

# The monetary policy and price stability nexus: The Nigerian case (1981-2016)

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Received 31st December, 2019; Accepted 8th February, 2020

**ABSTRACT:** The study evaluated the effects of monetary policy on price stability in Nigeria for the period 1981-2016. The consumer price index was used as the dependent variable while money supply, interest rate, exchange rate, Gross Domestic Product (GDP) and treasury bill rates were the independent variables. The research made use of secondary data obtained from Central Bank of Nigeria Statistical Bulletin and World Bank Development Indicators. The study employed Auto Regressive Distributive Lag (ARDL). The unit root test showed that all the time series data were not stationary series. The result showed in the short-run and long-run, exchange rate, money supply, GDP and open market operations have significant effects on price stability in Nigeria while interest rate is significant only in the short-run. Based on the findings, the study recommended among others, that Central Bank of Nigeria increase interest rates during inflation in order to control money supply and consequently inflation. Government should take policy actions swiftly so as to reduce lag problems. Also, monetary policy alone cannot be used to maintain price stability. It should, therefore, be supplemented by fiscal measures, non-monetary and non-fiscal measures.

**Keywords:** Consumer price index, exchange rates, Gross Domestic Product, interest rates, monetary policy, money supply, open market operations, price stability.

## INTRODUCTION

Government of nations attempt to manage their economic system using various policies and instruments. Boosting the growth of the economy fuels the actions of government of nations across the world and is evident in the development of polices (Okwo et al., 2012) and establishment of various institutions. Developed and developing nations alike strive to increase the growth of their economy (Onalo et al., 2016). Monetary policy, fiscal policy and income policy are imperative elements within the purview of public policy targeted at regulating and maintaining economic balance (Nnenna and Ihemeje, 2016; Stawska et al., 2019) or what Adesoye et al. (2012) termed macroeconomic stability. These policies are aimed at achieving macroeconomic objectives such as price stability, employment, balance of payments, output among others (Chimobi and Uche, 2010; Nasko, 2016). An interesting yet controversial area of study is the monetary policy and price stability paradigm. Though, Nasko (2016)

argued that particularly for developing economies, monetary policy goes beyond achieving price stability, principal among the objectives of monetary policy is price stability (Feridun et al., 2005; Itodo et al., 2017; Onakoya et al., 2017; Stawska et al., 2019) or a general trust in the currency through money supply control (Onakoya et al., 2017) in pursuit a desirable inflation or interest rate. This is crucial in order to protect the economy from the ripple effect of price instability or fluctuations reflected in increased business risks and uncertainty; ineffective planning and forecasting; deficient allocation of resources; unemployment; low savings and reduced output (Gross Domestic Product); uneven wealth distribution; lagging investment to mention but a few, hence, achieving price stability has become *sine qua non*. Price stability represents an annual rise in consumer price index (CPI) (Orphandies, 2006). Economies of the world hence strive to attain a desired level of stability in prices. Moreover, to

achieve international competitiveness, price stability is necessary. In order to achieve this feat, monetary policy which is Central Banks' prerogative (Ezeaku et al., 2018; Onakoya et al., 2017), through various direct and indirect instruments, channels their efforts towards regulating the stock of money in circulation in order to maintain a "balance".

However, achieving price stability has been elusive for many nations especially developing countries. Nigeria for example has experienced high volatility in inflation, exchange and interest rates. Even though, Okafor et al. (2015) commended the performance of monetary policy in relatively stabilizing the rate of inflation and increasing GDP, Itodo et al (2017) argued that inflation is one (among many others) of the most prominent pandemic facing the Nigerian economy in recent times, thereby creating great concern for individuals, firms, industries and policy makers especially because of the undue advantages it brings to some, undue disadvantages to others and most importantly retarding the economic growth and development of the nation. Adesoye et al. (2012) similarly pointed out that despite the implementation of monetary policy and the policy changes since the establishment of the Structural Adjustment Programme (SAP) in 1986, achieving price stability has been a herculean task for the Nigerian regulatory authorities. Adeoye and Saibu (2014) blamed the "failure" of monetary policy in achieving price stability on the under-development of the Nigeria's financial market. This however lacks much empirical evidence inclusive just as Nnenna and Ihemeje (2016) claimed that there is no consensus on the effect of monetary policy on economic stabilization amongst economists. The effectiveness of Nigeria's monetary policy faces attack on various fronts. Batini (2004) for instance, arguably asserted that Nigeria being an economy open to international capital inflow, achieving price stability simultaneously with a stable exchange rate is "impossible". These are few amid other challenges noted in literature such as a weak fiscal policy (Batini, 2004); weak transmission mechanism (Owolabi and Adegbite, 2014); low-quality statistics available to the CBN (Anowor and Okorie, 2016). If this should be the case, what is Nigeria's "best bet" in achieving price stability especially in the long-run? There is a need to also know if monetary policy is the best approach to solving inflation and what monetary policy best addresses price stability in the short and long-run. The dearth of literature accounting for the effects of monetary policy on price stability in Nigeria from 1981 (before the SAP) to 2016 (a more recent period) fuels the need for this study in order to bridge the knowledge gap. The significance of this paper is hinged on its duo approach using both direct and indirect instruments in investigating the effects of monetary policy on price stability. Time series approach was taken to study the trends of broad money supply, CPI, exchange rate, nominal GDP, real interest rate and treasury bill rates based on the analysis on data collected over a period of

35 years (1981-2016).

This research is organized into six main sections. The remaining part of this section will cover the research objectives and hypotheses. Section two is a review of relevant literature. Section three covers the theoretical framework, estimation techniques and model specification. Section four focuses on the findings and discussions respectively whilst conclusion and recommendations and policy statements are reported in section five.

### Research objectives

The study aimed at assessing the effectiveness of monetary policies on price stability in Nigeria's economy. However, the specific objectives were to:

1. examine the effect of money supply on price stability in Nigeria;
2. analyze the extent to which interest rate affect price stability in Nigeria;
3. examine the relationship between exchange rate and price stability in Nigeria; and
4. analyze the extent to which Open Market Operation (OMO) affect price stability in Nigeria.

### Research hypotheses

The study postulated four hypotheses, stated in their null form

**H<sub>01</sub>:** Money supply does not have significant effect on price stability in Nigeria.

**H<sub>02</sub>:** Variations in interest rate do not statistically account for significant variations in price stability in Nigeria.

**H<sub>03</sub>:** There is no significant relationship between exchange rate and price stability in Nigeria.

**H<sub>04</sub>:** OMO does not have significant effect on price stability in Nigeria.

## LITERATURE REVIEW

### Monetary policy

Monetary policy is a monetary management tool (Nasko, 2016; Okwo et al., 2012) which as defined by the Central Bank of Nigeria (CBN) (2011) is a combination of measures designed to regulate value, supply and cost of money in an economy, in consonance with the level of economic activities. The amount of money in circulation has to be controlled and regulated in order to avoid inflation, recession and some other economic disasters. The Monetary Policy Committee under the auspices of the Central Bank through the manipulation of the monetary instruments aims to achieve some macroeconomic

objectives such as full employment (Owolabi and Adegbite, 2014), price stability, balance of payment equilibrium, external balance, equality in income distribution and rapid economic growth (Nasko, 2016) which consequently improves the economic and social welfare of the people. By controlling the behaviours of money and credit, government through the Central Bank is able to influence savings and investment, Gross National Product, the rate of inflation and the balance of payments (Sean, 2019). Therefore, it suffices to say that the Central Bank since its inception in 1958 is the major determinant of supply of money, which could be narrow or broad money supply. Narrow money supply captures money in circulation including non-bank public and demand deposits or current accounts in the banks while broad money encapsulates narrow money as well as savings, time deposits and foreign denominated deposits (Okwo et al., 2012).

