# TRANSMISSION MECHANISM OF MONETARY POLICY IN NIGERIA

**By**

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## ABSTRACT

The Central Bank of Nigeria (CBN) has pursued among other goals, low and stable domestic price level and output growth using various monetary policy instruments. Despite these efforts, output growth rate averaged 1.32% between 1980 and 1989 and 2.87% between 1990 and 1999. Also, the monetary authority's inflation rate target of 5.00% in 1992 and 31.00% in 1995 escalated to 44.59% and 72.81% respectively. There has been limited attempt to investigate the channels through which monetary policy affects output and prices in Nigeria. This study, therefore, empirically investigated monetary policy transmission mechanism and sought to establish the relative effectiveness of various monetary policy instruments in Nigeria.

A Monetary Transmission Mechanism (MTM), predicated on Mishkin framework, that captures the impact of monetary policy in an economy was employed. The MTM focused on bank lending, exchange rate and interest rate channels, evident in most developing economies like Nigeria. A Structural Vector Autoregressive (SVAR) model, based on monetary policy transmission dynamics which identified the magnitude and impact of structural shocks, was developed to test the importance of these channels. Generic, composite and separate models including the impulse responses of the channels were estimated. Variance decomposition was also conducted to determine the magnitude of fluctuation attributable to different shocks. With quarterly data from 1970 to 2008, the time series properties of the models' variables were ascertained using the Augmented Dickey-Fuller and Phillips-Perron tests.

The effectiveness of Reserve Money (RM) as a monetary policy instrument over Interest Rate (IR) was evident as a marginal increase of 0.15% in RM precipitated increased output and prices declined by 0.20% and 0.60% respectively. The weakness of IR as a policy instrument was shown with an increase of 2.02% in IR yielding no significant response from output and prices. Bank lending declined from 0.89% in the first quarter to 0.23% below the baseline in the second quarter following a marginal increase of 0.05% in RM. Output declined consequently below the baseline by 0.12% and 0.15% while prices rose by 0.15% and 0.10% in the second and third quarters respectively. By implication, the weak response of exchange rate to similar increases in IR of 2.02% and RM of 0.15% suggested that this channel did not capture MTM in Nigeria. Also, output and prices' non-response to increase in IR of 2.02% and RM of 0.15% suggested that interest rate channel was weak. Bank lending channel remained the existing MTM in Nigeria, while the impact of monetary policy shock on output and prices occurred only after a time-lag of six years.

Reserve Money was a potent policy instrument with output responding more to policy variations than prices. Bank lending remained a significant channel for propagating policies to target variables. The CBN should therefore focus more on the use of RM as a policy instrument rather than a hybrid of RM and IR. There should also be emphasis on price level stability since this has the tendency of fostering output growth.



**Keywords:** Output, Price level, Monetary policy, Monetary transmission mechanism, Structural vector autoregressive.

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**DEDICATION**

This doctoral thesis is dedicated to my Lord and King; El Elohim Israel.

He is the GOD of all Glory, the author and giver of knowledge.

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## CERTIFICATION

We, the undersigned, hereby certify that this work was carried out by Samuel Olatunde OREKOYA under our supervision in the Department of Economics, Faculty of the Social Sciences, University of Ibadan, Nigeria.

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# CHAPTER ONE

# INTRODUCTION

## 1.1 Problem Statement

Money plays a pivotal role in the correct functioning of the economy in all countries of the world. Thus, to preserve this important role of money, the Nigerian government reposed the task of designing an appropriate monetary policy and maintaining a stable price level, among other important functions, with the Central Bank of Nigeria (CBN) as contained in the Act of 1958 (now CBN Act 2007). Notably, the impact of the policies designed by the central bank on the economy as a whole, especially the channels through which they affect prices and output among other macroeconomic variables, has remained a key issue in macroeconomic theory and policy.

The challenges confronting the central bank, aside from knowing the appropriate monetary policy instrument to choose for attaining a desired macroeconomic objective, include understanding the existence of lag between this monetary policy action and the subsequent response from the economy. Expediency therefore requires that the central bank has a proper knowledge and sound understanding of the consequences of its actions on first, the non-financial agents and ultimately on macroeconomic aggregates for successful policies. The central bank's choice of instruments for attaining its desired objectives at any particular time would be determined mainly by the structure of the economy, the state of development of money and capital markets as well as the institutional and legal frameworks within which the financial system operates.

Arguably, some controversies prevail among the different schools of thought concerning the appropriate instrument of monetary policy to adopt in achieving a desired macroeconomic objective. The monetarists are of the opinion that the choice of monetary policy instrument should be set such that it targets the growth of money supply or some monetary aggregates while the effectiveness of such instrument is best gauged by observing its impact on the desired macroeconomic variables. However, the Keynesians argue that the choice of the monetary

policy instrument should be set to target the interest rate while the effectiveness of such an instrument should be judged in terms of its impact on the desired macroeconomic variables (Vonnak, 2005).

In Nigeria, between 1959 and 1967, the main instrument of monetary policy was the exchange rate which was fixed at par between the Nigerian naira and the British pound. Due to the CBN's apprehension that devaluing the naira would raise the price of imports without any appreciable impact on exports, given the huge resources gulped by the civil war, the CBN became circumspect choosing rather to maintain the existing exchange rate and ultimately peg the currency to the US dollar. However, following the international financial crisis of the early 1970s which affected the US dollar, this rate was abandoned for the status quo until 1973 when it was again pegged to the US dollar. Ultimately in 1978, the naira was pegged to a basket of 12 currencies of Nigeria's major trading partners.

With the dominance of Nigeria's foreign currency revenue by proceeds from crude oil export to as much as 57.6 percent in 1970 and 96 percent in 1980, the conduct of monetary policy changed to monetary targeting, that is, controlling the monetary aggregates (Nnanna, 2001). This involved the use of market (indirect) and non-market (direct) instruments. Thus, in pursuit of the government's goals of promoting rapid and sustainable economic growth, the CBN rather than allow the interest rate to be determined by the market forces imposed quantitative interest rate which was below its determined minimum rediscount rate. In addition, to regulating deposit and lending rates, it placed direct/sectoral lending directives on bank deposits.

The adoption of the Structural Adjustment Programme (SAP) in 1986, however, ushered in a regime of financial sector reforms characterized by the free entry of retail banks and the dominance of indirect instruments for monetary control (Sanusi, 2002). With the operational framework of market instrument, only the operating variables, the monetary base or its components are targeted while the market is left to determine interest rates and allocate credit. In adopting the indirect market approach, the CBN's instruments for monetary control emphasised the use of open market operations (OMO), reserve requirements, CBN securities as well as moral suasion.

However, the poor performance of Nigeria's real sector and the changing structure of the economy have remained major challenges in the formulation and implementation of an appropriate monetary policy. Thus, while the monetary authority grew the economy's broad money (M2) at an average of 36.5 per cent and 18.8 per cent between 1975-1979 and 1980-84 respectively, the corresponding growth in the economy's output (GDP) for this same period stood at 17.5 per cent and 7.55 per cent. During this period, inflationary response was as high as 20.3 per cent and 20.5 per cent respectively. Further, while the CBN tinkered with monetary instruments to achieve a desired inflationary rate of 5 per cent, 25 per cent and 7 per cent in 1992, 1993 and 2001 respectively, the actual inflation rate in the economy was as high as 44.6 per cent, 57.2 per cent and 18.8 per cent respectively. These discrepancies between target and actual rates further confirm that the monetary authority is yet to have a full grasp of the appropriate instrument to use in achieving a desired policy target as well as when to "accelerate or slam the brake" in its pursuit of a stated goal.

Some policy related questions emerging from these are: How are monetary policy shocks propagated through the economy? What is the appropriate monetary instrument for achieving the CBN's objective? Which of the monetary transmission channels of monetary policy is in existence in Nigeria? How long does it take for a change in monetary policy to affect output and prices? Addressing these and other related issues constitute the main thrust of this study.

## 1.2 Objectives of The Study

The broad objective of this study is to establish the major channel(s) through which monetary policy impact some macroeconomic variables (especially inflation and output) and how long it takes for this impact to affect the real sector. To effectively capture this broad objective, the specific objectives are divided into three and these are to:

a) determine which of the central bank monetary policy instrument(s) is the most effective;

b) identify the channel(s) through which monetary policy variation affects output and price levels in Nigeria; and

c) determine the time lag between monetary policy variations and the effect on domestic price level and output (i.e. the speed with which monetary impulses are transmitted)

## 1.3 Justification for The Study

The transmission mechanisms of monetary policy work through various channels, affecting a number of variables and markets at different speeds and intensities. Identifying these transmission channels is important because they not only determine the most effective set of policy instruments but also the timing of policy changes. Understanding the transmission process will help the CBN design and implement appropriate monetary policy since the lags with which monetary policy operates are not only long but also vary depending on the extent of the economy's development. Policymakers would therefore like to know the exact channel(s) through which monetary policy variations affect output and prices as well as the corresponding lags associated with monetary shocks. In the light of the uncertainties associated with the transmission channels of monetary policy initiatives to output and prices, the study of these intricate links between policy instruments and key economic variables is crucial to ensure that appropriate policy measures are taken at any time to achieve a desired outcome in the future.

In Nigeria, in spite of the importance accorded monetary policy as an instrument of attaining macroeconomic objectives, its transmission mechanism is yet to be fully understood perhaps due to paucity of studies that rigorously and exhaustively investigate its importance. A consequence of this is the fuzzy perception of the channels of monetary transmission and impact by the CBN. This vagueness has remained a clog in the appropriate design and effective implementation of monetary policy, which more often than not, has made the monetary regulating authority to base its policy decisions mainly on untested received theories, hunches and at best, the "experience of technocrats" (Soyibo and Adekanye, 1992).

Some earlier attempts at investigating monetary policy transmission mechanism in Nigeria include Jimoh (1990) which only examines the relevance and role of interest rate sensitivity in the demand for money as a means of explaining the channels of monetary transmission and impact. Uchendu (1996) also attempts to identify the monetary transmission channel in Nigeria but rather than use basic econometric techniques for model specification and

estimation, he opted for historical and descriptive analysis which does not capture the transmission channel of monetary policy on output and inflation. Oyaromade's (2004) approach seems to assume, a priori, the existence of credit rationing hence his work focused on establishing the significance of credit rationing in Nigeria's financial system. He therefore concluded, without any specific test, that interest rate and credit channels of monetary transmission mechanism play a significant role in the transmission of monetary impulse to the real sector in Nigeria. His assertion that a particular channel is important is difficult to rely on since he fails to test this channel against other channels to determine its strength. His work also did not establish policy time lag that could help the CBN to determine when to apply shock towards achieving a desired policy goal or objective.

Other related studies on the relationship between monetary aggregates and the real sector focused their searchlight on examining the direction of causation with none seeking to establish the appropriate transmission channel of monetary policy in Nigeria. (Odedokun, 1989; Ajayi, 1983; Adewunmi, 1981).Thus, to confirm Wane's (1999) assertion that "the research area of understanding monetary policy transmission channels has not been adequately documented in Africa", establishing the channel through which monetary policy variations affect the real sector of the economy eluded most of these researchers' attention.

Thus, using a time-tested econometric tool of analysis that conforms with economic theory, the overriding objectives of this study shall be to establish the exact channel through which monetary policy propagates to output and price levels. Such an econometric analysis of the monetary transmission mechanisms will help us produce estimates of the lag structure involved between the change in the monetary policy instrument and its effect on output and price levels. Further, identifying the active channels of monetary transmission will provide a pertinent information on important intermediate variables that should be closely monitored by the monetary authority to control inflation and stabilize output fluctuations. Finally, understanding the feedback mechanisms between the different channels will help the CBN avoid adopting an excessively expansionary (or contractionary) policy stance.

## 1.4 Scope of The Study

The study focused on monetary policy and the transmission mechanism in Nigeria from 1970 to 2008. The choice of this period is informed by the availability of uniform time series data on relevant variables to the study. Quarterly time series data is employed to conduct the investigation.

## 1.5 Outline of The Study

The rest of the thesis is organized into five chapters. Following this introductory chapter is chapter two which provides the background to the study. This chapter, aside from presenting details of macroeconomic performance in Nigeria, also traces the monetary history of Nigeria from the inception of the Central Bank of Nigeria (CBN) and the various policies adopted by the monetary authority over time. Chapter three is on the divergent views among economists and policymakers about how monetary impulses are transmitted to the real sector and presents an in-depth review of the relevant literature. For clarity of exposition, this chapter is organized into theoretical, methodological and empirical literature. In chapter four, the theoretical basis for the research and analytical framework employed in the study is discussed. The model is specified here and the sources of data indicated. Chapter five dwells on the model estimation and evaluation as well as reports the results of the estimation and their implications for monetary policy. The thesis is concluded in Chapter six by summarizing the major findings and highlighting pertinent lessons for policy.

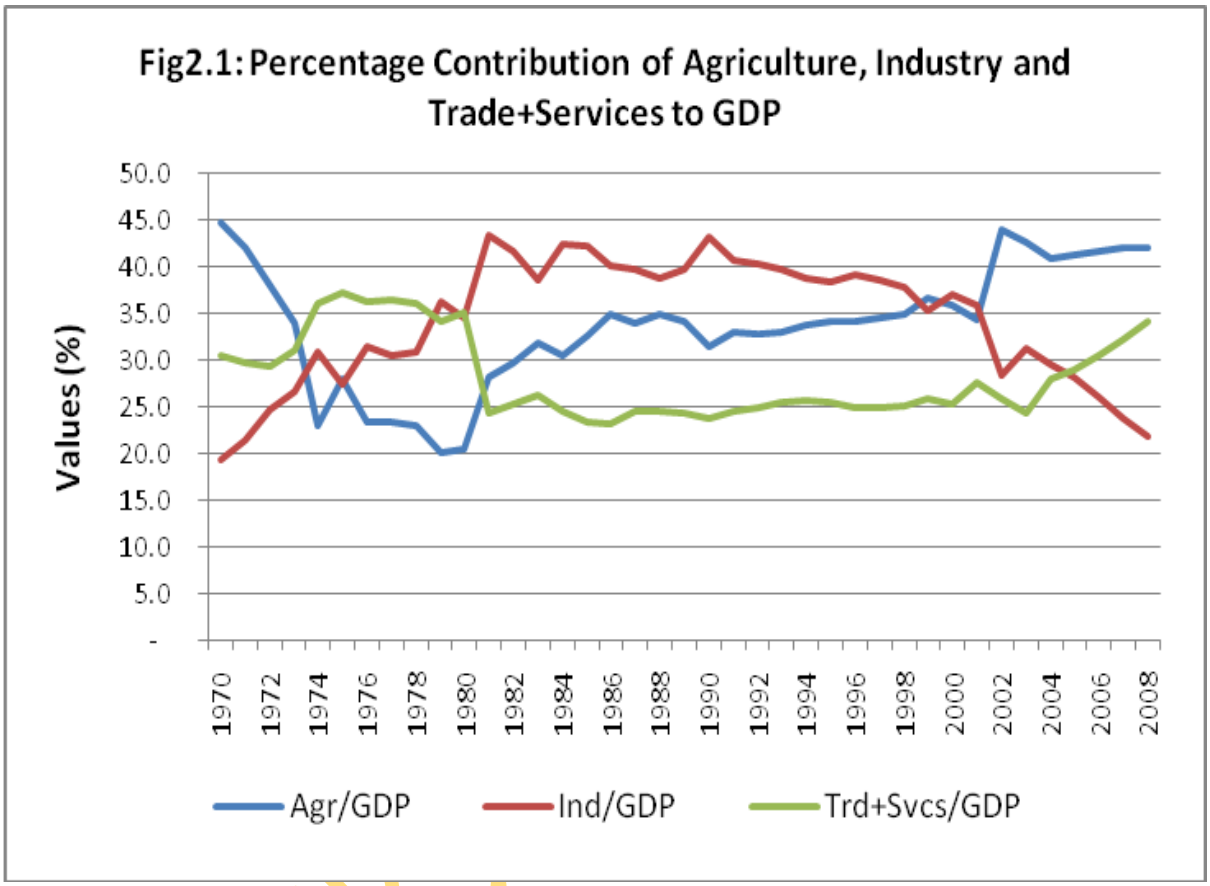
# CHAPTER TWO

# BACKGROUND TO THE STUDY

## 2.1 Overview of the Nigerian Economy

Within the first decade of Nigeria's attainment of independence, precisely between 1960 and 1970, the annual growth rate of the Gross Domestic Product (GDP) stood at 3.1per cent. Among the sectors of the economy, agricultural sector stood out as the mainstay of the economy providing food for domestic consumption as well as the foreign exchange required for importing raw materials and capital goods. Its contribution to the total GDP, despite the low commodity prices that prevailed at that time was 64 per cent in 1960, 62 per cent in 1963, 59 per cent in 1964, 52 per cent in 1968 while the average contribution of the industrial sector during this period remained as low as 10.5 per cent. Capital formation in the economy during this era was not satisfactory with Gross Domestic Investment as a percentage of GDP standing at 16.3 per cent while the average inflation rate stood at 5.1 per cent.

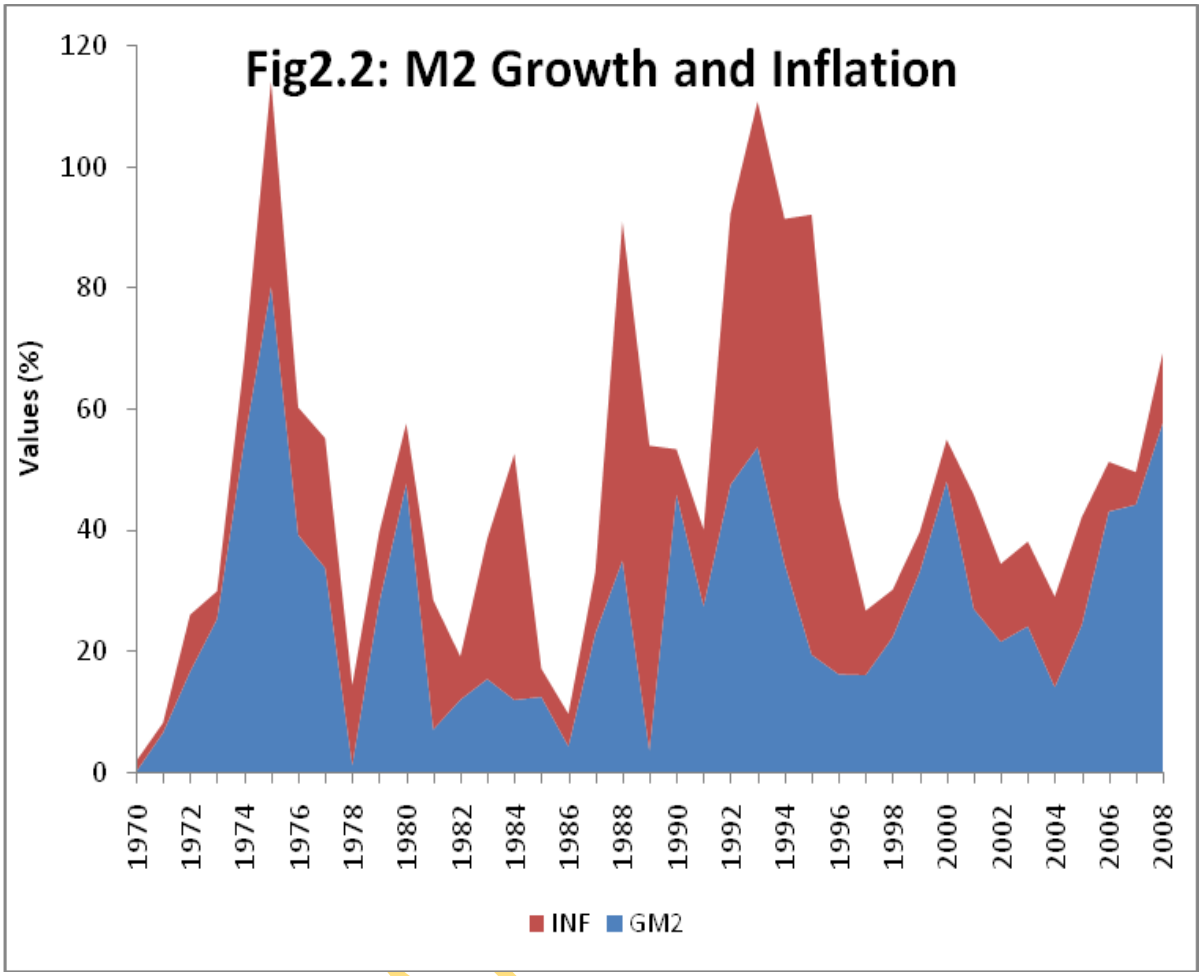
Notably, with the discovery of crude oil in commercial quantity in 1956 and the oil boom resulting from the Arab oil embargo on the USA in 1973, the industrial (oil) sector lured labour away from the agricultural sector as people attempted to reap the windfall from oil. Thus in addition to the predominance of subsistence agricultural production, ill-adapted technology, inappropriate policy and weak institutional capabilities; the oil factor further compounded the woes of the agricultural sector as production for both consumption and exportation declined unabated. Thence, the sector's contribution to GDP, as presented in Figure 2.1 below, began to fall from 44.7 per cent in 1970 to 34 per cent in 1973 and further to as low as 20.1 per cent in 1979. The industrial or put more aptly, oil sector at this time had become prominent; contributing 19.4 per cent, 24.8 per cent and 36.3 per cent to GDP in 1970, 1972 and 1979 respectively. Its contribution to exports increased from an average of 10.5 per cent between 1960 and 1970 to 73 per cent, 83 per cent and 93 per cent in 1971, 1973 and 1976 respectively.



