

An Econometrics Analysis of the Determinants of Exchange Rate in Nigeria (1980 - 2016)

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Abstract

The paper investigates the determinants of exchange rate in Nigeria using times series data ranging from 1980 to 2016 and employing the Vector Error Correction Mechanism (VECM) to separate the long-run determinants of exchange rate from its short-run determinants. The result from the dynamic model reveals that changes in domestic price level, interest rate differentials, trade openness, government purchases of tradable and non-tradable goods and capital inflow are the major long-run determinants of exchange rate in Nigeria while changes in the domestic price level, interest rate differentials and capital inflow are the major short-run determinants of exchange rate in Nigeria. The study recommended the actions of the monetary authorities towards the maintenance of relative low and stable price level, interest rate capable of attracting foreign investors and the design and implementation of trade policies which tend to increase the inflow of capital from abroad.

Keywords: Exchange rate, Determinants, Nigeria, VECM

Introduction

The management of exchange rate poses a serious problem to developing countries such as Nigeria, in terms of getting the “right exchange rate” usually in the context of the factors that causes volatility and also determines the exchange rate. The exchange rate is the most recognized and fundamental link between the internal and external economy, thus any mismanagement or distortion in the exchange rate will result to divergence in the internal and external economy equilibrium. Hence, special attention and critical devotion is required by the government of an economy through its monetary authority to analyze the major macro-economic factors that determines the exchange rate so as to maintain balances in the internal and external economy with the sole aim of attaining sustained growth in the economy (Dosse, 2007).

When it comes to economic policy making, the exchange rate is an important macroeconomic variable and thus much attention is given to the foreign exchange policies to ensure its appropriateness. Since the performance of other macro-economic variables are affected by its changes in value (depreciation and appreciation). The appreciation of exchange rate means less of local currency is required to get a foreign currency, while the depreciation of the exchange rate means, more of the local currency is required to get less of the foreign currency. When there is depreciation in one country’s currency in terms of the other, there is equally an appreciation in there currency of the foreign country’s currency. Therefore every country is on the go to attain appreciation in its currency, hence the need to find out the determinants of the exchange rate so as to focus on those that appreciate the exchange rate.

In Nigeria, it has not been an easy task in the determination of appropriate exchange rate. Before the introduction of Structural Adjustment Policy (SAP) in 1986, the Naira was said to be overvalued since it was on a fixed exchange rate regime, this led to the practice of flexible exchange regime so its actual value could be determined by the market forces of demand and supply. Even after the devaluation that followed, the Naira has not been able to get its appropriate value, the desired objectives are yet to be achieved by the exchange rate policies formulated overtime. The implementation of the fluctuating exchange rate policies such as the Second-tier foreign exchange market (SFEM), Dutch Auction System (DAS), Modified Dutch Auction System (MDAS), Weighted Dutch Auction System (WDAS), among others which did not give the required results led to the revert of the fixed exchange rate policy in 2008.

The determinants of exchange rate has been a serious issue of deliberation among economic scholars, policy makers and politicians in and outside of Nigeria. From available literatures sourced, the determinants of exchange rate tend to change from one country to the other, also from time to time in a particular country. Reasons may be due to

numerous exchange rate policies and programs set up by different successive administrations in the country, since there may be variation in the economic health of the country at different time.

Among factors that induced the inappropriateness of the Nigeria exchange rate is the nature of its production base, high dependence in importation, weak earnings from exportation of non-oil products, faulty policies of the fiscal and monetary authorities, insufficient inflow of foreign capital movement, shortfall between the demand and supply of foreign exchange, instability in the price of crude oil in international market, activities of speculators and reselling of foreign exchange by authorized dealers in the foreign exchange market in an inappropriate rate (round tripping), and the nature of the foreign exchange markets. Other factors that led to the misalignment of exchange rate in Nigeria is excessive debt burden, foreign capital moving out of the country due to unfavorable policy, and weak position of the balance of payment as there is problem of import exceeding export (Obadan, 2006).