When the government through CBN increases the supply of money with the object of reducing the cost of money, that is, an expansionary monetary policy (Ikechukwu et al., 2016). This may be initiated for example, to curb the growth rate of unemployment in the nation. While in contractionary monetary policy, the CBN reduces the money supply in order to slow down the pace of economic activities or protect asset values from deteriorating. However, these decisions are contingent on the economic state at the time (Ezeaku et al., 2018).

Monetary policy variables such interest rates, money supply, exchange rate channels, open market operations (OMO) (Nasko, 2016; Sean, 2019), liquidity ratio, cash reserve ratio and treasury securities (Ikechukwu et al., 2016) exerts significant effect on macroeconomic aggregates including but not limited to price stability (Nasko, 2016; Owolabi and Adegbite, 2014). For example, according to Adeoye and Saibu (2014), fluctuations in exchange rate is one of the leading sources of economic instability especially in developing countries. Irungu et al. (2019) also pointed out that the conducts of monetary policy underline the cost and availability of debt. By implication defines the government's ability to be able to access deficit financing. Nwosa and Oseni (2012) corroborated by Owolabi and Adegbite (2014) and Okafor et al. (2015) asserted that exchange rate exerts more influence on the domestic currency and inflation. Another significant instrument of monetary policy is the interest rate. Regulatory bodies use interest rate polices to regulate and manage growth of financial savings. Raising interest rate in an imperfect market (which is the case with Nigeria) is however inimical to investment and economic growth capable of crippling the financial sector (Adeoye and Saibu, 2014). Financing institutions charge relatively high interest rates discouraging business especially emerging enterprises (Babajide, 2011; Dankwa and Adoley, 2014; Forkuoh et al., 2015). Financial intermediaries are more concerned with high risk, short-term ventures rather than investing in long-term activities

(Adeoye and Saibu, 2014).

OMO in form of treasury bills/securities is often regarded as the most common and flexible tool available to government for monetary policy implementation and control (Emerenini and Eke, 2014). OMO refers to the trading of securities in the money market by the Central Bank (Adeoye and Saibu, 2014; Nasko, 2016). Balami et al. (2016) grouped OMO under the indirect/quantitative instrument of monetary policy which was not introduced until 1993 (Nasko, 2016) as a market based instrument for control. The central bank sells securities in situations where there is need to control inflation. Emerenini and Eke (2014) reported that the use of OMO viz a viz treasury bills has proven ineffective in managing inflationary pressures.

Quite a number of studies have documented varying effects of monetary policy on economic growth (Adeleke et al., 2013; Anowor and Okorie, 2016; Fasanya et al., 2013; Nnenna and Ihemeje, 2016); industrial growth (Ezeaku et al., 2018; Owolabi and Adegbite, 2014); exchange rate (Adeoye and Saibu, 2014; Balami et al., 2016; Feridun et al., 2005); price stability across industries (Hassan, 2012; Kalu et al., 2015; Onakoya et al., 2017). Research is also rife on the effect of monetary policy on aggregate economic price stability (Babatunde and Kehinde, 2016; Itodo et al., 2017; Okwo et al., 2012; Oseni, 2013; Sulaiman and Migiro, 2015) which has without doubt expounded our knowledge of the monetary policy and price stability nexus. However, controversial results reported by various scholars have left the issue of price stability largely unsolved in many economies of the world (Onakoya et al., 2017), Nigeria inclusive. Nigeria has been at the mercy of inflationary pressures (Itodo et al., 2017) for many years now enriching a minority while emptying the pockets of the majority and recent economic developments have further exacerbated the situation. The need for an effective monetary policy keeps growing annually and its efficacy can only be judged by its ability to meet desired objectives (Ikechukwu et al., 2016). Although, Adeoye and Saibu (2014) implied that monetary policies prove more efficient in developed financial markets (a category which does not include the Nigerian financial market), the need for an effective monetary policy cannot be overemphasized.

### **Price stability**

Price stability is an essential economic objective of government (Irungu et al., 2019) attempted to be managed by its regulatory bodies (CBN). Ikechukwu et al. (2016) defined price stability as achieving a single-digit annual inflation rate. Price stability prevails when inflation ceases to be a factor (Cecchetti et al., 2003). Conceptualizing price stability over the years has been caught between the web of qualitative and quantitative views. Orphandies (2006, p.3) quoting Chairman Greenspan, a proponent of qualitative metric of price stability, dismissed the

quantitative metric, saying:

*Rather, price stability is best thought of as an environment in which inflation is so low and stable over time that it does not materially enter into the decisions of households and firm.*

This view has been having growing acceptance among scholars (Cecchetti et al., 2003). Another qualitative view of price stability was expressed by Chairman Volcker saying:

*A workable definition of reasonable 'price stability' would seem to me to be a situation in which expectations of generally rising (or falling) prices over a considerable period are not a pervasive influence on economic and financial behaviour. Stated more positively, 'stability' would imply that decision-making should be able to proceed on the basis that 'real' and 'nominal' values are substantially the same over the planning horizon—and that planning horizons should be suitably long (Orphanides, 2006, p.4).*

Price stability and financial stability are both complementary yet conflicting goals of monetary policy (Feridun et al., 2005). Goodfriend and King (2001) in line with the new NeoClassical Synthesis reasoning, advocated that price stability should however be the prime object of monetary policy. Adeoye and Saibu (2014) positioned price stability as the “only” means of achieving sustainable growth. However, Feridun et al (2005, p.70) impressed that though price stability “*tends to produce stable macroeconomic conditions*”, achieving money growth and stable price levels is a herculean task (Ezeaku et al., 2018). This challenge is made even more challenging as policy makers especially in Nigeria rely mainly on estimates of economic variables (in light of paucity of complete and accurate information) which may be misleading to access choice of policy (Anowor and Okorie, 2016). This places an enormous task on the CBN in their attempt to achieve a tradeoff between growth and price stability. Inability to maintain price stability results in price hikes otherwise called inflation defined as the incessant rise in price of goods and services in an economy over a substantial period of time (Ikechukwu et al., 2016), while deflation is generally regarded as the opposite of inflation. Conceptually, inflation implies decline in the purchasing power of money “*where more money buys less goods*”. This may however be a misconception or overgeneralization as “a general increase in price may also imply improvement in product or service quality. A typical example is the case of Britain from between 2006-2016 where there was about 20% increase in general price of new cars.

