Determinants of Exchange Rates in Nigeria: An Empirical Evidence Using the Portfolio Balance Model.

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Abstract: *Development of theories concerning determinants of exchange rate have been progressive with the Portfolio Balance model being the most intuitive addressing the criticisms of forerunner theories. A test of this model in Nigeria will contribute to the discussion on its relevance in nations' economies. The study aimed to identify key determinants of exchange rates in Nigeria and ascertain the individual and joint effects of identified variables on the Nigerian exchange rate. Secondary data used were mainly sourced from Central Bank of Nigeria Statistical Bulletin and World Bank data base for the period 1982 to 2018. The Ordinary Least square method of regression estimation was adopted for analyses. The study's model related changes in exchange rates to changes in reserves, domestic credit, foreign inflation, real income, domestic bond and foreign bond. None of the exogenous variables at 5% level of significance had significant effect on exchange rate, their joint effect was also not significant with an F statistics of 1.123, 21.2% of changes in exchange rate were accounted for by changes in the models variables. Domestic credit, foreign prices, reserves and real gross domestic product had negative coefficients at -0.126, -0.0824, -0.0826, -2.446 respectively, while foreign bond and domestic bond had positive coefficients at 0.0364 and 0.0900 respectively. Reserves, domestic credit and foreign bonds contradict theoretical expectation while foreign prices, real gross domestic product and local bonds were in agreement, furthermore, real gross domestic product had the highest effect on exchange rate. Monetary and fiscal policies that engenders investment in productive sectors should be implemented to bring about economic growth and a progressively appreciating exchange rate.*
Key words: *exchange rate, portfolio balance model, unit root test.*

I.   Introduction

Literature is replete with theories concerning key variables that determines a country's exchange rate. Reasons for this interest by researchers and economic policy makers is that exchange rate is symptomatic of domestic economic state and underlying foreign currencies serve as the medium of exchange between the domestic and the world market for goods and services, in addition, exchange rate indicates the competitiveness of a country in a globalized world (Ajao, 2015) and the discovery of its determinants will be a pointer for policy directions and formulation in other to achieve key economic objectives of price stability, increased output, full employment and balance of payment equilibrium. In an open economy, faced with globalization and financial liberalization, multinationals profitability are affected by movement in exchange rate and increase their exchange rate risk exposure. A stable exchange rate assist lenders and borrowers to evaluate profitability of investments, financing and hedging thereby reducing operational risks (Nieh 2015, Rahman and Hossain 2003)

Theories on exchange rate determination can be broadly categorized into traditional and modern, the Mint Parity theory, Purchasing Power Parity Theory and the Balance of Payment Theories constitute the former, while the Asset Approach, Monetary Approach and the Portfolio Balance approach constitute the latter. Development of the theories has been progressive, with the Portfolio Balance approach being adjudged the most intuitive addressing perceived criticism of the forerunner theories. Empirical works have adduced various macroeconomic indices as factors determining exchange rate, commonly mentioned variables are money supply, interest rate, inflation rate, trade openness, government expenditure, foreign inflation, exchange rate regime, central bank independence and changes in the balance of payment. (Andersen and Bollerslev 1998, Evans and Lyons 2005, Laakonen 2007, Pavasuthipaisit 2010, Quiabano and Divino 2010, Khan and Qayyumm 2011, Ibrahim 2016) Authors have variously experimented combinations of some of these variables in a model to determine exchange rate changes, however, these combinations lack theoretical basis. Determinants of exchange rate is an ongoing debate and yet to be settled in literature, this paper is an attempt to further illuminate the subject matter and suggestions on improved management of domestic exchange rate is imperative and worthwhile. This study therefore, seeks to identify key determinants of exchange rate in Nigeria and ascertain the individual and joint effects of the identified exogenous variables on the Naira to Dollar exchange rate using

empirical evidence within the framework of the portfolio balance model. The rest of the paper contains, the conceptual literature review, theoretical literature review, empirical literature review, methodology, results, discussions and findings, and conclusion respectively.