ShabanaParveen, Khan and Ismail (2012) were of the view that the equality of the market forces of demand and supply in the foreign exchange market determines the equilibrium exchange rate of an economy. When there is need for exportation, it calls for the demand for foreign currency (foreign exchange) since the local currency can't be used for transaction in a foreign country on the other hand when there is call for foreign investment into a country, the foreign investment will be supplies with the currency of the country he/she wants to invest. Simply, export and foreign investment necessitate the demand for and supply of foreign currencies respectively. When there is disequilibrium in the demand for and supply of currency, it will have either a negative or positive impact in the exchange rate. Just like the workings of the goods market, when there is increase in the demand for a currency it will lead to increase in the values of the exchange rate (appreciation of exchange rate) on the other hand when the supply for currency increases, it lead to fall in the value of the exchange rate (depreciation of the exchange rate). At any point when the demand for currency exceeds the supply or the supply of currency exceeds its demand it will cause a disequilibrium in the foreign exchange market which is a case for appreciation and depreciation of the exchange rate respectively.

According to Ejaz, Abbas and Saeed (2002) in ShabanaParveen, Khan and Ismail (2012), under floating exchange rate regime in which the rate is managed by the country's monetary authority as against allowing the market forces of demand and supply to determine the exchange rate, (that is the managed floating), the exchange rate and budget deficit have a direct relationship. To them in the study of Pakistan exchange rate, the budget deficit is said to play a vital role in the determination of exchange rate in Pakistan. Williamson (1994) in Udoye (2009) was of the view that the equilibrium or appropriate exchange rate of a country is traditionally determined by some sets of vital macro-economic variables. As such, the permanent values of these vital macro-economic variables determine the long-run value of a country's exchange rate.

Apart from the macro-economic factors that determines exchange rate in a country, the forces of demand also contribute immensely to behaviour of exchange rate as the increase in demand for foreign exchange without an equal corresponding supply for domestic exchange will lead to depreciation of the exchange rate. On the other hand, when there is a shortfall in the demand of foreign exchange in favour of the supply of domestic exchange, it will lead to appreciation of the domestic exchange rate. Macro-economic factors that dampen as well determine the Nigeria's exchange rate as observed by Obadan (2006) include weak production base, dependent on importation, little or no export, fall in oil earnings, decrease in capital inflow, demand for foreign exchange exceeding the supply, debt burden, capital leaving the country and unfavourable balance of payment.

In the light of this, certain factors like changes in price (inflation), changes in interest rate, fluctuation in export and import, capital movement across countries, speculations, stock exchange influences, political stability, exchange control and protection policies and the nature of an economy determine the foreign exchange rate in great deal (Jhingan, 2008). Faulkner and Makrelor (2008) in Ayinla (2014) argued that there are other variables that determine the exchange rate apart from the productivity differentials according to the Balassa-Samuelson hypothesis. According to them, among factors that improve the exchange rate in an economy is when a country engage in more of export than importation and the improvement in the term of trade. These factors coupled increase the wealth of the country and the demand for tradable and non-tradable goods and services produced domestically. When the demand for locally produced goods and services increases, it will make the prices of the domestic goods and services to rise. When there is improvement in the term of trade of a country it causes the exchange rate to appreciate as against when the term of trade is not improving or declining, which will cause the exchange rate of the country to depreciate, this will also cause decline in the wealth of the economy, fall in the domestic demand and the prices.

Other than the introductory section, this study is divided into five sections, the next section will deal with the literature review, section three methodology, section four and five recommendations and conclusion.

Literature Review

The foreign exchange is a financial asset which dominates the foreign assets of most economy. The foreign exchange is mainly earned from the exportation of goods and services. The inflow of capitals from other countries, foreign aids and loans as well add up to the earnings of foreign exchange. The total amount of foreign exchange available in an economy at any period of time forms the foreign exchange resources of an economy. The fluctuation of the exchange rate as well as its depreciation is majorly caused by expansionary liquidity and the consequences of persistent excess liquidity in the banking sector's supply of inelasticity of both production locally and the foreign exchange market as well as the ineffective management of speculative activities in the foreign exchange market.