According to Emerenini and Eke (2014), inflation effect varies from country to country. Though supporters of the monetarists/neoliberal school of thought attribute price inflation to the quantum of money supplied, the

structuralists school on another hand argue that inflation is as a result of corruption, security, goods hoarding and hedging, infrastructure, public utilities among others. However, inflation in Nigeria can be significantly attributed to forces of demand and supply given that Nigeria is largely dependent on oil (crude oil) as her main stream of revenue (Akinbobola, 2012; Ezeaku et al., 2018; Ikechukwu et al., 2016). This dilemma further drives a wedge between policy formulation and effective implementation. It is evident that inflation is taking a significant toll on economic activities in Nigeria. Most sectors of an economy are price sensitive, some more than others. Batini (2004) resolved that emerging economies are usually more sensitive to changes in price levels relative to developed economies. Thus, for the real sector of the economy to flourish, there is a need for price stability. Price level is hence, “a critical piece” in navigating economic activities. Kalu et al (2015) commented on the negative effect price instability in Nigeria has been having on the price of building materials. In the same vein, Hassan (2012) expressed concerns for the problems faced by the agricultural sector of Nigeria, largely in part, due to price instability.

In order to access the price level of an economy, indices such as but not limited to CPI is used. According to Ikechukwu et al. (2016), percentage change in CPI is a measure of rate of inflation in an economy. CPI is though one of many for example price indices (Personal Consumption Expenditure (PCE)), it is a popular measure of an economy's price stability level (Babatunde and Kehinde, 2016; Sulaiman and Migiro, 2015). It estimates price level changes of consumer goods such as transportation, communication, food and beverages, education, health, electricity etc. (Ikechukwu et al., 2016) purchased or consumed by households. It can also serve as a benchmark for household real wages and salaries including pensions, hence providing efficient index for price regulation and managing inflation and deflation. Cecchetti et al. (2003) however criticized the CPI measure as not taking into consideration the substitution effect, in the sense that consumers are dynamic with their buying behaviours such that an increase in price of a commodity making it too expensive, may not necessarily affect the standard of living of the consumers, rather the consumers' willingness to make a “switch” to a less expensive product/service will lessen the effect such price hike (inflation) will have on their standard of living. However, so, many studies have applied the CPI in benchmarking general price levels (Adeoye and Saibu, 2014; Babatunde and Kehinde, 2016; Sulaiman and Migiro, 2015).

### **Empirical literature from Nigeria**

Babatunde and Kehinde (2016) assessed the impact monetary policy has on price stability in Nigeria using a period from 1970 to 2014 as reference. Secondary data analysis was done using ordinary least square regression

(OLS) model, unit root test and Johansen co-integration test. The proxy of price stability was the Consumer Price Index (CPI) while exchange rate and money supply were used as explanatory variables. Their findings showed that exchange rate and money supply influenced price stability in Nigeria both in the short-run and long-run.

Akinbobola (2012) provided quantitative analysis of the dynamics of money supply, exchange rate and inflation in Nigeria. The study used secondary data that were obtained from the International Financial Statistics (IFS). The scope of the study was 1986Q1 to 2008Q4. Estimation was done using Vector Error Correction Mechanism (VECM). The empirical showed that money supply and exchange rate have negative significant effects on inflationary pressure in the long-run, while foreign price and real output growth have direct effects on inflationary pressure. There was also empirical evidence of significant feedback from the long-run to short-run disequilibrium. However, there exists a causal linkage between money supply, exchange rate and inflation in Nigeria.

Chimobi and Uche (2010) examined the correlation between money, inflation and output in Nigeria. It was shown that a strong causal association exist among the variables. Particularly, inflation and output were granger caused by the money supply. They established the fact that money supply is essential to price stability in Nigeria. Hence, a move to stabilize money supply by the monetary authority is a good attempt to price stability.

Onayemi (2013) investigated the growth in output, monetary policy and stability price. The result of the estimation showed that positive effects on inflationary pressures were influenced by first lag of money supply, current money supply gap, first lag of price, current real output gap and first lag of real output gap while there was a negative effect on inflationary pressure by the second lag of price lag between 1950 and 2011. The result also showed that there was a significant long-run relationship.

Moreover, Oseni (2013) examined the effects of monetary policy and foreign exchange rate on price stability in Nigeria, discovering that foreign exchange rate had a better impact on price stability than on monetary policy rate. The study hence recommended that sound and efficient foreign exchange policies be put in place to realize price stability objective. In Nigeria, most studies related to monetary policy focused its effects on overall growth and development of the economy. Studies that have addressed the effectiveness of monetary policy on price stability have not offered substantial evidence to show that monetary authorities have made policy decisions that ensured price stability.

## METHODOLOGY

The nature of this research requires time series data extracted from Central Bank of Nigeria Statistical Bulletin, National Bureau of Statistics (NBS), World Bank

Development Indicators and other related secondary sources that were sourced on yearly basis from 1981 to 2016.

The variables used are money supply (M2), interest rate (INTR), exchange rate, gross domestic product (GDP), treasury bill rate (TBR) as explanatory variables and Consumer Price Index as a proxy of price stability.

## Theoretical framework

There are two principal theories about the demand-pull inflation, that of the monetarists and the Keynesians. The monetarists emphasize the role of money as the principal cause of demand-pull inflation. For them, inflation is always a monetary phenomenon. This is explained in the quantity theory of money using the familiar identity of Fisher's Equation of Exchange,

$$MV = PQ$$

Where: M is the money supply, V is the velocity of money, P is the price level and Q is the real output.

Assuming V and Q as constants, the price level (P) varies proportionately with the supply of money (V). The price level proceeds at the same rate at which the money supply expands. Thus,

$$P = f(M).$$

Furthermore, the Keynesians emphasize increase in aggregate demand as a source of demand side cause of price instability. Aggregate demand comprises of consumption, investment and government expenditures.

All these components determine output in a closed economy. The chain of causation between changes in output and prices is an indirect one through the rate of interest. When the quantity of money increases, its first effect is on the rate of interest which tends to fall. A fall in the interest rate would, in turn, increase investment which would raise aggregate demand. This implies that output has to change. Thus,

$$P = f(M, INT, GDP).$$

To conclude this framework, the economy can open to trade whereby exchange rate fluctuations will affect domestic price level and also government can control the economy through buying and selling of securities (Open Market Operation). This channel is however through the government authority's intervention that can be sterilized or non-sterilized.

## Model specification

Given the objectives of the study and the hypotheses

stated above, the following models was specified in line with Sulaiman and Migiro (2015) and Babatunde and Kehinde (2016) to capture the hypothesized relationship thus;

$$CPI_t = \alpha_1 CPI_{t-1} + \alpha_2 MSt + \alpha_3 INT_t + \alpha_4 EXR_t + \alpha_5 GDP_t + \alpha_6 TBR_t + Z\beta_1 \Delta MSt + Z\beta_2 \Delta INT_t + Z\beta_3 \Delta EXR_t + Z\beta_4 \Delta GDP_t + Z\beta_5 \Delta TBR_t + e$$

Where:  $CPI_{t-1}$  = Consumer Price Index,  $M2_t$  = Money Supply,  $INTR_t$  = Interest Rate,  $EXR_t$  = Exchange Rate,  $GDP_t$  = Gross Domestic Product,  $TBR_t$  = Treasury Bill Rate,  $e$  = stochastic or disturbance variable,  $t$  = time dimension of the variable,  $\Delta$  = change and  $t-1$  = lagged value of the variable.

