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# The Dominant Channels of Monetary Policy Transmission in Nigeria: An Empirical Investigation

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Mbutor O. Mbutor\*

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*The paper aims at identifying the dominant channel of monetary policy transmission in Nigeria. The standard vector autoregressive methodology is adopted. The data set for the study spans 1998:Q1 and 2006:Q4. ADF tests confirm stationarity. The impulse response function shows that an unexpected shock of the monetary policy rate does not have a contemporaneous effect on gross domestic product and Consumer price index. In the quarter after the policy shock, output and price shrink marginally. Variance decomposition shows that the change in the policy rate contributes 22 per cent to total variation in GDP in the third quarter. However, the highest dip in prices as a result of the policy shock is observed in the fourth quarter. Variance decomposition shows that the change in the CPI was mainly caused by GDP and lags of CPI itself. The inferences from the study show that the lending rate provides the strongest nexus for the propagation of monetary policy impulses in Nigeria*

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**Keywords:** Dominant Channel, Transmission Mechanism, Monetary Policy

**JEL Classification:** E52, E58, E65

## 1. Introduction

The literature on transmission mechanism of monetary policy the conduit through which monetary policy actions impact on the economy is so vast and varied that citations in the Google website on the subject amounted to over 1.6 million as of mid-February 2008. But what was regarded as the final spot on a subject has been disproved subsequently both in social and physical sciences. It is because of human curiosity, the subject of monetary policy transmission has grown sharply particularly since the mid-1980s. New theoretical insights have emerged thereby indicating that there could be no one transmission channel that could be regarded as universally applicable. Besides, in a world that is increasingly moving towards market orientation, it has become necessary that

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\* Mbutor is a Senior Economist in the Research Department of the Central Bank of Nigeria. The views in the paper are those of the author and do not in any way reflect the thinking of the management of the Central Bank of Nigeria. I owe nonpareil gratitude to Dr. Asuri Vasudevan for his advice.

knowledge of the relevance of a particular transmission channel to the particular circumstances of the economy informs monetary policy formulation. In most exercises of monetary policy making, it is the dominant transmission channel that would be the center of attention. The remaining transmission channels, however, would still need to be monitored because their influence on the domestic economy would be largely determined by the changing institutional set up and the international economic and financial developments.

The main purpose of this paper is to present an empirical study of the transmission mechanism that would be relevant at the present time to poor but important producers and exporters of crude oil that have undertaken extensive macroeconomic and structural reforms in recent years. The substantive empirical studies on the subject that focus on this category of countries have many limitations of methodology including the use of data for years that were characterized by different policy regimes. This paper takes Nigeria as an illustrative example of such a category of countries. The paper also makes use of high frequency data from quarter 1 1998 to quarter 4 2006 the initial year providing the base for analyzing the progress of reforms from 1999. The data sources are drawn from public and published: the IMF International Financial Statistics, the Central Bank of Nigeria, the Nigerian Stock Exchange and the National Bureau of Statistics.

The paper is organized thus: In Section I we present a brief introduction to the recent economic developments in Nigeria essentially to highlight the reasons why Nigeria has been chosen as a test case. Section II gives an overview of the main strands of the theoretical insights on the subject. We follow it up in Section III with a discussion on the methodology and data that are used for our study. Section IV deals with an econometric examination of the different transmission channels of monetary policy. In the final Section, the implications for policy are brought out.

### **Background on Nigeria**

Nigeria has a population of over 140 million and a huge amount of as yet not fully tapped resource base, both human and material. One out of every 6 Africans is said to be a Nigerian. The common language for communication throughout the country is English, a language of the international financial market. It has rich

mineral wealth and is a major crude oil producer in sub-Saharan Africa. It is a member of the OPEC. Its crude oil product, the Bonny Light, is sweet and commands a slight premium over the international price of the British Brent crude. Crude oil exports form on the average about 90 per cent of total merchandise receipts of Nigeria. When prices of crude go up, the US dollar receipts obtained from the sale of crude increase correspondingly. The dollar receipts bolster the revenue position of the Federation. The receipts obtained from crude sales at a benchmark crude price that is mentioned in the Federal Government budget together with the revenues obtained from other sources are allocated among the Federal Government, State and Local Governments according to an agreed formula. In general, the Federal Government gets a little over one half of the total amount for allocation while the remaining two tiers of government get the residual. The expenditures incurred by the three tiers of the Government tip up the circulation of the domestic currency, the Naira, contributing thereby to increase in money supply.

Since crude revenue forms a major chunk of total revenue at almost 87 per cent on the average in recent years, liquidity in the economy is determined to a substantial extent by the monetization of the petrodollar receipts from the sale of crude oil. Nigeria is the second largest economy in Africa, next to South Africa. This was facilitated by the extensive economic reforms since 1999. Reforms helped to propel growth and diversify economic activities. It also helped to bring about a deceleration in inflation. Annual real growth of GDP between 2000 and 2007 averaged about 6.1 per cent per annum. Between 1991 and 2000, the real GDP grew on the average by little less than 3 per cent a year. The annual average inflation rate in the eight years between 2000 and 2007 was about 12 per cent whereas it was 30.6 per cent in the period, 1991-2000. In the last two years, the inflation rate has been in single digit.

The barometer of business confidence and investment climate is often the stock market. The Nigerian stock market capitalization has been phenomenal during the reform period. It has been particularly so since 2004. From about N1.9 trillion in 2004, it went up to N5.1 trillion by 2006 and further to N10 trillion by end 2007. Banking sector's share in the stock exchange has been high in terms of the value of shares issued and traded and in terms of market capitalization. This has to do mainly with the bank consolidation that was carried out during 2004/2005 and the

confidence it has created in the financial system. Banks mobilized large amounts as a result from the primary market.

