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Validity of International Fisher Effect in the West African Monetary Zone

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This paper investigates the validity of the International Fisher Effect in the West African Monetary Zone (WAMZ). The conventional Engle-Granger and fractional cointegration tests were employed on nominal exchange differentials and exchange rates change of all the countries within the WAMZ except Liberia due to lack of data. We observed cointegrating relationship in fifteen out of the twenty country pairs; indicating evidence of common stochastic drift in nominal exchange differentials and exchange rates change.

However, the assumptions necessary for the validity of very weak International Fisher Effect were met for only between Ghana and Cape Verde and between Ghana and Sierra Leone at five percent significance level; an evidence of lack of macroeconomic coordination. It is important to note that macroeconomic coordination is necessary condition for currency union and seen as alternative to member countries meeting the convergence criterion. These findings are seen as setback to the common currency agenda of WAMZ because the findings signify lack of macroeconomic coordination among would-be currency union countries, which is a necessary condition for conduct of monetary policy.

Keywords: International Fisher Effect, West African Monetary Zone, Fractional Integration

JEL Classification: G15, E40, E43, C22

Introduction

An understanding of the relationship between exchange rates, interest rates, and other macroeconomic variables such as inflation rates is very important to the monetary authorities and central banks. This is because

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central banks dwell on coordination of these indicators to formulate monetary policy and management of foreign exchange. The movements in these variables are also critical to the activities of investors, arbitrageurs, speculators and other stakeholders in the international money market.

The International Fisher Effect (IFE) posits that the difference in interest rates between countries predicts the expected exchange rates between their currencies. In other words, differences in nominal interest rates between two countries for example should be proportional to an appreciation or depreciation in value of the respective currencies of these two countries. The IFE theory suggests that at any point in time, a country with relatively higher nominal interest rates should experience depreciation in value of its currency because high nominal interest rates reflect high expected inflation. This ensures that no investor in either country is better off with the same level of investment. In principle, if IFE holds, then an investor in a country with relatively higher nominal interest rate, although will benefit from the higher returns on his investment, should experience a reduction in the overall value of his investment and vice versa. In brief, the theory asserts that the higher interest rate country's currency is expected to depreciate until the real returns of investments are equalized across countries. The implication is that an uncovered interest arbitrage would be a profitless transaction.

With the proposed formation of West Africa Monetary Zone (WAMZ), it has become imperative to examine the validity of IFE. According to Arghyrou, Gregoriou and Kontonikas (2009), the validity of IFE implies the equality of real interest rate, which is necessary for effectiveness of monetary and fiscal policy. This paper contributes to macroeconomic convergence in the WAMZ by investigating the validity of IFE, which is missing in WAMZ macroeconomic convergence literature.

The findings revealed that nominal exchange differentials and exchange rates change of fifteen out of the twenty country pairs cointegrate. We however observed validity of very weak IFE for only between Ghana and Cape Verde and between Ghana and Sierra Leone at five percent significance level.

In the next section, background of the WAMZ is reviewed together with recent developments. Section 3 presents related studies and empirical

evidence on the validity of the international fisher effect. The final section explores the IFE in the WAMZ and conclusions drawn thereof.

The West African Monetary Zone

Over the last forty years, most economies in Sub-Saharan Africa have been characterised by exchange rate instability, financial fragility and high inflation. This was due to fixed exchange rates that were in operation almost across the globe, with occasional adjustments made by respective monetary authorities. The consequence of the fixed exchange rate regime was severe terms of trade shocks, particularly to primary commodity exporting African countries, which also resulted in over-valued exchange rate (Alagidede Tweneboah & Adam, 2008; Badiane & Makombe, 2014).

Although, contemporary look at the continent's growth performance leads to the conclusion that Africa is at a historical crossroads, which could lead to convergence with emerging markets, and ultimately with advanced economies (Sy, 2016) as against earlier view diverging from rather than converging on the industrialized world (Easterly & Levine, 1997; World Bank, 2003), the catching-up seems slower than expected. Pervasive corruption and implementation of inappropriate policies enhanced the development of parallel market for foreign exchange and other goods, speculative activities in agricultural trade, and smuggling of essential goods to neighbouring African countries (Kargbo, 2003; Collier, & Dercon, 2013). The elimination of national currencies and their replacement by a common regional currency continues to be a topical subject. The reasons for doing so range from the quest to promote regional solidarity and integration, and that independent national currencies may be subject to destabilizing speculation.

