A Comparative Study of the Channels of Monetary Transmission Mechanism and Inflation Targeting In Nigeria

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Abstract: *The paper makes a contribution to the ongoing debate by a comparative analysis of the channels of monetary transmission mechanism in Nigeria with a view to ascertaining the extent of their efficacy in addressing inflationary pressures in Nigeria. It provides a clear, sound and functional understanding of the monetary transmission process in order to help policy makers in Nigeria understand the relative strengths of the various channels and also make a choice of the channel that is most relevant in addressing a particular macroeconomic problem. Annual time series data, spanning from 1980 to 2014, on the variables representing transmission channels (interest rate, exchange rate, and asset prices) and inflation were estimated using the Johansen 1991 cointegration and error correction model. The result suggests that there is a long run cointegration and valid error correction mechanism among the variables used in the study. On the other hand, the VAR result showed that, in terms of the size of the coefficients, the interest rate channel, has the highest speed of transmission, implying that it has more strength in addressing inflation, this followed by exchange rate and finally, the asset price channels. The policy implication for the result suggest that the monetary authority should first, make a clear cut distinction between short-run and long-run objectives and embark on tight monetary policy measures through the interest rate to achieve short-run objective of low inflation.*
Keywords: *Inflation Targeting, Instability, Monetary Transmission Mechanism, Nigeria*

1. Introduction

The power to formulate and implement monetary policy in any country is vested on the central bank of that country. In most countries of the world, the goals of monetary policy include the attainment of price stability, balance of payment equilibrium and sustainable economic growth. However the extent to which these goals could be achieved depends largely on the efficacy of the channels though which monetary policy impulse is transmitted to the economy. The conduct of monetary policy requires effective transmission channels to lubricate the flow of policy action to different part of the economy in order to achieve targeted objectives. In Nigeria, the Central Bank of Nigeria (CBN) had, over the years, embarked on various inflation-targeting regimes in order to respond appropriately to the challenges of high double digit inflation that has characterized the economy since early 1970s. Different policy options have been adopted by the successive inflation-targeting regimes raging from adjustments in monetary official policy rate (MPR), exchange rate, credits to private sectors and asset prices, all with a view to achieving low single digit inflation among other objectives. What this suggests is that the various channels of monetary transmission (interest rate, exchange rate, credits and asset price channels) have been used by the CBN, at one time or the other, to achieve targeted monetary policy objectives.

The various transmission channels have their relevance differently, the subject of which of the channels of monetary transmission is the most effective and fastest in transmitting monetary impulse to affect aggregate economic variables is still subject to debate among researchers. Interestingly, contrary to the results of previous works on the efficacy of monetary transmission mechanisms revealed that interest rate is only effective in addressing inflation only in the long run, this study reveals that interest rate is effective in both the short and long run, but has a higher impact on inflation in the short-run than in the long-run. Therefore, it can be effectively used as an instrument of economic stabilization in both the short run and long run.

This immediately suggests a clarification of issues. The first is about the macroeconomic instability (inflation) in Nigeria. What accounts for the continuing macroeconomic instability in Nigeria, and is this trend likely to continue? The second question tries to explain what are various instruments used by the Central Bank of Nigeria to address the problem, and finally, how effective are these instruments in addressing the problems and the issues raised for monetary policy and planning for development? The

questions raised are significant for a high-inflation economy like Nigeria for some reasons. First, all channels of monetary transmission are relevant differently and therefore it is important that policy makers know the channel that is most relevant in addressing a particular macroeconomic problem. Second, there are mixed evidences regarding the efficacy of monetary policy transmission channels in controlling inflation in Nigeria and as such it is worthwhile to update previous results via the utilization a different econometric model as this will be of immense benefit in the academia. Furthermore, a comparative analysis of transmission channels would assist in the clarification of the sensitivity of each of the channels to monetary policy shocks and the speed with which the channels transmit impulse to the different sectors of the economy.

Thus, this study is an attempt to fill the existing gap in the previous studies, given that most previous studies do not always provide a convergence conclusion on the issues raised earlier about relative effectiveness of the different channels of transmission in tackling macroeconomic instability in Nigeria.

