On the Determinants of Inflation in Nigeria: 1980 - 2003

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This paper sets out to examine the main economic determinants of inflation in Nigeria over the period 1980-2003 using quarterly data. Using, among other measures, the Hodrick and Prescott filter, inflation is decomposed into its trend, cyclical, seasonal, and, random components. Based on the time series characteristics of the variables used in the analysis, the paper adopted the general-to-specific modelling approach to investigate the main determinants of each component. The results confirm that, in the long run, inflation is largely and positively related to the level of (narrow) money supply and, marginally, to fiscal deficit. In the medium term inflation is observed to be positively related to exchange rate depreciation and the growth of money supply. In the short run, it is observed that inflation is positively related to growth in money supply and exchange rate depreciation while it is negatively related to growth in real GDP. Some marginal significance is observed for the influence of pump price adjustment of petroleum products. The paper further observes that inflation is positively related to growth in money supply, exchange rate and growth in non-oil GDP. It is further observed that money supply affects inflation in the short to long run while exchange rate is influential in the short to medium run. Since fiscal deficit and government borrowing in Nigeria are largely financed by the (central) banking system, the findings lend support to the conventional elements of a typical stabilisation programme that reducing both the budget deficit and credit to the government are crucial in fighting inflation. Finally, since the results indicate the negative impact of economic growth on inflation, structural reforms and infrastructural improvements to increase the country's productive capacity should be considered important elements of an overall economic reform program.

Keywords: Inflation decomposition, determinants.

JEL Classification: E31

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I. Introduction

Inflation in Nigeria as a socio-economic phenomenon has received much attention in recent times. With the consumer price index (CPI) assuming a value of 11.1 by end of 1970, it rose to 22.6 in 1975[1] (in 1985 prices). Of course, the Udoji salary increase award, large flow of petrodollars, courtesy of the crude oil boom in the early 1970s, and rapid monetization of the petrodollar were easily identified by scholars as possible factors responsible for this growth in the price index (see Masha 1999; Aigbokhan, 1991; Asogu, 1991; Ekpo, 1992; and, Ikhide, 1993 amongst others). By 1983 the CPI stood at 73.1 and it was obvious that the slow growth in the industrialised economies and the rising prices and interest rates in such economies have been imported into Nigeria courtesy of the high marginal propensity to import. By 1986 the CPI had climbed to 111 and other indicators, like an overvalued domestic currency, low capacity utilisation, massive importation, low external reserve, and mounting external indebtedness suggest that the economy was under serious strain. To qualify for some external financial assistance from both bilateral and multilateral sources, the country agreed to implement a package of reform measures popularly called SAP (Structural Adjustment Programme). One of the core elements of the SAP was "getting prices right" through unbridled market mechanisms (see Anyanwu, 1992; NCEMA, 2000 and Analogbei 2000 for detailed discussions of the SAP). Hence, the country embarked upon a series of exchange rate reform measures aimed at getting the price of the domestic currency right.

The CPI which stood at 111 in 1986 when the reform measures started rose sharply to 293 by the end of 1990. By the time the Babangida administration and its attendant political crises were dispensed with in 1993, the CPI had climbed to 853. By the time the Junta leaders were weary of their incursion into Nigerian politics and voluntarily marched (back) to their barracks in 1999, the CPI stood at 3273 (again, using 1985 prices). The Olusegun Obasanjo administration was ushered in with high

[1] *Data used in this and subsequent sections are from various issues of the Annual Report and Statement of Accounts and Statistical Bulletin of the Central Bank of Nigeria.*

hopes. The administration pursued (and still pursuing) several reform policies in line with neo-liberal thinking and by 2002 the CPI stood at about 4900. It seems all efforts to curb the rising CPI were futile as it continued an unrelenting upward journey. Several attempts have been made, particularly since the late 1980s to explain why the CPI is defying all attempts to abate its rapid progression (see, for example, Adeyeye and Fakiyesi, 1980; Ajayi and Awosika, 1980; Anyanwu, 1992; and, Egwaikhide, *et al*. 1995). In virtually all the studies, attempts have been made to explain aggregate price behaviour using annual series. This study posits that since a time series can, in principle, be separated into its different components, these components are likely to be influenced by fundamentals of varying intensity and duration. Hence, a proper analysis of the driving forces behind inflation will require the examination of the determinants of these components separately. For example, factors that influence short run fluctuations in inflation may not be relevant in the long run or might have a smaller effect in the medium term. To the best of my knowledge, this is the first attempt to examine the dynamics and determinants of the different components of inflation for Nigeria[2]. The use of annual data for studying inflation (as it was done by past studies) implies that, at best, only medium to long run movements would be captured by such studies as short run fluctuations, such as seasonal effects, would be completely obliterated (see for instance the study by Domac and Elbirt (1998).

