An Empirical Analysis of Price Stability Effect of Nigerian Monetary Policy (1981 – 2012)

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Abstract— The study examines the price stability effect of Nigerian monetary policy from 1981 to 2012. The Error Correction Mechanism (ECM) model was employed after conducting a number of diagnosis test and ensured that the data were stable. The results of the analysis showed that monetary policy implementation has not yielded the expected outcome to ensure price stability. Also, Inflation, Monetary Policy Rate and Interest Rate are significant determinants of price instability while Money Supply and Exchange Rate cause price instability, though not significantly. The findings revealed that general price level increases as the exogenous variables increase. Therefore, restricted monetary policies should be put in place so as to reduce inflation rate to the barest minimum and the interest rate policies should be implemented in a way that will strengthen the purchasing power of the Naira.

Index Terms—Monetary Policy, Price Stability, Consumer Price Index, Inflation, Error Correction Mechanism.

I. INTRODUCTION

Price stability is a desideratum for every nation and has always been the core objective of monetary policy framework. This is borne of the perception that stability in prices of goods and services promotes economic growth. Price stability exists when there is sustainable low and stable inflation rate [1]. Price instability is reflected in rising inflation in nearly all the world and it poses a threat to the economic progress of a nation, thus; making the pursuit for price stability an utmost priority for every nation. The Central Bank of Nigeria (CBN) is saddled with the responsibility of price stabilisation in Nigeria. The CBN is empowered to carry out this responsibility through the provisions of the Banks and Other Financial Institutions Decree 25, 1991 (BOFID) (as amended) and the CBN Decree No. 24, 1991 (as amended). Price stability was pointed as a core target of the Central Bank and a pre-condition for smooth operation of the market economy and economic growth by the first conference of the Central Bank of European countries in 2001. The role of monetary policy in achieving price stability cannot be overemphasised.

Price stability can assist to achieve maximum sustainable output growth and employment ultimately, however, in the short period; a number of challenges can exist between the goals. Reference [2] stated that the quest for price stability in the economy connotes the indirect pursuance of the goal of economic progress, which can exist only under conditions of price stability and financial market efficiency. The efficiency of the financial market is disrupted in the face of fluctuations in general price level. In Nigeria, investors perceive monetary policy and macroeconomic events as principal causes of the uncertainty in the equity market, implying that macroeconomic parameters' shock could affect equity price as well as returns; thereby controlling the decisions of investors [3].

In ensuring price stability, the Central Bank in Nigeria implements policies that guarantee sustained economic growth through appropriately changing levels of money supply. In Nigeria, CBN performs its function through the monetary policy programme. The process of arriving at the CBN's monetary policy programme entails an appraisal of developmental changes in the economy over a specific period and designing policy measures that would ensure price stability [1]. Monetary policy is formulated and implemented based on the volume and direction of money supply and accessibility of financial resources in the economy. Reference [4] in his view says monetary policy is important for accessing the direction and magnitude of effect in changes of money supply and credit on the following; production, employment, price stability and economic growth and development. The CBN control the economy by influencing the activities and operation of Deposit Money Banks (DMBs). Banks' reserves are controlled by the apex monetary authority (CBN) using a number of monetary policy weapons – such as open market operations, liquidity ratio and cash reserve ratio [5][6].

Inflationary pressure on the economy does not put the CBN at a vantage position to achieve price stability. The persistent increase in the price levels tends to lead to an upward trend in inflation rates. Despite the different monetary regimes that have existed in Nigeria, price instability still poses severe danger to drivers of economic growth. Ever since the 1970s, Nigeria has witnessed fluctuations in inflation rate and consistent periods of double- digit inflation rate. The key problem facing CBN is how to curtail price instability in the face of other macroeconomic problems. The impetus for this study is a premise on the fact that price stability is fundamental to economic growth, employment generation, production and investors' investment decisions. If this is correct, then there is a need to investigate how monetary policy has achieved the desired result. This is because the literature on this role of CBN in Nigeria cannot be said to have been conclusive. Hence, further studies are required to

establish the clear-cut effect of CBN's monetary policy actions on price stability in Nigeria.

