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CONTENTS

MANAGEMENT THEMES

- Foreign Capital Flows and Industrial Development in Nigeria.
Olalekan Victor Daniyan, Ayodele Kolade, and Terkura Titus Bemaa Oreoluwa Kehinde Daniyan 1
- Organisational Commitment: The Roles of Employee Cynicism and Job Stress
Owoseni, Omosolape Olakitan, Ph.D 15
- The Role of Employees' Benefits as a Motivational Tool in Enhancing Productivity among Higher Institutions in Cameroon: A Study of the University of Buea, Buea, Cameroon
Francis A. Fumanya, Ph.D 24
- Justifying the Performance Improvement Paradigm using Strategic Management Hypothesis in Manufacturing Organizations
Ochugudu Achoda Ipuele, Ph.D 37
- Exploring the Adequacy of Leadership in Facilitating and Effecting Change.
Ukonu, Ifeanyi-chukwu Ojeka Obi, Chinwendu Vera, Edeoga, Georgina I., and Prof. Eneferole, Gideon A. 51
- Effect of Privatisation on the Performance of manufacturing Organisations.
Utor, Victor, Dewua, Philip, Mtswenem, Paul Shimadoo 63
- Human Resource Management in Nigeria Public Sector Organization: A Case Study of Michael Okpara University of Agriculture Umudike, Nigeria.
Ndubuisi Uchechukwu and Otusile Elizabeth 74
- Towards a Valid Measurement of Industrial Democracy for Employee Satisfaction.
Edwin Ode Ugaga Ph.D 82
- Human Resource Development Practices and Organizational Commitment in Nigerian Manufacturing Sector. **Ovini Oshiole Pogeson, Ugbomhe .O. Ugbomhe Ph.D and Aguwamba, Sunday M. (Ph.D)** 91
- Effects of Inventory Management on Corporate Profitability: A Study of 7up Bottling Company Plc, 9th Mile Plc, Enugu Plant.
Shakpande Comfort, Adagba, David Teryisa 101
- Impact of Emotional Intelligence on the Promotion Factor of Job Satisfaction among Nursing Professionals in Hospitals within Jos Metropolis, Nigeria
Priscilla Swatdunio Mshellia and Bello Sabo & Kabiru Jinjiri Ringim, 113

CONTENTS

Achieving Youths Economic self-reliance through Youth Entrepreneurship Education in Nigerian	
Madza, Mark Aondona and Akpera, Dinah Mgushir	120
Correlational Analysis of Workers Extra-Role Behaviour and Organizational Socialization: A Study of Road Passenger Transport Operators in Umuahia, Abia State	
Assoc. Prof. Ikechukwu Dialoke and Edeh Friday Ogbu	128
Influence of Product Knowledge on Consumers' Perception of Quality of Local Brands of Portland Cement in Nigeria	
Richard Jimin Agema	142
Determinants of Mathematics Achievement among Female Mathematics Students in Tertiary Institutions in Delta State.	
Agboma Dennis, Egbule A. C. Solomon	152
MARKETING THEMES	
The Dynamics of Money supply and Inflation in Nigeria	
Osemene Florence Ph.D, Adekunle Ahmed, Gbadebo Adedeji, Oyeleye Funke	161
Perception on Adoption of International Financial Reporting Standard for SMEs in Nigeria.	
Iorpev, Luper and Agbo, Alematu	171
Board Diversity and Financial Performance: Evidence from Nigerian Firms	
Akhalumeh, Paul Ph.D, Ohiokha, Friday Ph.D and Ireghan, Muktar	181
A Review of the Impact of Sustainability Reporting on Corporate Performance in Nigeria	
Ephraim Aondoakaa Kwaghfan, Ph. D, FCA. and Isaac Mbanongun Kwanum	193
Board of Governance and Credit Risk Management of Deposit Money Banks in Nigeria	
Hauwa Sanusi Junaid and Modibbo Abubakar	204
Public Expenditure: Implication on Economic Growth in Nigeria (1990-2014)	
Paul Aondona Angahar, PhD and Jacob Sesugh Angahar	219
A Comparative Analysis of Personal Income Tax Act 2004 and 2011: Effects on Personal Income of Employees in Nigeria.	
Nwarogu, Innocent Augustine Ph.D	231

