

## **CAUSES OF INFLATION IN SOME AFRICAN COUNTRIES: Evidence from using an error correction method for Nigeria**

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The paper examines the causes of inflation in few African countries using an Error Correction Method for Nigeria between 1970 and 2000. The paper uses government current expenditure, inflation rate, ratio of government deficits to Gross Domestic Product, and total money supply as the analytical variables. Using an econometric analysis of time series data, and testing for unit root, co-integration and error correction modeling, the evidence from the regression results shows that the major cause of inflation in Nigeria over the years is government increased budget deficits. Surprisingly, other factors do not have the same significant impact on inflation in Nigeria.

### **I. Introduction**

The purpose of this paper is to examine the causes and impact of government spending on inflation in Nigeria. Today, one of the thorniest policy issues in Nigeria is how to put inflation under effective control. The control of inflation has been a major focus of both monetary and fiscal policies of the government in the last few years, as demonstrated in various budgets and policy statements. Historically, the origin of the current inflation dates back to the 1970s when the revenue accruing to the government from the non-renewable oil resources rose steeply. With the increase in public expenditure, enhanced by oil revenues, there was vast expansion in aggregate demand, with an inelastic supply of domestic output, inflation inevitably resulted. The rapid growth in money supply, as a result of the monetisation of the oil earnings, also exerted upward pressure on the general price level.

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The price of crude oil slumped in the world market during the first half of the 1980s. Thus, Nigeria's crude oil, which was sold at slightly above US \$11 a barrel in the early 1981, fell precipitously to less than US\$9 by August 1986. This triggered a series of developments in the economy. One example was the state's fiscal crisis, as reflected in the persistent and substantial budget deficit, which cumulated to approximately N17.4 billion in the five years between 1980 and 1984. Monetary policy became highly expansionary as a large part of the deficits, incurred during this period, was financed through creation of credits. Indeed, the total domestic credit to the economy recorded an average annual growth rate of 29.9 per cent in 1980-84 and most of the increase was attributable to net claims by the government. Simultaneously, two-digit inflation at a mean yearly rate of 20.2 per cent was registered, as clearly evidenced, perhaps, in support of the monetarists' proposition. But inflation in 1984, which stood at almost 40 per cent is often explained by acute shortage of imported goods and services, imposed by inadequate foreign exchange earnings, a derivative of the steep fall in crude oil prices. (see, Egwaikhide, et al. (1994).

With the deepening internal and external disequilibria, it became imperative to adopt the Structural Adjustment Programme (SAP), which was done from July 1986. The SAP, which is predicated mainly on the principle of "getting price right" has foreign exchange rate reform as its central focus [Federal Republic of Nigeria, (1986)]. In pursuit of this, the Second-Tier Foreign Exchange Market (SFEM) was introduced in late September 1986, and since then the Naira has depreciated sharply against the US dollar and other major currencies. Quantitatively, the Naira, which traded at N4.62 : \$1.00 at the inception of SFEM (late September 1986), had exceeded N7.65 : \$1.00 (end 1986), a change of almost 65.6 per cent. During the same period, inflation leapt from 5 per cent to almost 41 per cent.

The above development shows that government expenditure has a role to play in Nigeria's recent inflationary process. Concomitant with this is the substantial budget deficit operated annually by the Federal Government in the last decade or so. Part of the budget deficit is financed through bank credit, which directly affects the money base. This also exerts upward pressure on the general price level and suggests that there are many sources of the current inflation. One major source is the government expenditure.

As part of the attempt to fill this lacuna, this paper examines the quantitative effects of government expenditure on inflation in Nigeria, using Error Correction Method. This study covers a period of 30 years from 1970-2000. The paper is divided into four sections. Section-II examines the related literature. Section-III analyses the empirical results while Section-IV gives the policy implications and conclusions.

