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Full Length Article

Testing for spillovers in *naira* exchange rates: The role of electioneering & global financial crisis

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Abstract

This study offers a new dimension to the analysis of spillover transmission in foreign exchange markets by accounting for the role of electioneering in addition to the global financial crisis. It does so by using Nigeria as a case study whose electioneering activities seem to be characterized by "money bags" with attendant effects on the behaviour of its domestic currency (*naira*). Thus, the study tests for spillover transmission among Nigeria's six most traded currencies namely the US Dollar, Euro, Pound Sterling, Yen, Swiss Franc and the West African Unit of Account (WAUA). Using the Diebold and Yilmaz (DY) (2009, 2012) approach, the results show that electioneering process in Nigeria appears to have greater spillover effects on the *naira* than the global financial crisis and this finding is robust to alternative measures of exchange rates. Some implications of the findings to investors and policy makers are documented.

JEL Classification: C32; D72; F31; F47

Keywords: Naira exchange rates; Spillover analysis; Electioneering; Global financial crisis

1. Introduction

The need to capture possible dynamics of *naira* exchange rate has become imperative owing to the recent sustained depreciation of the currency relative to major foreign currencies like US dollar, Euro, Pound sterling, and Swiss Franc, among others. This need is more pressing than envisaged on account of the implications of *naira* depreciation to an economy that is largely import dependent and oil-based. In any case, both the investors and policy makers are apprehensive when exchange rates are confronted with high risks and uncertainties. For instance, profit maximizing investors such as the portfolio investors are concerned about the risk associated with exchange rate volatility while the policy makers are deeply concerned about the multiplier effects of the volatility on the macro-economy ranging from price, trade, to investment and consumption. Thus, when exchange rate exhibits persistent volatility, the implications on the macro-economy are quite grievous. There is preponderance of empirical researches that have concluded that financial markets in developing countries are poorly developed and largely inefficient. However, the swooping consequences of the recent global financial crisis in 2007–2009 on financial markets in Africa (Collins & Biekpe, 2004) have renewed the interest to ascertain how well financial markets in developing economies are integrated to the global financial markets. After all, spillovers have been considered as a vital precondition to financial integration (McMillan & Speight, 2010).

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Motivated by these considerations, this study seeks to test for spillovers of Nigerian *naira* exchanges of the US dollar, the British Pound Sterling, the European Euro, the Swiss Franc, the Chinese Waua and the Japanese Yen. These are the most traded currencies in Nigeria. Particularly, the study considers different episodes using periods of election and global financial crises as the bases for the subsamples. Nigeria is a developing economy that appears to have witnessed untoward behaviour in its financial structure given these two factors. Firstly, the economy is increasingly becoming integrated into the global financial market (see Collins & Biekpe, 2004) and, through contagion effects, is bound to react to global financial behaviour. Secondly, the economic dimension of the Nigerian nation relies largely on its political 'barometer'. This makes electioneering processes to substantially affect the direction of foreign exchange behaviour where noise feeds into the rate at which the domestic currency is exchanged for some international referenced currencies. More so, the "money bag" electioneering process in the country begets some irrational behaviour which tends to introduce internal shocks into the economy with attendant implications on macroeconomic fundamentals; including the exchange rate. Also, portfolio investors seeking to maximize their returns are usually sceptical about successful transitions from one civilian rule to another due to the high risks and uncertainties that usually characterize a nascent democratic process like that of Nigeria. Thus, more insightful findings are discernible from using the subsamples determined by the electioneering period and global financial crisis. Above all, we also document the analytical procedures for the implementation of all the techniques used in the paper for spillover analysis. We do hope this will facilitate the application of these techniques in future research.[1]

Basically, the analysis of spillovers in the FX market have largely used the novel approaches developed by Diebold and Yilmaz (DY) (2009, 2012) while some other studies have extended the DY (2012) methods. In fact, DY (2014) have revised the early methods to incorporate some of the concerns raised by later researches but an extension of this model has only been applied to the stock markets (see Nishimura & Sun, 2018). However, a large retinue of studies still find the autoregressive approaches embedded in the GARCH family of methods (including its various extensions) desirable for investigating volatility spillovers (see for example, Lahaye & Neely, 2016; Inagaki, 2007; Speight & McMillan, 2001; Antonakakis, 2008; Raputsoane, 2008). While these newest development in the methods have been accommodated already in the literature, the Diebold and Yilmaz (2009, 2012) approaches are still desirable in testing for spillover effects in some respects, which form the basic additions of this study to the literature. First, the rapid transition to other approaches will be less circumspect. This is because the full appreciation of economic implications of empirical investigations will become completely lost to methodological elegance. It is in furtherance of this that this study employs the Diebold and Yilmaz (2009, 2012) approaches to evaluate spillovers for identical foreign exchange assets of different foreign currencies in emerging markets such as Nigeria. This study is the first in this regard, to the best of our knowledge. Secondly, this study accounts for how the global crisis has altered the degree of spillover within and among the foreign exchange markets. Studies that have investigated the role of global crisis were particular about how it affects the efficiency or otherwise of the foreign exchange markets. Prominent in this regard are the studies investigated by Speight and McMillan (2001) and Al-Khazali, Pyun, and Kim (2012).