II. Conceptual Literature Review:

Exchange Rate: This refers to the rate in which a local currency exchanges for a foreign currency; it is otherwise called foreign exchange rate and usually stated as the amount of a local currency that will exchange for a unit of foreign currency. Once the exchange rate of a currency has been fixed, the rate will be maintained all over the world through arbitrage. An exchange rate of N100 to one United States dollar in Nigeria is equivalent to $0.01 to one naira in the United States. If the exchange rate is N150 to the dollar in Nigeria and $0.01 to the Naira in the United States, arbitrageurs will buy dollars in the United States to sell in Nigeria and realize N50 on every dollar sold, the increased supply of the dollar in Nigeria will cause Naira to appreciate and the equality will be restored. The reduction of exchange rate of Naira to the dollar refers to appreciation of the Naira and depreciation of the United States dollar while increase in the foreign exchange rate of naira to the United States dollar means depreciation of the naira and appreciation of the United States dollar.

Exchange Rate Volatility
Connotes the stability or explosiveness of an exchange rate series, Kilicarslan(2018), specified that it is a good measure of risk exposure to users of the underlying currency. A volatile exchange rate series connotes high risk. According to Gujarati (2013), volatility implies wide and sustained swings in a series, when an exchange rate series exhibits wide swings for a period followed by a period of relative calm, it is said to experience volatility clustering. Exchange rate changes or movement and volatility are not synonymous. A fixed exchange rate cannot be volatile but a floating exchange rate may be volatile or not. Volatility was also described as large fluctuations around the central value of exchange rate, or short term fluctuations around the long term trends of exchange rate. (Oaikhenan and Aigheyisi 2015, Giannellis and Papadopoulus 2011)

Exchange Rate Regime
Exchange rates of a country's currency to a foreign currency may be allowed to change and swing according to the dictates of the demand for and supply of the foreign currency or it may be defended by the government and allowed to be stable. When the rate moves according to the changes in the demand and supply structure of the foreign currency, it is said to be floating or flexible, and when it is defended by the government so that a particular rate is maintained despite the changes in the demand and supply structure, it is said to be fixed. The fixed and floating are extreme positions with undesirable effects, as such, policy makers have over the years tried various mid positions which have been termed, adjustable peg and managed float. The following paragraphs discuss these concepts in details.

Floating Exchange Rates:
Under the Floating exchange rate system, the exchange rate is being determined by the forces of demand and supply without any intervention from the monetary authority. If there is excess supply of foreign currency due to a rate higher than the equilibrium (supply greater than demand), bidders will bid the price lower and lower until equilibrium is restored that is appreciation of the local currency. On the other hand a lower than equilibrium exchange rate will lead to excess demand (demand greater than supply), and bid rate will become higher and higher until equilibrium is restored, a case of depreciation of the local currency. Shifts in demand or supply of foreign exchange leads to new market determined equilibrium rate without the government intervening to maintain the old rate.

Fixed Exchange Rate System.
Under this system, the government fixes a particular exchange rate by legislation, this rate is the rate where all exchange transactions are carried out and the government maintains and defends this rate by selling or buying foreign reserve. A rightward shift in demands for foreign exchange (due to increased imports) with a constant supply curve for instance will result into depreciation of the local currency, to maintain the rate at the former rate therefore, the monetary authority will have to cause a shift in the supply rightwards by selling reserves. In the case of reduced demands for foreign exchange the monetary authority does the reverse reflection by buying foreign currency.

Adjustable Peg
After the World War II and with the establishment of the International Monetary Fund, countries exchange rates were pegged in terms of gold or the US Dollar at $35 per ounce of gold, the fixed exchange rates were allowed to fluctuate within a band of 1% above or below the fixed rate if the country concerned can

convince the International Monetary Fund that it has a fundamental disequilibrium in its balance of payment. That is the exchange rate was largely fixed but allowed to float within specified limits. The system had many flaws and finally collapsed in 1971.

Managed Float

After the collapse of the adjustable peg system, the group of ten industrial countries met at the Smithsonian Institution in Washington and agreed to new stable rates but with wider bands. The bands were initially 2.25 percent above or below the parities, and it was further expanded to 4.5 percent in 1973. In 1972, the European countries agreed that their currencies could fluctuate within smaller bands in relation to one another but could fluctuate within the agreed Smithsonian bands in relation to countries outside Europe. This is called the Snake in the Tunnel.

