Short-run and long-run determinants of exchange rate fluctuations: A tale of the Dollar and the Naira

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Abstract

The study provides evidence on the effects of changes in oil price, inflation, interest rate, budget balance, economic growth, external debt, domestic investment, and current account balance on exchange rate fluctuations in using the ARDL approach for the period 1970-2015 for the case of the Naira and Dollar. The study shows that changes in oil price, inflation, the current account and domestic investment have significant effects on exchange rate fluctuations both in the short and long run. Changes in external debt has significant effects on exchange rate fluctuations only in the long run. Changes in interest rate, budget balance and economic growth have significant effects on exchange rate only in the short run. In other words, a significant proportion of the high volatility of exchange rate in Nigeria is as a result of changes in oil price, inflation, interest rate, budget balance, economic growth, external debt, domestic investment, and current account balance. The logical conclusion is that in order to stabilize exchange rate in Nigeria, measures should be aimed at diversifying the economy, improving the current account position as well as reducing inflation.

Keywords: Naira-Dollar exchange rate fluctuations, Oil Price, Debt, Inflation, Interest, Growth, Investment, Budget, Current Account, ARDL.

JEL Code: D53, E01, E31, E41, F31

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1 Introduction

Exchange rate fluctuation – defined as the persistent changes in the exchange rate – has led recent discourse in the literature owing to its effects on both developed and developing economies. Concerns about exchange rate fluctuations have grown based largely on its impact on exports (Wang & Barrett, 2007; Vieira & MacDonald, 2016; Khaledi, Hani, Mortazavi & Khaliliyan, 2019), employment growth (Belke & Kaas, 2004; Dai & Xu, 2017), trade (Tenreyro, 2007; Musila & Al-Zyoud, 2012), inflation (Danjuma, Shuaibu, & Sa'id, 2013), investment (Fuentes, 2006), oil price shock (Dong, Ma, Wang & Wei, 2017), general economic activity (Adewuyi & Akpokodje, 2013; Gummi, Buhari, & Muhammad, 2017) and growth (Holland, Vieira, Silva & Bottecchia, 2011; Wesseh & Lin, 2018). Exchange rate fluctuations have powerful effects on tradable and non-tradable of countries through relative prices of goods and services (Bobai, Ubangida & Umar, 2013), triggering balance-sheet adjustments, valuation

changes, and shifts in risk-taking, both in real and financial assets, with impact on the real economy (Avdjiev, Bruno, Koch & Shin, 2019).

Although exchange rate fluctuations have historically been problematic for policy makers and experts, it has recently become more imperative with the greater integration of the global financial system. For example, despite various endeavors to maintain exchange rate stability by avoiding its fluctuations and misalignment, the Naira continues to depreciate against the American dollar. Available data shows that the Naira has depreciated against the Dollar since the 1970s by about 42750% (Figure 1). In the beginning, Nigeria practiced a fixed exchange rate policy, where the Naira was pegged against the British pound and afterwards the American dollar. However, the Bretton Woods international system of fixed exchange rates was terminated in the early 1970s. Since then the international monetary system advance with copious and conspicuous developments. Many countries forsook pegged exchange rates and instead either (i) practise a monetary policy based on flexible exchange rate or (ii) connect monetary policy to other countries through a monetary union or dollarization (Evans, 2013). Consequent upon these developments, Nigeria adopted a flexible exchange rate policy, allowing the Naira to float and its value relative to the American dollar controlled by market forces of demand and supply.

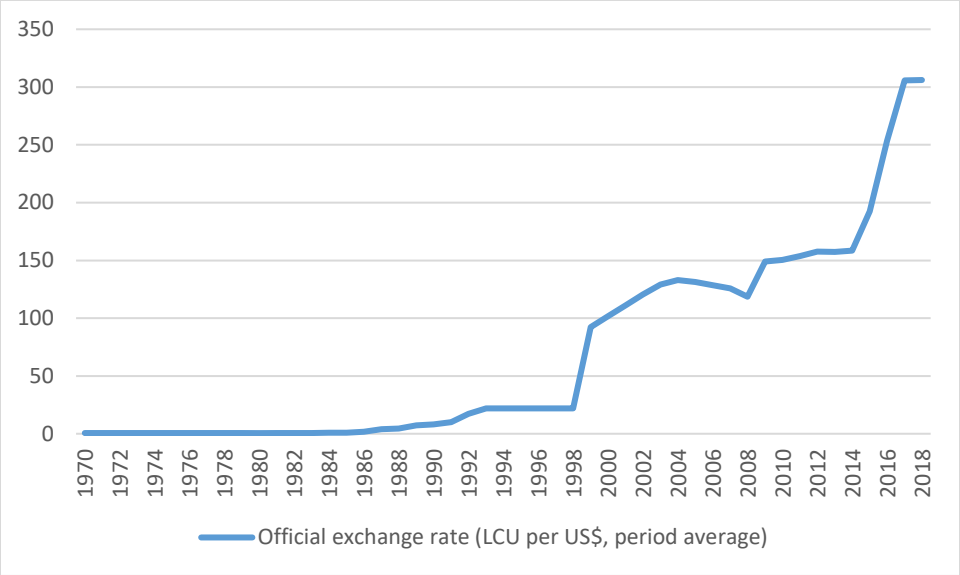

Figure 1. Evolution of Official Exchange Rate in Nigeria
Data Source: World Bank (2020)