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Under the auspices of ECOWAS, the heads of states of member countries adopted the ECOWAS monetary cooperation programme in 1987 to accelerate the process of integration within the sub region.

This programme entails the adoption of collective policies designed to achieve a harmonised monetary system. A single monetary zone was envisioned by member states by 2003, under which members will have to meet convergence criteria which include the following:

a. A ceiling on central bank financing of budget deficits of 10% of the previous year's tax revenue
b. The maintenance of single digit inflation for all countries
c. Restriction of the budget deficit to no more than 4% of GDP, and thereafter to 3%
d. Countries with floating exchange rates were to reduce variability of nominal exchange rates to less than 10% and thereafter to 5%

However, participating countries have failed to meet these criteria necessary to sustain the monetary union. As a result of the inability to meet these criteria, a second monetary zone made up of fewer countries was agreed to facilitate the whole process of integration. The West African Monetary Zone (WAMZ) was created in April 2000 with the signature of the Accra Declaration by the leaders of Gambia, Ghana, Guinea, Liberia, Nigeria and Sierra Leone. The objective of the West African Monetary Zone is to establish a monetary union characterized by a common central bank that will ensure the implementation of common monetary and exchange rate policies. The setting up of WAMZ has been motivated by the need to ultimately merge the two regional bodies: : L'Union Economiqueet Monetaire Ouest Africaine (UEMOA) and WAMZ; which will eventually lead to the adoption of a common ECOWAS currency (Balogun, 2008).

Similarly, WAMZ set out ten convergence criteria made up of four primary and six secondary criteria. The primary criteria are deeming to be the necessary condition for the introduction of the common currency. The four Primary Criteria to be achieved by each member country are:

a. A single-digit inflation rate at the end of each year
b. A fiscal deficit of no more than 4% of the GDP
c. A central bank deficit-financing of no more than 10% of the previous year's tax revenues
d. Gross external reserves that can give import cover for a minimum of three months.

The six Secondary Criteria to be achieved by each member country are:

a. Prohibition of new domestic default payments and liquidation of existing ones.
b. Tax revenue should be equal to or greater than 20 percent of the GDP.
c. Wage bill to tax revenue equal to or less than 35 percent.
d. Public investment to tax revenue equal to or greater than 20 percent.
e. A stable real exchange rate.
f. A positive real interest rate.

The WAMZ countries were due to reach the final convergent point before the year 2015 and issue a common currency to be called the *ECO*. This target was missed and now no more but single ECOWAS currency in 2020. The processes leading to this goal are already in motion. The challenge is the collective attainment of the primary convergence. This is evident from the status of compliance with primary convergence criteria from 2001-20012 presented in Table 1. The launching of monetary union in WAMZ has been postponed thrice following the poor performance in achieving the convergence criteria (Oshikoya & Tarawalie, 2010).

Table 1: Status of compliance with each Primary convergence criteria

Country Performance on the Primary Criteria- Dec 2001 - 2012							Status of compliance with each Primary convergence criteria by all countries-Dec 2001-2012			
	Gambia	Ghana	Guinea	Liberia	Nigeria	Sierra Leone	Inflation	Budget deficit	Central Bank financing of budget deficits	Gross External Reserves/Import Cover
2001	2	1	3	n.a	3	2	**3**	1	4	3
2002	1	0	2	n.a	3	2	**2**	1	2	3
2003	1	2	0	n.a	2	0	**0**	1	1	3
2004	3	1	0	n.a	3	2	**1**	1	3	4
2005	3	2	2	n.a	3	2	**1**	2	5	4
2006	4	2	1	n.a	4	2	**3**	3	3	4
2007	4	2	2	1	4	2	**2**	3	6	4
2008	4	0	1	3	3	2	**2**	4	4	3
2009	3	2	1	4	3	1	**3**	2	4	5
2010	2	3	0	4	2	1	**3**	0	3	5
2011	3	4	2	3	3	1	**2**	3	6	5
2012	3	3	2	3	3	2	**3**	2	6	5

Source: West Africa Monetary Institute, 2013

Note: The left panel of Table 1 presents the number primary convergence criterial satistfied by each member country from 2001 to 2012 and the right panel reports number of countries satisfying each criteria relating to the four basic criteria from 2001 to 2012.