Exchange rate, which is defined as the unit price of a country's currency in terms of the currency of other countries. In principle, especially under the floating exchange rate, exchange rate is determined by interplays of the market forces of demand and supply. Even though the market forces are said to determine the exchange rate under the floating exchange regime, the monetary authorities still manage the floating of the exchange rate informally.

Ibrahim (2016) using data spanning from 1960 to 2015 empirically using econometrics analysis studied the determinants of real effective exchange rate in Nigeria. The Vector Error Correction Mechanism (VECM) was used to separate the short-run fundamentals of exchange rate in Nigeria from the long-run fundamental. The regression result reveals that M2, NEER and the three dummy variables (civil rule dummy, SAP dummy and change to civil rule dummy) were the major short-run fundamentals of exchange rate in Nigeria, while term of trade, net inflow of capital into Nigeria, degree of openness and government expenditure are the long-run fundamentals of exchange rate in Nigeria.

Ajao and Igbekoyi (2013) using Nigerian time series data from 1981 to 2008 investigate The Determinants of Real Exchange Rate Volatility in Nigeria employing the GARCH (1, 1) technique to obtain exchange rate volatility. Having obtained the volatility of exchange rate through the GARCH (1,1) techniques, and the Co-integration analysis and ECM to test for existence of long-run relationship among the variables and capture their speed of adjustment towards long-run equilibrium respectively. Result from the analysis thus shows that the one period past of exchange rate, interest rate differentials, degree of openness of Nigerian economy and government expenditures are the major determinants of exchange rate in Nigeria.

Oriavwota and Oyovwi (2012) carried out an empirical research using a time series data from 1970 to 2010, on the determinants of real exchange rate in Nigeria. The research uses the OLS method of regression analysis, Johansen test for co-integration and error correction mechanism. The co-integration result reveals that exchange rate and variables included in the model has long-run relationship. The regression result employing the mechanism of error correction method shows that inflation rate, inflow of capital, and NEER are the main long-run determinants of exchange rate in Nigeria, while other variables such as terms of trade (TOT), government expenditure and technology progress included in the model do not determine exchange rate in Nigeria. The result thus suggests that Dutch disease syndrome holds in Nigeria.

Ben, Obida and Nurudeen (2010) employing a time series data from 1970 to 2007 empirically studies the determinants of exchange rate in Nigeria. The error correction mechanism (ECM) was used to capture the speed at which the variables return to long-run and the Johansen co-integration to determine if the dependent and independent variables included in the model have long-run relationship. The findings from the study confirm the Balassa-Samuelson hypothesis which states that rise in productivity (GDP) will cause appreciation on the exchange rate. The co-integration result shows that the variables possess long-run relationship and the regression result shows that inflation, GDP and the ratio of investment to GDP has a negative relationship with exchange rate which means appreciation of the exchange rate, while rise in foreign exchange reserve, interest rate and degree of openness has a positive influence on exchange rate which is a depreciation on the part of the exchange rate.

Udoye (2009) uses an annual secondary data spanning from 1970 to 2006 to empirically analyse the determinants of exchange rate. The Auto-Regressive Distributed Lag Model and error correction mechanism (ARDL-ECM) was employed to capture the influence of the lag values of the exchange rate and the independent variables on the exchange rate. The ADF statistics was employed to check for stationarity of the variables and the co-integration procedure to

check for long-run relationship in the model. The regression result shows that the main determinants of exchange rate are lag of exchange rate and the current and past year value of trade openness and also the existence of long run relationship between exchange rate and the GDP and trade openness.

Hsing (2006), studied the determinants of exchange rate fluctuations for Venezuela applying the extended Mundell-Fleming model. The study employed the OLS method of regression and was based on the examining of the short-term behaviour of Venezuela exchange rate. The result shows that M2 money balances and government expenditure has a positive relationship with the exchange rate of Venezuela while variables like the interest rate, inflation rate and the nature of risk of the country has a negative relationship with the exchange rate.