The large capital inflows facilitated mainly by the increase in the international prices of crude helped the country to pay off its debts to the Paris Club creditors. The external debt is low at a little over US \$ 3 billion as at end of December 2007. Partly owing to this, the country's sovereign and credit ratings have been high. The foreign exchange market has been liberalized with the introduction of wholesale Dutch auctioning system in early 2006 together with two-way quotes on the inter-bank dealings and direct sales of foreign exchange by the Central Bank to the licensed bureaux de change operators. These measures helped to bring about the unification of the exchange rates. Also, the gross official reserves stood high at over US\$51 billion as at end-2007 as against US\$7.7 billion at the end of 2002. The total foreign exchange assets held by commercial banks have also gone up during the same period. The inflow of foreign direct investment has been high. Foreign investment, both direct and portfolio is presently around US\$6 billion compared with little over US\$2 billion in 2002. There is a move to bring about complete current account convertibility by accepting the obligations under Article VIII of the International Monetary Fund (IMF). The country has unveiled a Financial System Strategy 2020 whereby the country aims to set up a modern financial sector that is diversified, deep and integrated and to be one of 20 largest economies by 2020.

Monetary policy formulation is in the hands of the Monetary Policy Committee (MPC) in the Central Bank of Nigeria (CBN). The MPC was formally constituted in 1999 but it has become a part of the Statute in May 2007. The objectives of monetary policy are essentially to secure monetary and price stability. In this connection, two objectives of the CBN may be mentioned here. The CBN has to secure financial stability and safeguard the external value of the Naira. As liquidity has been in abundance mainly owing to the large accretion of foreign exchange assets with the banking system as a whole, the CBN uses open market operations as a regular tool of policy. It also issues its own short-term paper along with the Federal Government which issues both treasury bills and treasury bonds. The two-way quotes are allowed. Repo market exists. The exchange rate of the Naira is market-determined with the CBN fast becoming a relatively small player in the foreign exchange market. CBN sales/purchases of foreign exchange

influence market liquidity. The CBN announces the Monetary Policy Rate (MPR) as required by law: it is essentially to signal its intention about the rate of interest and to influence the term structure of interest rates. The inter-bank call rate has, thus, become the focal point of attention. The inter-bank call market and the Government securities market have been growing since the reforms have been unveiled though the secondary market transactions have not acquired adequate depth.

It is against this background, the CBN has revealed its intention to move from the current policy framework that is a hybrid of monetary targeting and a loose form of interest rate targeting to inflation targeting framework by a period that is yet to be firmly established. There is, therefore, a more urgent need to understand as to which of the channels of monetary policy transmission is dominant and which of the others need to be kept in view in the short-to-medium term. Such an understanding would be based on the premise that oil-exporting countries face structural liquidity problems: excess liquidity in periods of rising crude oil prices and large capital inflows and severe liquidity crunch when crude oil prices collapse and other capital inflows stop. Since 1999, the excess liquidity in the economy is caused as much by rise in crude oil prices as by the signals that the macroeconomic and structural reforms have provided to investors, both domestic and international.

Peculiar factors which might have influences on the transmission process in Nigeria include underdeveloped financial system with very shallow scope, in terms of instruments and operational depth. Most transactions in Nigeria are cash based, implying that interest rate and other intermediate variables have little role to play in guiding general merchandise, a factor which obstructs the efficacy of monetary policy transmission, and oil revenue as the mainstay of foreign earnings imposes, sometimes, large volatilities in the interbank interest rates, thereby rendering the effect of monetary policy less predictable.

## **II Theoretical Review on Transmission Channels**

In the literature, the channels through which monetary policy impacts on the economy are essentially three. They are: the interest rate channel, the exchange rate channel and the credit channel. Our aim here is to highlight only the main

elements of each of the channels rather than to go through the entire literature. The interest rate channel is by far the most widely discussed in the macroeconomic literature. It posits that the action of monetary authorities can easily be conveyed to the real sectors of the economy through the dynamics of interest rates. The original followers of this approach considered only the real rates and not the nominal ones. However, most central banks can aim at nominal interest rates, since the real rates would be unknown at any point in time. The real rates, given the expected inflation rate, would generally move in the same direction as the nominal rates. When money supply (MS) increases, interest rate would be expected to fall, assuming that rates are determined by the relative forces of demand for and supply of funds. The fall in interest rate would push up investment and aggregate demand. Consequently, the total output rises. The reverse will be expected to play out when money supply shrinks. However, the speed of adjustments may not necessarily be the same because of the impact of sticky prices.

The earlier writers on this channel linked investment to production only. However, in credit-oriented societies, consumption particularly for durable goods also accounts for changes in interest rates. Taylor (1995) has shown convincing evidence on the impact of this view. The effect of interest rate changes are traced through the reaction of agents in the system. Usually, when a policy change causes interest rates to increase, consumers' propensity to save increases as current consumptions are deferred in order to take advantage of higher returns on interest bearing investments. Current consumption also declines, though only to the extent that it is interest elastic. Also, the rise in interest rates induces investors to prefer fixed income portfolios to equities and this causes equity prices to dip. The decline in equity prices in turn leads to net loss in household wealth and consumption is consequently depressed. For business entities, the rise in interest rate will reduce current profits, and cause a depression in Tobin's 'q' deflating the ability to source funds for current investment.

In a world where economies are being increasingly integrated, monetary policy decisions tend to take into account developments outside the domestic economic jurisdictions. Basically, earnings from international trade have become some of the highest sources of high-powered money for most economies in the world. International trade here may relate to the current and/or capital account



components of the balance of payments. Therefore, there is the need to consider the effects of changes in the exchange rate on the domestic monetary policy. If the domestic currency depreciates vis-à-vis other currencies, the net foreign assets (when monetized) will grow disproportionately relative to other components of the monetary base, thereby causing the supply of money to rise.

Traditionally, the exchange rate channel works through the net export medium. When the supply of money increases, domestic interest rates fall, as a result of expenditure switching. Consequently, net export and total output are expected to be enhanced. An enhanced net export will lead to increased total output so long as the value is positive. If net export is negative, signalling a net outflow of domestic resources, aggregate output is depleted and the general level of prices will be expected to rise. Exchange rate appreciation causes prices of imports to fall and expenditure tilts to imported products at the expense of domestic import substitutes. Appreciated currency also depresses the production of exports and consequently reducing the income from the export sector and dampening aggregate demand.