2. Literature Review

2.1 Channels of Monetary Transmission Mechanism

There is plethora of studies on the channels of transmission mechanism in the field of monetary economics. However, researchers do not have a meeting of minds on which of the channels is more effective. Mishkin (1995) identified four (4) channels of monetary transmission as: interest rate channel, credit channel, exchange rate channel and other Assets Price effects channel.

Interest Rate Channel of Monetary Transmission:

The interest rate channel of monetary policy transmission has been described by Ogunkola and Abubakar (2008), Clarida, Gali and Gertler (2000) and Besimi, Pugh and Adnett (2006) as the standard Keynesian channel of monetary transmission which operates within the IS-LM framework. It is *the* primary mechanism at work in conventional macroeconomic models. The basic idea is that, given some degree of price stickiness, any action by the central bank that increases the official policy rate (monetary policy rate [MPR]) is an indication that the bank is pursuing a contractionary monetary policy. An increase in MPR increases the nominal interest rates, will translates into an increase in the real rate of interest and the user cost of capital. These changes in turn lead to a postponement in consumption or a reduction in investment spending. This is precisely the mechanism embodied in conventional specifications of the "IS" curve, whether of the "Old Keynesian" variety, or the forward-looking equations at the heart of the "New Keynesian" macro models developed by Rotemberg and Woodford (1982) and Clarida, Galí, and Gertler (2000), among others. But as Bernanke and Gertler (1995) have pointed out, the macroeconomic response to policy-induced interest rate changes is considerably larger than that implied by conventional estimates of the interest elasticity's of consumption and investment. This observation suggests that mechanisms other than the narrow interest rate channel may also be at work in the transmission of monetary policy.

Credit (bank lending) Channel of Monetary Transmission:

Kashyap and Stein (2000) traced the origin of thought on the bank lending channel back to Roosa (1982) and also highlight Bernanke and Blinder's (1988) extension of the IS-LM model as one that accounts for this additional source of monetary non-neutrality. The credit channel relates to the bank lending (narrow credit channel) and the bank balance- sheet (broad credit channel) which have direct bearing with commercial banks or financial intermediaries. For narrow credit channel (bank lending), contractionary monetary policy that reduces the aggregate volume of bank reserves will reduce the availability of bank loans. Because a significant subset of firms and households relies heavily on bank financing, reduction in loans' supply will depress aggregate spending (Irland, 2005).

Exchange Rate Channel of Transmission Mechanism:

The *exchange rate channel* is an important element in conventional open-economy macroeconomic models. The chain of transmission here runs from interest rates to the exchange rate via the uncovered interest rate parity condition relating interest rate differentials to expected exchange rate movements. Thus, an increase in the domestic interest rate, relative to foreign rates, would lead to a stronger currency and a reduction both in net exports and in the overall level of aggregate demand. The effectiveness of the exchange rate channel depends on the exchange rate regime, the extent of exchange rate pass-through and the degree of openness to capital flows (Taylor, 1995).

Other Assets Price Channel (Equity Price Channel):
Other Assets Price Channel operates through the impact of monetary shocks on yields of equity shares, real estate, and other domestic assets. The channel works through the investment effect, which rely on Tobin's 'q' theory of money (1969) and the consumption effect, advanced by Modigliani (1963) in his the life-cycle income hypothesis. The Tobin's '*q'* theory (investment effects) defines 'q' as the market value of firms divided by the replacement cost of capital owned by the firm. Thus, a policy induced increase in the short-term nominal interest rate makes debt instruments more attractive than equities in the eyes of investors. Therefore the investment spending will rise because the firm can buy a lot of new investment goods with only a small issue of equity. However, with a lower value of *q*, firms find it less desirable to issue new shares of stock to finance new investment projects; hence, investment, output, and employment fall.

Inflation Expectations Channel of Transmission Mechanism
Although the inflation expectation channel of transmission mechanism was not recognized by Mishkin (1995) yet, it is another strong mechanism for monetary policy transmission. They are transmitted into the economy when firms adjust their prices in response to their perception of how future prices would trend. Thus, with well anchored expectations, monetary policy can easily respond to stocks and central banks would have greater flexibility in responding to financial market disturbances (Adamole, 2013).

