# Real Exchange Rate Determinants in Nigeria (1971-2000)

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*Abstract* - Nigeria possesses most of the prerequisites for building a strong and vital economy. However, all this potentials cannot automatically transform the country into prosperous nation. Conscious efforts and policies are required to encourage and attract domestic and foreign investors to improve the competitiveness of a nation. Conscious efforts and policies are required to encourage and attract domestic and foreign investors to improve the competitiveness of a nation's economic base. The study was set to analyze the Exchange Rate determinates in Nigeria (1971 – 2000). Six (6)  variables were used in the exchange rate model namely: balance of payment, fiscal deficit, import tax, openness of the economy, trends and exports tax. Data on these variables were obtained largely from Central of Nigeria's publication and empirically analyzed using econometric technique.

*GJMBR-B Classification :* *JEL Code : F31*

REAL EXCHANGE RATE DETERMINANTS IN NIGERIA 1971-2000

*Strictly as per the compliance and regulations of :*

# Real Exchange Rate Determinants in Nigeria (1971-2000)

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*Abstract -* Nigeria possesses most of the prerequisites for building a strong and vital economy. However, all this potentials cannot automatically transform the country into prosperous nation. Conscious efforts and policies are required to encourage and attract domestic and foreign investors to improve the competitiveness of a nation. Conscious efforts and policies are required to encourage and attract domestic and foreign investors to improve the competitiveness of a nation's economic base. The study was set to analyze the Exchange Rate determinates in Nigeria (1971 – 2000). Six (6) variables were used in the exchange rate model namely: balance of payment, fiscal deficit, import tax, openness of the economy, trends and exports tax. Data on these variables were obtained largely from Central of Nigeria's publication and empirically analyzed using econometric technique. The result reveals that the coefficient of multiple determination, $R^2$ became 0.95 percent with Durbin-Watson of 2.00. The result further reveals that import tax, trend, openness of economy and export tax had positive coefficients, implying a direct positive relationship between these variables and the real exchange rate. Hence, measures to improve the competitiveness of the economy should revolve around these four variables. However, openness of the economy, fiscal deficit and import tax were significant at 1 per cent probability level.

## I. Introduction

Protectionist trade policies in Nigeria emerged in the early 1960s, following the explicit adoption of an import substitution industrialization strategy as well as the deterioration in the country's terms of trade. There was also the associated balance of payments disequilibrium in the wake of the expiration of the commodity export boom of the post World War II era. Thus, an import – prohibiting tariff structure (comprising mostly duties above 50 per cent) was put in place. The Civil War of the late 1960s appeared to have given further impetus to the protectionist tendencies, as an appreciation of the nominal exchange rate was deliberately permitted.

Apart from its well known spending effect, the oil boom of 1973 – 1980 appears to have influenced changes in the country's external sector policy on three fronts. First, a substantial reduction in tariff rates (with import duties mostly below 50 per cent) was made. Second, a liberalized (and indeed generous) foreign exchanged and import payment policy was implemented. Third, there was a relatively greater use of quantitative restrictions (as opposed to import tariffs) in the period, especially following the first oil glut of 1976 – 1978 and the resulting balance of payments disequilibrium. However, in 1973 – 1978, a deliberate policy of naira appreciation was pursed and given the tremendous fiscal response of the government to the oil windfalls, a real appreciation of the exchange rate resulted. In the context of the Dutch disease phenomenon, such a real appreciation of the exchange rate, in the period of an export boom, was theoretically efficient. The long-run implication of such a development, however, especially in terms of sustainability, appears to have been missed or disregarded in policy circles. The end of the oil boom around 1980 brought about a phenomenal rise in the level of Nigeria's external debt, which grew at an unprecedented annual rate of 76 per cent between 1982 and 1985 (Ogun, 1995 b). Further, tariff rates on a variety of imports were hiked substantially as tariff rates in excess of 150 per cent became a common feature of Nigerian trade policy. In addition, the extent and use of quantitative restrictions in the period were unprecedented in the economic history of the country. In essence, over the period 1960 – 1985, the real exchange rate of the country appears to have been appreciated by restrictions, oil windfalls and external debt.