CONTENTS

Audit Reputation and Market Valuation of Listed Firms in Nigeria Patience Ota Ola and Nnubia, Innocent Chukwuebuka.	240
Effect of Corporate Governance on the Dividend Policy of Firms in Nigeria Nwarogu, Innocent Augustine Ph.D	249
Accountability and Transparency as a tool for Enhancing Better Work Environment Emmanuel Igbowase Abahyam	258
Developing Environmental Taxation in Cameroon: Practice-Problems & Perspectives Francis A. Fumanya, Ph.D	267
Managers' Opportunistic Behaviour and Operating Cashflows: Evidence from Nigeria Alematu Agbo (Mrs) Ph.D	281
The Relevance of Capital Structure on Corporate Performance: A Study of Selected Quoted Manufacturing Companies in Nigeria (2004-2013) Aime Tile Eminentuel and Yakubu, Susan Erdoo	289
Effect of Agricultural Credit Guarantee Scheme Fund on Agricultural Development in Nigeria Fanen Anande-kur MSc, MBA	301
Determinants of Dividend Policy of Nigerian Breweries Gbegi, Daniel Orsar, Ph.D and Pavtar, Augustine Agir	312
ECONOMICS AND POLICY THEMES	
Impact of Deposit Money Banks Credit on the Performance of Agricultural Sector Simeon T. Asom and Victor Ushahemba Ijirshar	331
Impact of Interest and Exchange Rates on Nigeria Manufacturing Sector Eche, Emmanuel, Sunday Aboh Okoh and Helen Douglas	342
Theories of Corporate Executive Fraud Clement C.M. Ajekwe, Adzor Ibiamke	349
Credit Financing and Small and Medium Enterprises in Nigeria Oladotun Larry, Anifowose and Taiwo Akinyemi, Ayedun	367
Financial Reporting Council of Nigeria, Ifrs Adoption and the Relationship between Corporate Governance and Profitability Measures of Nigerian Firms. Demaki, G.C. ¹ Ph.D. and Jeroh, E. ² Ph.D., ACA	382

Dynamics of Money Supply and Inflation in Nigeria

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pp 161-170

Abstract

This paper provided quantitative analysis of the dynamics of money supply, deficit financing and inflation in Nigeria. Using secondary data, the findings of the bounds test reveal that the estimated equation and the series are co-integrated. The ARDL results suggested a long run positive relationship exists between deficit financing and inflation, and long run positive relationship exists between money supply and inflation, and show a significant relationship in the short. The study recommends that the government must adopt appropriate macroeconomic policies to reduce budget deficit, which will result in reduction in inflation growth and in turn lead to the growth and development of the country.

Keywords: Fiscal Deficit; ARDL; Inflation

Introduction

Inflation has been a disputed term which poses a huge challenge to economists. Essentially, inflation refers to a continuous and constant rise in the general level of prices of goods and services in an economy. It divulges itself most clearly in the decline in the value of money. According to Yahya (2013), the major empirical explanations of inflation include fiscal, monetary and balance of payment aspects. Inflation is also premeditated to be due to a rise in the money supply. However, the fiscal perspective, vista inflation as rising from budget deficits which are considered central determinant of inflation. However, the fiscal aspect is closely related to the monetary views of inflation since government insufficiency are often financed by money creation in developing economies. Essentially, in the balance of payments aspect, emphasis is based on the exchange rate. The collapse of the exchange rate usually brings about inflation through increase in import prices and higher inflationary expectations which are often accommodated through an accelerated wage indexation mechanism.

Essien and Uche (2002) distinguish two features of inflation which are worth noting. Inflation is associated with general rise in an individual good and service price. In addition, once and for all increase in the price level does not meaningfully add momentum to the constructed inflation.

On the other hand, a onetime rise in the price of certain goods may cause a chain of price increases which can lead to a constant increase in inflation.

Inflation has been a problem in Nigeria since 1970s when the country's weak economic base became problematic, especially towards the end of 1970s. There were all sorts of disequilibria in the system caused by imbalance between the spending power and the productive capacity of the country. The distortions were caused by the nible depletion of the foreign reserves thus leading to disagreement in the balance of payments, and a nible expansion of overall monetary expenditure in the country which helped to

stimulate prices (Omofa, 2006).

As observed by Yahya (2013) inflation led to the abandonment of the German currency in the 1920s, caused a national strike in France in 1973 and a national riot in Egypt in 1977.

Also almost all free market countries have experienced some degree of protest against inflation.