Because of the incessant fall of the naira, however, more policies were employed to ensure exchange rate stability. These included among others: Second-Tier Foreign Exchange Market (SFEM), Autonomous Foreign Exchange Market (AFEM), Inter-bank Foreign Exchange Market (IFEM), the Enlarged Foreign Exchange Market (FEM), and the Dutch Auction System (DAS). Generally, the hopelessness and flop of each policy to help and achieve stability in the exchange rate invariably lead to the espousal of another (Evans, 2013). To the chagrin of the above, the incessant fall of the Naira-Dollar exchange rate is still a huge challenge to policy makers in Nigeria. It has rendered the Nigerian economy not just uncompetitive, but more uncertain.

In the literature, there are many determinants of exchange rate: oil price, inflation, interest rate, budget balance, economic growth, external debt, domestic investment, and the current account balance (Odusola & Akinlo, 2001; Taylor, 2001; Olomola, 2006; Akpan, 2009; Kilishi, 2010; Duarte and Schnabl, 2015;

Kelikume & Evans, 2015). Any of these determinants may serve as a source of uncertainty to exchange rate. In other words, changes in oil price, inflation, interest rate, budget balance, economic growth, external debt, domestic investment, and current account balance may have effects on the Naira-Dollar exchange rate. However, evidence of the effects of these changing dynamics on the exchange rate in Nigeria is nil with the few available studies on determinants of exchange rate only spouting models of exchange rate (e.g., Evans, 2013; Ca'Zorzi, M., Kolasa & Rubaszek, 2017; Bulut, 2018; Alam & Gilbert, 2019; Cheung, Chinn, Pascual & Zhang, 2019). This study thus fills this important gap in the literature.
In the light of the weighty contemporary realities and the empirical and theoretical exchange rate literature, this study intends to examine the changing determinants of the naira-dollar exchange rate fluctuations. Specifically, the study has the following specific objectives:

i. To investigate the effects of changes in oil price on exchange rate fluctuations
ii. To examine the effects of changes in inflation on exchange rate fluctuations
iii. To probe the effects of changes in interest rate on exchange rate fluctuations
iv. To explore the effects of changes in budget balance on exchange rate fluctuations
v. To investigate the effects of changes in economic growth on exchange rate fluctuations
vi. To examine the effects of changes in external debt on exchange rate fluctuations
vii. To investigate the effects of changes in domestic investment on exchange rate fluctuations
viii. To examine the effects of changes in current account balance on exchange rate fluctuations

The remainder of the paper is structured as follows: Section 2 outlines a review of the empirical literature on uncertainties and exchange rate. Section 3 describes the methodology and data used in the research. Section 4 presents the empirical analysis. Section 5 discusses the implications of the findings while section 6 concludes.

2 Theory and Review of Literature

The purchasing power parity theory postulates that the equilibrium rate of exchange is determined by the equality of the purchasing power of two inconvertible paper currencies (Jiang, Bahmani-Oskooee and Chang, 2015; Almasri, Månsson, Sjölander and Shukur, 2017; Iyke, and Odhiambo, 2017). In other words, the exchange rate is determined by the price levels in the two countries. The balance of payments theory of exchange rate states that the rate of exchange between two currencies is determined by the factors which are independent of internal price level and money supply (Gabaix and Maggiori, 2015; Stern, 2017). It maintains that the rate of exchange is determined by the flow of funds in the foreign exchange market and the balance of payments position of a country. In contrast to the balance of payments theory, the monetary approach to exchange rate states that the rate of exchange is determined by the balance of the demand and supply of the currency in each country (Beckmann, Glycopantis and Pilbeam, 2018). It maintains that the demand for money depends on the level of income, the price level and the interest rate.
Following the seminal paper by Branson (1981), there has been increasing interest in empirical research relating to real exchange rates. The motivation for this strand of literature has been to determine the variables which have robust effects on exchange rates in a cross-section of countries; see, in particular, Dornbusch and Fischer (1980), Bergstrand (1991), Chinn (2006), Frankel (1987), Phylaktis and Ravazzolo (2005), Towbin and Weber (2013), and Li and Wang (2017). Most often, a large set of possible explanatory variables are constructed and regression analysis is used to identify the variables which are statistically significant in explaining exchange rate.

In the exchange rate literature, the identification of the determinants of exchange rate on the basis of which exchange rates could be predicted has always been one of the perennial issues. Several studies have therefore developed models explaining exchange rate behavior. For example, Shylajan, Sereejesh and Suresh (2011), using the Johansen-Juselius cointegration technique, examined the link between the

Indian rupee-US dollar exchange rates and macroeconomic fundamentals. The results showed that there is a long-run relationship between exchange rate and the macroeconomic variables, validating the flexible-price monetary model. Beckmann and Czudaj (2017) analyzed the role of uncertainty on both exchange rate expectations and forecast errors of professionals for four major currencies. The authors consider economic policy, macroeconomic, and financial uncertainty as well as disagreement among CPI inflation forecasters to account for different dimensions of uncertainty. Based on a Bayesian VAR approach, they found that effects on forecast errors of professionals were more significant than the adjustment of exchange rate expectations. The findings point to different forecasting horizons and an unpredictable link between exchange rates and fundamentals. Additionally, the authors illustrated the importance of considering common unpredictable components for a large number of variables.

