

# AN EMPIRICAL ANALYSIS OF THE DETERMINANTS OF EXCHANGE RATE VARIATIONS IN NIGERIA

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## **Abstract**

*The study examines the determinants of exchange rate variations in Nigeria. Exchange rate is the price of one country's currency in terms of another country's currency. It is expected that stable exchange rates will facilitate economic growth. Based on the model specified, time series data were collected from secondary sources for the period 1980-2011. The ordinary least squares and cochrane-ortcutt regression techniques were used to analyze the data. The results indicate that inflation rate, interest rate and real gross domestic product play vital role in determining exchange rate variations in Nigeria. It was therefore recommended that government should ensure fiscal balance and effective monetary policy through contractionary fiscal and monetary policies to guarantee exchange rate stability.*

**Key words:** Exchange rate variations, ordinary least squares, Cochrane-ortcutt and Nigeria.

An exchange rate is the price of one country's currency in terms of another country's currency. This is the ratio at which two currencies are exchanged or traded for each other. The direction of trade between two countries depends on the exchange rate. It is therefore, important to say that exchange rate determines the terms of trade – a ratio at which a country can trade domestic products (exports) for her imports. A country's exchange rate is an important determinant of growth and its international competitiveness (Bah and Amusa, 2003; Walters and De Beer, 1999). Instability in the nation's exchange rate until 2006 was a unidirectional depreciation in all markets. However, with the introduction of the Wholesale Dutch Auction System (WDAS) in

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2006, the exchange rate has been stable with agreement of rates among the various segments of the foreign exchange market. These foreign exchange markets include Official Market/Interbank Foreign Exchange Market, Bureau de Change and Parallel Markets. As at 2008, the Naira exchanged for an average of N177 / US \$ 1 as against N281.7 / US\$1 in the parallel market in 1995. From this variation, we can imply that the naira has been appreciating over the United States dollar and other major comparative currencies. However, the Wholesale Dutch Auction System was replaced with the Retail Dutch Auction System (RDAS) early in 2009 and the naira depreciated to N180 per dollar in most Bureau De Change outlets in the country. This trend was blamed on the inability of the Central Bank of Nigeria (CBN) to meet increasing demand for foreign exchange. Also, it has been alleged that when the real exchange rate is perceived to have become excessively misaligned, it discourages domestic agents from holding assets domiciled in the domestic currency, which is a potential source of capital flow and exchange rate problems.

Variations in exchange rate are bound to affect domestic activities adversely and this will in turn, impair the attainment of sustainable growth and development which is the key objective of developing countries. Omotor (2008) posits an indirect linkage between inflation and real exchange rate. In order to conduct international transactions between countries with different currencies, it is necessary to exchange one currency for another. This study seeks to identify the determinants of exchange rate variations in Nigeria and explain the implications of such variations.

### **Statement of the Problem**

There has been a renewed interest in exchange rate management in Nigeria going by the structural imbalances relating to the production base that is weak and the nature of economy which is not diversified, import dependent production structure, fragile export base and low non-oil export earnings (Obadan, 2006). Various exchange rate movements have been witnessed in Nigeria both in the pre-SAP (fixed exchange rate) regime and the post-SAP (flexible exchange rate) regime and various problems attached to these regimes. However, the period was bedeviled by sharp practices perpetrated by dealers and end users of foreign exchange. These problems informed the need to adopt a more flexible exchange rate regime at the beginning of SAP in 1986. Since 1986 nevertheless, Nigeria has been witnessing persistent problems of import dependency, political instability, inflation, capital flight and lack of motivation for backward linkages in the production process. Solving these problems will give us valuable insight into the phenomenon of exchange rate variations and its determinants.