## II. Review of the Related Literature

Analysis of the public expenditure are usually geared towards functional relationship between certain casual variables and the relative public sector. Much attention has been paid to the process and stabilization of extreme inflation, at rates well in excess of 100 per cent a year [Bruno (1993), and Dornbusch et al. (1993)]. Little attention has been devoted to the inflationary problems in countries that are stuck with a stubborn, high double-digit inflation of around 20 per cent a year. Often the aftermath of stabilization programmes have successfully brought extreme inflation to an end [Dornbusch et al. (1993)]. Since 1920s it has been understood that at least money creation is one way of financing budget deficit. In the classic article, Keynes (1936), in commenting on the hyperinflation experiences of Germany and Russia, vividly pointed out how even the weakest governments always has one way left to pay its bills, namely, printing money. However, it has been found that this is not always the case [see for example, Frischer (1993)].

In Nigeria ample empirical literature exists on inflation and exchange rate devaluation. In 1974, a national conference on inflation in Nigeria was organized by the Nigeria Institute of Social and Economic Research (NISER) Ibadan, in which several aspects were addressed. A major section of the conference focused mainly on the proximate causes of inflation. In general, findings of some of the key articles in the conference revealed that neither monetary nor structural factors could alone explain Nigerian inflation. The striking evidence from this conference was that combination of both factors precipitate the inflationary process.

The causes of inflation have received attention of researchers in more recent years as well. The work of Aghevli and Khan (1978) is illuminating. Their study indicates that government expenditures respond faster to inflation than revenue, thereby generating an enlarged budget deficit, which further engenders inflation.

Chhibber et al. (1989) developed a detailed econometric model which takes into account both monetary and structural factors in the course of inflation in Zimbabwe. Their investigations show that monetary growth, foreign prices, exchange and interest rates, unit labour cost and the real income are the main determinants of inflation in this country. A similar macroeconomic model of inflation was employed for Ghana by Chhibber and Shafik (1990a). This study, which covers the period 1965-88, suggests that the growth of money supply is a key variable explaining the Ghanaian inflationary process. Variables such as official exchange rate and real wages did not exert any significant influence on inflation. However, a significant positive relationship was found between the parallel exchange rate and the general price level. Perhaps one policy implication arising from this is the recent price movement in Ghana, which has little relationship with the recent exchange rate policy implemented by the government.

Focusing on Uganda, Elbadawi's (1991) study revealed that rapid monetary expansion and the precipitous depreciation of the parallel exchange rate were the

principal determinants of inflation during 1988-89. From a comprehensive review of exchange rate and price movements the study concluded that devaluation of the official exchange rate resulted in inflation. This conclusion is consistent with findings of Chhibber and Shafik (1990a), with respect to Ghana.

The work of Tegene (1989) cannot be ignored as his method of analysis differs from others. He did not use econometric techniques to investigate the role of domestic money supply in the course of inflation, in six African countries. He employed the Granger and Piece causality tests. Evidence from his study demonstrated a unidirectional causality from monetary growth to inflation in the sample countries. A similar analytical methodology was employed by Canetti and Greene (1991), to evaluate the relative contributions of exchange rate movements and monetary expansion to price inflation in ten African countries, during the period 1978-89. The broad conclusion that emerged from this comprehensive investigation is that exchange rate movement and monetary growth explain the inflationary trend in countries, such as Sierra Leone, Tanzania and Zaire. Earlier, London (1989) had examined the role of money supply and exchange rate in the inflationary process, in 23 African countries. The pure monetarist model of the Harberger type was employed and the results revealed that in the period between 1974 and 1985 the growth of money supply, expected inflation and real income were significant determinants of inflation in the sample countries.

In examining exchange rate depreciation, budget deficit and inflation in Nigeria, Egwaikhide et al. (1994), obtained the result that lagged rate of inflation (used as a proxy for expected rate of inflation) has a negative sign and that this result is inconsistent with theoretical expectations. Following this result, an alternative definition of expected rate of inflation as in Oloponenia (1986) was employed. Although the coefficient for this variable was positive, it was not statistically significant even at the 10 per cent level. This is an indication, perhaps, that inflation expectation is not an important element in explaining the inflation process, during the period under study. As opposed to this the coefficient of lagged exchange rate (official) is highly significant, an indication that depreciation for the exchange rate exerts upward pressure on inflation but it takes a minimum period of one year before this is reflected in price inflation. The above result implies that the country's price inflation is caused both by monetary and structural factors.