Thirdly, this paper will be the first, to the best of our knowledge, to investigate the influence of political elections on volatility spillovers among foreign exchanges. The study of Nishimura and Sun (2018) conducted a pioneer study on the effects of political elections on spillover effect. The authors developed and applied a volatility spillover index, as an extension of the Diebold and Yilmaz (2014) approach, to investigate the role of the Brexit vote on volatility spillovers. However, the study focused only on the stock markets among five (5) European economies. Without prejudice to providing general inferences to all the financial markets, however, the foreign exchange market is distinct from the stock market in many respects. Majorly, the FOREX market is short-term oriented than the stock market. This suggests that the data generating process (DGP) in the foreign exchange markets has memory horizon that is shorter. Therefore, the application of an approach with a relatively medium-term or long memory horizon will be a misfit. More so, the propagation speed with which the effects of financial crises transmitted to these markets differ. As a result, this peculiarity was rightly captured in the DY (2009, 2012) approaches. It is the collection of these distinctive features that suggests that the blanket generalization might not be valid after-all and that the use of the DY (2009, 2012) approaches would still be appropriate.

The remaining sections of the paper are as follows: Section 2 presents the DY (2009, 2012) methodology and describes the data used for analyses. Section 3 discusses the findings while Section 4 concludes the paper.

2. Methodology and data

The interdependence among the *naira* exchange rates will be measured using the DY (2009, 2012) approaches. The approaches used in the computation of individual spillovers as well as the spillover index[2] are described below. The underlying framework for the spillover analysis is the vector autoregressive (VAR) model which allows for forecast error variance decompositions. The novelty of this approach however lies in its ability to compute spillover index which is a scalar value. This spillover index shows the intensity of interdependence of time

[1] See Appendix 1 in the supplementary material (available online only) for a brief review of the literature.

[2] Details of these approaches can be obtained from the original papers of Diebold and Yilmaz (2009, 2012), in order to conserve space, only the important features are highlighted in this paper.

series variables. Thus, a higher spillover index suggests a higher degree of intensity implying that unanticipated movements in one variable are more likely to spill over to other variables under examination. In setting up the spillover index, a two-variable first order stationary VAR is considered:

$$\mathrm{r}_t = \Phi \mathrm{r}_{t-1} + \varepsilon_t \tag{1}$$

where; $\mathrm{r}_t = (r_{1t}, r_{2t})$ and Φ is a 2×2 parameter matrix. The moving average representation can be written as:

$$\mathrm{r}_t = (\mathrm{I} - \Phi L)^{-1} = \Theta(L)\varepsilon_t \tag{2}$$

For convenience, equation (2) is rewritten as:

$$\mathrm{r}_t = \Theta(L)Q_t^{-1}\mathrm{u}_t = \mathrm{A}(L)\mathrm{u}_t \tag{3}$$

As a consequence, $\mathrm{u}_t = Q_t\varepsilon_t$; $E(\mathrm{u}_t\mathrm{u}_t^{'}) = \mathrm{I}$ and Q_t^{-1} is defined as the unique lower-triangular Cholesky factor of the covariance matrix of ε_t.

Using the Wiener-Kolmogorov linear least-squares forecast, the 1-step-ahead forecast is given as:

$$\mathrm{r}_{t+1,t} = \Phi \mathrm{r}_t \tag{4}$$

With the corresponding 1-step-ahead error vector given as:

$$\mathrm{e}_{t+1.t} = \mathrm{r}_{t+1} - \mathrm{r}_{t+1,t} = \mathrm{A}_0\mathrm{u}_{t+1} = \begin{bmatrix} a_{0,11} & a_{0,12} \\ a_{0,21} & a_{0,22} \end{bmatrix} \begin{bmatrix} u_{1,t+1} \\ u_{2,t+1} \end{bmatrix} \tag{5}$$

Given equation (5) and its covariance matrix defined as $E(e_{t+1.t}e_{t+1.t}^{'}) = \mathrm{A}_0\mathrm{A}_0^{'}$, the spillover index, expressed in percentage, is written as:

$$S = \frac{a_{0,12}^2 + a_{0,21}^2}{\mathrm{trace}\left(\mathrm{A}_0\mathrm{A}_0^{'}\right)} \times 100 \tag{6}$$

Note that the spillover index described in (6) is for a simple first-order two-variable case with 1-step-ahead forecast. For a p^{th}- order N-variable VAR with 1-step-ahead forecast, the spillover index is written as:

$$S = \frac{\sum_{\substack{i,j=1 \\ i \neq j}}^{N} a_{0,ij}^2}{\mathrm{trace}\left(\mathrm{A}_0\mathrm{A}_0^{'}\right)} \times 100 \tag{7}$$