More recently, the credit channel has come to the frontline of discussions of transmission mechanism. Changes in money supply are expected to affect the lending behaviour of banks, thereby altering the volume and direction of loan-related investments in the economy. The credit channel has two broad components, namely; lending and balance sheet views.

The lending view asserts that in regimes of tight monetary policy, banks are not able to substitute their traditional sources of funds (reserves with the central bank) with other sources, so they are forced to reduce the quantum of loans which they make, even when there are genuine demands from investors. The decline in the quantity of loans leads to a fall in investment and to subsequent decrease in aggregate output. The basic assumption is that the financial market is fraught with imperfections, arising mainly, from information asymmetry. A basic prediction from this view is that smaller firms or households who depend more on banks, are likely to be worse off in times of tight money. (Bernanke and Blinder (1993), Suzuki (2004), Mbutor (2005), for evidence of the lending view)

The balance sheet approach is similar to the lending view. The only difference with the lending view is that the fall in the quantity of loans occurs due to fall in the



net worth of firms which arises in turn from the rise in the policy rate hindering them from demanding loans from banks. Following the schematic presentation of Mishkin (1996), the balance sheet approach works thus: when money supply increases, the price of assets increases, adverse selection and moral hazard in making loans by deposit money banks decrease, bank lending increases, investment increases, and aggregate output similarly rises.

### **III. Methodology and Data Properties**

Monetary policy actions are propagated through series of intricate connections among macroeconomic variables in time and space. To effectively capture the complex interlinkages, vector autoregression (VAR) method is often used since it is a dynamic system that permits simultaneity of activities among included variables. In other words, the variables in the system freely express themselves at the same time and the impulse response function serves to trace out the impact of actions due to each variable in the entire system. VAR also provides the additional advantage of using reduced form equations as distinct from large scale models with numerous variables.

The appeal of this methodology for evaluating the transmission mechanism of monetary policy is that monetary policy impacts on the economy when other developments also play out -such that the interdependences of the parameters of the variables can be estimated without holding any one constant. For instance, the effect of exports on GDP would not be held constant while a monetary policy action is being contemplated. The method also captures the contemporaneous and lagged responses of the variables simultaneously (Mbutor 2005).

The method adopted in this paper is the vector autoregressive methodology and draws mainly from the benchmark specification for the euro area as presented by Peersman and Smet (2003). The VAR takes the form:

$$Y_t = A(L)Y_{t-1} + B(L)X_t + U_t \quad (1)$$

$Y$  is a vector of endogenous variables while  $X$  is a vector containing the exogenous variables. The inclusion of exogenous variables will capture developments in the world that could help capture the impact on domestic

variables. The assumption underlying the exogeneity of factors is that there is no feedback from the domestic variables to the foreign variables.

The benchmark specification for the vector of exogenous variables  $X$  contains world commodity price index ( $w_p$ ), the United States real GDP ( $y_t^{US}$ ) and the US short term real interest rate ( $s_t^{US}$ ).

$$X_t = (w_p, y_t^{US}, s_t^{US}) \quad (2)$$

The vector of endogenous variables  $Y$  includes domestic GDP ( $y_t$ ), domestic prices ( $p_t$ ), domestic short term nominal interest rate ( $s_t$ ), broad monetary aggregate ( $m3_t$ ), and the real effective exchange rate ( $x_t$ ).

$$Y_t = (y_t, p_t, s_t, m3_t, x_t) \quad (3)$$

This study focuses on the vector of endogenous variables for two reasons: first, the economy is small and yet not fully open and secondly, foreign investors generally rank macroeconomic stability as more important than interest rate differentials in decisions about their portfolio investments in developing countries. In applying the specification for this paper the merit of including the variables in the system of equations will be evaluated taking cognizance of the peculiarities of the Nigerian economy. This would imply that there could be modifications to the array of variables. In other words, the traditional explanations may undergo changes if policy framework shifts. To elaborate this point, let us assume, as is often the case that monetary policy actions aim to nurture growth through policy rate decisions. Thus, a reduction in policy rates energizes aggregate demand, catalyzing production and depressing the aggregate price level. Gross domestic product, in the traditional explanation, provides a gauge for the success of monetary policy.

In the case of Nigeria, in the current evolving situation, this explanation may need to be given a nuance. The aggregate price level is measured in Nigeria by the consumer price indices and the Central Bank of Nigeria Act 2007 explicitly ranks monetary and price stability as the prime objective of monetary policy. However, the CBN is keen to move as mentioned already to a policy framework such as the inflation targeting in the near future, in which event the variant that would be

targeting would require to be announced before hand. In case the Bank settles for flexible inflation targeting, the parameters for output and any other variables to be included will be greater than zero in the CBN's reaction function. In other words, the CBN will not only focus on price but also, implicitly, on other macroeconomic variables. In the case of Nigeria, exchange rate consideration is nearly indispensable for monetary policy making for two major reasons. One, the economy is largely a mono-product exporter, relying mainly on oil related revenue. In 2006, total government's revenue to GDP ratio stood at 32.7 per cent, out of which the revenue from the oil sector accounted for 29 per cent of GDP (i.e., 89 per cent of total revenue). As a result, the largest asset on the balance sheet of the central bank is the net foreign assets and predominantly drives money supply. Two, the economy is largely import dependent.

The money supply M3 in the specification given by Peersman and Smet (2003) will be substituted by M2 which is the broad money supply in Nigeria, defined as M1 plus quasi money. The rationale for including M2 is that until December 11, 2006 broad money was used as the sole intermediate target of policy. More so, there is quantitative evidence that money supply impacts inversely on interbank rates in Nigeria. Usually, between the 15th and 22nd of every month the Federation Account Allocation Committee meets and allocates accrued revenues to the three tiers of government. With a very short lag usually of about one week, the interbank call rates falls in response to the liquidity surge in the system every month. However, since the introduction of the MPR and the two-way quote at the Open Market Operations, the volatility of interbank rates after the allocations by the FAAC are made, has been dampened.