Pinto (1987) identified the determinants of parallel market premium as demand for domestic money, the financing of fiscal deficits, the rate of inflation and the terms of trade. He argued that inflation rises because the devaluation involved in unification of both the official and parallel exchange rates eliminates revenues from the export earnings at the over-valued official exchange rate, which requires increased monetization to finance a set level of government expenditure. However, this conclusion no longer holds in its entirety for Nigeria, since the introduction of an Autonomous Foreign Exchange Market (AFEM) in 1995. The more the economy

is liberalized, the less efficacious is the operation of the exchange rate system. The institution of a realistic exchange rate mechanism, in addition to complementary monetary and fiscal policies, would therefore ensure better economic performance.

Egwaikhede et al. (1994) analyzed the main factors which influenced inflation in Nigeria with a view to determining the relevant policy instruments that could reduce it. The study found that monetary expansion has been the dominant factor influencing inflationary growth in Nigeria, while exchange rate and growth in real income were also significant determinants. These findings are also consistent with that of Egwaikhede (1984). A major shortcoming of the study was in the approach adopted. The study regressed growth rate of inflation on the above-identified independent variables, but the relative impact of each variable on inflation, as well as the long-run relationship between inflation and each of the identified variables, were not determined in the study.

Egwaikhede et al. (1994), in their study of "Inflation Dynamics in Nigeria" indicated that the considerable devaluation of the Naira in the late 1980s and 1990s, in the midst of rising prices, might have promoted inflation. According to them, initially devaluation led to a rise in the prices of tradables and consequently non-tradables. The ensuing rise in the cost of living index, either as a result of the weighted average of the proportionate devaluation of the Naira or the response of factor incomes to prices, is likely to further promote inflation given the existing levels of inflation prior to devaluation. It was, however, shown in the study that exchange rate coefficients are not statistically significant; hence the emphasis was on monetary factors only.

Elbadawi (1991) also found that precipitous depreciation of the parallel exchange rate has a significant effect on inflation in Uganda. From this study, it follows that the exchange rate is a major force, behind the upsurge of inflation.

The indication derived from the reviewed studies is that inflation could be a cause for exchange rate volatility and vice-versa. Indeed, most of the studies focused on factors that determine inflation on one hand and those affecting exchange rate on the other. The vast body of economic literature on Nigeria holds inflation to be a consequence of Naira devaluation and not vice-versa. However, high inflation may increase imports and reduce exports, thus, worsening balance of payments position and this may bring about the need to devalue the currency. The implication of this is that the relative impact of each variable is not yet established. This is one of the issues addressed in this paper.

Based on review of the related literature on the causes of inflation, this paper undertakes an empirical study of the impact of government expenditure on inflation in Nigeria between 1970-2000, using error correction method (ECM).<sup>1</sup>

<sup>1</sup> For detailed discussion on the theoretical framework and Error Correction Method (see, Appendix-A).

### III. Analysis of the Empirical Results

The result of unit roots co-integration and error correction method series employed for the study are presented in this section. The estimation sample period is 1970–2000. The data series were gathered mainly from CBN statistic (2000). Appendix-B shows the data on government recurrent expenditure (GE), inflation (INF) ratio of government deficits to GDP (DEF), and the total money supply (M2), used in the study.

Result of Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) unit root tests for inflation and expenditure series are presented in Tables 1 and 2. Based on the 95 per cent critical value for the augmented Dickey-Fuller statistics, the null hypothesis of non-stationary is rejected for inflation and expenditure at level zero of Dickey-Fuller statistic test. The 5 per cent critical value is 3.5943.

Both inflation growth rate and expenditure are stationary at zero level 1 (0). The unit root tests shows that the stationary values are co-integrated to be utilized for error correction model. The results of error correction are presented in Table 3.