The primary objective of this paper is to decompose inflation into its various time series components and examine if these components are driven by the same fundamentals. Inflation is decomposed into its trend, cyclical, seasonal, and irregular components and we examine the determinants of each component (except the irregular) separately and jointly using the general-to-specific modelling strategy. The study observed that all the components are driven by the index of money, $M1$, used in the study. The level rather than the growth of $M1$ is important in the long run while the growth rate is important in the short to medium term. The rate

[2] *Discussions on the trend and evolution of Inflation in Nigeria are not pursued in this paper. Interested reader is referred to Ojameruaye (1998), Onwioduokit (1999), and Folorunso and Abiola (2000)*

of depreciation of the domestic currency and growth in GDP (real gross domestic product) were also observed to be important in the short term. In terms of the un-decomposed inflation series, it was observed that growth in money supply, exchange rate level and growth in non-oil GDP are the important variables. Marginal significance was observed for the impact of fuel price increase in the short run and the economic reform in affecting aggregate inflation rate. Hence, it is concluded that money supply is the only fundamental that is common in determining inflation in the short-to-long run, while other variables are important in the short-to-medium term. The rest of this paper is arranged as follows. Section 2 discuses the decomposition techniques used, while a core theoretical model of price determination is presented in section 3. In line with time series analysis, section 4 examines the time series properties of the data used in the analysis and the adopted estimation procedure. Section 5 discusses the results and the paper is concluded in section 6.

II. Inflation Decomposition

In time series analysis, it is traditional to decompose a time series into a variety of components, some or all of which may be present in a particular situation. If {*Y*} is the sequence of values of an economic index, then its generic element in additive form is liable to be expressed as:

$$Y_t = T_t + C_t + S_t + \varepsilon_t \quad \text{(1)}$$

while the multiplicative form is given as:

$$Y_t = T_t \times C_t \times S_t \times \varepsilon_t \quad \text{(2)}$$

where
T_t is the global trend,
C_t is a secular cycle,
S_t is the seasonal variation, and
ε_t is the irregular component.

It is clear that a log transformation of the multiplicative form will produce the additive version[3]. The trend component of the sequence represents the long run behaviour of variable *Y*. Simply put, trend implies the lack of a constant mean. That is, different sections of a series may have quite different sample means indicating that the population mean is time dependent. Trend is usually a low frequency component of the data. Trend could also be seen as the overall pattern of growth displayed by the series as a whole and is often referred to as the secular trend[4]. The secular trend may be one of persistent growth or decline, but it needs not be (Figure 1). The cyclical component represents the fluctuations caused by some predetermined events. It refers to patterns, or waves, in the data that are repeated after approximately equal intervals with approximately equal intensity. In other words, it is a sustained cyclical or quasi-cyclical component with period different from that of any seasonality in the data. Hence, it refers to any medium term fluctuation with a period of more than one year. The seasonal part is the periodic fluctuations which are assumed to have constant length and proportional depth caused by such factors as month of the year, holiday season, weather, and so on. These short term fluctuations are usually assumed to be calendar related. There may, however, be one or more peaks in a year.

When the trend, the secular cycle and the seasonal cycle have been extracted from the sequence, the residue is expected to correspond to an irregular component, ε_t , for which no unique explanation can be offered. It is expected that the residue should resemble a time series generated by a stationary stochastic process. Such a series has the characteristic that any segment of consecutive elements looks much like any other segment of the same duration, regardless of the date at which it begins or ends. If it is observed that the residue has a trend or any kind of regular pattern then it contains features which ought to have been attributed to the other components, which calls for a re-examination of the data generating process.