The rate at which inflation is rising and dampening budget implementation at all system of government as well as business daily activities in Nigeria has become a perturbing issue for many Nigerians. In fact inflation has been a sustained menace to the Nigeria system, since the 1990's. It is contra to this background that the researchers attempt to empirically analyze the extent of the effects of money supply, fiscal deficit on inflation.

Essentially, investigating this issue empirically in Nigeria is a notable challenge that is overdue in view of the mammoth significant importance attributed to it. Until recently, there was comparatively less empirical research on the relationship between deficit financing, money supply and inflation in Nigeria. As stated in this paper, the limited empirical studies on this point have utilized conventional econometric method best suited to identifying whether individual variables are related to inflation (Ayoedele & Emmanuel, 2005). It is cleared from the literature that earlier studies have examined the determination and targeting of inflation, (Asogu, 1991; Johnson, 1973; & Kuszczak and Murray, 2015) among others. As such, this paper will discover if long-run relationship exists between monetary growth, budget deficit and inflation in Nigeria. It also tackled the possible effects of exchange rate manipulation and monetary tenet on inflation in Nigeria.

The study explore the AutoRegressive Distributive Lag Model (ARDL) which has wax popular in economic analysis during the last decade. The study covered over the period of 1985 to 2014, based on the background that structural economic reforms started in Nigeria in 1986. AutoRegressive Distributive Lag Model (ARDL), corrects the lapses often

associated with OLS, also using ARDL method, one can investigate the relationship between the variables of importance in both the short-run and long run.

The current study also utilise a ECM technique to test the short and the long run relationship and the VDC to predict exogenous shocks of the variable.

The oddment of this paper is organized as follows. Section 2 discusses the literature review, the data and methodology used for the study will be discussed in Section 3, Section 4 analyses empirical results and Section 5 presents the conclusions and policy recommendations of the study.

Literature Review

The Concept of Inflation

Inflation is one of the most regularly used terms in economic analysis, yet the concept is variously misconstrued. Inflation as a concept has various schools of thought, but there is a consensus among economists that inflation is a continuous increase in the prices of goods and services. Simply put, inflation depicts an economic situation where there is a general increase in the prices of goods and services, monotonously. It could be defined as a continuing rise in prices as measured by an index such as the consumer price index (CPI) or by the implicit price deflator for Gross National Product (GNP). The term inflation in Jhingan (2006) is a persistent and appreciable rise in the general level of prices.

Different analyst have presented different theories on inflation. The economists who have provided the theories of inflation are broadly categorized into two, Monetarists and Structuralists. Monetarist associated inflation to the monetarist causes and suggested monetary measure to control it. The structuralists believed that inflation occurs because of the unbalance economic system and they used both monetary and fiscal measures together for sorting out economic problems. Essentially, this study is built on monetary theory of inflation.

Empirical Studies

Sizable empirical work has been done on money supply and its inflationary consequences in Nigeria. Omofa (2006), conducted an empirical investigation on money supply and its effect on the Nigerian inflationary process from 1985-2000. The primary objective of his study was to examine the effect of money supply on the Nigerian inflationary process. the study was based on the fulfillment of economic a priori criteria, i.e., sign and size of the estimates of interest. The traditional criteria relating to the R² were not used. The study made use of the F-ratio, the t-value and the Durbin Watson statistic in estimating the goodness of fit of the regression equation and statistical significance of the parameters. He used money supply in the current (Mt) and previous (Mt-1) period, the price level in the lag period of one (pt-1), foreign price (pt), interest rate (A), the level of output i.e., GDP (Y), the exchange rate (E) and the government deficit (GD) to analyze changes in the general price level, i.e., rate of inflation (Pt). The overall fit showed a very significant relationship between the price level and the exogenous variables. It showed that about 99.9% of the changes in the price level amid the period under consideration was explained by the model. The remaining 1% could be explained by other economic factors not included in the model. This tends to validate the monetarists contention that if monetary variables can be subjected to control, then the price level would be simultaneously controlled. This shows that if the explanatory variables can be sufficiently controlled, varied to about 99.9% the price level can be brought under reasonable control. Essentially, the overall significance was very high (i.e F-Statistic at 99.7%), it showed that the data fits into the model and at least one of the coefficients or parameters of the model is nonzero.