Until December 2006, the CBN used the MRR (Minimum Rediscount Rate) as the policy rate. However, it was not a transactions rate as it only signalled the direction of policy stance. The monetary policy rate, therefore, replaced the MRR and has since become the effective repo rate. For this study, MRR and the MPR will be used interchangeably. Recently, the stock market has become vibrant with the consolidation of banks and the successes in mobilizing funds in public offers. Therefore, asset prices (the All Share Index) are introduced in this paper to ascertain what impact they might have had or begin to have on monetary policy. The interbank rate is also included to capture the intermediate objective of CBN's monetary policy which is to keep the inter-bank rate less volatile.

The ordering of the variables in the model will follow the standard Cholesky decomposition which is based on the length of time it will take for each variable to respond to extraneous shocks. Theoretically, output takes a longer time to change in the face of policy changes than prices, while exchange rate reacts faster than prices. So technically speaking, this involves identifying monetary policy by taking the residual from the reduced-form interest rate equation and regressing it on the residuals from the output and price equations (Alam and Waheed, 2004) with the aim of recovering the underlying structural shocks by recursive orthogonalization.

The data set for the study spans 1998: Q1 and 2006: Q4. Usually, the temporal properties of time series data inform the specification of the VAR model and the approach to be adopted. A common consideration is whether the data should be differenced before application or applied in terms of levels. Generally, if the variables in the model are non-stationary, then the data should be differenced to avoid spurious results. However, while differencing improves the statistical efficiency of the parameter estimates, it could lead to substantial loss of economic interpretations of data.

Contemporary monetary policy is predominantly implemented in free market environment the quality of the data used for policy simulation must be firm. Accordingly, this study has attempted to scrutinize the data by examining as to whether there exist unit root among the variables. The Augmented Dickey-Fuller (ADF) tests are adopted to check for unit roots. The result of the Unit Root tests are presented in the table below

Table 1: Unit Root Test at Levels

Statistics	GDP	CPI	M2	LR	IB	SI	XR	MRR
ADF	-1.134154	-0.254820	2.072816	-0.940575	-2.030828	0.165603	-2.937269	-1.301419
<b>Critical Values</b>								
1 %	-3.632900	-3.632900	-3.646342	-3.632900	-3.632900	-3.632900	-3.632900	-3.632900
5%	-2.948404	-2.948404	-2.954021	-2.948404	-2.948404	-2.948404	-2.948404	-2.948404
10%	-2.612874	-2.612874	-2.615817	-2.612874	-2.612874	-2.612874	-2.612874	-2.612874

GDP is real gross domestic product, CPI the consumer price index, M2 the broad money, LR the average lending rate, IB the interbank call rate, SI the All Share Price Index, XR the exchange rate expressed as Naira per US Dollar, and MRR the minimum rediscount rate now replaced by the MPR. Analysis of the table above shows that all the included variables (at levels) are non-stationary at all the three levels of significance except the exchange rate which is stationary at the 10 per cent level of significance. Consequently, the unit root test results for the variables in their first differences have been worked out and reported in Table 2.

Table 2: Unit Root Tests at First Difference

Statistics	IPI	CPI	M2	LR	IB	SI	XR	MRR
ADF	-5.2373	-5.170995	-6.046133	-4.75953	-7.065264	-5.904077	-5.133315	-4.689281
Critical Value								
1%	-3.6463	-3.646342	-3.64634	-3.63940	-3.639407	-3.639407	-3.639407	-3.639407
5%	-2.9540	-2.954021	-2.954021	-2.951125	-2.951125	-2.951125	-2.951125	-2.951125
10%	-2.6158	-2.615817	-2.615817	-2.614300	-2.614300	-2.614300	-2.614300	-2.614300

Evidently, all the variables do not contain unit roots even at the 99 per cent confidence level. For technical efficiency in measuring the parameter estimates, the variables should be applied in their first differences. However, differencing comes with loss of economic relevance. And so since the VAR analysis is to identify the reaction of variables in a model to some stimuli, and not the measurement of parameter estimates, it could be considered adequate to apply the VAR approach to the data in their levels.

#### IV Econometric Estimates

The estimation results are presented in two stages. The first shows the traditional response of the variables to one standard deviation innovation on the policy variable. The second stage attempts to identify the weight of the effect of the proxy variable for the different channels of monetary transmission. To achieve the latter objective, lending rate or broad money or exchange rate (which are proxies for the interest rate channel, traditional channel and exchange rate channel,

respectively) will be exogenized at a time, so that the others are endogenized to isolate the effect of the former. Exogenizing any one variable will block off its effect on the system. The isolated effects will then be amenable for comparison to identify as to which of the variables has the strongest impact on output and/or prices.

