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Achieving Price Stability in Nigeria:
Monetary Policy Rate Approach vs. Foreign Exchange Policy Approach

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ABSTRACT

Earlier studies have reached a consensus that monetary policies generate more economic activities than fiscal policies in developing economies. This study has bridged the existing gaps in earlier studies by addressing the question of which of the instruments of macroeconomics is more effective in achieving price stability remains largely unanswered. The study observed that the presence of exogenous factor was responsible for the inability of the tight monetary policies of the CBN to mob excess liquidity from the economy. In the same vein, the exogenous factor destabilizes the steady economic growth that would have emanated from a relaxed monetary policy. The study also found foreign exchange rates (fx) to be a more effective instrument to achieving price stability than monetary policy rates (mpr). The Nigerian economy is largely import dependent with most of the importation being consumable goods and services and less of productive (capital) goods. The impact of changes in fx are more pronounced on the economy than changes in the interest rates. The attainment of price stability would become feasible if the apex bank accords priority to the formulation and deployment of foreign exchange policies that are sound in principle and effective in practice.

Keywords: *Foreign exchange, interest rates, monetary policies, price stability.*

INTRODUCTION

The apex banks play significant roles in the economic development and growth of the nation through the instruments of macroeconomics. In developed economies, price stability poses lesser challenges than in developing economies where the impact is more visible and spiral. The effect of inflation on import dependent nation could be more devastating than a similar scenario in other developed economies

Price stability in the economy regardless of its directional movements can cause either capital flights or disincentive to potential investors, both impacting on employment and the gross national products (GDP). The roles of many central banks revolve around price stability (Uchendu, 2009; Oesterreichische National Bank). For instance, in the deployment effective monetary policies, the Federal Reserve Bank, US is charged with ensuring maximum employment, price stability and moderate long-term interest rates. Some critics have argued that the three objectives of the monetary policy for the Federal Reserve Bank are conflicting but Plosser (2011) argue that rather they are complimentary. Plosser further argues that price stability is necessary for financial stability and achieving moderate long term interest rates by controlling inflation rates on long term investments.

Similarly, the European Central Bank (ECB) argues that price stability which implies avoiding prolonged inflation and deflation is necessary to achieve high levels of economic activities and reduce unemployment. Price stability according to Bernanke (2006) is both an end of monetary policy and a means to achieving other objectives of maximum employment and moderate long term interest rates preserve the integrity and purchasing power of the nation's money.

In Nigeria, the CBN has repeatedly made price stability (a situation that would ensure that inflation rate is kept to a single digit) a core objective of its monetary policy. The attainment of this objective has been a subject of contention over the years. According to Folawewo and Osinubi (2006), Ditimi, Nwosa and Olaiya (2011), Essien (2011) and Onyeiwu (2012), monetary policies which Onyeiwu (2012) described as an economic management technique to achieve sustainable economic growth and development have no significant impact on inflation in Nigeria. Neither of the studies explored the possibility of foreign exchange rate as an instrument to achieving price stability as an alternative to the several decades of adoption of interest rate instrument in the Nigeria economy. This study therefore undertakes a comparative analysis of the impact of interest and foreign exchange rates as instruments of price stability on inflation trend in Nigeria. The study in addition to contributing to relevant theories would also contribute to existing literatures and shift the frontier of knowledge as regards formulation and implementation of effective monetary policies directed at achieving price stability.

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The study would also assist policy makers in their efforts at stabilizing the economy's price towards national economic developments and growth with impact in increased employment generation.

CONCEPTUAL FRAMEWORK

The Nigerian economy is dependent largely on oil revenue which constitutes 20 *per cent* of the nation's GDP (African Economic Outlook, 2012). A tight monetary policy through a stringent MPR makes funding more inaccessible to borrowers which results in slowdown in economic activities. The economic slowdown is expected to create unemployment and reduce national outputs. The increase in the unemployment rate reduces aggregate demand, and consistent with basic economics, prices decline.

