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AN ECONOMETRIC ANALYSIS OF THE RELATIONSHIP BETWEEN EXCHANGE RATE DEPRECIATION AND INFLATION IN NIGERIA

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Abstract

Overtime, Nigeria has experienced persistent depreciation in its exchange rate, with inflation increasing at opposite direction, despite government's exchange rate policies to stabilize prices. Exchange rate is key in foreign trade, as no country can satisfy demands of its population by operating close economy due to nations are endowed with varying natural resources. Thus, exchange rate and inflation constitute key determinants of economic performance of any economy. This paper therefore investigates the relationship between exchange rate depreciation and inflation in Nigeria for the period 1980-2013, by applying Co-integration test, Vector Error Correction Model and Partial Correlation Coefficient analysis. Variables used in the study include inflation rate (INFR), exchange rate (EXCR), money supply (M2) and real gross domestic product (RGDP). The study conducted stationarity test, and found stationarity of the variables at second difference. The results of co-integration test revealed that long run relationship exist among the variables. Thus, since negative weak correlation value of -0.143 exist between inflation and exchange rate; the study recommends that government should consider both official and parallel exchange rate markets in its exchange rate policies, as over reliance on official market alone in tackling inflation problem would be frustrated, if parallel exchange market remained unchecked.

Keywords: Exchange Rate Depreciation, Inflation, Policy, Econometrics, Nigeria

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INTRODUCTION

In an economy, exchange rate is considered as an important instrument of macroeconomic policy. Increase or decrease in exchange rate both in tradable and non-tradable goods would seriously affect prices of goods and services in the country (Bobai et al., 2013). Due to influence of exchange rate on inflation movement in any economy, policy-makers have ever bordered about the behaviors of nominal and real exchange rates, and as well concentrated on the determination of exchange rate determinants of a nation. Obadan (2007) pointed out that to choose appropriate exchange rate regime in accordance with right level of exchange rate, is always the most critical decision facing an open economy due to its effects on economic performance, income distribution, standard of living, balance of payments, among other economic aggregates of the nation. In the same view, exchange rate was argued to be at the centre of macroeconomic policy debates in emerging economies (Sebastian, 2006). Nominal exchange rate is often applied as a way of reducing inflation, but in some countries like Latin America in most cases; exchange rate instrument is used as a way of taxing export sector. In that, currency crises abound and often result due to real exchange rate overvaluation.

Tamunonimim & Reginald (2013) explained exchange rate as a ratio between one unit of currency and the amount of another currency for which that unit is exchanged at a given period. Exchange rate plays important role in a country's level of trade. It is very critical for every free market economy. In real economy, exchange rate is the most watched, analyzed and government most manipulated macroeconomic indicator. Some countries try to control fluctuations in their currencies through imposition of restrictions on exchange rate movements. Exchange rate is classified into nominal exchange rate and real exchange rate. While nominal exchange rate involves monetary concept which measures relative prices of two currencies of two countries, real exchange rate on the other hand, measures relative prices of two goods involving tradable goods in relation to non-tradable goods. These two concepts are interrelated; in that, a change in nominal exchange rate will result in short run changes in real exchange rate. Therefore, as one of the most important prices in economy, domestic prices of traded goods, as well as exports and imports are seriously affected by exchange rate (Obadan, 2006). Appreciation or depreciation of exchange rate of a domestic currency has serious implication on economic activities of a nation. In a small open economy that does not have influence on the world prices of traded goods, an appreciation in the country's exchange rate would lead to low domestic prices of traded goods; while depreciation of the exchange rate value increases price of domestic traded goods.

In Nigeria, the analysis of exchange rate movements is very pertinent, knowing fully well that the economy has ever depended heavily on importation of goods and services. Therefore,

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any attempt by government to float exchange rate without corresponding economic diversification of the economy would result to exchange rate depreciation, which will in turn lead to increases in domestic prices of goods and services, and as well affects other macroeconomic indicators. Exchange rate depreciation appears to predict changes in other macroeconomic variables such as inflation, gross domestic product (GDP) growth, and fiscal deficit/GDP ratio etc. For instance, when Structural Adjustment Program (SAP) was adopted in Nigeria in 1986, procedures in foreign exchange allocation and import licensing were scrapped. Foreign exchange transactions were allowed to be determined by market forces under an auction system (Imimole & Enoma, 2011). This policy helped to remove the problem of overvaluation of the domestic currency; in that, naira was undervalued. Since then, the economy has persistently experienced exchange rate depreciation and increases in the imports' prices of goods and services of the country. For example, with the commencement of the structural adjustment program (SAP), exchange rate depreciated from N2.02 for a dollar to N4.02, N8.04 and N9.91 per dollar in 1987, 1990 and 1991 respectively. Inflation rates within these periods were 10.2%, 7.5% and 12.7% in 1987, 1990 and 1991, respectively (Honoland & Lane, 2003).

Similarly, the exchange rate further depreciated to N17.30 and N22.05 per dollar in 1992 and 1993 respectively, while the inflation rates rose to 44.8% and 57.2% in 1992 and 1993 respectively. Following the persistent depreciation of exchange rate in the economy, it then become necessary to completely reverse exchange rate floating policy in 1994 and reintroduce fixed exchange rate regime, with exchange rate of naira being pegged at N21.886 a dollar. However, the dismal performance of the economy at the end of that year, also led to reintroduction of floating exchange rate regime under autonomous foreign exchange market (AFEM), and this lasted for the period between 1995 and 1999. Consequently, exchange rate in return depreciated from the fixed rate of N21.89 a dollar in 1994 to all height of N81.00 a dollar in 1995. Barely one year after it was fixed, exchange rate further depreciated to N84.38 and N92.65 to a dollar in 1998 and 1999 respectively. It further depreciated to N128.75, N148.90, N150.298 and N164.02 in 2002, 2005, 2009 and 2010, respectively. The corresponding inflation rates were 76.8%, 51.6% in 1994 and 1995 respectively; by 1998, it declined to 11.9% and rose to 13.9% and 12.1% in 1999 and 2009, respectively; and again declined to 11.8% in 2010 (CBN, 2009, 2010).