Literature Review

IFE is one of the five interest rates parity conditions that results from arbitrage activities apart from the purchasing power parity, Fisher effect, interest rate parity, and the Expectations theory. The international fisher effect is the combination of the theory of purchasing power parity and the generalized Fisher effect (Sundqvist, 2002). It is therefore noteworthy to present a brief discussion of the fisher effect and the purchasing power parity and eventually establishing the connection between the IFE and these two theories.

The Fisher Effect

The Fisher hypothesis, initiated by Fisher (1930), suggests that there is a positive correlation between nominal interest rates and expected inflation. This was made on the basis that a permanent change in inflation rate will cause an equal change in the nominal interest rate, implying that real interest rates are constant and unaffected by monetary measures. The Fisher effect can be defined as a one-to-one relationship between nominal interest rates and expected inflation, leaving real interest rates independent of the inflation rate (Ray, 2012). Evidence of the Fisher hypothesis has been tested using the basic version of the equation below:

$$r_t = a + \beta n_t \qquad (1)$$

Since the hypothesis predicts a one to one relationship, β is expected to be equal to one (1), and $a$equal to zero, in order to conclude for a strong Fisher effect. If βis positive but not equal to one, then there is evidence of the weaker form of the Fisher effect. Bajo-Rubio et al (2003) reports the contributions made by Moazzami (1991), Mishkin (1992), Peláez (1995) , Crowder (1997) , Bajo-Rubio and Esteve (1998), or Koustas and Serletis (1999) in establishing some empirical evidence, following the early work of Rose (1988).

According to Westerlund (2008) in spite of the recent advances in econometric methodology for testing long-run relationships using co-integration techniques coupled with the wide acceptance of the Fisher effect in theory, the hypothesized long-run one-for-one relationship between inflation and nominal interest rates has proven very difficult to

establish empirically. Several empirical analyses have been done and various models have been proposed and tested (using data from both developed and developing countries) for the Fisher effect.

The Purchasing Power Parity (PPP)

The purchasing power parity states that the spot exchange rates between currencies will change the inflation rates between domestic and foreign countries. The basic concept underlying this theory is the law of one price. Thus, in effect the position of the PPP is that forces of arbitrage will result in the equalisation of prices of goods measured in the same currency. Purchasing power parity comes in two versions: the absolute version and the relative version. Alessandria and Kaboski (2004) states that, although Absolute purchasing power parity (PPP) is best known, it is one of the most easily rejected ideas in economics. Among the reasons include: transport cost, non-tradable goods, imperfect information and the substantial differences in the general price levels across countries so that the same basket of goods sells for a different price depending on the country in which it is sold. Price levels are strongly positively correlated with real per capita GDP, so that consumers in low-income countries pay considerably less for the same basket of goods than consumers in high-income countries. Nonetheless, it is argued that the weaker form of PPP, which is the relative PPP is expected to hold even in the presence of these distortions (Pilbeam, 2006). Thus in simple terms, the relative version of the PPP states that exchange rate between two countries will adjust by the inflation differential. Algebraically this relationship is expressed as:

$$\%\Delta S = \%\Delta P_h - \%\Delta P_f \quad (2)$$

$$\frac{S_{t+1} - S_t}{S_t} = \%\Delta P_h - \%\Delta P_f \quad (3)$$

Where $\%\Delta S$, is the percentage change in the spot rate between the two countries, $\%\Delta P_h$ is the domestic inflation rate and $\%\Delta P_f$ is the foreign inflation rate. In sum, according to Pilbeam (2006), PPP performed better for countries that are geographically close to one another and where trade linkages are high, that is, less trade restrictions and minimal transport cost. Thus, the PPP reported minimal deviations among between countries like France and Germany, Italy and Germany and

between the UK and Germany. However, the overall evidence on the PPP hypothesis was not impressive, Deviations of the PPP from some exchange rates was substantial and persistent. A number of factors have been identified to explaining the poor performance of the PPP hypothesis. Among them as noted earlier are transport cost, impediments to trade and imperfect competition. Others are statistical problems, differences in the level of productivity (Balassa, 1964; Samuelson,, 1964); and capital and goods market.