The end product of a tight monetary policy that focuses on interest rates (*mpr)* to achieve lower inflation and declined prices may become a mirage for the Nigerian economy as inflation rate often escalates and hardly responds to increased *mpr*. As depicted in Figure (I) below the infusion of exogenous factor (unearned incomes from periodic Federal Government allocations) into the economy with little or insignificant employment generation destabilizes the normal effect an increased *mpr* would exert on the prices and inflation. The fund inflows from the public sector spending would negates the CBN efforts to mob excess cash from the

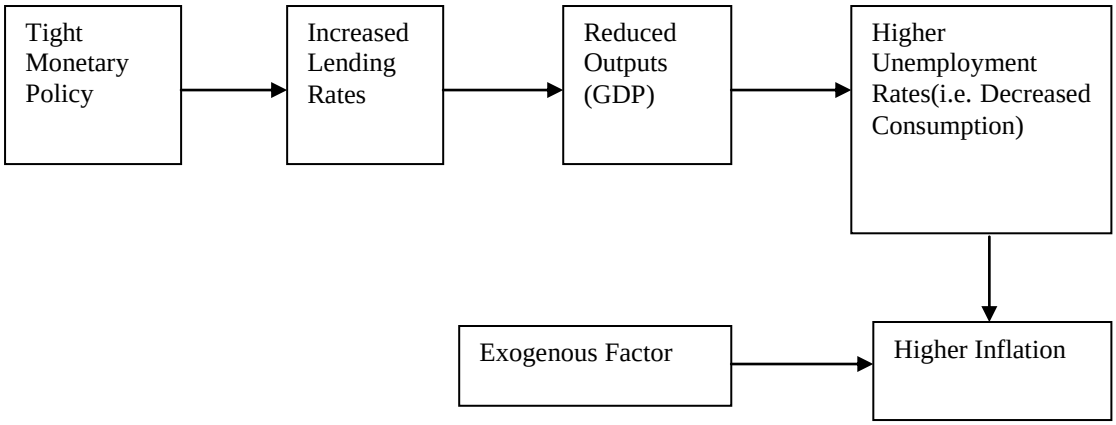

Figure I: *Chart Flow showing the effect of tight monetary policy on price stabilization*
Source: *Author*

economy through higher interest rates. In Nigeria, the inflows to the economy from the monthly federal allocations increase money supply (M2) available for lending. This exogenous factor is outside the controls of the CBN that is charged with the responsibility for the formulation and implementation of monetary policy. In a nutshell, rather than a tight monetary policy that focuses on interest rates to lead to the expected decline in inflation, the overwhelming impact of the exogenous factor makes the efforts ineffective.

A similar outcome of higher inflation as depicted in Figure (I) above also plays out in Figure (II) below even with a relaxed monetary policy that focuses on lower lending rates. The increased output reduces unemployment and increased consumption in the economy. The increased consumption may cause price increase if aggregate demand exceeds outputs. The presence of the exogenous factor as explained earlier would cause a higher inflation in spite of the relaxed monetary policy that focuses on interest rates to achieve price stability.

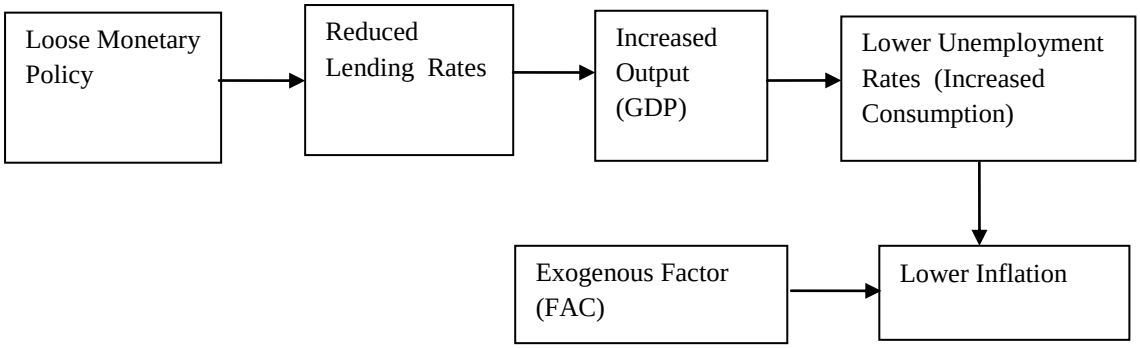

Figure II: *Chart Flow showing the effect of loose monetary policy on price stabilization*
Source: *Author*

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It is obvious from the two depicted scenarios that the deployment of monetary policy that focuses on interest rates to achieve price stability in the Nigerian economy may continue to be a misplaced effort. As much as this study is not contesting the effectiveness of monetary policy as against fiscal policy in achieving price stability in Nigeria, it has set out to examine which of the two macroeconomic instruments of (interest and foreign exchange policies) is best for the economy.