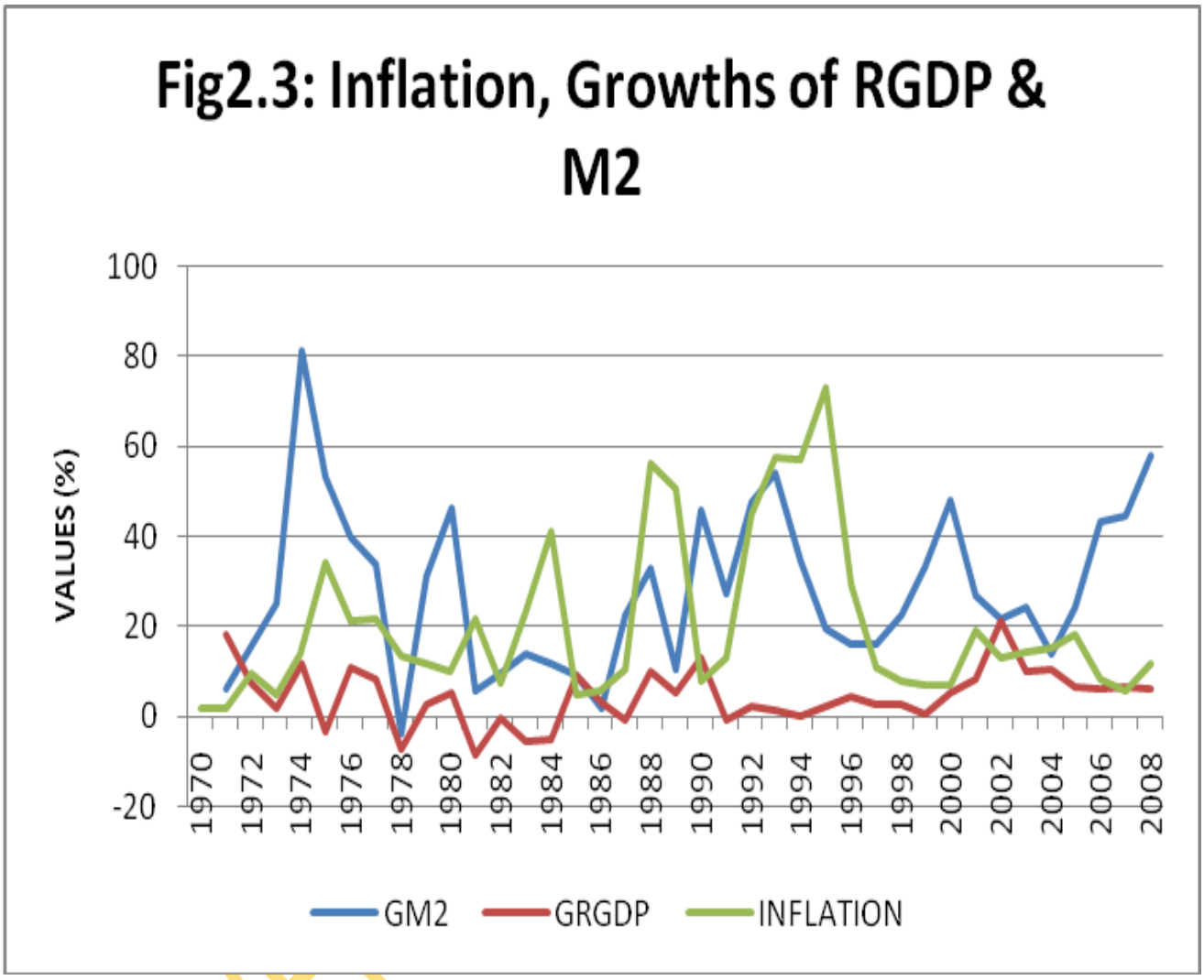

*Source*: Plotted by the author based on calculation from CBN Statistical Bulletin data 2009

The advent of oil boom brought in its trail two fundamental developments that had serious implications for the macroeconomic management of the economy. These were the heavy dependence on the oil sector - to the detriment of the agricultural sector- as the main source of foreign exchange earnings and government revenue, the extraordinary expansion of the public sector and the unsustainable growth in government expenditure arising from the massive investments in social, physical and economic infrastructure. Another factor that exacerbated the growth in government expenditure was the need to, as a matter of urgency, finance post-war developments which compounded and intensified inflationary pressures.

Further, the oil-dependent economy was concomitant with food production shortage. This became a problem as production could not match the pace of population growth hence a nation which used to be a large net exporter of food to the industrialised nations gradually became a net importer of basic foods. Encouraged by the then prevailing exchange rate regime, the Federal Government's move to counter the consequent increase in prices of foodstuff was to utilise huge amount of foreign exchange earnings from crude oil sales to import basic foods. To further worsen the problem precipitated by this measure, the government adopted and executed various ad-hoc and ill-conceived policies such as the Udoji award of 1975 and other non-productive jamborees like the "FESTAC 77". Thus, as shown in Figure 2.2 below, as money supply growth began to move from a single digit of 6.5 per cent in 1971 to double digits of 16.6 per cent in 1972, 54.5 per cent in 1974 and 80.3 per cent in 1975, the rate of inflation fuelled by Federal Government's expenditure also rose from single digit of 1.8 per cent in 1970 and 4.6 per cent in 1973 to 13.5 per cent in 1974 and further increased to 33.9 per cent in 1975.




*Source*: Plotted by the author based on calculation from CBN Statistical Bulletin data 2009




*Source*: Plotted by the author based on calculation from CBN Statistical Bulletin data 2009

Though the data available, as captured in Figure 2.3 above, shows that the economy recorded a relatively high GDP growth rate of 10.9 per cent in 1976 and 8.2 per cent in 1977; these were considered unimpressive and misleading as they were largely the product of the boom in the oil sector. This made Ekpo and Umoh (2009) to caution that such growth rate must be interpreted circumspectly because industrialisation which ordinarily should "imply the process of developing the capacity of a country to master and locate the whole production process within its border are lacking in this case".

During the study period, the country went through an austere economic policy which brought the nation's per capita GNP from US$830.00 in 1983 to US$370.00 in 1988 and US$250.00 in October 1990 (Nwankwo, 1992). Further, by 1978, a country which had thought that foreign exchange was not a constraint on development went borrowing on the Euro-dollar market at exorbitant rates. This turned the country into a debtor nation with a huge portion of the nation's GDP being spent annually on debt-servicing and payback. This development had serious implications for the nation in terms of the crime rate, civil and political unrest which are still prevalent in the society as consequences of the worsening socio-economic situation in the country. Consequently, the need to chart and adopt an enduring developmental agenda that could help curtail or forestall these problems.

Successive administrations have conceived of different economic reforms aimed at returning the economy to the path of recovery. Beginning with the Shagari regime, stabilisation measures which were demand-management in content were adopted with emphasis on exchange rate control, abolition of tax exemptions and increase in import duties designed to reduce demand for imports. While the economy was still grappling with these measures, the military came on board and introduced the pruning of government's expenditure by reducing the size of public sector and countertrade as a measure to reduce foreign exchange requirements. These led to massive retrenchment which compounded the unemployment problem in the country.

Following the failure of these measures, the country adopted the Structural Adjustment Programmes (SAP) in 1986, to alter and restructure the consumption pattern of the economy, remove price distortions and heavy dependence on crude oil export. The SAP mainly focused

on exchange rate, fiscal and monetary policies management, foreign trade liberalisation and external debt management. The fiscal policy management focused on the size of public sector, public expenditure, budget deficits and taxation while the monetary policy management targeted reviewing the restraint placed on domestic credit and interest rate liberalisation. The main thrust of the exchange rate management under this programme was to make the exchange rates market-determined. With this programme, the naira was floated and the two-tier exchange rate system was put in place with the hope that the rates would converge over time. The expectation was that the demand for imports would be curtailed, non-oil exports boosted, capital inflows would be encouraged, distortions imposed by the import licensing system eliminated and a realistic exchange rate attained.

With the floating of the naira at the foreign exchange market, foreign trade was equally liberalised to gain the full benefits of liberalisation. In that light, import prohibitions were eased and the import licensing system and surcharges were abolished. Customs and excise tariffs were restructured to reduce the average nominal rate of protection. In addition to this, a more comprehensive tariff structure with a definite but longer-term horizon was introduced alongside export policy reforms to support the growth and diversification of the export structure. External debt management under the reform also considered the issue of debt refinancing, rescheduling and deferment of obligations, debt buy-back and conversion.

The implementation of these reforms was unable to achieve its stated objectives because of its short time frame, poor sequencing of the prescribed reform measures, poor policy implementation, policy instability and lack of political will (Ekpo and Umoh, 2009). This made the problems of the economy to persist well into subsequent administrations and the general economic situation continued to deteriorate.

Despite the various measures put in place by the monetary authority to achieve some lofty macroeconomic objectives, the impact of the deposit money banks (DMBs) has not been felt in terms of providing the much needed long term financial needs of the real sector. Thus, apart from depositors demanding outrageous returns on their investment, another factor accounting for the DMBs' poor performance is the short-term nature of their deposit liabilities and the inappropriateness of using such deposit base to support long term lending. Deposit

money banks, at the expense of the real sector, had to lend at exorbitant rates on short-term in order to sustain their rent-seeking habit. The banking sector reform was therefore embarked upon so that deposit money banks can give priority to and make available, cheap and competitive credits to the real sector in a bid to accelerate the economy's growth.

The banking sector reform package was anchored on a 13-point programme. A major point being to increase the minimum capital base requirement of the banks from ₦2billion to ₦25billion so that big banks would emerge that would be able to support the growth of the real sector and compete in the international arena. The resultant appearance of these mega banks with robust capital and asset-base on the national economic landscape was expected to provide the spring board for launching the economy to greater sustainable heights and in the process achieve the long-term goals of reducing the level of poverty in the system, providing employment in the wider economy and creating wealth for all. Other key points in the programme include consolidating the banking institutions through mergers and acquisitions and the establishment of an Asset Management Company as an important vehicle for banking system distress resolution to purchase the non-performing risk assets of the banks (Soludo, 2004).

An assessment of the deposit money banks' performance since the implementation of these packages revealed that contrary to its predictions, the reform did not unlock and make available alternative funding scheme to support the emergence and growth of local private investment in the core economic sector. Also, it failed to provide a platform for accelerating the growth of the economy's real sector.

## 2.2 Conduct of Monetary Policy in Nigeria

Monetary policy, a major economic stabilisation tool, refers to the combination of measures designed by the monetary authority (the Central Bank of Nigeria) to regulate and control the volume, cost, availability and direction of money and credit in the economy in order to achieve some specific macroeconomic policy objectives. It can be described as a deliberate effort by the monetary authority, in consonance with the level of economic activities, to control the money supply and credit conditions for the purpose of achieving certain broad economic objectives. The monetary policy objectives, as designed by the CBN over the years have

remained the attainment of internal and external balance while emphasis on techniques/instruments to achieve these objectives has been changing over the years.

Under the colonial government, monetary policy conduct in Nigeria was largely dictated by the prevailing economic conditions in Britain. The instrument of monetary policy at that time was the exchange rate, fixed at par between the Nigerian pound and the British pound. This was very convenient, as fixing the exchange rate provided a more effective mechanism for the maintenance of balance of payments viability and for control over inflation in the Nigerian economy. This fixed parity lasted until 1967 when the British pound was devalued.

Despite the Nigerian civil war that broke out in the later part of this period, the monetary authorities did not consider it expedient to devalue the Nigerian pound in sympathy with the British pound. This was partly because a considerable proportion of the country's resources was being diverted to finance the civil war and also due to the apprehension that the devaluation of the Nigerian pound would only raise the domestic price of imports without any appreciable impact on exports. The monetary authorities, rather than devalue, decided to peg the Nigerian currency to the US dollar but imposed severe restrictions on imports via strict administrative controls on foreign exchange.

Following the devaluation of the US dollar because of the international financial crisis of the early 1970s, Nigeria abandoned the dollar peg and kept faith with the pound until 1973 when the Nigerian currency was once again pegged to the US dollar. This development brought to the fore, the severe drawbacks of pegging the Nigerian currency (naira) to a single currency thus establishing firmly the need to independently manage the naira exchange rate. Hence, in 1976 Nigeria pegged her currency to a basket of 12 currencies of her major trading partners.

Due to these developments, the monetary policy emphasis shifted in 1976 to monetary targeting which involved the use of market (indirect) and non-market (direct) instruments. This consequently made the focus of monetary policy to be predicated mainly on controlling the monetary aggregates with the belief that inflation is essentially a monetary phenomenon. Between this period and 1982, the monetary policy objective became that of accelerating the pace of rapid and sustainable economic growth and development, maintaining domestic price

stability as well as a healthy balance of payments position. Also, during this period and until the adoption of the SAP in 1986, the conduct of monetary policy in Nigeria relied mainly on direct control measures which involved the imposition of aggregate credit ceilings and selective sectoral control, interest rate control, cash reserve requirements, exchange rate control and call for special deposits. The use of market-based instruments such as open market operations was not feasible because of the underdeveloped structure of the financial market, characterised by limited menu of money market instruments, fixed and inflexible interest rates and restricted participation in the market.

Beginning from September 1993, selective removal of all credit ceilings for some banks was carried out by the monetary authority. Series of amendment to the Central Bank's Act was also carried out to reduce the influence exerted by the Ministry of Finance on the conduct of monetary policy. With the amendment granting more autonomy and discretion to the CBN in the conduct of monetary policy, monetary policy focus shifted significantly from growth and development objectives to price stability. Under the operational framework of market (indirect) instruments; only the operating variables, the monetary base or its components are targeted while the market is left to determine the interest rates and credit allocation.

### 2.3 Monetary Policy Techniques

Techniques of monetary policy can be classified broadly into two viz:

i. Direct and
ii. Indirect (also known as market-based).

#### i) Direct techniques

The direct techniques set or limit the desired quantities of monetary variables. They include interest rate ceilings and administrative determination of interest rates, quantitative restrictions on bank credit expansion, mandatory holdings of government securities and sectoral allocation of credit. The use of these techniques was abandoned in the 1980s when it became obvious that it resulted in substantial misallocation of resources because prices did not reflect their true value, thus sending wrong signals to investors and savers.

**ii) Indirect (or market-based) techniques**

The indirect or market-based techniques focus on the demand for and supply of financial assets, relying mainly on market forces to transmit their effects to the economy. These techniques, unlike the direct techniques which focus on the balance sheet of deposit money banks, target the balance sheet of the central bank. Thus, in line with the policy of financial sector liberalisation that accompanied the Structural Adjustment Programme (SAP) in the second half of the 1980s, the CBN embarked on the transition process from direct to indirect techniques of monetary management. The adoption of the indirect mechanism required interest rate policy to become the most important instrument of monetary management, aimed at regulating the cost of credit by deposit money banks, with the minimum rediscount rate (MRR) as the nominal anchor for all money market interest rates. The purpose of varying the interest rate is to alter the demand for and supply of financial assets in the direction that is consistent with the overall objectives of monetary policy, including output growth and inflation.

Quantity based instruments, mainly reserve money and other monetary aggregates, are chosen as intermediate targets for the purpose of achieving desired policy objectives. Most of them affect the availability (and also cost) of funds and, therefore, the decisions of economic agents. The quantity instruments operate mainly through Open Market Operations (OMO), where treasury bills purchases (or sales) increase (or decrease) the stock of reserve money, defined as the deposits which banks keep with the central bank. Variable cash reserve ratio, the ratio of cash to deposit liabilities that a bank must hold, liquidity ratio, the ratio of liabilities to be held in liquid assets and discount window operations are sometimes used to enhance the effectiveness of open market intervention, particularly in a relatively underdeveloped financial market environment. The effect of changes in any of these variables eventually impact on the real sector. Thus, in pursuance of the goals of price stability, the central bank is always mindful of the fact that its actions have important repercussions on the real sector.

Observably, a caveat here is that monetary policy works better where financial markets are efficient and well-developed and market participants are committed to the achievement of overall national economic goals. Thus, in the absence of a well-structured financial market; the conduct of market-based monetary policy is difficult and often produces perverse results or

truncates the transmission mechanisms of monetary policy. Taking the earlier argument as an example; raising interest rates in a liberalised financial market could increase the savings rate, the marginal productivity of capital and possibly, the rate of investment, as more financial resources are available to be channelled from savers to investors. This outcome cannot be taken for granted in an imperfect and oligopolistic financial market. In such a circumstance, high interest rates may actually not only discourage investments and thereby slowdown economic growth but could possibly precipitate financial sector crisis. Financial crises become unavoidable when financial intermediaries finance high-risk quick-return projects with low value-added (e.g. merchandise trading) rather than more productive long-term economic activities.

Similarly, monetary policy cannot achieve much in a situation where there is fiscal dominance and/or where the central bank is turned into a "printing press" for financing large government budgetary deficits. By the same token, financial intermediaries that are conscious of short-term gains or whose horizons are too short would always make choices that render monetary policy objectives difficult and sometimes, impossible to achieve in the long run.

One other important but very serious limitation to monetary policy is the degree of autonomy enjoyed by the central bank. Although central banks are ultimately responsible for the creation of money, the process is largely influenced by government's fiscal operations, in terms of the size and pattern of spending while responding to political questions of: "who gets what, when and how". An independent central bank ensures that the power to spend money is separated from the power to create money. It is encouraging to note that in Nigeria, the central bank currently enjoys instrument and operational independence and exercises the power for the general good of the economy and people of Nigeria (Donli, 2004).

### 2.3.1 Objectives, Instruments and Phases of Monetary Policy in Nigeria

There is a close relationship between monetary policy objectives and posture in all economies of the world. This means that the monetary policy stance is strongly influenced by the macroeconomics objectives set for a particular period and vice versa. For instance, if excess

liquidity is perceived within an economic system, monetary policy would most likely be restrictive with the main objective of attaining price stability. This order can be reversed in policy analysis with the setting of the objective of containing inflationary pressure thereby making monetary policy stance restrictive. The choice of instruments for attaining stated objectives at any particular time would be determined by the structure of the economy, the state of development of money and capital markets and the institutional and legal frameworks within which the financial system is operating. Based on the objectives and instruments of monetary policy and the changing macroeconomic environment in Nigeria, it is feasible to identify various regimes of monetary policy.

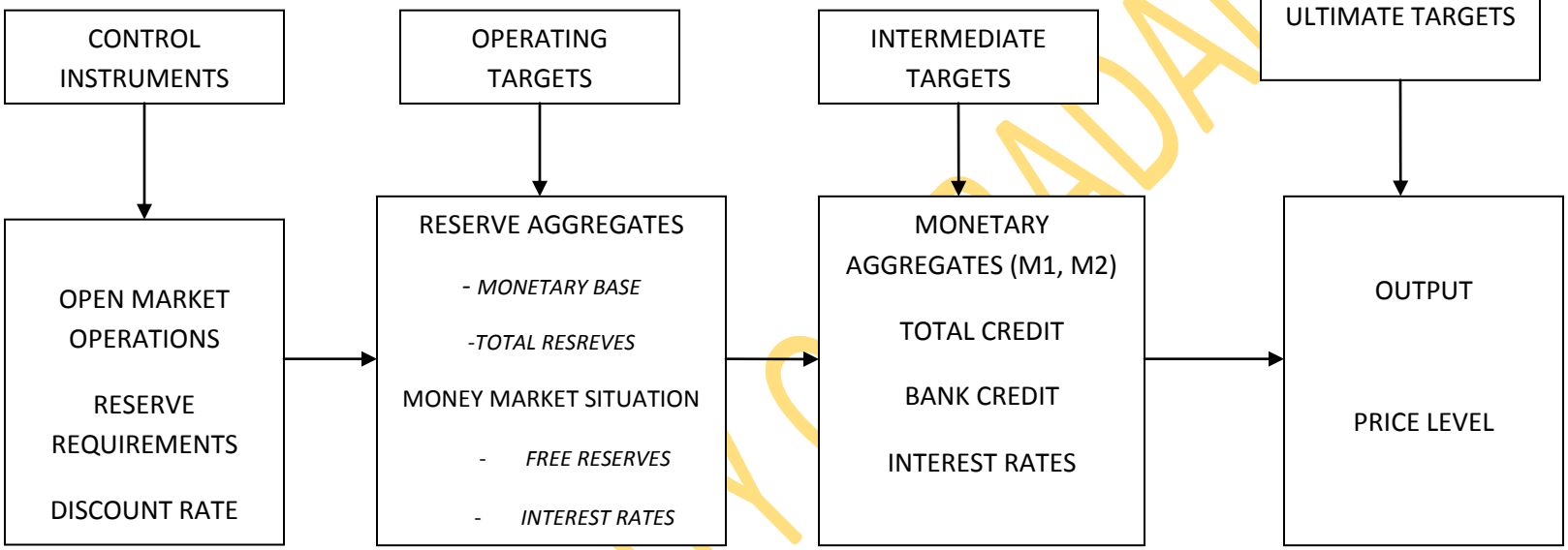
In Nigeria, the main objectives of monetary policy since the inception of the CBN in July 1959 have remained broadly the same; attaining price stability, full employment, achieving balance of payments equilibrium as well as ensuring economic growth and development. However, fluctuations in the fortunes of the economy and unexpected internal and external shocks have necessitated changes in emphasis of these objectives and in some cases the inclusion of some specific sectoral objectives. The changes in economic conditions have also led to variation in the posture of monetary policy. From a review of the annual reports of the CBN, monetary policy circulars to the banks and previous studies such as Ajayi and Ojo (1981); Teriba (1978); and Falegan (1987), a quantitative assessment of changes in monetary policy informed the classification in Nigeria between 1959 and 2000. Overall, twelve regimes were identified and these phases are summarised in Table 2.1 below.