### Estimation techniques

The study adopts quantitative analysis in determining the effects 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. The unit root test was used as a pre-estimation test. Analysis was done with using E-VIEWS. In order to confirm the relationships between the variables, ARDL Bounds test was used to evaluate the effects of monetary policy on price stability in Nigeria.

## RESULTS

### Trend analysis

#### *Trends in consumer price index (1981-2016)*

Consumer price index exhibits an upward moving slope. The graphical illustration in Figure 1 shows the trend of consumer price index in Nigeria from 1981 to 2016. Units are measured in percentages. Overall, the CPI exhibits an upward slope with the maximum value being 0.493799 in 1981 and 183.8926 as the maximum value. The weighted averages increased over the years as a result of inflation on the prices of commodities.

Figure 2 shows the trend of official exchange rate in Nigeria for a period of thirty-six years. The value for official exchange rate (LCU per USD, period average) in Nigeria increased over the years. As depicted by the graph, over the study period, the indicator reached a maximum value of 253.5 in 2016 and a minimum value of 0.617708 in 1981. Various internal factors out of which the exchange rate policy is key led to increase in the value of the indicator. Increasing excess demand for dollar makes Nigerians to pay more to get it. Hence, the upward slope.

#### *Trends in nominal GDP (1981-2016)*

Figure 3 shows the trend of Nominal Gross Domestic Product in Nigeria for thirty-six years. Overall, the Nominal

Gross Domestic Product exhibits an upward slope. However, its value increased to a more than doubled valued in 2010 (from 25236 billion naira in 2009 to 55469.35 billion naira in 2010). This shows that production in the nation increased over the years showing economic growth, likewise increments in the prices at which goods and services are sold in the market.

#### *Trends in real interest rate (1981-2016)*

The line graph in Figure 4 illustrates the trends in real interest rate in the country from 1981 to 2016. Units are measured in percentages (%). The real interest rate is the most volatile of all the variables used in the study. It is characterized by high fluctuations in its movement over the period under consideration. During the period, the maximum value for real interest rate was 25.2824% in 1998 while the lowest value was -43.5727% in 1995.

From 1986 to 1989, inflation declined on a sustained basis and consequently interest rates decreased. Before liberalization, real interest rates were generally negative as a result of the repressed regime leading to financial disintermediation and consequently low savings, low investment and low growth. After liberalization era, real interest rates were generally positive and market determined. However, interest rates are regarded as high or low relative to some economic fundamentals which are level of inflation rate, degree of uncertainty and risks, level of development and depth of financial markets, structure of the banking system and cost of funds to banks.

#### *Trends in broad money supply (1981-2016)*

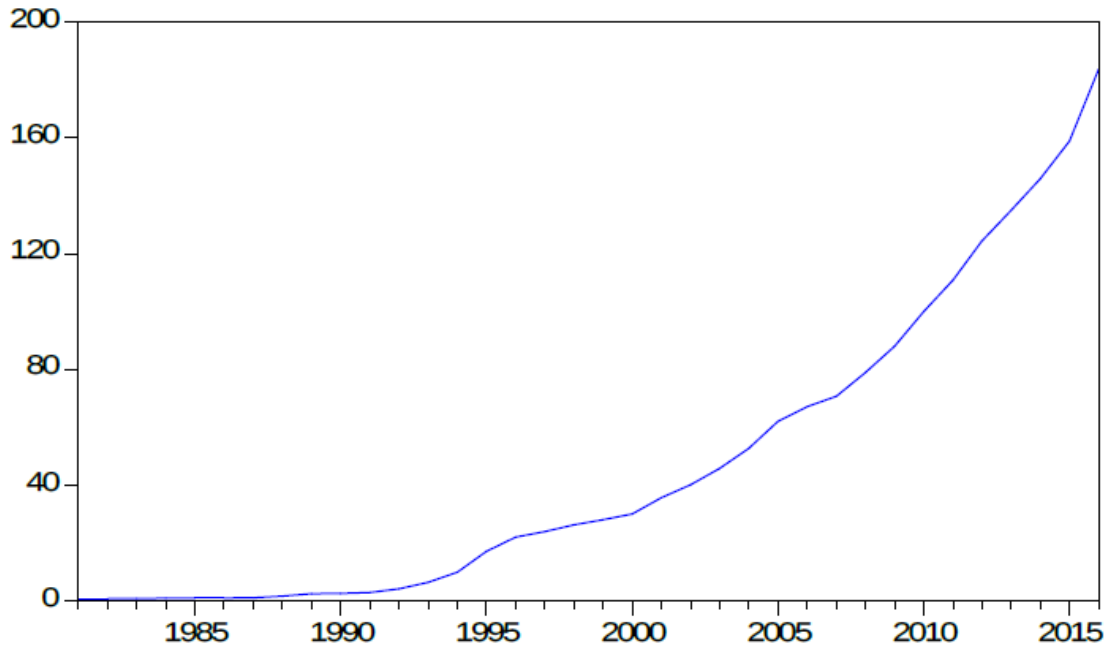
The graph in Figure 5 shows the line graph of broad money supply in Nigeria from 1981 to 2016. During the period, the indicator reached a maximum value of 21,607,680,000,000 in 2016 and a minimum value of 14,470,000,000,000 in 1981. Over the period of thirty-six years, broad money supply in Nigeria maintained and upward trend showing that the total volume of money supply in the economy increased.

#### *Trends in treasury bill rates (1981-2016)*

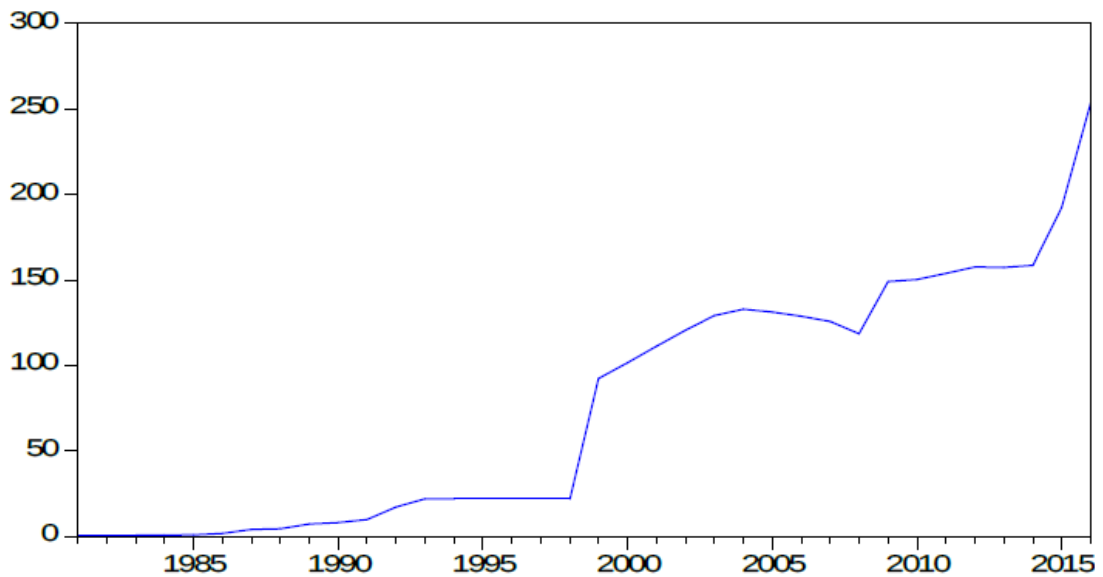
The graphical representation of the Nigerian treasury bill rates from 1981 to 2016 (Figure 6). Overall, there were high fluctuations in its movement caused by contractionary and expansionary monetary policy effects of open market operations among other factors. The contagion effect of the monetary policy of some developed countries also contributed to high fluctuations given that treasury bill rates are based on demand and supply.

