association and co-movements of these real exchange rates which more importantly have bearings and relationships with the lead economy in the region. One crucial implications of the failure of the validity of PPP to hold across the proposed Ecozone is that monetary models of exchange rate determination will be inappropriate for the proposed monetary union because purchasing power parity is a crucial building block of these monetary models of exchange rate determination.*

*Keywords: International Parity Conditions, Purchasing Power Parity, International Fisher Effect, Uncovered Interest Rate Parity*

## 1. Background

The desire to fasten the process of the monetary integration of the West African sub-region was indicated by the 15-member countries of the ECOWAS in 2000. This crystallised into a 2-phase programme for the creation of a single currency for the region. The first phase of this plan was the launching of a single currency to be known as ‘eco’ by members of the West African Monetary Zone (WAMZ) while the second phase was the merger of the WAMZ with the existing WAEMU to evolve a single currency for the whole of ECOWAS member states by January 2020. The WAMZ’s single currency failed to take-off and was postponed on three occasions in 2003, 2005 and 2009. In July 2014, due to lack of economic convergence among the WAMZ members, as well as apparent inadequate preparations, glaringly reflecting non-feasibility of the January 2015 take-off, the WAMZ gave up the introduction of the single currency as proposed WAMZ and at the same time took the decision to change focus and re-strategised by relinquishing the initial plan of the WAMZ-WAEMU merger and replacing this with rescheduling of the creation of a single currency for the 15-member ECOWAS countries by 2020. Primary criteria to be met by all member countries of the proposed monetary union are: (i) ratio of budget deficit (commitment basis, including grants) to GDP of less than or equal to 3%; (ii) average annual inflation rate of less than 10%; (iii) central bank financing of budget deficit of less than or equal to 10% of the previous year’s tax revenue; and (iv) gross external reserves - higher than or equal to 3 months of imports. The secondary criteria: (a) stable nominal exchange rate of +/- 10%; and (b) ratio of total public debt to GDP of not more than 70%.

Arising from the intention of the 15-member ECOWAS countries to adopt ‘eco’ as future single currency across the African sub-continent, this author consequently styled the region as the proposed Ecozone’.

To reflect the sizes of the economies of the proposed Ecozone countries in the context of nominal GDP and population of these countries, Table 1 below exhibits the proportion (in percentages of the WAMZ total) of these indicators for each country as at the end of 2017.

*Table 1: Sizes of the Economy, Base Money and Population of Ecozone Countries*

<b>WAMZ Country</b>	<b>% Size of Economy in 'Ecozone' (as measured by Nominal GDP (US\$) at end of 2018)</b>	<b>% Population Estimations in 'Ecozone' (as at end of 2018)</b>
<b>Benin</b>	1.7	3.0
<b>Burkina Faso</b>	2.3	5.2
<b>Cape Verde</b>	0.3	0.1
<b>Cote D'ivore</b>	7.1	6.6
<b>The Gambia</b>	0.3	0.6
<b>Ghana</b>	10.7	7.8
<b>Guinea</b>	1.9	3.5
<b>Guinea Bissau</b>	0.3	0.5
<b>Liberia</b>	0.5	1.3
<b>Mali</b>	2.8	5.1
<b>Niger</b>	1.5	5.9
<b>Nigeria</b>	65.1	52.0
<b>Senegal</b>	4.0	4.3
<b>Sierra Leone</b>	0.6	2.0
<b>Togo</b>	0.9	2.1

Source: IMF and Author's Estimation.

This research paper aims at appraising international parity conditions in the proposed monetary union, with specific focus on purchasing power parity (PPP), international Fisher Effect (IFE) and uncovered interest parity (UIP) and the Generalised PPP. The examination of simultaneous validity of these postulations and theories in the cases of the fifteen West African countries were performed. In these respects, these necessitated the investigation of directions of bilateral relationship of the countries of the Ecozone in which these countries at one point or the other, serve as 'domestic country/currency' against respective 'foreign country/currency'. The 15-member Ecozone constitutes one hundred and five (105) pairs or bilateral relationships.

## **2. Theoretical Background: International Parity Relationships**

Parity condition gives intuitive explanations of the movements in price and interest rates in different markets in relation to exchange rate. Theoretically, exchange rate (spot and forward) are influenced by interest rates and inflation. Therefore, international parity conditions (which are core to international finance) are economic theories linking exchange rate, price

levels and interest rates together. They are key relations applied in predicting movements in exchange rates. Four (4) parity conditions exhibiting interlinkages are: (i) Relative Purchasing Power Parity, (ii) Fisher Effect (close), (iii) International Fisher Effect (open), and (iv) Interest Rate Parity. The law of one price (LOOP) states that in a competitive market (free of transportation costs and official trade barriers – tariffs), identical goods sold in different countries must sell for same price when their prices are expressed in terms of the same currency. This law buttresses the important principle in trade theory that in a situation of ‘open trade’ and ‘costless trade’, identical goods must trade at same relative prices regardless of where they are sold (Krugman et al, 2015). The tendency of identical goods to sell for identical prices globally generates a link between exchange rate and prices. As prices change globally, it is necessary to exchange rate to also change in order to keep the prices measured in a common currency equal across countries. This adjustment of exchange rate to offset differing inflation rates between countries is the reason for exchange rate changes (Husted and Melvin, 2013). This relationship between exchange rate and price level is the purchasing power parity (PPP) which explains the movement in the exchange rate between currencies of two countries by price level changes in these countries.

The PPP theory states that the exchange rate between two countries’ currencies equals the ratio of the countries’ price levels. The prediction of PPP is that an increase (decrease) in the purchasing power of the domestic currency (as depicted by decrease (increase) in the domestic price level) will be associated with a proportional currency appreciation (depreciation) in the foreign exchange market. The PPP theory can be expressed in an equation as:

$$E = P - P^* \tag{1}$$

where  $E$  is exchange rate,  $P$  and  $P^*$  are price levels in the domestic and foreign countries respectively. The assertion of PPP (which is crucial for an economic bloc aiming at monetary integration and single currency) is that there is equality in price levels of all countries when measures in terms of same currency.

Although, the PPP equation may reflect the idea of LOOP, they are however, different. While LOOP applies to the individual commodity, PPP relates to the general price level. For every commodity, if LOOP hold true, PPP must hold automatically so far the reference basket of goods that estimates price levels in different countries are the same. An affirmation of PPP is

that even when the LOOP is true literally, economic forces behind it will assist it to equalise purchasing powers in all countries (Krugman et al, 2015).

There is absolute PPP and there is relative PPP. Absolute PPP (which is the strong-form-PPP) is the expression in Equation 1 that exchange rate is equal to relative price levels where the variables involved are transformed into logarithmic forms. This version of PPP holds that by comparing prices of a bundle of goods in two different countries (with conversions by exchange rate into a common currency measure), the price will then be equal. Drawing from Equation 1, the algebraic expression of the absolute PPP is:

$$E = \frac{P}{P^*} \quad 2$$

where the variables are not transformed into logarithm. Relative PPP (which is the weak-form PPP) states that the percentage change in the exchange rate between two currencies over a period of time equals to the difference between the percentage changes in national price levels. What this denotes is that that relative PPP begins with absolute PPP and then transform Equation 2 into percentage changes thus:

$$\% \Delta E = \% \Delta P - \% \Delta P^* \quad 3$$

Relative PPP accounts for market imperfections. As acknowledged by the proponents of the PPP theory, the absolute PPP is not likely to hold because of the existence of transport costs, trade impediments, distortion effects of tariffs, quotas and protections, imperfect information and competition etc., while it is argued that relative PPP can hold even in the presence of these highlighted problems. The argument of relative PPP is that exchange rate will adjust by the amount of inflation differentials between two economies. In the consideration of market imperfection, relative PPP, which is the long run path on which exchange rate moves with inflation is tested in this chapter.

Many empirical studies have reached the conclusion that PPP hold better in the long run than in the short run and that there can be prolonged and substantial deviations in the long run (Ardeni and Lubian, 1991). On the overall, it was argued that PPP holds better for traded goods than for non-traded goods (Officer, 1976). A stylised fact and major empirical regularity is that non-traded goods are usually more expensive in rich countries than in poor countries once the prices are converted into a common currency (Pilbeam, 2018). This is a vital point. Furthermore, the PPP theory holds better for relatively high inflation countries and underdeveloped capital markets. High-inflation countries' currencies (relative to their

trade partners) tend to experience rapid depreciation that reflects such high inflation, thus suggesting that PPP is a dominant foreign exchange rate determinant in such countries. PPP may not hold generally because of confounding effects through other factors that are determinants of exchange rate.

Husted and Melvin (2013) stressed that developing economies have very low prices for many goods and services when measured in terms of developed countries' currencies (such as the US dollar). In these developing economies, when overall economic activities are measured at market exchange rate, domestic products are understated. Furthermore, common findings show that PPP holds better for countries having high trade openness and perform poorly for countries with significant trade barriers. Because of the postulation that PPP holds better when countries concerned are geographically close and trade linkages are high (according to Frankel, 1981) in testing the validity of international parity relationships, this study generates thirty (30) pairs of bilateral nominal exchange rates in which all the six WAMZ countries, each serves as home economies to each other five member countries.