LITERATURE REVIEW

The issue of price stability has become a significant subject for academics and policy makers, and price stability is becoming a global objective for central banks across the globe (Kahn, 1996; Douch and Essadam, 2010, Ndjokou, 2011). Price stability is reflected in the inflation trends, hence policy makers tend to checkmate the trends by introducing measures that would either lower the higher rates or where it is at the desired level, sustains it.

There is no generally acceptable definition of price stability (Douch and Essadam, 2010) though Cihak (2007) argues that inflation provides the operational definition. Most definitions of price stability evolve around country inflation target. For instance, price stability in Nigeria according Owoye and Onafowora (2007), refers to the attainment of single-digit inflation rate on annual basis. The definition of price stability in Nigeria can be considered loose compared with other nations that are more specific. For instance, price stability in the United States of America and Britain is described as inflation rate of not more than 2 *per cent*. In any case, what is not in contention is that central banks' major task centers around it. A widely acknowledged concept of the term price stability as given by Greenspan (1996) is a situation where "economic agents no longer take account of the prospective change in the general price level in their economic decision making". Greenspan (1996) argue that to achieve economic stability and maximum efficiency in any economy, the "unproductive price-expectation-driven actions (inflation) must be eliminated from economic activities. The central policies must directly or indirectly aim at achieving price stability in the economy. Price stability would therefore be achieved when the inflation rate is minimal and insignificant to be giving cognizance in decision making.

Holding inflation down to economically viable level is a top order in most economies that are import (consumption goods) dependent because of the volatility of exchange rates, the impact of which is borne by the final consumers. A widely deployed approach in achieving controlled inflation is through the instruments of monetary policy which many critics, according to Mishra (2012), argued is of no effect because inflation arises from importation. Contrary to critics, Svensson (2000) was of the view that relationships exist between inflation and monetary policy to the extent that the latter can either aggravate or checkmate the former. There may not be a concession yet on the potency or otherwise of the monetary policy in achieving price stability and controlled inflation, a lot depends on the peculiarities of the economy.

Economies benefit immensely from price stability which Taylor (1996) defined as "1 or 2 per cent measured inflation". The benefits according to Taylor include efficiency of the monetary system and a more certain future as a result of improved economic well-being of the citizenry. He further argue that a positive correlation exists between lower inflation rates and higher and long-term economic growth rates. A low and steady inflation rate impacts on economic performance as it leads to increased national outputs and invariably employment stability. This appears to be logical and in consonance with any monetary policy goal. In a similar way, the European Central Bank (ECB) described the objective of price stability as that which refers to the general level of prices in the economy and aims at preventing both prolonged inflation and deflation. The ECB furthers stipulate that achieving price stability involves transparency of the price mechanism, controlled inflation risk through interest rates that create incentives for investment, avoiding unproductive activities that have tendencies to aggravate inflation amongst others. Significant to the developing economies is the unproductive activities that aggravate inflation in spite of the central banks deployment of monetary policy instruments. Significant portions of the national budgets over decades are expended on recurrent expenditures coupled with high profile levels of corruption, many of which have no positive economic impacts.

The relevance of foreign exchange in controlling inflation is traceable to purchasing power parity (PPP) theory, sometimes referred to as the theory of inflation. Casel (1918) widely acknowledged as the proponent of the theory had argued that without the theory, it would be difficult to discuss over-pricing (inflation) and under-pricing (deflation). Goodfriend (2008) opines that in open economies, without deployment of sound foreign exchange policies, curtailment of inflation may become counterproductive.

It is pertinent to observe that earlier studies appeared to have largely addressed with evidence from empirical analysis the question of which of monetary and fiscal policies contributes more to national economic developments and growth, though the debate remains a hot contest between extreme monetarists and

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keynesians. A larger segment of recent studies agreed that monetary policies benefit the economy more than the fiscal policies (Adefeso and Mobolaji 2010; Nijkamp and Poot, 2004; Aarle, Garretsen and Huart, 2003; Ajisafe and Folorunso, 2002). Advocates of fiscal policies against monetary policies include Arestis and Sawyer (2004) and Chowdhury (1986) and Batten and Hafer (1983). Ali, Irum and Ali (2008) in an attempt to address the question of which of fiscal and monetary policies is effective in attaining economic growth of the South Asian countries found monetary policies to be significant both in the short and long run. On the other hand, the study equally found the fiscal policies to be insignificant both in the short and long run.