### Descriptive statistics

Descriptive statistics show the qualities of the data used



**Figure 1.** Trends in consumer price index (1981-2016). Source: Authors' compilation from Central Bank of Nigeria Bulletin (various years).

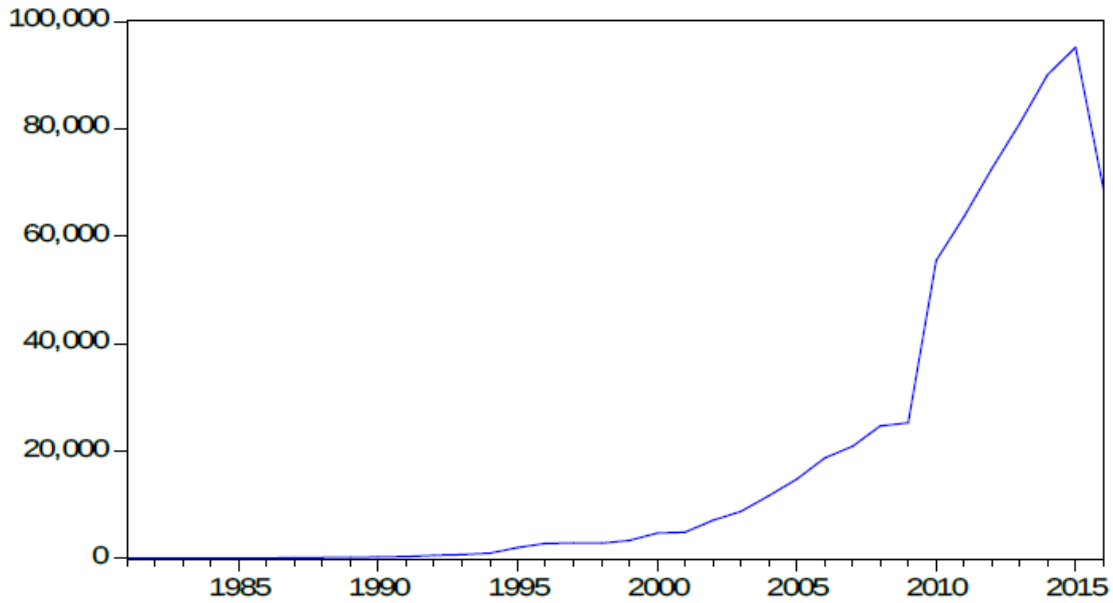


**Figure 2.** Trends in exchange rate (1981-2016). Source: Authors' compilation from Central Bank of Nigeria Bulletin (various years).

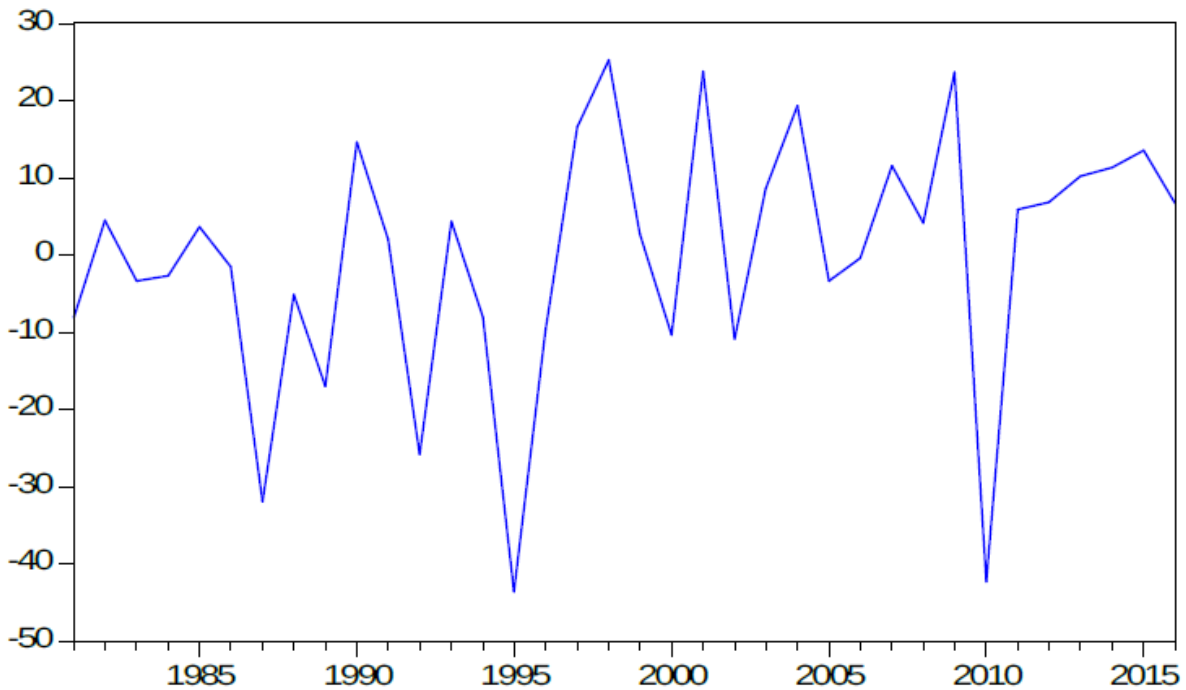
for estimation. This provides opportunity to define the appropriate methodology for estimation. The Table 1 summarizes the descriptive statistics.

From the Table 1, CPI represents Consumer Price Index, EXR represents Exchange Rate, INT represents Interest Rate, M2 represents Money Supply, GDP represents Gross Domestic Product and TBR represents

Treasury Bill Rate. From 1981 to 2016, consumer price index averaged 46.66528%, exchange rate was ₦76.46690 per USD, money supply was ₦4172.221 billion, and interest rate was on average of -0.105.883%, GDP averaged ₦19050.14 billion while treasury bill rate averaged 12.77574%. The mid observations of these variables when arranged in ascending or descending order



**Figure 3.** Trends in nominal GDP (1981-2016). Source: Authors' compilation from Central Bank of Nigeria Bulletin (various years).