It is well known from anecdotal, survey and econometric evidence that the relationship between the exchange rate and macro fundamentals is highly unstable (Evans, 2017a; Evans, 2019a). This could be explained when structural parameters are known and volatile, neither of which seems possible. Bacchetta and Van Wincoop (2013) contended that frequent variations in the relationship between exchange rate and macro fundamentals develop when structural parameters are not certain and change slowly. They showed that the reduced form relationship between macro fundamentals and exchange rates is driven by expectations of the parameters, not by the structural parameters themselves. Some studies in this strand of the literature have also examined the capabilities of measures of uncertainty to predict movements in macroeconomic and financial variables (e.g. Bloom, 2014; Balcilar, Gupta, Kyei and Wohar, 2016).
Another stream of the literature has also studied both domestic and foreign imbalances facing a number of developing economies who have embraced foreign currencies as a store of value, and a medium of exchange for domestic transactions (e.g., Mengesha and Holmes, 2011; Lay, Kakinaka and Kotani, 2012; Tweneboah, 2016). For example, Tweneboah (2016) examined dollarization/currency substitution, its impact on macroeconomic fundamentals, and the challenges it poses for effective formulation and transmission of monetary policy in Ghana. The evidence showed that exchange rate depreciation and financial development drive dollarization. Moreover, depreciation of the domestic currency drives demand for foreign currencies, while a more developed financial sector reduces dollarization. Although foreign interest rates and expected exchange rates (either separately or jointly) are relevant elements in the money demand function, the evidence is more in support of capital mobility and not currency substitution. As well, the impact of financial dollarization on nominal exchange rate volatility in Ghana is positive. Thus, as demand for U.S. dollars becomes more extensive, the cedi/dollar exchange rate becomes more volatile and unstable. Interestingly, the results also show that dollarization has not played a significant role in the dynamics of inflation volatility.

Similarly, in Pakistan, Waheed (2012) identified the determinants of nominal rupee-dollar exchange rate using cointegration approach. He showed that domestic output, relative price, current account balance, financial deepening, exports, budget deficit and interest rate differential, are significant determinants of rupee-dollar exchange rate. Further, he showed that uncertainty related to budget deficit, output, current account deficit, domestic investment contributes and external debt contributed to the volatility of rupee-dollar exchange rate.
For ECOWAS countries, Akinkunmi (2017) investigated the exchange rate rebound effects of central bank intervention, using panel data. He found that the effect of Central Bank intervention on exchange rate is non-significant and non-contributory to exchange rate rebound. Further, he showed that monetary policy rate significantly and positively affects exchange rate. For Nigeria, Nwafor (2006) examined the link between the naira-dollar exchange rates using the Johansen's multivariate cointegration technique. He found at least one cointegrating vector, validating the existence of a long-run monetary model of exchange rate.

This review shows that little has been done both empirically and theoretically, in the existing literature, to understand the effects of changes in oil price, inflation, interest rate, budget balance, economic growth, external debt, domestic investment, and the current account on exchange rate fluctuations, especially in Nigeria. The evidence in this strand of literature is nil, with the few available studies on exchange rate determination testing for models of exchange rate (e.g., Evans, 2013; Ca'Zorzi et al, 2017; Bulut, 2018; Alam & Gilbert, 2019). This study thus fills this important gap in the literature.

3 Data & Methodology

3.1 Model Specification

In the literature, there are many determinants of exchange rate such as oil price, inflation, interest rate, budget balance, economic growth, external debt, domestic investment, and the current account balance (Olomola, 2006; Akpan, 2009; Kilishi, 2010; Duarte and Schnabl, 2015). Any of these determinants may serve as a source of fluctuations to exchange rate. This study therefore posits that the link between the Naira-Dollar exchange rate and the changes in oil price, inflation, interest rate, budget balance, economic growth, external debt, domestic investment, and the current account can be determined with the following modification of Waheed's (2012) model:

$$Rer_t = \pi_0 + \pi_1 oil_t + \pi_2 Deb_t + \pi_3 Inf_t + \pi_4 Int_t + \pi_5 Cur_t + \pi_6 Grw_t + \pi_7 Inv_t + \pi_8 Bud_t + \varepsilon_t$$

Where *Rer* is the real exchange rate, that is, Nigerian Naira per US dollar in real terms; *Inf* is changes in inflation; *Int* is changes in interest rate; *Grw* is changes in growth; *Deb* is changes in external debt; *Oil* is changes in oil price; *Inv* is changes in domestic investment; *Bud* is changes in the budget balance; *Cur* is changes in the current account balance; and ε_t are the residuals.

3.2 Data

This study examines the effects of changes in oil price, inflation, interest rate, budget balance, economic growth, external debt, domestic investment, and the current account on the Naira-Dollar exchange rate fluctuations. To explore this knot empirically, time series data of Nigeria used spans from 1970 to 2015. The collected data include GDP growth, current account balance, total external debt stocks, gross fixed capital formation (% of GDP), official exchange rate, real interest rate, oil price, inflation, and budget balance. The data are obtained from the World Bank (2017).