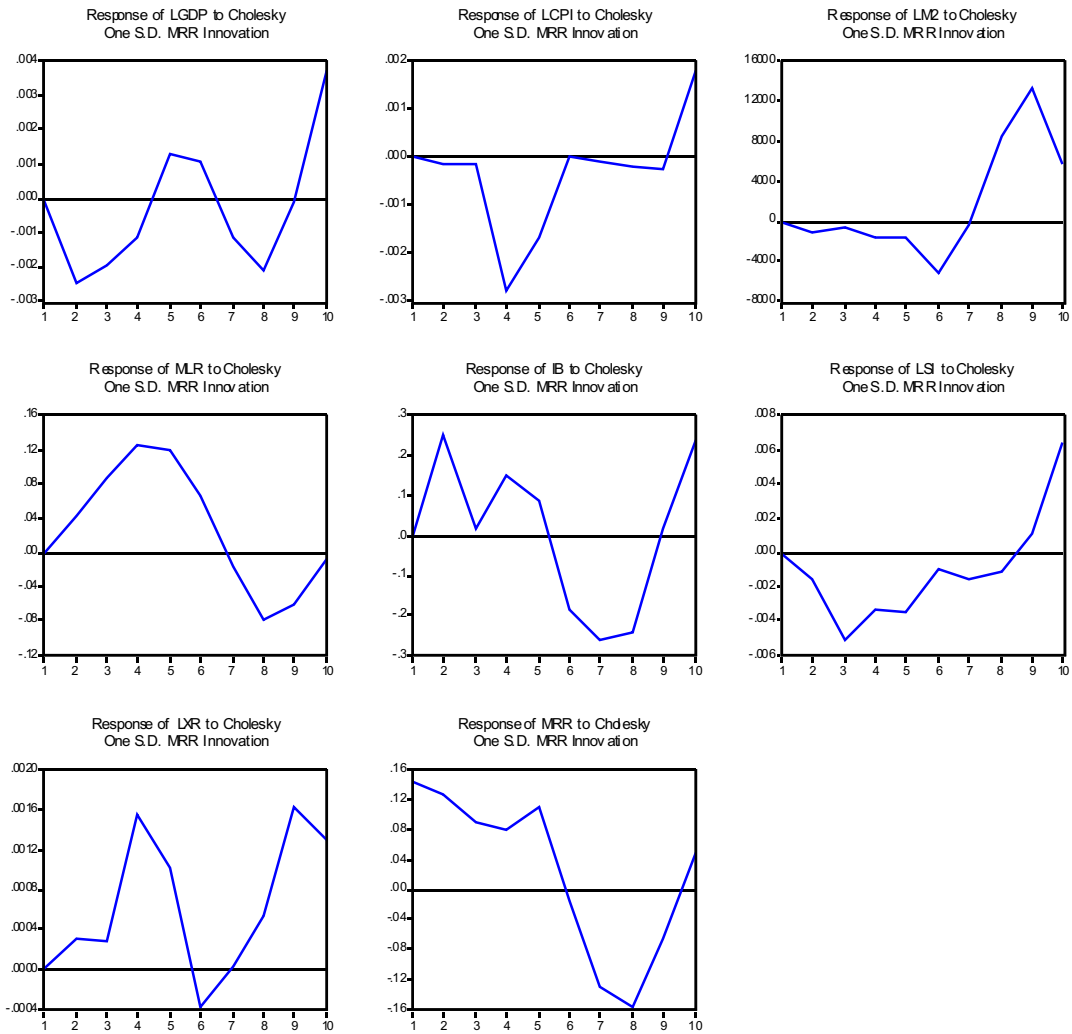
### **The Reference Model (Baseline System)**

Figure 1 below shows the impulse response function of the gross domestic product (GDP), consumer price index (CPI), broad money (M2), lending rate (MLR), weighted interbank call rates (IB), the all share price index (SI) at the Nigeria Stock Exchange, and exchange rate (XR) to innovations on the policy rate. The standard innovation is equivalent to 0.25 per cent positive innovation on policy rate. The results obtained are robust and do not change with alternative ordering of the variables.

### **Impulse Response of GDP**

From the result an unexpected shock on the MRR will not cause any change in the gross domestic product in the same quarter in which the shock occurs. However, in the second quarter, GDP falls by 0.2 percent. Until the fourth quarter the fall in output is sustained though at a decreasing rate.

**Fig.1: Impulse Responses in the Baseline System**





This inference is in line with the findings of Nnanna (2001) and Mbutor (2005) that changes in the policy rate had little effect on the GDP. One plausible reason for this development is the fact that the GDP is dominated by the agricultural sector which received only one per cent of total domestic credit in 2006. Therefore, it is inferred that agricultural activity is interest rate inelastic. Moreover, consumer loans formed an infinitesimal part of total loans and advances of banks. Had the conclusions been otherwise, households would have altered their consumption by the extent to which policy rates affect their borrowing for consumption.

### **Impulse Response of CPI**

The consumer price index does not react to the shock on the MRR in the first period. However, in the following two quarters, it fell marginally by an average of 0.02 per cent. The highest fall in the CPI came in the fourth quarter when it dipped by 0.3 per cent. Of the 0.3 per cent fall in prices, the variance decomposition of CPI shows that the change in MRR accounted for 0.31 per cent while money supply contributed 3.72 per cent. CPI and GDP accounted for 43 per cent and 27 per cent, respectively.

Changes in the policy rate have insignificant impact on prices because it operates at the short end of the market and do not have a significant effect on production activity. Moreover, price formation in Nigeria is also a structural phenomenon, mainly driven by speculation and announcement effects.

### **Impulse Response of Lending Rate**

Until recently, commercial banks (known as deposit money banks in Nigeria) lent short. So the moving average of central lending rates was adopted in the study to align the lending rate with the frequency of loan contracts. The lending rate does not react contemporaneously to changes in the MRR/MPR. However, in the second quarter it rose by 4 per cent. In the fourth and fifth periods, it rose by an average of 12 per cent, while the trend was reversed in the seventh period. The increase in the lending rate as a result of the policy shock is not surprising because until recently banks primarily depended on government deposits and facilities

from the Central Bank of Nigeria for their reserves. However, the surprising conclusion is that the rise in the lending rate did not depress output significantly. In the fifth quarter when the lending rate grew by the highest amount, output fell marginally. However, a priori, output should respond to lending rates with a lag. Assuming a lag of two quarters, the rise in the rate depressed output by 0.01 per cent. Such a weak effect could be attributed to the short term nature of DMBs' loans. In 2004 and 2006, the long term loans to total asset ratios of DMBs were, respectively, 0.0009 and 0.01, hardly an improvement. The variance decomposition of CPI shows that the lending rate has a visible impact on CPI in the fourth quarter when it contributed 8.40 per cent to the total forecast variance. For GDP, the variance decomposition shows that the lending rate contributes an average of below 14 per cent all through the ten quarters.

### **Impulse Response of Interbank Rate**

The transmission mechanism in Nigeria has two phases. The first is the transmission of monetary impulses to the interbank call market. The interbank rates fluctuate when liquidity is injected through the sharing of the federation revenue- which, as already indicated, is done monthly. So, the CBN's intermediate objective is to curtail large volatilities in the interbank rate. The other phase of the transmission process is the permeation of policy shocks through the financial system to the real sectors. However, the two phases are not mutually exclusive. Rather the first should facilitate the second in the sense that stable interbank rates over time provide an anchor for long rates, since long term rates can be derived as an envelope of short term rates.