Today, one of the central issues in Nigeria's economic policies is how to put inflation under effective control, using monetary and fiscal policies, as demonstrated in the various budgets and policy statements of the country. The continuous fall in the country's domestic currency was in line with the period of inflationary growth of the economy, which has resulted in continually falling in the standard of living of the average Nigerians (Rasaq, 2013). The period of

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the oil boom of 1970s automatically allowed for fiscal dominance by the government, coupled with series of macroeconomic imbalances that surfaced within the period, which has witnessed an upward trend in government revenue in terms of foreign exchange earnings from the sale of crude oil product. The massive oil revenue generated from the oil boom coincided with the post war era that led federal government to embark on massive spending on program such as reconstruction, rehabilitation and resettlement of the areas that were badly affected during the civil war. The above measures increased the currency in circulation and as a result, the annual growth rate of money supply further escalated from 56.6% to 91.3% in 1975 (CBN, 1982).

Meanwhile, monetary authorities, economists, as well as policy analyst have overtime worried over the adverse effects of inflationary pressure that emanate from exchange rate depreciation, having known that exchange rate and inflation rate are the major determinants of economic performance of any economy (Philip & Oseni, 2012). In Nigeria, persistent increase in price of goods and services dated back to mid-1970s, when fixed exchange rate policy was first adopted in the country. The situation worsened with the adoption of exchange rate deregulation regime in mid 1980s. Therefore, high inflation was according to civil war, salary awards (Udoji award) and excess public spending, as huge revenue was generated from oil boom era, which encouraged increase in public spending. This situation turn, triggered off high demand and high inflation in the economy. However, Elbadawi (1990) argued that exchange rate depreciation does not have any significant effect on inflation pressure in an economy, while Greene & Canetti (1991), Moser (1994) and Festus et al. (1994) argued that exchange rate movements is the major factor that explains inflationary change in an economy. It is against this background that this paper investigates the relationship between exchange rate depreciation and inflation in Nigeria.

REVIEW OF RELATED LITERATURE

Conceptual Issues

Exchange rate and inflation have been described as the key determinants of economic performance of any economy (Philip & Oseni, 2012). In view of this, assessing its relationship is pertinent because, an understanding of the nexus between exchange rate and inflation is very important for a successful adoption of inflation targeting as it would help to achieve some macroeconomic objectives of the country. Exchange rate is a key macroeconomic variable used as a measure for assessing international competitiveness. It can be described as an indicator of competitiveness of country's currency in which there is inverse relationship between the competitiveness of the currencies (Rasaq, 2013). To this end, as the value of the indicator decreases, the competitiveness of the country's currency increases in the international arena.

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Jhingan (2005) in his opinion identified variables influencing exchange rate of a country to include exports, imports and structural influences. When country's exports level is greater than its imports level, demand for the country's currency increases and it would positively affect the nation's exchange rate position. However, when the country's level of imports exceeds its exports level, demand for foreign currency would rise and exchange rate position of the country will move upward. Therefore, any policy that leads to increase in exports volume more than import volume of a country, will have tendencies to raise domestic currency value, vis-à-vis other foreign currencies. Philip & Oseni (2012) in supporting this argument explained that exchange rate influences an economy by affecting the values of domestic currency, external sector, domestic inflation, macroeconomic credibility, capital flows and financial stability. Therefore, increase or decrease in exchange rate of a country affects prices of imported goods and services, and hence, contributes to high inflation in the economy (CBN, 2008). In the same view, Adekunle (2010) opined that volatile exchange rate would make foreign trade and investment decisions more difficult, as volatility increases exchange rate risk.

Noer, Arie & Piter (2010) argued that the effect of exchange rate on inflation is a function of exchange rate policy position of a country. The regime of exchange rate policy of a nation plays key role in reducing fluctuations and risk in the real exchange rate, which affects inflation level and the entire economy. Imimole & Enoma (2011) described exchange rate depreciation as being responsible for increased local currency cost of imported inputs goods, such as raw materials and intermediate capital goods, as well as final goods via the channel of cost push inflation. It should be noted here that since non-tradable goods cannot be imported, excess demand for the goods leads to increase in prices in short run. Dewett (1982) postulated that currency devaluation makes imports of the devaluing country costlier and its demand for imports is elastic. A higher amount would adversely affect the balance of payments of the devaluing country. Then, if the demand for exports is elastic, with a fall in prices of exports as a result of devaluation, the foreigners will help to restore equilibrium in the demand for imports that is elastic and imports of the country will significantly reduce.

According to Umeora (2010), exchange rate, money supply, government deficit budget and interest rates are mainly responsible for inflation growth in different parts of the world in various degrees. However, the developing countries are worst affected by high inflation level. During high inflation period, currency loses its purchasing power. Adetiloye (2010) opined that inflation is a determinant of money supply, induced by price increases in an economy. It is affected by persistent currency depreciation in the process of exchange to goods and services. For import dominated economy, exchange rate devaluation will have positive effect on stock market by increasing input costs. Import dependence has serious implications on an economy.

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The least among them is imported inflation, which influences domestic prices of final goods. Sunusi (2007) cited in Bobai, Ubangida & Umar (2013) explained that a stable exchange rate is crucial for maintenance of price stability, as well as to attract foreign investment in an economy. For developing countries that are import dependent economies, and are importing virtually all its domestic fuel needs, foods and other items due to agricultural and manufacturing sectors neglects, would experience adverse effect on its prices of goods and services, as balance of payments would continue to be unfavorable. So, exchange rate stability is needed for price stabilization. It is in this view that most central banks across the world do intervene in the foreign exchange market in order to smoothen short run fluctuations of exchange rate.