## Table 2.1: Phases of Monetary Policy in Nigeria

| Phases of Monetary Policy in Nigeria | | | | | |
|---|---|---|---|---|---|
| | **PERIOD** | **OBJECTIVES** | **INSTRUMENTS APPLIED** | **MONETARY STANCE** | **MAJOR OCCURENCES / REMARKS** |
| 1 | July 1959-March 1962 | Maintaining a sound stable currency.<br>Developing the money and capital markets. | No conscious monetary policy undertaken.. | Monetary ease | Treasury bills first issued in 1960<br>1959 Banking Act amended (1962). |
| 2 | April 1962-March 1964 | Promoting economic development .<br>Nigerianising the credit base of the economy. | Discount Rate<br>Liquidity Asset Ratio<br>Moral suasion | Passive | Call money scheme and bill finance scheme were first introduced in 1962. |
| 3 | April 1964-Oct 1966 | Achieving BOP equilibrium .<br>Advancing economic development process. | As above<br>-Credit ceiling on exhortation basis | Restrictive | Previous monetary expansion brought the BOP under serious pressure. |
| 4 | Nov 1966-April 1970 | Stimulating economic activity in the private sector.<br>Raising funds for the Federal Government requirements. | As in 1962-1964<br>-Credit Ceiling on Legal basis | Monetary ease | Banking ordinance amended (1968). |
| 5 | 1970-1972 | Maintaining price stability - BOP equilibrium. | As above | Moderate Restraint | Focus on economic reconstruction. |
| 6 | April 1972-Mar 1976 | Containing inflationary pressures.<br>Stimulating activities in the productive sector.<br>Output expansion. | As in 1966-1970<br>Variable cash ratio<br>Sectoral credit guidelines. | Monetary ease | Certificate of deposit, ED stocks and bankers unit funds were first introduced in 1975. |
| 7 | April 1976-Dec 1979 | As in 1972-1976 Stimulating output expansion. | As in 1972-1976<br>Stabilisation securities. | Moderate Monetary Restraint | Credit guidelines was first prescribed for Merchant Banks in 1976. |
| 8 | 1980-1985 | Price stability,<br>Output expansion.<br>BOP equilibrium. | As in 1972-1976 | Restrictive | Stabilisation Securities suspended in 1979. |
| 9 | 1986-1994 | As above .<br>Diversifying the productive base of the economy. | Discount Rate .<br>Direct credit control.<br>Moral suasion. | Moderately Restrictive | OMO introduced in June 1993 and interest rate deregulated from August 1987. |
| 10 | 1994-2000 | Price stability,<br>Output expansion,<br>BOP equilibrium,<br>Exchange Rate stability. | As above<br>O M O | Moderately Restrictive | Stabilisation securities stopped in 1994 and interest rate regulated from 1994 and deregulated from October 1st 1996 |
| 11 | 2000- Dec 2005 | Price Stability ,<br>Exchange Rate Stability. | OMO, Reserve Requirement,<br>Discount Rate. | Moderately Restrictive | Dual credit reserve ratio introduced in July 2002. Banks capital base increased to N25billion in Dec 2005. |
| 12 | Jan 2006 - Dec 2008 | Price Stability .<br>Exchange Rate Stability. | As Above | Moderately Restrictive | WDAS replaced DAS in 2006 and bureau de change's admitted. |

*Source:* Oyaromade (2004) and author's update from Review of CBN Annual Reports.

FIGURE 2.4 : MONETARY CONTROL FRAMEWORK




*Source*: OKE (1993), CBN Economic and Financial Review, Vol. 31, No.4

- Control instruments are instruments used by the CBN especially in a liberalised and well-developed system for monetary control.
- Operating targets are variables under the direct control of the CBN thus it manages these variables and leave market mechanism to determine interest rates and allocation of credit.
- Intermediate targets are variables not under the control of the CBN. Nonetheless, the CBN can influence the operating variables which are related to the path of intermediate target variables in a predictable manner.
- The CBN tries to attain these objectives indirectly through the supply of money, credit and interest rates which are related in a stable manner to these ultimate goals.

### 2.3.2 Open Market Operations

These are short-term instruments introduced at the end of June 1993 and conducted wholly on Nigerian Treasury Bills (NTBs) including repurchase agreements (repos). This entails the sale or purchase of eligible government bills or securities in the open market by the CBN for the purpose of influencing deposit money banks' reserve balances, the level of base money and consequently the overall level of monetary and financial conditions. In this transaction, banks subscribing to the offer, through the discount houses, draw on their reserve balances at the CBN thereby reducing the overall liquidity of the banking system and the banks' ability to create money via credit. This development has greatly facilitated the conduct of monetary policy, allowing the CBN to effectively control money supply and monitor trends in the financial indicators. Thus, for an economy with well-developed money and capital markets, OMO can be a potent weapon of monetary control by the central bank to achieve the objectives of curbing inflation and sustaining economic growth.

For its implementation, the CBN's Research Department advises its trading desk at the Banking Operations Department on the level of excess or shortfall in bank reserves. Thereafter, the trading desk decides on the type, rate and tenor of the securities to be offered and notifies the discount houses 48 hours ahead of the bid date. The highest bid price (lowest discount rate quoted) for sales and the lowest price offered (highest discount offer) for purchases, with the desired size or volume, is then accepted by the CBN. The amount of securities sold at the OMO weekly sessions since the inception of the indirect monetary policy in 1993 has risen over a hundred-fold to N0.2 billion in 1994. Despite the slump in sales recorded in 1995, statistics for 1996 show an increase of 45.5 per cent in the amount sold at OMO over the 1995 sales. The OMO activities have been on the increase ever since, with average OMO sales increasing by over 300 percentage points to N7.73 billion in 2000 and astronomically to N989.9 billion and N1,808.4 billion in 2005 and 2006 respectively. This stupendous growth rate recorded during the last two periods could be attributable to: the attractive rates offered at the open market, the supply shortage of long tenured instruments offered at the primary market and the injection into the economy of N570.0 billion excess crude oil proceeds (Sanusi 2002).

### 2.3.3 Reserve Requirements

The CBN require the deposit money banks to maintain certain (or a minimum) reserve requirements in order to control their liquidity and influence their credit operations. These reserve requirements are usually expressed as a percentage of customers' deposits and can be manipulated by the CBN to vary the ability of commercial banks to make loans to the public by simply increasing the ratios. In this regard, they serve as instrument for liquidity management, ensuring the solvency of the banking system and prudential regulation. Thence, the CBN complements the use of OMO with reserve requirements. These are:

***i) The Cash Reserve Ratio (CRR)***

The statutory Cash Reserve Ratio (CRR) is defined as a proportion of the total demand, savings and time deposits which banks by law are expected to keep as deposits with the central bank. This requirement works in the direction of raising or reducing the liquidity of commercial banks thus impacting their credit creation ability. A high CRR reduces the ability of the banks to create credit since it reduces the amount of credit banks can give out to the private sector and government. This affects investment negatively and often results in a decline in economic growth. On the other hand, a low CRR increases the credit creation ability of banks as they are now free to lend their excess reserve to both the private sector and government. This in turn increases investment opportunities and thereby raises economic growth.

***ii) The Liquidity Ratio (LR).***

The CBN often impose upon deposit money banks a minimum LR and varies it according to the situation. It is designed to enhance the ability of commercial banks to meet cash withdrawals on them by their customers. Such LR stands for a proportion of specified liquid assets (such as cash, bills and government securities) in the total assets of a bank. That is, a proportion of banks' liquid assets to their total deposit liabilities. The CBN has varied the CRR and LR at various times in view of its desired objectives.

### 2.3.4 Discount Rate

The CBN discount window facilities were established strictly in line with the "lender of last resort" role that the central bank is expected to play. It is the rate of interest the central bank charges the commercial banks on loans extended to them. It is also the official minimum rate at

which the central bank would rediscount what is regarded as eligible bills. Accordingly, the CBN has continued to provide loans of a short-term nature (overnight) to banks in need of liquidity. The facilities are collateralised by the borrowing institution's holding of government debt instruments and any other instrument approved by the CBN and subject to a maximum quota. This implies therefore that the effectiveness of this policy is a function of the ability of commercial banks to have access to liquid assets and must not keep excess reserves. The Minimum Rediscount Rate (MRR) is the nominal anchor which influences the level and direction of other interest rates in the domestic money market. Its movements are generally intended to signal to market operators, the monetary policy stance of the CBN. For example, the discount rate was reviewed upwards by the CBN from 16.5 per cent to 18.5 per cent in June 2001 in order to contain the rapid monetary expansion arising from an expansionary fiscal policy.

## 2.4 Analysis of Money Supply Process

Under this section, we shall discuss the sources through which the activities of the various players in the money supply process ultimately affect the domestic money stock. There are five key players in the money supply process in Nigeria, namely; the Central Bank of Nigeria, Governments, deposit money banks, non-bank private sector and the external sector.

### *2.4.1 The Central Bank of Nigeria*

The supply of high-powered money in any economy is generally perceived to be determined by the central bank. The operational procedures commonly deployed by this agent to manipulate the stock of high-powered money are through the acquisition of assets using open market, rediscount and foreign exchange operations. The CBN, under the OMO, embarks on the sale or purchase of securities from the deposit money banks and non-bank public operators with a view to achieve some desired level of money stock. In some instances, the CBN uses the OMO to meet some public sector borrowing requirement. The OMO may be used for expansionary or contractionary policies depending on whether the CBN wants to increase or decrease the amount of money in circulation. Whichever policy pursued, there exists some parallelism between the policy and the money stock.

The CBN can also influence the amount of money in circulation through the discount window by varying the discount rate. Thus, a decrease in the discount rate is normally

considered an expansionary monetary policy since it induces commercial banks to borrow more while an increase is regarded as a contractionary. The effectiveness of this operation as a monetary policy tool depends on the market rate of interest vis-à-vis the discount rate charged by the CBN. The reason simply being that; if the market interest rate was lower than the discount rate, commercial banks would not turn to the central bank for loans hence, the purpose of using this policy to reduce money supply would be defeated.

Another means through which the central bank can influence money supply is the foreign exchange operation which involves the sale and purchase of foreign currencies. The exchange rate regime in existence determines the effectiveness of this method to influence money supply. The central bank, under a fixed exchange rate regime, normally intervenes by purchasing domestic currency in exchange for foreign currency when there is excess supply of domestic currency in order to prevent excessive devaluation of the domestic currency, a situation referred to as sterilisation. This results in a decline in the amount of money in circulation. When there is excess demand for domestic currency on the other hand, the central bank also intervenes by selling domestic currency in exchange for foreign currency thus resulting in an increase in money supply. The essence of sterilisation is to maintain fixed exchange rate regime. This policy measure has serious policy implications on the economy. Under a floating exchange rate regime, the nominal exchange rate is allowed to gain its equilibrium level through the forces of demand and supply.

### 2.4.2 The Government

Proceeds from crude oil exports have remained the largest source of the Federal Government's revenue while non-oil revenue such as VAT accounts for a smaller percentage of the total annual government revenue. Disbursing and expending these federally-collected revenue among the three tiers of government has remained one major source of money supply in the economy. This is due to the incessant increase in the recurrent expenditure of these tiers of government coupled with the fiscal autonomy of the lower tiers which often made it difficult for the monetary authority to synchronise their expenditure pattern. In addition, the governments accumulate huge fiscal deficits which are financed through various means such as sale of government bonds, borrowing from the CBN (credit creation/printing of money), running down

of reserve/asset among others. All of these have monetary implications as it increases the stock of high-powered money in circulation thereby fuelling inflation.

### 2.4.3 Deposit Money Banks (DMBs) or Commercial Banks

The deposit money banks' main function is that of financial intermediation which simply means receiving money from depositors and channelling them to those in need of funds. The DMBs pay interest on deposit and receive interest on loans they lend out to borrowers. The spread between the deposit and lending rate indicates the profitability of the intermediation process which has some monetary implications. The DMBs' ability to create bank money requires that they acquire enough funds to satisfy the demand for credit. The rate of profit on assets held by DMBs, in addition to the size of money markets and the instruments they offer, set the limit on credit creation.

From the money multiplier approach to money supply analysis, the channel through which the activities of commercial banks influence the money supply can be traced through the total reserve ratio.

### 2.4.4 Non-banking Public Sector

This basically comprises of the surplus and deficit spending units who, due to mismatch in their respective needs, gives the deposit money banks the opportunity to carry on their intermediation activities, which in turn affects the domestic money supply. The divergence between the needs of the surplus and deficit spending units is due to the fact that the former usually consists of a large number of small individual savers who only need to invest small amounts of money. The deficit spending units on the other hand consist largely of firms with great need for large amount of funds. This situation provides a platform for the DMBs to receive money from the surplus spending units and make them available to the deficit spending units. This role of the DMBs is referred to as financial intermediation. Thus the channel through which the behaviours of the non-bank public impact money supply can be traced through the currency deposit ratio (currency ratio) and /or interest rate on deposits.

Given the relationship existing between the currency ratio and the money multiplier, money can be said to be negative. An increase in the currency ratio therefore implies that loans

granted by the DMBs will generate a lower value of deposits since agents are holding more of their money in currency. With decrease in the DMBs' liability or public deposit, the banking systems' ability to create money is hindered and money supply decreases. Persistent increase in the currency ratio normally leads to intermediation in the banking sector which may result in a fall in investment and ultimately a decline in economic growth. There is also the belief that too much money in the hands of non-public sector may lead to excess liquidity which might eventually set in motion an inflationary spiral.

### 2.4.5 External Sector

As an open economy, the impact of trade on domestic money supply in Nigeria cannot be ignored. Nigeria exports crude oil, agricultural commodities and others to some countries while it also imports capital and consumer goods. The proceeds from these exports constitute a source of money supply to the economy. For instance, if there is an increase in the price of crude oil over the anticipated price, this will result in excess revenue and lead to an inflow of foreign currency. If such an inflow is monetised, it will lead to an increase in domestic money supply.

Also, the inflow of foreign currency in the form of remittance to family and relatives (through Western Union Money Transfer or MoneyGram) or as foreign investments equally affects the amount of money supply in the domestic economy. When these remittances are channelled through the banking sector, they are converted into domestic currency and paid to the beneficiaries in local currencies or invested locally thus affecting the amount of money supply.

Aside from those mentioned above, another veritable external source of money supply is donations from bodies such as the World Bank, IMF and AfDB. Donations from these bodies come in the form of financial assistance for budgetary support programmes to the receiving country and often serve to improve the Net Foreign Asset (NFA) position and hence increase the money supply. Notably, Nigeria has not benefited much from these in recent times.

## 2.5 Monetary Policy and Macroeconomic Performance

This section discusses the developments in monetary, fiscal and exchange rate policies as well as inflation and other macroeconomic variables. Given the CBN mandate of promoting macroeconomic stability through the conduct of monetary policy, it is pertinent to examine how far monetary policy has faired vis-à-vis the attainment of its mandated objectives of domestic price stability as a necessary condition for promoting increased output and employment growth and a healthy balance of payments position. This will provide a clear and better picture on the link and relationships amongst the variables of interest.

### 2.5.1 Review of Monetary Policy in Nigeria

Since the establishment of the CBN, monetary policy has been conducted under varying macroeconomic conditions and the stance has been dictated by the prevailing economic situation and the period's objectives. Overall, the administration of monetary policy in Nigeria since 1959 can be broadly grouped into phases/periods based on the specific objectives and posture. The early years of the emergence of the CBN was characterised by monetary ease, based on the relatively stable macroeconomic environment, the monetary objectives of developing the local money and capital markets and promoting economic development through the process of *Nigerianising* the credit base of the economy. The substantial increase in capital formation and domestic output in the early 1970s made monetary management less challenging. However, the growing involvement of the public sector in economic activities that are traditionally restricted to the private enterprise in a mixed economy, as well as the overdependence of the economy on the external sector, increasingly put greater pressure on monetary management in the 1970s. In the early 1980s, a tremendous demand was imposed on the conduct of monetary policy, as the period was inundated with a wide array of economic misfortunes, culminating in the inevitable introduction of economic adjustment programmes under which monetary policy appeared to have borne a relatively heavy share of the burden of adjustment (Ojo, 1992).

Given that monetary actions originate in the monetary sector and the initial impact of monetary policy is felt in the financial markets, most especially the money market, a review of development and growth of the financial markets will shed more light on the knowledge of the breadth, resilience and depth of these markets in Nigeria. This trend analysis of the financial markets is also important as the particular monetary instrument(s) to be put in place for

achieving a set of macroeconomic objectives are strongly influenced by the state of development of the money and capital markets.

### 2.5.2 Monetary Policy Formulating Procedure in Nigeria.

In compliance with the varying legislative framework, the procedure for formulating monetary policy in Nigeria has changed over the years. The monetary policymaking relationship between the CBN and the Federal Government (the Ministry of Finance) has been dictated mainly by the prevailing enactment governing the CBN operations. The CBN, prior to 1968, was exclusively responsible for the formulation and implementation of monetary and financial policies. From 1968 to 1988, the Federal Ministry of Finance was mandated to approve the monetary policy proposals and such proposals are to be sent to the Federal Executive Council (FEC) for approval in the case of disagreement with the CBN. This operating arrangement was unambiguously contained in the 1968 CBN (Amendment) Decree. Teriba (1978) aptly describes this arrangement as a situation whereby the FEC, the Federal Ministry of Finance (FMF) and the CBN constitutes *the monetary authority*.

The CBN amendment decree of 1991 formalised this arrangement that subsist between 1988 and 1996, in which monetary policies are sent directly to the President by the CBN. From January 1997 to December 1998, the CBN was required to send its proposals to the government through the Minister of Finance. Overall, between 1968 and 1997, the monetary and banking policy measures approved by government became a part of the annual budget and formed the basis of CBN's monetary and credit guidelines. Ajayi and Ojo (1981) while frowning at this arrangement note that "no one denies that a Central Bank cannot be fully independent of government but it is equally objectionable to make a central bank an arm of government". The central bank for the country, according to them, should be autonomous while the responsibility for the overall economic policy should be assigned to the government to ensure sustainable development. The major consequences of the CBN being under the control of the FMF identified by Falegan (1987), include: first, the possibility of the CBN being stifled of initiative and innovation thus confining it to the routine functions of exchange control administration and monotonous credit control operations and second, the day-to day monitoring of monetary tools and operations might be turned into an annual budgetary affair thus glossing over prompt remedies to emerging problems arising therefrom. However, reprieve from the control by the

FMF came the way of the CBN in December 1998 when it was granted instrument autonomy in the formulation and implementation of monetary and financial policies.

On factors considered in the formulation of monetary policy, the CBN begins its monetary management with a comprehensive review of the economic conditions as well as the observed and anticipated problems. Computation is also made of the optimum quantity of demand for money stock, consistent with predetermined targets for GDP growth, inflation rate and level of external reserves. The economy's absorptive capacity is thus derived from the optimum level of money and external reserves computed. This allows the CBN to use the monetary policy instruments at its disposal to keep money supply in line with optimal demand (CBN, 2000).

### 2.5.3 Monetary Policy and Real GDP Growth.

The effect of monetary policy on output, as gleaned from the literature, shows there is a direct and positive relationship between these two variables. Observably, the channels through which the effect of monetary policy impact on output differs based on the structure of a particular economy under review. In the case of Nigeria, there has been a sustained decline in the growth rate of real GDP since the early 1970s as it fell from 18.2 per cent in 1971 to 2 per cent in 1973 and further to as low as -3.2 per cent in 1975. A proximate factor for the growth rate in GDP in the year 1971 and 1972 was partly due to the huge government expenses on financing post-war reconstruction. The rate of growth in money supply also reflects this as it grows from 6.4 per cent in 1971 to 15.5 per cent in 1972 and 25.2 per cent in 1973. The growth of M2 in the subsequent year (1974) by 81 per cent, perhaps a fallout of the windfall from the Arab oil war, reflects the increase in the economy's activity as the real GDP grew in that same year by 12 per cent.

As the real GDP growth rate nosedived in 1977 from 8.2 per cent to -7.4 per cent in 1978, M2 growth rate also deepened to -3.7 per cent in 1978 from the previous year's figure of 33.7 per cent. Though, economic activities began to pick up shortly after a civilian government came into power as shown in the growth rate of M2 by 46.1 per cent in 1980, accompanied by a growth of real GDP by 5.3 per cent in that same year. However, this was short-lived as the real GDP

growth rate between 1981 and 1984 remained in the negative region ranging from -0.3 to -8.5 per cent even when M2 was growing at an average of 10.25 per cent per year.

Though the poor economic performance of the civilian government remained the leeway for the military interruption in 1984; economic performance for the 16years of military intervention and governance was not any better. While the average growth rate of M2 for the 16years stood as high as 25.3 per cent, economic performance as reflected by the average growth rate of real GDP for the same period stood as low as 3.17 per cent. Even the adoption of the SAP in 1986 could not help the economy's misfortune characterised by an abysmally poor annual real GDP growth rate. Only two post-SAP annual real GDPs, that is 1988 and 1990, exhibit some meaningful growth in economic activities. Given the challenges of the SAP such as short time frame, poor sequencing of the prescribed reform measures, poor policy implementation, policy instability and lack of political will; one is not surprised of its failure.