Methodology

Inflation is determined by many variables. These variables include the level of money supply, aggregate demand, cost of inputs of production, population, deficit

financing, and psychological factors. The model for this study is expressed as:

$$\text{Inf} = f(\text{Ms}, \text{Im}, \text{Df}, \text{exch}, \text{Pop}) \quad (1)$$

Essentially, *Df* and *INF* was inputted into the model to capture their impact on inflation

The regression notations is substituted to read
 $\text{Inf} = \alpha_0 + \beta_1 \text{Ms} + \beta_2 \text{Im} + \beta_3 \text{Df} + \beta_4 \text{Exch} + \beta_5 \text{Pop} + \mu$ (2)

The logged version of the model is as follows:

$$\text{LogInf} = \alpha_0 + \beta_1 \text{LogMs} + \beta_2 \text{LogIm} + \beta_3 \text{LogDf} + \beta_4 \text{LogExch} + \beta_5 \text{LogPop} + \mu \quad (3)$$

Where; Inf = Inflation

Ms = Money Supply (M2)

Im = Import

Exch = Exchange Rate

Df = Deficit financing

Pop = Population

U = Random Variable

In this study, money supply has been measured through M2 (Broad money) and has increasingly been recognized as a major determinant of inflation. Some researchers argue that there exists an adverse relationship between inflation and money supply (Johnson 1973). Whereas some other theorists argue that the relationship between the two variables is positive Asogu (1991).

Deficit financing is an important explanation of the increase in money supply. Thus, the structuralists are inadvertently emphasizing money supply when they emphasize deficit financing. Import prices explains the contribution of imported inflation.

Essentially, this study empirically estimated the dynamics of money supply, deficit financing and inflation and other fundamental macroeconomic factors with the help of the above described methodology for Nigeria. The study uses annual data on the variables described above covering 1985 to 2014. The data has been taken and compiled from Central Bank of Nigeria Statistics bulletin, International Monetary Fund database and World Bank database.

A priori expectation

It is expected that Ms, Im, Bd, Ad and Pop are positively related to inflation. This is given as: $\text{Ms} > 0$; $\text{Imp} > 0$; $\text{Df} > 0$; $\text{Exch} > 0$; and $\text{Pop} > 0$. This implies that as these variables increases; inflation also increases.

Co-Integration with ARDL

The ARDL model specification for equation (1) is;

$$\Delta \ln \text{INF}_t = \alpha + \sum_{i=1}^p \alpha_i \Delta \ln \text{INF}_{t-i} + \sum_{j=1}^q \beta_j \Delta \ln \text{Ms}_{t-j} + \sum_{k=1}^r \gamma_k \Delta \ln \text{Im}_{t-k} + \sum_{l=1}^s \delta_l \Delta \ln \text{Df}_{t-l} + \sum_{m=1}^u \theta_m \Delta \ln \text{EXCH}_{t-m} + \sum_{n=1}^v \phi_n \Delta \ln \text{POP}_{t-n} + \pi_1 \Delta \ln \text{INF}_{t-1} + \pi_2 \Delta \ln \text{Ms}_{t-1} + \pi_3 \Delta \ln \text{Im}_{t-1} + \pi_4 \Delta \ln \text{Df}_{t-1} + \pi_5 \Delta \ln \text{EXCH}_{t-1} + \pi_6 \Delta \ln \text{POP}_{t-1} + \varepsilon_t \quad (4)$$

In equation (4), η and b_4 = lag length for the Model, Δ = first differencing operator and ε = white noise disturbance error term. The long-run and short-run parameters of equation 5 and 6 would be estimated once a cointegration is established. The long-run relationship specification is:

$$\ln \text{INF}_t = \psi + \sum_{i=1}^p \alpha_i \ln \text{INF}_{t-i} + \sum_{j=1}^q \beta_j \ln \text{Ms}_{t-j} + \sum_{k=1}^r \gamma_k \ln \text{Im}_{t-k} + \sum_{l=1}^s \delta_l \ln \text{Df}_{t-l} + \sum_{m=1}^u \theta_m \ln \text{EXCH}_{t-m} + \sum_{n=1}^v \phi_n \ln \text{POP}_{t-n} + \varepsilon_t \quad (5)$$

