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**Exchange Rate Policies and Economic Growth:
An Investigation of the Nigerian Experience (1970-2001)**

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ABSTRACT

The downturn in the Nigeria economy is very worrisome especially in the wake of exchange rate policies pursued by different government at various time. This study is aimed at investigating the Nigeria economic growth vis-à-vis exchange rate policies adopted over a period of 32 years (1970-2001). Secondary data sourced from Central Bank of Nigeria (CBN) publications, Nigeria Deposit Insurance Corporation (NDIC) publications and Federal Office of Statistics, were utilized. The study recognized four exchange rate regimes over the period under investigation. Analysis of variance (ANOVA) and Duncan New Multiple Range Test (DNMRT) were used in our analysis and test. It was found that there is no sign different in the growth rate among the conventional, crawling bands, independent floating and managed floating exchange rate regimes in Nigeria. But on mean separation, it was found that there is significant difference in GDP growth rate among the conventional pegs (1970-1977) and crawling bands (1978-1985) exchange rate regimes in Nigeria. Given these results and the economic analysis, it is recommended among others, that an indigenous approach to exchange rate policy of tightly and moderately-managed exchange rate regime involving a de facto peg- and- watch mechanism with practical application of purchasing power theory (PPP) of exchange rate be vigorously pursued.

1. INTRODUCTION

The Nigeria economy is bedeviled with persistent imbalances, which create serious discomfort to both the government (sensitive ones) and the governed and do not in any way portray good economic image of the country at local and international levels. These imbalances have been attributed to factors ranging from political, social to economic. Within the economic factors, the most emphasized is the issue of exchange rate probably because of its economic importance in the economy. Different government at different times had adopted a number of economic policies and programmes and taken decisions aimed at creating an economic environment devoid of severe shocks. The Nigerian economy has been managed, regulated, deregulated and guided at one point or the other. Each budget year or development plan comes with a new economic problem-solving package or slogan. We had the economic stabilization measures in 1982, state of economic emergency in 1985 (Ahmed, 1985) Austerity measures in the late 80's and structural Adjustment Programme (SAP) in 1986. Unfortunately at each stage, the earlier stage of economic performance has always been better than the preceding one. This is economically very worrisome especially in our desperation for sustained economic growth.

Essentially, the Nigerian macroeconomic objectives of full employment, balance of payments equilibrium, price stability, equitable distribution of incomes and economic growth have been pursued at various times by various governments using policy (instrumental) variables especially exchange rate policy. Unfortunately major economic indexes have not proved the workability and/or appropriateness of this policy. Therefore, this paper is focused on examining the economic growth objective of government measured by the aggregate output [Gross Domestic Product (GDP)] vis-à-vis the various exchange rate policies adopted at various times, 1970-2001. This is with a view to determining the equality of the policies (ie significance difference) and most importantly ascertaining the direction of the difference.

Theoretical evidence has shown that exchange rate models predict a positive relationship between Gross Domestic Product (GDP) and real exchange rate (Lucas, 1982 and Svensson (1985)) in Stockman (1998:74). Dornbusch (1976) in Stockman (1998:77) found a positive correlation between output (GDP) and real exchange rate. Okereke (2004: 130 and 37) in an econometric study found a strong positive relationship between exchange rate and output measured by GDP. Even with adjusted values he still found similar result.

In this paper, as pointed earlier, efforts are geared at comparing the direction of significance different between the means of the GDP variables

(GDPGR) studied. This is aimed at identifying the importance and contribution of the instrumental variable (policies) to the growth of the nation. In order to achieve this, the paper is divided into six parts. Part 1 introduced the paper while Part 2 gives the methodological approach. Part 3 Presented data and result for the study, analyzed and finally interpreted the findings (results). Part 4 gave economic implication of the findings. Part 5 and 6 proffered recommendations and concluded the paper respectively.

2. METHODOLOGY

The study utilized mainly secondary data, which are sourced from Central Bank of Nigeria (CBN) publications, Nigeria Deposit Insurance Corporation (NDIC), Federal Office of Statistics (FOS), journals and other relevant publications. The absolute data values were converted into growth rates. The aim of the paper in comparing the significance difference between aggregate output (GDP) and exchange rate at various periods makes Analysis of Variance (ANOVA) the appropriate test tool.