The Smithsonian agreement broke down in 1973, and many countries reverted to the floating exchange rate system, the European countries agreement persist and now called Snake in the Lake as there is no more limits within which the European countries' currencies could fluctuate relative to other currencies. In 1979, the European Currency unit (ECU) was established, the ECU was a basket currency of a unit of account consisting of the major European currencies and member European country then fixes an exchange rate with the ECU which is pegged at that rate. Between 1973 and 1979 the adoption of the floating exchange rate system has become very popular among countries of the International Monetary Fund, this adoption of the floating rate system was largely due to large short term capital movement among countries, and the monetary authorities were unable to stop speculative activities during the regime of adjustable pegs. The high oil prices and the resultant recession of the industrialized countries in the 70s was also a factor. But the floating system is that of a managed float as it is without some level of intervention by the government, members countries of the International Monetary Fund where allowed to control the fluctuations in their exchange rates around some "normal limits", although the International Monetary Fund is Silent on what it termed normal. When government intervention is heavy, it is called Filthy Float and when there are no interventions it is called Clean Float.

THEORETICAL LITERATURE REVIEW:
The Mint- Parity Theory:

In the period between late 19th century and shortly after the Second World War, Gold was either the medium used for international trade settlement or all currencies were freely convertible to gold. Each currency has a fixed exchange rate to one ounce of gold, for instance if N100 can exchange for one ounce of gold and 200 cedis exchange for one ounce of gold then the exchange rate of naira to one cedis is 0.5. The relative exchange rates between any pair of currencies of the world was determined this way. This fixed rate was allowed to fluctuate within a band determined by the cost of transporting gold between any two countries. The upper band is called the gold export point or upper specie point, and the lower band is called gold import point or lower specie point.

The assumptions underlying the use of the mint parity theory are

i. The exchange price of gold to a country's currency once determined remains fixed.

ii. The country is ready to buy and sell any amount of gold at the fixed price

iii. Its supply of money consists of gold or paper currency which is backed by gold.

iv. Free movement of gold among countries is allowed

v. There is perfect capital mobility among countries of the world

vi. A country's price level varies directly with its money supply

vii. The adjustment mechanism is automatic through the workings of the Fisher's Quantity Theory of money; countries with surplus must accept gold and countries with deficits must pay gold.

The fisher's model equates quantity of money to its value through the equation

MV=PQ where M is the money supply, V is the velocity of money circulation, P is the price and Q is quantity of goods and services. Given a constant V and Q, a country with a surplus will accept gold and increase its money supply, this will result into increased prices and discourage exports while imports will be encouraged, the surplus will be wiped off and the equilibrium will be restored. In the case of a deficit, the country with the deficit must export gold and reduce its money supply, this will lead to reduced prices and exports will be encouraged while imports discouraged, this will ultimately cure the deficit. Critics of the Mint Parity Theory points to lack of free movement of gold, domestic prices being independent of fluctuations in the exchange rate and so forth. The theory has been jettisoned since the 1930s.

Purchasing Power Parity.

According to this theory, the exchange rate of any pair of currencies is the point where their respective purchasing powers are equal. The purchasing power of a currency is what a unit of the currency can buy which is determined by the price. According to Lipsey (2007), in the long term, the average exchange rates of any pair

of currencies depend on their relative purchasing powers. If one hundred naira can buy a bundle of goods in Nigeria and one Dollar can buy the same bundle in Great Britain, the purchasing Power Parity is N100 to a Dollar, this is taken to be the exchange rate of the Dollar to the Naira. Given a stable price level in the two countries, an undervalued naira (say N150 to $) makes imports dearer relative to local products, the demand for dollar will reduce and the equilibrium will be restored, the converse reflection applies in case the naira is overvalued (say N50 to $). The exchange rate of N100 to the Dollar based on the currencies purchasing power is not the actual exchange rate but modified by trade costs such as, transportation insurance, banking charges and so on, if the trade costs amount to N2, then the Upper limit called the Export Point is N102 to the Dollar and the lower limit called the Import Point will be N98 to the Dollar, as such the exchange rate of the Dollar to the naira will be allowed to fluctuate between N102 and N98. A Nigerian importer will be indifferent between buying a good for N98 in Nigeria and exchanging N100 for one Dollar to buy the same good in the Great Britain. The Purchasing Power parity Exchange rate is a moving par depending on the changes in the domestic prices of the countries involved. Jhingan (1997) identified two ways of using the Purchasing Power parity: the Absolute and the Relative. The absolute determines the exchange rates of currencies of any two countries as the ratio of the price indexes of the countries; on the other hand the relative measure takes the exchange rate as the domestic price of a foreign currency multiplied by the ratio of domestic price index to foreign price index. Symbolically the two measures are:

Absolute: $R_{ab} = P_a/P_b$. P_a and P_b are the price indexes of the countries concerned.

Relative: Domestic price of a foreign currency $\times P_a/P_b$. Policy makers prefer the relative measure because it is more intuitively appealing.

Despite the wide acceptance of the Purchasing Power parity theory as developed by Gustav Cassel, contenders of the theory points out the difficulty of calculating the price index due to differences in method, base year and coverage. The theory neglects the effect of capital movement, and structural changes in the economy which affects the price level, it also assume there is free trade whereas in reality there are various forms and degrees of trade protection implemented by countries of the world. Lastly, the direction of causality between exchange rate and price is yet to be established, again, the theory is only applicable in the long run; it fails to establish exchange rates in the short run.

The Balance of Payment Theory

This theory postulates that the exchange rate is determined by the forces of demand and supply for external currency as represented by the debit and credit sides of the balance of payment account respectively. Imports, unrequited outflows, and capital exports constitute debits and reasons for demanding foreign exchange, while exports unrequited inflows and capital imports constitutes the credits and supply of foreign currency. The equilibrium exchange rate is set where total debits of the balance of payments equals total credits , that is when the balance of payment is at equilibrium. Where there is a favourable balance of payment, credits exceed debits in the balance of payment, supplies of foreign exchange is more than the amount demanded, rates of exchange will be bided downwards making imports cheaper and increased, while supply of foreign exchange will be reduced until the equilibrium point is arrived at. Conversely in the case of deficit balance of payment where demands for foreign exchange is in excess of supplies, exchange rates will be bided upwards, imports will be reduced and exports encouraged until the equilibrium is arrived at again.

Opponents of this theory points to the facts that the assumption of free trade, perfect competition and that the demand for imported materials is inelastic do not hold in reality, countries impose various restrictions on trade to encourage exports while restricting imports and the demand for raw material is actually not perfectly inelastic. Again it's the changes in exchange rate that triggers correction of balance of payment problems and not the other way round and lastly the effect of domestic price levels of countries on the exchange rate is ignored in the analysis.

Modern Theories of Exchange Rate Determination

Before the 1970s theories of exchange rate determination were limited to the Mint Parity, Purchasing Power Parity and the Balance of payment Theories, movement in trade was thought to primarily determine the exchange rate as then, there were restrictions on capital movements among countries. As such a country with a deficit is expected to have a depreciating currency and a surplus country is expected to have an appreciating currency. But recent realities in world economic relationships have placed more emphasis on capital movements such that it now dwarfs trade movements. Again it has been noticed that some countries with deficit have appreciating currencies and those with surplus have depreciating currencies. These new evidences propelled new thoughts about exchange rate determination. The modern theories include, The Asset Approach, The Monetary Approach and the Portfolio Balance Approach.

The Asset Approach

This approach holds the view that exchange rates adjust to equilibrate international trade in financial assets instead of the traditional view that exchange rate adjust to equilibrate international trade in goods. The emphasis on financial assets is because goods prices adjust slowly relative to financial asset prices and financial assets are traded continually each business day. This is supported by the empirical evidence of higher volatility of exchange rate relative to trade prices. (Husted and Head 2007).

Asset approach models to exchange rate determination assume perfect capital mobility that is free capital flows, no capital restrictions or significant transaction costs, in such a situation the model of Covered Interest Parity holds.

Covered Interest Parity: The interest parity relationship results from profit seeking arbitrage activity. Let I_n and I_s be the interest rates in Nigeria and the United States respectively, and E and F be the spot and Forward exchange rates.