However, to restore equilibrium proximately may not be possible because of the speed of adjustment. This could be influenced by the adjustment process used to capture changes in any of the factors affecting fiscal deficit or exchange rate depreciation overtime. Hence, ECM can be used to capture the speed of adjustment of exchange rate depreciation equation. The ECM is:

$$\Delta \ln \text{INF}_t = \rho + \sum_{i=1}^p \beta_i \Delta \ln \text{INF}_{t-i} + \sum_{j=1}^q \gamma_j \Delta \ln \text{Ms}_{t-j} + \sum_{k=1}^r \delta_k \Delta \ln \text{Im}_{t-k} + \sum_{l=1}^s \theta_l \Delta \ln \text{Df}_{t-l} + \sum_{m=1}^u \phi_m \Delta \ln \text{EXCH}_{t-m} + \sum_{n=1}^v \psi_n \Delta \ln \text{POP}_{t-n} + \lambda \text{ecm}_{t-1} + \varepsilon_t$$

Where: ecm_{t-1} represents the error correction term lagged for one period and λ = the coefficients for measuring speed of adjustment in equation (6). In this ECM equation, we assume a lag length of $t-1$. Each coefficients of equation 6 represents the short run dynamics of the model.

Result and Discussion

Pretest: unit root and cointegration test

The results of the pretest are provided in Tables 1, 2 and 3 below. The pretest was necessary to confirm if the ARDL approach is appropriate.

Table 1: Unit root test for stationarity in level form
(Regression include an intercept without a linear trend)

Variables X_t	DF Statistics	ADF test Statistics	ADF Lag Length	ADF Critical Value	Remarks
INF	-1.8941	-2.0738	1	-3.5806	Non-stationary
MS	-1.9671	-2.6506	1	-1.9533	Stationary
IM	-4.2394	-5.2507	1	-3.5875	Stationary
DF	-3.5514	-4.1646	1	-2.9718	Stationary
EXCH	-1.2254	-2.0588	1	-3.5875	Non-Stationary
POP	-1.2613	-2.7337	1	-2.9718	Non Stationary

Source: Eviews output computed by the authors, 2016

Table 2: Unit root test for stationarity in first difference
(Regression include an intercept without a linear trend)

Variables X_t	DF Statistics	ADF test Statistics	ADF Lag Length	ADF Critical Value	Order of Integration
INF	-2.8939	-4.0638	1	-3.5806	I(1)
MS	-2.4403	-3.6506	1	-1.9533	I(0)
IM	-3.0579	-5.2507	1	-3.5875	I(0)
DF	-2.5514	-5.1646	1	-2.9718	I(0)
EXCH	-4.7441	-6.2875	1	-3.4501	I(1)
POP	-5.2613	-7.7337	1	-3.9718	I(0)

Source: Eviews output computed by the authors, 2016

Table 3: ARDL bound test

Computed F-Statistic: 5.15	Lag (K) = 2
Critical Bound Value (5%) ⁵	I(0): 2.649, I(1): 3.805

Source: E views output computed by the authors, 2016

The results in Tables 1 and 2 show that there is no enough evidence to accept the null hypothesis of non-stationary for all the series using the DF/ADF test-statistics. All the variables are not integrated of same order. That is, some of variables are either I(0) or purely I(1). If all the I(0) and I(1) series are mutually cointegrated, then the ARDL approach is unequivocally an appropriate technique for the estimation. Table 3 shows the results of the calculated F-statistics (Wald test) when each variable is considered as a dependent normalized variable in the ARDL-OLS regressions. This result reveals that the

calculated F-statistics(5.15) is higher than the upper bound critical value (3.805) at 5% error level. Based on this, the study concluded that a long run cointegration relationship exists for the estimated ARDL models. Thus, the null hypotheses of no cointegration are rejected. This implies INFLATION (INF) and representative independent variables are cointegrated. This means that for the periods studied there was a long run stable relationship among inflation, and vector of explanatory variables which includes broad money supply, import, deficit financing, exchange rate and population stationary. Since cointegration is

established in the test, then it follows that a non-spurious long run relationship exists and the error correction representation can be obtained. The result obtained by normalizing on INF in the long run is reported in Table 4 while Tables 5 and 6 present the result of the

short-run dynamic coefficients and the model diagnostic and stability tests, respectively.

Notes: Critical values are extracted from Pesaran (1997); Unrestricted Intercept and No Trend (Case III)

Table 4. Estimated Long Run Coefficients using ARDL Approach (Dependent variable: INF).