2.2 Theoretical Framework

The theories of monetary transmission mechanism discussed in this paper are as follows:

Keynesian Theory of Monetary Transmission Mechanism
The Keynesian theory of monetary transmission is credited to Keynes J.M. (1936) and his followers who latter perfected the Keynesian school of thought. The theory was based on the aggregate supply and demand interaction. In the Keynesian approach, a discretionary change in monetary policy affected the real economy through the two sides of market forces- the demand and supply sides. From the aggregate demand side, monetary policy was transmitted either directly through three channels; the exchange rate, the interest rate and wealth channel or indirectly through the bank credit which was transmitted through two channels: the bank-lending channel and the balance sheet channel. From the supply side, monetary policy impulse affected real variables via changes in inventory cost (Baksh & Craitgwell, 1997).

Monetarists Theory of Monetary Transmission Mechanism
The monetarist perspective is credited to Friedman (1967). The theory recognizes the interplay of relative prices with at least three assets, namely, money or base money which provides services as a medium of exchange; bonds or securities which yield a nominal return or interest; and the stock of real capital or claims to real capital. The monetarist perspective acknowledges that "The transmission process begins in the asset market". It does not say, however, what triggers it or how the process starts. It recognizes the open market operations by the central bank which, in this view, is "a simultaneous change in the stocks of base money and securities".

In the "traditional quantity approach", an open market operations purchase increases the base money and reduces the stock of debt held by banks or the public; the reverse case of open market sales decreases the base money and increases the public's debt holding. The logic of the monetarist channel of monetary transmission, according to Kuttner and Mosser (2002), is that because various assets are imperfect substitutes in investors' portfolios, changes in asset composition outstanding, brought about by monetary policy would lead to relative price changes which, in turn, can have real quantity effects. This study adopted the monetarist perspective of monetary transmission mechanism. The choice of this perspective was on the basis that it identified the asset market as the starting point of monetary transmission which is peculiar to the Nigerian situation.

2.3 Empirical Review

In Nigeria, several empirical studies have been conducted with a view to understanding how impulses are transmitted through monetary transmission channels to the economy to affect macro-economic aggregates. The findings of the studies, on the efficacy of the channels of transmission, revealed mixed results. These could be attributed to varying methodology, scope of coverage, monetary variables and data set employed by these researchers.

Francis and Eugene (2015) conducted a study on monetary transmission mechanism in Nigeria, using Factor Augmented Vector Autoregressive (FAVAR) Approach for the period 1970:1 to 2013:4. The findings from the study revealed that the effectiveness, dominance and the exact channel through which monetary policy impact on the Nigerian economy is at best mixed. Earlier, Bernhard (2013) conducted a similar study for Nigeria for the period 1970-2011, using Granger Causality; the study concludes that three channels are functional in Nigeria-the interest rate, exchange rate and the credit channels. Furthermore, Adeoye, et al (2014) using quarterly time series data for the period 1986 to 2010in Vector Autoregressive (VAR) model examined how monetary policy affect the role which bank credit plays in the transmission of monetary policy impulses to aggregate demand in Nigeria. The study established that in Nigeria, there is a close relationship between the bank credit and the aggregate demand, which suggests a stronger monetary transmission system via credit channels and investment multiplier. Using Error correction Models, Nenbee and Madume (2011) examined the impact of monetary policy on Nigeria's macroeconomic stability between 1970 and 2009. Macroeconomic stability was taken to be synonymous to price stability. They showed that only 47 percent of the total variations in the prices were explained by the monetary policy variables Money Supply (MOS), Minimum Rediscount Rate (MRR) and Treasury Bills (TRB) in the long-run. They concluded that monetary policy tools therefore have mixed impact on inflation in Nigeria. Latter, Ikechukwu (2014) *used the multivariate Vector Autoregressive Model to analyze the effects of monetary policy rate on other rates in Nigeria from 2007:1 to 2012:4.* The major findings of this study is that the pass-through of monetary policy rate into short term and long term retail interest rates in Nigeria is sticky. The only evidence of the effectiveness of monetary policy can be seen only in the relationship between monetary policy rate and interbank rates. **Udude (2014)** examined the impact of monetary policy on the growth of Nigeria economy between the period of 1981 and 2012. The study used the Vector Error Correction Model (VECM) to estimate the relationship of interest rate, exchange rate, liquidity ratio and broad money supply to gross domestic product. From the result, the study concluded that monetary policy did not impact significantly on economic growth of Nigeria within the period under review and that the inability of monetary policies to effectively maximize its policy objective most times is as a result of the shortcomings of the policy instruments used in Nigeria as such limits its contribution to growth.