In the spirit of the structural adjustment programme introduced in 1986, most of the aforementioned policy measures, which were assumed to be quantitative restrictions, became considerably narrowed. An interim tariff structure implemented in 1988 reduced tariff rates on most imports to below 50 per cent and a further review planned for 1994 was to produce a uniform tariff structure for the country. The auction market for exchange rate determination, which was introduced in 1986, appeared to have effectively checked the over-valuation of the nominal exchange rate. However, over 1985 – 1990, the country's external debt stock grew at an approximate average rate of 70 per cent to about US $33 billion. Essentially, therefore, the external debt burden of the country and the burgling balance of payments deficits appear to have constituted the prime factors accounting for changes in the real exchange rate in the post 1985 period.

The real exchange rate, which is commonly defined as the relative price of tradable to non-tradable, is an implicit rather than an explicit price. As a result, its

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definition and measurement procedure can sometimes be a subject of controversy. However, the real exchange rate index is often considered to be representative of international competitiveness and is used as a guide to monetary and exchange rate policies. The real exchange rate has come to be regarded as a very important issue in the current discussions on structural adjustment programme in Sub-Sahara Africa since it sent signals for inter and intra-sectoral resource allocation and long run growth of the economy, (Elbadawi, 1989). It is defined as the relative price of tradables to non-tradables in an economy and it measures the cost of domestically producing tradable goods (Edwards, 1988). Thus, it determines the degree of competitiveness of the economy and its external performance.

Overtime, three different concepts and measurement frameworks have been used for the equilibrium real exchange rate. The first approach is the purchasing power parity doctrine, which associates the equilibrium exchange rate with the value of the nominal exchange rate in a period of external balance (known as the base year), adjusted for inter-country differences in inflation rates between the current year and the base year. Three defects are usually associated with the purchasing power parity example, in Nigeria, external equilibrium could be associated with some years of oil boom. However, using any of these years as a representative equilibrium base year could be misleading since the value of the nominal exchange rate in the period was sustained by a transitory phenomenon. Second, under the purchasing power parity approach, equilibrium real exchange rate is deemed as a constant that does not change. However, in a world in which domestic and foreign goods are imperfect substitutes and there are real stocks to the system, it is desirable to have deviations from purchasing power parity. The reason is that the real exchange rate must adjust to the stock and this will require movements in the nominal exchange rate and domestic and foreign price levels (see Ballassa, 1964; Flood, 1981, Mussa, 1982; McGuirk, 1983; Baldwin and Krugman, 1987). Third, purchasing power parity does not seem to hold very well in the short run and probably not in the long run either (Dornbusel, 1980a; Frenkel, 1989).

## II. METHODOLOGY

### a) Analytical Technique

The model of our study is a single-equation model made up of a dependent variable and six (6) independent (explanatory) variables. The method of multiple regression analysis will, therefore, be used to evaluate the relationship between the dependent variable and the explanatory variables. Two methods of estimating the coefficients of economic relationship exist namely:

Singly-equation techniques, and imultaneous-equation techniques

Single-equation techniques are applied to one equation at a time were as the simultaneous-equation techniques are applied to all equations of a system at the same time. This implies that single-equation techniques like Classical Least Square (CLS) or Ordinary Least Squares (OLS), Indirect Leas Square (ILS), Two-stage Least Squares and other mixed estimation methods are used for single-equation models. Simultaneous-equation techniques such as three-stage least squares and full information maximum likelihood techniques (FIML) are used for system equations.

Even though only one econometric method may be theoretically most appropriate for the problem studied, it may not be application due to non-availability or defects of relevant statistical data and other information. Thus, given the limitation, a less suitable technique may have to be chosen. In which case, results of the estimation should be interpreted with caution taking into account the effects and possible errors introduced in the estimates by the use of the less appropriate technique.

