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Further Empirical Analysis of Inflation in Nigeria

O.M. Fakiyesi (Mrs.)*

This paper analyses the main factors which influence inflation in Nigeria with a view to determining the relevant policy instruments that will reduce it. The empirical analysis confirms the findings of earlier studies that monetary expansion significantly influences the rate of inflation in Nigeria. The other dominant factor is the exchange rate which has a significant and positive impact on inflation. Growth in real income and level of rainfall are also significant in explaining inflation in Nigeria.

I. INTRODUCTION

Inflation is said to occur when the general level of prices rises rapidly, and persistently over a period of time. This is undesirable to the public and policy makers. From the point of view of the public, inflation causes uncertainty about future prices. This affects decisions on expenditure, savings and investments, and causes misallocation of resources. It also allows substantial redistributions of income and wealth from savers to borrowers. To the policy maker, inflation hampers growth and development of an economy as it discourages savings and investments. These factors explain why policy makers put in lots of effort to reduce inflation and why several authors focus attention on the issue.

Inflation is now one of the intractable problems facing the Nigerian Economy. Having registered low rates of inflation in the years immediately after independence, the country experienced double-digit inflation in 1970. This was mainly as a result of the civil war. The next period of high inflation was 1974-1979 when the wage freeze was discontinued as recommended by the Udoji Salary Review Commission of 1974. Other periods of high inflation are 1984, 1988, 1989 and 1992 to date. Reduction of the high inflationary pressure is considered to be one of the most critical macroeconomic objectives in Nigeria.

The objective of this paper is to identify the major determinants of inflation in Nigeria and to suggest measures which could contribute to its reduction. In order to achieve this objective, the study makes use of an econometric model in which the rate of inflation is regressed on growth in real income, level of rainfall and money supply and a test of statistical significance of the explanatory variables is carried out. The study covers the period 1960-1994.

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Secondary data used are sourced from various publications of the Federal Office of Statistics and the Central Bank of Nigeria. The rest of the paper is organised as follows: Section II contains a review of the literature. This is followed by the theoretical framework in Section III, empirical analysis including specification of the model and presentation of results is done in Section IV, while Section V contains policy implications and conclusions.

II. LITERATURE REVIEW

Several authors have investigated various theories of inflation. The Research Department, Central Bank of Nigeria (1974) did a cross sectional analysis of the origins and development of inflationary pressures in some selected African countries. These are Nigeria, Ghana, Uganda, Zaire, Gabon, Morocco, Ivory Coast, Egypt, Sudan, Tunisia, Zambia and Kenya. The period covered was 1960-1972. Owing to data limitations, empirical investigations were limited to only six countries. The explanatory variables used were changes in money supply, deficit financing, and real Gross Domestic Product. With respect to Nigeria, changes in money supply and domestic credit had no significant impact on inflation rate although real income had a correct sign. As a result of the structural changes in the economy since then, the study cannot be relied upon now by policy makers in designing policies for combating inflation.

Kiguel and Liviatan (1988) showed that traditional stabilization programmes in Latin American countries were highly unsuccessful in combating inflation despite stringent cuts in government deficits. Sound management of exchange rate and money supply in addition to fiscal restraint are necessary to reduce inflation.

Asogu (1991) made an extensive review of the literature on inflation in Nigeria. His empirical analysis covering 1960-1989 proceeded in two steps. Inflation rate was expressed as a function of money supply and its lagged values, changes in domestic credit, real output, net exports, and net government expenditure. Imported inflation was expected to be picked up by changes in import price index and naira/U.S. dollar exchange rates. His results suggested that real output, especially industrial output, current money supply, domestic food prices and exchange rate changes were the major determinants of inflation in Nigeria. He concluded that fiscal and monetary tools together with growth in productivity may curtail inflationary pressures.

Empirical studies on hyper-inflation, particularly in Latin America and Europe, are of interest because of the lessons they provide on stabilization policies adopted for such crises. Dornbush (1992) and Kiguel and Liviatan (1992) offer lessons in stabilization both heterodox and orthodox for handling of inflation in eight countries with rates of inflation ranging from 15 to 30 percent. Their results suggest that inflation could be successfully reduced to low levels through a combination of tight fiscal policy, incomes policy and exchange rate commitments.