Regressors	Coefficient	ARDL(1,0,0,0)	
		t-Values	Prob. Values
M2	4.5174	-0.8141	0.0236
Δ IM	0.1326	-0.8617	0.0421
Δ DF	-0.0012	-0.2991	0.7674
Δ EXCH	-3.5072	-0.3572	0.7240
Δ POP	6.2767	-0.6222	0.5396

Significant at 5% level

Source: Eviews output computed by the authors, 2016

Estimated Short Run Coefficients using ARDL Approach (Dependent variable: INF).

Regressors	Coefficient	ARDL(1,0,0,0)	
		t-Values	Prob. Values
Δ M2	-22.13	-0.9309	0.3630
Δ IM	0.2673	-0.8317	0.4154
Δ DF	0.0121	-2.5942	0.0173
Δ EXCH	-0.2360	1.1262	0.0234
Δ POP	-2.5211	-0.2573	0.7995
ECM(-1)	-1.0942	-4.8521	0.0001

Significant at 5% level

Source: Eviews output computed by the authors, 2016

Robustness Indicators		
R ²		0.79
Adjusted R ²		0.56
Durbin Watson Stat		1.89
F Statistics		6.2 (0.005)
Serial Correlation,	F 1.142[0.231]	
Heteroskedasticity,	F 2.461[0.146]	

Source: Eviews output computed by the authors, 2016

The long run relationship of the estimated coefficients show that growth of money supply has a significant impact on inflation. This conformed to monetary theory that inflation is highly monetary dependent. Also, the import variable is significant at 5% level. The result shows that 1% increase in import leads to approximately 13% increase in inflation. All other variables are non significant.

On the short run representation, only the coefficient of changes in deficit financing and exchange rate are significant at 5 percent level, with negative sign of exchange rate implying that changes in exchange rate have significant negative effect on changes in inflation for the period studied. Essentially, the adverse effects of money supply raises further issues about the usual theoretical linkage between money supply and price. The traditional macroeconomic theory states that money should have positive and significant effect on price level. The economic justification for the negative effect of money supply on price level is that inflation is not caused only by aggregate demand pressure but rather due to hiccups in the supply chain of goods both from the domestic and foreign supply channel. In other words the fluctuation in the price level is more of aggregate supply induced rather than total demand. Also, given the higher coefficient of exchange rate, it seems that exchange rate is more important in the price determination in Nigeria than monetary expansion and real output production. This corroborates many other studies (Steven, 1997 and Ajakaiye, 1994). In an import dependent country like Nigeria, changes in exchange rate are directly reflected in the prices of the goods and services. The fiscal deficit have positive impact on inflation and is significant at 5%. The fiscal deficit is closely linked to the monetary expectations of inflation since government deficits are always financed by money creation in developing countries.

Essentially, on the short run representation import is positively related with

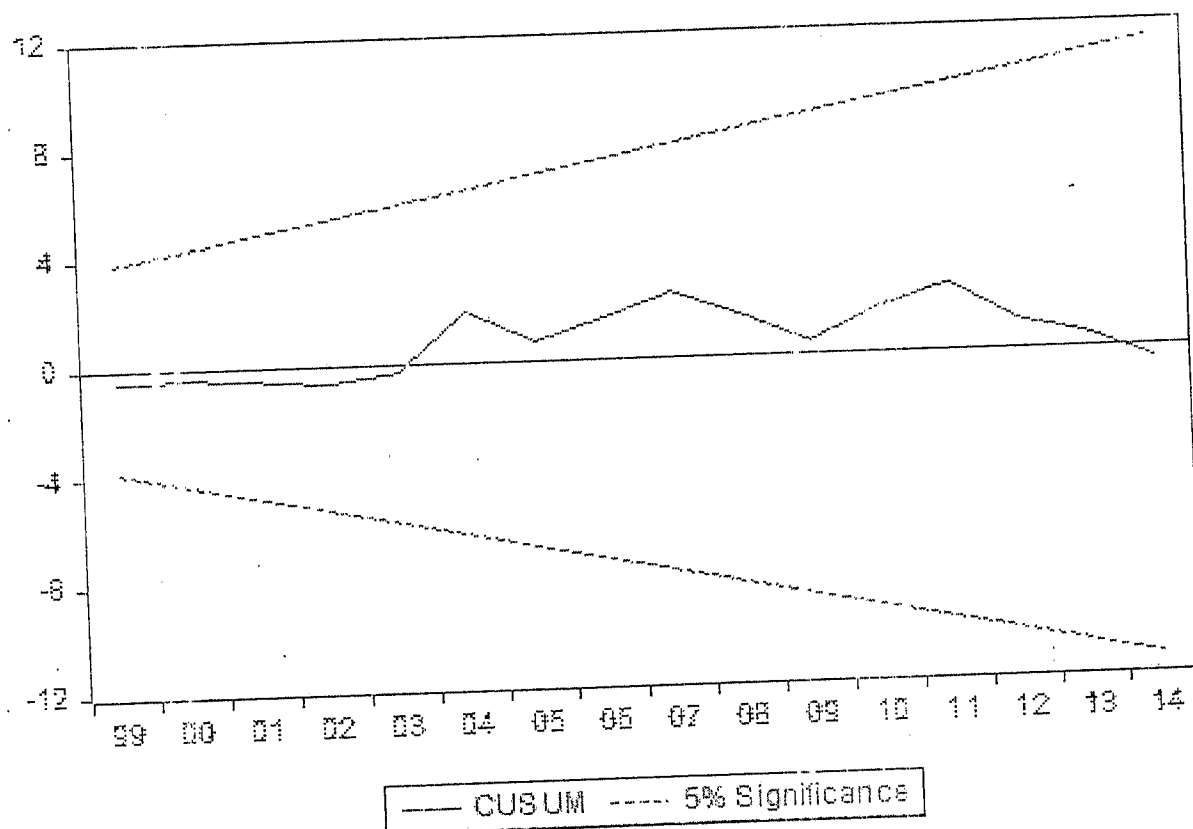
inflation in Nigeria, the collapse of the exchange rate normally brings about inflation through higher import price and increases in inflationary pressure are always accommodated through an accelerated wage indexation mechanism.