In the first period, the interbank rate does not react to the innovation on the MRR/MPR. This is unexpected since the interbank rates included in this study are overnight and not tenored. However, in the second quarter it turns with the expected sign growing by 25.3 percent.

### **Impulse Response of Exchange Rate**

Exchange rate is expressed in units of US dollars per naira. Thus, an increase in the exchange rate implies depreciation of the Naira. From the Cholesky ordering, the expectation is that exchange rate should react contemporaneously to the innovation in the policy rate. The expectation is based on the fact that the increase

in MRR/MPR should cause the yield on treasury bills and other fixed income instruments to rise, necessitating divestment from the foreign exchange market in favour of the domestic currency denominated assets, thereby causing the naira to appreciate.

From the results, it is evident that the exchange rate does not react in the first period. In the second and third periods the naira depreciates by an average of 0.03 per cent.

The weak reaction of the exchange rate, in terms of speed and magnitude, can be explained by three factors. First, until February 2006 the Central Bank of Nigeria was the main supplier of foreign exchange. Foreign exchange was supplied to end users through the retail Dutch Auction System (RDAS) and applicants had to fill out forms (A and M) indicating the purpose of the request. Consequently, most foreign exchange sourced through this medium were used for transactions purposes. Therefore, demand would not react to changes in the policy rate. The second factor is the fact that since retail dutch auction system was conducted weekly and later twice a week (on Mondays and Wednesdays) it was largely an inactive market. The third factor is that the sheer dominance of the CBN in the market before now, might not have allowed the true market based exchange rate to evolve. Studies by Masha (2001) showed that prices adjusted to the black market rate in Nigeria. When the foreign exchange market was liberalized from February 2006, the position has been reversed.

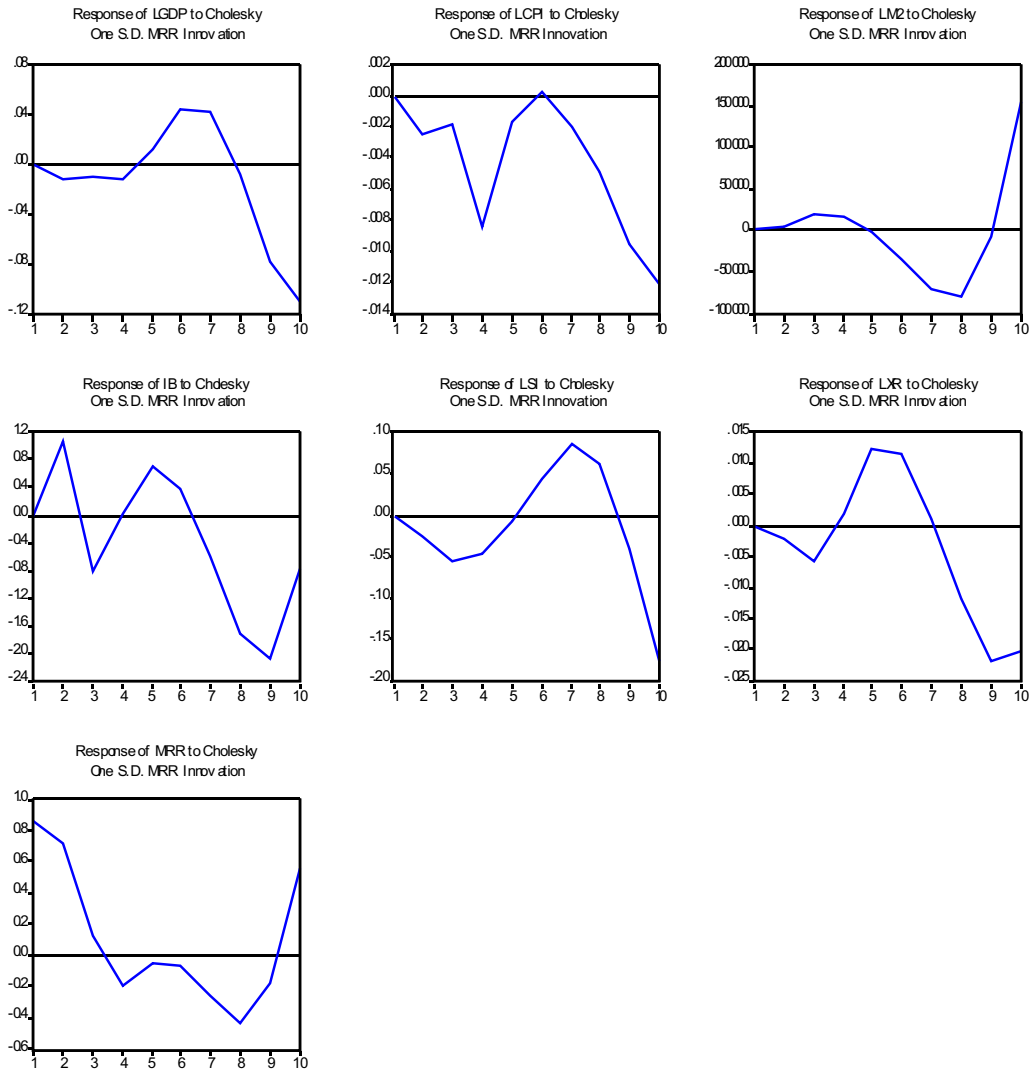
### **Impulse Response of the All Share Index**

Orthodox literature posits that the positive innovation in the policy rate should cause divestment from equities. Analysis of the results shows that the all share index did not react to the innovation on MRR in the first period. However, in the second and third periods the index fell by 0.02 and 0.05 per cent, respectively. The outcome is not surprising because the capital market has not been an active substitute for investments in Nigeria. However, the banking consolidation which was concluded in December, 2005 has caused a revolutionary interest in the capital market and made it more visible in investment considerations.