We have used the Ordinary Least Squares (OLS) estimation technique in this study because ours is a single-equation model since we are studying a simple phenomenon, which can be satisfactorily approximated with a single-equation model (Koutsoyiannis, 1985:21). Secondly, the purpose of the study is mainly for analysis and policy-making which makes the degree of bias of the estimates very crucial and the ordinary least square technique satisfies the Guass-Makov least squares theorem of providing the best linear unbiased estimate (BLUE) (Wanacott and Wanacott, 1972).

Ordinary Least Squares (OLS) also has the advantages of simplicity of computational procedure, data requirements are not excessive and hence, it is less expensive and less time consuming. The mechanics of ordinary least square are quite simple to understand and it is a component of most other econometric techniques. In fact, with the exception of full information maximum likelihood technique, all others involve the application of Ordinary Least Square. This technique has produced fairly satisfactory results when used in a wide range of economic relationships and it is the most commonly used in estimating relationships in econometric models (Koutsoyiannis, 1985:20).

In evaluating the theoretical meaning fullness and statistical reliability of our parameter estimates, we used various criteria such as: the economic apriori criteria, statistical criteria and the econometric criteria. The aprori criteria are based on economic theoretical expectations or postulations about the signs of the parameter estimates, which have earlier been stated. In most cases, economic theory gives us information about the sign of the parameters and none on their

magnitude or size, yet our evaluation is based on both. We will, therefore, reject a parameter(s) whose sign and size is "wrong" but if we accept it (them), the reasons for such acceptance are clearly stated. Orthodox econometricians see models constructed on aprori assumptions as the only true models irrespective of the results obtained. If these results are "unfavourable" (i.e. if the signs and sizes of the parameters do not confirm to apriori knowledge), the model should not be rejected, rather researcher should explain the results, which in many cases is attributable to data deficiency, (Koutsoyiannis, 1985:21).

The statistical criteria or first-order test is secondary only to the apriori theoretical criteria. It is determined by statistical theory and it aims at evaluating the statistical reliability or significance of the parameter estimates of the model. These include the coefficient of multiple determination ($R^2$), the standard errors (SE) or standard deviation (SD) of the estimates, the students 't' test and the F-statistic. Our analysis in this study has concentrated on $R^2$, 't'-test, and the F-statistic. We saw the S.E. test as being unnecessary since it is formally equivalent to the students 't' test (Koutsoyiannis, 1985:89). Finally, our results were validated using the econometric criteria (or second-order test). Econometric criteria determine the reliability of the first-order test and the S.E. of the estimates. This enables us to understand whether our estimates have the desirable properties of BLUE (Best Linear Unbiased Estimates).

## III.   MODEL SPECIFICATION

The estimated equation is give as

log $RER_t$ = $a_0$ + $a_1$ log $ToT_t$ + $a_2$ log $GEN_t$ + $a_2$ log $CF_t$
+$_4$ log $CP_t$ + $a_5$ log $TP_t$ + $a_6$ log $CAM_t$ + $a_7$ log 1
+$a_8$ log ($Z_t^*$ - $Z_t$) + $a_9$ log NER + $a_{10}$ gdpr
+ u ............................
Where ToT = terms of trade
GEN = public sector expenditure non tradable
CF = restriction on capital flows
CP = commercial policies
TP = technical progress
CAM = capital accumulation
Gdpr = gross domestic product
I = Interest rate

Amin *et al* (1997) used this model but the model has to be modified based on the following reasons:

i)  It was difficult to measure some of the variables found in this model;
ii)  It was modified to accommodate other variables found in other works example (Tsassa, *et al.,* 2001) in which our analytical technique was based on.

Based on reasons stated above, a new model was adapted which draws variable from other models and the analytical framework.

The model is written as:
RER = $a_0$ + $a_1$ log BOP + $a_2$ TREND + $a_3$ OPEN + $a_4$ DEF + $a_5$ IMP TAX + $a_6$ EXP TAX + u.
where RER = The real exchange rate

| | | |
|---|---|---|
| BOP | = | Balance of payment |
| DEF | = | Fiscal deficit |
| IMPTAX | = | Import tax |
| EXPTAX | = | Export tax |
| TREND | = | period in which the analysis of the data are considered. |
| OPEN | = | The degree of openness of the economy. |

## IV.   MEASUREMENT OF THE VARIABLES

The real exchange rate is an indispensable index indicating the degree of competitiveness of a country's economy. As such the statistical measurement ought to include the information which national economic agents would use when they make choices among different types of goods either as producers or consumers (Olopoenia, 1992). This depends on the choices of proxies for tradable and non-tradable (Edwards, 1989).