Furthermore, population has positive impact on inflation but this was not significant, this is due to deficiency in fiscal and monetary policy operated in the country. Only 56 percent of systematic variation in the value of changes in inflation was accounted for by changes in the series of attendant explanatory variables used, the remaining 44% is attributed to stochastic variable.

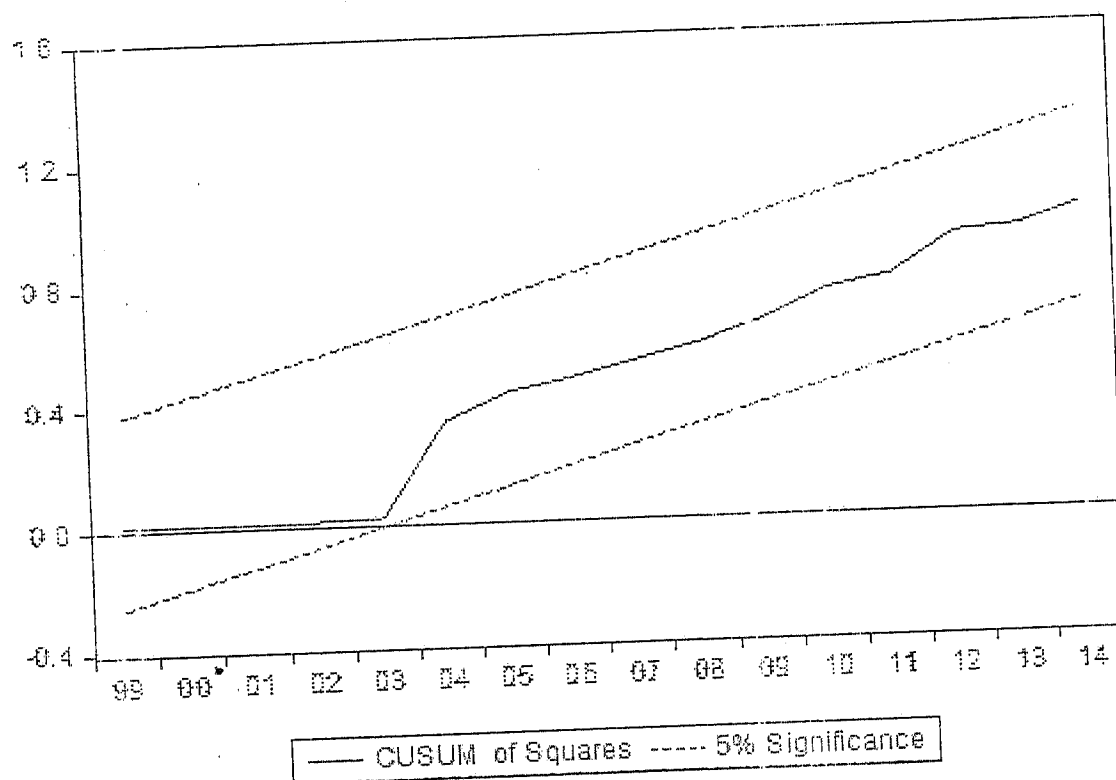
The coefficient of the ECM was found to have the right sign (being negative), large in magnitude and also highly significant. Conceptually, a significant error term with right sign indicates a feedback effect of any deviation exchange rate depreciation from its long run (or equilibrium) steady path thus suggest that any perturbation or disequilibrium will automatically adjust back to the long run equilibrium wholly at a high speed of 100 percent in each period sampled. The regression for the underlying ARDL fits very well at R² of 79 percent. The overall model is highly significant and there is no residual serial correlation which suggests that the model could fit for any policy formulation agenda. The model was subjected to the diagnostic tests against serial correlation, functional form misspecification and non-normal errors (Table 5).