Analysis of variance is a parametric statistic, which provides a means of inferentially comparing the direction of significance between two or more means (Obodozie,1996:39). It is used to test the difference among three or more groups. According to Nworuh (2001:105-5) the procedure for testing for the equality of three or more means is provided by a statistical technique known as the analysis of variance (ANOVA). The significance difference between the groups is tested using F-test (F -distribution named after the founder, R.A. Fisher), which is an extension of student's t-test that compares only two means or population.

F - test is used to test the significance of all the macroeconomic variables in the model. Precisely, it showed whether there is a significant difference in the growth rate of macroeconomic variables (eg.GDP) in the model and the various exchange rate regimes. Four regimes according to Shogo et al (2003: 5) are recognised for this purpose. The use of these four regimes, Conventional Pegs, Crawling Bands, Independently floating and managed floating, is to capture the fixed and flexible characteristics of Nigerian exchange rate policies over the years while their variations are held constant. The choice of these four regimes is to ensure the regularity of the sets and reliability of results obtained therefrom.

Analysis of Variance (ANOVA), which applies the logic of statistical difference, has the following computational steps;

1) Calculate the Sum of Squares Total (SST)

SST= Sum of squares of the individual observation in the group *Less* the Correction Factor (Term) [CF (CT)] = $\sum X_G^2 - CF$1.0

Where

$$\text{Correction Factor (CF)} = \frac{\text{Sum of Nominal Values in the groups Squared}}{\text{Total Number of Observations}} = (\sum X_G)^2 / N \dots\dots\dots 2$$

2) Calculate Within Group Sum of Squares (SS_w) =

$$SS_w = \frac{\text{Sum of Nominal Values in each Group Squared}}{\text{Number of Observations in each Group}}$$

$$= (\sum X_1)^2 / n + (\sum X_2)^2 / n + (\sum X_3)^2 / n + (\sum X_4)^2 / n - CF \dots\dots\dots 3$$

Where

- X₁....X₄ = Observational Values (X) in Groups (Regimes) 1 to 4
- n = Number of Observations in each Group or Mean
- N = Number of Observations for the whole group
- CF = Correction Factor

OR

Sum of the Mean of each group

3) Calculate Between-Group Sum of Squares (SS_B)

SS_B = Summation of the sum of Squares of Individual Observation in each Group *Less* Sum of Nominal Values in each Group *Divided* by the Number of Observations (n)

$$= \sum X_1^2 - \sum X_1/n + \sum X_2^2 - \sum X_2/n + \sum X_3^2 - \sum X_3/n + \sum X_4^2 - \sum X_4/n \dots\dots\dots 4$$

4) Calculate Between-Group Variance Estimate (df_B)

$$(df_B) = \frac{\text{Between-Group Sum of Squares}}{K-1} = \frac{SS_B}{K-1}$$

Where K = Number of Groups (Regimes)

5) Calculate the Within-Group Variance Estimate (df_w)

$$(df_w) = \frac{\text{Within-Group Sum of Squares}}{N - K} = \frac{SS_w}{N - K} \dots\dots\dots 5$$

Where N = Total Number of Observations in the whole Group Means

6) Calculate the Standard Error of Estimate

$$\text{Std. Error} = \sqrt{SS_T - SS_B - SS_w} \dots\dots\dots 6$$

7) Calculate the F-Value (F-ratio)

$$F\text{-ratio} = df_B / MSE + df_w / MSE \dots\dots\dots 7$$

This value obtained from expression 7 is compared with the F-distribution and appropriate decision taken based on the decision rules stated below.

$$F\text{-distribution} = F_{df_B, df_w, \alpha} \dots\dots\dots 8$$

Where

- df_N = degree of freedom for the Numerator
- df_D = degree of freedom for the Denominator
- α = Alpha

The results obtained from Steps 1 to 7 above are presented in an ANOVA Table shown below.