Rasche and Williams (2005) examined the effectiveness of monetary policies in addressing price stability through the containment of inflation within the predefined targets in a study that covered 21 developed economies including South Africa. With the exception of Brazil, Colombia, Hungary, Mexico and Philippines, the study found the monetary policies to be effective. In a similar study that focused on developing economies, Hammond, Kanbur and Prasad (2009) found monetary policies under the control of central banks unable to achieve predetermined price stability. The study identified lack of autonomy of the central banks, lack of well developed financial markets and lack of long term fiscal discipline as some of the challenges of effective implementation of monetary policies in emerging economies.

In Nigeria, Ajayi (1974) argues that fiscal policies impact more on the Nigerian economy than the monetary policies. This position was contradicted by Ajisafe and Folorunso (2002) and Adefeso and Mobolaji (2010) both of which empirically argue that monetary policy creates more economic activities than the fiscal policy. In a nutshell, monetary policy is critical in achieving economic growths through price stability (Dowd, 1995; Walsh, 2009). The question that remains unanswered for the Nigerian economy is which of the macroeconomic instruments is the best to achieving price stability. The Central Bank of Nigeria (CBN) in the past three decades has relentlessly engaged the interest rates as an instrument of monetary policy to achieve price stability in Nigeria (Ajisafe and Folorunsho, 2002; Nenbee and Madume, Ajayi and Atanda, 2012). Yet, inflation and unemployment are among major economic challenges that have remained untamed in the last two to three decades.

Batini (2004) in a related study in Nigeria opines that open economies like Nigeria where international capital flows are rampant, it is impossible to achieve the trio of stable foreign exchange rates, monetary policy and price stability. Foreign exchange policy can be explored to achieve price stability and contrary to Batini (2004), this study believes that this option should be of interest to policy makers in economies that are import dependent.

RESEARCH METHODOLOGY

The study examines three macroeconomic variables, namely, consumer price index (*cpi*), monetary policy rate (*mpr*) and foreign exchange rate (*fx*). The P denotes price movement (stability) in the economy. The variables which were sourced from the CBN Statistical Bulletins (2011) were examined from 1970 to 2009, a period of 40 years.

The analysis method adopted for the study is an ordinary least square (OLS) similar to Ajisafe and Folorunsho (2002) in their study of the relative effectiveness of fiscal and monetary policy on macroeconomic management in Nigeria. This study adapted model is therefore:

$$cpi = f(mpr, fx) \quad \text{(i)}$$

Where *cpi* is the price stability, *mpr* is the monetary policy rate and fx represents the foreign exchange rate.

We express equation (i) further:

$$cpi_i = \alpha + \beta_1 mpr_1 + \ldots + \beta_1 mpr_n + \beta_2 fx_i + \ldots + \beta_2 fx_n + \varepsilon_i \quad \text{(ii)}$$

Summing up equation (ii) in order to derive:

$$cpi_i = \alpha + \beta_1 \sum mpr_i + \beta_2 \sum fx_i + \varepsilon_i \quad \text{(iii)}$$

Equation (ii) is consistent with Bordes and Marimoutou (2001) as adopted by Ndjokou (2011) his study of monetary aggregates and price stability in the BEAC zone. This study in variance to Ndjokou (2011) adopted different macroeconomic variables.

Since we would be examining the extent of controls and influence the independent variables exact on *cpi*, the impact of changes in the independent variables are measured in the determination of price stability. Thus:

$$\Delta cpi_i = \alpha + \beta_1 \Delta \sum mpr_i + \beta_2 \Delta \sum fx_i + \varepsilon_i \quad \text{(iv)}$$

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For the empirical analysis, the three macroeconomic variables defined earlier above collected from 1970 to 2009, a period of 40 years. The data were source from the Central Bank Nigeria (CBN) Statistical Bulletin (2010). The study considered the period of the study which is very significant in the life span of Nigeria as an independent nation to be sufficient to determine the influence of the various monetary policies of the Government in achieving price stability.

Though many scholars arguably identified price stability with controlled inflation, but the study decided to use the consumer price index *(cpi)* as a measure of price stability. This is because, inflation though a macroeconomic variable is most often influenced by other macroeconomic variables, it hardly influences any though on a general scale, according to Umaru and Zubairu (2012), it impacts on the nation's economic growth and development.