BigBen (2009) stated that the ability of domestic firms to compete with its counterparts in the foreign firms in the international arena is predicated upon the relative price of domestic and foreign produced goods. He further illustrated that this relative price is to some extent, determined by the level of exchange rate. He therefore postulated that under purchasing power parity (PPP), relative prices ought to change in the same proportion with exchange rate movement. Schnabel (2007) cited in Asher (2012) theoretically argued that, floating exchange rate helps to easier adjustment in response to asymmetric country specific real shocks. In that, macroeconomic effect of low exchange rate volatility under fixed exchange rate regime is associated with low transactions costs for foreign trade and capital flow, thereby contributing to higher growth.

Generally, Obaseki & Bello (1996) cited in Asinya & Nelson (2014) identified three main theoretical foundations of exchange rate determination. These include traditional flow model, the portfolio balance model, the monetary model, as well as the purchasing power parity model, as a subset of the monetary model. The above models are some of the models that explain the relationship between exchange rate movements and inflation in the development literature. The explanations of these models are stated below.

Theoretical Framework

Traditional Flow Model

Traditional flow model argued that, it is market forces of demand and supply for foreign exchange that determines exchange rate in exchange market. The theory articulated that exchange rate is in equilibrium when the supply equates demand. And that current account imbalance is offset through net flow of capital in opposite direction. Therefore, a current account surplus is financed by acquisition of financial assets abroad or outflow of capital, while a deficit is financed by an inflow of capital. In this sense, current account is assumed to be a function of changes in relative prices and real income. Increase in domestic prices relative to foreign prices

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would result to exchange rate depreciation. This is because; increase in the domestic price is fed into costs thereby making exports costlier and highly competitive (Asinya & Nelson, 2014). Consequently, the supply of foreign exchange is limited. Imports on the other hand, increase since the inflation ridden economy is a more profitable place to export. If imports were very inelastic, import payments increase would raise demand for foreign exchange.

In the same token, Asinya & Nelson (2014) observed that exchange rate is determined by three main factors, which include relative price, income and relative interest rate. Increase in domestic interest rate relative to foreign interest rate would cause appreciation of exchange rate through induced capital inflow. So, a country that intends to strengthen its exchange rate must raise interest rate, lower prices and reduce real growth. An increase in real income leads to increase in the demand of imported commodity, and hence, exchange rate depreciation. Equally, an increase in domestic price relative to foreign prices would bring a negative effect on the exchange rate. The domestic goods would be more expensive in relative to foreign goods. This would lead to increase in import and finally to disequilibrium in exchange rate.

The Monetary Model

Monetary model attempts to explain changes in exchange rate in relation to changes in the demand for and supply of money between two trading countries. It identified the determinants of exchange rate to include money supply, real income and interest rate. The model explained that increase in money supply causes exchange rate to depreciate as a result of inflationary pressure that it generates. More so, increase in real income with fixed nominal money supply causes prices to change, leading to appreciation of exchange rate. While an increase in domestic interest rate was identified to lower demand for money and raises prices, and increase in prices leads to depreciation of exchange rate (Asinya & Nelson, 2014). However, one of the major criticisms of monetary model is the assumption that domestic and foreign bonds are close substitutes. Hence, it was argued that if two assets are not close substitutes, then account must be taken of the differences in their prices and yields.

The portfolio balance model

This model assumed that residents distribute their resources or wealth among three forms of assets, namely; monetary base, domestic bonds and foreign bonds. Exchange rate is in equilibrium when the holdings of these assets are in desired proportion. Increase in domestic wealth leads to rise in either monetary base, a holding from government bonds or from the current account surplus. Again, an increase in wealth increases demand for foreign bonds or

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assets leading to a depreciation of exchange rate as a result of capital outflow generated (Asinya & Nelson, 2014).

Moreover, increase in private sector holding of government bonds would drive bond prices down and raises interest rate. This situation would lead to appreciation of exchange rate, while an increase in domestic government bonds has uncertain effect on exchange rate. The rate of exchange rate may appreciate or depreciate, depending on the relative strength of substitution and income effects. It would appreciate if the substitution effect is stronger, and depreciate if the substitution effect is weak. An increase in foreign bonds would lead to capital flight, thereby increasing the demand for foreign exchange. Consequently, it would result to depreciation in the exchange rate. However, the major criticism of asset disturbance model is that it ignores the major determinants of trade, the role of expectations, as well as the role of purchasing power parity.

The Purchasing Power Parity model

The concept of purchasing power parity (PPP) is a crucial assumption in both versions of the monetary and portfolio balance models. The model was propounded by a Swedish economist known as Gustar Cassel in 1920. The theory represented a synthesis of the work of the nineteenth century economists like Ricardo, Wheatley and Thornton, etc. It argued that consumers should be able to buy the same quantity of goods in any country at the same amount of currency (Lyon, 1992 cited in Asher, 2012). It argued that the equilibrium exchange rate between two inconvertible paper currencies would be determined by equality of their purchasing powers. The major argument of the purchasing power parity model is that, exchange rate determination depends on the levels of relative prices. The implication is that in every change in price level, exchange rate also changes. The theory attempts to explain the equilibrium value of the exchange rate in terms of differences in inflation rate between two countries. In that, it assumed that exchange rate of currencies of two countries move in a way that seeks to offset the inflation differential between the two economies thereby maintaining real purchasing power of the two currencies. In view of the theoretical reviews above, this study adopts purchasing power parity theory to explain the relationship between exchange rate depreciation and inflation in Nigeria. This is because, the model laid more emphasis on the forces of demand and supply for foreign exchange as the main factor that determine exchange rate in an economy. Furthermore, the model explained that exchange rate depreciation has the capacity to increase export of a country, and as well make import price relatively high. And that domestic price of goods and services would be affected, thereby reducing purchasing power of the people through high prices of commodities in the economy.

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Empirical Review

Several scholars have empirically investigated the relationship between exchange rate depreciation and inflation both in the context of developed and developing economies. Some of which include Umeora (2010) who examined the effects of money supply and exchange rate on inflation in Nigeria for the period between 1982 and 2009 using multiple regression analysis (SPSS). A model was constructed with inflation being dependent variable, while money supply and exchange rate were employed as the independent variables. The empirical results showed that while money supply and exchange rate are correlated, each affects inflation in varying degrees. However, money supply was shown to have positive effect on inflation, while exchange rate has negative effect on inflation.