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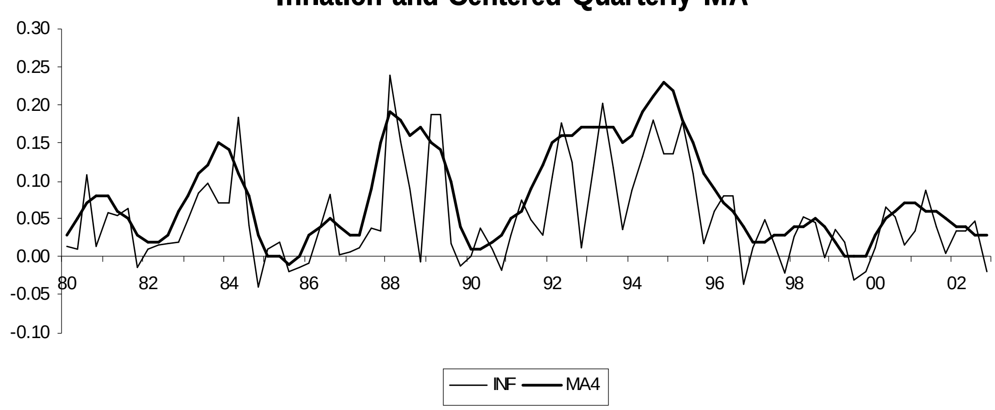
[3] *By our definition of inflation as* Δ *ln* CPI_t *it implies that an additive model will be appropriate.*

[4] *The approximate mean values of inflation for the years 1980-85, 86-91, 92-97, 98-03, respectively, are 1.28, 1.82, 2.91, and 0.86. The overall mean value is 1.75.*

In general, there are two distinct reasons for embarking on decomposition (Domac and Elbirt (1998)). The first reason, which is pertinent to this study, is to obtain a summary description of the important but salient characteristics of the sequence. It is expected that the eradication of the irregular and seasonal pattern will produce an index which is expected to give a clearer explanation of such important characteristics. This can provide useful insight into the dynamics of the sequence and help us better understand the structure and process that generates the series. The other purpose is to predict future values of the series[5]. There are no proven "automatic" techniques to identify trend components in the time series data; however, as long as the trend is monotonous (consistently increasing or decreasing) that part of data analysis is typically not very difficult. If the time series contain considerable error, then the first step in the process of trend identification is smoothing. Smoothing generally involves some form of local averaging of the data such that the non-systematic components of individual observations cancel each other out. The most common technique is *moving average* smoothening which replaces each element of the series by either the simple or weighted average of n surrounding elements, where n is the width of the smoothening window. In this study 4 quarter centred moving average $(2\times 4MA)$ of the series is used[6].

Figure 1.
Inflation and Centered Quarterly MA



[5] *We do not pursue this in this study.*

[6] *To avoid (end points) missing data problem, the computation was carried out over the 1979:2 – 2004:2 period.*

Since the averaging window is 4, the smoothening process will eliminate 4 quarter (or less) fluctuations such as seasonality and irregular components leaving the trend and cyclical components. From equation 1, we have

$$Y - MA_4 = (T + C + S + \varepsilon) - (T + C) = S + \varepsilon \quad (3)$$

The cyclical pattern can be removed by detrending the moving average as $MA_4 - T\ (= T + C - T)$. There are several methods available in the literature for detrending the moving average process. We use the Hodrick and Prescott (1997) filter, also known as *HP* filter, which is flexible, simple and can easily reproduce the series[7]. The cyclical component becomes the *MA* series less the detrended series from the filter. We now have the trend and cyclical components and what is left is to separate the seasonal component from the irregular component. This is done by deriving normalized (quarterly) seasonal indexes from the deviations in equation 2 and to use them to extract the seasonal components from the original series[8]. The various components are presented in Figure 2. The levels of linear association between these various components are presented as correlation figures in Table 1.

From Table 1 it can be observed that the secular cycle has a correlation of 0.20 with the trend and 0.66 with actual inflation. Also, the trend has a correlation of 0.48 with actual inflation while the seasonal component has a correlation of 0.89 with actual inflation. These results tentatively indicate that the various components are likely to be driven by different fundamentals. This represents the main hypothesis to be tested in this study.

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[7] *The trend series produced by direct application of least squares to the MA process with time and its squares as regressors has a correlation of 0.63 with the HP filter adopted at this stage.*

[8] *More advanced procedures such as the X11\X12 ARIMA styled methods exist, but I believe the procedure adopted here suffices for the focus of the paper.*