Methodology

As the study implies, data to be used will be time series data from 1980 to 2016 and will be collected from a secondary source basically the World Bank World Development Indicators (WDI) or the Central Bank of Nigerian Statistical Bulletin in cases where the suitable data are not obtainable in the WDI.

There exist several concepts of the exchange rate, ranging from the nominal exchange rate, real exchange rate, nominal effective exchange rate and the real effective exchange rate. The nominal exchange rate (NER) is unit price of a domestic currency relative to a foreign currency. Therefore an increase in the exchange rate is termed depreciation (or devaluation under the fixed exchange regime) while decrease in the exchange rate is referred to as appreciation (or revaluation under fixed exchange rate regime). The fixed exchange rate (FER) unlike the nominal, it is given by the ratio of the price level abroad and the domestic price level. As such it is a comparison of the relative prices of tradable goods to non-tradable goods. It is the adjustment of the nominal exchange rate for inflation in a domestic economy relative to the inflation rate of the foreign country. The real exchange rate is thus given as;

$$RER_t = NER_t P_t^* / P_t \quad (1)$$

Where RER_t is the real exchange rate at time t , NER_t is the nominal exchange rate at time t , and P_t and P_t^* is the domestic and foreign price at time t respectively.

Unlike the nominal and nominal effective exchange rate (NEER) which deals with the exchange between two country's currencies, the nominal exchange rate is the unadjusted (for inflation) weighted average rate of a country's currency relative to several foreign currencies, especially the currencies of major trade partners. Increase in the nominal exchange rate connotes appreciation of the domestic currency against the weighted basket of the currencies of its major trade partners, whilst decrease in nominal effective exchange rate signifies depreciation of the domestic currency. As such, it serves as a measure of international competitiveness of an economy.

Accordingly, the real effective exchange rate (REER) is the weighted average of an economy's currency relative to index or basket of several foreign currencies, especially the currencies of its major trade partners. The real effective exchange rate (REER) is given as;

$$REER_t = \sum_{i=1}^n W_{it} NER_{it} P_{it}^* / P_t \quad (2)$$

Where $REER_t$ is the real effective exchange rate at time t and W_{it} is the weights of a country's currency trade balance against individual country in the index.

Oriavwota and Oyovwi (2012) sees the real exchange rate to be of greater importance since it's the relative price of goods and services from a foreign country in terms of domestic goods and services. The real exchange rate as well pays a significant role in the signal of sector to sector growth in an economy. The real exchange rate also measures a country's competitiveness among economies. Apart from the measure of international competitiveness and indicator of sectorial growth, the real exchange rate acts as a guide in the allocation decision in both the spending and production of domestic and foreign goods and services in an economy. As an indicator of international competitiveness of an economy based on the foreign exchange market, the nominal effective exchange rate is being employed as a measure for this function.

In line with the purchasing power parity and interest rate parity theorem which the study employed as the framework of the study, the exchange rate between two inconvertible currencies is determined by the price ratios of the two countries. That is;

$$EXC = P_t/P_t^* \quad (3)$$

Where EXC is the exchange rate between two countries and P_t and P_t^* is price level in home country and foreign country in time t respectively. Therefore to obtain equilibrium exchange rate between these two countries under the PPP theorem, the price ratios is expected to be zero. The price level in the home country will be expected to be low relative to the price level in foreign country so as to attract exportation in the economy and achieve appreciation in the domestic currency. Thus at the point where the price levels in the two country is equal, the price ratio will be 1 and there will be equilibrium in the exchange rate between the countries.

Also under the interest rate parity theorem, exchange rate is determined by differentials of interest rate.

$$EXC = i^* - i \quad (4)$$

Where i^* and i is the interest rate in domestic economy and foreign country. Appreciation of the exchange rate is attainable when the interest rate in an economy relative to the foreign country is high as it will necessitate increase in flow of capital in the economy from the foreign country, as such equilibrium exchange rate can be attained at a point where the interest rate differentials between two countries is equal.

