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An empirical analysis of price stability effect of Nigerian monetary policy (1981-2012)

Abstract

Price stability is a desired monetary policy objective in every nation. Its effects on sustainable output growth, employment generation, economic growth and investors' investment decisions make it an utmost priority for all nations. 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 diagnostic tests and ensured that the data were stable. The results of the analysis showed that monetary policy has not played a prominent role in ensuring price stability. Treasury bill rate and interest rate are significant factors to reduce price instability while exchange rate and liquidity ratio reduce price instability, but are not significant. However, Monetary Policy Rate is seen to be a significant contributor of price instability. It is therefore recommended that restricted monetary policies should be put in place so as to bring inflation rate to a reasonable low level and the interest rate policies should be implemented in a way that will strengthen the purchasing power of the Naira.

Keywords: monetary policy, price stability, consumer price index, inflation, error correction mechanism.

JEL Classifications: B22, C22, E5, E52, E58, F63.

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 (CBN, 2011). 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 stabilization 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 overemphasized.

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. Nzotta and Okereke (2009) 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 (Christopher, 2006).

In ensuring price stability, the Central Bank in Nigeria implements policies that guarantee sustained economic growth through appropriate changing levels of money supply. In Nigeria, CBN performs its function through the monetary policy program. The process of arriving at the CBN's monetary policy program entails an appraisal of developmental changes in the economy over a specific period and designing policy measures that would ensure price stability (CBN, 2011). Monetary policy is formulated and implemented based on the volume and direction of money supply and accessibility of financial resources in the economy. Owosekun (2010) 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 controls 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 (Ajie & Nenbee, 2010; Masha, Essien, Musa & Abeng, 2004).

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 gross 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.

The CBN just like the monetary authorities of other countries employs direct and indirect forms of monetary policy in order to ensure price stability. The influence of direct and indirect monetary policies vary in the economy and can lead to a counter-effect on price stability if the dimensions in which each form affects price stability are not properly understood by the CBN. The persistent rise in the general level of price in the Nigerian economy prompted this empirical question – Has the CBN been capable of addressing price instability? 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 first section, the method of analysis is explained in the second section, the third section deals with the explanation of the findings and the final section makes recommendations and concludes the study.

1. 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 stabilization objective entails all key aspects of the macroeconomic environment. Price stability is experienced when inflation is reasonably low that it does not have significant influence on decisions of economic units. Orubu (2009) shows price stability is not an indication of zilch growth in inflation in a nation. Minute level of inflation is necessary for the expansion of an emerging economy. Monetary policy is key determinant of inflation rates. Various studies (Nenbee and Madume, 2011; Gul Mughal

and Rahim, 2012; Onyiewu, 2012; Adegboye, 2013) provide the empirical evidence on how monetary policy affects price stability in varied dimensions.

Nenbee and Madume (2011) 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. Gul, Mughal and Rahim (2012) 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 favorable influence on the endogenous variable.

Onyiewu (2012) examined monetary policy shock on Nigerian economy. Using OLS method to analyze 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. Ihezukwu's (2011) 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.

Amassoma, Nwosa and Olaiya (2011) conducted an appraisal of developmental changes in Nigerian monetary policy as well as its stabilization 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, Adegboye (2013) examined the efficacy of Nigerian monetary policy approach in stabilizing price using quarterly data from 1981 to 2009 and employing ECM as well as the Granger Causality test. It was 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 Chimobi and Uche (2010). 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. They advanced that stability in the supply of money is sine qua non to stability in price in Nigeria. Hence, an attempt to stabilize the supply of money by the monetary authority is a good at-

tempt at stabilizing price. Dabla-Norris and Floer-kemeier (2006) examined the role of monetary policy transmission mechanism in Armenia in the view of the intent of monetary authority to adjust from 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, Onayemi (2013) 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, Okwo, Eze and Nwoha (2012) 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, Oseni (2013) 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.

Myriad of studies in Nigeria related to monetary policy focused on its effect on the overall growth of the economy. However, few studies that have addressed the effectiveness of monetary policy on price stability have not offered substantial evidence to justify that the CBN has made policy decisions that ensured price stability. In addition, there is dearth of studies on the critical assessment of monetary policy via both direct and indirect monetary policy instruments on price stability in Nigeria which necessitated a study like this.

2. Methodology

The methodology followed in this study is as explained below in order to give a clear understanding of the steps involved.

2.1. Specification of the model. The model built assumes an underlying relationship between price stability and a number of direct and indirect monetary policy instruments. The model presents price stability measured by consumer price index (CPI) as a function of treasury bill rate (TBR), monetary policy rate (MPR), exchange rate (EXGR), liquidity ratio (LR), and interest rate (INTR). The model is specified in a functional form as:

$$CPI = f(TBR, MPR, EXGR, LR, INTR).$$

The model can be presented mathematically as:

$$CPI = \beta_0 + \beta_1 TBR + \beta_2 MPR + \beta_3 EXGR + \beta_4 LR + \beta_5 INTR + \mu \quad (1)$$

μ = error term; β_0 = intercept or constant parameter; $\beta_1 - \beta_5$ = coefficient of parameters.