**Determining the Relative Strength of the Channels of Transmission**

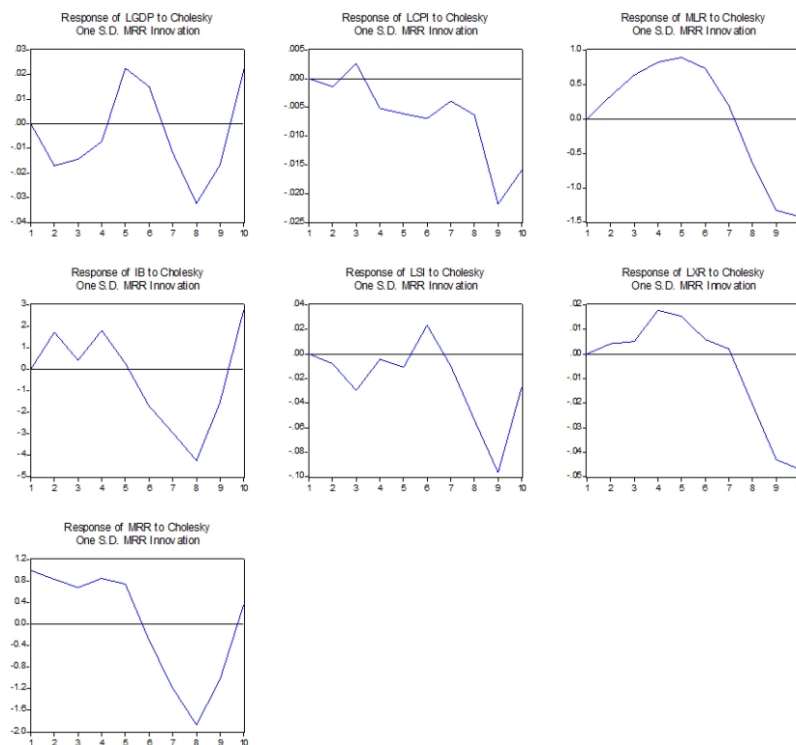
The essence of this section is to determine the relative impacts of the broad money, lending rate and exchange rate in the transmission process in Nigeria. Figures 2, 3, and 4 show the isolated effects of lending rate, broad money and exchange rate, respectively, in the transmission process.

**Fig 2: Impulse Response Results with the Lending Rate Exogenized**

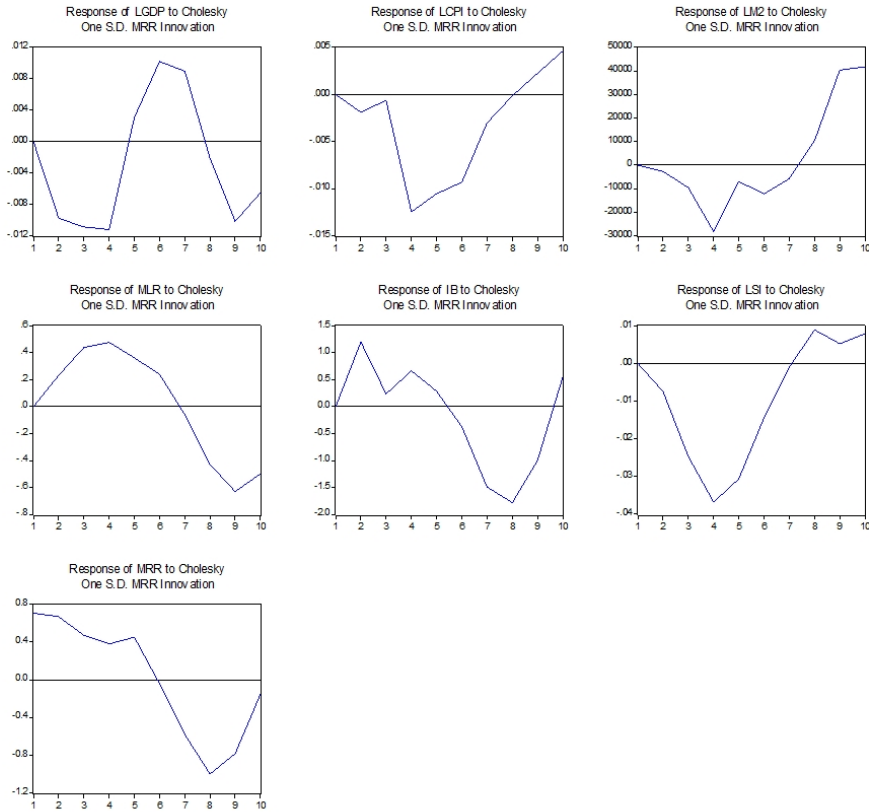


The figure shows the effect of a positive innovation on MRR without the lending rate in the system. There is no effect on the GDP in the first period. In the second and third periods, it falls by 1.3 per cent and 1.1 per cent, respectively. The highest impact was felt in the tenth quarter when it fell by 11.1 per cent. On the other hand, consumer prices did not respond to the policy innovation in the first period. It fell marginally by 0.3 and 0.2 per cent respectively in the second and third periods. The highest change in CPI as a result of the innovation on the MRR was in the tenth period when it fell by 1.2 per cent.

Fig 3: Impulse Response Result with Broad Money Exogenized



Without the effects of broad money, GDP is unaffected by the innovation on MRR/MPR in the first period. In the second and third periods it fell by 1.7 and 1.4 per cent, respectively. Although with a wrong sign, the highest impact was felt in the fifth quarter when it rose by 2.2 per cent. On the other hand, price fell by 1.3 per cent in the second quarter and felt the highest impact in the ninth period with a fall of 2.2 per cent.

**Fig.4: Impulse Response Results without the Exchange Rate**

Blocking off the exchange rate effect from the system, GDP begins to respond to innovations on the policy rate in the second period with a decline of 1 per cent. The magnitude of impact is sustained until the fourth quarter. On the other hand, consumer prices also decline by 1.8 and 1.2 per cent in the second and fourth quarters. The decline continues until the ninth period when the sign is reversed.