Table 1: ANOVA Table

Source of Variation	Sum of Squares	df	Variance Estimate (MS)	F-Value	Decision
Between Group					As shown above
Within Group					

The tabulated value or F-distribution table is compared with the calculated value. The decision rule is to accept the null hypothesis (H_0) if the F-ratio is less than the tabulated value at conventional level of significance (5%).

F-ratio < f-distribution. Otherwise reject. Thus the decision rule is to accept the null hypothesis (H_0) if t calculated is less than t tabulated at 5% level of significance. But reject H_0 if calculated t is greater than t tabulated (t_a)

That is, $t > t_a$ Reject H_0
 $t < t_a$ Accept H_0

It is important to note that ANOVA provides only a statistical comparison (significant difference) among groups but is insufficient to indicate the direction of difference. Therefore in order to determine the real difference in the mean (direction of difference), a further test is required. Tuckey (1953) in Obodoeze (1996:39) developed a test called Honestly Significant Test Difference (HSD) used to assert the direction of difference. Onuh and Igwemma (2000:205-15) also identified another two of such tests as Least Significant Difference (LSD) and Duncan New Multiple Range Test (DNMRT). For the purposes of this study, we used Duncan New Multiple Range Test (DNMRT).

Duncan New Multiple Range Test (DNMRT) is a test developed by Duncan to overcome the pitfalls inherent in Least Square Difference (LSD) test criterion. It is a multiple comparison test aimed at comparing each treatment mean with every other treatment means.

DNMRT is a test criterion that is applied irrespective of the significance or non-significance of the F-test. This is unlike LSD test. DNMR test is run using the following steps:

- 1) Calculate the standard error of mean ($S_{x'}$)

$$S_{x'} = \text{EMS}/r \dots \dots \dots 9$$

Where r = error degree of freedom

- 2) Significant Studentized Range (SSR). The values for SSR are generated by invoking SSR Table in the Appendix. This is based on the number of means being tested (2-n).

- 3) Calculate the Least Significant Ranges (LSR) for the various ranges of means. $LSR = SSR \times \frac{\text{EMS}}{n}$ or $SSR \times S_{x'}$ 10

Where $S_{x'}$ is as defined above.

4) Ranking the mean yield or arranging the regimes (treatment) means in increasing or decreasing order.

3. DATA AND RESULTS PRESENTATION, ANALYSIS AND INTERPRETATION

This section is concerned with presentation of data and results, analyses, test of hypothesis and interpretation of results upon which policy implications are drawn.

Table 2: Exchange Rate Regime 1 and GDP Growth Rate (1970-1977)

Year	(X1)	(X1) ²
1970	27.3	745.29
1971	21.4	757.96
1972	5.5	30.25
1973	6.5	42.25
1974	11.7	136.89
1975	-2.9	8.41
1976	11.2	125.44
1977	8.1	65.61
	$\Sigma X1 = 88.8$	$(\Sigma X1)^2 = 1912.1$
	$\bar{X} 1 = 11.1$	

Source: Author's calculation for ANOVA table

Table 3: Exchange Rate Regime 2 and GDP Growth Rate (1978-1985)

Year	(X2)	(X2) ²
1978	-7.4	54.7
1979	2.5	6.25
1980	5.5	30.25
1981	-26.8	718.24
1982	-.3	.09
1983	-5.4	29.16
1984	-5.1	26.01
1985	9.4	88.36
	$\Sigma X2 = -27.6$	$(\Sigma X2)^2 = 953.12$
	$\bar{X} 2 = -3.45$	

Source: Author's calculation for ANOVA table

Table 4: Exchange Rate Regime 3 and GDP Growth Rate (1986-1993)

Year	(X3)	(X3)2
1986	3.2	10.24
1987	-6	.36
1988	10	100
1989	7.3	53.29
1990	8.2	67.24
1991	4.8	23.04
1992	3	9
1993	2.7	7.29
	X3 = 38.6	(X3)2 = 270.46
	$\bar{X}_3 = 4.83$	

Source: Author's calculation for ANOVA table

Table 5: Exchange Rate Regime and GDP Growth Rate (194-2001)