Given the difficulties of classifying commodities into tradable, and non-tradable, it becomes difficult to identify real world counterparts of prices of tradable and non-tradable. This is because there is a high level of aggregation in national account data and there is no sector in the economy that does not produce both tradable and non-tradable. The inability to classifying exclusively tradable and non-tradable categories make the practical application in finding real world counterparts to price of tradable and price of non-tradable. Furthermore, international comparison based on world price index may be distorted by the use of different weight across countries.

The gross domestic product deflator has been used in some cases to overcome the problems of the world price. Since the gross domestic product deflator is a genuine price index of aggregate production, this indices is not subject to the distortions that come from price controls, a real exchange rate index computed using gross domestic product deflator at home and abroad provides a good indicator of changes in competitiveness in production (Amin, 1993). However, this measure suffers the drawback of being available only for a short period, and as in the case of consumer price index it has a good component of non-tradable goods (Edwards, 1989). In other cases the real exchange rate is computed as the ratio of unit labour cost. This is because this index is a direct measurement of relative competitiveness across countries. It is also argued that the relative labour cost is more stable than the relative goods prices. Unfortunately, this measure has the drawback that quality and availability of wage

rate data in many countries are poor that there makes the use of this index virtually impossible for many practical applications. Also this measure takes into account only one factor of production. This index will be biased to the extent that the capital-labour ratio differs across countries. Finally, it is an indicator based sensitive to cyclical productivity changes.

For the purpose of this study, a bilateral foreign exchange rate between Nigeria and United States of America, that is her highest trading partner, has been used as proxy for the real exchange rate. The openness of the economy was proxied as the sum of export and import divided by the gross domestic product for the period under review. While data on import tax, export tax and fiscal deficit were obtained from Central Bank of Nigeria statistical bulletin (Various issues) and Federal Office of Statistics.

## V. Discussion of Findings

The results of the multiple regression analysis on the determinants of real exchange rate in Nigeria are presented in this section. Annual data points for thirty years were collected for each of the six variables used in the regression analysis which was done using the Ordinary Least Square (OLS) method of estimation. These variables were balance of payment, openness of the economy, fiscal deficit, import tax, export tax and the trend, which is the period that the annual data points are taken for analysis. Data for balance of payment and fiscal deficit were gotten from the Central Bank of Nigeria Statistical Bulletin while openness of the economy was proxied. Imported tax and export taxes were derived from information bulletin of the Federal Ministry of Statistics.

*Table 1 :* Estimated Real Exchange Rate Equation.

| Dependent Variable | - | Real Exchange Rate |
|---|---|---|
| Method | : | Least Square |
| Sample (Adjusted) | : | 1971-2000 |
| Included Observations | : | 30 |

| Variable | Coefficient | Std. Error | T-stat. | Prob. |
|---|---|---|---|---|
| C | -1.162801 | 1.027222 | -1.131986 | 0.2693 |
| BOP | - 1.39E-05 | 7.45E-06 | -1.869981 | 0.0743 |
| TREND | 0.193499 | 0.088751 | 2.180259 | 0.0397 |
| OPEN | 2.658435 | 0.431103 | 6.166595 | 0.0000 |
| DEF | -0.000147 | 2.03E-05 | -7.214830 | 0.0000 |
| IMPTAX | 0.000408 | 5.56E-05 | 7.352171 | 0.0000 |
| EXPTAX | 2.62E-06 | 2.16E-05 | 0.121059 | 0.9047 |
| R-Squared | 0.963336 | S.D dependent var. | 9.308388 | |
| Adjusted R-squared | 0.953771 | Akaike info. criterion | 4.426522 | |
| S. E of regression | 2.001388 | Schwartz criterion | 4.753468 | |
| Sum of squared resid | 92.12773 | F-statistic | 100.7189 | |
| Log likelihood | -59.39784 | Prob (F-Statistics) | 0.000000 | |
| Durbin-Watson stat | 2.000600 | Mean dependent var. | 7.951533 | |