However, there has been resurgence in economic activity since the advent of democratic system of government in 1999 with average real GDP growth rate of 9.03 per cent between the fiscal years 2000 and 2008. Though a spike was observed in 2002 with real GDP growth peaking at 21.3 per cent, this was partly due to the last round of increase in crude oil prices and the difficulty of performing sterilisation operations by the CBN in a democratic setting where the lower tiers of government embarked on expansionary fiscal policies. This was occasioned by the rapid monetisation of the proceeds of excess crude earnings (Sanusi 2002). Notably, economic performance in the subsequent years remained moderately stable at 10.2 and 10.5 per cents in 2003 and 2004 respectively reflecting the politically stable environment prevalent in the economy. Thereafter, real GDP growth remained stable at an average of 6.3 per cent between 2005 and 2008 despite a seemingly high growth rate in M2 from 24.4 per cent in 2003 to 44.2 per cent and 57.8 per cent in 2007 and 2008, respectively.

# CHAPTER THREE

# LITERATURE REVIEW

## 3.1 Introduction

The conventional wisdom that immediately followed the Great Depression of the 1930s and Keynes' classic thesis was that *money does not matter*. However, after World War II, the re-emergence of monetarism led to the consensus that monetary policy can significantly affect real economic activities, at least, in the short run. The general consensus of monetary policy's potency notwithstanding, the precise nature of the causal links between monetary and real aggregates remain a bone of contention (Laidler, 1978). Observers have therefore painstakingly weighed differently the various specific channels through which monetary policy works. The weights attached to each of the channels of monetary transmission mechanism differ in the emphasis placed on money, credit, interest rates, exchange rates, asset prices or the role of deposit money banks (DMBs) and other financial institutions (Taylor, 1995). Divergent views and opinions exist as well about the monetary transmission process in individual industrialised nations while in the developing nations, the process still remains hazy and uncertain.

This chapter therefore reviews the plethora of literature on the monetary transmission mechanism particularly highlighting the theoretical, methodological and empirical literature on the various channels through which monetary impulses are transmitted to the real sector of the economy. The review of different works also attempts emphasizing the modelling techniques and methodology used by the authors and compare the empirical results emanating therefrom.

## 3.2 Theoretical Review

Various transmission mechanisms through which monetary policy can affect economic activities have long been established by theory and evidence. Given its complexity, however, tagging the monetary transmission mechanism as *black box* seems accurate since there are not one but many channels through which monetary policy simultaneously operates. Also, depending on the state of payments system and the money (especially financial) markets, the relative strength of the various channels vary from country to country. Thus, beginning with the

transmission of Open Market Operations (OMOs) to money market interest rates, the process passes through the reserves market or more broadly to market interest rate through the supply and demand for money.

Though the operating procedures, instruments and targets of monetary policy may vary across countries, monetary transmission remains the mechanism identified in the literature as the medium through which the central bank impact real economic activities. Macroeconomic theories and empirical studies have therefore, over time, developed different approaches that explain how such links actually work. However, one common feature among these links is that a change in monetary policy stance caused by central bank's action somehow translates into a change in aggregate demand that affects real output and domestic prices. Observably, there have been variations across countries on the operation of monetary transmission channels due to differences in the extent of financial intermediation, the size, concentration and health of the banking system, the development of capital markets and structural economic conditions (Cecchetti, 1999). Monetary transmission is therefore referred to as *black box* because of the numerous channels through which monetary policy operates simultaneously. In an attempt to unearth this *black box*, economists have come up with channels of monetary transmission that provide explanations on how this translation occurs and what eventually drives aggregate demand as well as output and prices up or down.

### 3.2.1 Channels of Monetary Transmission

The literature on the monetary transmission mechanism advocates a transmission process through which monetary policy decisions are converted into changes in real output and inflation (Baksh and Craigwell, 1997), though monetary actions originate in the monetary sector, the central bank's target variables -output, prices and full employment- are in the real sector of the economy. Thus, the channel through which the actions in the monetary sector affect the real sector is referred to as the transmission mechanism. In essence, it is the link between the monetary and the real sector of the economy. While Meltzer (1995) refers to a transmission process as describing the economy's response to an impulse, Pierce and Tysome (1985) in differentiating between a monetary transmission mechanism and a channel of monetary

influence posit that; the monetary transmission mechanism refers to the general conceptual framework within which the analysis of monetary disturbances may be undertaken while the channel of monetary influence refers to the route through which these monetary impulses influence the general variables. Thence they conclude that it is possible for a number of channels of monetary influence to coexist within the same monetary transmission mechanism.

The financial structure of a country and its macroeconomic environment determines the relative importance of the different channels of monetary transmission. The financial system's structure - which includes the degree of competition in the banking sector - determines the linkage between an instrument under the direct control of the central bank (e.g. reserve requirements) and the variables that drive the conditions in the non-financial sector (e.g. loan and deposit rate, asset prices and the exchange rate). In turn, the macroeconomic environment (e.g. the degree of financial leverage and competition in different sectors, currency denomination of liabilities, openness of the economy, etc) determines the link between the financial conditions and spending as well as investment decisions among households and firms (Kamin, Turner and Van't dack, 1998).

Mishkin (1995) identifies interest rate, exchange rate, bank credit and asset prices as the main channels of monetary transmission in the literature. The common trend that can be found in all of these channels is that fluctuation in the level of money supply resulting from variation in monetary policy stance – through the use of OMO or reserve requirement – essentially affects real economic variables (prices and output) through aggregate demand or supply. The various channels identified in the literature are analysed in what follows.

**i) Interest Rate Channel**

The interest rate channel which lies at the heart of the traditional Keynesian IS-LM model was originated by Hicks (1937) and also associated with the works of Taylor(1995), Cottarelli and Kourelis (1994) and Clarida, Gali and Gertler (2000). According to this theory, all agents in the economy hold only two types of assets, money and bonds as a superficial collection of all other financial assets. A monetary expansion through an open market purchase of bonds, the theorists claim, will lead to an excess supply of money thus making economic agents hold more

money and fewer bonds. Therefore, for equilibrium to exist in the assets market, short-term interest rate should fall to make economic agents accept extra money holdings. This fall in interest rate will lead to an increase in investment spending (due to decrease in the capital cost of financing investment) which will ultimately cause an increase in aggregate demand and output.

Also, such an increase in money which raises households real money balances for a given interest rate implies an excess of cash in the perception of households. It is predicted that when households begin to increase their bondholding in a bid to reduce their real balances, interest rate will reduce, lowering the cost of capital and consequently, causing an increase in investment spending, aggregate demand and output as well as price level. The increase in aggregate demand may lead to an increase in the general price level. The reverse scenario occurs for a contractionary monetary policy. This scenario is presented schematically below:

**Expansionary Monetary Policy=> Interest Rate↓=> Investment↑=> Output↑**

However, two conditions should be satisfied for the theory above to hold. First is that the central bank must have influence over the short and long run real interest rates. This can be the case when there is slow responsiveness of inflation in the economy. Second is that the components of aggregate demand should be interest rate sensitive.

**ii) Exchange Rate Channel**

The second contribution of the Keynesians to the monetary transmission debate is the exchange rate channel. This examines the relationship between net private capital inflows and monetary policy as well as how an alteration of the interest rate alters the attractiveness of a country's currency. This channel posits that an increase in the domestic currency's attractiveness will cause foreign investors to shift part of their investment to financial assets denominated in this currency. The currency, due to this, appreciates and lowers the competitiveness of the domestic industry which ultimately results in a decline in net exports (Kuttner and Mosser, 2002).

The exchange rate channel is an important element in conventional open-economy macroeconomic models. Though effective only under a flexible exchange rate regime, it works through both aggregate demand and supply effects, the chain of transmission being from the interest rate to the exchange rate via the uncovered interest rate parity condition (which relates the interest rate differentials to expected exchange rate movements). Thus, a decrease in the domestic interest rate relative to the foreign interest rates would lead to a weaker currency and an increase in both net exports and in the overall level of aggregate demand.

The exchange rate channel also involves interest rate effects (Mishkin, 1995). On the demand side, an expansionary monetary policy lowers domestic interest rate. The fall in interest rate causes deposit in the domestic currency and credit in foreign currency to become less attractive thus bringing about a real depreciation of the domestic currency. This in turn leads to higher net export and a stronger aggregate demand (Obstfeld and Rogoff, 1995). On the supply side, the real depreciation that results from monetary expansion raises the domestic prices of imported goods thus raising inflation directly. In addition, the high price of imported inputs contracts aggregate supply, reduces output and increases inflation. Thus, an expansionary monetary policy that results to a fall in domestic interest rate, according to this channel, will cause an outflow of capital. The outflow of capital puts pressure on the exchange rate and this leads to a depreciation of the domestic currency. Depreciation makes the foreign price of exports cheaper and the domestic price of imports expensive. This expands export and reduces import hence, an increase in net exports. The increase in net exports leads to a rise in aggregate demand and output. Also, the depreciation of the domestic currency together with the increase in aggregate demand results in an increase in domestic price level. On the other hand, a contractionary monetary policy stance will increase interest rate and cause exchange rate to appreciate. This will increase import and decrease export, thereby resulting in net exports declining and a fall in aggregate demand, output and price levels. This scenario is presented schematically below:

**Contractionary Monetary Policy => Interest Rate↑ => Exchange Rate↑ => Net Exports↓ => Output ↓**

The Mundell-Fleming theorem of a floating exchange rate regime, aided by an elastic balance of payments, remains the premise upon which the exchange rate as a key variable in the monetary policy transmission is anchored (Baksh and Craigwell, 1997). According to Mundell (1962), capital mobility implies an important relationship between short-term interest rate and exchange rate. This parity relationship states that the interest rate differential between any two countries is equal to the expected rate of change in the exchange rate between the two countries. If this relationship is violated, then capital would flow into the country with the higher returns until expected returns in both countries become equal. By this process, the interest rate parity relationship transmits monetary impulse through the effect of exchange rate changes on net exports to the real sector of the economy.

Contrasting the situation with what obtains under a fixed exchange regime; an expansionary monetary policy initially lowers the domestic interest rate and raises income thus resulting in capital outflows as well as current account deficit. The government's attempt to increase the money supply fails because its acquisition of domestic bonds is offset by its losses of foreign exchange reserves, leading to a constraint in conducting monetary policy. Premised on the aforementioned, Taylor (1995) and Obstfeld and Rogoff (1995) emphasise that a framework for the conduct of monetary policy must be inherently international in scope.

### iii) Credit Channel

The credit channel of monetary policy transmission operates as an accelerator of the mechanism and is closely linked to the interest rate channel in a way that further extends the effects of monetary policy. Unlike the interest rate channel, it shows an indirect impact of monetary policy on the real economy. Its emphasis is on how imperfect information and other *frictions* in the credit market work as an important channel of monetary policy. Due to information asymmetry in the credit market and enforcement cost, Bernanke and Gertler (1995) argue that, principal-agent problems arise in the financial market and create an external finance premium[1]. They therefore postulate that: variations in monetary policy stance alter the external

[1] External finance premium is the difference in cost between funds raised externally by issuing equity or debt and the opportunity cost of funds generated internally by retaining earnings.

finance premium facing borrowers and that; smaller firms which rely more on bank credit and have more limited access to external funds than larger ones could be expected to be more affected by an increase in interest rate (Gertler and Gilchrist, 1993, 1994; Bernanke, Gertler, and Gilchrist, 1996; Clements, Kontolemis and Levy, 2001). The strength of this effect however depends on the health of the banking system and the degree to which it can react to policy changes. Following the problems facing the credit markets, this channel is further decomposed into two basic channels of monetary transmission. These are the bank lending and balance sheet channels.

The *bank lending channel* postulates that banks play an important role in an economy by issuing liabilities (bank deposits) that contribute to the broad monetary aggregates and holding assets (bank loan) which scarcely has any substitute. The proponents of this channel therefore contend that for many banks; deposits represent the principal source of funds for lending and that for many firms, bank loans represents the principal source of funds for investment. Thus, variation in monetary policy stance then affects the external finance premium through the shifts in the supply of intermediated credits especially the quantity of loans supplied by the banking institutions to the credit markets. The main presumption of this argument is that monetary policy significantly alters the supply of bank loans, the asset side of the banks' balance sheet. However, there is need to note the fact that the problem of asymmetric information is prevalent more with small firms.

To apply the bank lending channel, consider an expansionary monetary policy which increases the aggregate volume of banks' reserves and deposits as well as the amount of credit available. Given that banks play a special role of lending to different classes of borrowers, this increase in loan will cause investment spending to rise as well as aggregate demand and output. This may eventually put an upward pressure on the general price level. The schematic presentation of the above scenario is shown below:

**Expansionary Monetary Policy=> Bank Reserve↑=> Bank Loan↑=> Investment↑=> Output↑ .**

For the bank lending channel to work, bank dependent borrowers must exist and the central bank must be able to significantly affect the supply of intermediated bank loans by altering the amount of loans available to the DMBs.

The *balance sheet channel* even though operates via the net worth of business firms (Bernanke and Blinder, 1988) rests on the notion of asymmetric information in credit markets and emphasizes the role of collateral in reducing moral hazards. Business firms with low net worth clearly signal to lenders that there is less collateral for their loans and so lenders are weary that losses from adverse selection may be higher. Therefore, a low net worth raises the adverse selection problem thus leading to decreased lending to finance investment spending. In addition, low net worth of business firms increases the moral hazard problem because it means that owners have a lower equity stake in their firms, giving them more incentive to engage in risky investment projects. Since taking on riskier investment projects makes it more likely that lenders will not be paid back, a decrease in business firms' net worth leads to a decrease in lending and hence in investment spending (Mishkin, 1995). A contractionary monetary policy stance which causes a fall in equity prices reduces the networth of firms and so leads to low investment spending and aggregate demand because of the increase in adverse selection and moral hazard problems. The contractionary monetary policy together with decrease in aggregate demand reduces domestic price level. Schematically, this is shown below:

**Contractionary Monetary Policy => Equity Prices↓ => Adverse Selection↑ => Moral Hazard↑ => Bank Loans↓ => Investment↓ => Output↓.**

**iv) Asset Price Channel**

The Keynesian paradigm for analysing monetary policy effects on the economy was strongly objected to by the monetarists on the ground that it focuses on only one relative asset price and the interest rate (Mishkin, 1995; and Meltzer, 1995). The classical monetarists model emphasizes the role of monetary aggregates in determining asset, goods and factor prices. They argue that monetary policy actions impact on prices simultaneously across a wide variety of markets for financial assets and durable goods especially in the market for equities and real

estate. In essence, this channel reflects the impact of monetary policy on the prices of bonds, shares, real estate, and other domestic assets. It operates through changes in firms' market value and in household's wealth. The former alters the relative price of new equipment, affecting investment spending while the latter affects household consumption and the availability of collateral for borrowing. Two monetary transmission channels namely *Tobin's q theory of investment* and *the wealth effects on consumption* emerged from this monetarists' argument.

Tobin's q[2] theory provides a mechanism through which monetary policy affects the economy via its effects on the valuation of equities. According to Tobin (1969), a high **q** implies that the market price of firms is high relative to the replacement cost of capital thus investment spending will rise while a low **q** implies that firms will reduce investment because the market value of firms is low relative to the cost of capital.

The monetary channel emphasizes that a link exists between Tobin's **q** and investment spending through the price of equity. An expansionary monetary policy through decrease in discount rate or decrease in reserve requirement ratio will increase money supply. This leaves the public with more money than it desires. Thus, a veritable means for the public to get rid of such excess is in the stock market by increasing the demand for equities which will correspondingly increase their prices. A rise in the price of equities will lead to a higher **q**, and thus increase investment spending. This results in an increase in aggregate demand and an increase in output which then triggers an increase in price level. The scenario analysed above is presented schematically below:

**Expansionary Monetary Policy => Equity Prices↑ => Tobin's q↑ => Investment↑ => Output↑.**

The second mechanism according to the monetarists for transmission through equity prices is the wealth effect on consumption. According to the life cycle model of Modigliani (1971), consumption spending is determined by the consumer's life time resources which consist of human and real capital plus financial wealth (mainly common stocks). The monetarists posit therefore that an expansionary monetary policy will increase the demand for stocks which will

[2] Tobin (1969) defines q as the ratio of the market value of firms to the replacement cost of capital.

cause their prices to rise. When this happens, the value of individual consumers' financial wealth increases consequently increasing their lifetime resources and consumption. This increase in consumption impacts positively on aggregate demand, output as well as price level. The schema below portrays this scenario:

**Expansionary Monetary Policy => Equity Prices↑ => Financial Wealth↑ => Consumption↑ => Output↑.**

**v) Cash Flow Channel**

There also exists another channel of transmission through which monetary policy affects the real sector and this is known as the cash flow channel**.** Here, the same logic with asymmetric information applies. In this mechanism, the changes in intensity of adverse selection and moral hazard are rooted in improvement/deterioration of a firm's cash flow. For instance, if an expansionary monetary policy first lowers short-term nominal interest rates, then the firm may find it easier to service its short-term debt because interest payments are now lower. This implicitly improves the firm's cash flow and comforts the lender that the loan granted to this firm will be serviced and repaid when due. Consequently, moral hazard and adverse selection problems diminish, engineering new lending and thus increasing investment spending and output and causing price to increase through an increase in investment spending and output. The picture is captured by the schema below:

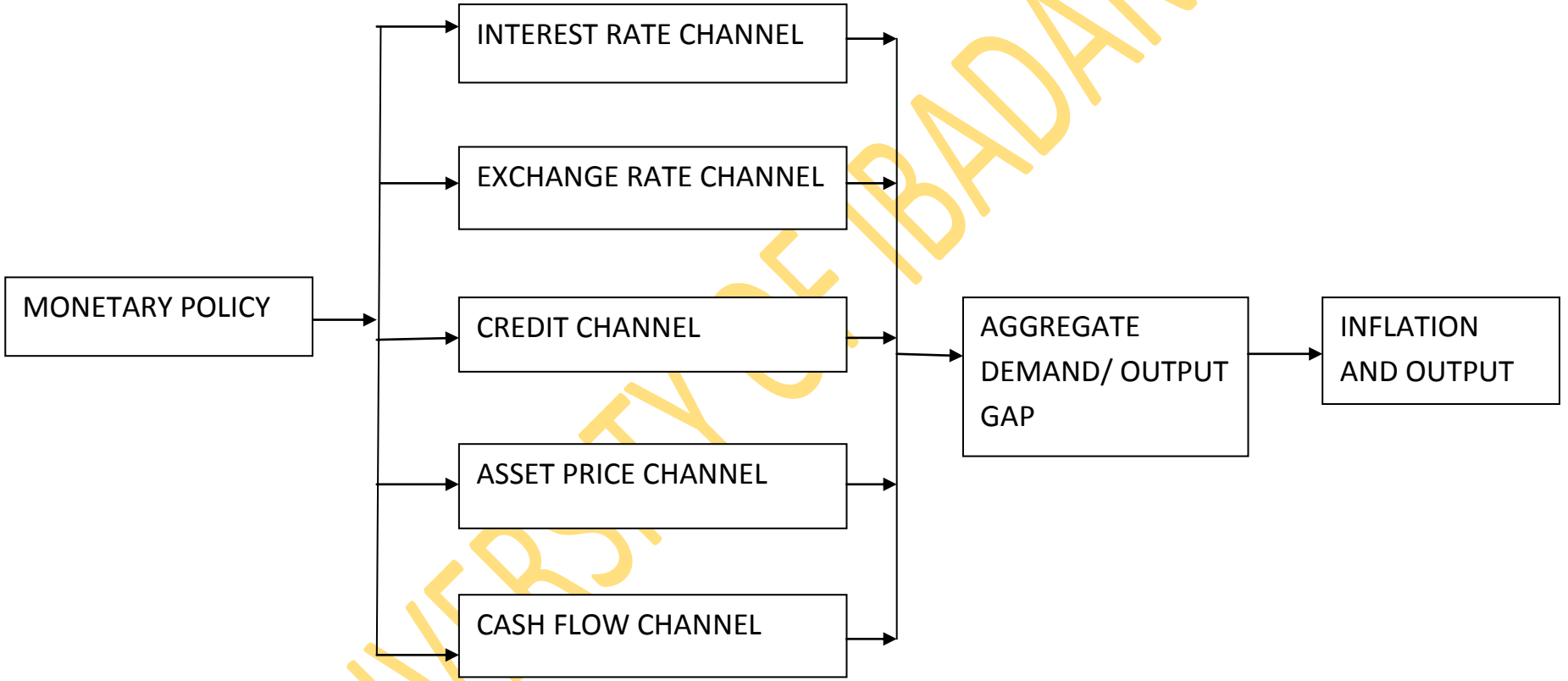
**Expansionary Monetary Policy => Nominal Interest Rate↓ => Cash Flow↑ => Adverse Selection↓=> Moral Hazard↓=> Bank Loans↑=> Investment↑=> Output↑.**

In spite of the above analysis of the various channels, establishing the existence of a particular lending channel in any country may not be as simple as explained above for two reasons. First, changes in interest rates usually occur in response to changes in economic conditions which makes it difficult to recover from the data, the pure effect of the interest rate change on economic activities. Second, all channels of monetary transmission tend to work at the same time which complicates their separate identification. Following an interest rate increase, for

instance, bank credit may decline due to either lower demand for loans (the interest rate channel and, possibly, the balance sheet channel), or reduced supply of loans (the bank lending channel), or both (Brooks, 2007).