The International Fisher Effect

The brief review of the fisher effect and the purchasing power parity reveals a link between the Fisher effect, the PPP and the IFE. Whiles the fisher effect looks at the relationship between interest rates and inflation, PPP establishes a relationship between inflation rate differentials and exchange rates. The IFE then comes in to link exchange rates to interest rates. The simplified equation of the international fisher effect is given as:

$$S_e = S_o \times \left[\frac{1+Rh}{1+Rf}\right]. \quad (4)$$

Where "*Rh*" is interest rates in home country, "*Rf*" is interest rates in foreign country, "*Se*" is the future spot rate whiles "*So*" is the spot rate.
When the IFE holds, the currency with the lower interest rate is expected to appreciate relative to the currency in the higher interest rate. However, it does not mean that the interest rates differential is an accurate predictor of the spot rate. This condition means that over time the prediction errors will cancel out. The real rates of interest of the international fisher effect should lean toward equilibrium because of arbitrage (Shapiro &Atulya 2009).

Based on this hypothesis put forward by IFE, does available evidence present results that are consistent with the theory? In their study, Aliber and Stickney's(1975) found that the international Fisher effect to hold, in the long term, in study of seven industrialised countries(Belgium, Canada, France, West Germany, Netherlands, Switzerland and the United Kingdom) and six Latin American countries (Argentina, Brazil, Chile, Colombia, Mexico and Venezuela) for the period 1966 to 1971.

Empirical test of the IFE was carried out in the United States by Carmichael and Stebbing (1983). With a sample of 3-month T-bill rates between first quarter of 1953 to fourth quarter of 1978, they found evidence in support of the international fisher hypothesis. In another study by the same authors, this time with a sample of 5-year industrial debenture yield between 1963 to 1981 in Australia, evidence was found in support of the hypothesis. Moazzammi (1991), used the same sample of data employed by Carmichael and Stebbing (1983), examined the presence of a long-run relationship between nominal interest rates, real interest rates and the inflation rate. Moazzammi found that the data used by Carmichael and Stebbing supports the presence of a long-run relationship between the nominal interest rate (before and after tax) and the inflation rate as suggested by the Fisher Hypothesis. However, by using error correction modelling approach that distinguishes the long-run coefficients from the coefficients that are short-run in nature, found no evidence in support of IFE both in the US and Australia. The differences in results are clearly as a result of the different statistical methods used over the same sample.

A test of the IFE theory was conducted by Thomas (1985). He examined results of purchasing future contracts of currencies with higher interest rate that contained discounts (relative to the spot rate) and selling futures on currencies with low interest rate that contained premiums. As indicated earlier, If the IFE theory holds, currencies with high interest rate should depreciate while the low interest rate currencies should appreciate, therefore yielding insignificant profits by the transactions. However, Thomas found that 57 percent of the transactions created by this strategy were profitable. The average gain was higher than the average loss.

Woodward (1992) examined yields of index bonds over the period 1982 to 1990 and found no evidence to support the IFH in Britain. Similarly, Choudhry (1997) found no evidence in support of the IFH in both Belgium and France, whiles little evidence was found in Germany over the period 1955 to 1994.

A study by Shalishali and Ho (2002) examined the IFE in 8 industralised countries: Canada, France, Germany, Japan, Netherlands, Sweden, Switzerland and UK by using quarterly data covering the period between 1972 and 1996. Employing OLS regression, they concluded

that while the theory holds for some countries, it does not hold for others, nevertheless, in most cases the theory holds except for a few instances. Their study also revealed that while the IFH holds between two countries, when these same countries are interchanged as home and foreign country, different results is obtained. They attributed this to trade restrictions between countries. Crowder (2003) uses data on short-term nominal interest rates and inflation rates collected from eight industrialized nations between January 1960 to August 1993. The results indicate that the Fisher relation has a great deal of support with all eight countries exhibiting cointegration between nominal rates and inflation.

Review of related studies also present some mixed results. Ersan (2008) tested the presence of IFE by examining the effect of interest rate differences on the behaviour of exchange rates among group of five countries: Turkey and the G-5 countries of United States, United Kingdom, Japan, France and Germany. Although He found evidence in support of the IFH for all pairs of countries, the magnitude of the effect is found to be lower than expected which indicates that there might be other factors in economy, such as inflation rates, that affect the exchange rate movements.

Utami and Inanga (2009) applied a test of the IFE to four countries: USA, Japan, Singapore, and the UK, using Indonesia as the "home country". Data involved yearly interest rates and interbank offer rates between 2003 and 2008. Regression results showed that interest rate differentials had positive but no significant effect on changes in exchange rate for the USA, Singapore, and the UK relative to that of Indonesia. On the other hand, interest rate differentials had negative significant effect on changes in exchange rates for Japan.