By loglinearising, the model becomes:

$$\log CPI = \beta_0 + \beta_1 \log TBR + \beta_2 \log MPR + \beta_3 \log EXGR + \beta_4 \log LR + \beta_5 \log INTR + \mu \quad (2)$$

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

$$\Delta \log CPI = \beta_0 + \beta_1 \sum \log TBR_{t-1} + \beta_2 \sum \log MPR_{t-1} + \beta_3 \sum \log EXGR_{t-1} + \beta_4 \sum \log LR_{t-1} + \beta_5 \sum \log INTR_{t-1} + \gamma ECM_{t-1} + \square_t \quad (3)$$

Δ – change; $t-1$ – lagged value of each variable; $\square_t$ – white noise residual; γ – coefficient of ECM; ECM – error correction term.

The ‘*a priori*’ or theoretical expectation is the predicted association among the dependent parameter and the independent parameters. It is expected that $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5 < 0$, which implies negative association with the dependent variable.

2.2. 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 hypothesized 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 analyzed with the use of the ECM, Johansen co-integration test and the Augmented Dickey-Fuller (ADF) unit root test.

3. Analysis and discussion of findings

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

3.1. 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 1 reports the results of the test.

Table 1. Results of ADF test

Variable	Test statistic @ level	Test statistic @ 1 st difference
<i>CPI</i>	3.327336	-3.218382**
<i>TBR</i>	-2.708945	-6.332352*
<i>MPR</i>	-3.004780	-6.808571*
<i>EXGR</i>	-2.118645	-5.231250*
<i>LR</i>	-3.096488	-5.582530*
<i>INTR</i>	-2.927523	-6.239833*

Source: Author's computation.

Notes: *(**) denotes data contains no unit root at 5% (10%) Mackinnon critical value.

From Table 1, it can be seen that all variables are stationary after first differencing. After performing the ADF unit root test, the order in which the variables are integrated is determined. The order of integration is presented in the Table 2 (below), showing that the variables are integrated in similar order.

Table 2. Order of integration

Variable	Order of Integration
<i>CPI</i>	I(1)
<i>TBR</i>	I(1)
<i>MPR</i>	I(1)
<i>EXGR</i>	I(1)
<i>LR</i>	I(1)
<i>INTR</i>	I(1)

3.2. The Johansen cointegration 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 3 (below).

Table 3. Johansen cointegration test result (trace test)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical value	Prob.**
None *	0.858275	144.2673	95.75366	0.0000
At most 1 *	0.643623	85.65126	69.81889	0.0016
At most 2 *	0.635982	54.69825	47.85613	0.0100
At most 3	0.398143	24.38168	29.79707	0.1848
At most 4	0.218462	9.149644	15.49471	0.3517
At most 5	0.056819	1.754915	3.841466	0.1853

Source: estimates from E-views output.

Notes: Trace test indicates 3 cointegrating eqn(s) at the 0.05 level. * Denotes rejection of the hypothesis at the 0.05 level. ** MacKinnon-Haug-Michelis (1999) p-values.

The Table (3) above shows that long-run relationship (cointegration) exists among consumer price index and treasure bill rate (*TBR*), monetary policy rate (*MPR*), exchange rate (*EXGR*), lending rate (*LR*) and interest rate (*INTR*). Trace test indicated three co-integrating

equations at 0.05 critical level. The existence of cointegration is necessary to develop an error correction model; hence, error correction mechanism can be proceeded to.

3.3 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 4 and 5 respectively.

Table 4. Result of ECM 1 (Over-parameterized model) dependent variable = D(*CPI*,2)

Variable	Coefficient	t-Statistic	Prob.
D(<i>CPI</i> (-1),2)	-0.147216	-0.557409	0.5850
<i>C</i>	0.559624	1.279639	0.2189
D(<i>TBR</i> ,2)	-0.314196	-1.583108	0.1330
D(<i>TBR</i> (-1),2)	-0.009116	-0.039450	0.9690
D(<i>MPR</i> ,2)	0.662768	2.344897	0.0323
D(<i>MPR</i> (-1),2)	0.115971	0.305180	0.7642
D(<i>EXGR</i> ,2)	-0.014515	-0.400447	0.6941
D(<i>EXGR</i> (-1),2)	-0.001783	-0.057924	0.9545
D(<i>LR</i> ,2)	-0.050422	-1.066673	0.3020
D(<i>LR</i> (-1),2)	-0.049084	-1.116970	0.2805
D(<i>INTR</i> ,2)	-0.290821	-1.788764	0.0926
D(<i>INTR</i> (-1),2)	0.044657	0.250316	0.8055
ECM(-1)	-0.006937	-0.106917	0.9162

Source: author's computation.