3. Methodology

3.1 Data Collection Sources

The data used in this study were collected from the publications of the Central Bank of Nigeria (CBN) and National Bureau of Statistics (NBS).Transmission variable indicators on which data were collected are interest rate, exchange rate and asset prices. The data spanned from 1980 to 2014.

3.2 Estimation procedures

The empirical approach utilized in this study is the unrestricted vector auto-regression (VAR) model. The choice of the VAR methodology was based on the argument by Sim (1980) that it allowed for proper model smoothening. The results of VAR estimates are more efficient than those of OLS, as it does not imposed unrealistic restrictions as OLS does Sim (1980). This method represents the standard practice in assessing the dynamic responses of macroeconomic variables to monetary policy shocks. Also, long-run and short-run dynamics are established using different techniques such as the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Unit Root test, Johansen Co-integration test and Vector Error Correction Mechanism (VECM). Four VAR systems, for the four variables of the study were estimated. Each system consists of three endogenous monetary policy variables (interest rate, exchange rate and asset prices) and a lagged inflation. The unrestricted VAR model for this study is specified as follows:

$$INF_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 INF_{t-i} + \sum_{i=1}^{k} \alpha_2 INT_{t-i} + \sum_{i=1}^{k} \alpha_3 EXC_{t-i} + \sum_{i=1}^{k} \alpha_4 ASP_{t-i} + e_\alpha \quad \text{.....(1)}$$

$$INT_t = \beta_0 + \sum_{i=1}^{k} \beta_1 INT_{t-i} + \sum_{i=1}^{k} \beta_2 INF_{t-i} + \sum_{i=1}^{k} \beta_3 EXC_{t-i} + \sum_{i=1}^{k} \beta_4 ASP_{t-i} + e_\beta \quad \text{.....(2)}$$

$$EXC_t = \gamma_0 + \sum_{i=1}^{k} \gamma_1 EXC_{t-i} + \sum_{i=1}^{k} \gamma_2 INF_{t-i} + \sum_{i=1}^{k} \gamma_3 INT_{t-i} + \sum_{i=1}^{k} \gamma_4 ASP_{t-i} + e_\gamma \quad \text{.....(3)}$$

$$ASP_t = \lambda_0 + \sum_{i=1}^{k} \lambda_1 ASP_{t-i} + \sum_{i=1}^{k} \lambda_2 INF_{t-i} + \sum_{i=1}^{k} \lambda_3 INT_{t-i} + \sum_{i=1}^{k} \lambda_4 EXC_{t-i} + e_\lambda \quad \text{.....(4)}$$

Where;

α_0, β_0, γ_0 and λ_0 = dimensional column vector of the intercepts,

$_j$, β_j, γ_i and λ_j = dimensional vector of partial slope parameters (j = 1……. 4),

$e_\alpha, e_\beta, e_\gamma, e_\lambda$, = dimensional vector of the stochastic error term residuals,

K = maximum lag length; INF = Inflation Rate; INT = Real Interest Rate; EXC = Real Exchange Rate; ASP = Aggregate Asset Prices.