Because price level data are non-existing, the available consumer price indices (which is index numbers whose value is 100 during the base year of the data) are commonly used. For both domestic and foreign countries, consumer price index (CPI) are constructed as:

$$CPI_t = \frac{P_t}{P_0} \quad 4$$

where  $P_t$  and  $P_0$  are the consumer price level at time t and the base year respectively. If the home country's CPI is divided by foreign country's CPI, this results into:

$$\frac{CPI_t}{CPI_t^*} = \left(\frac{P_t}{P_t^*}\right) X \left(\frac{P_0^*}{P_0}\right) \quad 5$$

where \* depicts the foreign country. Assuming the absolute PPP in Equation 2 holds in the base year, the actual exchange rate in the base year equals to the PPP exchange rate for the base year. An empirical measure of PPP exchange rate by cross multiplying terms in Equation 5 thus:

$$E_t = E_t PPP = E_0 \left(\frac{CPI_t}{CPI_t^*}\right) \quad 6$$

As a commonly used technique which involves the correlation of the actual exchange rates movements and the PPP counterpart, Equation 6 allows for the test of the validity of PPP (Husted and Melvin, 2013). This PPP exchange rate which re-establishes PPP relative to the



base period offsets the relative inflation between a pair of countries, in consideration of the base period.

A further way of assessing long run PPP is to investigate the stationarity of real exchange rate (RER). The assumptions of absolute PPP is that RER is constant. The RER is nominal exchange rate adjusted for national prices. If the RER is stationary, any percentage change in price levels would be offset by equal magnitude of nominal exchange rate depreciation/appreciation. If RER contains unit roots, this then means that RER shocks are permanent with a further implication that PPP does not hold. For this purpose, bilateral RER were estimated for the WAMZ countries as:

$$q = s \left( \frac{p}{p^*} \right) \quad 7$$

where  $q$  is real exchange rate.

Here, PPP is tested under the null hypothesis that RER is a random walk (that is, RER contains unit root and not stationary) against the alternative hypothesis that RER is stationary (Messe and Rogoff, 1988 and Mark, 1989). Although, the unit root tests of RER were performed ‘with and without time trend’, it is more appropriate to apply the model without trend in determining the stationarity of RER. This is because the inclusion of linear time trend is not theoretically consistent with long run proposition of PPP. Some empirical studies also suggested the inconsistency of time trend in RER with the PPP hypothesis (Culver and Papell, 1999; Holmes, 2002; Zhang and Lowinger, 2006; Acaravci and Acaravci, 2007)

According to the Quantity Theory of Money (QTM), in the long run, money supply growth causes changes in price, while it is a general consensus among economists that money supply growth does not affect real variables in the long run. Consequently, real interest rate should not be impacted by money supply growth. If this holds, all inflation changes must be reflected in the nominal interest rate. The explanations of the ‘Fisher Effect’ is on how the nominal interest rate is affected by changes in inflation, in response to money supply growth. This thus reflects the effect of money supply growth on the nominal interest rate as clearly expressed in the QTM and Fisher equation. Fisher effect is therefore an expression that allows for the impact of inflation on nominal interest rate, in which increasing inflationary expectations causes increasing nominal interest. The Fisher equation is expressed as:

$$r = i - \pi^e \quad 8$$

Where  $r$  is real interest rate,  $i$  is nominal interest rate and  $\pi^e$  is expected inflation. ‘Fisher Effect’ depicts one-to-one relationship between nominal interest rate and inflation rate. This was brought to the fore by Irving Fisher who theorised a direct relationship between inflation rate and nominal interest rate. According to this postulation, all things being equal, a rise in a country’s expected inflation rate will eventually cause an equal rise in interest rate, and vice versa. A currency with high rate of inflation should also bear interest rate higher than a currency with lower rates of inflation.

This is the one-to-one relationship between nominal interest rate and inflation in ‘Fisher Effect’ expressed thus:

$$i = \pi^e \tag{9}$$

This Fisher effect for a domestic economy while the foreign version of this equation can be stated as:

$$i^* = \pi^{e*} \tag{10}$$

From the UIP condition and the Fisher hypothesis, there is a theoretical suggestion that currencies with higher interest rates depreciate because higher nominal interest rate reflects higher expected inflation. This is what the international Fisher effect (IFE) suggests. In order to clearly understand how relative nominal exchange rates changes among countries affect a country’s currency, it is necessary to recollect and consider the implications of the theories of PPP and Fisher effect. The implication of PPP is that exchange rate will move in order to offset changes in inflation rate differential. Therefore, a rise in a domestic inflation rate relative to that of a foreign country should associate with a fall in the value of the home country’s currency. Secondly, this should also associate with a rise in the domestic country’s interest rate. When these two conditions are put together, there will be IFE which is also known as Fisher effect (open). It can therefore be stated that IFE equals to the combination of the PPP and Fisher effect (closed).

International Fisher Effect (IFE) hypothesises that interest rate differentials is based on inflation differences. The higher the interest rate, the higher the inflation rate which subjects a currency to the weaker condition of depreciation. IFE therefore portends that differences in nominal interest rate between two countries should be proportional to depreciation or appreciation of the currencies of the two countries. The international Fisher effect (IFE) is an

economic and exchange rate model applied in predicting nominal exchange rate movements between two or more foreign currencies based on the relationship between the prevailing interest rate in these countries.

Just like the PPP theory, IFE conjectures that interest rate differentials (and not inflation differential) influences exchange rate changes. IFE also states that an estimated change in the current exchange rate between any two currencies is directly proportional to the difference between the nominal interest rate of these two countries as a particular time, indicating that IFE estimated exchange rate are equally based on nominal interest rates relationships. If IFE theory explains the relationship between interest rates and exchange rate, it impliedly proposes interest rate differential as a prediction of the future changes in spot exchange rate.

Automatically, nominal interest rate differentials reflects inflation differential by a no-arbitrage system or by a PPP. This depicts that there is close relationship between PPP and IFE due to the high degree of correlation between interest rate and inflation rate. What IFE is therefore saying is that the currency of a country reflecting lower (higher) interest rate should experience appreciation (depreciation) relative to the currency of the country bearing higher (lower) interest rate. These show that there is proportional relationship between depreciation/appreciation of currency, prices and nominal interest rate differential. This link between interest rate, inflation and exchange rate is provided by IFE.

However, the validity of IFE depends largely on capital market integration which implies free flows of capital across markets. This is however problematic in developing economies like the African economies (unlike developed economies). Given the foregoing explanations, international Fisher Effect can be expressed as:

$$\% \Delta e = \left( \frac{1+i_d}{1+i_f} \right) - 1 \quad 11$$

or

$$\% \Delta e = \left( \frac{i_d - i_f}{1+i_f} \right) \quad 12$$

where  $\Delta e$  is the percentage change in exchange rate,  $i_d$  and  $i_f$  are the domestic and foreign nominal interest rates respectively.  $\Delta e$  will be positive if  $i_d > i_f$ , implying that domestic currency will depreciate relative to the foreign currency due to high inflationary expectations in the domestic country. On the other hand, if  $i_d < i_f$ ,  $\Delta e$  will be negative. These therefore connote positive relationship between exchange rate changes and interest rate differentials.

The position of IFE is that the nominal exchange rate between two countries should adjust for nominal interest rate differentials. These adjustment can occur either through (i) international capital flow (international money market) or trade and flow of goods. Therefore, free capital mobility is a condition for IFE to hold. Because the IFE theory is based on the PPP theory, the IFE theory might not hold due to the same reason that caused the PPP theory not to hold in the presence of other factors (other than inflation) affecting exchange rate movements and thus prevent exchange rate from adjusting according to the dictates of inflation differentials. Going by the foregoing analyses and the interconnectivity of the parity conditions and with the consideration of model Equations 9 and 10 above, IFE can be expressed and estimated as the relationship between relative nominal interest rates and relative inflation thus:

$$(i - i^*) = (\pi - \pi^*) \quad 13$$

where \* indicate the foreign variables.

Interest rates parity is state that interest rate differential between two countries is equal to the difference between the spot and forward exchange rates. The covered interest rate parity (CIP) is a condition that the price of risk-free asset having an identical maturity should be equal across countries after being translated into a common currency. This is arbitrage condition. The uncovered interest rate parity (UIP) occurs when the difference between interest rates equals to the difference in the spot exchange rate. If IFE states that change in exchange rates have to do with expected differences in interest rate, which means that the market will react in trying to achieve the UIP.