Against this background information, the study evaluates the price stability effect of Nigerian monetary policy from 1981 to 2012. This study sheds light into how CBN has fared in its ability to maintain price stability and also make recommendations based on its findings. The remaining part of this article is structured as follows: the review of literature is focused in the second section, the method of analysis is explained in the third section, the fourth section deals with the explanation of the findings and the fifth section makes recommendations and then concludes the study.

II. LITERATURE REVIEW

It is theoretically believed that monetary policy is pivotal in achieving price stability in an economy. Instability in the price level of commodities unequivocally leads to an upward drift in inflation rates. Literatures suggest pursuit of price stabilisation objective entails all key aspects of the macro-economic environment. Price stability is experienced when inflation is reasonably low that it does not have significant influence on decisions of economic units. Reference [7] shows that price stability is not an indication of zilch growth in inflation in a nation because a low level of inflation is necessary for the expansion of an emerging economy. Monetary policy is key determinant of inflation rates. Various studies [8] [9] [10] [11] provide the empirical evidence on how monetary policy affects price stability in varied dimensions.

Reference [8] investigated monetary policy impact on Nigeria's macroeconomic stability measured by stability in price from 1970 to 2009. Adopting Error Correction Mechanism (ECM) and Co-integration, it was discovered that instruments of monetary policy had conflicting results with respect to their effect on inflation. Reference [9] reviewed how the decisions of monetary authorities influenced inflation, interest rates, money supply, gross domestic products and exchange rates. On the whole, the study conceived that rigid monetary policies with balanced adjustment in exogenous variables exert favourable influence on the endogenous variable.

Reference [10] examined monetary policy shock on Nigerian economy. Using OLS method to analyse data between 1981 and 2008, the result showed that monetary policy exerts a positive impact on GDP growth and Balance of Payments but a negative impact on the rate of inflation. The findings suggest that monetary policy has affected economic growth positively but could not ensure price stability. Reference [12] study using annual Nigerian data from 1970 to 2010 reported that monetary policy is negatively and significantly connected with the general price levels in the early period while positively related on the long-term.

Reference [13] conducted an appraisal of developmental changes in Nigerian monetary policy as well as its stabilisation consequences from 1986 to 2009. It was deduced that the policy had a deterministic impact on money supply and exchange rate while it produced an opposite impact on price instability. The study concluded that maintenance of price stability has been influenced majorly by monetary policy. In contrary, [11] examined the efficacy of Nigerian monetary policy approach in stabilising price using quarterly data from 1981 to 2009 and employing error correction modelling (ECM) as well as the Granger Causality test. The study found that the role of monetary policy in achieving the objective of price stability has been less than successful in Nigeria.

The correlation between money, inflation and output in Nigeria was examined by [14]. The study showed a strong causal association amongst the parameters. Specifically, the duo of inflation and output were granger caused by the supply of money. It was advanced that stability in the supply of money is sine qua non to stability in price in Nigeria. Hence, an attempt to stabilise the supply of money by the monetary authority is a good attempt at stabilising price. Reference [15] examined the role of monetary policy transmission mechanism in Armenia in the view of the intent of monetary authority to adjust from to a regime targeting inflation to the medium term. The study found that the ability of monetary policy to determine the level of economic activity and inflation was restricted because key mechanisms of monetary transmission were implemented incompletely.

In a recent study in Nigeria, [16] assessed the growth in output, monetary policy and stability in price. The estimated results revealed that the first lag of price gap, current money supply gap, first lag of money supply gap, current real output gap and first lag of real output gap exerted positive effect on existing price gap between the 1950 and 2011 fiscal year while second lag of price gap exerted negative effects on inflationary pressure. The result also indicated evidence of long-term relationship. Also, [17] appraised the outcomes of monetary policy on macroeconomic stability from 1985 to 2010. The result was insignificant and concluded that monetary policies have not impacted meaningfully on price stability. In addition, [18] conducted an analogical examination on monetary policy rate and foreign exchange rate on price stability in Nigeria, and found that foreign exchange rate exerted a better impact on price stability than monetary policy rate. The study suggested that price stability will be achieved with sound and efficient foreign exchange policies.