Unit Root Test

Combining the three given data of Consumer Price Index (CPI), Interest Rate (INTR) and Foreign Exchange Rate (FXR) for a period of 40 years using co integration technique where CPI is the dependent variable, a function of both INTR and FXR that are independent variables. Before we test for co integration using vector error correction mechanism, we have to test for the unit root or stationary level of all the variables to be used. However, the unit root test was found i.e was non stationary at level for all the variables employed but both INTR and FXR was stationed at 1st difference.

Thus we had to run the 2nd differencing before all the conditions are met.

H_0: all the variables have the unit root i.e non stationary

H_1: all the variables did not have unit root i.e stationary

Decision Rule : Accept H1 when P value is < than 5% and t-statistic of 5.3036 is greater than the critical values of 4.2529 in absolute value all at 1%, 5% and 10% level of significance for *cpi*.

Test of Co-integration

Since the variables employed are co-integrated at 2nd level difference, we apply Johansen- Juselius maximum likelihood method of co-integration to obtain the number of the co-integrating vectors.

H_0: there is no co-integration which is rejected when p-value is < than 5%

H_1: there is co-integration which is accepted when p-value is > than 5%

Another way to make decision as regard acceptance or rejection is to compare both the
Trace Statistic and Max- Eigen Statistic to their critical values. They should be greater than critical values for rejection or otherwise for acceptance.

Decision Rule: Both the Trace Statistic and Max-Eigen Statistic indicate 1 co-integrating equation at the 5% sig level. And even their P values are greater than 5% respectively. The absolute value of Max Log likelihood of 324.0451 gives the result as follows:

Normalized co-integrating coefficients (standard error in parenthesis)

Cpi	*mpr*	*fx*
1.0000	3.5636	1.2235
	(1.7841)	(0.4511)

Evidence shows that both *mpr* and *fx* have positive impact on the *cpi* while their coefficients indicate the variability rate. In accordance with Granger, if there is evidence of co-integration between two or more variables then a valid error correction model should also exist between *mpr* and *fx*.

Vector Error Correction Estimates (VECM)

As *cpi, mpr* and *fx* are co-integrated, a VECM representation could have the following form, in equations (iv) to (vi).

$$\Delta cpi_t = a_1 i \Delta cpi_{t-1} + a_2 i \Delta mpr_{t-1} + a_3 i \Delta fx_{t-1} + a_4 i \Delta * EC1_{t-1} + e_1 t \ldots\ldots\ldots \quad (iv)$$

$$\Delta mpr_t = \alpha_1 i \Delta cpi_{t-1} + \alpha_2 i \Delta mpr_{t-1} + \alpha_3 i \Delta fx_{t-1} + \alpha_4 i \Delta * EC1_{t-1} + e_2 t \ldots\ldots \quad (v)$$

$$\Delta fx_t = \beta_1 i \Delta cpi_{t-1} + \beta_2 i \Delta mpr_{t-1} + \beta_3 i \Delta fx_{t-1} + \beta_4 i \Delta * EC1_{t-1} + e_3 t \ldots\ldots \quad (vi)$$

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Where:

- $a_1, .a_2, .a_3, .a_4$ represent the estimated coefficients of causality effects of all the variables on *cpi*;
- $\alpha_1, \alpha_2, \alpha_3, \alpha_4$ represent the estimated coefficients of causality effects of all the variables on *mpr*.
- $\beta_1, \beta_2, \beta_3, \beta_4$ represent the estimated coefficients of causality effects of all the variables on FXR, and
- $EC1_{t-1}$ and *e* represent error correction estimates and error terms respectively which determine the long run causality effect of the model.

Since the estimated coefficients of the variables used are non zero, it means there exists both short run and long run causality relationship between the macroeconomic variables.

DISCUSSION OF FINDINGS

The study found that the *cpi* was at its lowest ebb between 1970 and 1972 when the index was 0.20% and what could be considered steady increase was sustained when the index hit a single digit of 1.0 in 1981. In about a decade apart the index hit two and three digits of 10.4 and 117.9 in 1992 and 2003 respectively. The *mpr* remains constant at 4% from 1970 t0 1975 while a crash of between 12.5% and 25% was observed between 1976 and 1977. The *mpr* was stable at 10% between 1984 and 1986. Similarly, the a US dollar exchanged for less than a unit of the local currency (*NGN1*) until 1986 when US1/NGN2.206. It is pertinent to note that though there was a military intervention in governance in Nigeria between December, 1983 and May, 1999, all the macroeconomic variables remain relative stable 1986 when they appear to be irresponsive to macroeconomic policies of the Government.