Figure 2

Components of Inflation

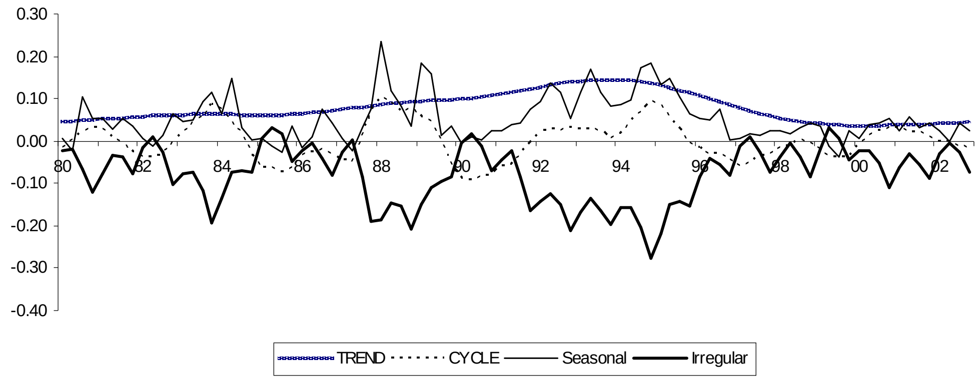

Table 1: Correlation Matrix of the Various Components

	Trend	*Cycle*	*Seasonal*	*Irregular*	*Inflation*
Trend	**1.00**				
Cycle	**0.20**	**1.00**			
Seasonal	**0.55**	**0.74**	**1.00**		
Irregular	**-0.64**	**-0.76**	**-0.77**	**1.00**	
Inflation	**0.48**	**0.66**	**0.89**	**-0.50**	**1.00**

III The Core Theoretical Model.

It is now quite common to start the analysis of the determinants of inflation in developing economies from the popular *IS-LM* model framework for a small open economy (see Kim 2001 and Lissovolik 2003). The general price level is postulated to be a weighted average of some basket of goods and services. Goods and services are categorized as tradable and non-tradable. Hence, the aggregate price index is expressed as[9]:

$$p_t = \eta p_t^t + (1-\eta) p_t^n, \quad 0 < \eta < 1. \qquad (4)$$

[9] *All the variables are expressed in logarithm except interest rates.*

where the superscript (t) indicates tradable and (n) non-tradable goods. The general assumption is that the price of tradable goods in a small open economy is determined by the world market price p_t^f and the domestic exchange rate e_t as follows:

$$p_t^t = \alpha e_t + \beta p_t^f \quad (5)$$

For the non-tradable goods, the demand is assumed to be related to the nature of the overall demand in the domestic economy hence, the price of non-tradable goods is a function of domestic money market conditions such that real money supply ($m_t^s - p_t$) equals real money demand ($m_t^d - p_t$) giving:

$$p_t^n = \lambda\left[(m_t^s - p_t) - (m_t^d - p_t)\right] = \lambda(m_t^s - m_t^d) \quad (6)$$

and λ is considered a scale factor which expresses the relationship between aggregate demand and demand for non-tradable goods. Hence, an increase in money supply will increase the price of non-tradable goods. It is further assumed that the demand for nominal money balances is an increasing function of, a scale variable (income, wealth, or expenditure, in real terms) and an index of expected real rates of return (own rate of return on money and opportunity cost of holding money) adjusted for expected inflation rate as follows:

$$m_t^d = \phi_1 + \phi_2(y_t - p_t) + \phi_3(r_t + \pi^e) \quad (7)$$

In this study, expected inflation rate is assumed to be determined by the inflation rate in the previous period

$$\pi^e = \Delta p_{t-1} \quad (8)$$

Substituting equations 8 and 7 into equation 6 yields

$$p_t^n = \lambda\left[m_t^s - (\phi_1 + \phi_2(y_t - p_t) + \phi_3(r_t + \Delta p_{t-1}))\right] \quad (9)$$

Hence, substituting equations (9) and (5) into equation (4) the general price level p_t can be expressed as:

$$p_t = p(e_t, p_t^f, m_t^s, y_t - p_t, r_t + \Delta p_{t-1}) \quad (10)$$

Hence, the estimable static long run equation would be represented linearly as follows:

$$p_t = \beta X_{it} + \mu_t \quad (11)$$

where β is a vector of estimable coefficients, X is a vector of proposed fundamentals as reflected in equation (10) and μ_t is an unobservable component that is assumed 'white noise'. The above equation serves as a core model in the analysis of the determinants of inflation in Nigeria. However, some modifications need to be made to the equation to reflect Nigerian peculiarities. We introduced three dummy variables to capture the effects of wage adjustment, adjustments to pump price of petroleum products, and the economic reform period that commenced in 1986. Furthermore, the core price equation has no fiscal variable. However, analysts are of the opinion that government fiscal behaviour in terms of the size of its deficit and\or borrowing from the banking system are key driving forces behind the rapid growth in money supply (see for example Masha (1999). Hence, we include a measure of fiscal behaviour of the government.