Uncovered interest rate parity (UIP) states that exchange rate will change at a rate that offsets the interest rate differential. The UIP condition is such that expected rate of depreciation or appreciation of an exchange rate is equal to the interest rate differential between two the countries affected. Thus, UIP is expressed as:

$$\% \Delta E = i - i^* \quad 14$$

Where  $\Delta E$  is the expected rate of depreciation or appreciation of the domestic country's currency in a direct quotation system while  $i$  and  $i^*$  are the domestic and foreign interest rates respectively. Higher interest rate is expected to cause depreciation while low interest rate leads to currency appreciation. What UIP says is that expected change in foreign exchange price offsets the difference in the nominal rates of returns. Nevertheless, UIP does not imply CIP. The requirements of UIP goes beyond friction-free financial markets. Investors may be indifferent about currency denomination of their financial assets so far these assets have same

expected returns, even regardless of the volatility of these returns. Specifically, the investor may care less about currency risks involved. Such risk neutrality stance denotes ‘perfect substitutability’ of financial assets which is the implication of the UIP. Therefore, UIP is a relationship that must hold when domestic and foreign financial assets are perfect substitute in the situation of capital mobility. This is an assumption of monetary models of exchange rate determination.

### **3. Data and Methods**

Annual, quarterly and monthly data of the proposed ‘Ecozone’ countries for money market interest rates, US dollar nominal exchange rates, consumer price index (CPI) and CPI inflation over a period of 28 years between 1990 and 2017 were sourced from the databases of World Bank, IMF and EIU and applied for this study. However, there were limitations of data in the cases of some countries thereby reducing the span of period of coverage in these cases. Because the WAEMU (the CFA Zone) countries are already in a monetary union, a consequential approach taken in this paper was to perform some specific assessments of international parity conditions for the WAMZ countries (the non-WAEMU countries in proposed ‘Ecozone’). These were meant to reveal specific information relevant in these respects.

For the WAMZ and proposed ‘Ecozone’ countries under assessment, absolute PPP should imply cointegration between the nominal exchange rates and relative foreign and domestic prices; relative PPP should connote cointegration of changes in nominal interest rates and changes in relative foreign and domestic prices; while IFE should require cointegration between nominal interest rate differentials and inflation differentials. As an initial step, Equation 7 was estimated to generate the PPP exchange rates for the Ecozone countries in order to investigate the levels of equality of PPP exchange rates and market exchange rates of the proposed ‘Ecozone’ and further establish the degree of deviations (if any) of these rates from each other and as well establish the degree of association (correlation) of these two exchange rates over the period covered by the validity tests. For the purpose of the cointegration estimations, the Augmented Dicky-Fuller (ADF) and Phillip-Perron (PP) unit root tests were performed at the first stage to check for the order of integration of the variables employed in the cointegration analyses because residual-based cointegration tests require all variables (at least the dependent variable) to be to an integration order of one. Fully modified least square (FMOLS) cointegrating regression were performed for each of the 30 bilateral relationships and the residuals of these FMOLS estimation results were tested

for unit root/stationarity under the residual-based single equation cointegration methods which require the residuals to be stationary if the variables are cointegrated to be the econometric variants of Residual-based cointegration tests (Engle-Granger, Phillips Ouliaris and Park's Added Variables tests) and the statistical methods of Pearson Moment Correlation and were appropriately applied. While Engle Granger and Phillips Ouliaris test the null hypothesis of no cointegration against the alternative hypothesis of cointegration, Parks' Added Variable Tests were applied to test null hypothesis of cointegration. The cointegration tests were performed at 5% level of significance.

The Johansen cointegration test procedures based on vector autoregression (VAR) were applied to test for cointegration of the RERs of the proposed Ecozone countries. This method is independent of the choice of endogenous variables and also helps in capturing feedback effects between variables. The RERs applied for the GPPP evaluation were estimated for 14 member countries of the proposed Ecozone, with the lead economy and the possible anchor country, Nigeria as the foreign/base country. The monthly RER data were transformed into logarithm. The first step in the procedure was to test the RERs for stationary. It is essential that the RERs must meet the precondition of non-stationarity for the Johansen cointegration method to be appropriate. The second step was the VAR lag length selection through the various lag length selection criteria (the Akaike Information Criteria (AIC), Schwarz Information Criterion (SC), Hannan-Quinn Information Criterion (HQ), Final Predictor Error (FPE) etc). The cointegration tests were performed at 5% level of significant.

#### **4. Results and Findings**

The preliminary investigation of deviations of the estimated annual PPP exchange rates and market exchange bilateral exchange cross-rates across the proposed 'Ecozone' countries as well as the results of estimates of the strength of association of these two forms of exchange rates over a period of eighteen (18) years are exhibited in Table 4 below. The Table reveals that while the linear association of the nominal market exchange rates and the PPP theoretically inclined exchange rates were low and negative in the cases of the WAEMU countries and Cape Verde, the Pearson Product-moment correlation estimation of the degrees of association of the two classes of exchange rate (reported in percentage translations of the correlation coefficients) were very high (at over 90 percentages) and positivity moved towards same direction in the cases of the WAMZ countries (The Gambia, Ghana, Guinea, Liberia, Nigeria and Sierra Leone).

*Table 4: Deviations of PPP Exchange Rates from Market Exchange Rates and Correlation Estimates in the Proposed 'Ecozone' (2001-2017)*

	<b>BN</b>	<b>BU</b>	<b>CP</b>	<b>IV</b>	<b>GM</b>	<b>GH</b>	<b>GU</b>	<b>GB</b>	<b>LB</b>	<b>ML</b>	<b>NR</b>	<b>NG</b>	<b>SN</b>	<b>SL</b>	<b>TG</b>
<b>2001</b>	267	253	39	254	-2	0.2	652	238	12	242	238	45	225	-1062	295
<b>2002</b>	227	214	33	211	0	0.2	692	194	21	190	197	47	185	-784	249
<b>2003</b>	115	99	15	90	6	0.1	529	107	15	92	100	47	81	-842	165
<b>2004</b>	70	61	9	43	5	0.1	118	62	8	66	58	41	38	-804	127
<b>2005</b>	61	46	11	40	3	0	943	61	7	52	37	27	45	-1064	98
<b>2006</b>	54	46	9	39	3	0	1625	63	6	55	48	19	46	-129	111
<b>2007</b>	17	17	1	0.1	-0.8	-0.0	-10	11	5	18	17	14	-11	-371	68
<b>2008</b>	-32	-44	-6	-42	-3	-0.0	-196	-49	0.4	-36	-46	-1	-59	-515	-28
<b>2009</b>	-19	-35	-2	-25	-0.4	0.1	-239	-18	0.6	-25	-27	14	-25	-386	-31
<b>2010</b>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>2011</b>	-21	-21	-5	-31	1	0	-77	-32	-2	-22	-22	-7	-24	231	-25
<b>2012</b>	-5	8	1	10	3	0.2	-618	5	-5	0.4	24	-20	17	43	10
<b>2013</b>	-18	-3	-1	-11	5	0.2	-1477	-9	-5	-5	3	-32	4	-139	-7
<b>2014</b>	-5	6	-0.1	-5	10	0.9	-2038	6	-6	-1	16	-43	17	-81	0
<b>2015</b>	91	99	16	86	8	1	-2293	97	-10	88	109	-27	114	173	88
<b>2016</b>	103	108	18	90	8	1	-1487	97	-9	105	115	2	118	915	92
<b>2017</b>	101	105	17	86	0	1	652	90	-1	96	103	19	111	1163	95
<b>Corr.</b>	<b>-0.34</b>	<b>-0.28</b>	<b>0.09</b>	<b>-0.31</b>	<b>0.90</b>	<b>0.97</b>	<b>0.97</b>	<b>0.12</b>	<b>0.96</b>	<b>0.21</b>	<b>0.14</b>	<b>0.90</b>	<b>0.20</b>	<b>0.97</b>	<b>-0.23</b>

Source: Author's Estimations. The interpretations of countries abbreviations here as expressed in Appendix 1

These portend close linear association of the market exchange rates and the PPP theoretically predisposed exchange rates across the WAMZ.

Regarding the investigations of the PPP (absolute and relative), IFE and UIP, results of the various unit roots tests of variables employed in the tests of validity of the international parity conditions are reported in Table 5 to Table 8 below:

*Table 5: Results of ADF and PP Unit Roots Tests of Cross Exchange Rates*

		<b>ADF</b>		<b>PP</b>	
<b>Home Country</b>	<b>Foreign Country</b>	<b>With Constant</b>	<b>With Constant &amp; Trend</b>	<b>With Constant</b>	<b>With Constant &amp; Trend</b>
<b>GAMBIA</b>	<b>Ghana</b>	-4.253	-4.192*	-4.871*	-3.867**
	<b>Guinea</b>	-1.280	-3.034	-1.359	-2.115
	<b>Liberia</b>	-1.813	-2.275	-1.698	-2.308
	<b>Nigeria</b>	-2.031	-2.012	-2.051	-2.079
	<b>S/Leone</b>	-3.536*	-3.429***	-3.004**	-2.728
<b>GHANA</b>	<b>Gambia</b>	0.274	-1.499	-0.796	-0.857
	<b>Guinea</b>	-1.185	-1.018	-1.185	-1.018
	<b>Liberia</b>	-1.478	-0.401	1.309	-0.635
	<b>Nigeria</b>	-0.006	-1.128	-0.206	-1.447
	<b>S/Leone</b>	-0.073	-1.666	-0.399	-1.540
<b>GUINEA</b>	<b>Gambia</b>	-1.093	-1.535	-1.209	-1.768
	<b>Ghana</b>	-1.765	-1.517	-1.483	-1.421
	<b>Liberia</b>	-1.204	-1.484	-1.271	-1.484
	<b>Nigeria</b>	-1.655	-2.044	-1.396	-1.481
	<b>S/Leone</b>	-1.986	-1.987	-1.851	-1.609
<b>LIBERIA</b>	<b>Gambia</b>	-1.698	-2.009	-1.572	-1.826
	<b>Ghana</b>	-7.720*	-6.356	-6.441*	-3.621**
	<b>Guinea</b>	-1.850	-2.783	-1.187	-1.864
	<b>Nigeria</b>	-1.800	-1.659	-1.775	-1.573
	<b>S/Leone</b>	-2.681***	-2.584	-3.456*	-2.428
<b>NIGERIA</b>	<b>Gambia</b>	-2.085	-1.988	-2.248	-2.173