The methods used in the literature to proxy changes or uncertainty include standard deviation of the variable, five year moving average, five years moving standard deviation, and the conditional variance estimated from generalized autoregressive conditional heteroscedasticity (GARCH). This study uses the conditional variance estimated from GARCH. The conditional variances of budget balance, economic growth, external debt, domestic investment, oil price, inflation, interest rate and current account balance were estimated from GARCH model to generate the relevant uncertainty variables.

Table 1. Description of Variables

Indicator Name	**Definition**
Current account balance	Current account balance is the sum of net exports of goods and services, net primary income, and net secondary income.
External debt stocks	Total external debt is debt owed to nonresidents repayable in currency, goods, or services. Total external debt is the sum of public, publicly guaranteed, and private nonguaranteed long-term debt, use of IMF credit, and short-term debt. Short-term debt includes all debt having an original maturity of one year or less and interest in arrears on long-term debt.
Gross fixed capital formation (% of GDP)	Gross fixed capital formation (formerly gross domestic fixed investment) includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings.
Official exchange rate	Official exchange rate refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (local currency units relative to the U.S. dollar).
Real interest rate	Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator.
Growth rate of GDP	Growth rate is the rate at which a nation's GDP changes/grows from one year to another.
Oil price	Crude oil prices are annual oil prices calculated by International Energy Agency from daily data by taking an unweighted average of the daily closing spot.
Inflation	Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.
Budget Balance	The government budget balance, also alternatively referred to as general government balance, public budget balance, or public fiscal balance, is the overall difference between government revenues and spending.

Source: World Bank (2020)

The conditional variances of budget balance, economic growth, external debt, domestic investment, oil price, inflation, interest rate and current account balance were estimated from asymmetric GARCH model to generate the relevant uncertainty variables. Asymmetric GARCH can capture the asymmetry in the exchange rate data. In order to capture asymmetry effects in the exchange rate data, an asymmetric GARCH models is used. The results are reported in the appendix.

3.3 Econometric Approach

ARDL bounds testing approach, as originally introduced by Pesaran and Shin (1999) and further developed by Pesaran, Shin and Smith (2001), is used in this study. The ARDL bounds testing approach has a number of benefits, such as capability to measure both long-run and short-run effects at once (Bentzen & Engsted 2001), appropriateness even for small sample size (Ghatak & Siddiki 2001), and

validity even when the variables are a mix of I(0) or I(1). A two-step procedure is followed in the estimation of the ARDL model. The first step of the analysis is the ARDL bounds test for the joint significance of the variables. Restricting all estimated coefficients of lagged level variables equal to zero, the null hypothesis of no cointegration is tested against the alternative hypothesis of cointegration via an F-test with an asymptotic non-standard distribution. Two asymptotic critical value bounds provide a test of cointegration. The upper bound assumes that all the regressors are *I*(1) while the lower bound assumes that all are *I*(0). The null is rejected if the computed F-statistics is higher than the upper band, thus indicating cointegration (Pesaran and Pesaran, 1997; Evans, 2017b). The null cannot be rejected if the computed F-statistics is less than the lower band, supporting the absence of cointegration. Inference would be inconclusive if the statistics fall within the band (Saibu, Alenoghena, Evans and Tewogbade, 2016).

Having established the long run relationship, the final step of the ARDL analysis will involve estimating the coefficients of the long-run relationship and making relevant inferences about their values (Pesaran and Pesaran, 1997). This stage involves two further steps: "The first stage involves selecting the orders of the lags based on Schwarz Bayesian Information Criteria (SBIC) or the Akaike Information Criteria (AIC). In the second step, the selected optimal ARDL model restricted to the lag structure defined in the first stage of the final ARDL process is then estimated including the short run and error correction model" (Tandrayen-Ragoobur, 2010, p. 11). Constructing a lagged error correction term to represent the whole set of lagged level variables, the short run coefficients can be estimated as an error correcting model which allows for long run estimates.

4 Empirical Analysis

Before estimation of the model, it is appropriate to check for the time series properties of the data to determine their order of integration (Adeola and Evans, 2017; Alenoghena and Evans, 2017; Nwaogwugwu and Evans, 2017). This is to ensure that the variables are not stationary at an order of I(2) because the computed F-statistics provided by Pesaran, Shin and Smith (2001) are valid only when the variables are I(0) or I(1). To test the order of integration of the variables in the model therefore, the Augmented Dickey Fuller and Phillip-Perron tests are used, as shown in Table 2. Both tests confirm that the variables are a mix of I(0) and I(1).

Table 2. Augmented Dickey Fuller and Phillips-Perron Unit Root Tests

	Augmented Dickey Fuller		*Phillips-Perron*	
	Level	*First difference*	*Level*	*First difference*
Rer	-1.80	-4.02	-1.99	-3.99
Inf	1.59	-4.00	-2.08	-3.84
Int	-1.73	-6.66	-2.73	-4.86
Grw	-1.38	-4.09	-1.90	-3.57
Bud	0.04	-4.89	-1.52	-5.30

Cur	0.04	-6.11	-0.91	-9.06
Deb	-2.08	-5.58	-2.11	-5.62
Oil	-1.64	-5.56	-1.60	-5.57
Inv	-2.82	-5.87	-2.90	-5.91
	Critical values: 1% level -3.63 5% level -2.94 10% level -2.61		Critical values: 1% level -3.63 5% level -2.94 10% level -2.61	

Notes: Lag length selected by Schwarz Info Criterion.