## VI. Discussion of Findings

The result which was estimated through Ordinary Least Square method showed that the coefficient of multiple determination, $R^2$, shows a reasonably high explanation of the variations in the real exchange rate by the explanatory variables, (i.e. $R^2$ = 0.96). This implies that 96 per cent of the total variations in the real exchange rate is accounted for by the explanatory variables. When $R^2$ is adjusted for the increase in explanatory variables in the model, the $R^2$ becomes 95 per cent. This indicated that the regression line is a good fit.In investigating the presence of serial correlation, the value of the Durbin-Watson statistics is taken into consideration. We know that Durbin-Watson statistics (d) determined by the disturbance terms depends not only on the number of observations (n) and the number of explanatory variables (k), but also on the time pattern of these explanatory variables. When there is no serial correlation in the residuals, then the auto-regressive coefficient $\hat{O}$ = O and the Durbin-Watson (d) = 2 and as $\hat{O}$ ranges from its maximum value of +1 (high positive serial correlation) to its minimum value of -1 (negative serial correlation) so the value of d ranges from 0 to 4. In the result of our analysis, the Durbin-Watson statistics (d) = 2.00 indicating a case of no serial correlation at 1% significance level. This is in line with the assertion of Koutsoyiannis (1985) that whenever there is no serial correlation, the value of Durbin-Watson will be 0. In the multiple regression analysis, time trend has been used as one of the variables. There are instances in which economist think there are potentially important but immeasurable or (unmeasured) factors whose effect on the dependent variable is changing fairly steadily overtime. Examples might include tastes (in a demand equation) and the state of technology (in

production or supply function). The time trend here captures the changes in the state of technology in the economy over the period of this research. Applying the general results of multiple regression, the multiple regression estimates of $b_1$, $b_2$, $b_3$, $b_4$, $b_5$, $b_6$ arises from the association between the deviations of real exchange rate which is the dependent variable on balance of payment, openness of economy, fiscal deficit, import tax, and export tax from their time trends and not at all from association between time trends.

In the multiple regression for real exchange rate, the coefficients of $X_2$, $X_4$ and $X_5$ are effectively zero (which means that the partial correlation between $X_2$, $X_4$ and $X_5$ and real exchange rate given $X_1$, $X_3$ and $X_6$ are nearly zero). The coefficient of fiscal deficit $b_4$ shows a negative partial correlation with the real exchange rate. This implies that an increase in this variable would bring about a drop in real exchange rate i.e., its real appreciation and consequently a competitive loss. The coefficient of balance of payment is negatively signed indicating an inverse relationship with the real exchange rate. It has met its economic prior sign. This indicates that an increase in this variable will bring about a loss in the real exchange rate, i.e. its real appreciation and consequently a competitive loss. The coefficient of import tax, export taxes openness and trend all shows a positive relationship with the real exchange rate. This implies that an increase in these variables would raise the real exchange rate and thus trigger its real depreciation and improve its competitiveness. The regression result of our equation showed a negative intercept and result is statistically significant at 1 per cent probability level.

## VII. POLICY RECOMMENDATIONS

This study attempted to isolate the real exchange rate in Nigerian economy. Six variables were used in the analysis and the behaviour of these variables have been noted, based on the results of the analysis. However, the following recommendations are made for further studies:

1. Further studies on the real exchange rate determinants in the long run should be carried out to ascertain the long-term effects of these variables on the economy.

2. There should be standard measurements of most of the economic variables in order to ensure uniformity across countries of the world. In cases where proxies are to be used, there should equally be uniformity.

3. Research on this subject area should be constantly carried out to ensure the formulation of policy over time that will improve the competitiveness of the economy, based on the variables that will be used.

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