Also, the operation of monetary transmission channels varies systematically across countries due to differences in the extent of financial intermediation; the size, concentration and health of the banking system; the development of capital markets; and structural economic conditions (Cechetti 1999). The depth, breadth and structure of the financial system determines the link between the monetary policy instruments under the control of the central bank (short-term interest rate, reserve requirements) and the variables that drive the conditions in the non-financial sector (e.g., loan and deposit rates; asset prices; and the exchange rate). The macroeconomic environment as well as structural features of the economy (e.g., degree of monetisation and dollarisation; cash-based payments system; size of the informal sector; openness of the economy and inflows of private and official financing resources) will determine the link between financial conditions and spending/investment decisions among households and firms.

**FIGURE 3:1 STYLISED REPRESENTATION OF THE TRANSMISSION MECHANISM**




SOURCE: AUTHOR

## 3.3 Methodological Review

From the plethora of economic literature reviewed, we observed that various methodologies have been explored and applied by researchers to identify the transmission mechanisms and effects of monetary policy on inflation and output. These can be classified into five main categories: the descriptive analysis approach; the big macro-econometric models; the small macroeconometric models; the Dynamic Stochastic General Equilibrium (DSGE) approach, also called the New Open Economy Macroeconomics (NOEM); and the variants of Vector Autoregressive (VAR) models such as the Structural Vector Autoregressive (SVAR) and the Vector Error Correction Models (VECM).

### 3.3.1 Descriptive Analysis Approach

The earliest approach is the descriptive analysis which observes and compares relevant economic variables to make inference about monetary transmission mechanism. Though this methodology is purely descriptive and very simple to handle, it is marred with some fundamental shortcomings. The most notable of these is that studies conducted using this methodology do not make use of basic econometric techniques to perform any empirical analysis and as such model specification and estimations are ignored. Since empirical results are lacking, it implies that conclusions made from such studies may not have any economic interpretation. Also, being descriptive in nature, it may not be suitable for our present study because it does not capture the direct and indirect effect of monetary policy on inflation and output as well as trace the transmission mechanism. Empirical works using this approach include Jimoh (1990) which examines the relevance and role of interest rate sensitivity in the demand for money as a means of explaining the channels of monetary influence. Uchendu (1996) also explores this methodology to identify the monetary transmission channel in Nigeria and came to a conclusion that the credit channel of monetary transmission exists and is more relevant to the Nigerian economy.

### 3.3.2 The Big Macroeconometric Model Approach

The second approach is the big macroeconometric models which usually specify all the important relationships in the economy and link the different markets together so that monetary policy transmission mechanism can be identified. Most of the studies on macroeconometric model used Ordinary Least Square (OLS) estimation techniques in arriving at the parameter estimates. Despite the advantages associated with OLS in terms of its simplicity and the best linear unbiased estimator (BLUE) property, it fails to capture the direct and indirect effects of monetary policy on domestic price and output. Also, empirical analyses using this type of methodology are known to require a large data for specific variables, often not available. This data-hurdle may seriously affect the estimation process. This aside, the approach has further been found to be lacking in transparency due to the theoretical assumptions underlying the different interrelated sectors which may eventually lead to the problem of misspecification (Tarawalie, 2008).

In exploring this methodology, Aron and Muellbauer (2000) developed a big macroeconometric model to forecast the effect of interest rate change on output for South Africa. They cited the presence of structural breaks from political and policy regime as a justification for its forecasting superiority over recursive forecasting from vector autoregressive model. They noted the inclusion of important monetary policy regime shift, which altered the output response to interest rates and the control for other structural changes (e.g., trade liberalisation), to have addressed the *Lucas critique* in forecasting output growth. They observe further that there are important and persistent effects of high real interest rate, which significantly constrained growth in the 1990s and potential growth benefits from fiscal discipline. Allen and Robinson (2004) empirical works further explore this methodology by constructing an aggregated macroeconomic model to simulate the behaviour of the Jamaican economy under different policy rules. The model provides them a platform to note the existence of a direct transmission from interest rate to exchange rates through portfolio substitution as well as to observe the impact of monetary policy on inflation in the second quarter after an innovation.

### 3.3.3 The Small Macroeconometric Model Approach

The third approach which specifies the important relationships that address specific channels of monetary transmission mechanism in the economy is the use of small macroeconometric models. Unlike the big macroeconometric models, this approach is not data-intensive and requires fewer variables. Formulating this model is anchored on sound economic theory whose parameter estimates are known to have salient economic interpretations. Aside from being easier to handle in terms of model specification and estimation, the model also provides linkages within and across equations in order to capture the direct and indirect effect of the monetary transmission mechanism. Fanelli and Paruolo (1999) explore this methodology for Italy and other members of the European Union countries before the adoption of the stage III of EMU while Brooks (2007) also designes something similar for Turkey. He builds the model for quarterly data on some financial variables such as liquidity, size, capitalisation of firms as well as dummies to proxy ownership status and stock market participation. His model is designed to test the effective propagation channel of monetary policy by the banking sector, depending on their liquidity position.

Modelling this approach for a Sub-Saharan country, Tarawalie (2008) did the same for Sierra Leone by building a small macroeconometric model in the form of a system of equations to study the transmission mechanism of monetary policy in the country. His empirical work used quarterly data on some macroeconomic variables such as real exchange rate, inflation, real GDP, interest rate, treasury bill rate, private sector credit and broad money (M2) from 1990 to 2006 to establish the channel through which monetary policy transmits to the real sector.

From the literature surveyed so far, most researches conducted using the second and third approaches above tend to adopt the Ordinary Least Square (OLS) estimation technique in arriving at the parameter estimates. In spite of its simplicity and "best linear unbiased estimator" property, using OLS to estimate the coefficients of macroeconometric models may be inappropriate since it tends to overestimate the coefficients. Also, macroeconometric models for monetary policy analysis are often designed with the intent of describing the interactions of key macroeconomic variables over the medium-term. Their main purpose, in

any case, is not to produce a forecast understood as best guess of the values of the main variables. Thus in reality, these models do not produce the forecast rather economists do. What such models can do, at best, is to provide a coherency check on the judgment that produces the main forecast. These models only allow for systematic analysis of risks to the forecast, including sensitivity to various assumptions, shocks and policy responses as well as provide a framework that can help to ask the right questions.

### 3.3.4 The Dynamic Stochastic General Equilibrium Approach

The fourth approach, recently being used everywhere by modellers is the dynamic stochastic general equilibrium (DSGE) model. The DSGE model, though emerging, is also called the New Open Economy Macroeconomics (NOEM). It is actually based on the New Keynesian thinking which merges Keynes ideas - that markets can fail - with the classical economics of rational human beings (Canova and Sala, 2005). The model follows the earlier rational expectations models of Lucas (1972) and Sargent and Wallace (1975) by stressing the role of expectations in the monetary transmission mechanism. As emphasized by Kimball (1995), by deriving these expectation forms for the IS and Phillips curves from completely spelt-out descriptions of the optimising behaviour of households and firms, the New Keynesian model takes advantage of the powerful microeconomic foundations introduced into macroeconomics through Kydland and Prescott's (1982) real business cycle model (Ireland, 2005). The DSGE model has the advantage of offering coherent frameworks for structuring policy discussions. However, a major problem with the use of this methodology is how to empirically validate its findings. The other challenge is how to effectively communicate the features of the methodology and the implications of its findings to policymakers and the general public. Overall, at their current stage these important limitations of DSGE are yet to be resolved. Rotemberg and Woodford (1997), Smets and Wouters (2003), Ireland (2004, 2005), Canova (2004), Canova and Sala (2005), Rubio and Rabanal (2005), Gali and Rabanal (2005) and Fernández-Villaverde, (2009) are among the authors who have explored this methodology.

### 3.3.5.1 The Vector Auto-regressive Approach

Vector auto-regressive (VAR) models and its variants are the fifth methodology known to have been extensively explored by various researchers in the developed, developing as well as quasi-emerging market economies of the world in their attempt at resolving the monetary transmission mechanism of their respective economies. The consideration and popularity of VAR as benchmarks in econometric modelling of monetary policy transmission followed the groundbreaking work of Sims (1980) and a widely accepted notion that this class of models provide a certain mix between a mere "data-driven" approach and an approach coherently based on economic theory (Fry and Pagan, 2005; Borys and Horvath, 2007; Ngalawa, 2009).

Sims (1992) estimates separate VARs for Japan, Germany, France, the United Kingdom and the United States of America using monthly data. His variables include industrial production, consumer prices and short-term interest rate as measures of monetary policy and money supply as well as exchange rate and commodity prices' indexes. He makes the identifying restriction that the interest rate variable potentially affects other variables contemporaneously, while the interest rate is not affected by innovations in any of the other variables. Also, similar to the identifying assumptions of Sims (1992) that monetary policy is predetermined, Bernanke and Blinder (1992) did a study on the credit channel in the United States, using the US federal funds rate, unemployment rate, logarithm of consumer price index (CPI), deposits, loans and securities. They were able to establish that both the conventional money demand and the credit mechanisms operate in the economy. They also established the time-lag between when a positive shock to the federal funds rate affects the volume of deposit held by institutions.

While making similar identifying assumptions as Sims (1992) and explicitly including commodity prices to avoid price puzzle, Christiano, Eichenbaum and Evans (1996) used US quarterly data to test the effect of monetary policy shocks. Variables used for their analysis include real GDP, the GDP deflator, commodity prices, US federal fund rate, non-borrowed reserves, total reserves and net funds raised through financial markets. Alternating between two policy variables, the federal funds rate and non-borrowed reserves, they establish the effect of a shock to US federal funds rate on the business sector as well as its lag

and duration. However, Weber, Gerke and Worms (2009), also exploring the VAR methodology, conducted a study of the Euro area to investigate if there has been any significant change in the overall transmission of monetary policy to inflation and output. The study used a few variables such as real GDP, domestic nominal short-term interest rate, GDP deflator and real housing wealth on quarterly data from 1980:1 to 2006:4. Their study provides a clear link between variation in monetary policy and the longrun responses of real output and inflation in the Euro area countries. They however cautioned that monetary policy should neither concentrate on too narrow a set of indicators nor ignore important explanations or models for inflation when judging its stance or making decisions premised on it.

Bonci and Columba (2008) followed the work of Christiano, Eichenbaum and Evans (1998) by adopting a recursive vector auto regression (VAR) approach on quarterly data from 1980 to 2002 to identify the impacts of monetary policy shocks on the Italian economy. Their model variables consist of industrial production index; CPI; import price of raw materials; the nominal exchange rate of the Italian lira vis-à-vis the German mark; a policy interest rate, the repo rate; and a monetary aggregate (M2). All the variables, except exchange and interest rates were seasonally adjusted. The variables were ordered from the most exogenous (starting from the left) to the most endogenous, reflecting their identifying assumption that policy shocks (i.e. shocks to interest rate) have only lagged effects on the first four variables in their equation. In addition, they include four lags in the VAR model, driven by established criteria selection approach.

Motivated by the vast literature, they also explored different specifications of the VAR model. In particular, they considered different interest rates, such as the three month interest rate, the overnight interest rate and different averages of these rates and of the repo rate, as policy rate. They also considered GDP measures as an alternative to industrial production. Moreover, they went further by attempting to use other monetary aggregates in place of M2, such as M1 and M3 measured with simple or moving averages and different definitions of each aggregate. Alternative measures of inflation (the GDP deflator) and of commodities' prices (including or excluding oil) and a number of definitions of the exchange rate were also used: effective, vis-à-vis the German mark, vis-à-vis the US dollar, real or

nominal. In an attempt to control for commodity prices exogeneity, they observed a problem in the quality of monetary aggregates response with other variables also showing no improvement. From this, commodity prices were assumed exogenous. Finally, even if the focus of the study was not concerned with structural parameters, the researchers excluded the last four years of the sample to account for a possible change in the monetary policy regime at the begining of the single currency era and detected no significant changes in results.

In order to explain the Belarusian economy's response to unexpected changes in monetary policy and exogenous variables, Horvath and Maino (2006) conducted an investigation also exploring a VAR model on monthly data from 1995 to 2005. Their study made use of variables such as real GDP, CPI, real exchange rate, inter-bank rate, US federal funds rate and monetary aggregate. The research provides a link between exchange rate pass-through and prices as well as between interest rate policy variations and the financial market developments or sophistication. It highlighted the extent to which fiscal dominance and government intervention in the financial markets are explored to control the exchange rate, the direction, size and terms of credit with respect to their impact on monetary policy transmission in an economy.

Using VAR model on variables of interest such as real effective exchange rate, real output, foreign exchange reserves, US federal funds rate, interest rate, three-month CD rates, retail spread for quarterly data from 1996:Q1 to 2005:Q1 to examine the transmission mechanism of monetary policy in Jordan; Poddar, Sab and Khachatryan (2006) provided a link between the current operating target of monetary policy, the spread between three-month CD rates as well as the influence of the US federal funds rate on bank retail rates and foreign exchange reserves. The short-term period of their data which precludes them from making any strong statements about longrun relationships between variables and the structural reforms of unprecedented magnitude that occurred during the period of analysis, remains a strong caveat to the reliability of their results.

Kuijs (2002) carried out an empirical investigation of monetary policy transmission mechanism and inflation in Slovak using VAR model. Monthly data series between 1993 and 2000 were used for some unique variables such as changes in foreign prices, the wage costs, modest effect of aggregate demand and the exchange rate. The study, apart from providing a

link between monetary policy variation and price, also establishes the lag between policy variation and economic variables. Also, a similar study of monetary transmission mechanism in Egypt, Al-Mashat and Billmeier (2007), using VAR model, confirms the existence of a monetary policy transmission channel to real variables and added that the introduction of interest corridor bodes well for the country's adoption of inflation targeting over the medium term.

### 3.3.5.2 The Structural Vector Autoregressive Approach

In terms of monetary policy analysis, the VAR methodology has further been extended by various authors such as Sims (1986), Bernanke (1986), Blanchard and Watson (1986), Shapiro and Watson (1988), Blanchard and Quah (1989), Gerlach and Smets (1995); Leeper, Sims and Zha (1996); and Christiano, Eichenbaum and Evans (1998). Using structural VAR – a variant of VAR – for analysis has the advantage that the necessary restrictions on the estimated reduced form model, required for identification of the underlying structural model, can be provided by economic theory. These restrictions can be either contemporaneous or longrun in nature depending on whether the underlying disturbances are considered to be temporary or permanent in nature. Once the identification is achieved it is possible to recover the structural shocks. These shocks can then be used to generate impulse response and variance decomposition functions to assess the dynamic impact of shocks on different economic variables. Further, these functions can be used to test whether such shocks affect the economic variables as economic theory would predict, thus providing a check on the theory.

Angeloni, Kashyap, Mojon and Terlizzese (2003) among other authors have applied this SVAR methodology for the developed countries while Borys and Horváth (2007) have also used it to examine the effects of Czech monetary policy on the economy within the VAR, structural VAR and factor-augmented VAR frameworks. They used variables such as GDP, CPI, net price index, nominal exchange rate, inter-bank interest rate and real-time output gap instead of GDP for their analyses. Their rationale for using the real-time output gap instead of current GDP growth is that the former results in estimates that are more precise. Regarding prices at the sectoral level, tradables adjust faster than non-tradables, in line with microeconomic evidence on price stickiness. There is no price puzzle, as our data

come from a single monetary policy regime. The results indicate a rather persistent appreciation of the domestic currency after a monetary tightening, with a gradual depreciation afterwards.

Some other authors have also explored this approach for some Sub-Saharan African countries. This include Mugume (2009) who deploys the SVAR model for MTM in Uganda using variables such as GDP, broad money, CPI, interest rate, nominal effective exchange rate, lending rate and credit to the private sector and employed monthly data series. He confirms the capability of monetary policy to influence economic activity and inflation. At about the same period, Ngalawa (2009) conducted an empirical study of monetary transmission mechanism in Malawi using the SVAR methodology**.** With the aid of monthly data for 1988:1 to 2005:12 on a good number of macroeconomic variables such as gross domestic product (GDP), broad money (M2), consumer price index (CPI), bank rate, exchange rate, reserve money and credit to private sector. His study provides a veritable link between monetary policy and some key economic variables.

### 3.4 Empirical Review

Various studies have been conducted by researchers to establish the transmission mechanism of monetary policy and the effects of its shocks on output and inflation. While most of these studies were done using various econometric tools of analysis, it is interesting to note that the empirical debate still remains inconclusive. For instance, establishing the existence of a lending channel in any country may not be as easy as the econometric tools available may want to predict. This may either be due to; changes in interest rates which usually occur in response to changes in economic conditions, making it difficult to recover the pure effect of the interest rate change on economic activities from the data or because all channels of monetary transmission tend to work at the same time which complicates their separate identification (Brooks, 2007). The aforementioned challenges notwithstanding, this section still documents a review of some empirical works carried out in both the developed and developing economies in the attempt to explain the existing transmission channels of monetary policy.

### i) Interest Rate Channel

The interest rate channel works through the effect of real interest rate developments on aggregate demand. The traditional Keynesian view postulates that monetary policy can influence the *real cost of borrowing* by setting nominal short-term interest rates. Owing to price rigidities, nominal interest rate changes lead to corresponding real interest rate changes which have an impact on business, inventory investment as well as on consumer durable spending. Sims (1992) evidence on the effects of monetary policy in five OECD countries shows that in all the countries under study, there are significant negative responses of output to positive innovation on interest rates. He makes the identifying restriction that the interest rate variable potentially affects other variables contemporaneously while the interest rate is not affected by innovations in any of the other variables. He went on to conclude that the response of output to interest rate innovations is similar in all the countries examined while output has a hump-shaped response to monetary policy shocks.

In order to explain the Belarusian economy's response to unexpected changes in monetary policy and exogenous variables, Horvath and Maino's (2006) show a significant exchange rate pass-through to prices and interest rate policy following, instead of leading the financial market developments. Their study also reveals that the transmission mechanism is significantly affected by the economy's financial structure—the sophistication of financial markets, the financial condition of the banking system, the degree of dollarisation (widespread domestic use of foreign currencies for transactional purposes and as a store of value), balance sheet heterogeneity—and by the macroeconomic environment. A remarkable conclusion from their findings is that an important issue with respect to the effectiveness of monetary policy transmission in Belarus is the extent of fiscal dominance and of government intervention in the financial markets, aimed at controlling the exchange rate and the direction, size and terms of bank lending.

Also using a VAR framework for the period 1997 to 2000 to examine the monetary transmission mechanism in Mexico, Martinez, Sanchez and Werner (2001) support the above findings. The result of their research shows that interest rate, in addition to its effect through the exchange rate, has significant effects on aggregate demand and ultimately on the price level. Even though they find a high pass-through of changes in the exchange rate to prices in

Mexico, they concluded their findings with a note that interest rate significantly influence the lending-deposit rate spread which in turn has a significant impact on output. However, using similar techniques for Slovak Republic, Kuijs (2002) observes clearly that monetary policy variation affects inflation significantly. Using data of higher frequency on a different set of economic variables; the researcher concludes that interest rate is the transmission channel of monetary policy in Slovak Republic. Further in the researcher's opinion, change in the money supply seems to have a modest but rapid impact on prices while the measured effect of interest rate changes on output and price levels is modest and gradual but appears to have become more important in recent years.

While most studies reviewed focus their attention on measuring the effects of monetary policy on output, Clements, Kontolemis and Levy (2001) focus their attention on determining the relative strength of the different channels through which monetary policy affects output. Thus, deviating from the common trend, they carried out a study of ten euro area countries to unravel the strength of the various channels through which monetary policy is transmitted to macroeconomics variables especially price level and output. They find out, like Ehrmann (2000) and Mojon (2000) did, that the interest rate channel rather than the credit and exchange rate channels explains larger proportion of the observed channel through which macroeconomic variables respond to monetary policy shock across the euro area countries. According to Clements et al (2001), "the assessment of the reasons behind differences in the strength of the transmission mechanism reveal that the interest rate channel was by far the dominant factor easily over-shadowing the effects of the exchange and credit channels in most countries". Some years later, Weber, Gerke and Worms (2009) claim they could not ascertain the existence of any channel of monetary transmission and came to the conclusion that changes in the transmission process have not altered the long run responses of real output and inflation to monetary policy.

Also, investigating the transmission mechanism of monetary policy in Czech Republic, Borys and Horváth (2007) included real-time output gap instead of GDP. Their rationale for using the real-time output gap instead of current GDP growth is that using the former results in better precise estimates. They find that a contractionary monetary policy shock has a negative effect on the degree of economic activities and the price level, both with

a peak response after about one year. Their results also indicate a rather persistent appreciation of the domestic currency after a monetary tightening, with a gradual depreciation afterwards.

However, prior to the study above, in a separate investigation carried by Arnostova and Hurnik (2005) on Czech Republic for a sample from 1998 to 2004 - after the adoption of inflation targeting – a different result was obtained. They find that prices respond with a peak after around five to six quarters from the time of shock, albeit, there is some evidence for a price puzzle in the first two quarters after the shock. They also observe that output fell after monetary contraction with a peak after about one year but there was a delayed overshooting in the exchange rate, as it depreciated only after some four to five quarters after the monetary policy innovation. Also similar to the findings of Christiano, Eichenbaum and Evans (1996) and Bernanke and Gertler (1995) where prices only respond to monetary policy after seven to eight quarters; Clements et al (2001) observe that for between eight and twelve quarters, - the period of peak output response in most countries - the interest rate channels in most countries under investigation accounted for about 80 percent of the effects of monetary policy. Flowing from this, Clements et al (2001) warn that while the credit channel appears important in a few countries of the euro-area, the overarching importance of differences in the strength of the interest rate channel should not be forgotten.