Source: Research findings

Since the ADF and Phillips-Perron (PP) unit root tests have notoriously low power, the study also uses the Dickey-Fuller-GLS (Elliot, Rothenberg, and Stock, 1996), and the Ng and Perron (2001) tests as supplementary. The literature suggests that these tests have superior power. As shown in Table 3, both tests confirm that the variables are a mix of I(0) and I(1).

Table 3. Dickey-Fuller GLS and Ng-Perron Unit Root Tests

	Dickey-Fuller GLS		*Ng-Perron*	
	Level	*First difference*	*Level*	*First difference*
Rer	-1.57	-3.96	-4.12	-14.77
Oil	-1.57	-2.08	0.77	-8.41
Deb	-1.37	-5.67	-3.22	-42.74
Inf	-6.67	-7.17	-22.48	-121.45
Int	-4.71	-5.73	-20.18	-21.25
Cur	-2.29	-4.16	-11.79	-15.96
Grw	-1.92	-6.72	-2.91	-19.74
Inv	-1.43	-1.97	-1.14	-8.85
Bud	-5.68	-6.90	-16.49	-26.49
	Critical values: 1% level -2.63 5% level -1.95		Critical values: 1% -13.80 5% -8.10 10% -5.70	

	10% level	-1.61	

Notes: Lag length selected by Schwarz Info Criterion.

Source: Research findings

The ARDL bounds test for the cointegration test is as shown in Table 4. The critical values are reported in the same table based on Narayan (2004) with small sample size between 30 and 80. The calculated *F*-statistic (*F*-statistic = 5.21) is higher than the upper bound critical value at 1 per cent level of significance. This implies that the null hypothesis of no cointegration cannot be accepted at 1 per cent level and therefore, there is a cointegration relationship among the variables.

Table 4. ARDL Bounds Test

Test Statistic	Value	k
F-statistic	5.21	8
Critical Value Bounds		
Significance	I(0) Bound	I(1) Bound
10%	1.95	3.06
5%	2.22	3.39
2.5%	2.48	3.7
1%	2.79	4.1

Source: Research findings

The ARDL long-run and the short-run coefficients, are estimated by using Schwartz Criterion to select the appropriate lags. Once it is established that a long-run cointegration relationship exist among the variables, equation (2) was estimated using *ARDL(2, 2, 2, 2, 0, 2, 2, 2, 2)* specification.

The long-run estimates of the model are presented in Table 5 below. The estimated coefficients of the long-run relationship show that changes in oil price, external debt, inflation, current account balance and domestic investment have significant effects on exchange rate fluctuations. Conversely, changes interest rate, growth and budget balance have insignificant effects on exchange rate in the long run. Succinctly, this study establishes that, in the long run, a significant proportion of the high volatility of exchange rate in Nigeria is caused by changes in oil price, external debt, inflation, current account balance and domestic investment.

Table 5. Long Run Estimates

Dependent Variable: *Rer*

Variable	Coefficient	t-Statistic	Prob.
Oil	-0.09	-1.84	0.07**
Deb	0.01	3.14	0.00*
Inf	-0.04	-1.92	0.02**
Int	-1.34	-1.61	0.14
Cur	0.01	2.11	0.04**
Grw	-1.85	-1.36	0.22
Inv	0.92	2.56	0.02**
Bud	0.02	0.04	0.97
C	1198.17	2.76	0.03**
Breusch-Godfrey Serial Correlation LM Test:		0.70*	
Breusch-Pagan-Godfrey Heteroskedasticity Test		0.91	

*Notes: * significant at 1%; ** significant at 5%; *** significant at 10%.*

Source: Research findings

The fact that the variables are cointegrated provides support for the use of an error correction representation in order to investigate the short-run dynamics. Estimation results based on Schwartz Bayesian Criteria are presented in Table 6 below. Changes in oil price, inflation, interest rate, current account balance, growth, domestic investment and budget balance have significant effects on exchange rate in the short run. Interestingly, only changes in external debt has insignificant effects on exchange rate in the short run. In other words, in the short run, a significant proportion of the high volatility of exchange rate in Nigeria is due to changes in oil price, inflation, interest rate, current account balance, growth, domestic investment and budget balance. Further, the lagged error term, *Ect*(-1), in our results, is negative and significant at 5% level. The coefficient of -0.37 indicates high rate of convergence to equilibrium.