4. Analysis and Discussion of Findings

4.1 Result of Augmented Dickey-Fuller Unit Root Test

Table 1: ADF Unit Root Test H_0: The Series has a Unit Root

Variables	ADF Levels	ADF1st Difference	PP Levels	PP Difference	Remarks
LINF	-2.92[1]	-5.52[1]**	-2.90[1]	-10.2[1]**	**I (1)**
LINT	-2.40[1]	-6.20[1]**	-2.36[1]	-6.25[1]**	**I (1)**
LEXC	-1.52[1]	-5.41[1]**	-1.57[1]	-5.41[1]**	**I (1)**
LASP	-0.02[1]	-3.52[1]**	-0.53[1]	-3.37[1]**	**I (1)**
ADF Critical Value at 5% = -2.95;				**PP Critical Value at 5% = -2.96**	

*** indicates significant at 5%*

***[1]** Indicates that a maximum lag length included in the tests.*

Table 1 shows the result of the unit root test conducted, for both ADF and PP at levels, all the variables are non stationary since their calculated values are less than the critical values in absolute terms, implying that at levels, the null hypotheses that each of the variables has a unit root cannot be rejected.

Table 2: Result of Test for Co-integration Rank

No. of CE(s)	λ_{Trace}	5%	λ_{max}	5%
None *	68.37	55.25	34.31	30.81
At most 1*	34.07	35.01	22.11	24.24
At most 2	11.95	18.40	9.560	17.15
At most 3	2.394	3.841	2.394	11.22

** denotes rejection of the hypothesis at the 0.05 level*

The result of co-integration in Table 2 above revealed that there is one co-integrating equations in the system with its maximum eigen value and trace statistic greater than critical values at 5 percent. Therefore, the null hypothesis of no co-integration is rejected.

Table 3: Estimated Long-run Co-integration Vectors

Variables	Coefficients	Standard errors	P values
LINF	1.000	0.721	0.214
LINT	-1.72	0.148	0.045
LEXC	0.06	0.143	0.033
LASP	-0.04	-0.034	0.048

***Source:** Computed by the researchers (extracted from e -view 8)*

The result of the estimated long run co-integrating vectors is reported in Table 3. The results indicated that the estimated coefficients of long-run for all the variables have the correct expected signs. Similarly, all the coefficients are statistically significant except the coefficient of inflation. Although, inflation is insignificant, it cannot be excluded from the model because it is the dependent variable in the system.

Table 4: Estimated Short-run Dynamic Equations for VECM Dependent Variable (INF)

Variables	Coefficients	t- Values	P- Values
C	5.600	2.674	-0.462
? LINF (-1)	0.238	1.700	0.096
? LINT (-1)	-2.265	3.296	0.009
? LEXC(-1)	0.039	0.432	0.401
? LASP (-1)	-0.044	3.156	0.0062
ECM_{t-1}	-0.577	4.859	0.003
Diagnostic Test	Statistics		P-values
R-squared	0.63		
DW-stat	1.98		
LM test	0.93		0.37
ARCH test	0.29		0.18
Jacque-Bera	**1.22**		**0.54**

Source: *Computed by the researchers (extracted from E -view 8)*

From the dynamic model in Table 4, the estimated error correction term is consistent with the expected negative sign and significant at 5% level of probability. This suggests that there is feedback adjustment mechanism from short-run to long-run equilibrium among the variables used in the analysis. The diagnostic statistics suggest that the data relatively fits the model well, the result suggest that the model is robust. However, the Jarque-Bera test for non-normality indicates that the null hypothesis of non-normality cannot be rejected, given the reported p-value of 0.54. The coefficient of ECM indicates an annual speed of adjustment of about 58% per annum. This suggests that about 58% of the disequilibrium errors, which occurred the previous year, are corrected in the current year. In addition, the coefficients of interest rate is negative in both short and long run, but are larger in the short run than the long run; this therefore, suggest that the impact of interest in the transmission mechanism is larger in the short run. However, the exchange rate has positive but insignificant impact on macroeconomic fluctuation (inflation) while asset prices lagged for one period has negative effects and statistically significant at 5%. Thus a unit increases in exchange rate increases inflation by about 3.9% while a unit increase in asset prices decreases inflation by about 4.4% respectively.