Cheng (2006) examined the impact of a monetary policy shock on output, prices and the nominal effective exchange rate for Kenya and lends support to the interest rate channel. From his findings, he contends that an exogenous increase in short-term interest rate will lead to a fall in prices and an appreciation of the nominal exchange rate but with insignificant impact on output. His empirical findings further suggest that Kenya's nominal exchange rate is highly susceptible to monetary policy given its appreciation following an increase in the short term interest rates. He concludes that this probably reflects the mobility of capital associated with interest rate differentials vis-à-vis other countries. He further reveals that variations in the short-term interest rate account for significant fluctuations in the nominal exchange rate and prices while accounting little for output fluctuations. Mugume (2009) conducted a similar investigation for Uganda using the same methodology, data set but adding credit to the private sector as well as lending rate to replace the variables that

represented the economy's openness, that is, oil price and US federal funds rate. He affirms that interest rate is the transmission channel through which monetary policy is propagated to the real sector. However, he cautions that the capability of monetary policy to influence economic activities and inflation is still limited and also, that this channel remains weak even though there is some evidence of transmission to prices of changes in treasury bills rate.

Notably, the results from several studies comparing the monetary transmission mechanism in euro area countries were found to have varied considerably though "they share a few common threads" (Britton and Whitely, 1997). Gerlach and Smets (1995) in a study of some euro area countries conclude that while the effects of monetary policy shocks on output and inflation were not vastly different across countries, they were somewhat larger in Germany than in France or Italy. Dornbusch, Favero and Giavazzi (1998), however, observe that the effects of changes in the short term-interest rates on output- holding the intra euro area exchange rate constant- was about twice as large in Italy as in Germany and France, and about three times as large as in Spain. Ramaswamy and Sloek (1998) however opine that the full effect of an unanticipated contraction in MP on output in Austria, Belgium, Finland, Germany, and the Netherlands took twice as long to occur and was twice as deep in France, Italy, Portugal and Spain.

Following the findings in the above studies, among others, that part of the differences in the response of economic activities to monetary policy during the pre-EMU period reflect differences in monetary policy reaction functions rather than different transmission mechanisms; Clements, et al (2001) did investigation to identify the differences in the monetary policy transmission mechanism across the countries in the euro area. They constructed an empirical model on the basis of common reaction functions and their result confirm that even when a common monetary policy is implemented, its effects on economic activities are likely to differ across EMU countries. They also constructed an aggregate measure for the effect of monetary policy on prices and output to examine the relative strength of the credit, exchange rate and interest rate channels of monetary transmission. From this, they conclude that the interest rate channel rather than the credit and exchange rate channels explains the larger proportion of the observed differences in the transmission mechanism across countries. Further, they conclude that the heterogeneous response only

reflects the differences in reaction functions across countries and the relative importance countries attached to achieving low inflation. Also, that inflation is likely to assume a more prominent role in the European Central Bank's objective function than it had for many countries during the Exchange Rate Mechanism (ERM) period. In summarising their findings, they note that the timing and depth of the response to interest rate shocks vary markedly among countries, suggesting that, in the absence of other off-setting policies (e.g. fiscal policy), a common monetary policy could still further exacerbate divergences in cyclical positions.

In sum, the contention is that interest rate, like the other monetary transmission channels remain largely ineffective in the face of underdeveloped financial intermediation and only rudimentary capital markets and non-bank financial institutions. Most pertinent however is the fact that the effectiveness of the monetary transmission channel may be constrained in Nigeria as in most other transition and developing economies by a number of factors. Two among which are the transmission of policy interest rates to market interest rates may be incomplete and because spending and investment decisions may be insensitive to the availability and cost of credit. Both factors seriously hamper the effectiveness of monetary policy in emerging and developing economies.

**ii) Exchange Rate Channel**

Empirical evidence has shown that, although the interest rate channel is the most important transmission channel in industrial countries with developed financial markets, the exchange rate channel is generally the dominant channel of monetary policy transmission in transition economies (Coricelli, Égert, and MacDonald, 2005; Al-Mashat and Billmeier, 2007 and Dabla-Norris and Floerkemeier, 2006). Likewise, the exchange rate channel is particularly important in small open or developing economies with flexible exchange rates. The channel assumes that changes in the monetary policy stance are directly reflected in the exchange rate as it exerts influence on the external position through changes in aggregate demand and supply and, ultimately, output. When compared to other transmission channels,

this mechanism seems to generally constitute the most important channel of monetary policy transmission, especially in countries with underdeveloped financial markets.

In the light of this, Saizar and Chalk (2008) employed the VAR model to carry out a study which examined how monetary policy can transmit its effects to the real economy when credit is low. Their findings reveal that monetary policy relies on the belief that, by changing the interest rate in money markets, they can impact the cost of credit to households and firms and thus affect overall economic activities and inflation through this channel. However, empirical evidence from the data available to them suggests that the effectiveness of changes in policy interest rates in influencing the path of inflation appears to be unrelated to the level of credit and that, instead, the willingness to allow exchange rate flexibility is a far more important determining factor. Thus, when controlling for the exchange rate regime, it is clear that allowing for exchange rates to move flexibly is a far more important factor in ensuring that monetary policy can influence domestic inflation.

In a similar attempt at unraveling the transmission mechanism of monetary policy for Armenia by Dabla-Norris and Floerkemeier (2006), they find out that the capability of monetary policy to influence economic activity and inflation remains limited since the important channels of monetary transmission are not fully functional. They also observe that, as in other emerging and transition economies with a high degree of dollarisation, the exchange rate channel has a strong impact on inflation rate. Also, that the interest rate channel in particular remains weak, though there is some evidence of transmission to prices of changes in the repo rate.

Lyziak (2001), in an attempt to explain the transmission mechanism for Poland, undertook a thorough overview of the relative importance of different monetary policies in Poland using the Bernanke and Blinder (1988) model. His study reveals that the exchange rate channel is the quickest way to affect inflation, and that the real appreciation of the exchange rate constituted an important pillar of the Polish dis-inflationary process. However, Al-Mashat and Billmeier (2007), also using a VAR model, did an evaluation of the monetary transmission mechanism in Egypt and came to a conclusion that the exchange rate channel plays a strong role in propagating monetary shocks to both output and prices and that other channels such as bank lending and asset price are rather weak. They, however discover from

their findings, that the interest rate channel is underdeveloped though it appears to be strengthening with the introduction of the interest rate corridor since 2005. These conclusions confirm Durevall and Ndung'u's (1999) earlier finding, using Kenya data from 1974 to 1996, that exchange rate has long-term effects on prices while interest rates and money supply have short-term effects.

Contrary to the opening paragraph claim that "the exchange rate channel is generally the dominant channel of monetary policy transmission in transition economies", the presence of an independent exchange rate channel is controversial. Friedman (1980) refutes the role of the exchange rate in the transmission of monetary policy, arguing that monetary policy affects output and prices through changes in asset portfolios and in investment decisions. He argues further that the movements in the exchange rate are only a consequence of these on output and prices, either domestically or abroad. Thus, even if one is ready to accept the existence of an exchange rate channel, as described by the asset theory of the exchange rate, the issue arises whether the latter is independent from the interest rate channel. In fact, one could argue that the capital inflows that generate a worsening of the terms of trade and a reduction of net exports are induced by the same increased differential in domestic and foreign interest rates that generate lower investment.

### iii) Credit Channel

There are two versions of the credit channel. One is the bank lending which relies on the dual nature of banks as holders of reserve-backed deposits and as originators of loan. The second is the balance sheet which focuses on the supply of funds from all financial intermediaries and markets and has no special role for the banks. It arises from the presence of asymmetric information problems in credit markets.

The empirical evidence in support of a bank lending channel, in most countries, is mixed. Bernanke and Blinder (1992) carried out a study on the credit channel in the USA and find that both the conventional money demand and the credit mechanisms are in operation. Also that a positive shock to the federal funds rate reduces the volume of deposits held by institutions immediately after the shock and peaks after nine months. In addition after a

period of two years, the entire long run impact of the decline in deposits is reflected in loans. They conclude that their findings support the operation of a credit channel. Christiano, Eichenbaum and Evans (1996) used VAR estimation techniques for US quarterly data to test the effect of monetary policy shocks on macroeconomic variables. They make similar identifying assumptions as Sims (1992) and explicitly included commodity prices to avoid the price puzzle. The policy variables used alternately were the federal funds rate and non-borrowed reserves. Their results show that the initial effect of a positive shock on the federal funds rate is to increase net funds raised by the business sector for almost a year which declines thereafter.

In the United States, Kashyap and Stein (2000) find that small and illiquid banks are more responsive to monetary policy actions. Kishan and Opiela (2000) establish that small banks with low capital base tend to contract their lending during monetary contractions more than other banks. Ashcraft (2006) argues that though bank loans are special for small firms, they are not special enough to make the lending channel important for monetary transmission in the United States. However, in the euro area, results vary across time and countries. In a case study, Favero, Gavazzi and Flabbi (1999) find no evidence for the bank lending channel following the tightening of monetary conditions in 1992 in France, Germany, Italy and Spain. Liquidity appears to be an important factor in determining the effects of monetary policy in most euro countries, except Finland and Portugal (Erhmann, Gambacorta, Martinez-Pages, Sevestre and Worms, 2001). Bank size is found to make a difference in Greece (Brissimis, Kamberoglou, and Simigiannis, 2001) and the Netherlands. In addition, loan supply of well-capitalised banks is less responsive to monetary policy shock in the Netherlands and Portugal (Erhmann, et al., 2001).

For emerging market countries, there seems to be more support for the bank lending channel. Poddar, Sab and Khachatryan (2006) observe that monetary policy has been successful in influencing reserves as well as in driving bank deposit and lending rates. They conclude that monetary policy has been less successful in influencing aggregate activity with little evidence found for the claim that the operating target of the central bank has an impact on output. They also do not find any evidence of monetary policy significantly affecting economic activity as aggregate activity responds marginally to changes in bank lending rates.

Brooks (2007) however observes that bank liquidity has a significant effect on loan supply. This suggests that the effect of monetary policy can be transmitted through the banking sector, depending on its liquidity position. Evidence also emerge from Ahmed, Shah, Agha and Mubarik (2005) for Pakistan to establish that bank lending channel is the mechanism through which monetary policy propagates its effects on aggregate spending and price.

An earlier attempt at explaining the monetary transmission mechanism in Nigeria was provided by Uchendu (1996) wherein he finds out that the credit channel of monetary policy exists and is more relevant to the Nigerian economy. Uanguta and Ikhide (2002) conducted an investigation of monetary transmission mechanism for Namibia and came out with a result showing that a tightening of monetary policy, as evidenced by an increase in the repo or bank rate, causes lending rates to increase in the domestic economy leading to a decrease in private investment and hence a decrease in output. Their finding further lends credence to the importance of the bank lending channel**.** In another study of the monetary transmission channel in Sierra Leone, Tarawalie (2008) establishes bank lending channel as the means through which monetary policy are transmitted to the real sector in the economy.

These empirical findings notwithstanding, review of literature show that two key conditions must be satisfied for the bank lending channel to operate. The *first* essential element is that banks should not be able to fully shield their loan portfolios from changes in monetary policy. The presumption here is that banks cannot offset completely the decline in liquid funds - due to restrictive monetary policy - by resorting to alternative sources of funding without incurring additional costs. The *second* crucial element is that there should be a substantial group of borrowers, firms or consumers, that cannot insulate their spending from the reduction in bank credit else, they will depress real investment and consumption (Bernanke and Blinder, 1988; Bernanke and Gertler, 1995; Farinha and Marques, 2001). Brooks (2007) indicates that banks can play a role in monetary transmission mechanism and that bank liquidity has a significant effect on loan supply. This suggests that, depending on its liquidity position, the effect of monetary policy can be propagated by the banking sector.

**iv) Asset Price Channel**

Empirical findings of Fillardo (2004) reveal that there are at least two reasons for considering the stock price channel as irrelevant in Hungary. *First*, there is no empirical evidence that monetary policy affects stock prices since only estimates for the instantaneous impact of monetary policy decisions on the Hungarian stock market index are available. Rezessy (2005) finds no effect, which is in contrast with Rigobon and Sack (2004), who note significant decreases in major US stock market indices after an unexpected tightening. Taking into account the ability of stock markets to absorb news quickly, it is hard to imagine that monetary policy shocks have only a delayed effect on equity prices. *Second*, shares play a minor role in Hungarian households' financial wealth amounting typically to approximately ten percent of all financial assets during the past ten years. The same is true for other securities, like government bonds. Their amount has never exceeded ten percent of total assets. Even households' financial wealth itself is not as large as in more developed countries. At the end of 2004, total financial assets excluding items that are not supposed to play a role in the asset price channel (cash, deposits, insurance technical reserves) amounted to 40percent of the country's annual GDP.

According to the findings of Egert and MacDonald (2006), the asset price channel is still of limited importance and is probably going to remain a low profile transmission channel. Stock and bond markets matter little to investment and consumption decisions through the wealth and income effects, given that these markets are dominated massively by foreign investors rather than by domestic ones. As a consequence, price movements on these markets have limited impact on the domestic economy via these two effects, though the effect of monetary policy via the property market appears not very important for the time being, this channel may grow more powerful in the future with the dynamic development of borrowing related to housing.

Housing wealth may play a more important role in the asset price channel, as its market value is more than three times larger than household financial assets. Kiss and Vadas (2005) estimated the effect of an interest rate increase on house prices. Feeding their results into the consumption function of the country's central bank quarterly projection model, they obtained an estimate that combines the asset price channel with the credit channel, as the

consumption function cannot distinguish between the two mechanisms. They also detect a significant effect of the interest rate on private consumption and housing investments through house prices. However, comparing the result to other macro-level estimates like Vonnák (2005) and taking into account the relative size of the interest rate shock, we can conclude that even the housing market is unable to explain the effect of monetary policy.

The above notwithstanding, if market valuation is believed to play a role in investment decisions, large fluctuations in asset prices unrelated to fundamentals which lead to over or undervaluation of asset prices, can cause over or under-investment. This raises the question of whether monetary policy should respond to asset price bubbles. A question which is all the more relevant since asset price booms and busts are observed to occur on a regular basis. On this, Bernanke and Gertler (2000) opine that monetary policy should react to asset prices only if they influence expected future inflation. It is also argued that reacting to asset prices may induce increased inflation volatility. However, Alexandre (2002) demonstrates that reacting to non-fundamental shocks to asset prices leads not only to more stability in inflation and asset prices but also to more stable investment and thus, ultimately, to more stable output. Filardo (2004) argues that monetary policy should step in only in the event that an asset price bubble has macroeconomic implications (macroeconomic asset price bubble). Although it may prove tricky to identify and to react to such bubbles, Cecchetti et al. (2000) consider uncertainty not to exceed that prevailing for other parts of the monetary transmission mechanism.

**v) Cash Flow Channel**

Attempting to affirm the existence of cash flow channel in their country, Christiano, Eichenbaum and Evans (1996) conducted a study of the effects of monetary policy shocks on the economy of the United States of America. They observe that net funds raised by the business sector rose for roughly a year after contractionary monetary policy shocks. Thereafter, as the recession induced by the policy shocks took hold, net funds raised by the business sector declined. They thus conjecture that the initial rise in net funds raised reflects

a deterioration in firms' cash flow due to a fall in sales, an initially unchanged level in production and a rise in inventories.

Bonci and Columbia (2008) conclude from their empirical findings that the result for the main macroeconomic aggregates are consistent with the literature and do not seem to be affected by the empirical puzzles that have plagued a number of works. Moreover, new features of the transmission of monetary policy shocks are provided through the flow-of-funds responses. Non-financial firms were observed to have decreased both their acquisition of new financial assets and their issuance of liabilities up to a year after the shock; there is no strong evidence in favour of financial frictions that would prevent firms from adjusting their nominal expenditures promptly. In the first quarter after the shock, households increase their short-term liabilities, diminish the acquisition of liquid assets and shares and increase the amount of securities in their portfolio. The public sector increases net borrowing (the public deficit rises) until almost two years after the shock. However, financial corporations decrease the funds borrowed up to three quarters while during the same period, the foreign sector increases the amount of borrowed funds (i.e. Italy's net external position improves).

On the time lag between when monetary policy actions are taken and when the impacts are transmitted to the real sector of the economy**,** Borys and Horváth (2007) observe specifically that in Czech, the degree of economic activities falls after a contractionary monetary policy shock with a bottom after about one year (11 to 14 months). This seems to be similar, in terms of persistence of responses of economic variables to monetary shocks, to the transmission in more developed countries, including the euro zone (e.g. Mojon and Peersman, 2001). Their results point to the usefulness of monthly data, as opposed to quarterly data, in cases where the time span under study is relatively short. According to the authors, using the monthly data enable them to obtain the results that are in line with economic theory, a finding which contrasts some previous empirical studies on the Czech Republic that have employed the quarterly data.

While Kuijs (2002) observes that it takes around ten months for changes in monetary policy to impact macroeconomic variables in Slovak, Bernanke and Blinder (1992) used monthly data to test whether tight monetary policy reduces bank lending in the USA. They find that after a monetary contraction, banks' holdings of deposits and securities dropped

immediately while bank loans fell only after six months. They interpret this lagged response of loans as either supporting or refuting a bank lending channel and argue further that this evidence supports bank-lending effects, since there is a persistent decline in loans. In addition, empirical analysis of monetary transmission in the USA by Cecchetti (1994) also establishes that output growth is significantly correlated with money growth at lags of up to ten years. They however maintain that there are several possible interpretations of this finding but that they strongly suggest monetary shocks have something to do with aggregate real fluctuations

Findings from the composite model of Ngalawa (2009) indicate that the bank rate is a more effective tool of monetary policy than reserve money. According to him, while bank rate shocks account for 4.8 percent of the fluctuations in output after six months, 7.8 percent after one year, 5.8 percent after two years and 6 percent after five years, reserve money shocks account for 0.6 percent of the output fluctuations after six months, 3.5 percent after one year, 8 percent after two years and 4.1 percent after five years. He interprets this to mean that interest rate shocks account for a larger proportion of the fluctuations in output up to one year and, thereafter, reserve money shocks account for most of the variations in output. Reserve money shocks are found to account for only 0.9 percent of the fluctuations in consumer prices after six months, 1.1 percent after two years and 0.5 percent after four years while bank rate shocks account for 0.7 percent of the fluctuations in consumer prices after six months, 3.7 percent after two years and 7.7 percent after four years, illustrating that the bank rate accounts for most of the consumer price variations given the two operating targets.

The bank lending model of Ngalawa (2009) also shows that Bank lending responds to a 2.2 percent sudden increase in the bank rate with a decline, recording the lowest point at 1.7 percent below baseline after two years. He finds this response to be significant between twelve and thirty months. M2 is also observed to respond to the shock with an instantaneous decline of 0.8 percent, before rising in the next six months and declining thereafter. The response is marginally significant between sixteen and twenty-four months. Also, an unanticipated 5.7 percent increase in bank lending causes output to rise, peaking at 1.3 percent above baseline after fifteen months while a sudden 5.8 percent increase in M2 also causes output to rise, peaking at 1.6 percent above baseline after five months.

Overall, he concludes by claiming that output fluctuations are largely attributed to M2 up to about one year, exchange rates at about two years and bank lending from about three years and beyond. Collectively, bank lending, exchange rates and M2 account for 8.12 percent of the fluctuations in output after one year, 19.4 percent after two years, 28 percent after three years and 36.9 percent after five years. Excluding own shocks, variations in consumer prices are mostly accounted for by exchange rates up to about three years and by bank lending thereafter.

All the above notwithstanding, various literature search reveal that the transmission mechanism of monetary policy is not only affected by an economy's financial structure—the sophistication of financial markets, the financial condition of the banking system, the degree of dollarisation, balance sheet heterogeneity—but also by the macroeconomic environment. Needless, therefore, to state that a key component for the effectiveness of monetary policy transmission is the extent of fiscal dominance and of government intervention in financial markets aimed at controlling the exchange rate, and the direction, size, and terms of bank lending. Thus, given the over-reliance of the Nigerian economy on crude oil revenue and its role in determining the government's expenditure, fiscal dominance remains an important factor to consider in conducting any study to determine the transmission mechanism of monetary policy in Nigeria.

Also, in dollarised economies, it is critical - especially for monetary policy formulation - to take a close examination of the economy from a balance sheet perspective with an emphasis on currency, maturity and capital structure mismatches. The balance sheets of banks, firms and households in many emerging and developing economies have liabilities mostly denominated in foreign currency while assets are largely denominated in domestic currency. This is a clear case of *currency mismatch* which exposes them to exchange rate risk. *Maturity mismatches* of liabilities and liquid assets expose balance sheets to roll-over or liquidity risk and to interest rate risk. Finally, *capital structure mismatches* stem from relying on debt rather than equity to finance investment. This leads to a decline in dividends when income falls while at the same time, debt service remains unchanged, claiming a larger portion of income.

Flowing from the foregoing, there is no doubt that there exists various channels through which monetary policy shock is transmitted to output and inflation while the literature also reveal that different policy instruments have different effects on output and prices. Another important observation from the review of literature is that; most of the empirical works carried out on developing countries conclude with exchange rate, interest rate and bank lending channels as the monetary transmission channels in operation in the country under study. This review is thus concluded with a note that, the importance of any given channel depends on the structure and development of the economy under study.