A ₦1 investment for one year in Nigeria earns (1+In). The equivalent of N1 in Dollars is 1/E Dollars, and if such is invested in the United States, it will earn $1/E(1+I_s)$. Since the investor is in Nigeria, the investment will have to be converted to naira and the returns will be exposed to interest rate risk. To cover such risk the investor will hedge by selling forward contract to be received in future period in the forward market, therefore the investment abroad becomes.

$1/E (1+I_s) F$.

The investor will be indifferent between $(1+I_n)$ local returns and $1/E (1+I_s) F$. if he invests abroad. That is

$(1+I_n)$ = $1/E (1+I_s) F$. ………………………………… 1

Equation 2 can be rewritten as

$$\frac{1+I_n}{1+I_s} = \frac{F}{E}$$ ……………………………………………………………2

Subtracting 1 from both sides, it results into

$$\frac{I_n - I_s}{1+I_S} = \frac{F-E}{E}$$ ……………………………………………..3

In general

$$\frac{I_n - I_f}{1+I_f} = \frac{F-E}{E}$$ …………………………………………..4

Equation 4 is the covered Interest Parity equation where I and I_f are the domestic and foreign interest rates and F and E are the Forward and Spot Exchange rates.

Since the relationship will hold continuously, spot and forward exchange rates as well as interest rates adjust instantaneously to changing financial market conditions.

Monetary Approach.

The Monetary approach explores an economic model relating money demand, money supply, balance of payment and exchange rate. The model assumes that base money has two components: Domestic Credit and International Reserves, there is perfect capital mobility and that domestic and foreign bonds are perfect substitutes. Given that Changes in the base money alters money supply.

In a small Open economy, demand for money can be expressed as.

$L = kPY$ ………………………………………………………………… 5

Where L is the demand for money, P and Y are price and income respectively and k is the constant. This equation holds as demand for money increases with increase in price and income.

The supply of money equation becomes

$M = R+ D$……………………………………………………………..6

Where M is the money supply, R the international reserves and D, Domestic Credit.

With the assumption of equilibrium in the money market, then money supply will equal money demand, thus

$L = M$ i.e

$KPY = R + D$ --7

Drawing from the Absolute Purchasing Power Parity

$E = P/P^f$ therefore $P= EP^f$ and substituting this in equation 7

$KEP^f Y = R+ D$ ---8

In terms of percentage changes equation 8 can be written as.

$E^/ + P^{f/} + Y^/ = R^/ + D^/$ $(K^/ =0$. since k is constant) ------------------------------------9

This can be rewritten as

$R^/ - E^/ = P^{f/} + Y^{/}- D^/$... …. 10

Equation 10 means that percentage change in reserves (the balance of payments) minus the percentage change in exchange rates is equal to the foreign inflation rate plus the percentage growth in real income minus the percentage change in domestic credit.

Equation 10 can be rewritten as.

$$E' = (R' + D') - P^{f'} - Y' \quad\text{...} \quad 11$$

That is changes in exchange rate can be accounted for by changes in money supply $(R' + D')$ minus foreign inflation rate, minus percentage change in real income.

In fixed exchange regime $E' = 0$ then

$$R' \quad = \quad P^{f'} + Y' - D' \text{ or } \quad (R' + D') = P^{f''} - Y' \quad \text{..........}12$$

That is with fixed exchange regime, money supply adjusts to money demand through international flows of money via balance of payment imbalances (Husted and Melvin 2007).

With a flexible exchange rate regime, there is no government intervention, that is reserve flows R' equal to zero, whereas exchange rates changes are non- Zero with flexible exchange rate, equation 10 becomes

$$E' \quad = \quad D' - P^{f'} - Y' \text{---}13$$

An increase in domestic credit will, given a constant P^f and Y (constant money demand) lead to an increase in exchange rate, and since E' is domestic currency units per foreign currency unit, an increase in E means that the domestic currency is either appreciating at a slower rate or depreciating at a faster rate. Under the monetary approach to exchange rate determination, domestic monetary policy will not cause flows of money internationally but will lead to exchange rate changes (Watson & Head 2007). Again increases in demand for money $(P^{f'} + Y')$ given a constant domestic credit will reduce the exchange rate.