In order to attain effectiveness of the model, there is the need to simplify the model to a more parsimonious model which introduces short-run dynamics. The parsimonious model is estimated from the over-parameterized model by choosing the variable with the lower probability value (p-value) between the lead and lagged values of each exogenous variable.

Table 5. Result of ECM 2 (parsimonious model) dependent variable = D(*CPI*,2)

Variable	Coefficient	t-statistic	Prob.
D(<i>CPI</i> (-1),2)	-0.182244	-1.046084	0.3074
<i>C</i>	0.602249	1.505775	0.1470
D(<i>TBR</i> ,2)	-0.439978	-3.027062	0.0064*
D(<i>MPR</i> ,2)	0.758808	3.258363	0.0038*
D(<i>EXGR</i> ,2)	-0.017172	-0.623592	0.5396
D(<i>LR</i> (-1),2)	-0.039331	-1.180432	0.2510
D(<i>INTR</i> ,2)	-0.323081	-2.546450	0.0188*
ECM(-1)	-0.001036	-0.018797	0.9852

Source: Author's computation

Notes: $R^2 = 0.517607$. Adjusted $R^2 = 0.356809$. F-statistic (p-value) = 3.218991(0.017636)*. (*) denotes significance at 5% significance level.

From the result in Table (5) above, γ is -0.001036 and its negative value portend that the γ is significant. It therefore indicates that the short-run dyna-

mics adjusts to the long-run equilibrium at the rate of approximately 0.10% annually. The speed of adjustment in the ECM 2 is marginally higher than that what was obtainable in ECM 1. This implies that *CPI* adjusts very slowly to changes in monetary policy.

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

$$CPI = -0.602249 - 0.439978TBR + 0.758808MPR - 0.017172EXGR - 0.039331LR - 0.323081INTR - 0.001036ECM(-1) + \square t. \quad (4)$$

From equation (4), it can be deduced that all explanatory variables are inversely related to *CPI* except *MPR*. Their respective negative coefficients given as; -0.439978, -0.017172, -0.039331, -0.323081, and +0.758808 for *MPR*, therefore, implies that a unit rise in any of the explanatory variables leads to a decrease in *CPI* by the value of corresponding coefficient of each instrument. The positive coefficient of *MPR* indicates that it increases *CPI* by the value of its coefficient. If all the variables remain unchanged, *CPI* falls by 0.602249. *TBR*, *EXGR*, *LR*, and *INTR* are in consonance with their theoretical expectation while *MPR* is not. The p-values of the explanatory variables show that only *TBR*, *MPR*, and *INTR* exert significant influence on *CPI*, following the rule that $p\text{-value} \leq 0.05$. This shows that *TBR*, *MPR* and *INTR* 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 0.52 which implies that the variables that makes up the model can account for approximately 52% of the behavior of *CPI* while the remaining 48% can be linked to factors not specified or present in the model.

Consumer price index is a measure of inflation (increase in general price level) or price instability in the economy. From our findings, treasury bill rate reduces price instability, implying that open market operations by CBN have ensured price stability. Monetary policy rate is the rate charged by CBN when lending to commercial banks, 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 stability 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 ensure price stability in the economy. Also, the liquidity ratio and interest rate reduced price instability. The coefficient

of multiple determination indicates that monetary policy fairly contributes to price stability in Nigeria.

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. The study employed Augmented Dickey-Fuller (ADF) unit root test, Johansen cointegration test and Error Correction Mechanism in its econometric analysis. The unit root test was carried out to establish that the time series data on all the variables are stationary, which is prerequisite for the Johansen Co-integration test. The result of Co-integration established the fact that there is a long-term relationship among the variables. The error correction mechanism confirmed that the price level slowly adjusts to changes in the monetary policy instruments. In the light of the weak coefficient of multiple determination and other findings of this study, it concludes that monetary policy in Nigeria over the years has not contributed substantially to price stability; thus suggesting that CBN has not played prominent role in ensuring price stability. However, treasury bill rate, monetary policy rate and interest rate significantly contribute to price stability while exchange rate and liquidity ratio are insignificant contributors of price instability in Nigeria. This study offers support to Onyeiwu (2012) and Adegboye (2013).

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 and 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 regulatory and supervisory framework for the financial sector should be strengthened. This can be achieved by laying down strict prudential rules and regulations to separate and strengthen the role of Central Bank of Nigeria in ensuring price stability.
3. The interest rate policies implemented should be made to strengthen the purchasing power of the Naira.
4. Restrictive monetary policies should be put in place so as to pull down inflationary pressure to a reasonable extent.
5. CBN should design policy measures that promote the value of Naira and check exchange rate fluctuations.
6. The CBN should increase the use of Open Market Operation as monetary policy instrument.

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