Table 6. Short Run Estimates

Dependent Variable: Δ*(Rer)*

Variable	Coefficient	t-Statistic	Prob.
Δ*(Rer(-1))*	1.41	3.61	0.01**
Δ*(Oil)*	-0.02	-2.33	0.04**

Δ*(Oil(-1))*	0.02	2.66	0.03**
Δ*(Deb)*	0.05	-0.57	0.59
Δ*(Deb(-1))*	0.01	1.21	0.27
Δ*(Inf)*	0.02	-0.21	0.84
Δ*(Inf(-1))*	0.01	1.71	0.09***
Δ*(Int)*	-0.49	-2.64	0.03**
Δ*(Cur)*	0.02	2.85	0.02**
Δ*(Cur(-1))*	0.01	1.12	0.30
Δ*(Grw)*	-0.16	-1.76	0.09***
Δ*(Grw(-1))*	0.18	1.84	0.11
Δ*(Inv)*	0.49	2.05	0.08***
Δ*(Inv(-1))*	0.79	2.98	0.02**
Δ*(Bud)*	0.04	-4.07	0.00*
Δ*(Bud(-1))*	0.03	1.41	0.20
Ect(-1)	-0.37	-2.02	0.04**
F-statistic		17.47*	
Breusch-Godfrey Serial Correlation LM Test		0.95	
Breusch-Pagan-Godfrey Heteroskedasticity Test		0.81	

*Notes: * significant at 1%; ** significant at 5%; *** significant at 10%.*

Source: Research findings

The diagnostic tests are in order. For both the long and short run models, the Breusch-Godfrey Serial Correlation LM test suggests no autocorrelation in the disturbance of the error term, and also the Breusch-Pagan-Godfrey Heteroskedasticity test denotes that the errors are homoscedastic and independent of the regressors.

Further, the stability of the short-run dynamics and the long-run coefficients are examined. In line with Pesaran and Pesaran (1997), CUSUM tests are applied to the residuals of the model (Brown, Durbin, and Evans, 1975). "The CUSUM test makes use of the cumulative sum of recursive residuals based on the first set of *n* observations and is updated recursively and plotted against break points. If the plot of CUSUM statistics stays within the critical bounds of 5% significance level..., the null hypothesis that all coefficients in the error correction model are stable cannot be rejected. If either of the lines is crossed, the null hypothesis of coefficient constancy can be rejected at the 5% level of significance" (Tandrayen-Ragoobur, 2010, p. 16).

Figure 2 and 3 provides the graphs of the CUSUM tests. It is categorically evident that the plots of CUSUM are within 5% of critical bands. The CUSUM plots do not cross the critical bounds, indicating no evidence of any significant structural instability. This infers that the estimated long and short run models are stable. This gives credence to the fact that there exists short and long run stability of the naira-dollar exchange rate fluctuations model.