A managed float exist where the exchange rate is determined freely by market forces but with central bank intervention to peg the rates at some desired level with a managed float, equation 10 holds , that is

$$R' - E' \quad = P^{f'} + Y' - D \text{…………………………………………………………………}14$$

That is given a money supply (D) and money demand $(P^{f'} + Y')$ condition , reserves can be adjusted to intervene in other to keep changes in exchange rate at desired level in other to keep the equality.

Portfolio Balance Approach

The Portfolio Balance Approach assumes perfect capital mobility like the Monetary Approach but differs from it by assuming that domestic and foreign bonds are not perfect substitutes. This assumption of imperfect bonds substitute made adjustments to the monetary approach imperative. Increase supply of domestic bonds for instance will increase the risk premium on domestic bonds; this will lead to the depreciation of domestic currency in the spot market. If the spot exchange depreciates today and the expected future spot rate remains unchanged, the expected rate of appreciation (depreciation) over the future increases (decreases). For instance, suppose the naira to the dollar rate is presently N200 to the dollar, suppose also that the Naira is expected to appreciate and become N190 to the dollar in one year's time. Then the expected rate of appreciation of the Naira is

$(200-190)/200 \times 100 = 5\%$

An increase in domestic bond supply will result into depreciation of the current exchange rate say to N205 per dollar, meaning that the expected rate of appreciation is now $205-190)/205 \times 100 = 7.3\%$

This way supply of the domestic and foreign bonds affects exchange rates and the monetary approach equation can be adjusted thus

$$E' \quad = \quad D' + B' - B^{f'} - P^{f'} - Y' \quad \text{----------------------------------- } 15$$

An increase in foreign bond supplies $B^{f'}$ causes the domestic currency to appreciate at a faster rate (E' falls) or appreciate at a slower rate. An increase in domestic bond supplies B' causes the domestic currency to depreciate at a faster rate ((E' increases) or appreciate at a slower rate.

In conclusion, the assumption that domestic bonds are perfect substitutes to foreign bonds as used under the Monetary Approach, do not hold in practice, this makes the Portfolio Balance Theory the most intuitive of all the theories of exchange rate determination. The Portfolio Balance Model adjusts for the effects of Money Supply, Money Demand, Domestic and Foreign Bonds and the effect of the absolute Purchasing Power Parity. The following comes to mind.

i. in a floating exchange system R' (Balance of Payment) will be Zero. Thus $E' = D' + B' - B^{f'} - P^{f'} - Y'$ ……………16

ii. with a fixed exchange system, changes in exchange rates is Zero (it is actually Fixed), and will be absent in the equation thus

$$R' \quad = \quad D' + B' - B^{f'} - P^f - Y' \text{…………………………………………………………}17$$

iii. With a managed float, equation 10 is adjusted for the effects of domestic and foreign bonds thus,

If $\quad R' - E' \quad = \quad P^{f'} + Y' - D'$ ………………………………………………………18

Then $E' = (R' + D') \quad - \quad (P^{f'} + Y')$ ………………………………………..…………………19

With the effects of bond prices the equation becomes

$$E' = (R' + D') \quad - \quad (P^{f'} + Y') + B' - B^{f'} \text{…………………………….………………}20$$

That is to arrive at increase in exchange rate (Depreciation of local currency) there must be an increase or positive change in money supply ($R^/ + D^/$), reduction or a negative change in demand for money ($P^{f/} + Y^/$), that is reduction in the price of foreign goods and reduction in real income or Wealth, there will also be an increase in the supply of local bonds (capital) and a reduction in the inflow of foreign capital (FDI). To achieve a domestic currency appreciation the reverse reflection holds, that is reduce money supply, increase wealth, increase in price of foreign goods, increase in foreign capital and reduction in domestic capital (Bonds).