#### *Interpretation*

The aim of this econometric equation is to empirically test the impact of government expenditure, money supply and government deficit on inflation in Nigeria. The examination of the econometric results show that the overall fit is highly satisfactory with  $R^2$  of 0.91. Thus, 91 per cent of the systematic variation of the model

**TABLE 1**

Unit Root Tests for Inflation

Variables	DF <sup>a</sup> Test Statistic	ADF <sup>b</sup> Test Statistic	95% Critical Value for the AD <sup>a</sup> and ADF <sup>b</sup> Statistic Test	Remarks
DINFL	4.8617	–	–	–
DINFL (1)	–	4.9128	3.5943	Stationary
DINFL (2)	–	3.7473	3.5943	Stationary
DINFL (3)	–	3.7225	3.5943	Stationary

<sup>a</sup>Dickey Fuller. <sup>b</sup>Augmented Dickey Fuller.

TABLE 2

## Unit Root Tests for Expenditure

Variables	DF <sup>a</sup> Test Statistic	ADF <sup>b</sup> Test Statistic	95% Critical Value for the AD <sup>a</sup> and ADF <sup>b</sup> Statistic Test	Remarks
DGGE	8.0039			
DGGE (1)	-	5.3446	3.5943	Stationary
DGGE (2)	-	4.2339	3.5943	Stationary
DGGE (3)	-	3.7630	3.5943	Stationary

<sup>a</sup>Dickey Fuller. <sup>b</sup>Augmented Dickey Fuller.

TABLE 3

## The Dependent Variable in dINFL

Independent Variables	Lagged	Coefficient	T-Ratio
dINFLI	1	0.355790	2.14940
dGGE	0	0.028698	0.62528
dGGE	1	0.170780	2.37470
dGGE	2	0.135870	2.53720
dDEF	0	0.047756	0.17269
dDEF	1	1.199600	3.96990
dM <sub>2</sub>	0	0.147750	-0.96121
dM <sub>2</sub>	1	0.753320	3.49680
dM <sub>2</sub>	2	0.729880	2.92620
ECM <sub>-1</sub>	0	-1.015200	-6.44450

$R^2 = 0.9123$        $F(10,15) = 11.8278$   
 $\bar{R}^2 = 0.8062$       S.E. of Regression = 7.9852  
 D.W. = 1.7551      Mean of Dep. Variable = 0.46154

is explained by the ECM. The whole regression is highly significant at one per cent, since the calculated value is greater than the theoretical value. There is an absence of the problem of serial correlation and the standard error is minimize at 7.9852.

The t-ratios show that current government expenditure on inflation is positive but insignificant. However, one and two year lagged values of government expenditure are significant. This implies that the current government expenditure does not significantly promote inflation in Nigeria. However, the cumulative effects, especially the first and second lagged values, have positively and significantly increased inflation in Nigeria. The ratio of government deficit to gross domestic product also shows a similar pattern as government expenditure. The current value is positive, but insignificant, while the cumulative lagged effect is positive and significant. The result also shows that the current money supply is not responsible for inflation in Nigeria. However, the cumulative effects of money supply are responsible for the high rate of inflation in Nigeria. Lastly, inflation itself has a lagged cumulative effect in Nigeria, implying that inflation feeds upon itself, such that it has a cyclical cumulative fluctuation effect on the Nigerian economy. Based on these results, there is a need for policy makers to take into consideration the lagged policy effects of both fiscal and monetary and other related policies with appropriate relevant data, before embarking on any macroeconomic policy. This is to ensure that implementation of these policies does not promote unnecessary and volatile inflation in the long run, in Nigeria.