Table 5: Vector Auto-regression (VAR) Estimates

VARIABLES	INF	INT	EXC	ASP
INF(-1)	0.3612 [2.231]**	-0.0016 [-0.040]	0.0088 [0.0300]	2.765 [2.440]**
INT(-1)	1.070 [1.970]**	0.757 [5.613]**	1.1009 [1.126]	2.708 [0.713]
EXC(-1)	-0.091 [-1.656]*	0.0038 [0.262]	0.832 [7.956]**	0.428 [1.053]
ASP(-1)	-0.0036 [-1.679]*	-0.0004 [-0.641]	-0.0024 [-0.618]	1.016 [6.689]**
C	4.639 [0.547]	5.0091 [2.379]**	-8.122 [-0.532]	-46.10 [-0.777]
R-squared	0.740	0.640	0.775	0.959
Adj. R-squared	0.697	0.591	0.744	0.949
F statistic	6.435	12.91	24.95	1462.0

** indicates that it is significant at 10%*
*** indicates that it is significant at 5%*

4.3 Estimated Result for Vector Auto-regression (VAR)

To make a comparison of the variables of the study and ascertained their efficacy in addressing inflation, four systems of VAR equations are estimated using a maximum lag length of 1 as earlier reported in table 1. The result is shown in table 5.

From the result in the Table 5, it is evident that all the lagged dependent variables affect inflation in the current year however, in terms of the size of the coefficients the effect, on inflation, of a change in interest rate is higher than those of exchange rate and asset prices combined. As can be observed from the table, the interest rate channel has more strength in transmitting monetary impulses to the economy for the period under investigation. The negative impact of interest rate on inflation conformed to the *apriori* expectation and significant at 5% level of probability.

The Table also revealed that exchange rate and asset prices had marginal impacts on inflation. This result also supports the findings of Benhard (2013), of a positive relationship between exchange rate and inflation in Nigeria. This finding partly supports the result of study by Abdulwahab (2012) that interest rate channel is the most significant transmission mechanism in most developing economies but disagrees with Benhard (2013) whose findings supports the relevance of the exchange rate channel in the economy. In a way, these results from the study add to the existing body of knowledge.

5. Conclusion and Recommendations

5.1 Conclusion

Monetary policy in Nigeria plays a significant role in controlling inflation through its various transmission channels. To compare the efficacy of the various channels of transmission, the Johansson co-integration, vector error correction and VAR techniques were adopted. The findings from the study revealed that in Nigeria, monetary policy shocks are transmitted to the economy through the interest rate, exchange rate and asset price, however, the interest rate channel is more responsive to monetary policy shocks as compared to other channels. Surprisingly however, the coefficient of interest rate is larger in the short run than the long run. This is contrary to the findings of most previous studies that interest rates are more effective in the long-run. However this could be a new finding that has move the body of existing knowledge forward as it conformed to the Keynesian arguments on the importance of short-run policy targets, though, disagreed monetarists' long-run policy-based theory. This, however, does not invalidate previous studies with opposite findings neither does it suggest the irrelevance of the monetarists views on the workings of macroeconomic variables in Nigeria.

5.2 Recommendations

Based on the findings of the study, it is recommended that there should be a clear cut distinction between short-run and long-run objectives by the monetary authority. For short-run objectives such as controlling inflation, the CBN can embark on tight monetary policy measures through the interest rate and probably the asset price channels since the later is associated with the former. There should be periodic review of interest rate rather than maintaining a long term rate. This involved raising the monetary policy rate (MPR) within a fixed short term interval and by so doing, increases the nominal interest rates which, again translates into increase in the real rate of interest (the cost of capital assets). These changes in turn lead to a postponement in consumption or a reduction in investment spending and will slow down the inflationary pressure. Second, to achieve the long-run objectives of monetary policy will require further regulatory regimes and the strengthening of other channels of monetary transmission apart from the interest rate and the asset price channels.

5.3 Limitations and Suggestions for further Research

The fact that this study is one of the recent attempts to make a comparative study of the channels of monetary transmission mechanisms and inflation-targeting in Nigeria does not suggest the completeness of the research in this area. Further research may explored the possibility using a different methodology, possibly the structural VAR approach, to find out if the result will agreed or disagreed with the findings of this study, especially on the abnormal insensitivity of exchange rate to policy shock. It may also be of interest to extend the scope of this study backward from 1980 and beyond 2014 in order to see the robustness of the estimated models.

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