Combining (3) and (4) we obtain;

$$EXC = P_t/P_t^*, i^* - i \quad (5)$$

Thus based on theory, exchange rate between two countries is determined by the price and interest rate differentials.

In-line with the work of Udoye (2009), Ibrahim (2016) and Ben, Obida and Nurudeen (2010) among others, apart from the price level and interest rate, trade policy, government purchased of tradable and non-tradable goods, and the inflow of capital to an economy also determines the exchange rate of the economy. Thus (5) transforms to;

$$EXC = [P_t/P_t^*, i^* - i, t_x/t_m, G_t + G_{nt}, C_{inflow}] \quad (6)$$

Where t_x/t_m is the ratio of total export to total import (this can be used to measure the degree of openness of an economy), $G_t + G_{nt}$ is the sum of government purchases of tradable and non-tradable goods and C_{inflow} is the inflow of capital to an economy. To simplify the model and due to non-availability of data, we compress (6) to;

$$EXC = f[P, INT, OPEN, G, CAPF] \quad (7)$$

Where P is the price level and it is proxy for annual average inflation rate in an economy, INT is the interest rate measured by the real interest rate, OPEN is the degree of openness of Nigerian economy measured by the difference between total export and import, G is the total government expenditure and CAPF is the inflow of capital measured by foreign direct investment in an economy.

Since in the literates as in Udoye (2009), Ibrahim (2016) and Ben, Obida and Nurudeen (2010), the past year value of the exchange rate is seen to also influence the movement of exchange rate and the response of the dependent variables is not usually instantaneous, the dynamic model will be suitable for the study. But there will be need to check for the stationarity of the variables to determine their order of integration as well as the co-integration test if they happen to be integrated of same order which connotes long-run relationship among the models and the resultant dynamic model will be the ARDL-ECM or VECM depending on the co-integration vector. Therefore (7) transforms to;

$$LogEXC_t = \delta_0 + \delta_i D_t + \mu_t \quad (8)$$

Equation (8) is the transformed log-linear model. Where D_t is the vector of the determinants of exchange rate in (7). If the variables after unit root test are found to be integrated of same order of integration not greater than 1 and as well

confirmed by the Johansen co-integration technique that there exist among the variables, the error term from the regression of the non-stationary variables can be used to tie their short-run behavior to their long-run behavior. Thus **Eqn. (3.6)** transforms to;

$$\Delta \text{LogEXC}_t = \delta_0 + \delta_1 \sum_{i=0}^n \text{Log} \Delta \text{EXC}_{t-i} + \delta_i \sum_{i=0}^n \Delta D_{t-i} + \alpha (\text{LogEXC}_t - \delta_0 - \delta_i D_t) + v_t \quad (9)$$

Equation (9) is a dynamic model as it captures the lagged values of the dependent variable and the explanatory variables in the model. $D_t = [P, \text{INT}, \text{OPEN}, G, \text{CAPF}]$ and $\alpha (\text{LogEXC}_t - \delta_0 - \delta_i D_t)$ is the amount of shocks in the long-run from the regression of the non-stationary variables, it can be simply represented as ε_{t-i} . Therefore we estimate **(10)** if there exist long-run relationship among the variables.

$$\Delta \text{LogEXC}_t = \delta_0 + \delta_1 \sum_{i=0}^n \text{Log} \Delta \text{EXC}_{t-i} + \delta_i \sum_{i=0}^n \Delta D_{t-i} + \alpha \varepsilon_{t-i} + v_t \quad (10)$$

The Augmented Dickey-Fuller (ADF) unit root test technique will be used to test the stationarity of the variables as well as their order of integration, the Johansen Co-integration technique will be also employed to test for long-run relationship among the variables.