Sowa and Kwakye (1993) identified sources of inflationary pressures in Ghana. They showed that inflation in Ghana could be explained by real and monetary shocks in the

economy. They concluded that measures to control inflation must emphasize enhancing production, particularly food and supply of goods.

Moser (1994) used a reduced form elasticity model to analyse the dominant factors influencing inflation in Nigeria. These factors are changes in broad money, changes in exchange rate, real income and average rainfall. These were utilized in conjunction with their lagged values. The statistical significance and relative explanatory power of the key factors were tested using the standard Ordinary Least Squares estimation techniques on annual data for the period 1960-1992. A number of additional standard tests were performed to assure normality and reject heteroskedasticity. His results confirmed the basic findings of earlier studies, namely, monetary expansion driven mainly by expansionary fiscal policies explain to a large extent the inflationary process in Nigeria. He identified other important factors influencing inflation in Nigeria as the devaluation of the naira as well as agro-climatic conditions. He concluded that concurrent monetary and fiscal policies have major impact on inflation in Nigeria.

III. THEORETICAL FRAMEWORK

A number of approaches to the explanation of inflation have been suggested and tested in the literature. The classical theory of inflation defines demand pull inflation as rapidly rising prices that occur where changes in investments, government expenditure and net exports increase aggregate demand over and above the economy's productive capacity when the economy is near full employment. The effect of increased demand will be mainly on prices. Demand pull inflation occurs under different circumstances. It could occur during cyclical booms, in wartime, and immediately after war period. This explains the high inflation ranging from 9.6 to 15.6 per cent between 1969 and 1971 when Nigeria was engaged in the civil war compared with 3.9 and 5.4 percent in 1965 and 1973 shortly before and after the war.

A different kind of inflation occurs from shifts in the supply curve. Such shift could result from increases in the money wage rate brought about by union activities or an increase in monopoly markup. Such shifts lead to higher prices and lower output. This source of inflation is known as Cost Push Inflation. This type of inflation was witnessed between 1974 and 1979 after the wage freeze was lifted in 1974 which reinforced cost push pressures.

Another theory of inflation is structural inflation. This model explains inflation as the long-run tendency of prices to rise especially in the industrialized Western countries owing mainly to differences in the rates of growth of productivity in the industrial and services sectors.

The Monetarist or Neo-Fisherian approaches to inflation seek to ascribe observed rates of inflation in different countries to the respective growth rates of the money supply per unit of the national product. This school of thought believes that inflation is mainly a monetary phenomenon. It may not be concluded that inflation in Nigeria is a purely monetary issue as it is influenced by other factors apart from changes in money supply.

Another theory of inflation is known as imported inflation. For a country that engages in World trade, a number of channels have been identified whereby inflation may be transmitted from one country to another. Given a system of fixed exchange rates, these

channels include price effects in which inflation is transmitted directly through goods entering international markets; demand effects in which excess demand spills over from one country to another; and liquidity effects where changes in foreign reserves occasioned by balance of payments outcomes affect the money supply. Nigeria is highly susceptible to this type of inflation because of her large volume of imports.

In Nigeria, inflation moves with a lag with fluctuations in money supply (chart 1). Between 1970 and 1981, peaks in growth of broad money were associated with double-digit inflation. Since 1984 to date, the rate of inflation has grown faster than that of money supply. This trend suggests that although growth in money supply may be significant in explaining inflation in Nigeria, it is not the only factor.

With a relatively stable exchange rate regime (chart 2) after independence, the rate of inflation hit a high level of 33.9 percent in 1975. This was due largely to the ending of the wage freeze in 1974. There was another peak in 1984 with the rate of inflation reaching 39.6 per cent. This high rate resulted mainly from supply shortages as the level of industrial production fell. The other periods of high inflation have been 1988 to date with the exception of 1990 and 1991. The major reason adduced for this surge after 1988 is the substantial depreciation of the naira in 1986. Other reasons are increases in government deficit expenditure, high interest rates and depressed investments. In 1990 and 1991 inflation rates stood at 7.4 and 13.0 per cent, respectively as the exchange rate was =N=8.7071 and =N=9.865 to the US dollar. As the exchange rate deteriorated further from 1991 onwards, the rate of inflation also leaped to astronomical heights. It is evident from this chart that from 1986, deterioration in the exchange rate adversely affected the inflation rates.