In order to ascertain which variable has the most effect, Table 4 shows the baseline effects of the innovation on MRR/MPR with the contribution of the proxy variables for the different channels of monetary policy transmission in Nigeria, while Table 6 shows the impulse responses of the variables with the lending rate, money supply, and exchange rate exogenized in turns. Thus, the isolated effect of each of the exogenized variables will be measured by the difference in impulse response rate and or impulse response time of the goal variables (GDP and CPI)

between the baseline system and the systems which have the variables exogenized. The differences in response rate and response time are measured in absolute terms. Table 6 shows these differences.

**Table 4: Baseline Effect with all the Variables**

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Change in GDP Per cent	0	-0.3	-0.2	-0.11	0.1	0.11	-0.11	-0.2	-0.01	0.04
Contributions										
Lending rate	0	11.64	12.6	10.97	17	17.4	15.37	18.17	16.9	14
Broad Money	0	1.64	1.64	1.42	0.9	0.93	0.68	0.95	0.94	0.55
Exchange Rate	0	0.6	1.97	1.63	1.2	1.19	1.12	0.8	1	1.29
Change in Price per cent	0	-0.02	-0.02	-0.3	-0	0	0	-0.02	-0.02	0.02
Contributions										
Lending rate	0	0.05	0.6	8.38	6	5.15	4.88	6.6	8.5	5.5
Broad Money	0	6.5	5.9	3.7	2.6	2.64	5.2	6.3	5.3	3.8
Exchange Rate	0	0.11	1.35	1.19	6.8	7.8	7.7	6.16	4.9	3.2

**Table 5: Impulse Response Results with Variables Exogenized**

		Broad money Exogenized									
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Change in GDP Per cent		0	-1.7	-1.4	-0.7	2.2	1.5	-1.2	-3.2	-1.7	2.2
Change in Price per cent		0	0.13	0.26	-0.1	-0.5	-0.7	-0.4	-0.6	-2.2	-1.6
		Exogenized Exchange Rate									
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Change in GDP Per cent		0	-0.97	-1.1	-1.2	0.3	1	0.1	-0.2	-1	-0.7
Change in Price per cent		0	-0.2	-0.06	-1.2	-1.1	-0.9	-0.3	-0	0.2	0.4
		Lending Rate Exogenized									
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Change in GDP Per cent		0	-1.3	-1.1	-1.2	1.2	4.3	4.2	-0.9	-7.9	-11.1
Change in Price per cent		0	-0.3	-0.2	-0.8	-0.17	0.02	-0.2	-0.5	-1	-1.2



**Table 6: Comparable Effects of Lending Rate, Broad Money and Exchange Rate**

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
(1) Change in GDP due to MLR	0	1	0.9	1.09	-1	-4.19	-4.31	0.7	7.89	11.1
(2) Change in CPI due to MLR	0	0.28	0.18	0.54	-0	-0.02	0.2	0.48	0.98	1.22
(3) Change in GDP due to M2	0	1.4	1.2	0.59	-2	-1.39	1.09	3	1.69	-2.16
(4) Change in CPI due to M2	0	-0.15	-0.28	-0.25	0.3	0.7	0.4	0.58	2.18	1.62
(5) Change in GDP due to XR	0	0.67	0.9	1.09	-0	-0.89	-0.21	0	0.99	0.74
(6) Change in CPI due to XR	0	0.18	0.04	0.9	0.9	0.9	0.3	-0.01	-0.22	-0.38

1 Is the difference between the baseline effect of a change in MRR on GDP and effect without the lending rate

2 Is the difference between the baseline effect of a change in MRR on CPI and effect without the lending rate

3 Is the difference between the baseline effect of a change in MRR on GDP and effect without the broad money

4 Is the difference between the baseline effect of a change in MRR on CPI and effect without the broad money

5 Is the difference between the baseline effect of a change in MRR on GDP and effect without the exchange rate

6 Is the difference between the baseline effect of a change in MRR on CPI and effect without the exchange rate

To determine the variable with the most impact on GDP, compare rows 1, 3 and 5. The effects are compared in absolute terms such that between -10 and +9, -10 should have a higher effect.

**In terms of size of impact on GDP**, the lending rate has the highest impact with the magnitude of its effect at 11.1 percentage points in the tenth quarter. Money Supply has the second highest effect on GDP with a magnitude of 1.4 percentage points in the second quarter. The exchange rate's impact on GDP seems to be comparatively low.

**In terms of speed of impact**, money supply impacts earliest on GDP in the short term and this occurs in the second quarter.

**In terms of size of Impact on CPI**, compare rows (2, 4 and 6). Broad money has the highest impact on prices at 2.18 percentage point's change in the ninth quarter.

**In terms of speed of impact**, the lending rate has the fastest impact in the second quarter with a 0.28 percentage points change.

## **V Conclusion**

This study has identified the dominant channel of monetary policy transmission mechanism in Nigeria, after it was clear that various channels of transmission are present but in varying degrees. Lending rate, broad money supply and the exchange rate have been identified as representing the credit channel, the traditional channel and the exchange rate channel, respectively. The response of GDP and the consumer price index has been used to gauge the impact of monetary policy in the study.

From the analysis of the results, the lending rate has the highest impact on GDP though only in the tenth quarter. However, in terms of the time of impact, broad money supply has the fastest impact on GDP, causing it to change by 1.4 percentage points in the second period. Exchange rate is less visible than either lending rate or money supply. As regards aggregate prices, broad money has the highest impact of 2.8 percentage points in the ninth quarter, while the lending rate has the fastest impact, causing a change of 0.28 percentage points in the CPI in the second period.

The results show that the quantity of money supply still remains relevant and has to be, therefore, reckoned with in policy making. Our study also suggests that the role of the banking system in propagating monetary impulses to the real sector should be recognized as critical.

The following are the policy implications: First, the Central Bank should evolve policies which have pronounced effects on the lending rate since it is a very potent medium for transmitting monetary policy signals; Second, money supply should remain a major consideration in the choice of any monetary policy framework for Nigeria; and finally, efforts must be made to keep the banking system stable since it is the major conveyor of monetary policy impulses.

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