The spillover index for the general case of a p^{th}- order N-variable VAR with H-step-ahead forecast is written as:

$$S = \frac{\sum_{h=0}^{H-1}\sum_{\substack{i,j=1 \\ i \neq j}}^{N} a_{0,ij}^2}{\sum_{h=0}^{H-1} \mathrm{trace}\left(\mathrm{A}_0\mathrm{A}_0^{'}\right)} \times 100 \tag{8}$$

Note that $a_{0,ij}^2$ and $a_{0,ji}^2$ are cross variance shares or spillovers where $i \neq j$ while $a_{0,ii}^2$ and $a_{0,jj}^2$ are own variance shares. Thus, $\sum_{\substack{i,j=1 \\ i \neq j}}^{N} a_{0,ij}^2$ gives the sum of all the spillovers while $\mathrm{trace}\left(\mathrm{A}_0\mathrm{A}_0^{'}\right)$ gives the total forecast error variation.

One of the limitations of the DY (2009) approach is that it is sensitive to VAR ordering. In essence, the spillover index obtained from a particular VAR ordering may change if the variables are reordered. This is due to the Cholesky factorization used by DY (2009) in which the variance decompositions are influenced by the ordering of the variables. This is one of the contributions of DY (2012). Essentially, the latter proposed a modification that is invariant to ordering, among other things. They employed the generalized VAR framework of Koop, Pesaran, and Potter (1996) and Pesaran and Shin (1998) (KPPS hereafter) to produce variance decompositions which are invariant to the ordering. The KPPS H-step-ahead forecast error variance decompositions denoted by θ_{ij}^g is written as:

$$\theta_{ij}^g(H) = \frac{\sigma_{jj}^{-1}\sum_{h=0}^{H-1}\left(e_i^{'}A_h\Sigma e_j\right)^2}{\sum_{h=0}^{H-1}\left(e_i^{'}A_h\Sigma e_i\right)} \tag{9}$$

where; Σ is the variance matrix for the error vector ε, σ_{jj} is the standard deviation of the error term for the jth equation and e_i is the selection vector, with one as the ith element and zeros otherwise. Since the sum of the contributions to the variance of the forecast error is not equal to one – that is $\sum_{j=1}^{N}\theta_{ij}^g(H) \neq 1$; DY (2012) normalized each entry of the variance decomposition matrix by the row sum in order to use the full information of the matrix. The normalized KPPS H-step-ahead forecast error variance decompositions represented by $\tilde{\theta}_{ij}^g(H)$ is expressed as:

$$\tilde{\theta}_{ij}^g(H) = \frac{\theta_{ij}^g(H)}{\sum_{j=1}^{N}\theta_{ij}^g(H)} \tag{10}$$

where; $\sum_{j=1}^{N}\tilde{\theta}_{ij}^g(H) = 1$ and $\sum_{i,j=1}^{N}\tilde{\theta}_{ij}^g(H) = N$ by construction. Given (9) and (10), the total spillover index is written as:

$$S^g(H) = \frac{\sum_{\substack{i,j=1 \\ i \neq j}}^{N}\tilde{\theta}_{ij}^g(H)}{\sum_{i,j=1}^{N}\tilde{\theta}_{ij}^g(H)} \times 100 = \frac{\sum_{\substack{i,j=1 \\ i \neq j}}^{N}\tilde{\theta}_{ij}^g(H)}{N} \times 100 \tag{11}$$

In our analysis, we consider a second order 6-variable VARs with 10-step-ahead forecasts. The results obtained are discussed in the next that follows.[3] Basically, the study employs time series closing exchange rate data set of five-day weekly frequency spanning different time periods for each of these currencies; subject to the available data at the official website of the Central Bank of Nigeria (CBN). Data used ranges between 12/10/2001 and 3/10/2015; spanning 3241 observations for their level series and 3240 for their return series. Only the data for Swiss Franc begins from 7/12/2005, thus, a total number of 2289 observations is available and used for this exchange rate. For the purpose of clarity, an increase in exchange rate here denotes depreciation in ***naira*** relative to these most traded currencies while a decrease implies an appreciation. Even though, we carry out preliminary analyses on both level and return series, empirical analysis is done using the return series to circumvent the problem of non-stationarity usually encountered with the level series (see Escanciano & Lobato, 2009).

[3] The program used to compute the spillovers is available on request.

Table 1
Estimates from spillover tests with the effects of electioneering.