A study by Shalishali (2012) applied regression analysis to historical exchange rates and interest rate differentials for eight selected countries in Asia. Each of the country was used both as a home country and a foreign country. While the IFE theory holds for some of the countries, it was rejected in others. It was realised that the IFE was not supported when some countries used as home countries were interchanged to foreign countries. He suggested that the different results may be as a result of some impediments to trade that may hinder adjustment of exchange rates between countries. This is supported by Shalishali and

Ho (2002), who also found similar results when countries were interchanged.

Finally, Ray (2012) also examined the existence of IFE between USA and some selected Asian countries: India, Korea and Japan. Interestingly the findings of Ray support that of Shalishali (2012). Interest rate differentials were regressed on inflation rates between the first quarter of 2001 to second quarter of 2012. Existence of partial Fisher effect was found in the USA, whiles none was evidenced in India, Korea and Japan. Similar to the findings of Shalishali (2012), when each country is treated interchangeably as home country and foreign country to demonstrate the direction of International fisher Effect, mixed results were obtained. The theory holds when some countries were used as home country but was refuted when they were used as foreign countries. Ray found that when USA is treated as foreign country, the theory holds between all Japan-USA, Korea-USA and India-USA.

Methodology and Data Collection

The IFE postulates that $\frac{S_{t+1}-S_t}{S_t}=\frac{i_D-i_f}{1+i_f}$, where S_t and S_{t+1} are the exchange rate of domestic currency per unit of foreign currency at time t and $t+1$ respectively. i_D and i_f are nominal interest rates of domestic country and foreign countries respectively.

To test for IFE, the relative change in exchange rate is regressed against nominal interest rate differential among the selected country pairs, mathematical, we write

$$e_t=\alpha+\delta\lambda_t+\varepsilon_t \qquad (5)$$

where $e=\frac{S_{t+1}-S_t}{S_t}$, $\lambda=\frac{i_D-i_f}{1+i_f}$ and ε is the error term.

The necessary condition for IFE to hold is the existence of cointegration between e and λ, that is, if $Y_t=\left[e_t\lambda_t\right]'$, then the long-run IFE restriction on Y_t is that $\beta'Y_t=e_t-\lambda_t$, ε_t, is stationary, $I(0)$. In addition, we except the cointegration vector to be close to one for full

International Fisher effect, thus $\beta = \begin{bmatrix} 1 & -1 \end{bmatrix}$ and $\alpha = 0$. If δ is significantly different from zero but less than one and $\alpha = 0$, we have partial IFE. The latter conditions are the sufficient conditions.

According to Barkoulas, Baum, and Oguz (1999), the conventional way of testing cointegration among variables which only allow for an integer order of integration in the equilibrium error process is restrictive and ad hoc assumption.Thisis because a fractionally integrated error correction term is mean-reverting and covariance non-stationary though not exactly as I(0) which is mean reverting and covariance stationary , therefore, in spite of its significant persistence in the short run, the effect of a shock to the system eventually dissipates, so that an equilibrium relationship among the system's variables prevails in the long run. On this basis, we employ fractional cointegration which relaxes this rigid limitation by allowing a fractional differencing parameter, d. In this case, we are able to distinguish between the cases where the equilibrium errors are really non-mean reverting and where they are actually mean reverting but exhibiting significant persistence in short run. The value of *d* is estimated for the equilibrium error from a cointegrating regression and the null hypothesis *d* =1 tested against the alternative *d* <1.

Following Granger and Joyeux (1980); Hosking (1981); Joyeux (2010). Coleman and Sirichand (2011) equation (1) is can be modeled as a fractionally cointegrated,
I(*d*), process

$$(1-L)^{d}(\varepsilon_t - \mu) = z_t \qquad (6)$$

where L is the lag operator, d is fractional difference parameter, μ is the unconditional mean of ε_t, and z_t is stationary with zero mean and finite variance. A flexible parametric process of order (p,d,q) called the ARFIMA (p,d,q) model incorporates both long-term and short-term memory.

$$\Theta(L)(1-L)^{d}(\varepsilon_t - \mu) = \Psi(L)z_t \qquad (7)$$

where $\Theta(L)$ and $\Psi(L)$ are autoregressive and moving average polynomials, respectively, with rootsthat lie outside the unit circle and z_t is Gaussian white noise. ε_t is mean reverting provided $d \in \left[-0.5 \;\; 1 \right)$ and fractional cointegration is established. The process of establishing fractional cointegration analysis involves two steps. First, the IFE equation (1)is estimated with ordinary least squares; then the residual series, ε_t, is used to estimate the differencing parameter, d .To estimate d and perform hypothesis testing, a semi-parametric procedure suggested by Geweke and Porter-Hudak (1983)is employed[3].