IV. Time Series Properties of Variables

It is now a common practice to examine the time series properties of variables to be used in modelling as this could inform the modelling strategy and reduce (if not eliminate) the risk of spurious regression. We use the ADF (Augmented Dickey-Fuller) and the KPSS (Kwiatkowski-Phillips-Schmidt-Shin**)** procedures to test for the order of integration of the series (and where conflicting results are given we checked using the Phillip-Perron test). The lag length of the ADF is based on the lag that minimises the AIC (Akaike Information Criterion) with an upper bound of 11 lags, while in the KPSS test, the Newey-West bandwidth was selected through a Bartlett Kernel estimation technique. The estimations were done with the intercept alone and intercept and trend options. All the variables are expressed in logarithm (except interest rate). The ADF tests the null of a unit root against the alternative of stationarity while the KPSS tests the null of stationarity against the alternative of a unit root. The choice of the KPSS test to supplement the widely used ADF test is based on evidence that tests designed on the basis of the null that a series is *I*(1) have low power in rejecting the null. Reversing the null and alternative hypotheses is helpful in overcoming this problem (Kwaitkowiski *et al*. 1992).

Table 2 presents the unit root tests for inflation and its components. For each variable we report the ADF and the KPSS *t*-statistic with the constant only option then followed by the constant and trend options. Strictly, since the components (except trend) are supposed to be detrended series, using the trend option is not required[10]. Furthermore, since the irregular component is by assumption containing unexplainable variations, it should be ignored. The unit root tests present mixed results. Inflation is observed to be mean stationary in level (hence in first difference) but trend stationary in first difference. The trend component is confirmed mean stationary in level by the KPSS and mean and trend stationary in first difference. The ADF does not confirm the variable to be either mean or trend stationary[11]. The secular cycle component is confirmed mean and trend stationary in levels (hence in first difference) by both tests. The seasonal component is also confirmed mean and trend stationary in levels by both tests[12].

Table 2: Unit Root Tests

	Level		1st Diff		Remark
Variable	**ADF**	**KPSS**	**ADF**	**KPSS**	
Inflation	-2.98**	0.15**	-6.02**	0.16**	*I*(0)
	-2.94	0.15	-6.02**	0.10**	
Trend	-2.17	0.28**	-2.44	0.43**	*I*(0) / *I*(1)
	-1.36	0.27	-2.96	0.11**	
Cycle	-4.97**	0.03**	-5.15**	0.02**	*I*(0)
	-4.95**	0.03**	-5.12**	0.02**	
Seasonal	-4.85**	0.15**	-8.28**	0.50*	*I*(0)
	-4.82**	0.14**	-8.25**	0.50*	
Irregular	-2.35	0.16**	-4.68**	0.28**	*I*(0) / *I*(1)
	-2.30	0.16**	-4.73**	0.27**	

Note: **(*) 5(10) percent significance. 5 percent critical values for ADF and KPSS with only a constant option, respectively, are approximately -2.8951 and 0.4630.

[10] *We report these for completeness.*
[11] *The Phillip-Perron test (though not reported here) confirms inflation to be mean and trend stationary in level and first difference and also the trend variable to be mean and trend stationary in first difference.*
[12] *The lags for the tests were selected based on the Akaike Information Criterion while bandwidths were selected based on Bartlett Kernel estimation. Individual intercepts is assumed.*

In general, the components of inflation could be described as stationary in levels (i.e., are *I*(0) variables). Unit root tests (for constant only option) for the other variables identified in section 3 are presented in Table 3[13]. From both the ADF and KPSS tests we observed that exchange rate depreciation and federal fiscal deficit are stationary in levels while others are not. The KPSS test suggests that all the variables are stationary in first difference while the ADF test tends to suggest that M1 (narrow money) and M2 (broad money) are not stationary at first difference[14]. The small sample size of the data (compared with the asymptotic properties of the tests) allows us to conclude that apart from fiscal deficit and exchange rate depreciation which are stationary in level (and government borrowing by the KPSS and Phillip-Perron tests), other variables are stationary in their first difference.