	<i>Ghana</i>	-2.459	-3.840***	-2.460	-3.084
	<i>Guinea</i>	-1.683	-1.075	-1.182	-1.198
	<i>Liberia</i>	-1.932	-1.913	-1.899	-1.925
	<i>S/Leone</i>	-2.150	-2.126	-2.211	-2.189
<b>SIERRA</b>	<i>Gambia</i>	-2.730***	-2.698	-2.436	-2.372
	<i>Ghana</i>	-1.802	-3.087	-1.539	-2.499
	<i>Guinea</i>	-2.213	-1.330	-2.180	-1.608
	<i>Liberia</i>	-1.846	-3.952**	-1.794	-2.664
	<i>Nigeria</i>	-2.577	-2.711	-2.771***	-2.920

Source: Author's Estimations and EViews 10

Note: \*, \*\* and \*\*\* denote 1%, 5% and 10% levels of significance respectively

Table 6: Results of ADF and PP Unit Roots Tests of Absolute PPP Term (P-P\*)

<i>Home Country</i>	<i>Foreign Country</i>	<b>ADF</b>		<b>PP</b>	
		<i>With Constant</i>	<i>With Constant &amp; Trend</i>	<i>With Constant</i>	<i>With Constant &amp; Trend</i>
<b>GAMBIA</b>	<i>Ghana</i>	-2.704*	-4.723*	-11.524*	-9.780*
	<i>Guinea</i>	-7.200*	-5.171*	-5.688	-2.556
	<i>Liberia</i>	-0.498	-3.913***	-1.402	-2.453
	<i>Nigeria</i>	-3.518*	-7.093*	-8.940	-20.828*
	<i>S/Leone</i>	-1.824	-0.041	-3.792	-1.777
<b>GHANA</b>	<i>Gambia</i>	0.995	-2.782	1.268	-2.053
	<i>Guinea</i>	-4.579	-3.143	-3.257**	-1.694
	<i>Liberia</i>	-0.395	-3.311***	0.715	-3.549**
	<i>Nigeria</i>	-0.968	-1.400	-0.505	-2.040
	<i>S/Leone</i>	0.373	-3.228***	1.194	-0.835
<b>GUINEA</b>	<i>Gambia</i>	-2.108	-1.496	-1.793	-0.869
	<i>Ghana</i>	-3.049	-1.912	-2.426	-1.125
	<i>Liberia</i>	-1.870	-3.444***	-1.943	-1.551
	<i>Nigeria</i>	-2.898***	-1.350	-2.629***	-1.492
	<i>S/Leone</i>	-0.590	2.165	1.758	-2.161
<b>LIBERIA</b>	<i>Gambia</i>	-0.190	-3.255	-0.715	-2.511
	<i>Ghana</i>	-1.845	-4.092**	-0.653	-2.957
	<i>Guinea</i>	-3.312**	-1.827	-3.427	-1.815
	<i>Nigeria</i>	-1.605	-2.814	-1.406	-2.837
	<i>S/Leone</i>	-1.658	-3.329*	-1.577	-3.545**
<b>NIGERIA</b>	<i>Gambia</i>	-1.735	-3.079	-1.678	-3.133
	<i>Ghana</i>	-2.595**	1.773	-1.043	-1.524
	<i>Guinea</i>	-4.697*	-3.051	-4.489*	-2.307
	<i>Liberia</i>	-1.564	-2.852	-1.369	-2.880
	<i>S/Leone</i>	-3.471	-0.489	0.281	-2.541
<b>SIERRA</b>	<i>Gambia</i>	-1.712	-0.149	-3.389**	
	<i>Ghana</i>	-0.930	-5.532	-0.338	-1.815*
	<i>Guinea</i>	-1.156	-0.904	-3.525**	-4.184
	<i>Liberia</i>	-2.135	-3.594	-1.866	-3.269***
	<i>Nigeria</i>	-4.247	-0.796	0.241	-2.126

Source: Author's Estimations and EViews 10

Note: \*, \*\* and \*\*\* denote 1%, 5% and 10% levels of significance respectively



Table 7: Results of ADF and PP Unit Roots Tests of Real Exchange Rates

		ADF		PP	
Home Country	Foreign Country	With Constant	With Constant & Trend	With Constant	With Constant & Trend
<b>GAMBIA</b>	<i>Ghana</i>	-8.059*	-4.493*	-15.018*	11.576*
	<i>Guinea</i>	-6.448*	-4.457*	-7.897*	-5.285*
	<i>Liberia</i>	-1.847	-3.468***	-1.881	-2.190
	<i>Nigeria</i>	-7.032*	-5.886*	-6.948*	-5.816*
	<i>S/Leone</i>	-2.554	-2.459	-2.306	-2.010
<b>GHANA</b>	<i>Gambia</i>	3.441	2.108	4.033	2.173
	<i>Guinea</i>	-3.918*	-4.564*	-2.519	-2.308
	<i>Liberia</i>	2.876	0.395	3.017	0.305
	<i>Nigeria</i>	0.743		1.485	-0.511
	<i>S/Leone</i>	0.473	1.935	0.872	-1.059
<b>GUINEA</b>	<i>Gambia</i>	-1.847	-1.499	-1.824	-1.648
	<i>Ghana</i>	-2.414	-2.525	-1.908	-1.837
	<i>Liberia</i>	-2.086	-1.527	2.060	-1.527
	<i>Nigeria</i>	-2.523	-2.342	-2.337	-1.555
	<i>S/Leone</i>	-1.785	-2.492	-2.028	-2.103
<b>LIBERIA</b>	<i>Gambia</i>	-1.863	-2.069	-1.951	-2.158
	<i>Ghana</i>	-1.658	-5.991*	-0.243	-3.704**
	<i>Guinea</i>	-4.940*	-3.420**	-5.035*	-3.457**
	<i>Nigeria</i>	-2.805**	-3.221**	-2.850*	-3.282***
	<i>S/Leone</i>	-3.313**	3.416**	-2.181	-2.193
<b>NIGERIA</b>	<i>Gambia</i>	-1.585	-2.175	-1.619	-2.295
	<i>Ghana</i>	-2.390	-3.900**	-2.357	-3.076
	<i>Guinea</i>	-6.589*	-8.228*	-7.269*	-4.932*
	<i>Liberia</i>	-3.044**	-3.380**	-3.032***	-3.435***
	<i>S/Leone</i>	-2.871***	4.800**	1.950	-2.401
<b>SIERRA</b>	<i>Gambia</i>	-2.361	-2.312	-2.050	-1.950
	<i>Ghana</i>	-1.334	-2.973	-0.580	-1.908
	<i>Guinea</i>	-2.221	-3.614**	2.815***	-3.498***
	<i>Liberia</i>	-3.458**	3.540**	-2.156	-2.101
	<i>Nigeria</i>	-2.743**	3.894**	-1.966	-2.401

Source: Author's Estimations and EViews 10

Note: \*, \*\* and \*\*\* denote 1%, 5% and 10% levels of significance respectively

Table 8: Results of ADF Unit Roots Tests (Exchange Rates Changes/CPI Differentials and IFE Terms)

		Exchange Rate		CPI Differentials		IFE Terms	
Home Country	Foreign Country	With Constant	With Constant & Trend	With Constant	With Constant & Trend	With Constant	With Constant & Trend
<b>GAMBIA</b>	<i>Ghana</i>	-5.700*	-5.704*	-2.396	-2.584	-2.358	-2.660
	<i>Guinea</i>	-6.366*	-6.305*	-4.524*	-6.149*	-2.022	-1.665
	<i>Liberia</i>	-4.880*	-5.022*	-3.119**	-3.157***	-0.683	-2.308
	<i>Nigeria</i>	-8.426*	-8.392*	-6.038*	-6.303*	-2.324	-2.756
	<i>S/Leone</i>	-6.266*	-2.666*	-3.708*	-3.637**	1.801	1.435
	<i>US</i>	-6.000*	-5.972*				
<b>GHANA</b>	<i>Gambia</i>	-5.712*	-5.712*	-2.396	-2.584	-2.223	-3.062
	<i>Guinea</i>	-6.042*	-6.153*	-4.912*	-5.845*	-1.837	-0.185
	<i>Liberia</i>	7.262*	-7.345*	-4.054*	-3.050*	-2.887**	-3.222***
	<i>Nigeria</i>	-6.896*	-6.860*	-8.717*	-8.822*	-3.662*	-3.636
	<i>S/Leone</i>	-5.375*	-5.337*	-2.243	-2.204	0.511	0.100
	<i>US</i>	4.054*	-4.110*				
<b>GUINEA</b>	<i>Gambia</i>	-5.819*	-5.768*	-4.524*	-6.149*	-0.705	-0.496
	<i>Ghana</i>	-5.249*	-5.409*	-4.912*	-5.845*	-1.992	-1.866
	<i>Liberia</i>	-7.429*	-7.468*	-6.925*	-7.756*	-1.535	-0.441
	<i>Nigeria</i>	-5.602*	-5.708*	-4.651*	-5.613*	-2.900**	-2.945