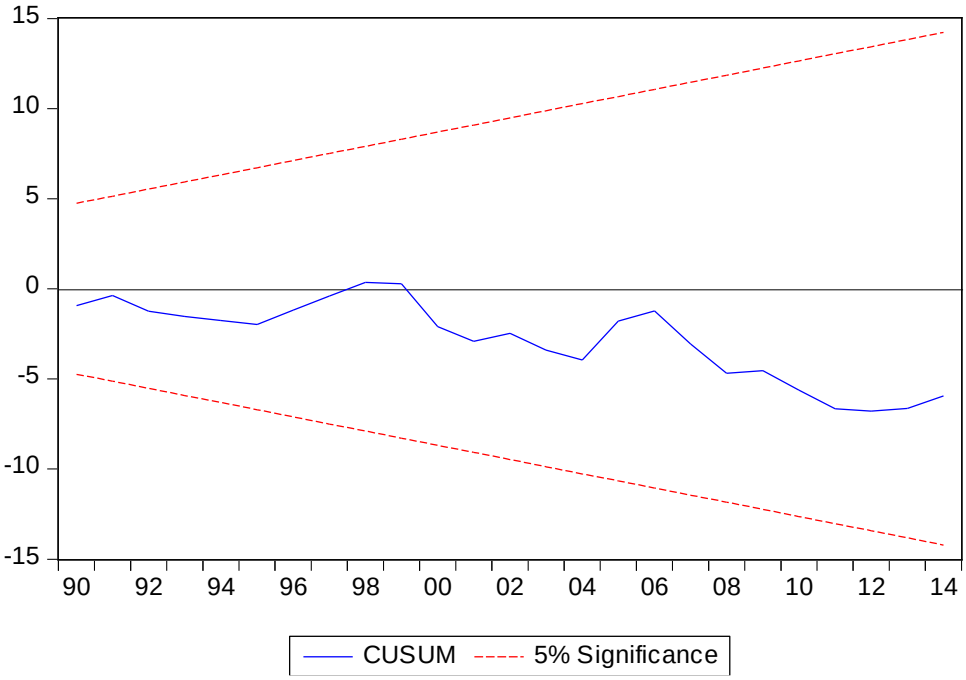

Figure 2. CUSUM Test for the Long-run Model

Source: Research findings

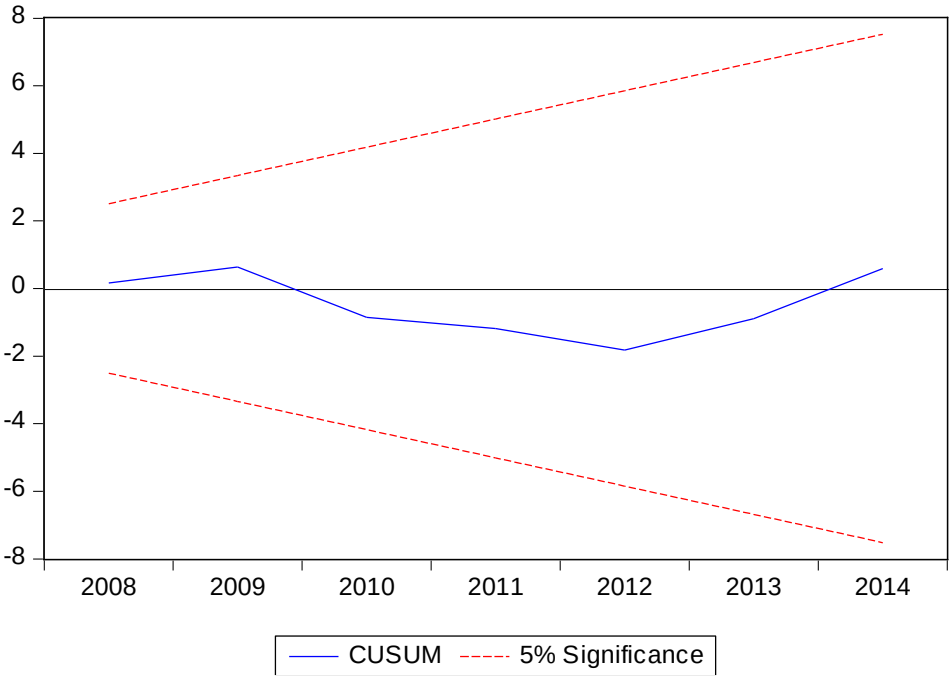

Figure 3. CUSUM Test for the Short-run Model

Source: Research findings

5 Discussion and Implications

The purpose of this study is to investigate the effects of changes in oil price, inflation, interest rate, budget balance, economic growth, external debt, domestic investment, and current account balance on the Naira-Dollar exchange rate fluctuations. First, the study has shown that changes in oil price has significant effects on exchange rate both in the long and short run. The finding is in line with studies such as Olomola (2006) which found that oil price shock is an important determinant of real exchange rates in Nigeria. Similarly, testing whether exchange rates are cointegrated with real oil prices, Chen and Hsu (2013) found that real oil prices may be the dominant source of real exchange rate movements and that there is a link between real oil prices and real exchange rates. Their panel predictive regression estimates suggest that real oil prices have significant forecasting power for real exchange rates.

In an oil-exporting country like Nigeria, oil price volatility is a great challenge to policy makers. For example, the price of oil fluctuated between $17 and $26 at different times in 2002. It hovered around $53 per barrel by October 2004. Crude oil prices slumped by 47% in July 2014. The current price of crude oil as of March 13, 2020 was $33 per barrel amid the Saudi-Russian oil price war and the coronavirus pandemic. In fact, the price of oil has witnessed significant fluctuations since 1974. Persistent oil shocks have severe macroeconomic implications, thus inducing challenges for policy making - fiscal or monetary in Nigeria over the three decades (Olomola, 2006; Akpan, 2009; Kilishi, 2010; Adeniji, Obi and Evans, 2018).

The study has also shown that changes in the current account has significant effects on exchange rate both in the long and short run. This aligns with the balance of payments theory of exchange rate which

states that the rate of exchange is determined by the flow of funds in the foreign exchange market and the balance of payments position of a country. (Gabaix and Maggiori, 2015; Stern, 2017). This finding supports Chinn and Wei (2013) who tested Friedman's (1953) hypothesis that the exchange rate can serve as an adjustment mechanism for current account imbalances. Using a sample of 170 countries Chinn and Wei (2013) found a robust correlation between exchange rate flexibility and current account reversion. The finding is also in line with Hermann and Jochem (2013) who found some evidence for the adjustment of current account balances to exchange rate changes in the European Union. The current account position has remained an economic policy concern in Nigeria, like other developing economies. Like Brazil, Turkey or India, Nigeria's current account can be described in the words of Duarte and Schnabl (2015, p. 4) as "the breeding ground for classical balance of payments and foreign debt crisis due to risky foreign exchange exposure". For example, the current account position of Nigeria, like other oil-exporting countries shows high degree of volatility due to fluctuations in oil prices, production volumes and oil sector-related imports (Morsy, 2009). The current account level is further complicated by (i) the fact that oil resources are exhaustible and the need for intergenerational equity; (ii) the presence of the Dutch disease phenomenon[1]. Even in East Asia, particularly China, where there are current account surpluses, it continues to be the origin of trade conflicts and concerns about currency wars (Evans, 2019b).

Also, the study has shown that changes in inflation has significant effects on exchange rate both in the long and short run. The finding is in line with studies such as Odusola and Akinlo (2001) which found that inflation is an important determinant of exchange rate fluctuations in Nigeria. A higher inflation rate in Nigeria compared to other countries will tend to reduce the value of the naira. Succinctly, changes in relative inflation rates leads to changes in the exchange rates. Also, markets anticipate future inflation. If a policy is likely to cause inflation, market participants will sell the currency causing it to fall in anticipation of the inflation.