Imimole & Enoma (2011) examined the impact of exchange rate depreciation on inflation in Nigeria for the period 1986-2008, using Auto Regressive Distributed Lag (ARDL) co-integration procedure. The variables employed in the investigation include inflation rate, nominal exchange rate, money supply, government expenditure and real gross domestic product (RGDP). The empirical findings showed that exchange rate depreciation, money supply and real gross domestic product are the main determinants of inflation, and that exchange rate depreciation has positive and significant long run effect on inflation in Nigeria. Maku & Adelowokan (2013) examined the determinants of inflation rate, amidst macroeconomic fluctuations in Nigeria for the period between 1970 and 2011, using autoregressive model. The variables used in the investigation include inflation rate, growth rate of gross domestic product, growth rate in money supply, ratio of fiscal deficit, ratio of import to GDP, first lag of inflation rate, exchange rate, and interest rate. The results indicated that fiscal deficit and interest rate have positive effects on inflation rate in Nigeria. Similarly, macroeconomic indicators such as real output growth rate, broad money supply growth rate, and previous level of inflation rate also exert increasing pressure on the inflation rate of the country.

Philip & Oseni (2012) empirically investigated the nexus among monetary policy, exchange rate and inflation rate in Nigeria, using co-integration and multi-variate vector error correction model for the period 19862010. The result showed that long run relationship exist among the variables, while the vector error correction model (VECM) estimation showed that a unidirectional causation exist between exchange rate and inflation rate. Adetiloye (2010) investigated the relationship between exchange rate and consumer price index (CPI) in Nigeria, using the techniques of correlation and Granger causality analysis to examine the significance of the relationship existing between consumer price index and exchange rate. It was found that there is high positive relationship between the ratio of imports and the index that existed between the parallel and official rates. The coefficient between autonomous exchange rates and

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the consumer price index (CPI) is less significant than official rate. In the same way, Asinya & Nelson (2014) examined exchange rate depreciation and government policies in Nigeria, using ordinary least squares (OLS) econometric technique for 1980-2011. Econometric model used in the study include unit root test, co-integration test and Vector Error Correction (VEC) model. The result empirically showed that significant relationship exist between government fiscal and monetary policies and exchange rate depreciation.

Bobai, Ubangida & Umar (2013) examined the impact of exchange rate volatility on inflation in Nigeria's economy for the period between 1986 and 2010, using Vector Error Correction Mechanism, impulse response function, variance decomposition, ARCH and GARCH. A stationarity test was carried out using the Augmented Dickey-Fuller (ADF) and Phillip-Peron (PP) tests. The variables were found to be stationary at first difference at 5% level of significance. The VECM result indicated a negative shock between exchange rate and inflation; that is, a one percent increase in inflation rate would lead to about 42% decrease in exchange rate. The major findings from the ARCH and GARCH results showed that the presence of volatility is persistent.

BigBen (2009) studied the impact of money supply and exchange rate on the consumer price index in Nigeria for the period from 1971 to 2005, using Granger causality test and Vector Error Correction analysis. The variables employed in the study include consumer price index, nominal exchange rate, money supply and real domestic output. The empirical results indicated that both money supply and exchange rate causes consumer price index, whereas causality runs from the consumer price index to money supply and exchange rate. The result also, showed that money supply and exchange rate both have positive impact on the consumer price index. The VECM results suggested that money supply is not an effective policy variable for the control of inflation in Nigeria. The results further identified exchange rate, as an effective policy instrument for efficient moderation of consumer price index. Tamunonimim & Reginald (2013) investigated the causal relationship among exchange rate, balance of payments, external debt, external reserves, gross domestic product growth rate and inflation rate in Nigeria's post Structural Adjustment Program (SAP). Annual time series data ranging from 1987 to 2011 were used as the research sample period. The analytical methods used in the study include Augmented Dickey-Fuller (ADF) and Philip-Peron unit root tests, Johansen co-integration test, equation estimation and Granger causality tests. Johansen co-integration result showed that there exists a long run equilibrium relationship among the indicators. The Granger causality test showed a unidirectional causality relationship running from exchange rate to balance of payments, external reserves and gross domestic product growth rate. The independent variables indicate a unidirectional causality from gross domestic product growth rate to external

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reserve. However, the empirical evidence also showed that there is a causal relationship between exchange rate and some macroeconomic indicators in Nigeria in post SAP period.

Adeniji (2013) empirically examined the impact of exchange rate volatility on inflation in Nigeria using ADF, PP and KPSS test of unit root tests, Johansen-Julius co-integration test, VECM model, Granger causality test, impulse response function and variance decomposition for the period of 1986 - 2012. The unit root test result showed that all variables were stationary at first difference, while Maxi-eigenvalue showed long run relationship among the variables. VECM test result established positive and significant relationship among inflation, exchange rate, money supply and fiscal deficit, while gross domestic product showed negative relationship in that regard. Granger causality result showed a bi-directional relationship between all the variables; subsequently, exchange rate was found to influence inflation in Nigeria. Rasaq (2013) analyzed the impact of exchange rate volatility on macroeconomic variables in Nigeria using correlation matrix, ordinary least square (OLS) and Granger causality test. The findings showed that exchange rate volatility has a positive influence on gross domestic product, foreign direct investment and trade openness, but with negative influence on the inflation rate in the country.

Osei-Fosu & Osei-Fosu (2013) examined the nexus between stock prices and exchange rates in Ghana by applying standard unit root test to each of the time series, co-integration test, as well as the Granger causality test. The tests indicated that there is evidence of long run relationship between stock prices and exchange rates and that no causality runs between the two variables. Sami, Syed & Parvez (2012) investigated the relationship between foreign direct investment (FDI) and exchange rate volatility. The results demonstrated that FDI has positive association with exchange rate depreciation and that exchange rate volatility deters FDI. The results of Granger causality test suggested that exchange rate volatility granger causes foreign direct investment but not vice versa.