	<i>S/Leone</i> <i>US</i>	-5.617* -5.991*	-5.767* -6.141*	-2.022	-2.157	-2.631***	-3.693**
<b>LIBERIA</b>	<i>Gambia</i>	-5.344*	-5.401*	-3.119**	-3.157***	-0.753	-1.806
	<i>Ghana</i>	-5.154*	-5.318*	-4.054*	-3.051	-2.087	-2.192
	<i>Guinea</i>	-7.238*	-7.192*	-6.925*	-7.756*	-2.527	-1.346
	<i>Nigeria</i>	-8.599*	-8.590*	-7.467	-7.399*	-4.146*	-4.352*
	<i>S/Leone</i> <i>US</i>	-2.406 -5.687*	-2.314* -5.717*	-3.048**	-3.224***	-0.401	-0.378
<b>NIGERIA</b>	<i>Gambia</i>	-9.060*	-9.074*	-6.038*	-6.030*	-1.779	-2.120
	<i>Ghana</i>	-8.829*	-8.820*	-8.717*	-8.822*	-4.036*	-4.076*
	<i>Guinea</i>	-6.223*	-6.283*	-4.651*	-5.613*	-1.450	-1.075
	<i>Liberia</i>	-8.983*	-9.038*	-7.467*	-7.399*	-2.617***	-2.964
	<i>S/Leone</i> <i>US</i>	-9.031* -9.056*	-9.015* -9.086*	-3.693*	-3.057	-0.928	1.378
<b>SIERRA</b>	<i>Gambia</i>	-5.935*	-5.963*	-3.708*	-3.637**	-2.781***	-3.060
	<i>Ghana</i>	-5.704*	-5.673*	-2.243	-2.204	-3.051**	-2.955
	<i>Guinea</i>	-6.156*	-6.235*	-2.022	-2.158	-1.755	-2.358
	<i>Liberia</i>	-2.159	-6.182*	-3.048**	-3.224***	-1.802	-1.493
	<i>Nigeria</i> <i>US</i>	-7.495* -6.419*	-7.480* -6.714*	-3.693*	-3.057	-2.410	-2.320

Source: Author's Estimations and EViews 10 Output

Note: \*, \*\* and \*\*\* denote 1%, 5% and 10% levels of significance respectively

Virtually all the WAMZ countries' variables for the cointegration tests of relative PPP were stationary, and this makes cointegration tests inappropriate in these respects. Consequently, this study resorted to the application of the Pearson Product-Moment correlation estimations of the terms of relative PPP for the 30 bilateral relationship across the WAMZ in order to establish the strength of linear association between percentages changes in exchange rates and percentage changes in inflation differentials. The stronger the association of these two variables of relative PPP, the closer the Pearson correlation coefficient will be to either +1 or -1 depending on whether the relationship is positive or negative, respectively.

Table 9: Results of Residual-based Cointegration Tests of Absolute PPP in the WAMZ

		<i>Phillips-Ouliaris Tests</i>		<i>Park's Added Variable Tests</i>
<i>Home Country</i>	<i>Foreign Country</i>	<i>tau-statistics</i>	<i>z-statistics</i>	<i>Chi-square</i>
<b>GAMBIA</b>	<i>Ghana</i>	-2.587	-12.845	4.361
	<i>Guinea</i>	-2.631	-9.963	95.023*
	<i>Liberia</i>	-2.450	-9.635	133.507*
	<i>Nigeria</i>	-2.750	-12.999	14.341*
	<i>S/Leone</i>	-2.336	-10.365*	12.748*
<b>GHANA</b>	<i>Gambia</i>	-1.756	-9.396	23.709*
	<i>Guinea</i>	-0.682	-2.126	185.207*
	<i>Liberia</i>	-1.766	-6.416	76.931*
	<i>Nigeria</i>	-1.222	-4.560	25.446*
	<i>S/Leone</i>	-2.213	-8.730	32.718*
<b>GUINEA</b>	<i>Gambia</i>	-2.205	-7.813	76.586*
	<i>Ghana</i>	-1.568	-5.824	99.751*
	<i>Liberia</i>	-2.693	-12.656	20.389*
	<i>Nigeria</i>	-2.816	-15.684***	9.118*
	<i>S/Leone</i>	-2.857	-15.327***	7.328**
<b>LIBERIA</b>	<i>Gambia</i>	-8.634	-2.270	113.668*
	<i>Ghana</i>	-3.218***	-14.280	52.801*

	<i>Guinea</i>	-3.111	-13.590	33.036*
	<i>Nigeria</i>	-3.827**	-21.751**	14.939*
	<i>S/Leone</i>	-1.812	-6.325	21.964*
<b>NIGERIA</b>	<i>Gambia</i>	-2.199	-8.990	10.900*
	<i>Ghana</i>	-3.323***	-20.677**	10.627*
	<i>Guinea</i>	-3.169***	-16.066***	8.900*
	<i>Liberia</i>	-4.159*	-24.895*	13.671*
	<i>S/Leone</i>	-2.735	-12.381	6.387**
<b>SIERRA</b>	<i>Gambia</i>	-2.331	-10.310	7.311*
	<i>Ghana</i>	-1.893	-6.645	14.412*
	<i>Guinea</i>	-2.846	-15.424**	3.661
	<i>Liberia</i>	-1.773	-6.345	19.971*
	<i>Nigeria</i>	-2.664	-11.481	5.013***

Source: Author's Estimation and Eviews 10 Output

Note: \*, \*\* and \*\*\* denote 1%, 5% and 10% levels of significance respectively

The outcome of the Phillips-Ouliaris and Park's Added Variable residual-based cointegration tests for absolute PPP across the WAMZ are highlighted in Table 9 above. For most bilateral absolute PPP relationships (except for The Gambia/Sierra Leone and Nigeria/Liberia). The test statistics (tau and z) yielded by the Phillip-Ouliaris tests failed to reject the null hypothesis of no cointegration (that is, unit roots in the residuals) at 1% level of significance. Apart from The Gambia/Ghana and Sierra Leone/Guinea relationships, the chi-square statistics produced for all the WAMZ countries revealed that the Park's Added Variable tests reject the null hypothesis of cointegration of the series at 1% level of significance. These two residual based cointegration tests consequently provided evidence to suggest that the absolute PPP does not hold across the WAMZ.

The results of further ADF and PP (with constant only) unit roots tests of bilateral RER as exhibited in Table 10 below show that the null hypothesis of unit roots cannot be rejected for virtually all the WAMZ countries at 1% level of significance (except for some cases of three The Gambian-based RER and Liberia/ Guinea RER).

*Table 10: Results of ADF and PP Unit Roots Tests of Real Exchange Rates*

		<b>ADF</b>		<b>PP</b>	
<b>Home Country</b>	<b>Foreign Country</b>	<i>With Constant</i>	<i>With Constant &amp; Trend</i>	<i>With Constant</i>	<i>With Constant &amp; Trend</i>
<b>GAMBIA</b>	<i>Ghana</i>	-8.059*	-4.493*	-15.018*	11.576*
	<i>Guinea</i>	-6.448*	-4.457*	-7.897*	-5.285*
	<i>Liberia</i>	-1.847	-3.468***	-1.881	-2.190
	<i>Nigeria</i>	-7.032*	-5.886*	-6.948*	-5.816*
	<i>S/Leone</i>	-2.554	-2.459	-2.306	-2.010
<b>GHANA</b>	<i>Gambia</i>	3.441	2.108	4.033	2.173
	<i>Guinea</i>	-3.918*	-4.564*	-2.519	-2.308
	<i>Liberia</i>	2.876	0.395	3.017	0.305
	<i>Nigeria</i>	0.743	0.935	1.485	-0.511
	<i>S/Leone</i>	0.473	1.935	0.872	-1.059
<b>GUINEA</b>	<i>Gambia</i>	-1.847	-1.499	-1.824	-1.648
	<i>Ghana</i>	-2.414	-2.525	-1.908	-1.837
	<i>Liberia</i>	-2.086	-1.527	2.060	-1.527