Table 3: Unit Root Tests on Proposed Fundamentals

	Level		1st Diff		Remark
Variable	**ADF**	**KPSS**	**ADF**	**KPSS**	
Exr.	-0.43	1.27	-8.81**	0.127**	*I*(1)
Exr_Depr	-8.81**	0.13**	-6.17**	0.174**	*I*(0)
DEFICIT	-5.04**	0.19**	-6.81**	0.104**	*I*(0)
M1	0.25	1.29	-2.10	0.204**	*I*(1)
M2	1.27	1.30	-1.34	0.307**	*I*(1)
NONOIL GDP	0.21	1.29	-6.55**	0.036**	*I*(1)
Real GDP	-1.67	1.03	-2.67*	0.181**	*I*(1)
Govbr	0.39	0.19**	-7.25**	0.035**	*I*(0)/*I*(1)
Interest.	-1.53	1.08	-3.85**	0.047**	*I*(1)

Notes: **(*) Significant at 5(10) percent. 5 percent critical values for the ADF and the KPSS are, respectively, -2.895 and 0.4630. Exr_depr is exchange rate depreciation, positive sign indicates depreciation. Deficit is calculated as log of government expenditure less log of government revenue. Govbr is net government borrowing from the banking system. Int. is interest rate in percent.

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[13] *There are several measures of exchange rate that can be used to examine inflation dynamics. However, in an import dependent economy like Nigeria, a depreciation of the nominal exchange rate is expected to push up prices of final consumer imports and basic inputs that are imported if the price increase is passed on. Furthermore, in the short run, domestic prices are likely to react to (expected) changes in the nominal rate rather than the real rate. For practical purposes, in the short-to-medium term, movements in the real and nominal rate are similar (IMF, 2004). Hence, in this study we use the nominal exchange rate depreciation.*

[14] *The Phillips-Perron test indicates that all the variables are mean stationary at first difference and that in fact government borrowing is mean stationary in level.*

IV.1 Estimation Procedure

The unit root test results (presented in Tables 2 and 3) suggest that the variables do not have the same order of integration. Inflation, exchange rate depreciation, deficit, and to some degree, government borrowing, were observed to be stationary in their levels while other variables are stationary in their first differences. Thus, now-fashionable time series econometric procedures that are appropriate for *I*(1) variables are not applicable in this case. However, given the presence of non-stationary variables, it is necessary to guard against the possibility of estimating spurious relationships. The time-series approach to overcoming this difficulty is to difference the non-stationary variables (to achieve stationarity) and use them in their transformed form together with the other (stationary) variables. This procedure, while statistically acceptable, has the disadvantage of ignoring long-run relations embodied in level variables. We therefore opt to use the general-to-specific modelling procedure of Hendry, which minimises the possibility of estimating spurious relations while retaining long-run information (Hendry 1995). Under this procedure, the long-run relationship being investigated is embedded within a sufficiently complex dynamic specification, including lagged dependent and independent variables, in order to minimise the possibility of estimating spurious relationships (Athukorala and Sen 1996). The estimation procedure starts with an over-parameterised autoregressive distributed lag (ADL) specification of an appropriate lag order:

$$Y_t = \alpha_0 + \sum_{i=1}^{m} A_i Y_{t-i} + \sum_{i=0}^{m} B_i Z_{t-i} + \mu_i \qquad (12)$$

where α_0 is a constant, *Yt* is a (n x 1) vector of endogenous variables, *Z*t is a (k x 1) vector of explanatory variables, and *Ai* and *Bi* are (n x n) and (n x k) matrices of parameters. Equation 11 constitutes the “maintained hypothesis” of our specification search[15]. The estimation procedure is first to estimate the unrestricted equation (using OLS) and then progressively simplify it by restricting statistically insignificant coefficients to zero and reformulating

[15] *We conducted the J-test as proposed by Davidson and Mackinnon (1981) and the result tends to favour the use of m1 as against m2 in the analysis.*

the lag patterns where appropriate in terms of levels and differences to achieve orthogonality and maintain the long run relationship. To be acceptable, the final equation must satisfy various diagnostic tests. In applying this estimation procedure, we set the initial lag length on all variables in the general ADL equation at six periods. This is the established practice in modeling with quarterly data[16].

V. Results

Different estimations were carried out for inflation and the various components of inflation (except the irregular component). Table 4 presents the results from these estimations. We report the results for our preferred models. For the coefficients we set the 10 percent significance level as the reporting benchmark.