### **Literature Review**

#### **Conceptual Clarifications**

According to Anyanwu and Oaikhenan (1995), exchange rate refers to the price of one currency (the domestic currency) in terms of another (the foreign currency). Iyoha (2003) notes that exchange rate is the link between the various national currencies in the sphere of international trade and payments. It is simply a price i.e., it is the relative price of a given currency in terms of another. Indeed, the concept of exchange

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rate is so vital and critical that it is normally used to describe the international monetary system in use at any time (Iyoha, 2003). In other words, international finance experts often use the term, exchange rate system to mean and identify an international monetary system – set of rules, regulations, conventions and institution that govern the settlement of international debts. In a similar manner, O’Sullivan and Shelfrin, (1998) looked at exchange rate as the rate that measures a unit of foreign currency per dollar, that means, for Nigeria and United States N150:\$1. The importance of exchange rate determinants cannot be overemphasized when dealing with international or open economics.

### **Determinants of Exchange Rate Variations**

An exchange rate denotes the value of a nation’s currency in terms of another currency at a given point in time. The leading theory of exchange rate determination in the long run is the theory of Purchasing Power Parity (PPP). This theory is credited to Gustav Cassel in 1920 and states that the PPP is simply obtained as the product of the base period exchange rate and the ratio of relative price between the trading countries. The purchasing power parity theory will hold exactly if there are no transportation costs or other barriers to trade internationally. According to Okoduwa (2005), the purchasing power parity in practice do not actually reflect the exchange rate because all goods and services are not traded internationally and exchange rates tend to reflect only the value of goods and services traded internationally. Iyoha, (2002) explains there are three basic approaches to the issue of exchange rate determination. Okojie (2006), Jhingan (2005) and McConnel and Brue (1999) identified the determinants of exchange rate as changes in price, changes in exports and imports, capital movements, influence of bank rate, speculation, stock exchange influence, changes in taste, changes in interest rates, relative income changes, policy of exchange control and protection, nature of the economy, political condition and structural changes.

### **Theoretical Framework, Model Specification and Methodology**

#### **Theoretical Framework**

There are various theories and approaches that are associated with determinants of exchange rate. Some of these approaches are explained as follows:

#### **The Traditional Flow Model (TFM)**

The traditional flow model of exchange rate views exchange rate as the outcome of the interaction between the demand for foreign exchange and the supply of foreign exchange. In simple term, it postulates that the exchange rate is determined by the forces of demand for and supply of foreign exchange. The model states that exchange rate is in a state of equilibrium when supply equals demand for foreign exchange. Hence any divergence in the exchange rate is translated into imbalance in the current account (Iyoha, 2002).

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This model summarized the determinants of the real exchange rate (RER) as follows;

$$R_x = f(I, Y_d, r)$$
$$\frac{\partial R_x}{\partial I} > 0; \frac{\partial R_x}{\partial Y_d} > 0 \quad \frac{\partial R_x}{\partial r} < 0$$

The independent variable I and r can also be defined as

$$I = I_d/I_f$$

$$r = r_d/r_f$$

Where  $R_x$  = Exchange Rate

$I_d$  = Domestic Rate of Inflation

$I_f$  = Foreign Rate of Inflation

$y_d$  = Domestic Interest Rate

$r_d$  = Foreign Interest Rate

$r$  = Domestic Interest relative to foreign interest rate.

From the model above, it is prescribed that a country intending to strengthen its exchange rate, must raise interest rate, reduce real income level and lower prices.

### **Portfolio Balance Model (PBM)**

This is also called the asset disturbance model. Okhira and Saliu (2008) assume that there are three forms of assets which are monetary base, domestic bonds and foreign bonds which economic agents may hold in their portfolio. According to Iyoha, (2002), the portfolio balance model views the determination of exchange rate as resulting from both the substitution between money and financial assets within the domestic economy and the substitution between domestic financial assets and foreign assets. The model (PMB) further states that the exchange rate is in equilibrium when the holding of the assets are in their desired proportion. The model mathematically states:

$$R_x = f(MB, DB, FB)$$

$$\frac{\partial R_x}{\partial FB} < 0; \frac{\partial R_x}{\partial MB} < 0 \quad \frac{\partial R_x}{\partial DB} > 0$$

The model above states that, an increase in demand for foreign bonds (assets) leads to depreciation of  $R_x$ ; also an increase in the monetary base leads to depreciation of  $R_x$  but the increase in demand for domestic assets (bonds) leads to appreciation of  $R_x$ . The R is the exchange rate from the domestic country's point of view.