#### **IV. Policy Implications and Conclusions**

The premise of this work has been in Nigeria (1970-2000), using error correction representation. The regression results found that implementation of monetary and fiscal policies do not result in current inflation, but the cumulative lagged effects of these policies had been responsible for inflationary trends in Nigeria. This result is not surprising, in view of excessive government expenditure and fiscal budget deficit embarked upon by successive governments, since the discovery of oil and aftermath of high oil revenues. Hence the present volatile inflationary trends in Nigeria have been due to the effects of the cumulation of the past successive expansionary policies, since independence. The result agrees, in part, with Ajayi and Awosika (1980), Pinto (1987) and Chibber and Shafik (1990a) that the major determinants of inflation in Nigeria are money supply and real income; but this is a result of government's consistent and increasing budget deficits over the years. Therefore, to curb the present inflationary rate in Nigeria, there is a need for government to spend judiciously. Specifically, it should spend on important income yielding capital projects, like iron and steel industry, that will assist in the establishment of infrastructure for economic development rather than spending huge budget on Festivals of Arts and Culture, like in 1977. There must be a proper feasibility study

based on pareto-optimality on every budget allocation, coupled with transparency. Government should formulate and implement policies that enhance easy fiscal policies and tight monetary policies to maintain internal balance and to solve the twin problems of inflation and unemployment. Moreover, there is a need to expand the productive base of the nation to create more avenues for absorptive foreign revenue that can maintain stable inflation.

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## Appendix-A

### Theoretical Framework and Estimation Method

In the recent years, econometric analysis of time series data has increasingly gravitated to issues of unit roots, co-integration and error-correction modelling. The importance of testing for the existence of unit roots became generally accepted after demonstration by Granger and Newbold (1974) and that regression equations between the two non-stationary series could give “spurious” or meaningless results. That is, the regression could give “good fits” judging by the usual goodness-of-fit statistics when in fact the series are almost independent. It has then been shown that only relationship specified between stationary time-series variables can be meaningful. However, it was found that many time-series variables are stationary only after the first or second differencing. Clearly, the use of difference variables for regressions would imply the loss of valuable information about the long-run equilibrium information and the long run equilibrium relationship, between the variables. Thus, there arose the need to integrate short-run dynamics with the long-run equilibrium. The theory of co-integration pioneered by Granger (1969) and Engle and Granger (1987) addresses this issue of integrating short-run dynamics with long-run equilibrium. Basically, the new theory demonstrates that, if two time series variables are co-integrated, i.e., if there is a meaningful long-run relationship between them, the error-correction model (ECM) can describe the short-run dynamics. This is known in the literature as the “Granger representation theorem” Maddala (1992).

#### *a) Co-integration and Unit Root Tests*

The empirical test of co-integration is usually preceded by a unit root test in which the order of integration of each series employed is determined. The determination of the order of integration of each series is necessary for cointegration and indeed, for error correction models, simply because each series involved in the estimation of a model must be integrated of the same order [Engle and Granger, 1987]. Both the Dickey-Fuller (ADF) unit root tests are, indeed, employed to determine the order of each series.

Adopting the simple economic relationship of random walk with drift, the DF test is based on the following equations.

$$X_t = a + bX_{t-1} + U_t \quad (1)$$

where  $X_t$  = the series.

Under the null hypothesis of unit root, the coefficient of  $X_{t-1}$  will not be statistically different from zero, (i.e.,  $B = 0$ ); if there is no unit root, the series  $X_t$  is said to be stationary in levels or integrated of order zero, (I[0]). If there is a unit root, but differencing the series once makes it stationary, then it is said to be integrated of order one (I[1]).

In addition to testing for the unit root, equation (1) will establish, if there is a drift ( $a, 0$ ), the error term,  $U_t$ , should be white noise. If  $X_t$  is a first order autoregressive process (AR[1]), then the single lagged value of the variable will be sufficient to ensure this condition. If the process is not AR(1), then the additional difference terms will need to be added to equation (1), to make the error term to still have the properties of zero mean, constant variance and non-autocorrelated (known also as the white noise) – the Augmented Dickey-Fuller (ADF). The ADF test is therefore based on equation (2) below:

$$X_t = a + BX_{t-1} + U_t \quad (2)$$

The null hypothesis of non-stationary is rejected if the t-statistic is less than the critical t-value (i.e., if estimated  $B$  is significantly negative). The critical values adopted in this study are adapted from Charemza and Deadman (1992).