The advent of civilian government in 1999 has not left any significant positive impact on the economic indices. Surprisingly, inflation did not reflect any significant correlation with *cpi*, an indication that inflation measures in Nigeria have not been a correct reflection of products prices. Inflation rates were likely products of manipulation.

The *cpi* was at a minimum and a maximum of 0.2 and 216 during each of 1970 and 1972, and 2009 respectively with an average of 43.87, and indication that products price rise at an average of 43.87 *per cent* every year. For the same period, inflation averages at 20.03 *per cent*, a further indication of an earlier assertion that inflation rates in Nigeria could be manipulated. The *mpr* was at a minimum of 3.0 *per cent*, maximum of 28 *per cent* and an average of 10.67 *per cent*. Lastly, the *fx* was at a minimum of USD1/NGN0.5464 and maximum of USD1/NGN148.7316. The exchange rate averaged at USD1/NGN38.6305.

The adjusted R-square which explains the extent to which the independent variables account for the changes and behaviour of the dependent variable (*cpi)* is 0.8733. This implies that 87.33 *per cent* of the observed changes and behaviour noticeable in *cpi* results from the combination of *mpr* and *fx* overtime. It is equally instructive to note that *cpi* as a measure of price stability can be significantly achieved in Nigeria if the two independent variables are properly managed by the Central Bank.

In conformity with our expectation though devoid of any empirical evidence, rather based on the age-long dependence of the Central Bank of Nigeria to achieve price stability through the monetary policies, the study found *mpr* to be positively but insignificantly related to *cpi* at coefficient of 0.0103. From 1958 when the Central Bank of Nigeria came into existence and assumed the role of price stability in Nigeria, its major tool for achieving that objective has remained the instruments of monetary policies (*mpr)*. From the observed the *mpr's* positive coefficient of 0.0103, it's indicative that monetary policy (*mpr)* can be engaged to achieve price stability in Nigeria but the likelihood of achieving the desired low inflation rate is very insignificant. This is the reason the attainment of price stability as being pursued by the Central Bank of Nigeria would remain a mirage, rather, the efforts to achieve price stability through *mpr* in Nigeria would continue to aggravate inflations.

The study also found that *F-test* (129.5116) was significant at 0.05 level of significance, implying that the independent macroeconomic variables (*mpr, fx*) examined in the model, collectively and significantly impact on the *cpi*. Surprisingly, the *fx* was found to be positively and significantly related to *cpi* at coefficient of 1.1066. This suggests that foreign exchange policies impact positively and significantly on product prices. The foreign exchange policies in Nigeria overtime hovers between the fixed, flexible and hybrid methods and to a large extent determination of the exchange rates were not free from Government intervention.

Appendix V shows that between 1970 and 1978, *cpi*, *mpr* and *fx* followed the same trend. Though the economy between the periods was under dictatorship, the economic indices have shown that that was the best period in the history of Nigeria as the exchange rates were stable and the currency remained stronger than United States

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dollars. Observable deviations became obvious from 1986 as the *fx* commenced a different trend from the other two economic indices. Between 18992 and 1998, the exchange rate was pegged while 322.03 *per cent* devaluation of the currency occurred in 1999 which incidentally ended the dictatorial rule in Nigeria. Though, the *fx* is strictly under CBN controls and not fully determined by the free forces of demand and supply, it maintains a similar trend with *cpi* between 2000 and 2002 and from now 2008 to 2009. The deviation from the trend observed between 2003 and 2007 could have resulted from the CBN refusal to allow the market force to influence the *fx*. Surprisingly, rather than the *fx* and *mpr* to follow the same trend, the former appears to have adopted a more similar trend with *cpi*, though between 1970 and 1996, the index was at variance with the other macroeconomic variables. This suggests that to achieve price stability in an economy like Nigeria where there is high incidence of *fx* outflows resulting from importation of consumable goods, flights of proceeds of corruption to foreign accounts, and high dependence on crude oil revenue, engagement of *mpr* is a misplacement, rather more emphasis should be on *fx*.