Currency Pairs	FX	NSF	ND	NW	NY	NP	NE	CFO
Panel A: Diebold and Yilmaz (2009) Test								
Naira_Swiss_Franc	NSF	95.9^{f}	0.0^{f}	0.8^{f}	1.6^{f}	0.2^{f}	1.5^{f}	4^{f}
		70.6^{e1}	0.0^{e1}	8.9^{e1}	1.0^{e1}	12.0^{e1}	7.5^{e1}	29^{e1}
		48.4^{e2}	23.1^{e2}	0.9^{e2}	9.1^{e2}	6.0^{e2}	12.5^{e2}	52^{e2}
		60.0^{e3}	4.5^{e3}	3.5^{e3}	16.3^{e3}	12.6^{e3}	3.2^{e3}	40^{e3}
Naira_Dollar	ND	0.1^{f}	94.7^{f}	0.4^{f}	0.2^{f}	0.2^{f}	4.5^{f}	5^{f}
		2.4^{e1}	88.8^{e1}	1.2^{e1}	0.3^{e1}	3.3^{e1}	4.8^{e1}	12^{e1}
		0.9^{e2}	91.1^{e2}	4.9^{e2}	0.1^{e2}	1.1^{e2}	2.0*^{e1}	9^{e2}
		0.3^{e3}	52.5^{e3}	1.7^{e3}	0.7^{e3}	26.0^{e3}	18.7**^{e1}	47^{e3}
Naira_Waua	NW	8.7^{f}	25.4^{f}	40.2^{f}	3.4^{f}	2.5^{f}	19.8^{f}	60^{f}
		37.3^{e1}	2.1^{e1}	41.5^{e1}	7.1^{e1}	3.3^{e1}	8.7^{e1}	59^{e1}
		1.1^{e2}	3.6^{e2}	36.1^{e2}	4.6^{e2}	18.3^{e2}	36.3^{e2}	64^{e2}
		0.5^{e3}	24.3^{e3}	8.6^{e3}	5.8^{e3}	9.3^{e3}	51.4^{e3}	91^{e3}
Naira_Yen	NY	0.1^{f}	4.5^{f}	12.8^{f}	80.5^{f}	0.0^{f}	2.0^{f}	19^{f}
		44.4^{e1}	2.8^{e1}	1.6^{e1}	34.1^{e1}	12.3^{e1}	4.8^{e1}	66^{e1}
		5.7^{e2}	1.4^{e2}	3.0^{e2}	75.8^{e2}	1.8^{e2}	12.4^{e2}	24^{e2}
		2.0^{e3}	1.9^{e3}	0.1^{e3}	95.0^{e3}	0.8^{e3}	0.2^{e3}	5^{e3}
Naira_Pound	NP	1.0^{f}	21.3^{f}	1.5^{f}	2.2^{f}	73.6^{f}	0.4^{f}	26^{f}
		10.5^{e1}	6.4^{e1}	11.6^{e1}	45.0^{e1}	24.1^{e1}	2.3^{e1}	76^{e1}
		5.4^{e2}	8.5^{e2}	2.6^{e2}	0.5^{e2}	50.8^{e2}	32.3^{e2}	49^{e2}
		1.0^{e3}	13.8^{e3}	8.7^{e3}	4.9^{e3}	42.4^{e3}	29.2^{e3}	58^{e3}
Naiara_Euro	NE	14.8^{f}	0.1^{f}	1.1^{f}	0.4^{f}	1.0^{f}	82.5^{f}	17^{f}
		38.9^{e1}	7.6^{e1}	8.9^{e1}	16.9^{e1}	6.9^{e1}	20.9^{e1}	79^{e1}
		0.7^{e2}	21.5^{e2}	4.0^{e2}	4.3^{e2}	0.7^{e2}	68.8^{e2}	31^{e2}
		2.7^{e3}	8.2^{e3}	2.6^{e3}	3.8^{e3}	1.7^{e3}	81.0^{e3}	19^{e3}
Contribution to Others		25^{f}	51^{f}	17^{f}	8^{f}	4^{f}	28^{f}	132^{f}
		134^{e1}	19^{e1}	32^{e1}	70^{e1}	38^{e1}	28^{e1}	321^{e1}
		14^{e2}	58^{e2}	15^{e2}	19^{e2}	28^{e2}	95^{e2}	229^{e2}
		7^{e3}	53^{e3}	17^{e3}	32^{e3}	50^{e3}	103^{e3}	261^{e3}
Contribution including Own		121^{f}	146^{f}	57^{f}	88^{f}	78^{f}	111^{f}	22.1%^{f}
		204^{e1}	107^{e1}	74^{e1}	104^{e1}	62^{e1}	49^{e1}	53.5%^{e1}
		62^{e2}	149^{e2}	51^{e2}	94^{e2}	79^{e2}	164^{e2}	38.2%^{e2}
		66^{e3}	105^{e3}	25^{e3}	127^{e3}	93^{e3}	184^{e3}	43.4%^{e3}
Panel B: Diebold and Yilmaz (2012) Test								
Naira_Swiss_Franc	NSF	91.3^{f}	0.1^{f}	1.1^{f}	1.3^{f}	0.1^{f}	6.1^{f}	9^{f}
		68.7^{e1}	0.4^{e1}	21.4^{e1}	0.5^{e1}	8.4^{e1}	0.5^{e1}	31^{e1}
		39.4^{e2}	19.3^{e2}	0.8^{e2}	12.2^{e2}	9.2^{e2}	19.1^{e2}	61^{e2}
		59.8^{e3}	5.1^{e3}	3.7^{e3}	10.9^{e3}	14.9	5.6^{e3}	40^{e3}
Naira_Dollar	ND	0.1^{f}	91.6^{f}	1.0^{f}	1.1^{f}	0.3^{f}	6.0^{f}	8^{f}
		2.4^{e1}	90.9^{e1}	2.2^{e1}	0.3^{e1}	1.9^{e1}	2.3^{e1}	9^{e1}
		0.9*^{e1}	89.9*^{e1}	5.1^{e2}	1.4^{e2}	0.8^{e2}	1.9^{e2}	10^{e2}
		0.2**^{e1}	42.0**^{e1}	1.8^{e3}	0.8^{e3}	33.8^{e3}	21.4^{e3}	58^{e3}
Naira_Waua	NW	8.0^{f}	24.1^{f}	37.8^{f}	5.9^{f}	2.8^{f}	21.4^{f}	62^{f}
		34.4^{e1}	1.2^{e1}	43.7^{e1}	4.9^{e1}	4.7^{e1}	11.2^{e1}	56^{e1}
		1.1*^{e1}	3.7*^{e1}	37.2^{e2}	9.3^{e2}	17.9^{e2}	30.8^{e2}	63^{e2}
		0.4**^{e1}	20.1**^{e1}	7.1^{e3}	5.5^{e3}	11.8^{e3}	55.1^{e3}	93^{e3}
Naira_Yen	NY	0.1^{f}	3.9^{f}	10.4^{f}	83.6^{f}	0.2^{f}	1.7^{f}	16^{f}
		33.4^{e1}	3.2^{e1}	4.4^{e1}	32.8^{e1}	22.7^{e1}	3.5^{e1}	67^{e1}
		5.8^{e2}	1.3^{e2}	3.0^{e2}	78.8^{e2}	2.4^{e2}	8.7^{e2}	21^{e2}
		1.8^{e3}	1.6^{e3}	0.2^{e3}	87.2^{e3}	2.7^{e3}	6.6^{e3}	13^{e3}
Naira_Pound	NP	1.0^{f}	21.3^{f}	1.0^{f}	0.3^{f}	76.1^{f}	0.2^{f}	24^{f}
		7.5^{e1}	4.0^{e1}	11.0^{e1}	32.0^{e1}	38.0^{e1}	7.6^{e1}	62^{e1}
		5.7^{e2}	8.8^{e2}	2.7^{e2}	0.7^{e2}	57.9^{e2}	24.1^{e1}	42^{e2}
		0.9^{e3}	13.1^{e3}	8.6^{e3}	4.6^{e3}	38.2^{e3}	34.5^{e3}	62^{e3}
Naiara_Euro	NE	13.6^{f}	0.1^{f}	1.1^{f}	0.5^{f}	1.5^{f}	83.2^{f}	17^{f}
		37.2^{e1}	5.6^{e1}	16.6^{e1}	13.2^{e1}	5.5^{e1}	21.9^{e1}	78^{e1}
		0.6^{e2}	20.0^{e2}	3.6^{e2}	3.0^{e2}	1.4^{e2}	71.4^{e2}	29^{e2}
		2.4^{e3}	7.1^{e3}	1.8^{e3}	4.0^{e3}	2.3^{e3}	82.5^{e3}	18^{e3}
Contribution to Others		23^{f}	50^{f}	15^{f}	9^{f}	5^{f}	35^{f}	136^{f}
		115^{e1}	14^{e1}	56^{e1}	51^{e1}	43^{e1}	25^{e1}	304^{e1}
		14^{e2}	53^{e2}	15^{e2}	27^{e2}	32^{e1}	85^{e2}	225^{e2}
		6^{e3}	47^{e3}	16^{e3}	26^{e3}	65^{e3}	123^{e3}	283^{e3}