# CHAPTER FOUR
# THEORETICAL FRAMEWORK AND METHODOLOGY

This chapter presents the theoretical framework for the research. Specifically, the theoretical relationship between monetary policy shocks and economic variables is highlighted. Following this, the empirical model, estimation techniques and procedure are examined. The types and sources of data used for the empirical analysis are also discussed and the chapter concludes by presenting the error correction model.

## 4.1 Theoretical Framework

For several years, empirical investigations of the channels through which the effects of monetary policy are transmitted to the real sector were conducted based on the IS-LM model. Hence, general discussion and analysis of the transmission mechanism and its theoretical framework has remained rooted mainly in the IS-LM framework – a model introduced by Hicks (1937) which relates money and the interest rate to aggregate income or output. The proposition of Hicks (op. cit) is that, if the monetary authority decides to embark on contractionary monetary policy, then the interest rate will rise. The resultant increase of the interest rate, for instance, on the cost of borrowing is to reduce both consumption and investment spending so that aggregate spending fluctuates in tandem with changes in money stock. And since aggregate spending, output and income are the same in a closed economy, output and spending will change together.

Following a detailed and exhaustive analysis of empirical research works conducted to unravel the propagation mechanism of monetary policy to the real sector of the economies of some developed and developing countries, the channels of monetary policy transmission deemed to be operational in Nigeria are mainly the Interest Rate, Exchange Rate and Credit (Bank Lending). In line with this, we provide a detailed analysis of the framework for each of these channels, establishing the link between monetary policy shocks and macroeconomic aggregates separately.

### 4.1.1 Credit (Bank Lending) Channel

The bank lending model is a component of the credit channel of monetary transmission. The underlying argument in the credit channel is that asymmetric information and costly enforcement of contracts create agency problems in financial markets (Bernanke and Gertler, 1995). Two mechanisms explain this process: balance sheet and bank lending. The balance sheet model operates through the net worth of business firms (Mishkin, 1995) and transmission occurs either through equity prices or interest rates and firms' cash-flows. These will affect the severity of adverse selection and moral hazard problems, which in turn impact on lending, investment and output. Owing to data constraints, the balance sheet channel is not pursued further in this study.

The credit channel operates via the influence of monetary policy on the supply of money and bank loans, that is, the quantity rather than the price of credit. A contractionary monetary shock reduces bank reserves and therefore the total amount of bank credit available, leading to a fall in investment by bank-dependent borrowers and possibly in consumer spending. In essence, the impact of a contractionary shock on the policy rate will be to significantly raise the bank lending interest rates. The effect of this shock on private sector credit will then be to cause a rise in inflation due to decline in investment and output.

Thence, for the workings of credit channel in Nigeria, a monetary policy tightening by the authority will effectively limit commercial banks' ability to supply loans by reducing bank reserves. Thus, a reduction in the amount of excess reserves and the commercial banks' inability to substitute bank reserves with alternative sources of investment funds could make Nigerian banks respond speedily to any restrictive policy measure. Equally important is the extent to which economic agents are dependent on bank financing. Even though substantial inflows of remittances via money transfers could serve as leverage to firms' sources of finance for business and real estate investment in Nigeria, arguably, the impact of this has not been sufficient to inhibit the effectiveness of the credit market. Finally, though there exists the informal sector which operates in the shadow economy and relies on cash for transactions, the magnitude of this is not sufficient to be a constraint to the effectiveness of the credit channel in the Nigerian economy.

### 4.1.2 Exchange Rate Channel

Monetary policy can influence the exchange rate through interest rates (via the risk-adjusted uncovered interest rate parity), direct intervention in the foreign exchange market or inflationary expectations. Changes in the exchange rates could affect aggregate demand and the price level through their influence on: the cost of imported goods; the cost of production and investment; international competitiveness and net exports; and firms' balance sheets in the case of high-liability dollarisation. There are several reasons to expect the nominal exchange rate to have an important influence on inflation and aggregate demand in Nigeria. First, the effect of exchange rate changes on inflation may be significant due to the relatively high share of imports in GDP (estimated to be around 25 percent in 2008). Second, there is a significant amount of foreign currency cash in Nigerians' portfolios and Nigerian aggregate demand is substantially affected by the development of remittance flows from abroad. Consequently, any appreciation or depreciation of the local currency can result in a wealth effect with a potential impact on consumption spending. Third, changes in the real exchange rate have implications for the international competitiveness of exports and import-competing goods.

### 4.1.3 The Interest Rate Channel

The interest rate channel works through the effect of real interest rate developments on aggregate demand. As postulated by the traditional Keynesian view, monetary policy will influence the real cost of borrowing by setting nominal short-term interest rates. Thus, owing to price rigidities, nominal interest rate changes will lead to corresponding real interest rate changes which will have an impact on business, housing and inventory investment as well as on consumer durable spending. In Nigeria case therefore, aggregate demand should respond to changes in bank lending rates, though at an indeterminable rate, given the levels of monetisation and financial intermediation in the economy. From our understanding of the Nigerian economy, even though there are handfuls of foreign currency-denominated loans to the private sector and the multinational companies, the magnitude of these has not in any way impacted the responsiveness of borrowers to domestic interest rate movements. Market segmentation alongside with competition among banks cannot be said to have any

meaningful impact on the interest rate elasticity of demand for deposits and loans. This is evidenced by the high and persistent banking spreads which hovers between 12 and 20 percentage points in Nigeria.

## 4.2 Methodology

In this section, several aspects of the methodology for this thesis are discussed. They include models, key variables including the modalities of measuring them and data sources as well as estimation techniques.

### 4.2.1 Model Specification

The theoretical framework discussed in the previous section analysed the nature of the relationship between monetary policy shocks and macroeconomics variables in the Nigerian economy. In line with this, we specify the relationship between output in the economy and the other variables to be used for this study in a general form as presented in equation (4.1) below:

$$RGDP = f(RM, IR, M2, CPS, NEER, CPI) \quad --- \quad (4.1)$$

From equation (4.1), output, proxy by real gross domestic product (RGDP) is stated to be dependent on reserve money (RM), bank interest rate (IR), broad money (M2), credit to the private sector (CPS), nominal effective exchange rate (NEER) and price level proxy by the consumer price index (CPI).

All the variables in equation (4.1) above are assumed endogenous and dynamic meaning they are determined within the model. This is consistent with the underlying theoretical framework that is, exchange rate, interest rate and credit channels that explain the interrelationships among the variables in equation (4.1).

The inclusion of seven variables in this study is premised on the need to avoid erosion of degrees of freedom and further over-parameterisation of the model. The choice of these variables for the basic model is based mainly on the hypothesised workings of the monetary transmission mechanism in terms of monetary policy instruments' variables and target variables. The level of output, as measured by the real GDP and price level captures the macroeconomic variables that constitute the major targets of monetary policy action.

Contextually, the macroeconomic objectives to be targeted in this study are twofold; increasing output and minimizing inflationary tendency in the economy. The analysis of the SVAR model places strong emphasis on identifying the channels through which monetary policies are propagated to the real sector of the economy.

### 4.2.2 Key Variables

Bank interest rate $(IR_t)$ , also called the minimum rediscount rate (MRR) is defined as the rate at which the central bank provides short-term loans to commercial banks and discount houses in its function as a lender of last resort. The choice of this rate hinges on the fact that it represents the anchor for the determination of other rates. In our preliminary analysis, experimentations with other forms of interest rates, especially the lending rate, show that there is no significant difference between the empirical results emanating from the use of different rates. This is because the various interest rates move in tandem throughout this period of the analysis. The variable enters the estimable model as an instrument target of monetary policy. Reserve money $(RM_t)$ is also employed as an instrument target of monetary policy in the model. Components of $RM_t$ are identified as total cash reserves held by the central bank, vault cash in commercial banks and currency held by the non-bank public. The credit to the private sector ($CPS_t$) variable captures commercial bank loans and advances to the private sector and it enters the SVAR as an intermediate target of monetary policy. Similarly, exchange rate $(NEER_t)$ enters the model as an intermediate target of monetary policy. Nominal effective exchange rates of the Nigerian naira (₦) vis-à-vis the United States dollar (US$) as reported by the CBN adjusted for relative movements in general prices of Nigeria and its major trading partners are used as a proxy for $NEER_t$. Aggregate money supply is measured by the sum of currency in circulation, demand deposits plus savings and time deposits (M2). The use of broad money as proxy for money supply has become popular in literature on research conducted in the developed and developing countries alike, though in the latter their money and capital market is still developing. This is mainly because the line of division between the narrow and broad money is waning by the day. This variable also enters the model as an intermediate target of monetary policy. Consumer price indexes $(CPI_t)$ are measured by all items as national composite consumer

price index. The variable enters the model as a monetary policy goal. A measure of output $(RGDP_t)$ enters the model as a monetary policy goal as well.

### 4.2.3 Data Sources and Type

The study employs quarterly time series data for 1970:Q1 to 2008:Q4 from the annual series available during the period. The starting and the cut-off dates correspond to the date when the latest data on all variables of interest was available. In our empirical analysis, we also took the natural logarithm of the real GDP, broad money, consumer price level, nominal effective exchange rate, credit to the private sector and reserve money. Apart from aiding interpretation and compactness of results presentation, this form of transformation tend to reduce heteroskesdasticity significantly (Enders, 2004). The major source of data for this study is the CBN statistical bulletin of 2008.

### 4.2.4 Estimation Techniques

Given that a simultaneous equation system models the dynamic relationship between the endogenous and exogenous variables, a vector representation of the Structural Vector Autoregression (SVAR) system can therefore be given by the equation below:

$$Ax_t = C(L)x_{t-1} + Dz_t \quad --- \quad (4.2)$$

where A is an invertible $(n \times n)$ matrix of variable coefficients describing contemporaneous relations among the variables. The elements of the square matrix, A, are the structural parameters on the contemporaneous endogenous variables and $C(L)$ is a *kth* degree matrix polynomial in the lag operator L. $D$ is an $(n \times n)$ matrix whose non-zero off–diagonal elements allow for direct effects of some shocks on more than one endogenous variable in the system. The vector Z above is assumed to consist of unobservable variables, interpreted as disturbances to the structural equations while $x_t$ and $z_t$ are vectors with length equal to the number of structural equations in the model[3].

[3] If observable exogenous variables exist, they are included as explanatory variables in the VAR.

The key features of the structural form of the model are that there may be simultaneous links between the elements of vector $x_t$ , defined by the matrix of coefficients $A$. Thus, to transform the structural VAR specification model in 4.2 above into a reduced-form/ standard VAR representation model, we therefore pre-multiply it by $A^{-1}$ as follows:

$$x_t = A^{-1}C(L)x_{t-1} + A^{-1}Dz_t \quad --- \quad (4.3)$$

which in standard matrix form we write as follows with $x_t$ defined exclusively in terms of a vector of predetermined variables:

$$x_t = \sum_{i=1}^{p} \Psi_i x_{t-i} + e_{t'} \quad ---(4.4)$$

where $\Psi_1 = A^{-1}C$ and $e_t = A^{-1}Dz_t$ is an $(n \times 1)$ vector of error terms assumed to have zero means, constant variances and to be serially uncorrelated with all the right hand side variables as well as their own lagged values though they may be contemporaneously correlated across equations. The variance-covariance matrix of the regression residuals in equation (4.4) is defined as $\sum = E\left(e_t, e_t'\right)$.

Given the estimates of the reduced form VAR in equation 4.4, the structural economic shocks are separated from the estimated reduced form residuals by imposing restrictions on the parameters of matrices A and D as in equation 4.5:

$$Ae_t = Dz_t \quad ---(4.5)$$

derived from equation 4.3.

We identify structural model from the above by making the following assumptions:

(i) orthogonality of the structural disturbances, $e_t$ ;

(ii) macroeconomic variables do not simultaneously react to monetary variables, while the simultaneous feedback in the reverse direction is allowed for, and

(iii) monetary block of the model reflects the operational procedures implemented by the monetary policymaker (Favero, 2001).

The orthogonality assumption of the structural innovations that is, $E\left(z_t, z_t^{'}\right)=1$, and the constant variance-covariance matrix of the reduced-form equation residuals, that is $\Sigma = E\left(e_t, e_t^{'}\right)$ impose identifying restrictions on A and D as presented below in equation 4.6:

$$A\sum A^{'} = DD^{'} --- (4.6)$$

The matrix $\Sigma$ is the variance/covariance of the estimated residuals, $e_t$, of the standard VAR.

$$\sum_e = E\left[e_t e_t^{'}\right] = A^{-1}DE\left[z_t z_t^{'}\right]D^{'}A^{-1^{'}} = A^{-1}D\Omega D^{'}A^{-1^{'}} --- \quad (4.7)$$

Given
$$\left.\begin{aligned} e_t &= \left[A^{-1}Dz_t\right] \\ \Sigma_t &= E\left[e_t e_t^{1}\right] \end{aligned}\right\}$$

where: E is the unconditional expectations operator and $\sum_e$ is the covariance matrix for the shocks.

$$\left.\begin{aligned} z_t &\sim N(0,\Omega) \\ e_t &\sim N(0,\Sigma_t) \end{aligned}\right\} \quad --- \quad (4.8)$$

An ordinary least squares estimate of the VAR provides an estimate of $\sum_e$ which can then be used with equation 4.8 to obtain estimates of A, D and $\Omega$.

Since matrices A and D are both $(n \times n)$, a total of $2n^2$ unknown elements can be identified upon which $n(n+1)/2$ restrictions are imposed by equation 4.6 . To identify A and D, therefore, at least $2n^2 - n(n+1)/2$ or $n(3n-1)/2$ additional restrictions are required. These restrictions can be imposed in a number of ways. We use the Sims' (1980) recursive factorisation approach based on a Cholesky decomposition of matrix A which assumes that elements of matrix A are recursively related and are, therefore, lower triangular. The implication of this relationship is that identification of the structural shocks is dependent on the ordering of variables, with the most endogenous variable ordered last (Favero, 2001). Thus, with a given ordering, the first variable has no contemporaneous relationships with all other variables in the model, indicating that its reduced form shock is identical to its structural shock; the second variable has contemporaneous interactions only with its own and

the first structural shock; the third variable is contemporaneously affected by its own and the first two structural shocks and so on. However, in this framework, the system is just (exactly) identified. The exactly identified or just identified condition is obtained when the number of information is equal to the number of parameter to be estimated. It is only under the exactly or just identified and over-identified conditions that the estimation process can take place.

### 4.2.5 Estimation Procedures

The procedure for operating a straightforward SVAR involves a number of discrete steps. First, we need to determine the order of integration of the variables. The next step involves estimating the reduced form VAR, ensuring that enough lags are incorporated to ensure no serial correlation in the residuals. An important aspect in specification of the VAR is the determination of the lag order of the autoregressive lag polynomial since all inference in the VAR model depends on the correct model specification. We therefore use established information criterion to determine the optimal lag length, that is, seeking to measure the closeness of an estimated model to the true data-generating process over the domain of the regressand. There are various other test procedures for the determination of the lag length but the commonly used ones are the Akaike, the Schwartz and the Hannan-Quinn information criteria.

In several contributions, the effect of lag length selection has been demonstrated. Lutkepohl (1991) indicates that selecting a higher order lag length than the true lag causes an increase in the mean square forecast errors of the VAR and that under-fitting the lag length often generates auto-correlated errors. Braun and Miinik (1993) show that impulse response functions and variance decompositions are inconsistently derived from the estimated VAR when the lag length differs from the true lag length. Johansen (1991) and Gonzalo (1994) point out that VAR order selection may affect proper inference on cointegrating vector and rank. After the reduced form VAR is estimated, we then impose sufficient restrictions to identify the structural parameters of the model.

For the purpose of this study, seven variables are included in the SVAR, namely; Output and consumer prices which enter as policy goals or the ultimate targets; reserve money and bank lending rate as operating targets; and commercial bank loans to the private

sector, exchange rates and broad money as intermediate targets. The structural shocks in equation 4.6 are identified according to the following scheme:

$$A=\begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & a_{34} & a_{35} & a_{36} & a_{37} \\ a_{41} & a_{42} & 0 & 1 & 0 & 0 & 0 \\ a_{51} & a_{52} & 0 & 0 & 1 & a_{56} & 0 \\ 0 & 0 & 0 & a_{64} & 0 & a_{66} & 0 \\ 0 & 0 & a_{73} & a_{74} & a_{75} & a_{76} & 1 \end{pmatrix}; \quad e_t=\begin{pmatrix} e_t^{RGDP} \\ e_t^{CPI} \\ e_t^{CPS} \\ e_t^{NEER} \\ e_t^{M2} \\ e_t^{IR} \\ e_t^{RM} \end{pmatrix}$$

$$D=\begin{pmatrix} d_{11} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & d_{22} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & d_{33} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & d_{44} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & d_{55} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & d_{66} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & d_{77} \end{pmatrix}; \quad z_t=\begin{pmatrix} z_t^{RGDP} \\ z_t^{CPI} \\ z_t^{CPS} \\ z_t^{NEER} \\ z_t^{M2} \\ z_t^{IR} \\ z_t^{RM} \end{pmatrix} \quad - - - \quad (4.9)$$

The non-zero coefficients $a_{ij}$ and $d_{ij}$ in matrices A and D, respectively, show that any residual $j$ in matrices $e_t$ and $z_t$, in that order, has an instantaneous impact on variable $i$. The first two equations suggest that output and consumer prices are sluggish in responding to shocks to monetary variables in the economy. This scheme is based on the observation that most types of real economic activities may respond only with a lag to monetary variables because of inherent inertia and planning delays (Karame and Olmedo, 2002). Proposed by Bernanke and Mihov (1995), the validity of this argument has been supported by a number studies (Cheng, 2006; Becklelmans, 2005; Vonnak, 2005; Karame and Olmedo, 2002).

Commercial bank loans and advances to the private sector are postulated to be contemporaneously affected by all variables in the system. Blundell-Wignall and Gizycki (1992) argue that expectations of future activity form an important determinant of credit demand by economic agents. Assuming current output, price level, exchange rates, interest

rates and money supply give some indication of what is expected in the future (Becklelmans, 2005) and that economic agents are indeed forward looking, bank lending may respond contemporaneously to all variables in the system.

Modelling contemporaneous responses of exchange rates to other variables in a SVAR is relatively standard across studies. Becklelmans (2005) uses a real trade-weighted exchange rate index in a study of Australia and assumes that the index responds instantaneously to all variables in the system. Borys and Horvath (2007) in a study of the Czech Republic and Piffanelli (2001) in a study of Germany assume all variables in the system affect exchange rates instantaneously. In a study of Kenya, Cheng (2006) employs a nominal effective exchange rate and maintains that the exchange rate responds contemporaneously to all variables in the SVAR. Thus, given the depth of Nigeria's financial sector while the exchange rate may respond contemporaneously to changes in the level of output and consumer prices, there is reason to believe that it may also respond contemporaneously to monetary variables as well.

Some studies include variables that specifically capture external price shocks, most common of which are oil price shocks. Oil price disturbances are usually singled out among other shocks. Other studies also incorporate international financial market interest rate shocks and the Federal Reserve Bank Funds Rate has been widely used as a proxy for these shocks. This study, however, does not explicitly model the external shocks for two reasons. One of which is the fact that, it is expected that any disturbance in the external sector will be captured by the exchange rate variable. The other very important reason is that, the complete SVAR analysed in this study has seven variables, which is already large by SVAR standards. Increasing the number of variables without proper justification, therefore, is likely to reduce the power of the model without making meaningful additions.

The fifth equation in 4.9 above is a standard money demand function. The equation postulates that money demand behaviour in the country makes aggregate money supply respond contemporaneously to changes in consumer prices, output and interest rates but not to other variables in the system, akin to Sims and Zha (1998). The last two equations constitute the monetary policy feedback rule. While the Central Bank of Nigeria's tacit desire is to target inflation via reserve money, there is reason to believe that the monetary authority

also target short-term interest rates. The study, therefore, assumes that the country employs hybrid operating procedures, with the bank rate and reserve money as operating targets. In this framework, both interest rates and reserves are expected to contain information about monetary policy (Bernanke, 1996). The country's effective operating target, accordingly, is determined empirically.

The monetary policy feedback rule is drawn on the assumption that information delays impede policymakers to react within the present to economic activity and price level developments (Karame and Olmedo, 2002). Both the bank rate and reserve money, therefore, do not respond contemporaneously to output and consumer prices. The bank rate, specifically, responds contemporaneously to exchange rates only. While exchange rate data is available real-time, data on other variables including bank loans and monetary aggregates is usually available to the monetary authorities with a lag. Reserve money, on the other hand, is assumed to respond contemporaneously to all monetary variables because by its definition, this information is inherent in the monetary aggregate.

### 4.2.6 Analysis

Analysis of the SVAR is carried out in three modular experiments. First, a generic model comprising the country's monetary policy goals and operating targets is estimated. Output and price levels enter the model as policy goals while bank rate and reserve money go in as operating targets. The rationale for estimating the generic model is to establish how the two monetary policy goals respond to each of the operating targets and to find out if monetary authorities react to changes in the policy goals. In addition, the estimated generic model is used to determine which of the two monetary policy operating-targets has a greater impact on the policy goals. At the second level of analysis; bank lending, exchange rates and interest rate, representing three different transmission processes, are separately appended to the generic model and estimated. At the third and final level of analysis, all variables found to hold important information in the country's monetary transmission process are pooled and a composite SVAR is estimated.