CONCLUSION

Earlier studies have reached a consensus that monetary policies generate more economic activities than fiscal policies in developing economies and particularly in Nigeria but they did not identify which of the macroeconomic instruments is more effective in achieving price stability. This study has bridged the gap in the earlier studies by examining which of the two instruments would put inflation under control in Nigeria. The study observed that the presence of exogenous factor in the form of uncontrolled inflows of M2 in form of rent income from the downstream oil sector (unproductive sector) was responsible for the inability of the tight monetary policy of the CBN to mob excess liquidity from the economy. In the same vein, the exogenous factor destabilizes the increasing but stable prices that would have emanated from a relaxed interest rate by causing excessive increase that is not justified by economic activities.

The study found *fx* to be a more effective instrument to ach\ieving price stability than *mpr*. The Nigerian economy is largely import dependent with most of the importation being consumable goods and services and less of productive (capital) goods. The impacts of changes in *fx* are more pronounced on the economy than changes in the interest rates. The attainment of price stability would be more feasible in Nigeria if the apex bank gives priority to the formulation of foreign exchange policies that are both sound in principle and effective in practice.

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Appendix I: Results of Descriptive Statistics

Variables	Mean	Minimum	Maximum	1st Quartile	3rd Quartile	Median	Std. Dev.	No. of Observ.
cpi_i	43.869	0.226	215.989	0.845	65.942	5.596	62.040	40
mpr_i	10.671	3.000	28.020	6.250	14.278	10.000	6.037	40
fx_i	38.630	0.546	148.732	0.669	94.458	7.715	53.575	40

Appendix II: Results of Regression Analysis of *cpi, mpr and fx* Variables (1970 – 2009)

Dependent Variable: *cpi*
Method: Least Squares
Date: 06/28/13 Time: 11:49
Sample: 1970 2009
Included observations: 40

Variable	Coefficient	Std. Error	t-Statistic	Prob.
mpr	0.010261	0.350091	0.029309	0.9768
fx	1.106603	0.065584	16.87299	0.0000

R-squared	0.876582	Mean dependent var	43.89475
Adjusted R-squared	0.873334	S.D. dependent var	62.11099
S.E. of regression	22.10541	Akaike info criterion	9.078228
Sum squared resid	18568.66	Schwarz criterion	9.162672
Log likelihood	-179.5646	Hannan-Quinn criter.	9.108760

Appendix III: Results of Unit Root Test Analysis of *cpi, mpr and fx* Variables (1970 – 2009)

Null Hypothesis: D(*cpi*,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.303556	0.0000
Test critical values:	1% level	-4.252879	
	5% level	-3.548490	
	10% level	-3.207094	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(*cpi*,3)
Method: Least Squares
Date: 06/28/13 Time: 13:02
Sample (adjusted): 1976 2009
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(*cpi*(-1),2)	-2.348267	0.372530	-6.303556	0.0000
D(*cpi*(-1),3)	1.091254	0.331708	3.289806	0.0027
D(*cpi*(-2),3)	0.997666	0.257042	3.881334	0.0006
D(*cpi*(-3),3)	0.870364	0.151157	5.758012	0.0000
C	-1.307910	1.371404	-0.953701	0.3484
@TREND(1970)	0.118668	0.056880	2.086283	0.0462

R-squared	0.866328	Mean dependent var	-0.027059

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Adjusted R-squared	0.842458	S.D. dependent var	8.022117
S.E. of regression	3.184099	Akaike info criterion	5.313001
Sum squared resid	283.8777	Schwarz criterion	5.582359
Log likelihood	-84.32102	Hannan-Quinn criter.	5.404860
F-statistic	36.29370	Durbin-Watson stat	2.320437
Prob(F-statistic)	0.000000		

Appendix IV(a): Results of Vector Auto Regression Analysis of *cpi, mpr and fx* Variables (1970 – 2009)

Date: 06/28/13 Time: 12:09
Sample (adjusted): 1973 2009
Included observations: 37 after adjustments
Trend assumption: Linear deterministic trend
Series: *cpi, mpr, fx*
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.454689	33.95946	29.79707	0.0157
At most 1	0.249565	11.52268	15.49471	0.1813
At most 2	0.024029	0.899916	3.841466	0.3428

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.454689	22.43677	21.13162	0.0326
At most 1	0.249565	10.62277	14.26460	0.1742
At most 2	0.024029	0.899916	3.841466	0.3428