Table 1 (*continued*)

Currency Pairs	FX	NSF	ND	NW	NY	NP	NE	CFO
Contribution including Own		114^{f}	141^{f}	52^{f}	93^{f}	81^{f}	119^{f}	$22.7\%^{f}$
		184^{e1}	105^{e1}	99^{e1}	84^{e1}	81^{e1}	47^{e1}	$50.7\%^{e1}$
		53^{e2}	143^{e2}	53^{e2}	105^{e2}	90^{e2}	156^{e2}	$37.6\%^{e2}$
		66^{e3}	89^{e3}	23^{e3}	113^{e3}	104^{e3}	206^{e3}	$47.2\%^{e3}$

Source: Authors Computations. Note: $^{f, e1, e2}$ and ^{e3} denote full sample and sub-samples of 2007, 2011 and 2015 election periods respectively.

Exchange rate return is described as the continuously compounded exchange rate percentage returns at time t calculated as below:

$$R_t^i = \log\left(E_t^i / E_{t-1}^i\right) * 100 \quad (12)$$

where R_t^i is the exchange rate returns of a given country i at time t; E_t^i is the exchange rate of that country at time t, while E_{t-1}^i represents one period lag in the exchange rate. See Appendix 2 in the Supplementary Material, available online, for some preliminary analyses on these exchange rates.