III. Empirical Literature Review

Jhingan (1997), identifies macroeconomic variables that determine exchange rate, these include, price level, levels of import and export, protection policies and interest rate. The interplay of these variables ultimately affect the demand and supply of foreign currency which determine the exchange rate in a floating exchange rate regime, Ayinla (2014) further pointed out that trade balance between export and import majorly determines exchange rate, in addition, Obadan (2006) identifies weak production capacity, import dependence, low export, reduction in capital flow, debt burden, capital flight and unfavorable balance of payment as elements contributing to exchange rate changes and volatility.

Were, Kamau and kisinguh (2013), investigate exchange rate determination in Kenya using the Vector Error Correction Model (VECM), their results shows that current account balance contributes to the determination of exchange rate, increase current account balance, higher domestic interest rate relative to foreign interest rates and rise in foreign price level have appreciating effects on exchange rate, while rise in domestic price level is associated with a depreciating domestic currency. Khan and Qayyum (2010) presents an empirical evidence on Purchasing Power Parity (PPP) for the exchange rates of Pakistan domestic currency against the United States Dollar. The study usesJohanseen (1988) and Johansen and Juselius (1990) multivariate cointegration and bound testing cointegration approach over quarterly observations between 1982 and 2005. They establish evidence to support the existence of long run PPP.

Cuiabano and Divino (2010), test the variant of the monetarist exchange rate determination model described by Obstfeld and Rogoff (1996), for Brazil exchange rate, gross domestic product, Brazil interest rate, United States interest rate and inflation formed the variables. They establish the existence of long run equilibrium among the variables and conclude that the uncovered interest parity hypothesis did not hold in the period.Sakanko and David (2017), investigate the determinants of exchange rates in Nigeria using the Vector Error Correction Model (VECM) using data from 1980 to 2016. They identify domestic price level, interest rate, trade openness, government purchase of tradable and non-tradable goods and capital inflow as major long run determinants, while inflation rate and interest rate were identified as major short run determinants.

Oriavwote and Oyovwi (2012) investigate the determinants of real exchange rate using the Parsimonious Error Correction Model and data from 1970 to 2010. They identify capital flow, price level and nominal effective exchange rates as significant factors affecting real exchange rate, while, government spending, technological progress and terms of trade are not significant. Similarly Oke and Adetan (2018), adopt the Error Correction Mechanism (ECM) to examine the determinants of exchange rate in Nigeria using data from 1986 to 2016. The study conclude that Gross Domestic Product, interest rate and inflation are significant determinants of exchange rate in Nigeria within the sample period.

Considerable studies on the determinants of the volatility of exchange rates exists in literature, popular method to estimate volatility of exchange rate include the Autoregressive Conditional heteroscedasticity (ARCH), Generalised Autoregressive Conditional heteroscedasticity (GARCH), and the E-GARCH models. For instance,Abdalla (2012), investigate volatility characteristics (clustering, persistence and leverage effects) of exchange rate in selected Arab countries using the framework of the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model and daily observation from 1st January 2000 to 19th November 2011. Evidence of persistence and leverage effects were established and the study conclude that exchange rate volatility can be adequately modelled by the class of the GARCH models, similarly,Mirchandani, 2013, investigate macroeconomic factors leading to excessive volatility of the Indian Rupee using the correlation matrix. The study establish high correlation between exchange rate and macroeconomic variables of inflation, interest rate, foreign investment Gross Domestic product growth and current account balance. Furthermore, Kilicarslan (2018), investigate factors affecting exchange rate volatility in turkey within the period 1974 and 2016. The study adopt the GARCH model to generate the real exchange rate volatility series and the coefficients of the long run relationship between the variables are estimated using the FMOLS method. The study concludes that domestic investment, money supply and trade openness have positive relationship with exchange rate volatility, while foreign direct investment, output and government expenditures have negative relationship with real exchange rate.

Ajao (2015), used the GARCH (1, 1) and Error Correction Mechanism (ECM) to investigate the determinants of exchange rate volatility in Nigeria using data for 1981 to 2008. The study identify trade openness, government expenditure, interest rate movement and lagged values of exchange rates as significant

factors influencing real exchange rate. Similarly, Hassan, Abubarkar and Dantama (2017), adopt the ARCH models to investigate the sources of exchange rate volatility in Nigeria using quarterly data from 1989 to 2019. The study reveals that net foreign asset and interest rate have positive and significant impact on exchange rate volatility while the fiscal imbalance, economic openness and oil price have positive insignificant impact on exchange rate volatility.