III. METHODOLOGY

The methodology followed in this study is as explained below in other to give a clearer understanding of the steps involved Specification of the Model.

The model built assumes an underlying relationship between price stability and a number of macro-economic variables directly or indirectly related to monetary policy. The model presents price stability measured by Consumer Price Index (CPI) as a function of Inflation Rate (INFR), Monetary Policy Rate (MPR), Exchange Rate (EXGR), Money Supply (MS), and Interest Rate (INTR). Though CPI is a measure for inflation; however, real inflation rate was still included in the

model to reflect the impact of macroeconomic instability on CPI. The model can be presented mathematically as;

$$CPI=\beta_0+\beta_1INFR+\beta_2MPR+\beta_3EXGR+\beta_4MS+\beta_5INTR+\mu \quad (1)$$

μ: error term
β_0: Intercept or Constant parameter
β_1- β_5: Co-efficient of parameters
By loglinearising, the model becomes;

$$logCPI=\beta_0+\beta_1logINFR+\beta_2logMPR+\beta_3logEXGR+\beta_4logMS+\beta_5logINTR+ \quad (2)$$

Also from equation (2), an error correction mechanism (ECM) model can be formulated as;

$$\Delta logCPI=\beta_0 +\beta_1\sum log\ INFR_{t-1}+ \beta_2\sum logMPR_{t-1}+\beta_3\sum logEXGR_{t-1}+\beta_4\sum logMS_{t-1}+ \beta_5\sum log\ INTR_{t-1}+ \gamma ECM_{t-1}+\mathcal{E}_t \quad (3)$$

Δ - Change
t-1- Lagged value of each variable
$\mathcal{E}_t$- White noise residual
γ – Coefficient of ECM
ECM -Error Correction Term

The *'a' priori* or theoretical expectation is the predicted association between the dependent variable and the independent variables. It is expected that *β_2, β_3, β_4, β_5< 0 while β_1 > 0*. If < 0, it implies negative association while if > 0, it implies positive association.

A. Estimation Technique, Variables, Samples and Data Source

The study adopts quantitative analysis in determining the effect monetary policy has in maintaining price stability in Nigeria. The study hypothesised that monetary policy does not have a significant effect on price stability in Nigeria. Time series data on yearly basis from 1981 to 2012 was extracted from the Statistical Bulletin of CBN. The model built is analysed with the use of the Error Correction Mechanism (ECM), Johansen Co-integration Test and the Augmented Dickey-Fuller (ADF) Unit Root Test

IV. ANALYSIS AND DISCUSSION OF FINDINGS

The findings were arrived at using the above econometric techniques and developing an Error Correction Model (ECM) by estimating an over-parameterised model, which is further simplified into a parsimonious model in order to introduce short-run dynamism.

A. Augmented Dickey-Fuller (ADF) Unit Root Test

The Performance of this test for time series data is considered mandatory to establish that the data is stationary because time series data is assumed to contain unit root. The need for the data to be stationary is essential because non-stationary data tends to produce spurious results that are misleading. After conducting the test on each variable, the integrating order of the variables is determined. To establish that the data is void of unit root, the ADF test statistics value

must be in excess of the Mackinnon Critical Value with the comparison done, ignoring negative sign (-). TABLE I reports the results of the test.

TABLE I. RESULTS OF ADF TEST

Variable	Test Statistic Value @ level	5% Mackinnon Critical Value @ level	Test Statistic Value @ 1st difference	5% Mackinnon Critical Value @ 1st difference	Test Statistic Value @ 2nd difference	5% Mackinnon Critical Value @ 2nd difference
CPI	-1.956434	-2.9627	-4.257357*	-2.9665	--------- -	--------- -
INFR	-3.429677*	-2.9627	--------- -	--------- -	--------- -	--------- -
MPR	-2.332993	-2.9627	-5.326063*	-2.9665	--------- -	--------- -
EXGR	-1.939419	-2.9627	-3.507835*	-2.9665	--------- -	--------- -
MS	-0.138589	-2.9627	-2.840962	-2.9665	-4.27081*	2.9705
INTR	-2.354371	-2.9627	-5.560485*	-2.9665	--------- -	--------- -