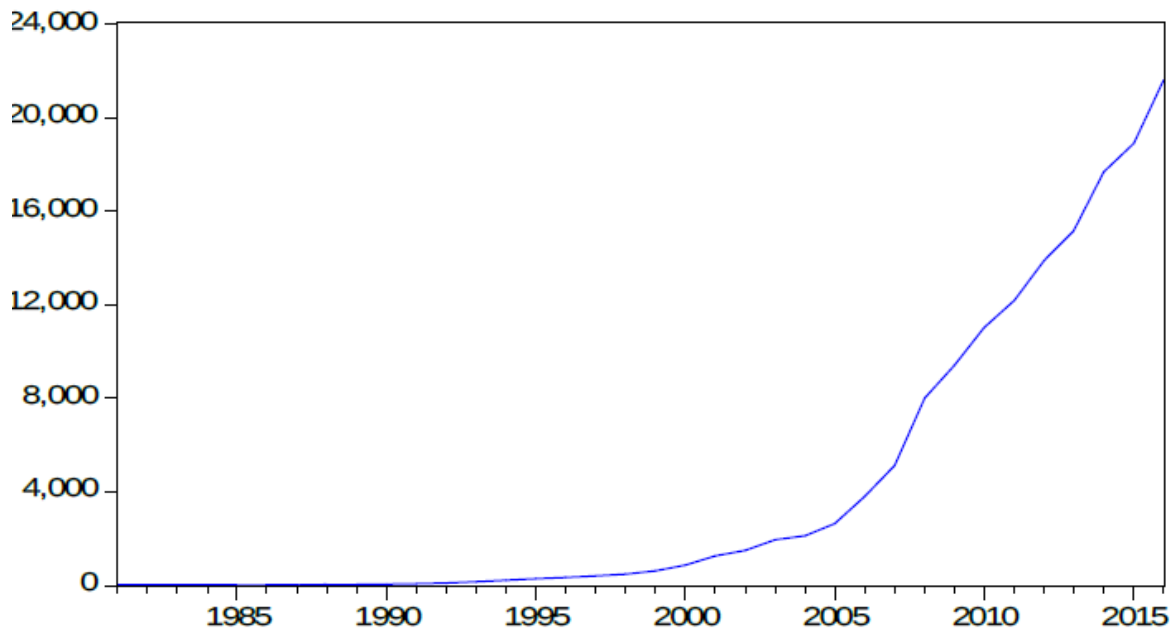


**Figure 4.** Trends in real interest rate (1981-2016). Source: Authors' compilation from Central Bank of Nigeria Bulletin (various years).

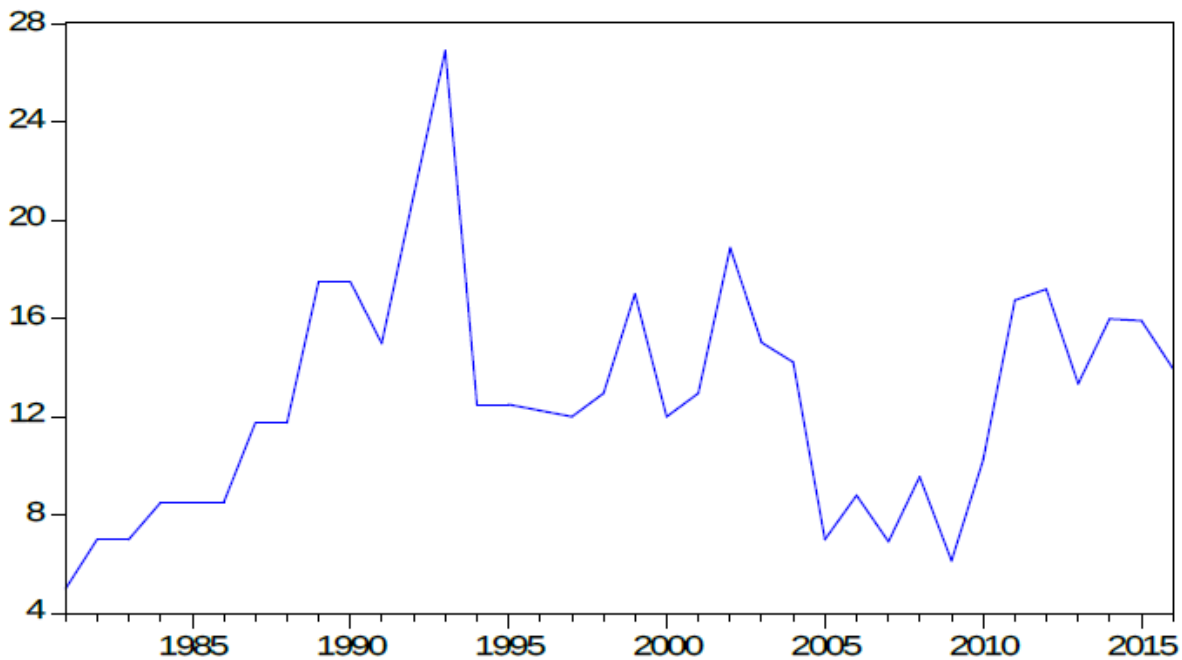
are 27.06562, 57.20175, 3.227297, 558.5500, 3109.433, 12.50000 respectively.

Between the periods considered, the highest and lowest obtainable values of consumer price index were

183.8926% in 2016 and 0.493799% in 1981 respectively, the exchange rate was also at its peak in 2016 with a value of ₦253.5000 per USD and lowest in 1981 with a value of ₦0.617708 per USD. However, money supply was



**Figure 5.** Trends in broad money supply (1981-2016). Source: Authors' compilation from Central Bank of Nigeria Bulletin (various years).



**Figure 6.** Trends in treasury bill rate (1981-2016). Source: Authors' compilation from Central Bank of Nigeria Bulletin (various years).

₦21607.68 billion in 2016 and 14.47000 in 1981 as the highest and lowest values respectively. The maximum value for interest rate was 25.2824% in 1998 and the minimum value was -43.5727% in 1995 while GDP was

₦95177.74 billion in 2015 and ₦51.73179 billion in 1981 as the highest and lowest values respectively. Meanwhile, the treasury bill rate was at its peak in 1993 with a value of 26.9% and lowest in 1981 with a value of 5%.

**Table 1.** Summary of descriptive statistics

Statistic	CPI	EXR	MS	INT	GDP	TBR
Mean	46.66528	76.46689	4172.187	-0.105997	19050.14	12.77574
Median	27.06562	57.20175	558.5490	3.227297	3109.433	12.50000
Maximum	183.8926	253.5000	21607.68	25.28227	95177.74	26.90000
Minimum	0.493799	0.617708	14.47117	-43.57266	51.73179	5.000000
Std. Dev.	52.58075	71.94682	6363.748	16.59365	29476.78	4.679687
Skewness	1.072119	0.426145	1.450980	-0.938746	1.503083	0.631529
Kurtosis	3.049785	1.991982	3.742182	3.780658	3.741623	3.646238
Jarque-Bera	6.900354	2.613746	13.45831	6.201598	14.38056	3.019412
Probability	0.031740	0.270665	0.001196	0.045013	0.000754	0.220975
Sum	1679.950	2752.808	150198.7	-3.815904	685805.2	459.9267
Sum Sq. Dev.	96765.72	181172.1	1.42E+09	9637.221	3.04E+10	766.4814
Observations	36	36	36	36	36	36

Source: Authors' computation (2017).