### **Model Specification**

Based on the literature reviewed and theoretical framework, we have been able to establish some form of relationship between exchange rate and some key variables such as inflation rate, interest rate and real gross domestic product (RGDP). This relationship is expressed below in the functional form as follows;

$$ER = f(INFL, INTR, RGDP)$$

This can be expressed in econometric form as:

$$ER = \alpha_0 + \alpha_1 INFL + \alpha_2 INTR + \alpha_3 RGDP + U_t$$

Where:

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ER = Exchange Rate

INFL = Inflation Rate

INTR = Interest Rate

RGDP = Real Gross Domestic Product

$U_t$  = Error term

The apriori expectations are presented thus;

$\alpha_0, \alpha_1,$  and  $\alpha_3 > 0$

$\alpha_2 < 0$

From the apriori expectations, there should be a positive and direct relationship between the independent variables – inflation rate and real gross domestic product and dependent variable – exchange rate. On the other hand, a negative and inverse relationship exists between exchange rate and interest rate.

**Methodology of the Study**

This study made use of secondary data from various sources among which are the National Bureau of Statistics, Central Bank of Nigeria Statistical Bulletin and Annual Report and Statements of Account. This study adopted the Ordinary Least Squares (OLS) regression technique to analyze the variables in the model.

**Presentation and Interpretation of Results**

**Table 1: Relationships between Exchange Rate and the Explanatory Variables (Ordinary Least Squares Estimation)**

Dependent Variable	Explanatory Variables	Estimated Coefficient	Standard Error	T-Ratio
Exchange Rate	INTP	-38.1124	17.6555	-2.1587
	INFL	-.24279	.28979	-0.83779
	INTR	-.38319	1.0986	-0.34880
	RGDP	.3006.3	.3313	9.0748
$R^2 = .79058$ D.W = .62727		$\bar{R}^2 = .76545$	F(3,25) = 31.4597	

$$EX = \alpha_0 + \alpha_1 INFL + \alpha_2 INTR + \alpha_3 RGDP + U_t \quad (4.1)$$

$$-38.1124 - 0.24279 INFL - 0.3819 INTR + 0.3006.3 RGDP$$

$$(-2.1587) \quad (-0.83779) \quad (-0.34880) \quad (9.0748)$$

**Note:** The figures under each coefficient in bracket are the t-ratios.

The results estimated in table 1 above examined empirically the determinants of exchange rate variations in Nigeria. Exchange rate is the dependent variable while inflation rate (INFL), interest rate (INTR) and Real Gross Domestic Product (RGDP) are the independent variables. The F-statistic of 31.45 shows that the model is statistically significant both at 1% and 5% levels of significance because the observed F-value is greater than the F - table value of 4.68 and 2.99 respectively. It also depicts a high linear

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relationship between the dependent variable (ER) and the regressors (INFL, INTR and RGDP).

The coefficient of determination ( $R^2$ ) shows the explanatory variables explained over 79% of the systematic variations in exchange rate in Nigeria. The other 21% are attributed to other determinants of exchange rate variations not explicitly stated in the model. The adjusted coefficient of determination of over 75% was high which suggests a strong explanatory power or ability of the regressors. The model therefore exhibits a good fit.

The RGDP and interest rate conformed to the apriori expectations while inflation rate did not. The t-ratios for the regressors are statistically significant for RGDP and INFL at 5% significance level. This is because the observed t-values are greater than the t-table values with RGDP (9.0748) greater than 1.71 and INFL (0.83779) greater than 0684. But the interest rate (0.34880) is not significant since its observed t-value is less than the t-table value and less than 2.0 following the rule of the thumb. The Durbin-Watson statistic test indicates the presence of positive autocorrelation in the model with a value of 0.62727 which falls outside the region of acceptance ranging from 1.80 to 2.20. The model also has with the problem of multi-collinearity as its t-ratios are very low except for RGDP. In order to correct these problems of positive autocorrelation and multi-collinearity and in order to make the t-ratios highly significant, a further test, the Cochrane-Orcutt method was used. The result obtained using the Cochrane-Orcutt shows that the model was free from autocorrelation and that the t-ratios became highly significant. This is shown in table 2 below.