Data

The data for this study is monthly cross exchange rate and nominal interest rate time series data from 1998M02 to 2012M08 for Cape Verde, the Gambia, Ghana, Nigeria and Sierra Leone. Liberia and Guinea are members of WAMZ but excluded from this study due to the non-availability of the required data. The nominal interest is measured by Treasury bill (T-bill) rate. The exchange rates and nominal interest rate were extracted International Monetary Fund- International Financial Statistics (IFS) database.

Cointegration Test

To test whether relative change in exchange and nominal interest rate differential among the selected country pairs are cointegrated, we first test for the existence of unit roots in the stochastic process generating these series. We employed ADF-GLS and ADF to test for unit root and KPSS for stationarity. The ADF-GLS is a variant of ADF proposed by Elliott, Rothenberg and Stock (1996), which is more efficient than the usual ADF in handling the parameters pertaining to the deterministic term. The results showed that all the derived variable e and λ are of $I(1)$ and non-stationary. The unit root results are not report for want of space but available upon request.

[3] See Barkoulas, Baum, and Oguz (1999) for details of the spectra regression of GPH

We proceed to test for presence of cointegration between paired countries using both conventional cointegration test by employing Engle-Granger two-step test (ADF test) and Fractional cointegration using GPH test to estimate the d parameter. The results are presented in columns 3 and 4 of Table 1. The results from the conventional cointegration test show that the relative change in exchange rate and nominal interest rate differential of the country pairs are cointegrated (for every X/Y, X is the domestic country and Y, the foreign country) except Cape Verde/Gambia, Cape Verde/Ghana, Cape Verde/Sierra Leone, Gambia/Cape Verde, Gambia/Sierra Leone, Ghana/Cape Verde and Nigeria/Cape Verde. In general, the conventional cointegration (Engle-Granger) rejected seven out of the twenty pair-wise country combinations. As indicated, the conventional cointegration is restrictive and therefore fraction cointegration is conducted on all the country pairs and reported in column three of Table 1. The results identified two additional country pairs, Cape Verde/Ghana and Ghana/Cape Verde, to be cointegrated. The results show that the relative change in exchange rate and nominal interest rate differential of the country pairs of all the WAMZ countries considered in this study have common stochastic drift except Cape Verde/Gambia, Cape Verde/Sierra Leone, Gambia/Cape Verde, Gambia/Sierra Leone and Nigeria/Cape Verde. The Cape Verde departure from most of the WAMZ countries is not surprising since it is of observer status and its currency is pegged against the Euro.

Table 2: Pair wise International Fisher Effect Test-Fractional and Engle-Granger Cointegration

Domestic	Foreign	Fractional Cointegration	Engle - Granger	The OLS regression estimates of Equation (1) for paired Countries	
		GPH Test	ADF	α	δ
Cape Verde	Gambia	0.27 [0.10]	-2.881	0.00[0.51]	0.05[0.03]
Cape Verde	Ghana	0.42**[0.03]	-2.72	-0.00[0.58]	0.06[0.01]
Cape Verde	Nigeria	-0.07[0.67]	-3.08**	-0.01[0.02]	0.02[0.55]
Cape Verde	Sierra Leone	0.12[0.61]	-2.59	0.01[0.26]	0.11[0.11]
Gambia	Cape Verde	0.16[0.52]	-2.09	0.00[0.61]	0.04[0.01]
Gambia	Ghana	-0.13**[0.04]	-3.32**	-0.01[0.00]	0.03[0.02]
Gambia	Nigeria	-0.26**[0.01]	-6.32***	-0.00[0.01]	-0.00[0.87]
Gambia	Sierra Leone	0.02[0.91]	-2.78	0.00[0.61]	0.02[0.21]
Ghana	Cape Verde	-0.27**[0.01]	-2.77	0.00[0.35]	0.05[0.01]
Ghana	Gambia	-0.25**[0.02]	-3.51**	0.01[0.00]	0.03[0.01]
Ghana	Nigeria	-0.36***[0.00]	-4.22***	-0.00[0.74]	0.05[0.07]
Ghana	Sierra Leone	-0.22**[0.04]	-3.64***	0.01[0.15]	0.09[0.01]
Nigeria	Cape Verde	0.17[0.30]	-2.81	0.01[0.01]	0.02[0.51]
Nigeria	Gambia	-0.07[0.70]	-4.65***	0.00[0.01]	-0.00[0.95]
Nigeria	Ghana	-0.24**[0.02]	-3.17**	0.00[0.40]	0.01[0.77]
Nigeria	Sierra Leone	0.02[0.92]	-3.41**	0.02[0.01]	0.16[0.02]
Sierra Leone	Cape Verde	-0.26**[0.04]	-3.66***	-0.01[0.33]	0.10[0.08]
Sierra Leone	Gambia	-0.22[0.12]	-5.46**	-0.00[0.86]	0.09[0.09]
Sierra Leone	Ghana	-0.40***[0.00]	-7.37***	-0.00[0.31]	0.09[0.03]
Sierra Leone	Nigeria	-0.28**[0.02]	-5.12***	-0.01[0.03]	0.15[0.01]