Year	GDPGR for Ex. Rate Regime 4 (X4)	(X4)2
1994	1.3	1.69
1995	2.2	4.84
1996	3.4	11.56
1997	3.2	10.24
1998	2.4	5.76
1999	2.7	7.29
2000	3.8	14.44
2001	3.9	15.21
	(X4) = 22.9	(X4) = 71.03
	$\bar{X}_4 = 2.86$	

Source: Author's calculation for ANOVA table

Where:

- X1 = GDP Growth Rate for the Conventional Pegs (Exchange Rate Regime 1)
- X2 = GDP Growth Rate for the Crawling Bands (Exchange Rate Regime 2)
- X3 = GDP Growth Rate for the Independently Floating (Exchange Rate Regime 3)
- X4 = GDP Growth Rate for the Managed Floating (Exchange Rate Regime 4)

ANOVA RESULTS

SST	=	2736.23
SSW	=	862.21
SSB	=	321.74

F-value = 1.67 (Within group) and 1.45 (Between group)

Standard error = $\sqrt{SST - SSB - SSW} = \sqrt{2736.23 - 321.74 - 862.2} = 1552.8$

dfB = $321.74/3 = 107.25$; dfW = $862.21/7 = 123.17$

Table 6: ANOVA Summary Result

Source of variation	Df	SS	MS	F-value
Within group	8-1=7	862.21	123.17	1.67
Between group	4-1=3	321.74	107.24	1.45
Error	7x3=21	1552.28	73.92	
Total	31	2736.23		

Source: Calculated

Tabulated F-value at $P < 0.05$

FV1V2 (0.05) for Within group = F721 (0.05) = 2.49

FV1V2 (0.05) for Between group = F321 (0.05) = 3.07

Decision: Since the calculated F-values of 1.67 and 1.45 for 7,3 and 21 degrees of freedom at 5 percent probability levels, are less than the tabulated F-value (2.49 and 3.07 respectively), we accept the null hypothesis and reject the alternative, going by the decision rule. Therefore, we conclude that there is no significant difference in GDP growth rate among the conventional pegs, crawling bands, independently floating and managed exchange rate regimes in Nigeria.

The above result and the decision following it may not convey the true effect of the different regimes and their combinations on GDP growth rate in Nigeria. In order to achieve this, we need to separate the means (mean separation) using Duncan New Multiple Range Test (DNMRT), as described above.

The result from the DNMRT is presented below;

$$S_x = \sqrt{73/4} = 4.298$$

Table 7: Significant Studentized Range(SSR)

P-value	2	3	4	5	6	7	8
SSR	2.95	3.10	3.18	3.25	3.30	3.34	3.36

Source: Onu and Igwenma (2000).

Table 8: Least Significant Range (LSR)

P-value	2	3	4	5	6	7	8
SSR	2.95	3.10	3.18	3.25	3.30	3.34	3.36
LSR	12.67	13.32	13.67	13.97	14.18	14.35	14.45

Source: Derived

Table 9: Summary Results of Mean Separation Between group

Group	GDP Growth Rate	*Mean (Rate)
1	Conventional Pegs	11.1a
2	Crawling bands	3.45b
3	Independently floating	4.83ab
4	Manage	2.86ab

Within Group

GDP Growth Rate	*Mean (Rate)
Yr1	6.1a
Yr2	6.38a
Yr3	6.1a
Yr4	-2.45a
Yr5	5.5a
Yr6	-0.2a
Yr7	3.22a
Yr8	6.02a

Source: Derived

*The letters 'a' and 'b' in superscripts are used to categorise means separated by assigning the same letter(s) to the means with common underscore. If means of two groups compared have different letters, it shows a significant difference but if the letter(s) in superscript are found in any of the two groups compared, it indicates no significant difference.