From Table 4 we observed that one, two, and four period lags of the trend component of inflation are significant in explaining variations in the trend components. We also observed the significance of current and one period lag in money supply and one quarter lag in fiscal deficit (at 10 percent). The result indicates that largely, the past behaviour of the trend component of inflation and money supply are the main determinants of long run inflation in Nigeria. In other words, long run behaviour of inflation in Nigeria is influenced largely by monetary variables.

In terms of the secular cyclical component, we observed that one and second quarter lags of the cyclical component, fourth quarter change in exchange rate; third and fourth quarter lags in money supply affect the cyclical component. The fourth quarter lag of money was significant but with a negative sign. Generally, all the variables have their expected signs and the model explains about 90 percent of the variation in the cyclical component. It could be observed that the cyclical component is largely driven by growth in the fundamentals rather than the levels of the fundamentals.

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[16] *Quarterly values for output were derived by interpolation using a procedure developed at the Centre for Econometric and Allied Research (CEAR), University of Ibadan.*

The seasonal component is largely influenced by one period lags of growth in money supply, real GDP, and change in exchange rate, and current change in exchange rate. The dummy for petroleum price adjustment was observed to be significant at 10 percent. Seasonal dummies were included and observed to be insignificant. All the variables have the expected signs. However, the model could only capture about 47 percent of the variation in the seasonal behaviour of inflation. The seasonal component of inflation is observed to be largely influenced by short run movements (quarterly growth) in money supply, GDP, and exchange rate.

In modelling the (un-decomposed) inflation series, we observed that the first, second, and fourth quarter lags of inflation were significant at 5 percent in explaining current inflation. The main fundamentals are two quarter lag of growth in money supply, current and two quarter lag of exchange rate and current and four quarter lag of growth in non-oil GDP. The economic reform dummy (period $\geq$ 1986:03 =1, others zero) is observed to be significant at 10 percent. Essentially, inflation is determined by money growth, exchange rate, and growth performance in the non-oil sector. About 54 percent of the variation in inflation is captured by the model and all the variables have the expected signs.

Table 4: Final OLS Estimates of Inflation Components

$$TR_t = 0.01 + 0.88TR_{-1} + 0.33TR_{-2} - 0.25TR_{-4} + 0.02\,M1 - 0.02M1_{-1} + 0.005DEF_{-1}$$

1.37 8.75** 2.62** -3.47** 1.99** -2.02** 1.80*

$\overline{R^2}$ = 0.98, SER = 0.004, DW =2.17, F =984.29(0.00), $BG1_{LM}$ = 3.30(0.12), $BG2_{LM}$ = 1.04(0.15), ARCH1 = 0.01(0.92), ARCH2 = 0.01 RESET1 = 0.03(0.85), RESET2 =1.73(0.111).

$$CY_t = -0.003 + 1.47CY_{-1} - 0.65CY_{-2} + 0.02\Delta EXR_{-4} + 0.21\Delta M1_{-3} - 0.18\Delta M1_{-4}$$

-1.03 19.13 ** -8.57** 2.00** 3.39** -2.80**

$\overline{R^2}$ = 0.90, SER = 0.015, DW =2.22, F =158(0.00), $BG1_{LM}$ = 2.31(0.13), $BG2_{LM}$ = 1.34(0.27), ARCH1 = 0.00(0.98), ARCH2 = 0.54 RESET1 = 0.134(0.716), RESET2 =0.452(0.638).

$$SEAS_t = 0.004 + 0.05SEAS_{-1} + 0.25\Delta M1_{-1} - 0.29\Delta RGDP_{-1} + 0.04\Delta EXR + 0.04\Delta EXR_{-1} + 0.02D\_F$$

0.49 5.95** 2.43** -2.25** 1.67* 1.76* 1.92*

$\overline{R^2}$ = 0.47, SER = 0.04, DW =2.05, F =12.65(0.00), $BG1_{LM}$ = 0.11(0.74), $BG2_{LM}$ = 0.15(0.86), ARCH1 =0.053(0.817), ARCH2 = 0.03 (0.971), RESET1 = 0.103(0.749), RESET2 =0.512(0.601).

$$INF_t = 0.01 + 0.33INF_{-1} - 0.23INF_{-2} + 0.33INF_{-4} + 0.48\Delta M1_{-2} + 0.05EXR - 0.06EXR_{-2} - 0.50\Delta NGDP - 0.47\Delta NGDP_{-4} + 0.04D\_R$$

0.71 3.62** -2.64** 4.25** 3.93** 2.75** -3.38** -2.30** -2.56** 1.76*

$\overline{R^2}$ = 0.54, SER = 0.044, DW =1.83, F =10.42(0.00), $BG1_{LM}$ = 1.65(0.202), $BG2_{LM}$ = 0.85(0.432), ARCH1 =0.03(0.873), ARCH2 = 0.065 (0.936), RESET1 = 3.67(0.060), RESET2 =1.95(0.149).