Note: ** indicate s significance at 5% level and *** indicates significance at 1%

As the IFE postulates, we expect our long-run vector to be close to one for full International Fisher effect, thus $\beta = \begin{bmatrix} 1 & -1 \end{bmatrix}$ and $\alpha = 0$. If δ is

significantly different from zero but less than one and $\alpha = 0$, we have partial IFE. The OLS estimates recorded in column 5 and 6 of Table 1 show that full international fisher effect does not hold in any of the country pairs; however, there are identified cases where partial IFE holds. Four cases of partial IFE were identified at 5% significance level: Cape Verde/Ghana, Ghana/Cape Verde, Ghana/Sierra Leone and Sierra Leone/Ghana. We further observed that the IFE holds for country pairs; Ghana/Nigeria, and Sierra Leone/Cape Verde at 10% significant. The evidence from the literature shows that full international fisher effect is not empirically supported and therefore partial IFE is not surprising (Ray, 2012; Hatemi-J and Irandoust, 2008).Though the δ is significantly different from zero, the magnitude of δ ranges from 0.05-0.10 which are far below the expected value of $\delta = 1$ making it "weak partial IFE". The implication is that there is little evidence of the validity of international fisher effect in the WAMZ and that nominal interest rate differentials do not largely offset exchange rate changes. An indication of lack of macroeconomic coordination necessary for smooth take-off of the currency union, which fit well in the literature on macroeconomic coordination for WAMZ, see example, Adam et. al (2010) and Alagidede et. al (2008).

Conclusion

This paper examines the validity of IFE in the West African Monetary Zone by applying conventional cointegration and fractional cointegration techniques.The results suggest that fifteen out of the twenty country pairs have their relative changes in exchange rate and nominal interest rate differentials cointegrated as indicated by both conventional and fractional cointegration. Therefore, there is a stable long-run relationship between relative changes in exchange rate and nominal interest rate differentials in the WAMZ.

However, the assumptions necessary for the validity of weak IFE were met for only between Ghana and Cape Verde and between Ghana and Sierra Leone at 5% significance level. The implications are that nominal interest rate differentials do not offset exchange rate changes in WAMZ, which is important for smooth function of currency union. The IFE theorem posit that real interest rates must be same among the countries

and there must be an existence of integrated capital markets. That is, high level of capital mobility or capital flow freely across borders. The inability of West Africa countries to activate the existing protocols under ECOWAS Trade Liberalisation Scheme (ETLS), occasional political instability and homogenous nature of their economic structures hinder integration of WAMZ countries and thereby, the insufficient empirical evidence to indicates that IFE hold among WAMZ countries.

These findings are seen as setback to the common currency agenda of WAMZ. Macroeconomic coordination among would-be currency union countries is a necessary condition for the conduct of monetary policy. The evidence of lack of exchange rate coordination partly confirms non-readiness of WAMZ for smooth and sustained take-off of the common currency. Thus, postponement of take-off again from 2015 to 2020 was prudent. To avert future postponement, policies aimed at removing nuisance restrictions should be pursued by WAMZ. In addition, treaties and protocols contained in ECOWAS ETLS should be activated.

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