Adeyemi, Paul & Oluwatomsin (2013) investigated the impact of currency devaluation on Nigeria's trade balance using Johansen co-integration and variance decomposition analyses from 1970 to 2010. The variables used in the investigation include trade balance, real domestic income, domestic money supply, domestic interest rate, and nominal exchange rate. The empirical results indicated that long run relationship exist among trade balance, domestic income, domestic and foreign money supply, domestic interest rate and nominal exchange rate. The major findings of the study include that exchange rate induce an inelastic and significant relationship with trade balance in the long run. More so, the result indicated that causality does not run between exchange rate and trade balance and that money supply volatility contributes more to variance in trade balance than exchange rate volatility.

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Aminu, Bello & Salihu (2013) examined the impact of exchange rate volatility on export in Nigeria, by applying Ordinary Least Square (OLS), Granger causality test, ARCH and GARCH techniques and Augmented Dickey-Fuller technique were used to test the presence of unit root. The study showed that exchange rate impact positively on export. More so, the elasticity results revealed that, demand for Nigerian products in the World market is fairly elastic. Therefore, for export to improve and foreign exchange earnings to increase, the country should devalue its currency by reducing the prices of its products so as to increase demand, which involved changing from import-led to export-led economy. Oyovwi (2012) examined the impact of real exchange rate volatility on Nigeria's imports, using the Augmented Dickey-Fuller (ADF) unit root test, and co-integration test. Parsimonious ECM model was also estimated with the Schwarz criterion and Akaike information criterion as lag length selection criterion. The result indicated that real exchange rate volatility has no significant effect on Nigeria's imports. Alalade, Adekunle & Joseph (2014) investigated the effect of exchange rate regimes on non-oil export revenue in Nigeria. It specifically focused on the effects of some macroeconomic variables such as inflation, price index, gross domestic product (GDP), exchange rate and degree of openness as had on non-oil export revenue in Nigeria as well as the performance of the non-oil export sector over the period ranging from 1986 to 2010. The study discovered that exchange rate, degree of economic openness, GDP, inflation rate and price index collectively accounted for increase in non-oil export revenue. The study also discovered that one percent increase in the naira exchange rate result to a decrease in non-oil export revenue. Similarly, BigBen (2011) examined the relationship between real exchange rate and aggregate trade balance in Nigeria. The empirical results suggestion showed no cointegration in the trade balance model. The results further showed that depreciation and/or devaluation improves trade balance and that Marshall-Learn (ML) condition holds for Nigeria within the period under review. Opaluwa, Umeh & Abu (2010) examined the impact of exchange rate fluctuations on the Nigerian manufacturing sector. The result of the study showed that exchange rate fluctuation has adverse effect on manufacturing GDP.

Loto (2011) investigated the effect of exchange rate depreciation on the Nigeria's trade balance for the period from 1986 to 2008. The empirical results showed that devaluation and/or depreciation does not improve the trade balance, since the sum of demand elasticities for imports and exports is less than unity, the Marshall-Lerner condition do not hold. The study therefore, concluded that devaluation or depreciation cannot improve the trade balance of Nigerian economy. Devaluation or depreciation can only benefit countries that are originally export based before the devaluation or depreciation of the currency. Oladipupo & Onotaniyohuwo (2011) empirically investigated the impact of exchange rate on the balance of

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payments position of Nigeria, using Ordinary Least Square (OLS) method for the period of 1970 - 2008. The empirical result indicated that exchange rate has significant impact on balance of payments position of Nigeria. The result also showed that exchange rate depreciation actually lead to improved balance of payments position if fiscal discipline is imposed. Victor & Samuel (2012) investigated the relationship between real exchange rate and inflation in Nigeria using co-integration test, error correction model (ECM) and ARCH technique for the period between 1970 and 2010. This result showed that inflation has been susceptible to real exchange rate fluctuations in Nigeria. Noer, Arie & Piter (2010) conducted a comparative investigation of the relationship between inflation rate and the real exchange rate, using explorative statistics and granger causality test. The study found a strong correlation between the movements of inflation rate and the real exchange rate in most countries investigated by using data covering 1986-2008 and adopting autoregressive distributed lag model (ARDL) and co-integration techniques.

Mandizha (2014) studied the relationship between inflation and exchange rate depreciation in Zimbabwe's infamous hyperinflation for the period from 2001 to 2005, using Granger causality test. The result indicated that exchange rate has positive impact on economic growth. Similarly, the result indicated that interest rate and inflation rate have negative impact on economic growth of the country. Babatunde & Olufemi (2014) investigated the relationship between exchange rate volatility and monetary policy shocks in Nigeria using classical ordinary least square, Engle-Granger approach and error correction mechanism model (ECM). The results revealed that both real and nominal exchange rates in Nigeria have been unstable. The results also showed that the variation in the monetary policy variable explains the movement and behaviour of exchange rate through a self-correcting mechanism process with little or no intervention from the monetary authority. Obansa, Okoroafor, Aluko & Millicent (2013) empirically investigated the relationship existing among exchange rate, interest rate and economic growth in Nigeria for the period of 1970-2010 through the applications of vector auto-regression (VAR) approach, with specific emphasis on impulse response factor and forecast error variance decomposition. The empirical result of the study showed that exchange rate has greater impact on economic growth than interest rate in the economy.

RESEARCH METHOD

Research Design

This paper examines the relationship between exchange rate depreciation and inflation, as well as the impact of exchange rate deprecation on inflation in Nigeria for the period 1980-2013. The study adopts ex-post facto research design in the investigation. The analytical methods employed in the study include Co-integration test, Vector Error Correction Model (VECM) and

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Partial Correlation Coefficient analysis. The Co-integration test examines the long run equilibrium relationship between exchange rate and inflation, while the Vector Error Correction Model (VECM) looks into the short run dynamics and long run relationship between the variables. More so, the Partial Correlation Coefficient analysis test investigates examine the degree of correlation between exchange rate and inflation in Nigeria. The variables employed in study include inflation rate (INFR) as the dependent variable, whereas the independent variables include exchange rate (EXCR), money supply (MS) and real gross domestic product (RGDP). In order to obtain estimation results, computer application of econometric package of E-view version 7.0 is used to estimate the econometric approaches mentioned above.