IV. EMPIRICAL ANALYSIS

The presentation of the empirical analysis is divided into two parts. The first part discusses the model, while the second part highlights the summary statistics and the robustness of the estimates.

IV. 1 THE MODEL

Recent studies on inflation in developing countries seem to agree that the rate of growth of money supply, growth in income and fluctuations in the foreign exchange market are important variables which explain the rate of inflation. Moser (1994), among others, brought in rainfall because weather induced variations in food supplies have been a major non-monetary factor in the movement of the general price level. This is also related to the high weight attached to food in the basket used in the computation of the Consumer Price Index (CPI) commonly used as a measure of inflation.

In this study, inflation (P) is assumed to be dependent on growth in broad money (M_2), the rate of exchange of the naira vis-a-vis the US dollar (E), growth in real income (Y), the level of rainfall (R), and the level of anticipated inflation which is based on the previous year's level of inflation (P_{t-1}). This relationship is expressed as follows:

$$P = f(M_2, E, Y, R, P_{t-1}) \quad (1)$$

It is expected that changes in growth of money supply would affect price changes with a lag. The relevant equation for estimation is equation (2) where $M2_{t-1}$ is the lagged value of the growth rate of broad money, E_0 is the

$$P = a_0 + b_1 M2_{t-1} + b_2 E_0 + b_3 Y + b_4 R + b_5 P_{t-1} + \mu \quad (2)$$

official exchange rate, P_{t-1} is the lag in the rate of inflation, and μ is the error term. All the other variables are as earlier defined. It is assumed that the error term is independently and normally distributed.

From 1960 to 1986, the relatively stable exchange rate regime did not permit wide fluctuations in the exchange rate and so is not expected to significantly affect price formation during the period. With the introduction of the Structural Adjustment Programme (SAP) in 1986, the substantial exchange rate devaluations are expected to affect inflation rate.

We expect that increases in money supply, the naira/U.S. dollar exchange rate, given the level of inflation in the previous time period, will lead to increase in inflationary pressures. Growth in real income is expected to have a smothering effect on inflation. The expected signs of our equations are thus:

$$\frac{\delta P}{\delta M2_{t-1}} = b_1 > 0 \quad (3)$$

$$\frac{\delta P}{\delta E_0} = b_2 > 0 \quad (4)$$

$$\frac{\delta P}{\delta Y} = b_3 < 0 \quad (5)$$

$$\frac{\delta P}{\delta R} = b_4 < 0 \quad (6)$$

$$\frac{\delta P}{\delta P_{t-1}} = b_5 > 0 \quad (7)$$

IV.2 EMPIRICAL RESULT

Using macro-economic data covering the period 1960-1994, an ordinary least squares (OLS) technique was used to estimate equation (2). The results are presented in Table 1. The regression results indicate that lagged value of growth in broad money is significant at the 95 and 99 percent confidence levels in explaining inflation in Nigeria. If the desire of the monetary authorities is to keep down the level of inflation then a restrictive monetary policy, complemented by fiscal measures must be strictly adhered to.

The other significant variable at the 95 per cent confidence level is the exchange rate which confirms the influence on the price level of external sector developments. A one per cent growth in the exchange rate has a more than proportionate impact on the rate of inflation. Growth in real income and the level of rainfall are significant at the 80 per cent confidence level. Both have the correct sign (-). The only variable that is not significant irrespective of the confidence level is the past inflation (P_{t-1}). It, however, has a correct

sign. A possible explanation for its insignificance is the use of yearly data.

The R^2 indicates that the explanatory variables account for 68.2% of the variations in the rate of inflation. This is a good fit. The F statistics at $F(5,27)$ indicates that the regression is significant. The inclusion of lag variables makes DW statistics irrelevant. However as we indicated earlier, to really undertake a dynamic analysis of inflation in the country, a more disaggregated data would have to be used. The unavailability of quarterly data would make this unfeasible presently.