Result

This section presents and discuss the result of the estimation of **Equation (10)**. The presentation and discussion of the unit root and co-integration tests will precede after which the long-run and short-run regression analysis will follow.

Table 1: Unit Root Test

Variables	ADF Stat. (1 st Diff.)	5% Critical Value	Order of Integration
Log(EXC)	-5.093653	-2.948404	I(1)
P	-5.664218	-1.950687	I(1)
INT	-6.282211	-1.951000	I(1)
OPEN	-8.257936	-1.950687	I(1)
G	-7.146600	-1.950687	I(1)
CAPF	-8.412005	-1.950687	I(1)

Source: E-views Analysis Computed by Author

Employing the Augmented Dickey-Fuller Unit root test, the variables in **Equation 3.8** were found not to be stationary at levels, as shown in **Table 1**, hence they were made stationary after first differencing. After first differencing, all the variables in the model were found to be stationary. Since all the variables are stationary of same order of integration, this gave rise for the need for test of the existence of long-run relationship among the variables, and this will be carried out using the Johansen co-integration test.

Table 2: Unrestricted Co-integration Rank Tests

Hypothesized No. of CE(s)	Trace		Max-Engen	
	Trace Stat.	Critical Value	Max-Engen Stat.	Critical Value
None	117.3134	95.75366	56.14609	40.07757

Source: E-views Analysis Computed by Author

The result of the unrestricted co-integration rank test employing Johansen co-integration technique is presented in **Table 2**. Both the Trace and maximum Engen statistics confirms the existence of long-run relationship among the variables integrated of same order as well both indication 1 co-integrating vector. Hence, we estimate the error correction model to determine the long-run and short-run estimate of the model established in **Equation (3.8)**, this is due to fact that the variables are integrated of same order and their resulting error term is stationary at levels.

Table 3: Long-run Regression Estimate

Dependent Variable: $\text{Log}(EXC(-1))$

Variable	Coefficient	t-Statistic
Constant	3.559417	-
$P(-1)$	-0.124472	-14.3437
$INT(-1)$	0.479908	11.9056
$OPEN(-1)$	-0.042325	-5.79880
$G(-1)$	-0.160298	-5.85047
$CAPF(-1)$	0.945369	10.9856

Source: E-views Analysis Computed by Author

*Note: * (**) -1% (5%) Level of Significance*

From the long-run estimates in **Table 3**, all the variables are statistically significant and thus the major determinants of exchange rate in Nigeria. The Nigerian price level (inflation) as a major appreciating determinant of nominal exchange rate in Nigerian. From the long-run estimates, a unit changes in Nigerian price level will lead to about 13% decrease (appreciation) in the Nigerian exchange rate. This result although statistically significant, it do not corroborate the Purchasing Power Parity (PPP) theory which asserts that increase in the domestic price level will result to depreciation of the domestic currency relative to the foreign currency, this is because increase in the domestic price level will reduce exportation and increase importation which will as well increase the demand for the currency of the foreign currency which will ultimately bring about depreciation in the domestic currency in term or the foreign currency. Therefore, the PPP theory do not hold in the long-run. Interest rate differentials as well nullify the Interest rate parity theory in the long-run. This is due to the depreciating effect of interest rate differentials on the nominal exchange rate. From the long-run estimate in **Table 3**, a percent changes in interest rate differentials of the domestic economy will result to about 48% increase (depreciation) of the nominal exchange rate. Based on the interest rate parity theory, changes in interest rate is expected to have an appreciating effect on the nominal exchange rate, this can be thus be assumed that the interest rate parity theory do not also hold in the long-run.