Model Specification

The model illustrating the relationship between exchange rate depreciation and inflation in Nigeria is specified as follows:

$$INFR = f(EXCR, MS, RGDP) \quad (1)$$

In linear function, the model is as follows:

$$INFR = \delta_0 + \delta_1 EXCR + \delta_2 MS + \delta_3 RGDP + e_t \quad (2)$$

Where;

INFR = Inflation Rate, EXCR = Exchange Rate, MS = Money Supply, RGDP = Real Gross Domestic Product, δ_0 = Constant term, e_t = error term, and δs = coefficients of the regression equation.

Data Description and Sources

In order to empirically examine the relationship between exchange rate depreciation and inflation, as well as the effect of exchange rate depreciation on inflation in Nigeria, inflation rate (INFR) is used to represent annual percentage change in price level of commodities in the economy. Hence, inflation rate is measured by annual percentage change in consumer prices. Furthermore, real exchange rate (EXCR) is used to represent the rate at which a unit currency of a country exchanged for another. It is the value of one country's currency in terms of another country's currency. Real exchange rate is defined as the product of nominal exchange rate, expressed as the number of units of foreign currency per domestic currency unit. It is the relative price level, expressed as the ratio of price level in the domestic country to the price level in the foreign country. Thus, it involves two countries that used exchange rate as a bilateral rate. Money supply (MS) on the other hand is total volume of money in circulation at any given period. Real gross domestic product (RGDP) is used as a common proxy for economic growth; real gross domestic product (RGDP) is the GDP as adjusted for inflation, hence, it is obtained

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by deflating the nominal GDP with GDP deflator. However, data for these variables are sourced from the Central Bank of Nigeria (CBN) annual Statistical Bulletin ranging from 1980 to 2013 years.

Estimation Procedures

3.4.1 Unit Root Test

This estimation procedure examines the unit root level of the series used in the investigation. It enables the study to determine the integrated order of the data series through the application of the Augmented Dickey-Fuller (ADF) unit root test. The test will accept the alternative hypothesis of there is stationarity, if it found the time series to be integrated of the same order, and reject the null hypotheses of non-stationary, if it found otherwise. Hence, ADF test is conducted by applying the following regression equation.

$$\Delta yt = \alpha_0 + \alpha 1 yt\text{-}1 + \sum_{n=1}^{n} \alpha \Delta y; + et \quad (3)$$

$$\Delta yt = \alpha_0 + \alpha 1 yt\text{-}1 + \sum_{n=1}^{n} \alpha \Delta y; + \delta t + et \quad (4)$$

n = 1

Where;

Y represents a time series, t = linear time trend, Δ = first difference operator, α_0 = constant, n = optimum number of lags in the development variable and e_t = error term. Hence, if the result of ADF fails to reject the test in levels but rejected it in the first difference, it implies that the series contains one unit root and it is of integrated order one. But if the test fails to reject the test in both levels and at first difference, but rejects it in second differences, it means that the series contains two unit roots and it is of integrated order two.

Co-integration Test

This stage of estimation procedure tests the long run equilibrium relationship among the data series of the same order via Johansen co-integration test. The meaning is that, if in the long run, two or more data series move closely together, whether the series itself is trended, the difference between them is constant. Theoretically, they can wander arbitrarily far away from each other. Johansen & Juselius (1990) stated that achieving result in this test amounts to establishing maximum-likelihood test procedure. Meanwhile, Johansen co-integration model is expressed below:

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$$\boldsymbol{\lambda}\ \text{trace}\ (r) = -T\sum_{i=r+1}^{\wedge} \ln\ (1-\lambda\ t) \quad (5)$$

Where;

T= number of usable observations, $\boldsymbol{\lambda}$ = estimated eigenvalue from the matrix; trace test (λ trace) tests null hypothesis. Rejecting null hypothesis implies that the data series contain unit root and should be differenced at least once to achieve stationarity.

Vector Error Correction Model (VECM)

The estimation procedure involved using conventional vector error correction model (VECM) to investigate the short run dynamics and long run equilibrium relationship among the data series. The application of VECM is necessary because, it is used to correct temporary short run deviation of a series within long run equilibrium relationship. The model of VECM is specified thus:

$$\Delta Y_t = a_0 + a_1 \Delta X_t + a_2 u_{t-1} + \varepsilon_t \quad (6)$$

Where;

$Y_t = Y_t - Y_{t-1}$, a_1 and a_2 are the dynamic adjustment coefficients of the data series, u_{t-1} is the residual lag that refers to as short run deviation from the equilibrium position, and it is estimated to correct long run equilibrium error, ε_t is the error term. This method is applied because the study employed more than one endogenous variable. The model for the vector error correction model is expressed below.

$$\Delta LINFR_t = \beta_0 + \beta_1 \Delta EXCR_{t-1} + \beta_2 \Delta MS_{t-1} + \beta_3 \Delta RGDP_{t-1} + ECM_{t-1} + U_t \quad (7)$$

Where;

ΔL **=** change in natural logarithm of the variable; for example, $\Delta LINFR_t$ **=** a change in natural logarithm of inflation rate, β_0 **=** constant term, βs are coefficients of the independent variables, ECM = error correction model and U_t = error term. This method is estimated in order to investigate the dynamic behavior of the relevant variables.

Partial Correlation coefficient analysis

This step of estimation procedure is focused on the analysis of partial correlation coefficient analysis. It measures the strength and direction of relationship among the variables of the study. A low correlation coefficient implies weak correlation, while a high correlation coefficient suggests strong correlation between the variables. Direction of change depends on the sign borne by the coefficient value. If the coefficient value borne positive sign, it means that the change of the dependent variable moves in the same direction with the independent variable (s)

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and vice-versa. Hence, to measure the correlation coefficient of the variables, Pearson correlation coefficient analysis is adopted and the model is represented as thus:

$$r_{XY.Z} = \frac{r_{XY} - r_{XZ}\, r_{YZ}}{\sqrt{(1 - r^2_{XZ})(1 - r^2_{YZ})}} \quad (8)$$

Where;

r = correlation coefficient, x and y are the variables used in the investigation.