3. Results and discussion

Furthermore, Tables 1–4 relate to the spillovers among the *naira* exchanges over the full sample and the various subsamples using the periods of electioneering and global financial crisis. The results in Tables 1 and 2 are partitioned into Panel A and Panel B for DY (2009) and DY (2012), respectively. Tables 1 and 3 cover the electioneering case, while Tables 2 and 4 are about the global financial crisis. It is instructive to note that the total spillover effects for the two scenarios of electioneering and global financial crisis effects are noted at the bottom-right of the two tables; denoted in percentages. Starting with Panel A, of the full sample for the electioneering sub-sample effects, the own spillover of these currencies hover around 74–96 percent with the Swiss Franc and US Dollar having the highest own spillovers of 96 and 95 percent respectively and the lowest being the Pound Sterling with 74 percent. The implication is that the spillovers from other currencies to these currencies are majorly negligible. The only exception for this behaviour is the own spillover of the *waua* that suggests that the currency is largely influenced by spillovers from other currencies to the tune of about 60 percent with only an approximately 40 percent for own spillover.

Considering the effects of the electioneering processes for the three election periods captured in this study, we find that the behaviour significantly changed from their full sample pattern. The election periods considered are the 2007, 2011 and 2015 elections in Nigeria. We capture six (6) months preceding the election and we seek to monitor the effect this would have on the *naira* exchanges. The 2007, 2011 and 2015 elections seem to generate higher cross spillover effects from other currencies to the Swiss Franc as it increases from 4 percent to as high as 29 percent, 52 percent and 40 percent respectively. The contemporaneous changes for the spillover effects from other currencies to the US Dollar are 12 percent, 9 percent and 42 percent for 2007, 2011 and 2015 elections respectively.

Similarly, the *naira* exchanges of the Pound Sterling and Euro show that the cross as well as own spillovers for the electioneering effects differ markedly from the full sample case with higher cross spillovers and lower own spillovers during the former period. Even the *waua* which ordinarily has more spillovers from other currencies still reflects the electioneering processes in the country and its impacts on currency exchanges of *naira*. Also, the total spillover effect for the full sample is computed as 22.1 percent while higher values are obtained for the 2007, 2011 and 2015 election periods. Specifically, we obtain 53.8 percent, 38.2 percent and 43.4 percent for the 2007, 2011 and 2015 elections (see Table 1, Panel A and Table 3). Looking at the Panel B of Table 1, we find that the results obtained from DY (2012) are quite similar to DY (2009) and they both follow the same pattern in terms of the behaviour of own and cross spillovers across the various subsamples. The total spillover effects are also computed as 22.7 percent and 50.7, 37.6 and 47.2 per cent for the 2007, 2011 and 2015 electioneering periods (see Table 1, Panel B).

Table 2 considers the spillover effects among the currencies necessitated by the global financial crisis of 2007–2009; we consider 2005–2006 as the pre-global crisis period and the 2010 till date as the post crisis period. Interestingly, we find that these three sub-sample periods produce different spillover effects for both own and cross spillovers. Ordinarily without the effect(s) of the global financial crisis, the full sample case suggests spillovers from other currencies to these six reference currencies range between 4 and 26 percent; except for the *waua* which has 60 percent from other currencies. This implies that most of these currencies are largely affected by own spillovers to the tune of 74–96 percent. When the effect of the global crisis is accommodated however, the spillovers from other currencies significantly reduce during and post-crisis periods from its pre-crisis period while own spillovers increase substantially. The only exception in this regard is the US Dollar where the spillovers from other currencies during the pre-crisis to the tune of 9 percent is less than those obtained during and post-crisis periods which are estimated as 36 and 35 percent respectively (see Table 1, Panel B). This behaviour is also noticed for the spillover obtained for the DY (2009). Table 3 summarizes the total spillover effect due to the global financial crisis of 2007–2009. The total spillover index shows that the pre-crisis period records the highest spillover which is estimated as 43.6 percent and 56.8 percent for DY (2009) and DY (2012) respectively. During the crisis however, the total spillover reduces to 33.0 percent and 36.0 percent for the two tests respectively and declines further to 32.7 and 34.2 per cent for the two tests respectively after the crisis.

Basically, Tables 3 and 4 compares the spillover effect among the selected *naira* exchange rates for the electioneering and global crisis effects. As evident, the spillovers from these

Table 2
Estimates from spillover tests with the effects of global financial crisis.