	<i>Nigeria</i>	-2.523	-2.342	-2.337	-1.555
	<i>S/Leone</i>	-1.785	-2.492	-2.028	-2.103
<b>LIBERIA</b>	<i>Gambia</i>	-1.863	-2.069	-1.951	-2.158
	<i>Ghana</i>	-1.658	-5.991*	-0.243	-3.704**
	<i>Guinea</i>	-4.940*	-3.420**	-5.035*	-3.457**
	<i>Nigeria</i>	-2.805**	-3.221**	-2.850*	-3.282***
	<i>S/Leone</i>	-3.313**	3.416**	-2.181	-2.193
<b>NIGERIA</b>	<i>Gambia</i>	-1.585	-2.175	-1.619	-2.295
	<i>Ghana</i>	-2.390	-3.900**	-2.357	-3.076
	<i>Guinea</i>	-6.589*	-8.228*	-7.269*	-4.932*
	<i>Liberia</i>	-3.044**	-3.380**	-3.032***	-3.435***
	<i>S/Leone</i>	-2.871***	4.800**	1.950	-2.401
<b>SIERRA</b>	<i>Gambia</i>	-2.361	-2.312	-2.050	-1.950
	<i>Ghana</i>	-1.334	-2.973	-0.580	-1.908
	<i>Guinea</i>	-2.221	-3.614**	2.815***	-3.498***
	<i>Liberia</i>	-3.458**	3.540**	-2.156	-2.101
	<i>Nigeria</i>	-2.743**	3.894**	-1.966	-2.401

Source: Author's Estimation and Eviews 10 Output

Note: \*, \*\* and \*\*\* denote 1%, 5% and 10% levels of significance respectively

This consonance hugely confirmed the residual-based cointegration test results that the long run absolute PPP does not hold in WAMZ countries.

For the proposed 'Ecozone' at large, the results of the residual based cointegration of nominal exchange rate and relative prices results of absolute PPP where Nigeria (the lead economy within the proposed monetary union) was made the foreign (base) country are highlighted in Table 11 below:

*Table 11: Results of Residual-based Cointegration Tests of Absolute PPP in the Proposed Ecozone Countries*

<b>Ecozone Countries</b>	<b>Phillips-Ouliaris Tests</b>		<b>Park's Added Variable Tests</b>
	<i>tau-statistics</i>	<i>z-statistics</i>	<i>Chi-square</i>
<i>Benin</i>	-1.728	-8.070	16.229*
<i>Burkina Faso</i>	-1.689	-8.856	18.313*
<i>Cape Verde</i>	-1.936	-7.158	14.537*
<i>Cote D'Ivoire</i>	-1.739	-6.179	16.740*
<i>The Gambia</i>	-2.498	-11.769	2.450
<i>Ghana</i>	-1.905	-6.042	27.046*
<i>Guinea</i>	-2.224	-8.891	0.013
<i>Guinea Bissau</i>	-4.465*	-33.336*	15.433*
<i>Liberia</i>	-3.208***	-21.031**	4.819**
<i>Mali</i>	-1.657	-5.643	16.674*
<i>Niger</i>	-1.685	5.719	16.951*
<i>Senegal</i>	-1.699	-5.908	17.211*
<i>Sierra Leone</i>	-1.927	-6.701	18.192*
<i>Togo</i>	-1.730	-6.086	15.450*

Source: Author's Estimations and EViews 10 Output

Note: \*, \*\* and \*\*\* denote 1%, 5% and 10% levels of significance respectively.

For the assessment of the validity of absolute PPP across the proposed Ecozone, the results of the Phillips-Ouliaris and Park Added variable tests of cointegration are expressed in Table 11 below. For the Philips-Ouliaris tests, apart from Guinea where the two test statistics are

significant at 1% level of significance, we cannot reject, at this same level of significance, the null hypothesis of no cointegration of the terms of absolute PPP for all the proposed Ecozone countries evaluated. The Park's Added Variable tests revealed that we reject the null hypothesis that the terms of absolute PPP are cointegrated for all the proposed Ecozone countries except Guinea. Thus, the Park Added Variable results complimented the results generated by Philips-Ouliaris. Therefore, on the overall, these connote that absolute PPP failed to hold valid across the proposed Ecozone.

*Table 12: Results of ADF Unit Roots Tests of 105 Bilateral Real Exchange Rates of 'Ecozone' Countries*

<b>Country Pairs</b>	<b>ADF t-Statistics</b>	<b>Country Pairs</b>	<b>ADF t-Statistics</b>
<i>Benin-Burkina Faso</i>	-1.969	<i>The Gambia-Liberia</i>	-1.592
<i>Benin-Cape Verde</i>	-2.701***	<i>The Gambia-Mali</i>	-0.986
<i>Benin-Cote D'Ivoire</i>	-1.876	<i>The Gambia-Niger</i>	-1.008
<i>Benin-The Gambia</i>	1.694	<i>The Gambia-Nigeria</i>	0.673
<i>Benin-Ghana</i>	-0.567	<i>The Gambia-Senegal</i>	-0.939
<i>Benin-Guinea</i>	-1.401	<i>The Gambia-Sierra Leone</i>	-1.539
<i>Benin-Guinea Bissau</i>	-6.105*	<i>The Gambia-Togo</i>	-1.939
<i>Benin-Liberia</i>	1.577	<i>Ghana-Guinea</i>	-3.483**
<i>Benin-Mali</i>	-4.949*	<i>Ghana-Guinea Bissau</i>	-2.125
<i>Benin-Niger</i>	-4.500*	<i>Ghana-Liberia</i>	-0.850
<i>Benin-Nigeria</i>	2.253	<i>Ghana-Mali</i>	-5.521*
<i>Benin-Senegal</i>	-2.137	<i>Ghana-Niger</i>	-4.772*
<i>Benin-Sierra Leone</i>	1.501	<i>Ghana-Nigeria</i>	-4.047*
<i>Benin-Togo</i>	-1.611	<i>Ghana-Senegal</i>	-6.555*
<i>Burkina Faso-Cape Verde</i>	-2.786***-	<i>Ghana-Sierra Leone</i>	-5.020*
<i>Burkina Faso-Cote D'Ivoire</i>	2.521	<i>Ghana-Togo</i>	-7.599*
<i>Burkina Faso-The Gambia</i>	1.904	<i>Guinea-Guinea Bissau</i>	-1.694
<i>Burkina Faso-Ghana</i>	0.125	<i>Guinea-Liberia</i>	-6.119*
<i>Burkina Faso-Guinea</i>	-1.587	<i>Guinea-Mali</i>	-0.499
<i>Burkina Faso-Guinea Bissau</i>	-3.208**	<i>Guinea-Niger</i>	-1.309
<i>Burkina Faso-Liberia</i>	1.804	<i>Guinea-Nigeria</i>	-1.507
<i>Burkina Faso-Mali</i>	-2.909***	<i>Guinea-Senegal</i>	-1.473
<i>Burkina Faso-Niger</i>	-3.534*	<i>Guinea-Sierra Leone</i>	-1.665
<i>Burkina Faso-Nigeria</i>	2.269	<i>Guinea-Togo</i>	-3.560**
<i>Burkina Faso-Senegal</i>	-0.693	<i>Guinea Bissau-Liberia</i>	2.462
<i>Burkina Faso-Sierra Leone</i>	1.542	<i>Guinea Bissau-Mali</i>	-8.763*
<i>Burkina Faso-Togo</i>	-1.635	<i>Guinea Bissau-Niger</i>	-4.766*
<i>Cape Verde-Cote D'Ivoire</i>	-2.626***	<i>Guinea Bissau-Nigeria</i>	2.373
<i>Cape Verde-The Gambia</i>	2.174	<i>Guinea Bissau-Senegal</i>	-2.434
<i>Cape Verde-Ghana</i>	0.081	<i>Guinea Bissau-Sierra Leone</i>	3.511
<i>Cape Verde-Guinea</i>	-1.601	<i>Guinea Bissau-Togo</i>	-4.655*
<i>Cape Verde-Guinea Bissau</i>	-3.472**	<i>Liberia-Mali</i>	-8.238*
<i>Cape Verde-Liberia</i>	1.668	<i>Liberia-Niger</i>	-7.651*
<i>Cape Verde-Mali</i>	-2.814***	<i>Liberia-Nigeria</i>	-0.193
<i>Cape Verde-Niger</i>	-2.747***	<i>Liberia-Senegal</i>	-7.896*
<i>Cape Verde-Nigeria</i>	2.211	<i>Liberia-Sierra Leone</i>	-2.893***
<i>Cape Verde-Senegal</i>	-3.004**	<i>Liberia-Togo</i>	-1.985
<i>Cape Verde-Sierra Leone</i>	3.639	<i>Mali-Niger</i>	-2.704***
<i>Cape Verde-Togo</i>	-2.528	<i>Mali-Nigeria</i>	2.332
<i>Cote D'Ivoire-The Gambia</i>	2.194	<i>Mali-Senegal</i>	-0.865
<i>Cote D'Ivoire-Ghana</i>	0.302	<i>Mali-Sierra Leone</i>	-3.437**
<i>Cote D'Ivoire-Guinea</i>	-2.075	<i>Mali-Togo</i>	-2.030
<i>Cote D'Ivoire-Guinea Bissau</i>	-3.276**	<i>Niger-Nigeria</i>	2.411