EMPIRICAL RESULTS AND DISCUSSIONS

Unit Root Test

Table 1: Augmented Dickey Fuller (ADF) Unit Root Test
Trend and Intercept (Series at level)

Series	ADF Test Statistic	5% Critical values	10% critical values	Remarks
INFR	-3.015452	-3.552973	-3.209642	Not Stationary
LEXR	-0.809024	-3.552973	-3.209642	Not Stationary
LMS	-2.262735	-3.552973	-3.209642	Not Stationary
LRGDP	-12.56618	-3.552973	-3.209642	Stationary

Sources: Researcher's compilation from E-views 7

Table 2: Augmented Dickey Fuller Unit Root Test
Trend and Intercept (Series at 1st Dif.)

Series	ADF Test Statistic	5% Critical values	10% critical values	Order	Remarks
INFR	-5.476967	-3.557759	-3.212361	1	Stationary
LEXR	-5.231429	-3.557759	-3.212361	1	Stationary
LMS	-3.029292	-3.557759	-3.212361	1	Not Stationary
LRGDP	-40.36867	-3.557759	-3.212361	1	Stationary

Sources: Researcher's compilation from E-views 7

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Table 3: Augmented Dickey Fuller Unit Root Test

Trend and Intercept (Series at 2nd Dif.)

Series	ADF Test Statistic	5% Critical values	10% critical values	Order	Remarks
INFR	-7.458753	-3.562882	-3.215267	2	Stationary
LEXR	-8.448866	-3.562882	-3.215267	2	Stationary
LMS	-7.094621	-3.562882	-3.215267	2	Stationary
LRGDP	-33.97706	-3.562882	-3.215267	2	Stationary

Sources: Researcher's compilation from E-views 7

The above tables 1 to 3 represent the estimation of unit root test. The results show that all the variables become integrated of the same order at second difference, through the application of the Augmented Dickey-Fuller (ADF) unit root test at 5% and 10% critical values. In comparing the values of the ADF statistics and the critical values at the chosen critical values, the results showed that the values of ADF statistics of the variables are individually greater than the chosen critical values at second difference (see table 3), which means that the time series become stationary after second difference. The implication is that, since the study found the variables to be integrated of the same order at second difference, it means that the study can proceed to estimate for long run relationship among the variables in order to achieve a better empirical result.

Co-integration Test

Table 4: Unrestricted Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	
None *	0.685059	65.40473	47.85613	0.0005
At most 1	0.391838	29.58822	29.79707	0.0528
At most 2	0.261423	14.17149	15.49471	0.0784
At most 3 *	0.142826	4.777561	3.841466	0.0288

Source: Researcher's compilation from E-views 7

Trace test indicates 1 co-integrating equation(s) at the 0.05 level

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Table 5: Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.685059	35.81650	27.58434	0.0035
At most 1	0.391838	15.41673	21.13162	0.2608
At most 2	0.261423	9.393930	14.26460	0.2548
At most 3 *	0.142826	4.777561	3.841466	0.0288

Source: Researcher's compilation from E-views 7

Max-eigenvalue test indicates 1 co-integrating equation(s) at the 0.05 level

Tables 4 and 5 above represent the estimation of co-integration test through the application of Johansen co-integration method. The results indicated one co-integrating equation in both the trace statistic and the max-Eigen statistic. This means that it is only one value of the trace statistic and max-Eigen statistic in the estimation results that is greater than the chosen critical value (5%), and it implies that long run equilibrium relationship exist among the variables since at least there is one co-integrating equation. The evidence of this claim is shown in Tables 4 and 5, as indicated by the p-values of 0.0005, 0.0528, 0.0784 and 0.0288 respectively, for the variables such as INFR, EXCR, MS and real GDP respectively. The result also illustrated that eigenvalues are statistically greater than zero, which further confirmed the results of the max-Eigen statistic. Drawing from the above facts, the study therefore rejects the null hypothesis (H_0) of no long run equilibrium relationship between the variables, and accepts that long run equilibrium relationship exists between exchange rate and inflation.

Vector Error Correction Model (VECM) Test

Since long run equilibrium relationship have been established in the co-integration investigation, the study proceed with the estimation of vector error correction model (VECM) in order to examine the short run dynamics and long run relationship among the variables. Hence, the estimation result is shown below.

Table 6: Vector Error Correction Model Test

Co-integrating Eq:	CointEq1
INFR(-1)	1.000000
LEXR(-1)	-24.98557
	(4.32512)
	[-5.77685]

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Table 6....