Also, the study has shown that changes in interest rates has significant effects on exchange rate both in the long and short run. The finding is in line with the monetary approach to exchange rate states which states that the demand for money depends on the level of income, the price level and the interest rate (Beckmann, Glycopantis and Pilbeam, 2018). The finding is also in line with studies such as Taylor (2001) which has shown that interest rate is an important determinant of exchange rate fluctuations. Higher interest rates mean a higher return relative to other countries. Higher interest rates attract foreign capital, causing exchange rate to increase. The opposite relationship also exists for declining interest rates: lower interest rates decrease exchange rates. Also, the study has shown that changes in domestic investment has significant effects on exchange rate both in the long and short run. This is not surprising, given that exchange rates in many developing economies experience high volatility which is translated into a high degree of uncertainty for private investors regarding both the profitability and the cost of investment. Consequently, volatile (real) exchange rates are associated with erratic swings in the relative profitability of investment in the traded and non-traded goods sectors of the economy.

Interestingly, only changes in external debt has insignificant effects on exchange rate in the short run. However, it has significant effects in the long run. In fact, Saheed, Sani and Idakwoji (2015) show that external debt is statistically significant in explaining exchange rate fluctuations in Nigeria. With continuous increase in public spending, and low capital formation, the Nigerian governments have resorted to borrowing outside the country. Considering that borrowings results in debt servicing, servicing external debt has led to demand for foreign currency which influences the exchange rate of the country.

[1] Dutch disease phenomenon: where an oil boom leads to a real appreciation of the domestic currency reducing the competitiveness of non-oil exports and increasing imports

The study has shown that, in the short run, changes in growth and budget balance has significant effects on exchange rate. This finding is in line with such studies as Hakkio (1996) and Ito, Isard and Symansky (1999), and Su, San and Su (2003). Considering the significance of uncertainty due to budget balance, when a government experiences a budget deficit, the likely financing method is to increase government borrowings, thus putting upward pressure on real interest rates. High interest rates attract foreign capital inflows but push up the currency value (Su, San and Su, 2003). Considering the significance of changes in growth, foreign investors inevitably seek out countries with strong economic performance in which to invest their capital. Therefore, strong economic growth can cause increased confidence in a currency and a movement of capital to the currencies of such countries.

6 Conclusion, Implications and Future Research

The study has provided evidence on the effects of changes in oil price, inflation, interest rate, budget balance, economic growth, external debt, domestic investment, and current account balance on the Naira-Dollar exchange rate fluctuations using the ARDL approach for the period 1970-2015. Having established the presence of a long-run relationship between the naira-dollar exchange rate and the macroeconomic dynamics, the study shows that changes in oil price, inflation, the current account and domestic investment have significant effects on exchange rate fluctuations both in the short and long run. Changes in external debt have significant effects on exchange rate fluctuations only in the long run. Changes in interest rate, budget balance and economic growth has significant effects on exchange rate fluctuations only in the short run.

Table 7. Macroeconomic Factors Affecting Exchange Rate fluctuations

Short-run Changes	**Long-run Changes**
Oil price	Oil price
Inflation	Inflation
Current account balance	Current account balance
Domestic Investment	Domestic Investment
Interest rate	External debt stocks
Growth rate of GDP	
Budget Balance	

Source: Research findings

Succinctly, the study has shown that changes in oil price, inflation, interest rate, budget balance, economic growth, external debt, domestic investment, and current account balance have significant effects on exchange rate fluctuations. Therefore, the factors that matter in determining oil price, inflation and the current account in case of oil-exporting economies like Nigeria (i.e. the fiscal balance, the oil balance, oil wealth, and the degree of maturity in oil production) should be considered in stemming the tide of exchange rate fluctuations. For example, the various factors responsible for change in crude oil prices (e.g., demand-supply dynamics, changes in OPEC policy, Niger Delta militancy, geopolitical events) should be considered in encouraging exchange rate stability. There is need to monitor the prices of energy-intensive goods and services which are linked to energy prices. Abrupt changes in oil prices will continue to have wide-ranging ramifications (e.g., drastic fall in exchange rate and net revenue realization) until the economy is well-diversified away from oil (Evans and Saibu, 2017).

Also, the factors that matter in determining inflation in case of oil-exporting economies like Nigeria (e.g., interest rate, deficits, money supply, population growth rate, activities of the middlemen and monopolistic activities, distribution, bottlenecks, high production costs) should be considered in promoting exchange rate stability. More importantly, domestic productivity and exports should be encouraged in the medium to long run while aggregate demand should be curtailed in the short run. This among other policy options would stabilize the value of the naira against key world currencies.

Oil-exporting economies' specific characteristics (i.e. the underground oil wealth and the degree of maturity in oil production) that have been identified in the literature to significantly affect the equilibrium current account balance should also be considered. It is noteworthy that changes in the current account provide information about the interactions and expectations of all economic agents in an economy and reflect the stance of overall macroeconomic policies. Therefore, Nigerian policymakers should pay attention to the current account balance as a key macroeconomic indicator. They should try to understand factors underlying its movements, evaluate its sustainability, and design policy measures to correct it. To this end, policymakers would need to determine the level of current account that could lead to exchange rate stability in Nigeria.

The analysis presented in this study has left a number of important questions unanswered, providing a fertile ground for future studies. For example, a better understanding of the channels through which the macroeconomic factors could lead to variations in the exchange rate could have important policy implications for exchange rate stability. Also, from an intertemporal perspective, examining the different degrees of persistence of shocks to the current account on exchange rate fluctuations would be innovative.

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