Currency Pairs	FX	NSF	ND	NW	NY	NP	NE	CFO
Panel A: Diebold and Yilmaz (2009) Test								
Naira_Swiss_Franc	NSF	95.9[f]	0.0[f]	0.8[f]	1.6[f]	0.2[f]	1.5[f]	4[f]
		81.2[pr]	0.2[pr]	0.3[pr]	5.1[pr]	2.2[pr]	11.0[pr]	19[pr]
		85.9[c]	1.2[c]	2.9[c]	3.6[c]	1.9[c]	4.6[c]	14[c]
		93.7[po]	0.0[po]	0.7[po]	2.9[po]	0.3[po]	2.4[po]	6[po]
Naira_Dollar	ND	0.1[f]	94.7[f]	0.4[f]	0.2[f]	0.2[f]	4.5[f]	5[f]
		4.5[pr]	95.3[pr]	0.0[pr]	0.0[pr]	0.1[pr]	0.1[pr]	5[pr]
		8.3[c]	73.9[c]	10.7[c]	1.2[c]	4.6[c]	1.4[c]	26[c]
		0.6[po]	73.6[po]	17.0[po]	0.1[po]	2.8[po]	5.8[po]	26[po]
Naira_Waua	NW	8.7[f]	25.4[f]	40.2[f]	3.4[f]	2.5[f]	19.8[f]	60[f]
		40.2[pr]	0.6[pr]	31.6[pr]	8.9[pr]	6.6[pr]	12.1[pr]	68[pr]
		9.5[c]	17.6[c]	35.9[c]	2.2[c]	9.2[c]	25.6[c]	64[c]
		14.1[po]	23.2[po]	39.9[po]	6.6[po]	0.1[po]	16.2[po]	60[po]
Naira_Yen	NY	0.1[f]	4.5[f]	12.8[f]	80.5[f]	0.0[f]	2.0[f]	19[f]
		38.7[pr]	1.1[pr]	0.4[pr]	57.2[pr]	2.4[pr]	0.2[pr]	43[pr]
		9.8[c]	25.5[c]	8.2[c]	55.5[c]	0.9[c]	0.0[c]	44[c]
		0.1[po]	4.2[po]	10.5[po]	83.6[po]	0.1[po]	1.5[po]	16[po]
Naira_Pound	NP	1.0[f]	21.3[f]	1.5[f]	2.2[f]	73.6[f]	0.4[f]	26[f]
		46.5[pr]	0.0[pr]	0.3[pr]	3.0[pr]	44.5[pr]	5.6[pr]	56[pr]
		11.3[c]	0.6[c]	8.7[c]	8.3[c]	69.0[c]	2.1[c]	31[c]
		1.5[po]	41.4[po]	10.5[po]	1.9[po]	42.1[po]	2.6[po]	58[po]
Naiara_Euro	NE	14.8[f]	0.1[f]	1.1[f]	0.5[f]	1.5[f]	83.2[f]	17[f]
		53.5[pr]	0.2[pr]	0.7[pr]	4.6[pr]	12.7[pr]	28.4[pr]	72[pr]
		14.4[c]	1.1[c]	0.0[c]	0.1[c]	2.7[c]	81.7[c]	18[c]
		22.5[po]	0.9[e2]	4.9[po]	0.8[po]	0.2[po]	70.7[po]	29[po]
Contribution to Others		25[f]	51[f]	17[f]	8[f]	4[f]	28[f]	132[f]
		183[pr]	2[pr]	2[pr]	22[pr]	24[pr]	29[pr]	262[pr]
		53[c]	46[c]	30[c]	15[c]	19[c]	34[c]	198[c]
		39[po]	70[po]	44[po]	12[po]	3[po]	29[po]	196[po]
Contribution including Own		121[f]	146[f]	57[f]	88[f]	78[f]	111[f]	21.1%[f]
		265[pr]	97[pr]	33[pr]	79[pr]	68[pr]	57[pr]	43.6%[pr]
		139[c]	120[c]	66[c]	71[c]	88[c]	115[c]	33.0%[c]
		133[po]	143[po]	83[po]	96[po]	46[po]	99[po]	32.7%[po]
Panel B: Diebold and Yilmaz (2012) Test								
Naira_Swiss_Franc	NSF	91.3[f]	0.1[f]	1.1[f]	1.3[f]	0.1[f]	6.1[f]	9[f]
		31.2[pr]	0.2[pr]	0.1[pr]	15.4[pr]	21.9[pr]	31.2[pr]	69[pr]
		76.4[c]	0.6[c]	3.6[c]	2.8[c]	2.6[c]	14.1[c]	24[c]
		91.0[po]	0.6[po]	1.0[po]	2.0[po]	0.2[po]	5.3[po]	9[po]
Naira_Dollar	ND	0.1[f]	91.6[f]	1.0[f]	1.1[f]	0.3[f]	6.0[f]	8[f]
		4.2[pr]	90.7[pr]	0.0[pr]	1.4[pr]	2.2[pr]	1.6[pr]	9[pr]
		7.5[c]	64.5[c]	11.0[c]	4.4[c]	6.5[c]	6.2[c]	36[c]
		0.5[po]	65.7[po]	24.8[po]	0.4[po]	1.1[po]	8.4[po]	35[po]
Naira_Waua	NW	8.0[f]	24.1[f]	37.8[f]	5.9[f]	2.8[f]	21.4[f]	62[f]
		17.2[pr]	0.5[pr]	13.3[pr]	16.2[pr]	22.0[pr]	30.8[pr]	87[pr]
		7.9[c]	13.7[c]	30.2[c]	5.9[c]	8.2[c]	34.0[c]	70[c]
		12.9[po]	23.8[po]	39.7[po]	8.5[po]	0.8[po]	14.3[po]	60[po]
Naira_Yen	NY	0.1[f]	3.9[f]	10.4[f]	83.6[f]	0.2[f]	1.7[f]	16[f]
		19.1[pr]	0.8[pr]	0.2[pr]	45.9[pr]	14.2[pr]	19.8[pr]	54[pr]
		8.1[c]	19.8[c]	7.7[c]	61.1[c]	0.5[c]	2.8[c]	39[c]
		0.1[po]	3.7[po]	7.6[po]	86.2[po]	1.1[po]	1.3[po]	14[po]
Naira_Pound	NP	1.0[f]	21.3[f]	1.0[f]	0.3[f]	76.1[f]	0.2[f]	24[f]
		19.2[pr]	0.1[pr]	0.1[pr]	10.3[pr]	38.4[pr]	32.0[pr]	62[pr]
		9.8[c]	0.3[c]	8.2[c]	5.6[c]	68.2[c]	7.9[c]	32[c]
		1.3[po]	38.0[po]	14.3[po]	1.8[po]	41.8[po]	2.8[po]	58[po]
Naiara_Euro	NE	13.6[f]	0.1[f]	1.1[f]	0.5[f]	1.5[f]	83.2[f]	17[f]
		21.5[pr]	0.1[pr]	0.2[pr]	12.8[pr]	25.8[pr]	39.6[pr]	60[pr]
		12.7[c]	0.6[c]	0.1[c]	0.2[c]	2.8[c]	83.6[c]	16[c]
		21.4[po]	0.3[e2]	5.3[po]	1.4[po]	0.2[po]	71.4[po]	29[po]
Contribution to Others		23[f]	50[f]	15[f]	9[f]	5[f]	35[f]	136[f]
		81[pr]	2[pr]	1[pr]	56[pr]	86[pr]	115[pr]	341[pr]
		46[c]	35[c]	31[c]	19[c]	21[c]	65[c]	216[c]
		36[po]	66[po]	53[po]	14[po]	3[po]	32[po]	205[po]