<i>Cote D'Ivoire-Liberia</i>	1.411	<i>Niger-Senegal</i>	-2.438
<i>Cote D'Ivoire-Mali</i>	-3.209**	<i>Niger-Sierra Leone</i>	3.767
<i>Cote D'Ivoire-Niger</i>	-4.885*	<i>Niger-Togo</i>	-2.241
<i>Cote D'Ivoire-Nigeria</i>	2.181	<i>Nigeria-Senegal</i>	-6.707*
<i>Cote D'Ivoire-Senegal</i>	-2.523	<i>Nigeria-Sierra Leone</i>	-3.438**
<i>Cote D'Ivoire-Sierra Leone</i>	3.547	<i>Nigeria-Togo</i>	-5.522*
<i>Cote D'Ivoire-Togo</i>	-2.735***	<i>Senegal-Sierra Leone</i>	3.910
<i>The Gambia-Ghana</i>	1.832	<i>Senegal-Togo</i>	-1.300
<i>The Gambia-Guinea</i>	0.547	<i>Sierra Leone-Togo</i>	-5.955
<i>The Gambia-Guinea Bissau</i>	-2.007		

Source: Author's Estimation and EViews 10 Output

Note: \*, \*\* and \*\*\* denote 1%, 5% and 10% levels of significance respectively

Further investigations of the validity of absolute PPP in the proposed 'Ecozone' were performed through the test of stationarity of real exchange rates (RER) of member countries in relation to Nigeria, the lead economy. Across the proposed 'Ecozone', this involved unit root tests of 105 bilateral RERs. The results of the Augmented Dicky Fuller (ADF) unit root tests in these respects are exhibited in Table 12 above.

The results of the ADF unit roots test for the 105 bilateral real exchange rates (RERs) within the proposed Ecozone are mixed. Nevertheless, the results in Table 12 clearly exhibit that vast majority of these bilateral RERs are not significant at 1% level. Only very few are significant at this level as well as 5% and 10% significance levels respectively. What these entail is further confirmation that absolute PPP failed to hold valid in the proposed Ecozone.

The relative PPP correlation tests results in Table 13 below generally reflected low and medium linear association between changes in exchange rates and in relative price changes differentials. These results are not encouraging in giving supports for relative PPP across the WAMZ.

*Table 13: Results of Correlation Tests of Relative PPP in the WAMZ*

<i>Home Country</i>	<i>Foreign Country</i>	<i>Correlation</i>	<i>Home Country</i>	<i>Foreign Country</i>	<i>Correlation</i>
<b>GAMBIA</b>	<i>Ghana</i>	0.35	<b>LIBERIA</b>	<i>Gambia</i>	0.36
	<i>Guinea</i>	0.64		<i>Ghana</i>	-0.00
	<i>Liberia</i>	0.40		<i>Guinea</i>	0.36
	<i>Nigeria</i>	0.07		<i>Nigeria</i>	0.20
	<i>S/Leone</i>	0.00		<i>S/Leone</i>	0.17
<b>GHANA</b>	<i>Gambia</i>	0.33	<b>NIGERIA</b>	<i>Gambia</i>	0.04
	<i>Guinea</i>	0.56		<i>Ghana</i>	0.05
	<i>Liberia</i>	0.01		<i>Guinea</i>	0.54
	<i>Nigeria</i>	0.10		<i>Liberia</i>	0.23
	<i>S/Leone</i>	0.34		<i>S/Leone</i>	-0.21
<b>GUINEA</b>	<i>Gambia</i>	0.63	<b>SIERRA</b>	<i>Gambia</i>	-0.02
	<i>Ghana</i>	0.58		<i>Ghana</i>	0.34
	<i>Liberia</i>	0.38		<i>Guinea</i>	0.42
	<i>Nigeria</i>	0.56		<i>Liberia</i>	0.19
	<i>S/Leone</i>	0.49		<i>Nigeria</i>	-0.19

Source: Author's Estimation and Eviews 10 Output

On the overall, these PPP tests indicate that the validity of both absolute and relative PPP could not be established in the WAMZ, thus making PPP to be irrelevant in the exchange rate determination throughout the WAMZ.

In Table 14 below, the results of Phillips-Ouliaris and Park's Variable Added residual-based cointegration tests for IFE depict that across the WAMZ, the null hypothesis of no cointegration of nominal interest rate differentials and inflation differentials cannot be rejected at 1% significance level in the Phillips-Ouliaris tests which thus produced evidence to infer that IFE failed to hold for these WAMZ's bilateral relationships. It is significant to state at this point that these results yielded supports for the conjecture that if PPP fails to hold, IFE will not hold. However, there were mixed (and contradictory) output yielded by the Chi-square statistics of the Park's Variable Added tests at 1% significance level.

*Table 14: Results of Cointegration Tests for International Fisher Effects in the WAMZ*

		<i>Phillips-Ouliaris Tests</i>		<i>Park's Added Variable Tests</i>
<b>Home Country</b>	<b>Foreign Country</b>	<i>tau-statistics</i>	<i>z-statistics</i>	<i>Chi-square</i>
<b>GAMBIA</b>	<i>Ghana</i>	-2.273	-10.169	0.346
	<i>Guinea</i>	-1.617	-7.309	0.577
	<i>Liberia</i>	-2.100	-9.110	46.700*
	<i>Nigeria</i>	-2.222	-10.222	5.367**
	<i>S/Leone</i>	-1.061	-4.476	4.405**
<b>GHANA</b>	<i>Gambia</i>	-2.273	10.169	0.346
	<i>Guinea</i>	-0.993	-3.134	0.182
	<i>Liberia</i>	-2.208	-10.479	35.007*
	<i>Nigeria</i>	-2.983	-15.925	0.066
	<i>S/Leone</i>	-1.383	-5.803	1.079
<b>GUINEA</b>	<i>Gambia</i>	-1.616	-7.309	0.577
	<i>Ghana</i>	-0.993	-3.134	0.082
	<i>Liberia</i>	-1.310	-3.164	26.331*
	<i>Nigeria</i>	-1.593	-4.901	5.348**
	<i>S/Leone</i>	-2.338	-9.626	11.572
<b>LIBERIA</b>	<i>Gambia</i>	-2.100	-9.110	46.700*
	<i>Ghana</i>	-2.208	-10.479	35.007*
	<i>Guinea</i>	-1.310	-3.164	26.331*
	<i>Nigeria</i>	-3.165***	-17.105***	9.447*
	<i>S/Leone</i>	-2.399	-12.945	0.001
<b>NIGERIA</b>	<i>Gambia</i>	-2.222	-10.222	5.368**
	<i>Ghana</i>	-2.983	-15.925	0.066
	<i>Guinea</i>	-1.594	-4.901	3.673**
	<i>Liberia</i>	-3.165***	-17.105***	9.447*
	<i>S/Leone</i>	-1.477	-5.806	1.483
<b>S/LEONE</b>	<i>Gambia</i>	-1.062	-4.476	4.405
	<i>Ghana</i>	-1.383	-5.803	1.079
	<i>Guinea</i>	-2.339	-9.626	11.572*
	<i>Liberia</i>	-2.399	-12.945	0.001
	<i>Nigeria</i>	-1.477	-5.806	1.483

Source: Author's Estimation and Eviews 10 Output

Note: \*, \*\* and \*\*\* denote 1%, 5% and 10% levels of significance respectively

Results of the Engle-Granger, Phillip-Ouliaris and Park Added Variables cointegration tests for the validity of international Fishers effect in the entire proposed 'Ecozone' as displayed in Table 15 below.

*Table 15: Results of Cointegration Tests for International Fisher Effects in the Proposed Ecozone*

<i>Ecozone Countries</i>	<i>Engle-Granger Tests</i>		<i>Phillips-Ouliaris Tests</i>		<i>Park's Added Variable Tests</i>
	<i>tau-statistics</i>	<i>z-statistics</i>	<i>tau-statistics</i>	<i>z-statistics</i>	<i>Chi-square</i>
<i>Benin</i>	-2.267	-7.503	-2.412	-8.861	1.801
<i>Burkina Faso</i>	-2.147	-7.299	-2.346	-8.931	1.479
<i>Cape Verde</i>	-1.666	-5.284	-1.805	-5.107	12.285*
<i>Cote D'Ivoire</i>	-2.141	-6.744	-2.273	-7.897	1.789
<i>The Gambia</i>	-3.042	-16.738*	-3.120***	-17.401***	0.309
<i>Ghana</i>	-2.303	-11.067	-2.476	-12.550	13.542*
<i>Guinea</i>	-2.101	-7.978	-2.301	-9.556	14.014*
<i>Guinea Bissau</i>	-2.398	-7.701	-2.513	-8.907	1.638
<i>Liberia</i>	-2.732	-10.217	-2.868	-11.757	0.313
<i>Mali</i>	-2.051	-6.646	-2.205	-7.906	1.741
<i>Niger</i>	-2.414	-8.371	-2.574	-9.999	1.410
<i>Senegal</i>	-2.124	-6.713	-2.269	-7.980	1.823
<i>Sierra Leone</i>	-1.416	-4.055	-1.417	-3.991	2.391
<i>Togo</i>	-2.409	-8.770	-2.598	-10.645	0.802

Source: Author's Estimation and Eviews 10 Output

Note: \*, \*\* and \*\*\* denote 1%, 5% and 10% levels of significance respectively

From Table 15 results of cointegration tests for international Fisher effects, Engle Granger and Philips-Ouliaris test clearly point that we cannot, at 1% level of significance reject the null hypothesis of no cointegration of the terms of international Fisher effects employed in this study. This connotes that international Fisher effect failed to hold valid in the Ecozone. However, this conclusion was only supported by the Park Added Variable tests results for Cape Verde, Ghana and Guinea. Nevertheless, with the outcomes of Engle Granger and Philips-Ouliaris tests, it could be inferred that generally, international Fisher effects failed to fold across the proposed West African monetary region.