Notes: **(*) implies 5(10) percent significance level. TR, CY, and SEAS are, respectively, the trend, cyclical, and seasonal components of inflation. NGDP is real non-oil GDP, DEF is fiscal deficit, EXR is exchange rate, INF is inflation, RGDP is real GDP. ? implies first difference. *t*-statistics are reported under the coefficients. D_F and D_R are the fuel price increase and economic reform dummies. The diagnostic tests are reported below each result. SER is the standard error of regression, DW the Dubin-Watson statistic, F the test of joint significance, BG_{LM} the Breusch-Godfrey Serial Correlation LM Test (using one and two lags), ARCH is the Engle's autoregressive conditional heteroscedasticity test (using one and two lags), RESET is Ramsey test for functional form mis-specification (using one and two fitted terms). The F values (and their equivalent *prob*. values in brackets) are reported.

V. 1 Summary of Findings

In general, some tentative findings emerged from the analyses. First, it is observed that the long run (trend) behaviour of inflation in Nigeria is largely influenced by the past levels of trend inflation and money supply. This lends credence to studies like Adamson (1989) that argued that "Nigeria's inflationary experience can be traced ultimately to excessive monetary growth". However, this study observed that the level rather than the growth of money is the important factor in the trend behaviour of inflation in Nigeria. It is observed that the cyclical movement in inflation is due to exchange rate changes and monetary growth (with the cycle itself being self propagating). Studies like Masha (1999) have also argued that variation in the parallel market exchange rate was one of the determinants of price level behavior in Nigeria.

The main factor driving seasonal fluctuation in inflation is growth in money supply and real GDP, with exchange rate changes having some marginal effects. In the general case, it is observed that growth in money, exchange rate changes (defined as $\Delta \ln exc$) and growth in non-oil GDP (with the reform dummy at 10 percent) are the main determinants of inflation in Nigeria. In all the components, monetary variables feature prominently as a major determinant of inflation. Except for the trend component, exchange rate also features as a significant determinant of inflation in Nigeria.

It is observed that the shorter the duration of the fluctuation in inflation the more difficult it is to explain the variations in inflation, For example, large proportion of the variation in the trend component was captured while less than half of the variation in the seasonal component was captured by our model. When inflation is modelled as a single series, just above half of the variation in inflation was captured by the model. In terms of policy, the paper suggests that in the long run, a well coordinated monetary policy that ensures optimal money supply will help reduce the rapid growth in price level. In the short-to-medium term, it will be important to put in place measures that will stem rapid growth in money supply, stem devaluation of the currency and enhance growth performance in the non oil sector.

VI. Conclusion

This paper examined the determinants of the various time series decomposition of inflation in Nigeria. It was observed that the behaviour of money, narrowly defined, is a major driving force behind the observed behaviour of inflation in Nigeria particularly in the long run. In the short-to-medium term, output and exchange rate were observed to play some significant role in determining movements in the price level in Nigeria.

Hence, based on the proposed hypothesis, the paper argues that money supply is the only common determinant of inflation in the short-to-long term. Other variables are relevant depending on the duration under consideration. Hence, the paper submits that the various components of inflation are driven by different fundamentals. This evidence supports the view that pure monetarist theories of inflation are able to account, to a large extent, for the price dynamics in Nigeria from the eighties up to 2003. The paper finds that it is easier to capture long run behaviour of inflation than capturing short run fluctuations in inflation, given the model adopted. This finding has significant implications for inflation predictions. Attempts to predict aggregate movement in inflation might require taking into consideration, separately, the various time series components of inflation. In terms of policy dimension, it is argued that since fiscal deficit and government borrowing in Nigeria are largely financed by the banking system, with serious implications for monetary growth, the findings lend support to the conventional elements of a typical stabilisation program that reducing both the budget deficit and credit to the government are crucial in fighting inflation. Finally, since the results indicate the negative impact of economic growth on inflation, structural reforms and infrastructural improvements to increase the country's productive capacity and ease supply constraints should be considered important elements of an overall economic reform program. Future studies can investigate other decomposition methods and use other means of generating quarterly data for the relevant variables.

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