Table 2 (*continued*)

Currency Pairs	FX	NSF	ND	NW	NY	NP	NE	CFO
Contribution including Own		114^{f}	141^{f}	52^{f}	93^{f}	81^{f}	119^{f}	$22.7\%^{f}$
		112^{pr}	92^{pr}	14^{pr}	102^{pr}	125^{pr}	155^{pr}	$56.8\%^{pr}$
		122^{c}	100^{c}	61^{c}	80^{c}	89^{c}	148^{c}	$36.0\%^{c}$
		127^{po}	131^{po}	93^{po}	100^{po}	45^{po}	103^{po}	$34.2\%^{po}$

Source: Authors Computations. Note: $^{f, pr, c}$ and ^{po} denote full sample and sub-samples for pre-, during and post- global financial crisis periods respectively.

Table 3
Spillover indexes for the effects of electioneering and global financial crisis.

Sample Range	Spillover index: D&Y (2009) Test	Spillover index: D&Y (2012) Test
Full Sample	22.10%	22.70%
e1: 2007 Election	53.50%	50.70%
e2: 2011 Election	38.20%	37.60%
e3: 2015 Election	43.40%	47.20%

Table 4
Spillover index.

Sample Range	Spillover index: D&Y (2009) Test	Spillover index: D&Y (2012) Test
Full Sample	22.10%	22.70%
Pre-Crisis	43.60%	56.80%
Crisis Period	33.00%	36.00%
Post-Crisis Period	32.70%	34.20%

two effects behave in opposite directions. The three electioneering processes under review (2007, 2011 and the 2015 elections) increase the total spillover effects of these *naira* exchanges with the 2011 election being the least with 38.2 percent and the 2007 election being the highest with 53.5 percent spillover. The spillovers from these elections are all greater than the full sample case which is taken as the average value. For the global financial crisis, total spillover effects follow a downward trend. Intuitively, it suggests that the occurrence of the global crisis has redefined the currency interactions among these economies as the spillover effects continue to reduce and remain low from its pre-crisis level (see Table 4). Nonetheless, internal shocks occasioned by political processes and policy surprises may have implications on the behaviour of the spillovers.

4. Conclusion

This study investigates the spillover effects among six most traded currencies namely the US Dollar, Euro, Pound Sterling, Yen, Swiss Franc and the West African Unit of Account (WAUA). It employs data covering both the electioneering episodes in Nigeria and global financial crisis. The sub-samples for the electioneering activities are determined based on the three election periods covered in the analyses namely 2007, 2011 and 2015 elections. For the global financial crisis, three sub-samples are also considered for the periods of pre-, during and post-crisis. Using the Diebold and Yilmaz (2009, 2012) tests for the spillover effects, we find that during the electioneering episodes, the *naira* exchange rates tend to experience greater spillovers than during the episodes for global financial crisis. In addition, the former produces a somewhat increasing spillover effect, while the latter produces a decreasing spillover effect. In other words, significant variations in the *naira* exchange rates are more likely to be noticed during the electioneering period and these variations may fuel higher volatility among the most traded foreign currencies in the country.

Conflicts of interest

None declared.

Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.bir.2018.07.007.

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