The results of the tests of Pearson moment correlation for UIP in the WAMZ are as exhibited in Table 16 below. While correlation estimations for the WAMZ countries are bi-directional, the estimations for the WAEMU countries are unidirectional. The results revealed weak positive and negative correlations between exchange rate changes (appreciation and depreciation) and interest rate differentials across the WAMZ. The strongest of the linear association of 0.56 was recorded in the case of Guinea/Nigeria. It is equally interesting to note the positive correlation of the WAEMU countries with the WAMZ countries at the highest of Liberia's 0.51 and Sierra Leone's 0.24. Upon the whole, the linear associations are



very weak across region, thus depicting weak uncovered interest parity relationships in the proposed Ecozone. These failed to provide for the justification of the validity of uncovered interest parity (UIP) across the proposed monetary zone.

*Table 16: Results of Correlation Tests for Uncovered Interest Rate Parity (UIP) in the Ecozone*

<i>Home Country</i>	<i>Foreign Country</i>	<i>Correlation</i>	<i>Home Country</i>	<i>Foreign Country</i>	<i>Correlation</i>
<b>GAMBIA</b>	<i>Ghana</i>	0.14	<b>LIBERIA</b>	<i>Gambia</i>	-0.01
	<i>Guinea</i>	-0.04		<i>Ghana</i>	0.24
	<i>Liberia</i>	0.04		<i>Guinea</i>	0.04
	<i>Nigeria</i>	-0.01		<i>Nigeria</i>	-0.01
	<i>S/Leone</i>	-0.06		<i>S/Leone</i>	-0.06
<b>GHANA</b>	<i>Gambia</i>	0.15	<b>NIGERIA</b>	<i>Gambia</i>	0.08
	<i>Guinea</i>	0.23		<i>Ghana</i>	0.06
	<i>Liberia</i>	0.27		<i>Guinea</i>	0.07
	<i>Nigeria</i>	0.16		<i>Liberia</i>	0.05
	<i>S/Leone</i>	0.11		<i>S/Leone</i>	-0.16
<b>GUINEA</b>	<i>Gambia</i>	-0.03	<b>SIERRA</b>	<i>Gambia</i>	-0.07
	<i>Ghana</i>	0.27		<i>Ghana</i>	-0.04
	<i>Liberia</i>	0.11		<i>Guinea</i>	-0.27
	<i>Nigeria</i>	0.56		<i>Liberia</i>	-0.09
	<i>S/Leone</i>	-0.31		<i>Nigeria</i>	-0.14
<b>CAPE VERDE</b>	<i>Gambia</i>	-0.10	<b>WAEMU COUNTRIES</b>	<i>Cape Verde</i>	-0.02
	<i>Ghana</i>	0.31		<i>Gambia</i>	0.29
	<i>Guinea</i>	0.41		<i>Ghana</i>	0.43
	<i>Liberia</i>	-0.01		<i>Guinea</i>	0.37
	<i>Nigeria</i>	-0.15		<i>Liberia</i>	0.51
	<i>Sierra Leone</i>	0.11		<i>Nigeria</i>	0.21
	<i>WAEMU</i>	-0.02		<i>Sierra Leone</i>	0.24

Source: Author's Estimation and Eviews 10 Output

*Table 17: Results of ADF Unit Roots Tests of Real Exchange Rates of Ecozone Countries*

<i>Proposed Ecozone Countries</i>	<i>ADF Test t-statistics</i>
Benin	-1.6129
Burkina Faso	-1.7202
Cape Verde	-2.1714
Cote D'Ivoire	-1.6467
The Gambia	-3.1611
Ghana	-1.1492
Guinea	-2.4817
Guinea Bissau	-0.2856
Liberia	-2.1841
Mali	-1.7792
Niger	-1.7518
Senegal	-1.7028
Sierra Leone	-2.9234*
Togo	-1.6222

Source: Author's Estimations and EViews 10 Output

The unit roots test of the RERs displayed in Table 17 above reveal that apart from the Sierra Leonean RER, all other RERs with the proposed monetary union are non-stationary.

Consequently, Sierra Leone was expunged from the Johansen cointegration tests. The results therefore gave the go-ahead to proceed with the test of cointegration without Sierra Leone.

All the VAR lag length selection criteria indicated lag length of 2 for the estimation of the Johansen cointegration applied. The results of the Johansen cointegration tests of the RERs in the proposed Ecozone are as displayed in Table 18 below showing the Trace test statistic and the Max-Eigen statistic.

**Table 18: Results of the Johansen Cointegration Tests of Real Exchange Rates of Ecozone Countries**

<i>Hypothesised No. of CE(s)</i>	<i>Trace Statistic</i>	<i>Max-Eigen Statistic</i>
<i>None</i>	591.3379	63.50803
<i>At most 1</i>	527.8299*	55.72209
<i>At most 2</i>	472.1078*	51.53034
<i>At most 3</i>	420.5775*	51.15562
<i>At most 4</i>	369.4219*	50.88745
<i>At most 5</i>	318.5344*	50.59054***
<i>At most 6</i>	267.9439*	50.31340*
<i>At most 7</i>	217.6305*	49.97554*
<i>At most 8</i>	167.6549*	48.52985*
<i>At most 9</i>	119.1251*	45.77884*
<i>At most 10</i>	73.34624*	41.28832*
<i>At most 11</i>	32.05792*	23.8665*
<i>At most 12</i>	8.191603*	8.191603*

Source: Author's Estimation and EViews 10 output

Note: \* and \*\*\* indicate the rejection of null hypothesis of no cointegration at 1% and 10% level of significance respectively.

The two test statistic failed to generate similar results. However, from the Johansen cointegration results in Table 18, it could be proven that there is 'at most 12' cointegration relationships as indicated by the two test statistics at 1% level of significance. What this implies is that there is cointegration (a long run association) of virtually all the RERs in the proposed Ecozone; indicating that these RERs move together in the long run. Since the bilateral exchange rates estimated in this study were based on the proposed Ecozone's anchor country, Nigeria, this implies a degree of financial and monetary integration to a reasonable extent.

## **5. Conclusions and Implications for the Proposed Monetary Integration**

This paper is to appraise international parity conditions in the proposed West African monetary union herein tagged as 'Ecozone' with specific focus on purchasing power parity (PPP), international Fisher Effect (IFE) and uncovered interest parity (UIP). The examination of simultaneous validity of these postulations and theories in the cases of the fifteen West African countries were performed through the investigation of directions of

bilateral relationship of the countries of the Ecozone in which these countries at one point or the other, serve as ‘domestic country/currency’ against respective ‘foreign country/currency’. There were 105 bilateral relationship across the 15-member Ecozone. Monthly, quarterly and annual data spanning averagely over a period of 28 years between 1990 and 2017 were employed in this study. Residual-based cointegration test methods of Engle-Granger, Philip-Ouliaris and Park’s Added Variable and the Johansen cointegration tests were applied in evaluating these parity conditions. Statistical evaluation of correlation was employed as appropriate in situation where cointegration deemed inappropriate. Results generated by various empirical estimations generally revealed that the international parity theoretical propositions of absolute PPP, relative PPP, international Fisher Effects and the uncovered interest parity are hugely not valid across the proposed Ecozone. These connote lack of appreciable financial integration across the proposed Ecozone. However, the cointegration of real exchange rate, based on the possible anchor country for the proposed monetary union, Nigeria, holds. This has positive implications for the proposed monetary integration of the West African continent as there are evidences to conclude that there are long run association and co-movements of these real exchange rates which more importantly have bearings and relationships with the lead economy in the region. One crucial implications of the failure of the validity of PPP to hold across the proposed Ecozone is that monetary models of exchange rate determination (flexible price monetary model, sticky price monetary model and real interest rate differentials monetary model) will be inappropriate for the proposed monetary union because purchasing power parity is a crucial building block of these monetary models of exchange rate determination.

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## Appendix 1

### Interpretations of the Abbreviations of the Ecozone Countries

	<i>Abbreviation</i>	<i>Full Names of Member Countries</i>
1	BN	Benin
2	BU	Burkina Faso
3	CP	Cape Verde
4	IV	Cote D'Ivoire (Ivory Coast)
5	GM	The Gambia
6	GH	Ghana
7	GU	Guinea
8	GB	Guinea Bissau
9	LB	Liberia
10	ML	Mali
11	NR	Niger
12	NG	Nigeria
13	SN	Senegal
14	SL	Sierra Leone
15	TG	Togo