#### b) Causality Test

The cointegration says nothing about the direction of causal relationship between the variables, but if two variables are found to be co-integrated, it follows that there must be a Granger causality in at least one direction. Therefore, the causality test developed by Engle and Granger, et al. (1987), which is based on an error correction representation, is employed. The error correction equations used for testing causality between co-integrated variables are as follows:

$$INF_t = a_0 + \sum_{i=1}^p b_i INF_{t-i} + \sum_{j=1}^q c_j GE_{t-j} + d_0 ECM^1_{t-1} \quad (3)$$

$$\text{and } GE_t = a_1 + \sum_{i=1}^p c_i EXR_{t-i} + \sum_{j=1}^q f_j INF_{t-j} + d_1 ECM^2_{t-1} \quad (4)$$

where  $ECM^1_{t-1}$  in equation (3) and  $ECM^2_{t-1}$  in equation (4) are the lagged error terms from the following cointegration equations, respectively:

$$INF_t = \alpha + BGE_t + ECM^1_t \quad (5)$$

$$GE_t = \alpha + BINF_t + ECM^2_t \quad (6)$$

For instance, in order to be a unidirectional causality from GE to INF, the estimated coefficients on lagged GE in equation (3) should be significantly different from zero, as a group (i.e.,  $O_{c_j}$ ,  $O$ ) and the set of estimated coefficients on lagged INF in equation (4) should not be significantly different from zero (i.e.,  $O_{c_j}$ ). To find the effect of inflation in Nigeria, this research paper included some other variables to determine the causality, but special emphasis is placed on exchange rate deregulation. This is therefore specified as follows:

$$\text{InF}_t = a_0 + a_1 \text{InF}_{t-1} + a_2 \text{GGE}_t + a_3 \text{M2}_t + \text{ECM}_{t-1} \quad (7)$$

where:

INFL = Inflation rate in Nigeria.

GGE = Government expenditure.

M2 = Money supply.

It is pertinent to note that the long-run relationship between inflation and money supply is reflected in the coefficient of the Error Correction Method (ECM) variable. The coefficient of the ECM indicates the speed of adjustment of inflation to money supply in the long run. Thus, the feedback effect between inflation, and money supply is 0.2.

## APPENDIX-B

## Government Expenditure Figures

OBS	INFL	GE	DEF	M2
1970	13.80	0.70	-8.70	0.61
1971	15.60	0.80	2.60	0.63
1972	3.20	1.00	-0.80	0.62
1973	5.40	0.96	1.50	0.83
1974	13.40	1.50	9.80	1.18
1975	33.90	2.70	-2.00	2.04
1976	21.20	3.80	-4.00	3.29
1977	15.40	7.70	-2.40	4.79
1978	16.60	6.80	-2.80	5.09
1979	11.80	11.80	3.80	6.15
1980	9.90	4.80	12.00	14.40
1981	20.90	4.80	3.90	15.60
1982	7.90	4.90	-7.20	16.90
1983	23.20	5.30	11.80	19.40
1984	39.60	6.10	-5.90	21.60
1985	5.50	5.50	-4.20	23.80
1986	5.40	5.60	-11.30	24.20
1987	10.20	10.70	-5.40	32.10
1988	38.30	13.70	-8.40	42.80
1989	40.00	20.80	-6.70	46.20
1990	7.50	27.20	-8.50	64.90
1991	13.00	25.60	-11.00	86.20
1992	44.50	36.10	-7.20	128.60
1993	57.20	93.50	-15.50	192.50
1994	57.00	79.20	-7.70	267.80
1995	72.80	108.90	0.10	295.20
1996	29.30	141.00	1.30	368.80
1997	8.50	160.00	-0.20	431.20
1998	10.00	182.50	-4.70	522.50
1999	6.60	449.70	-8.40	699.80
2000	6.90	461.60	-2.90	624.00

*Source:*

Various issues of Federal Office of Statistics, Annual Report of Central Bank of Nigeria, National Budgets, and Periodicals (1970-2000).