*denotes data contains no unit root

Source: Estimates from E-views output

Subsequent to conducting the test, the order in which the variables are integrated is determined. The order of integration is presented in the TABLE II (below), showing that the variables are not integrated of the same order

TABLE II. ORDER OF INTEGRATION

Variable	Order of Integration
CPI	I(1)
INFR	I(0)
MPR	I(1)
EXGR	I(1)
MS	I(2)
INTR	I(1)

B. The Johansen Co-integration Test

This determines whether variables interact with each other in the long run. Employing trace test, the circumstance for confirming co-integration is that the critical value must be lower than the trace statistic value at the significance level of 5%. Trace test reveals the number of co-integrating equations (CEs) present. The result of the test is presented in TABLE III (below).

TABLE III. JOHANSEN CO-INTEGRATION TEST RESULT (TRACE TEST)

Hypothesised No. of CE(s)	Trace Statistic	0.05 Critical Value	p-value**
None*	120.3697	95.75366	0.0004
At most 1 *	74.24050	69.81889	0.0212
At most 2	45.03682	47.85613	0.0898
At most 3	25.19597	29.79707	0.1546
At most 4	13.00182	15.49471	0.1147
At most 5 *	5.928987	3.841466	0.0149

**MacKinnon-Haug-Michelis (1999) p-values*
Test indicates 2 CEs at the 0.05 critical level
Source: Estimates from E-views output

The TABLE 3 above shows that long-run relationship (co-integration) exist among Consumer Price Index and Inflation Rate (INFR), Monetary Policy Rate (MPR), Exchange Rate (EXGR), Money Supply (MS) and Interest Rate (INTR). Trace test indicated two co-integrating equations at 0.05 critical level. The existence of co-integration is necessary to develop an error correction model; hence, error correction mechanism can be proceeded to.

C. Error Correction Mechanism

Error Correction Mechanism put in short-run dynamics into the long-run equilibrium relationship by first developing an over-parameterized model (ECM 1) before simplifying the model into parsimonious model (ECM 2). The results of ECM 1 and 2 are presented in TABLES IV and V respectively

TABLE IV. RESULT OF ECM 1

Variable	Coefficient	t-Statistic	p-value
C	-0.003372	-0.220114	0.8286
D(INFR,2)	0.048448	5.010313	0.0001
D(INFR(-1),2)	0.027319	2.600766	0.0193
D(MPR,2)	0.177769	2.209355	0.0421
D(MPR(-1),2)	0.018334	0.201373	0.8429
D(EXGR,2)	0.098498	1.763327	0.0969
D(EXGR(-1),2)	-0.063284	-1.195249	0.2494
D(MS,2)	0.175774	0.914186	0.3742
D(MS(-1),2)	0.367790	2.030615	0.0593
D(INTR,2)	-0.033100	-0.295881	0.7711
D(INTR(-1),2)	0.280676	2.309432	0.0346
ECM(-1)	-0.220668	-1.952783	0.0686

R^2=0.806393 Adjusted R^2=0.661188 F-statistic=5.553470
Source: Estimates from E-views output

The γ in ECM 1 possesses significant influence because it is negatively signed. The significance validates its effectiveness in amending divergences that may occur in the long-run. The γ is -0.220668 which implies that 22% of variances that may be experienced on the long-run are corrected per annum. The low value of γ means that CPI

adjusts slowly to changes in INFR, MPR, EXGR, MS and INTR.

ECM 2 is estimated from the result of ECM 1, choosing the variable with the lower probability value (p-value) between the lead and lagged values of each explanatory variable.