**Table 2.** Result augmented Dickey-Fuller.

Variables	Level				First Difference			
	Model 1		Model 2		Model 1		Model 2	
	T-STAT	PV	T-STAT	PV	T-STAT	PV	T-STAT	PV
EXR	1.3202	0.9983	-1.3835	0.8484	-3.6443***	0.0099	-3.9726**	0.0195
INT	-5.8922***	0.0000	-6.3125***	0.0000	-7.2627***	0.0000	-7.1533***	0.0000
CPI	-1.4113	0.5624	-0.7760	0.9579	-3.4289**	0.0170	-3.7246**	0.0345
Log(m2)	-1.1217	0.6944	-2.0264	0.5665	-3.2975**	0.0229	-2.6471	0.2638
Log (GDP)	-1.0080	0.7396	-0.8905	0.9459	-4.6714***	0.0007	-4.7377***	0.0030
TBR	-2.946**	0.0300	-3.083	0.1259	-3.639*	0.0000	-4.242*	0.0000

Model 1 and 2 are unit root test with intercept and with intercept and trend respectively. \*, \*\* and \*\*\* indicate significance at 10% level, 5% level and 1% level, respectively. Source: Authors' computation (2017).

The standard deviation indicates the level at which the series deviates from the original estimates. The closer the standard deviation to zero (0), the better it is, but it cannot be concluded whether it is normally distributed or not using standard deviation, so normality test was adopted. Considering the skewness statistics whose threshold value for symmetry (or normal distribution) is zero, none of the variable is exactly zero (although EXR is close to zero). While the skewness statistics of -0.938736 of interest rate show that interest rate is negatively skewed (since it is less than zero). CPI, EXR, M2, GDP and TBR are positively skewed since their skewness statistics are greater than zero.

On the other hand, the kurtosis value whose threshold is three indicate that EXR is platykurtic (lowly peaked) while CPI, INT, M2, GDP and TBR are leptokurtic (highly peaked), implying that these variables have higher tendency of having outliers. Although skewness statistics indicate that EXR is normally distributed (since it is closer to 0) and kurtosis value indicate CPI is normally distributed (since it is closer to 3), neither skewness nor kurtosis can singularly confirm the normality of a series. Hence, since

the Jarque-Bera statistics combines skewness and kurtosis properties, it provides a more comprehensive information. Using Jarque-Bera, since its probability value for the variables (with the exception of exchange rate and treasury bill rate) are less than 10%, it therefore suggests that the hypothesis of normal distribution is rejected and the series cannot be regarded as having a normal distribution. However, since the Jarque-Bera probability value for exchange rate and treasury bill rate are greater than 10%, it therefore suggests that the hypothesis of normal distribution cannot be rejected for exchange rate and treasury bill rate. Thus, exchange rate and treasury bill rates are said to be normally distributed.

The unit root result using Augmented Dickey-Fuller (ADF) test is shown in Table 2. The unit root result shows the order of integration of the variables (Table 3). CPI, EXR, GDP and M2 were stationary at first difference level with integrated order of 1, while interest rate and treasury bill rate were stationary at level with integrated order of 0.

Since it has been established that some variables are not stationary at level, there is need to check whether there is existence of similar trend properties between or among

**Table 3.** Order of integration

Variables	Order of integration
CPI	I(1)
EXR	I(1)
INT	I(0)
Log (m <sup>2</sup> )	I(1)
Log (gdp)	I(1)
TBR	I(0)

Source: Authors' computation (2017).

**Table 4.** Co-integration tests

Test Statistic				
F-Statistic	4.801957			
Critical value bounds				
Significance	10%	5%	2.5%	1%
I(0)	2.75	3.12	3.49	3.93
I(1)	3.79	4.25	4.67	5.23

Source: Authors' computation (2017).

the series as a regression model on co-integrated series. Using the ARDL bounds test, the result above showed that with the assumption of exogeneity on money supply, real interest, exchange rate, nominal GDP and treasury bill rate. It is not inconclusive to establish short-run and long-run relationship between exchange rate, money supply, and real interest rate, nominal GDP, treasury bill rate at 10%, 5% and 1% level of significance. This study examines and estimates both the long-run and short-run dynamics (Table 4).

### Short-run (Dynamic) model result

The short run model in Table 5 shows that short-run movements in consumer price index for the sample period were caused by negative changes in gross domestic products, money supply, interest rates, exchange rates and treasury bill rates. In other words, all the explanatory variables have inverse relationships with the explained variable (CPI) in the short-run. However, gross domestic product, a year lag in money supply, interest rates, a year lag in exchange rates and treasury bill rates are significant at 1% level of significance (i.e. 99% confidence level).

A 1% decrease in GDP results in 0.0002% increase consumer price index and vice versa. The coefficient of MS is not significant in the short-run, however, a 1% decrease in previous year's MS increases the current year's MS by 0.0004% and this is statistically significant. Also, 1% increase in interest rate, exchange rate and treasury bill rates decrease consumer price index by 0.35522%, 0.00507% and 0.217123 respectively. However, it is

important to note that a 1% increase first year lag of exchange rate reduces the consumer price index by 0.0642%. This value is significant statistically.

Furthermore, the error correction term shows that there is a 27.1% speed of adjustment from short-run dynamics to long-run equilibrium. Moreover, 99.9% change in consumer price index is caused by the variables used in the model while the remaining 0.01% is caused by factors not listed in the model. This is indicated by the 0.999 value of the R<sup>2</sup>, Durbin Watson test is 1.9083.

### Long-run model result

From the long-run results reported above, it was shown that all the variables except money supply and exchange rates have negative relationships with consumer price index. As GDP increases by 1%, CPI reduces significantly by 0.000883% while 0.012620% increase in CPI is caused by a 1% increase in Money supply, both at 5% level of significance. Also, a 1% increase in interest rate results in a 0.130824% decrease in CPI. A 1% change in exchange rate has positive significant effect on CPI by increasing price instability by 0.165785%.

Furthermore, OMO through the use of treasury bill rates have negative long-run relationship with CPI as a 1% change in treasury bill rates reduces price instability by 0.799647%. This statistically significant at 1%. However, in the long-run, if no changes occur in variables, CPI falls by 3.9567% (Table 6).

The co-efficient of money supply ( $\alpha_2$ ) expresses the positive relationship between price stability and money supply. Interest rates co-efficient, gross domestic product coefficient and treasury bill coefficients reveal the negative relationship between price stability and interest rate, gross domestic product and treasury bill rates. However, the long-run positive coefficient of exchange rate during the sample period does not follow the a priori expectation. From the work of Babatunde and Kehinde (2016), exchange rate and money supply have significant effects on price stability in the long-run. This is also evident in this study. In the short-run, the a priori expectation for the coefficients of interest rates, exchange rates, gross domestic product and treasury bill rates should be accepted. In the long-run, the a priori expectation for all the variables except exchange rates should be accepted.