The other variables included in the model, OPEN (degree of openness of the domestic economy), G (total government expenditure) and CAP (the inflow of foreign capital to domestic economy) are also key determinants of the nominal exchange rate in Nigeria. The degree of openness of the Nigerian economy have an appreciating impact on the nominal exchange rate. A unit changes in the degree of openness of Nigerian economy will lead to 0.42% decrease (appreciation) in the nominal exchange rate. Total government expenditure as well have an appreciating effect on the nominal exchange rate. On average, a percent increase in the expenditure of the government will bring about 16% appreciation of the nominal exchange rate. Unlike the degree of Nigerian economy openness and the total expenditure of the government, the inflow of foreign capital to the domestic economy have a depreciating effect on the nominal exchange rate. A percent changes in the inflow of capital from abroad will lead to 94% increase (depreciation) in in the nominal exchange rate. The long-run estimates of the degree of openness of Nigerian economy, total government expenditure and the inflow of capital into Nigerian follows the findings of Ibrahim (2016) that total government expenditure and the degree of openness of Nigerian economy have an appreciating effect on real effective exchange rate while the inflow of capital have a depreciating effect on the real effective exchange rate.

Table 4 shows the corresponding short-run of the estimated long-run regression in **Table 3**. The choice of the one period lag is guided by the Schwarz Information Criterion (SIC). The R^2 , F-statistics and Durbin-Watson statistics attest to the correctness of the model. The coefficient of the error correction term $\mu(-1)$ is rightly stated as it is negative, less than one and highly statistically significant.

From the short-run estimate in **Table 4**, one period lag of exchange rate have a depreciating effect on the nominal exchange rate. On average, a unit change in the one period lag of nominal exchange rate will result to 18% decrease (depreciation) in the Nigerian exchange rate. This depreciating effect on exchange rate lag on nominal exchange rate is in-line with the findings of Ibrahim (2016) that the lag of real exchange rate have a depreciating effect on real

exchange rate and it disprove the assertion of Udoye (2009) in which the one period lag of exchange rate have an appreciation on the nominal exchange rate. Findings further approve the findings of David (2017) that one period lag of nominal exchange rate have a depreciating effect on the nominal exchange rate.

Changes in the domestic price level in the short-run estimates have a depreciating impact on the nominal exchange rate. Based on the short-run estimates in **Table 4**, a percent change in domestic price level will result to 0.12% increase in nominal exchange rate. This result support the PPP theory, since increase in the domestic price level will lead to decline in export and increase in importation which will necessitate the increase in demand for foreign currency relative to the domestic currency which will ultimately lead to depreciation of the domestic currency. Thus the PPP theory can be said to be plausible in the short-run phenomenon. This depreciating effect of changes in domestic price level of exchange is against the findings of Ben, Obida and Nurudeen (2010), Udoye (2009) and David (2017) that changes in domestic price level will bring about appreciation of the domestic currency. Again, based on the t-statistics and the probability value of the changes in domestic price level, it is thus a major short-run determinant of nominal exchange rate in Nigeria.

Changes in the domestic interest rate differentials have an appreciating effect on the nominal exchange rate. On average, a percent changes in the domestic interest rate differentials will lead to about 0.68 percent decrease (appreciation) in the nominal exchange rate. This result also uphold the interest rate parity theory, in which increase in the domestic interest rate relative to the interest rate of a foreign county will lead to appreciation of the domestic currency as it will necessitate increase in the inflow of foreign capitals that will mandate the increase in supply and demand for domestic currency which will bring about appreciation of the domestic currency. This appreciation effect of domestic interest rate is in-line with the findings of David (2017) and against the assertions of Ben *et al.* (2010) and Udoye (2009). Again, based on the statistical significance of domestic interest rate differentials, it is therefore a major short-run determinant of nominal exchange rate in Nigeria.

The extent to which Nigerian economy is open have an appreciating effect on the nominal exchange rate in Nigeria. When the degree of openness changes by a percent it will lead to about 0.0021 percent decrease (appreciation) in the nominal exchange rate. Increase in the degree of openness of an economy tend to lead to free flow of international trade, again an economy with little or no trade restriction tend to enjoy appreciation in its currency. This result as well align with the assertions of Ibrahim (2016) in which changes in the degree of openness cause the real effective exchange rate of Nigeria to appreciate, and the findings of Udoye (2009), Oriavwota and Oyovwi (2012) and David (2017) and disprove the stand of Obi *et al.* (2010) that openness of Nigerian economy cause the nominal exchange rate to depreciate. Although not a major determinant of nominal exchange rate in Nigeria due to its statistical insignificance.