Table 1: Ordinary Least Squares Estimation "P"

Explanatory Variables	Coefficient	Std. Error	T-Ratio
a_0 (Constant)	27.9390	16.86	1.66****
$M2_{t-1}$	0.3693	0.1196	3.09*
E_0	1.0644	0.4356	2.44**
Y	-0.1981	0.1247	-1.59****
R	-0.0174	0.0122	-1.43****
P_{t-1}	0.0803	0.1505	0.53
R^2		0.6823	
R^2 Adjusted		0.6235	
D.W.		1.5249	
F-Statistics (5, 27)		11.6000	
Residual Mean Square		121.5000	

* Significant at the 1 percent level

** Significant at the 5 percent level

**** Significant at the 20 percent level

V. POLICY IMPLICATIONS AND CONCLUSIONS

The rate of inflation in Nigeria has grown from the single digits in the 1960s to the double digits since the 1970s. The results of our analysis confirm the findings of the Research Department, CBN (1974), Asogu (1991) and Moser (1994) that monetary expansion explains, to a large extent, the inflationary pressures in Nigeria. The lagged value of growth in broad money, naira/U.S. dollar exchange rate, growth in real income and the level of rainfall were significant in explaining the rate of inflation. The exchange rate depreciation has significant impact on the rate of inflation. In fact this variable seems to have the highest

CHART 1.
INFLATION AND GROWTH IN MONEY SUPPLY (M2)

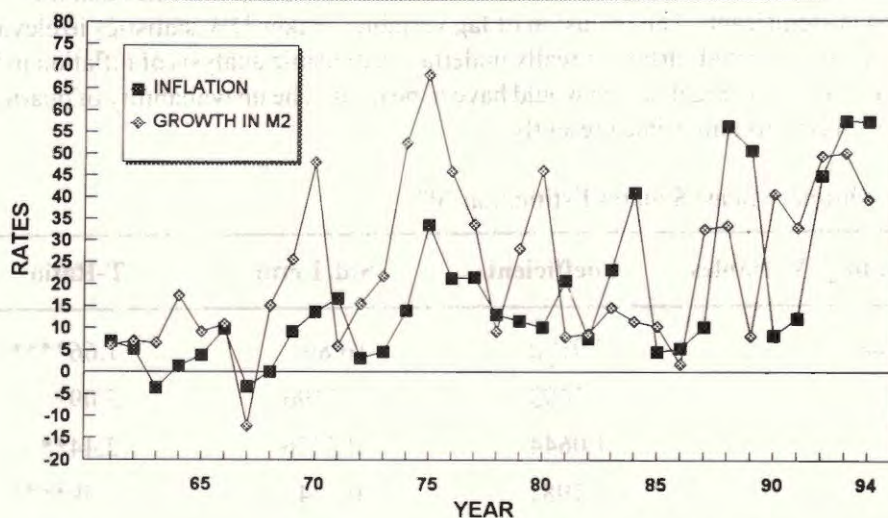
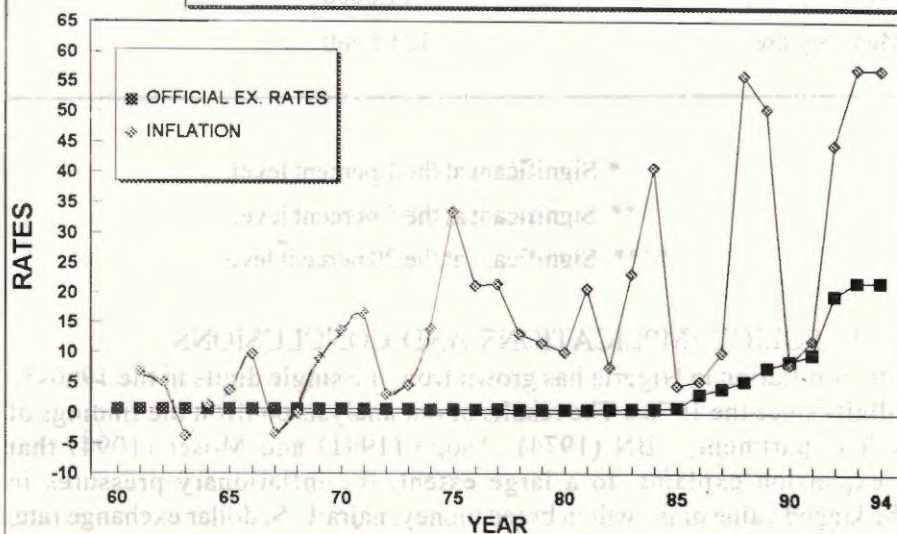


CHART 2.
INFLATION AND OFFICIAL EXCHANGE RATES.



effect on inflation. The continuous devaluation of the naira increases domestic prices. The government must thus embark on a relatively stable exchange rate policy, while limiting the expansion in monetary growth and exercising fiscal discipline (which includes trimming down of deficit financing).