### Post estimation test (Diagnostics test)

Sequel to the adoption of the classical least square technique, for any estimated model to be valid, there are certain assumptions that are needed to be verified. The Table 7 shows the result of the test on these assumptions.

The Jarque-Bera test suggest that the residuals are normally distributed since the probability value is less than the 10% significance level. Hence, the hypothesis of non-normal distribution for the residuals be rejected. The

**Table 5.** Short-run (Dynamic) model result.

Variables	Coefficient	Std error	t- value	Prob.
GDP	-0.000240	0.00049	-4.863341	0.001
D(LMS)	-0.000416	0.00598	-0.695305	0.4941
D(LMS(-1))	-0.004174	0.000735	-5.682203	0.0000
D(INT)	-0.0355220	0.016062	-2.211500	0.0577
D(LEXR)	-0.005074	0.021567	-0.235258	0.8162
D(EXR(-1))	-0.064242	0.020500	-3.133795	0.0048
D(TBR)	-0.217123	0.079321	-2.737268	0.0120
D(@TREND))	0.693027	0.145571	4.760730	0.0001
Coint Eq (-1)	-0.271523	0.085902	1.084435	0.0045

$R^2 = 0.999634$ , Adjusted  $R^2 = 0.999451$ , F-Stat= 5466.921, Durbin-Watson Stat = 1.9083. Source: Authors' Computation (2017).

**Table 6.** Long-run model result.

Variables	Coefficient	Std error	t-value	Prob
GDP	-0.00883	0.000386	-2.288615	0.0321
L(MS)	0.012620	0.002820	4.474700	0.0002
INT	-0.130824	0.085906	-1.522874	0.1420
EXR	0.165785	0.049937	-3.319858	0.0031
TBR	-0.799647	0.218816	-3.654429	0.0014
C	-3.956720	3.746177	-1.056202	0.3023
@TREND	2.552366	0.513611	4.969456	0.001

The a priori expectation in the model are;  $\alpha_3 < 0$ ,  $\alpha_4 < 0$ ,  $\alpha_5 < 0$  and  $\alpha_6 < 0$  while  $\alpha_2 > 0$ . Source: Authors' Computation (2017).

**Table 7.** Post estimation test (Diagnostics test).

Test	F-Stat (Prob)
Jarque-Bera test	0.987183 (0.610430)
Breusch-Godfrey Test	0.540107 (0.5909)
ARCH test	0.16260(0.8507)
Ramsey-Reset test	2.5081(0.1282)

Source: Authors' computation (2017).

Breusch-Pagan serial correlation (LM) test result suggest that the hypothesis of no autocorrelation cannot be rejected since the probability value is greater than a 10% critical level. The ARCH test result whose probability value is greater than 10%, respectively indicate that there is heteroscedasticity. The ramsey reset test shows that the model is correctly specified in a linear form. Thus, the hypothesis of constant variance can be rejected. These are expected given the nature of variables and evidence from stylized facts.

## DISCUSSIONS

In light of the analysis, it can be inferred that real interest rate affects consumer price index which implies that an

increase in real interest rate increases cost of borrowing, discourages consumers from borrowing and spending and consequently reduces price stability. Increased interest rate also increases the value of exchange rate leading to lower export and more imports (Adeoye and Saibu, 2014). However, when interest rates are reduced, more people are able to borrow money and money supply increases. This causes the economy to grow and inflation to increase, as a growing money supply increases inflation.

Exchange rate and money supply also explain changes in prices in the short-run and long-run. Exchange rate which is the relative price of a country's currency to another, explains international resource allocation (Oseni, 2013). From the result provided above, and given the level of dependence of the Nigeria industrial sector on foreign goods, an increase in exchange rate (leading to a depreciation in naira) makes the domestic cost of inputs rise i.e. productive foreign resource scarce thereby increasing prices. This is in tandem with Oseni (2013) explaining that exchange rate had higher impact on price stability than monetary policy rate. In other words, when exchange rate increases and naira depreciates, foreign investors panic due to this loss and new investors are discouraged since they will consider it risky to invest with an officially depreciating currency, hence, this reduces total investments in the economy and general fall in prices.

Increasing money supply by the authorities leads to excess money in circulation and the consumer price index increases. However, the results show that changes in broad money make price unstable in Nigeria and this effect is significant in the long-run. However, the first year lag of both exchange rate and money supply have negative significant effects on consumer price index. This is similar to the report of Akinbobola (2012) reporting that money supply and exchange rate have negative significant effects on inflationary pressure. Babatunde and Kehinde (2016) also showed that exchange rate and money supply influenced price stability in Nigeria both in the short-run and in the long-run. Other studies that provide empirical support for this finding include Chimobi and Uche (2010) and Onayemi (2013). Proper attention should be given to the time lapse between when the previous year changes in money supply and changes in exchange rate recognized by the monetary authority will result in economic reality for the current year.

Increase in aggregate demand is one of the causes of price stability. As gross domestic product increases, cost of living as reported by consumer price index also increases. GDP and consumer price index directly affect each other and only a steady and controlled growth can cancel the negative impacts they have on each other.

OMO have been statistically effective in controlling price stability in Nigeria. Government through the money market engage in contractionary and expansionary measures to control price stability (Emerenini and Eke, 2014). Consumer price stability as proxied by inflation rate in Nigeria. By buying short-term securities such as treasury bills from the public, money supply in the economy increases while selling of short-term securities to the public reduces money supply in the economy. This is consistent with this study.

### Conclusions and recommendations

With respect to the analysis carried out, monetary policy has significant effects on price stability in Nigeria. The study concludes that reduced interest rate causes the economy to grow and inflation to increase. Reducing spending is important during inflation because it stops economic growth which in turn reduces rate of inflation and consequently brings about price stability. The study revealed that monetary policy alone cannot be used to maintain price stability, it should, therefore, be supplemented by fiscal measures, non-monetary and non-fiscal measures. Fiscal measures are highly effective for controlling government expenditure, personal consumption expenditure, and private and public investment. All the aforementioned measures should be used simultaneously to ensure price stability. Significant recommendations include the following:

1. Monetary authorities should raise interest rates when there is need to do so. They should also embark on

contractionary measures that help to reduce available credit, which can reduce spending. While it may be difficult to remove imported goods completely from the components of the consumer price index, it is necessary to reduce the consumption of imported goods that have local substitutes, thereby reducing imports.

2. Local production and infant industries should be encouraged to boost domestic production, reduce leakages of foreign exchange and also, increase the value of the naira relative to other currencies. Also, policies aimed at ensuring steady growth of the economy such as youth empowerment, granting of credit facilities to local producers etc. should be encouraged.
3. A more balanced approach of monetary and fiscal management of the foreign exchange side or the country in order to produce a fairly and stable exchange rate can stabilize price levels. In addition, the monetary authorities should aim at controlling government expenditures, consumer expenditures and both private and public investments which are the components of GDP.
4. The money and capital markets in Nigeria should be strengthened as the workings of monetary policy depend on these markets. The use of OMO should also be increased. Inside and outside time lags should be duly evaluated and reduced to the barest minimum.

### CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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