LMS(-1)	30.69409			
	(5.91162)			
	[5.19217]			
LRGDP(-1)	-53.05800			
	(18.1445)			
	[-2.92419]			
C	338.9040			
Error Correction:	D(INF)	D(LEXR)	D(LMS)	D(LRGDP)
CointEq1	-0.598965	0.006124	-0.004592	-0.000397
	(0.21674)	(0.00581)	(0.00140)	(0.00071)
	[-2.76353]	[1.05320]	[-3.28271]	[-0.55781]
D(INFR(-1))	0.088598	-0.001685	0.000282	0.001175
	(0.17995)	(0.00483)	(0.00116)	(0.00059)
	[0.49235]	[-0.34904]	[0.24287]	[1.98668]
D(INFR(-2))	-0.099452	-0.008207	0.001103	0.000644
	(0.20098)	(0.00539)	(0.00130)	(0.00066)
	[-0.49483]	[-1.52206]	[0.85015]	[0.97414]
D(LEXR(-1))	-12.13363	0.289891	-0.062095	-0.010751
	(10.4268)	(0.27972)	(0.06729)	(0.03428)
	[-1.16370]	[1.03637]	[-0.92280]	[-0.31361]
D(LEXR(-2))	9.973107	0.084050	0.031856	-0.020179
	(8.46135)	(0.22699)	(0.05461)	(0.02782)
	[1.17867]	[0.37028]	[0.58338]	[-0.72539]
D(LMS(-1))	-2.204196	0.322685	0.174573	0.031170
	(29.9733)	(0.80409)	(0.19343)	(0.09854)
	[-0.07354]	[0.40130]	[0.90249]	[0.31630]
D(LMS(-2))	23.67238	-0.837499	0.362577	-0.047097
	(29.7466)	(0.79801)	(0.19197)	(0.09780)
	[0.79580]	[-1.04949]	[1.88871]	[-0.48157]
D(LRGDP(-1))	-178.1841	2.135791	-1.336295	0.414105
	(83.7826)	(2.24763)	(0.54070)	(0.27545)
	[-2.12674]	[0.95024]	[-2.47144]	[1.50335]
D(LRGDP(-2))	4.233254	0.060775	-0.096405	-0.046192
	(8.60208)	(0.23077)	(0.05551)	(0.02828)
	[0.49212]	[0.26336]	[-1.73659]	[-1.63332]
C	3.584477	0.116596	0.180497	0.046357
	(9.54635)	(0.25610)	(0.06161)	(0.03139)
	[0.37548]	[0.45528]	[2.92978]	[1.47700]
R-squared	0.555394	0.187911	0.603361	0.492893
Adj. R-squared	0.364848	-0.160127	0.433373	0.275562

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The table 6 above illustrates the estimation results of the vector error correction model (VECM). In the estimation, the results showed that the relationship between the variables met a priori expectation of the study; thus, it satisfied the stability condition of the study as well. This implies that the estimation results possessed the desired negative sign for each of the equation, and that the value of error correction model (ECM) is less than one, which means that it falls within the accepted region. Error correction term (ECT) has a value of -0.598965, with its associated t-statistical value of -2.76353. This implies that the speed of adjustment between the short run dynamics and the long run equilibrium relationship is 59.9%. The result also indicated that exchange rate (EXCR) has negative and significant effect on inflation rate (INFR). Therefore, this finding negates the findings of other studies as reviewed in the study.

Similarly, the results showed that the value of F-statistics is 2.915, while its associated Prob(F-statistics) value is 0.0208. This demonstrated that the joint influence of the explanatory variables such as exchange rate (EXCR), money supply (MS) and real GDP on the dependent variable (INFR) is statistically significant. The result also revealed that the value of the computed coefficient of multiple determination (R^2) is 0.555394, which implies that 55.5% of the variations in INFR are explained by the independent variables, while the remaining 44.5% of the variations is attributed to other factors not included in the model.

Partial Correlation Coefficient Test

Table 7: Correlation Coefficient Test

	INFR	LEXCR	LMS	LRGDP
INFR	1	-0.14277	-0.24288	-0.19125
LEXCR	-0.14277	1	0.942011	0.836101
LMS	-0.24288	0.942011	1	0.88867
LRGDP	-0.19125	0.836101	0.88867	1

Source: Researcher's compilation from E-view 7

In table 7 above, the estimation result illustrates the test of partial correlation coefficient test. In the correlation matrix, the result indicated no strong correlation between inflation (INFR) and the independent variables such as exchange rate (EXCR), money supply (MS) and real gross domestic product (RGDP). The correlation coefficients values of the independent variables include -0.143 (EXCR), -0.243 (MS), and -0.191 (RGDP) respectively. These imply that negative and weak correlation exists between the dependent and the independent variables as indicated

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by the negative coefficient values of the variables. The implication is that the explanatory variables including exchange rate (EXCR) does not have significant correlation with inflation rate in Nigeria.

CONCLUSION AND RECOMMENDATIONS

The primary objective of the study is to examine the relationship between exchange rate depreciation and inflation, as well as the impact of the exchange rate on inflation in Nigeria for the period from 1980 to 2013, through the applications of Co-integration test, Vector Error Correction Model (VECM) and Correlation Coefficient analysis. The study employed ex-post facto research design by employing Nigeria's data obtained from the Central Bank of Nigeria (CBN) statistical bulletin from 1980 to 2013. The variables used for the investigation include inflation rate (INFR) as the dependent variable, whereas the independent variables involves exchange rate (EXCR), money supply (MS) and real gross domestic product (RGDP). Unit root test was conducted, and the result indicated that all the data series were integrated of the same order at second difference at 5% and 10% level of significance.

More so, the result of the Johansen co-integration test demonstrated that long run equilibrium relationship exists between inflation rate and the independent variables such as exchange rate (EXCR), money supply (MS) and real gross domestic product (RGDP). The result of the Vector Error Correction Model (VECM) revealed that exchange rate (EXCR) does not have significant effect on inflation rate (INFR) in Nigeria. On the average, it was estimated that 1% increase in exchange rate, decreases inflation in Nigeria by 24.9%. ECT result indicates that it will take 59.9% annually to correct temporary deviation within long run equilibrium relationship in the economy. Furthermore, the results of the partial correlation coefficient test illustrated that weak and negative correlation exists between the dependent variable (inflation rate) and the independent variables (exchange rate, money supply and real gross domestic product). This implies that a change in each of the independent variable(s) does not significantly lead to changes in the dependent variable.

In view of the findings above, the study therefore recommends as follows: that government should consider the activities of the parallel exchange rate market in its exchange rate policies while tackling inflation problem in the economy, as effort to stabilize prices would always be altered by unofficial exchange rate activities. The study also recommended that government should expand the scope of monetary authorities in order to strengthen them to control the activities of parallel exchange market in order to avoid continuous hike in exchange rate as seen in the corridors of foreign exchange market today, as depending solely on official exchange rate would not capture the reality of the exchange market. Similarly, government

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should look inward to encourage production of export goods, rather than continuing to devalue or depreciate the country's currency without tradable goods to export and reap the gain accrue to such devaluation policy.

The researchers appreciate that no work is all encompassing. We therefore suggest that further study should include other macroeconomic variables in the model and also expand the scope of the data, if data are available, to capture larger sample size.

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