Interpretations

Results from the ANOVA Table 6 and the mean separation that followed, we came up with the following major conclusions. First, that there is no significant difference in the GDP growth rate among the conventional pegs, crawling bands, independently floating and managed exchange rate regimes in Nigeria. Secondly, there is significant difference in GDP growth rate among the conventional pegs and the crawling bands (Fixed) exchange rate regimes. Thirdly, there is no significant different in GDP growth rates among the fixed exchange rate regime and floating exchange rate regime. A curious observation of the means (7.7) of the two compressed regimes (Fixed and Floating) confirms this finding. The no significant difference result is expected given the fact that exchange rate is not a significant factor influencing GDP in Nigeria, as confirmed by the independent flow of causality tests found in Okereke (2004). Sequel to this, it is logical to conclude that the significant difference in GDP growth rate found may be attributed to exchange rate appreciation in that period, which agrees with a priori reasoning, ceteris paribus. Other factors may have also contributed to the significant difference.

4. POLICY IMPLICATIONS

The significant difference in the fixed regime as shown in the result indicates a more responsive policy. Thus exchange rate policy adopted between 1970-1985 impacted favourably on the GDP and provided for more stability in the Nigerian exchange rate. It means that differences observed in the GDP growth rate across the regimes (1970-85) did not occur by chance but as a result of the effect which the difference regimes had on GDPGR. However, on the mean separation within each of the regimes indicates no significance difference in the GDP. Therefore isolating the fixed regime we observe that the exchange rate policy did not respond to the economic stability of macroeconomic variables like GDP. Essentially, it can be accounted respectively to the appreciation and depreciation of the naira value over these periods. This is in line with long run theoretical expectation. As domestic currency appreciates, GDP increases and vice versa in the long run. Therefore, the difference in GDP growth rate can be attributed to exchange rate and probably to the economic boom associated with the period. The mean separation within each of the four regimes on the other way indicates that there is no significance difference in the GDP growth rate within each regime separated. This result is expected especially in a weak-prone exchange rate regime. It also buttresses the neutrality of exchange rate in

determining GDP in Nigeria. It requires serious policy attention especially on the non-oil sector.

5. RECOMMENDATIONS

Given the results and the economic analysis, it is strongly recommended that an indigenous approach to exchange rate policy be pursued and vigorously too. This should be embodied in a chauvinistic attitude and consideration of Nigeria immediate environment, circumstances and peculiarities. A tightly and moderately managed exchange rate policy with greater emphasis on productive base and patriotism is advocated. This involves a de facto peg-and-watch mechanism with practical application of Purchasing Power Parity (PPP) theory of exchange rate. Source of pressure on exchange rate must be identified, eliminated and checked continually. Multiplicity of rates must also be avoided. The dichotomy between official rate and commercial rate in the Nigerian foreign exchange market should be eliminated. The adoption and objective implementation of these recommendations would help in stabilizing exchange rate as well as enhancing and sustaining the economic growth of the Nigerian nation.

6. CONCLUSION

Exchange rate is a fundamental and vital instrument in any economic management. Its stability in relation to the realities of our environment determines significantly the prosperity of the economic indicators. The duality treatment of the dependent and independent variables in the study models using causality test revealed that exchange rate is not a significant factor influencing the selected macroeconomic variables in Nigeria. Also, the instability of these variables call for concern and policy change as well as total reform of Nigerian's value system. Given these results, among others, one can conclude that focusing on exchange rate policy in general and current exchange rate policy in particular is not an antidote to Nigerian economic imbalances since devaluation has not responded positively to economy. It requires a rethink and a change of the current exchange rate policy that is dominated by the influence of International Monetary Fund (IMF). It is more appropriate to consider the realities of our immediate economic structure and environment. A more indigenous policy framework is most preferred in our peculiar economic, social and political environments. We have, therefore, advocated for a de facto moderately-managed exchange rate regime supplemented by other recommendations suggested in this study especially stronger productive base and patriotic leadership. This is the Nigerian solution and not the IMF's or World Bank's solution given that Nigerian

Naira is on its own without any place in the international financial market. We must not continue to devalue already over devalued currency. Based on the recommendations and remarks, it is hoped strongly that their objective implementation will go a long way in stabilizing exchange rate, macroeconomic variables and most importantly improve the standard of living of Nigerians.

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