The purchases of tradable and non-tradable goods by government also have an appreciating effect on the nominal exchange rate in Nigeria. On average, a percent changes in the purchase of tradable and non-tradable goods by the government will result to about 0.097 per cent decrease (appreciation) in the nominal exchange rate in Nigeria. Although not statistically significant and thus not a major determinant of nominal exchange rate in Nigeria, its appreciation effect on exchange rate follows the assertions of Ibrahim (2016), Ben *et al.* (2010), and Oriavwota and Oyovwi (2012). When

Again the inflow of capital from foreign economies have an appreciating impact on the nominal exchange rate in Nigeria. *Ceteris paribus*, a percent change in the inflow of capital from foreign economies will lead to 0.56 percent decrease (appreciation) on the nominal exchange rate in Nigeria. When capital from foreign economies move into Nigerian economy, it will lead to appreciation of the naira exchange as the in-flow of capital will require the demand for naira, and increase in the inflow of capital is synonymous to increase in importation and ultimately the demand of Nigerian naira. Although for capital to flow into the Nigerian economy it might be either due to low price level relative to that of the foreign economy or high interest rate. Thus, increase in the Nigerian interest rate or low inflation rate will bring about increase in the in-flow of capital. This result also follows the findings of Ibrahim (2016), Oriavwota and Oyovwi (2012) and David (2017).

Table 4: Short-run Vector Error Correction Estimates

Dependent Variable: $\Delta \text{Log}(\text{EXC})$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.177634	0.060132	2.954075*	0.0064
$\Delta \text{Log}(\text{EXC}(-1))$	0.023200	0.217709	0.106565	0.9159
$\Delta P(-1)$	0.012323	0.005409	2.278252**	0.0308
$\Delta \text{INT}(-1)$	-0.068099	0.030377	-2.241786**	0.0334
$\Delta \text{OPEN}(-1)$	-0.000212	0.004282	-0.049552	0.9608
$\Delta G(-1)$	-0.009743	0.023393	-0.416505	0.6803
ΔCAPF	-0.056122	0.029364	-1.911254***	0.0666
$\mu(-1)$	-0.119942	0.054152	-2.214918**	0.0354
$R^2 = 0.254642$, F-statistic = 1.317745, Prob(F-statistic) = 0.280082, Durbin-Watson stat = 1.904225				

Source: E-views Analysis Computed by Author

*Note: * (**) [***] -1% (5%) [10%] Levels of Significance*

Conclusion

The paper investigates the determinants of exchange rate in Nigeria from 1980 to 2016 employing the Vector Error Correction Model (VECM) to establish the long-run and short-run determinants of exchange rate in Nigeria and the credibility of the PPP and interest rate parity theories in Nigerian economy. Haven carried out empirical analyses such as the unit root test, co-integration test which led to the use of VECM, the major long-run determinants of exchange rate were revealed to be changes in price level, interest rate differentials, trade openness, government purchases of tradable and non-tradable goods and the inflow of capital while the short-run determinants of exchange rate are inflation rate, interest rate differentials and inflow of capital. The dynamic model thus reveal that the PPP and interest rate parity theories are realistic only in the short-run, in the long-run they take inverse position.

Recommendations

Therefore, from the study, the following policy recommendations are made;

Since the changes in price level takes a depreciating effect on the nominal exchange rate, the monetary authorities are charged with the obligation of maintaining the price level at a rate which will attract capital inflow.

Again it is recommended of the monetary authority to fix the interest at a rate which will as well attract foreign investors into the country.

Efforts should be geared towards the design and implementation of policies which will attract foreign capital inflow.

Although not a major determinant of exchange rate in Nigeria, the degree of openness of Nigerian economy and government purchases of tradable and non-tradable goods should be increased.

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