The stability of error corrections model should always subjected to graphical investigation (Pesaran, Shin & Smith, 1995). A schematic representation of the Cumulative Sum (CUSUM) and the Cumulative Sum of Square (CUSUMSQ) are also established. The cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) plots is shown in schematic from a recursive estimation of the model show a stability in the coefficients over the sample period.

Plot of Cumulative Sum of Recursive Residuals



Plot of Cumulative Sum of Square of Recursive Residuals



The straight lines represent critical bounds at 5% level of significance

Figure 1. Stability Test.

Variance Decomposition (VDC) Analysis

The results of the VDC are presented in Table 6. The column SE is the forecast error of the variable to be forecast at various lengths into the future. The empirical evidence indicates that 24.65% of inflation change is contributed, its own innovative shocks. Further shock in deficit financing explains inflation by 57.86% and the money supply contributes to

inflation by 9.58%. The share of other variables is very minimal. During the initial period, the variation in changes in inflation is caused by the inflation itself. As time passes, the change in inflation is contributed by government fiscal differences. However, the impact exerted by other macroeconomic variables on inflation is very low. Therefore, it can be stated that over the horizon of 10 years, fiscal deficit plays the most important role, explaining 57% variation in inflation in Nigeria.

Table 6. Variance Decomposition (VDC) Analysis.
Variance Decomposition of INF:

Period	S.E.	INF	M2	DF	IMPORT	EXCH	POP
1	12.86072	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	14.76581	83.42852	5.706556	9.748988	0.048571	0.998953	0.068411
3	19.63973	52.99538	8.478635	34.2453	2.140536	1.833094	0.306954
4	20.86025	48.87304	7.542462	31.82569	6.024399	5.425423	0.308986
5	23.63231	38.20176	9.269364	41.90317	5.475820	4.261733	0.888153
6	27.47562	28.28220	9.359483	52.83223	4.076033	4.672805	0.777241
7	28.68523	26.19061	8.728075	54.07380	4.026420	6.054439	0.926656
8	28.99772	26.04162	8.932255	52.94979	4.097454	6.387766	1.591110
9	29.52825	25.27725	9.441838	53.30987	3.951750	6.160784	1.858516
10	29.90715	24.65298	9.581765	53.77055	4.011406	6.165183	1.818112

Cholesky Ordering : INF M2 DF IMPORT EXCH POP

Conclusion

This paper examined the dynamic of money supply, fiscal deficit on inflation in Nigeria. It adopted the monetarist's method based on its usefulness for the purpose at hand. From the various econometric tests carried out, it was revealed that fiscal deficit had significant impact on the price level in Nigeria. The implication of this result is that, the focal point by the monetarists on the relative effectiveness of monetary policy in controlling inflation may be the best policy for the Nigerian economy. Money supply, import, and population are important variables in explaining variation in the price level, though with a negligible effect on it.

Premised on the findings of the study, the

following recommendations are hereby made:

- Government should pursue conservative fiscal policies by reducing substantially the fiscal deficit. It should be noted that fiscal deficits when financed through the financial set up as currently done in Nigeria not only increase aggregates but impinge directly on the money supply.
- The Central Bank of Nigeria should continue to focus on controlling the growth of the money stock through a restrictive monetary policy.
- The above recommendations underscore the need for monetary and fiscal co-ordination as they complement each other. Government should not be pursuing a liberal fiscal policy when the

Central Bank is advocating restraint in the face of mounting pressure on the price level.

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