Our results suggest that by allowing limited growth in broad money and stimulating the productive capacity of the economy to generate increase in income will lead to lowering the rate of inflation. Nigeria can learn from Latin America countries. For instance, in 1994, Brazil adopted a new economic program to achieve a lasting reduction of inflation. The monetary authorities first strengthened public finances and eliminated indexation. These efforts were followed by the introduction of a new currency and by measures to curb the inflow of foreign capital.

If the restrictive monetary stance advocated in 1995 is maintained in 1996 and the objective of the exchange rate policy remains the deliberate build up and strengthening of external reserves, then confidence can be enhanced in the economy. An autonomous foreign exchange market (AFEM) was introduced in 1995 to strengthen the external reserves and ensure stability in the market. If above objectives are realised, and conditions for a stable political and economic environment are created, including an independent Central Bank which can predictably, promote economic stability and generate effective monetary policy, inflation would be substantially reduced. A policy which relies on excessive CBN facility to finance government budget deficit should be discouraged and not seen as a credible solution. It is also important that government maintains the credibility of its anti-inflationary policies. That would involve sticking firmly to inflation targets once they have been set.

APPENDIX 1:

YEAR	CPI ¹	GDP ² (=N=' million)	OEX ²	M2 ² (=N=' million)	RAIN ³ (mm)
1960	7.2	2413.5	0.7143	295.6	1463.8
1961	7.7	2544.1	0.7143	313.6	948.6
1962	8.1	2791.3	0.7143	335.8	1338.5
1963	7.8	2945.7	0.7143	357.5	1588.7
1964	7.9	3144.9	0.7143	419.5	1324.5
1965	8.2	3360.9	0.7143	457.9	1215.0
1966	9.0	3614.5	0.7143	507.5	1347.1
1967	8.7	2950.2	0.7143	444.6	1347.1
1968	8.7	2877.8	0.7143	511.7	1566.8

APPENDIX 1 Contd.

1969	9.5	3851.3	0.7143	642.2	1722.0
1970	10.8	5205.1	0.7143	950.0	1346.0
1971	12.6	6570.7	0.6579	1005.4	1405.0
1972	13.0	7208.3	0.6579	1161.4	1352.0
1973	13.6	11198.7	0.6579	1414.1	1339.0
1974	15.5	18515.1	0.6162	2156.3	1394.0
1975	20.7	21207.3	0.6257	3622.5	1471.0
1976	25.1	26991.7	0.6310	5278.9	1487.0
1977	30.5	31651.0	0.6513	7057.5	1273.0
1978	34.5	33861.2	0.5849	7699.5	1597.0
1979	38.5	40514.6	0.5703	9857.2	1362.0
1980	42.4	46555.8	0.5419	14397.4	1400.0
1981	51.2	50749.1	0.6356	15548.1	1269.0
1982	55.1	51709.2	0.6720	16893.9	1176.0
1983	67.9	57142.1	0.7486	19368.9	1056.0
1984	95.6	63608.1	0.8081	21600.5	1170.0
1985	100.0	72355.4	0.9595	23818.6	1327.0
1986	105.4	73061.9	3.1828	24216.0	1306.0
1987	116.1	108885.1	4.1664	32092.8	966.0
1988	181.2	145243.3	5.3530	42780.3	1426.0
1989	272.7	224796.9	7.6221	46222.9	1330.0
1990	295.1	260636.7	8.7071	64901.7	1434.0
1991	330.9	324010.0	9.8650	86152.5	1596.0
1992	478.4	549808.8	19.6610	128517.7	1044.0
1993	751.9	697095.2	21.8860	192458.7	954.0
1994	1180.7	897498.1	21.8860	267759.8	897.0

- Sources: (1) Federal Office of Statistics
 (2) Central Bank of Nigeria
 (3) J.O. Akintola (1986) and Central Bank of Nigeria

OEX = Official Exchange Rate

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