**Table 2 Relationships between Exchange Rate and the Explanatory Variables (Cochrane-Orcutt Method AR (7) Converged After 29 Iterations)**

Dependent Variable	Explanatory Variables	Estimated Coefficient	Standard Error	T-Ratio
Exchange Rate	INTP	81.8926	35.0168	2.3387
	INFL	.27897	.12960	2.1525
	INTR	2.3939	.77460	3.0904
	RGDP	-.4464.3	.1660.3	-2.6888
$R^2 = 0.94249$ $\bar{R}^2 = .89021$ D.W = 2.2283     F(10, 11) = 18.0271				

$$EX = \alpha_0 + \alpha_1 INFL + \alpha_2 INTR + \alpha_3 RGDP + U_t \quad - \quad - \quad - \quad - \quad (4.2)$$

$$81.8926 + 0.27897 INFL + 2.393 INTR - 0.4464.3 RGDP$$

$$(2.3387) \quad (2.152) \quad (3.0904) \quad (-2.688)$$

**Note:** The figures under each coefficient indicate the t-ratios.

The results estimated in table 2 above empirically examined the determinants of exchange rate variations in Nigeria. Exchange rate is the dependent variable while the explanatory variables consist of interest rate, inflation rate and Real Gross Domestic Product. From table 2, over 94% of the systematic variations in exchange rate in Nigeria

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can be explained by the independent variables while the remaining 6% is captured by the error term. The F - statistic is quite significant for its value of 18.03 is greater than the F - table value of 4.54 at 1% significance level. The  $\bar{R}^2$  of 0.89 shows a high level of goodness of fit of the model.

The inflation rate variable conformed to the expected sign while the interest rate and RGDP were wrongly signed. The results show that all the t-ratios are significant at the 5% level because the observed value for INFL (2.15), INTR (3.09) and RGDP (2.68) are all greater than the table value (1.18). The Durbin-Watson statistic of 2.22 shows the absence of serial correlation or autocorrelation in the model as against what was experienced in table 4.1.

## **Conclusions**

Based on the model specified, time series data were collected from secondary sources for the period 1980-2011. Using the Ordinary Least Squares and Cochrane-Orcutt regression techniques of analysis, the results indicated that inflation rate, interest rate and real Gross Domestic Product play vital roles in determining exchange rate variations in Nigeria and hence, affect economic growth. However, for the domestic economy to create wealth and generate employment for its citizens, it has to produce more, import less, export more and buy more local goods. All these and in particular, the exchange rate determinants cited in this study if properly harnessed, will bring about the right exchange rate which will in turn, facilitate the optimal performance of the Nigerian economy as part of the new integrated global village. Therefore, the government should ensure the following;

1. Restructuring the economy to ensure diversification of the production base in order to increase output productivity thereby, lowering inflation.
2. Ensuring fiscal balances and effective monetary policy: This is done by contractionary fiscal and monetary policies to guarantee exchange rate stability.
3. There is the need to guide trade liberalization policy. Here, the government must pursue a realistic and pragmatic exchange rate policy in the less free trade areas that would stem capital flight and ensure more investment in the Nigerian economy. This is necessary so as to prevent the fluctuations in the exchange rate.
4. Stabilizing the earnings from crude oil upon which the economy depends heavily: Through the stabilization of the crude oil earnings, over-dependence on importation would be reduced, thereby, strengthening the export base to include the non-oil export earnings.
5. Reducing the excess demand for foreign exchange: This will result to the overvaluation of the local currency especially under the fixed exchange rate.

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