TABLE V. RESULT OF ECM 2

Variable	Coefficient	t-Statistic	p-value
C	-0.003196	-0.168267	0.8679
D(INFR,2)	0.035407	4.358858	0.0003*
D(MPR,2)	0.181662	3.045679	0.0059*
D(EXGR,2)	0.083714	1.525227	0.1415
D(MS(-1),2)	0.302719	1.669849	0.1091
D(INTR(-1),2)	0.209062	3.026348	0.0062*
ECM(-1)	-0.231108	-1.770261	0.0905*

* denotes significance at 5% significance level
Source: Estimates from E-views output

From the result above, γ is -0.231108 and its negative value portend that the γ is significant. It therefore indicates that the short-run dynamics adjusts to the long-run equilibrium at the rate of approximately 23% annually. The speed of adjustment in the ECM 2 is marginally higher than that what was obtainable in ECM 1.

From the parsimonious model, the short-run dynamic equation can be stated mathematically as;

$$CPI=-.003196+0.035407INFR+0.181662MPR+0.083714EXGR+0.302719MS+0.209062INTR-0.231108ECM(-1) + \varepsilon_t \quad (4)$$

From (4), it can be deduced that all explanatory variables are directly related to CPI with their respective positive coefficients given as; 0.035407, 0.181662, 0.083714, 0.302719, and 0.209062, therefore, implies that a unit rise in any of the explanatory variables lead to an increase in CPI by the value of corresponding coefficient of each explanatory variable. If all the variables remain unchanged, CPI falls by 0.03196. MPR, EXGR, MS, and INTR are not in consonance with their theoretical expectation while INFR is in conformity. The p-values of the explanatory variables show that only INFR, MPR, and EXGR exert significant influence on CPI, following the rule that p-value ≤ 0.05. This shows that INFR, MPR and EXGR are major determinants of price stability. The test of statistical significance on the model reveals the adequacy of the model to capture how monetary policy affects price stability. This is confirmed from the p-value of F-statistic (0.001776) which falls below 0.05 and this connotes that the model is a reliable predictor of price stability in the horizon of the Nigerian economy. R^2 showed an approximate value of 0.59 which implies that the variables that makes up the model can account for approximately 59% of the behaviour of Consumer Price Index (CPI) while the remaining 41% can be linked to factors not specified or present in the model.

Consumer Price Index is a pointer to the level of price instability in the economy. From our findings, inflation increases price instability, implying that inflationary pressure has not been adequately controlled by CBN and this in turn

further destabilises the economy by increasing price instability. Monetary Policy rate which is the rate charged by CBN to lend to commercial banks borrow from the CBN, and it is fixed to ensure price stability in economy. However, the monetary policy rate set by CBN has not curtailed price instability rather it further promotes it at the detriment of the economy. Increased price instability is also caused by exchange rate of Naira to the U.S dollars. This implies that the activities in the foreign exchange market tend to affect the general price level in the economy. Also, the volume of money supply causes instability in price. This is because money supply increases yearly leading to more money in circulation; hence, there is too much money in economy chasing few goods. Interest rate is on the high side and this implied increase in the cost of capital resulting to upward movement in price level because increase in the production cost is shifted to the final consumers.

V. CONCLUSION AND RECOMMENDATIONS

Price instability is a major source of concern for countries, most especially the developing ones. The study provides insightful evidence on the effect of Nigerian monetary policy on price stability. Monetary policy is linked to price stability in the long run. However, the results of the analysis indicate that monetary policy contributes to price instability because all the indices of monetary policy except inflation fail to conform to their respective theoretical expectation. Inflation, Monetary Policy Rate and Interest Rate add significantly to price instability while Exchange Rate and Money Supply are insignificant contributors of price instability in Nigeria. In line with the outcome of the study, it concludes that monetary policies in Nigeria over the years have not been implemented in a way to ensure price stability. These findings corroborate the studies of [10] and [11].

The following are the recommendations of the study:

1) The CBN should consider the implication of their decisions when lending to commercial banks. The apex bank should allocate credit to banks at rate reasonable for them to borrow so as to guarantee that banks do not charge high lending rate when allocating financial resources to the public;

2) The government should consider the level of macroeconomic stability when determining the volume and direction of money;

3) The interest rate policies implemented should be made to strengthen the purchasing power of the Naira;

4) Tight monetary policies should be put in place so as to pull down inflationary pressure to a reasonable extent; and

5) CBN should design policy measures that promote the value of Naira and check exchange rate fluctuations.

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