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

Cpi	*mpr*	*Fx*
0.024686	0.087972	0.030202
0.069255	0.038139	-0.075943
-0.008797	0.198562	0.016805

Unrestricted Adjustment Coefficients (alpha):

D(*cpi*)	1.643022	0.388756	0.415903
D(*mpr*)	1.572188	-0.216354	-0.296397
D(*fx*)	0.267253	4.857979	-0.865965

1 Cointegrating Equation(s): Log likelihood -324.0451

Normalized cointegrating coefficients (standard error in parentheses)

Cpi	*mpr*	*Fx*

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1.000000	3.563596	1.223450
	(1.78411)	(0.45109)

Adjustment coefficients (standard error in parentheses)

D(*cpi*)	0.040560
	(0.01523)
D(*mpr*)	0.038812
	(0.01196)
D(*fx*)	0.006597
	(0.05143)

2 Cointegrating Equation(s): Log likelihood -318.7337

Normalized cointegrating coefficients (standard error in parentheses)

Cpi	*mpr*	*fx*
1.000000	0.000000	-1.520628
		(0.27374)
0.000000	1.000000	0.770031
		(0.15073)

Adjustment coefficients (standard error in parentheses)

D(*cpi*)	0.067483	0.159367
	(0.04506)	(0.05876)
D(*mpr*)	0.023828	0.130057
	(0.03550)	(0.04630)
D(*fx*)	0.343037	0.208792
	(0.13806)	(0.18005)

Appendix IV(b): Results of Vector Auto Regression Analysis of *cpi, mpr and fx* Variables (1970 – 2009)

Vector Error Correction Estimates
Date: 06/28/13 Time: 12:21
Sample (adjusted): 1973 2009
Included observations: 37 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
cpi(-1)	1.000000
mpr(-1)	3.563596
	(1.78411)
	[1.99740]
fx(-1)	1.223450
	(0.45109)
	[2.71219]
C	-126.6081

Error Correction:	D(*cpi*)	D(*mpr*)	D(*fx*)
CointEq1	0.040560	0.038812	0.006597
	(0.01523)	(0.01196)	(0.05143)
	[2.66270]	[3.24482]	[0.12829]
D(l*cpi*(-1))	0.237113	-0.212520	1.091066
	(0.20939)	(0.16442)	(0.70694)
	[1.13238]	[-1.29254]	[1.54336]

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D(*cpi*(-2))	0.076236	-0.763197	-1.144604
	(0.23775)	(0.18668)	(0.80266)
	[0.32066]	[-4.08820]	[-1.42601]
D(*mpr*(-1))	0.071038	-0.676065	0.496093
	(0.22523)	(0.17685)	(0.76040)
	[0.31540]	[-3.82274]	[0.65241]
D(*mpr*(-2))	0.283751	-0.592994	-0.966288
	(0.22747)	(0.17862)	(0.76799)
	[1.24740]	[-3.31990]	[-1.25821]
D(*fx*(-1))	-0.009131	-0.040798	0.163832
	(0.06011)	(0.04720)	(0.20293)
	[-0.15190]	[-0.86441]	[0.80732]
D(*fx*(-2))	0.004439	-0.109734	-0.012705
	(0.06187)	(0.04858)	(0.20889)
	[0.07175]	[-2.25863]	[-0.06082]
C	4.237646	5.537362	3.057317
	(1.82369)	(1.43200)	(6.15705)
	[2.32366]	[3.86687]	[0.49656]
R-squared	0.796906	0.472464	0.201730
Adj. R-squared	0.747884	0.345128	0.009044
Sum sq. Resids	408.5473	251.8990	4656.767
S.E. equation	3.753377	2.947231	12.67194
F-statistic	16.25588	3.710369	1.046938
Log likelihood	-96.93199	-87.98577	-141.9512
Akaike AIC	5.671999	5.188420	8.105468
Schwarz SC	6.020306	5.536726	8.453775
Mean dependent	5.858108	0.249459	4.001992
S.D. dependent	7.475178	3.641968	12.72964

Determinant resid covariance (dof adj.)	16868.19
Determinant resid covariance	8121.895
Log likelihood	-324.0451
Akaike information criterion	18.97541
Schwarz criterion	20.15094

Appendix V: Comparative Trends of *cpi, mpr* and *fx* Variables (1970 – 2009)