IV. Methodology

Following the work of Cuiabano and Divino (2010), this work tests the portfolio balance approach to exchange rate determination which models exchange rate changes as being determined by changes in; money supply (reserves plus domestic credit), foreign inflation, real income and the balance between the supply of domestic and foreign bonds. Symbolically, the model is stated thus

$ER' = (R+D)' - (PF+Y)' + LB' - FB'$ …………………………………………………………..21

Where ER' is changes in exchange rate, R' is changes in international reserve, D' represents changes in domestic credit (credit to private sector), PF' is changes in foreign inflation(United States inflation rate) and Y' represents changes in real income (real GDP). Lastly LB' and FB' represent changes in the supply of domestic(total capital credits) and foreign bonds (total capitalcredits) respectively. To depict changes and correct for differences in measurements, the logarithm form of equation 1 will be used thus

$logER = \beta_0 + \beta_1 logR + \beta_3 logD - \beta_4 logpF - \beta_5 logY + \beta_6 logLB - \beta_7 logFB + U$ where u, is the stochastic error term. ……………………………………………………………………………22

*Apraori*logR, logD and logLB are expected to be positive and logPF, logY and log FB are expected to be negative.

Secondary data used in the study were mainly sourced from Central Bank of Nigeria Statistical Bulletin and World Bank data base for the period 1982 to 2018. The Ordinary Least square method of regression estimation was adopted for analyses. In addition, the variables were tested for unit root using the augmented dickey fuller (ADF) method and the series enters the equation at their stationary levels.

V. Results, Discussions And Findings.

Unit Root Analyses

Table 1: Result of unit root analysis using the Augmented dickey fuller method with trends and intercept

	Variables	Probabilities
1	Log ER	0.7957
2	D(log ER)	0.0003[*]
3	Log R	0.0403[*]
4	Log D	0.5200
5	D(logD)	0.0119[*]
6	Log PF	0[*]
7	Log Y	0.3769
8	D(log Y)	0.1189
9	D(log Y,2)	0[*]
10	Log LB	0.5505
11	D(log LB)	0.0144[*]
12	Log FB	0.6260
13	D(log FB)	0.0006[*]

Source: Authors' computation 2019.

Figures with asterisk indicate that variable is stationary

According to table 1, reserve, foreign prices and local bonds are stationary at level while exchange rate, domestic credit, foreign bond and local bond are stationary at first difference, however, income was stationary at second difference.

Test of Hypotheses and Significance

Table 2: regression result

Variable	coefficient	probabilities
C	0.990	0.0567
D(LD)	-0.1276	0.7456
D(LFB)	0.036	0.6868
D(LLB)	0.090	0.1129
LPF	-0.082	0.3935
LR	-0.083	0.1074
D(LY,2)	-2.446	0.1424
R	21.22%	
F	1.123	0.3777
DURBIN WATSON	1.96	

Table 2 indicates that increase in local bonds depreciates the Naira, while increases in foreign inflation and income appreciate the naira, these are in line with *apraori* expectation. However, contrary to expectation, increase in domestic credit and reserves (money supply) appreciate the naira meanwhile, increase in foreign bond depreciate the naira.

None of the exogenous variables have statistically significant effect on the Naira to the Dollar exchange rate. According to the coefficient of determination R^2, 21.22% of changes in exchange rate are caused by changes in the exogenous variable used in the study. This is corroborated by the F statistics which is not significant, that is jointly, the exogenous variables do not significantly affect exchange rate. The Durbin Watson statistics precludes the problem of autocorrelation.

VI. Conclusion

The study result shows that exchange rate determination in Nigeria can poorly be strictly modelled after the portfolio balance approach to exchange rate determination within the sample period. Expanding the exogenous variables to include more macroeconomic indices will be worthwhile, these variables may include, domestic inflation, interest rate, central bank independence, trade balance and government expenditure. Income has the highest effect on exchange rate, its close monitoring is imperative. Monetary and fiscal policies that engenders investment in productive sectors should be implemented to bring about economic growth and a progressively appreciating exchange rate in Nigeria.

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