### 4.2.7 Generic Model

Investigation of the monetary transmission process commences with a simple four variable generic model. The vector of endogenous variables included in the model is presented in equation 4.10:

$$RGDP_t = f[CPI_t, IR_t, RM_t] \quad ----(4.10)$$

Following the identification scheme in system of equation 4.10, the equation separating structural economic shocks from the estimated reduced form residuals for the generic model is presented as:

$$\begin{pmatrix} 1 & 0 & 0 \\ a_{21} & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} e_t^{CPI} \\ e_t^{IR} \\ e_t^{RM} \end{pmatrix} = \begin{pmatrix} d_{11} & 0 & 0 \\ 0 & d_{22} & 0 \\ 0 & 0 & d_{33} \end{pmatrix} \begin{pmatrix} z_t^{CPI} \\ z_t^{IR} \\ z_t^{RM} \end{pmatrix} \quad ----(4.11)$$

#### 4.2.7.1 Channels of Monetary Transmission

In line with our outlined objective, we move the analysis further from the generic model to examination of more specific transmission channels for the purpose of establishing the monetary transmission process. The three channels deemed to exist in Nigeria are therefore considered, *viz.*, bank lending, exchange rates and interest rate channels, with particular attention to measuring the importance of each channel in the transmission process.

#### 4.2.7.2 BANK LENDING CHANNEL

The bank lending model is a component of the credit channel of monetary transmission. The underlying argument in the credit channel is that asymmetric information and costly enforcement of contracts create agency problems in financial markets (Bernanke and Gertler, 1995). Two mechanisms explain this process: balance sheet and bank lending. The former model operates through the net worth of business firms (Mishkin, 1995) and transmission occurs either through equity prices or interest rates and firms' cash-flows. These will affect the severity of adverse selection and moral hazard problems, which in turn impact on lending, investment and output. Owing to data constraints, the balance sheet channel is not pursued further in this study.

The bank lending model, on the other hand, operates through quantity rather than price of credit. A monetary policy shock is assumed to be transmitted through changes in bank reserves, the total amount of available bank credit and lending. The channel presumes that

firms facing informational frictions in financial markets rely on bank loans for external finance because it is prohibitively expensive for them to issue securities in the open market (Disyatat and Vongsinsirikul, 2003). A decline in available bank credit, therefore, adversely affects investments and output. Appending commercial bank loans to equation 4.11 transforms the generic model to a bank lending model and the corresponding vector of endogenous variables becomes:

$$RGDP_t = f[CPI_t, CPS_t, IR_t, RM_t] \quad ----(4.12)$$

$$\begin{pmatrix} 1 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 \\ a_{31} & a_{32} & 1 & a_{34} \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} e_t^{CPI} \\ e_t^{CPS} \\ e_t^{IR} \\ e_t^{RM} \end{pmatrix} = \begin{pmatrix} d_{11} & 0 & 0 & 0 \\ 0 & d_{22} & 0 & 0 \\ 0 & 0 & d_{33} & 0 \\ 0 & 0 & 0 & d_{44} \end{pmatrix} \begin{pmatrix} z_t^{CPI} \\ z_t^{CPS} \\ z_t^{IR} \\ z_t^{RM} \end{pmatrix} \quad ----(4.13)$$

### 4.2.7.3 THE EXCHANGE RATE CHANNEL

Taylor (1995), Obstefield and Gertler (1995) and others have drawn attention to monetary policy operating through exchange rates and net exports. Monetary policy can influence the exchange rate through interest rates, direct intervention in the foreign exchange market or inflationary expectations. The changes in the exchange rate, in turn, affect aggregate demand through the cost of imported goods, the cost of production and investment, international competitiveness and firms' balance sheets in the case of high-liability dollarisation (Dabla-Norris and Floerkemeier, 2006). We shall be investigating the channel by appending the exchange rate variable to the generic model. The vector of endogenous variables in the exchange rate model is, accordingly, presented as follows:

$$RGDP_t = f[CPI_t, NEER_t, IR_t, RM_t] \quad ----(4.14)$$

The five variables in the model are output, consumer prices, exchange rates, bank rate and reserve money. In line with system of equations (4.5), the model is identified according to the following scheme:

$$\begin{pmatrix} 1 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 \\ a_{31} & a_{32} & 1 & a_{34} \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} e_t^{CPI} \\ e_t^{CPS} \\ e_t^{IR} \\ e_t^{RM} \end{pmatrix} = \begin{pmatrix} d_{11} & 0 & 0 & 0 \\ 0 & d_{22} & 0 & 0 \\ 0 & 0 & d_{33} & 0 \\ 0 & 0 & 0 & d_{44} \end{pmatrix} \begin{pmatrix} z_t^{CPI} \\ z_t^{CPS} \\ z_t^{IR} \\ z_t^{RM} \end{pmatrix} \quad ----(4.15)$$

#### 4.2.7.4 THE INTEREST RATE CHANNEL

An alternative channel of monetary transmission is the traditional Keynesian view which postulates that monetary policy can influence the *real cost of borrowing* by setting nominal short-term interest rates. The channel emphasizes the role of interest rates in the transmission mechanism, elevating the process to a direct link between changes in aggregate money supply and absorption (Bolnick, 1991). According to this view, owing to price rigidities, nominal interest rate changes lead to corresponding real interest rate changes which have an impact on business, housing and inventory investment as well as on consumer durable spending. These occur primarily because of the existence of a time lag between observing the impulses and being able to distinguish between permanent and transitory impulses and real and nominal shocks. Appending to the generic model, the vector of endogenous variables in the interest rate model is presented as:

$$RGDP_t = f[CPI_t, IR_t, M2_t, RM_t] \quad ----(4.16)$$

where: the five variables in the model are output, consumer prices, bank rate, broad money and reserve money. Following the identification scheme in system of equations (4.5), the model is identified as:

$$\begin{pmatrix} 1 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 \\ a_{31} & a_{32} & 1 & a_{34} \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} e_t^{CPI} \\ e_t^{M2} \\ e_t^{IR} \\ e_t^{RM} \end{pmatrix} = \begin{pmatrix} d_{11} & 0 & 0 & 0 \\ 0 & d_{22} & 0 & 0 \\ 0 & 0 & d_{33} & 0 \\ 0 & 0 & 0 & d_{44} \end{pmatrix} \begin{pmatrix} z_t^{CPI} \\ z_t^{M2} \\ z_t^{IR} \\ z_t^{RM} \end{pmatrix} \quad ----(4.17)$$

#### 4.2.7.5 THE COMPOSITE MODEL

The possibility that bank lending, exchange rate and interest rate channels may contain important additional information for the country's monetary transmission process from the analysis carried out in the previous section cannot be ruled out. In the light of this, a composite model of monetary transmission in Nigeria can be drawn with the following vector of endogenous variables:

$$RGDP_t = f[CPI_t, CPS_t, NEER_t, M2_t, IR_t, RM_t] \quad ----(4.18)$$

identified according to system of equations (4.6). Impulse responses for the consolidated model over some period of years shall then be carried out. This will help establish the most important channels of monetary transmission in the Nigerian economy.

Following this, a general identification scheme based on short run restrictions developed in system of equations (4.9) will then be used for identifying structural shocks in each of the models. Analysis in the study shall be carried out only for the short run to conform with the subject matter under investigation. In essence, since there is a general consensus among economists that monetary policy affects only the price level in the long run, there shall be little or no need in extending the investigation of the monetary transmission process to cover the long run.

**ERROR CORRECTION MECHANISM (ECM)**

If the variables in our empirical model have unit roots from the Augmented Dickey-Fuller (1979) and Phillips-Perron (1988) tests conducted, then we can capitalise on the likelihood of co-movements in their behaviour hence, the possibilities that they trend together towards a long run equilibrium. Premised on Granger representation theorem (Engle and Granger 1987), the error correction model is specified as follows:

$$\left.\begin{aligned}\Delta RGDP_t = \alpha + \sum_{i=1}^{N}\beta_i \Delta RGDP_{t-i} + \varphi \Delta CPI_t + \sum_{j=1}^{M}\delta_j \Delta CPI_{t-j} + \eta \Delta RM_t + \sum_{k=1}^{P}\Phi_k \Delta RM_{t-k} + \\ \psi \Delta IR_t + \sum_{l=1}^{Q}\gamma_l \Delta IR_{t-l} + \sigma \Delta CPS_t + \sum_{h=1}^{R}\lambda_h \Delta CPS_{t-h} + \partial \Delta M2_t + \sum_{f=1}^{S}\xi_f \Delta M2_{t-f} + \\ \mu \Delta NEER_t + \sum_{g=1}^{V}\varpi_g NEER_{t-g} + \theta Z_{t-1} + \varepsilon_t\end{aligned}\right] \quad ---(4.19)$$

where: $\alpha, \beta, \varphi, \delta, \eta, \Phi, \psi, \gamma, \sigma, \lambda, \partial, \xi, \mu, \varpi, \theta$ are the parameter estimates, $\Delta$ denotes the first difference operator and $\varepsilon_t$ is a random error term.

Equation 4.19 implies that the first differences of the variables are explained by lagged differences and the lagged stationary linear relationship, $Z_{t-1}$.

Thus, the nature of the error correction term is what determines the nature of the cointegration relationships among the variables (Engsted and Bentzen, 2001). If the cointegrating relations (equilibrium conditions) are imposed, the error correction models describe the way output will adjust towards their equilibrium state in each time period. In the short run, deviation of output from their long run equilibrium path will feed back on their future changes in order to force their movement towards the long run equilibrium state since the variables are supposed to be cointegrated. The cointegration term is known as the *error correction* term since the deviation from long run equilibrium is corrected gradually through a series of partial short run adjustments. The cointegrating vectors from which the error correction terms are derived are each indicating an independent direction where a stable, meaningful long run equilibrium exists. The coefficients of the error correction terms, however, represent the proportion by which the long run disequilibrium in the dependent variable is corrected in each short-term period.

# CHAPTER FIVE

# ANALYSIS OF EMPIRICAL RESULTS

The preoccupation of this chapter is to investigate the time series properties of the SVAR model variables of this study and present its empirical findings. Specifically, the statistical and time series properties of the variables are discussed in order to explicitly establish compatibility of the series with the inherent characteristics of the models vis-à-vis the estimation techniques employed.

## 5.1. Statistical Properties of the Variables

The characteristics of the annual time series data used in the regression analysis are presented in the summary statistics table below. It provides information about the means, medians, standard deviations as well as the skewness and Jarque-Bera statistics of each variable. As indicated by the various statistics in Table 5.1, the variables are not haphazardly distributed. The mean values of the natural log of real gross domestic product (RGDP) and the natural log of consumer price index (CPI) are 11.77 and 1.86 respectively while the mean of values of bank rate of interest (IR) and natural log of reserve money (RM) stood at 14.67 and 10.14 respectively also. The summary of statistics Table 5.1 also provides information on other explanatory variables such as the natural logs of amount of credit to the private sector, nominal effective exchange rate (NEER) and broad money (M2).

**Table 5.1: Summary Statistics of Variables**

| Sample: 1970:I - 2008:IV | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **RGDP** | **CPI** | **NEER** | **CPS** | **M2** | **IR** | **RM** |
| Mean | 11.77 | 1.86 | 3.22 | 10.70 | 11.25 | 14.67 | 10.14 |
| Median | 12.37 | 1.70 | 4.60 | 10.30 | 10.76 | 16.50 | 9.38 |
| Maximum | 13.42 | 5.26 | 4.73 | 15.88 | 16.03 | 29.80 | 14.14 |
| Minimum | 8.35 | -1.47 | -1.61 | 5.86 | 6.89 | 6.00 | 5.96 |
| Std. Dev. | 1.49 | 2.30 | 2.04 | 2.75 | 2.59 | 6.66 | 2.56 |
| Skewness | -1.12 | 0.06 | -1.09 | 0.06 | 0.07 | 0.25 | -0.01 |
| Kurtosis | 2.97 | 1.49 | 2.76 | 1.99 | 1.94 | 2.01 | 1.68 |
| | | | | | | | |
| Jarque-Bera | 32.44 | 14.85 | 31.54 | 6.73 | 7.37 | 7.95 | 11.30 |
| Probability | 0.00 | 0.00 | 0.00 | 0.03 | 0.03 | 0.02 | 0.00 |
| | | | | | | | |
| Observations | 156 | 156 | 156 | 156 | 156 | 156 | 156 |

Further, the skewness and standard deviation statistics show that the variances of the variables are not unnecessarily large while the Jarque-Bera statistics of each variable accepts the null hypothesis of normality at one per cent level of significance. Also, given the time scope of the study (1970:I to 2008:IV) and the frequency of the data (quarterly), all the variables have 156 observations.

## 5.2. Stationarity Tests

Rather than the exception, it is the rule in time series analysis to investigate the stationarity of macroeconomic variables before they are used in regressions. The reason for this is that estimation with non-stationary variables results in bias and inconsistency of the estimates of coefficient standard errors thus increasing the likelihood of drawing false inferences. Due to this and Enders' (1995) suggestion that "it is safer to use two types of unit root tests", the variables for our analysis are subjected to two types of unit root tests to determine whether they are stationary series or non-stationary series. If the results from these unit root tests reinforce each other, then we have confidence in the results. The tests employed are the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP). For both tests, two models are considered: with drift as well as with drift and trend. The null hypothesis in both the ADF and PP tests is the presence of unit root.

The results of the unit root test as presented, based on the PP and the ADF test statistic using both the Akaike and Schwarz information criteria, indicate that all the variables under consideration exhibit unit roots at different critical levels. However, none of the variables was found stationary in levels. The variables are only found stationary after differencing once. This implies that the variables are integrated of order one (I(1)). The unit root results are presented in Tables 5.2, 5.3 and 5.4 below.

Appendix 2 also provides a graph showing the trends of the data in the variables of the model to be estimated.

**Table 5.2: Unit Root Test Result Using Augmented Dickey-Fuller**

| Variable | | ADF using (AIC) | | Decision |
|---|---|---|---|---|
| | | With Drift | With Drift & Trend | |
| RGDP | Level | -2.134051 | 1.975052 | I(1) |
| | ΔLevel | -12.7485 | -12.8803 | |
| M2 | Level | 0.277984 | -2.386134 | I(1) |
| | ΔLevel | -3.522293 | -3.548122 | |
| RM | Level | -0.724024 | -2.833557 | I(1) |
| | ΔLevel | -3.752137 | -3.750775 | |
| IR | Level | -1.45827 | -1.430317 | I(1) |
| | ΔLevel | -9.803652 | -9.813752 | |
| CPI | Level | -0.604036 | -2.067708 | I(1) |
| | ΔLevel | -3.647734 | -3.627714 | |
| NEER | Level | -1.607933 | -1.428179 | I(1) |
| | ΔLevel | -12.32883 | -12.33341 | |
| CPS | Level | 0.77461 | -1.88318 | I(1) |
| | ΔLevel | -3.46324 | -3.54105 | |

| | CRITICAL VALUES | |
|---|---|---|
| | 1% | 5% |
| (i) Auxilliary Regression with Drift | -3.472813 | -2.880088 |
| (ii) Auxilliary Regression with Drift and Trend | -4.018748 | -3.439267 |

(iii) Δ represents first difference operator

**Table 5.3: Unit Root Test Result Using Augmented Dickey-Fuller**

| Variable | | ADF using (SIC) | | Decision |
|---|---|---|---|---|
| | | With Drift | With Drift & Trend | |
| RGDP | Level | -2.134051 | -1.975052 | I(1) |
| | ΔLevel | -12.7485 | -12.8803 | |
| M2 | Level | 0.277984 | -2.386134 | I(1) |
| | ΔLevel | -3.522293 | -3.548122 | |
| RM | Level | -0.724024 | -2.833557 | I(1) |
| | ΔLevel | -3.752137 | -3.750775 | |
| IR | Level | -1.45827 | -1.430317 | I(1) |
| | ΔLevel | -9.803652 | -9.813752 | |
| CPI | Level | -0.604036 | -2.067708 | I(1) |
| | ΔLevel | -3.647734 | -3.627714 | |
| NEER | Level | -1.607933 | -1.428179 | I(1) |
| | ΔLevel | -12.32883 | -12.33341 | |
| CPS | Level | 0.70444 | -1.82612 | I(1) |
| | ΔLevel | -3.81777 | -3.88376 | |

| | CRITICAL VALUES | |
|---|---|---|
| | 1% | 5% |
| (i) Auxilliary Regression with Drift | -3.472813 | -2.880088 |
| (ii) Auxilliary Regression with Drift and Trend | -4.018748 | -3.439267 |

(iii) Δ represents first difference operator

**Table 5.4: Unit Root Test Result Using Phillips-Perron**

| Variable | | PP | | Decision |
|---|---|---|---|---|
| | | With Drift | With Drift & Trend | |
| RGDP | Level | -2.185773 | -1.935429 | I(1) |
| | ΔLevel | -12.75159 | -12.91157 | |
| M2 | Level | 0.492624 | -2.967089 | I(1) |
| | ΔLevel | -16.60027 | -16.60581 | |
| RM | Level | -0.506785 | -2.3937 | I(1) |
| | ΔLevel | -14.09597 | -14.05967 | |
| IR | Level | -1.869974 | -2.598298 | I(1) |
| | ΔLevel | -14.79955 | -16.92982 | |
| CPI | Level | -0.168143 | -2.06442 | I(1) |
| | ΔLevel | -14.60826 | -14.56133 | |
| NEER | Level | -1.645284 | -1.47121 | I(1) |
| | ΔLevel | -12.32883 | -12.33332 | |
| CPS | Level | 0.4005 | -2.77334 | I(1) |
| | ΔLevel | -17.12366 | -17.13431 | |

| | CRITICAL VALUES | |
|---|---|---|
| | 1% | 5% |
| (i) Auxilliary Regression with Drift | -3.473096 | -2.880211 |
| (ii) Auxilliary Regression with Drift and Trend | -4.018748 | -3.439267 |

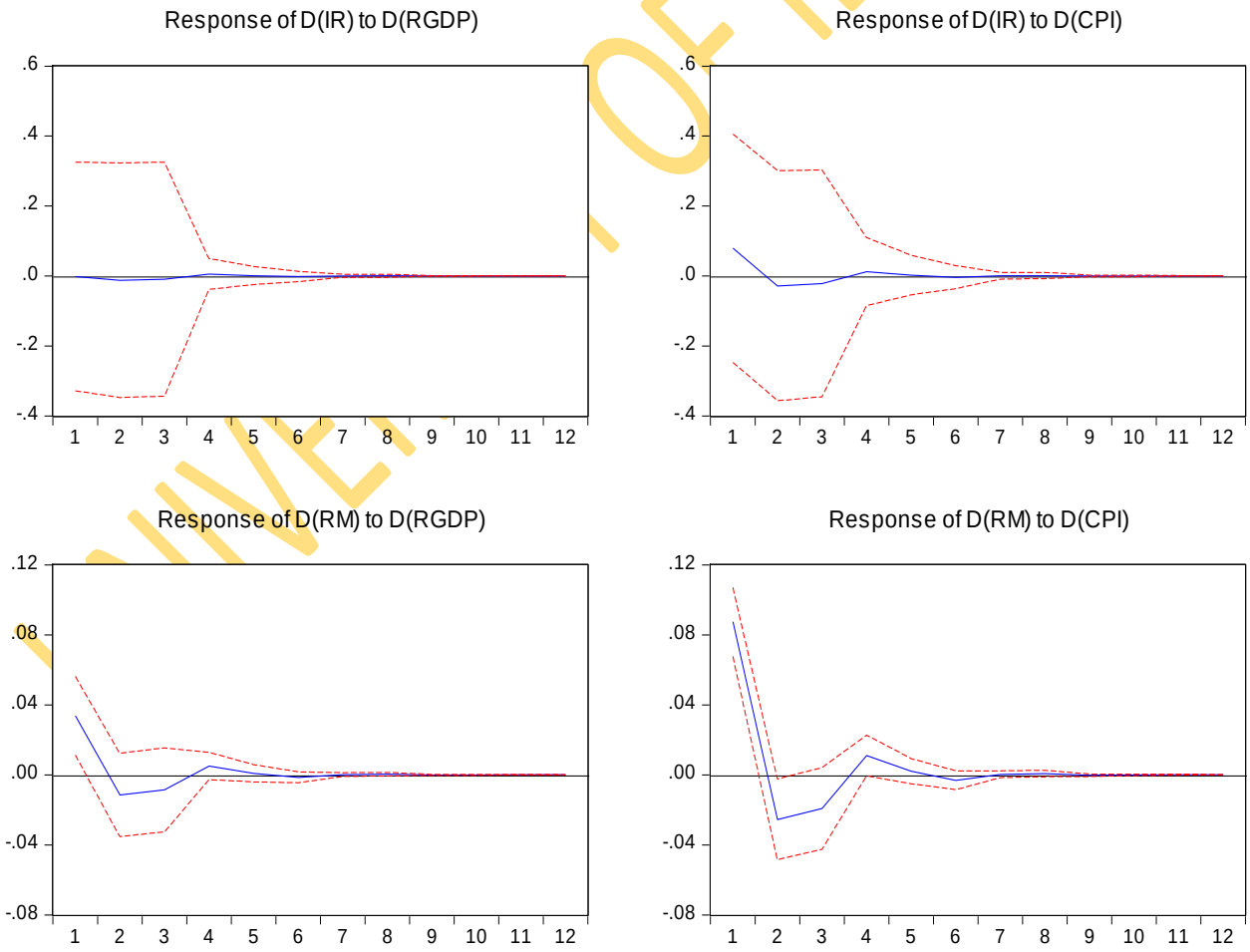
(iii) Δ represents first difference operator

## 5.3 The Impulse Responses of Bank Interest Rate and Reserve Money:

### The Generic Model

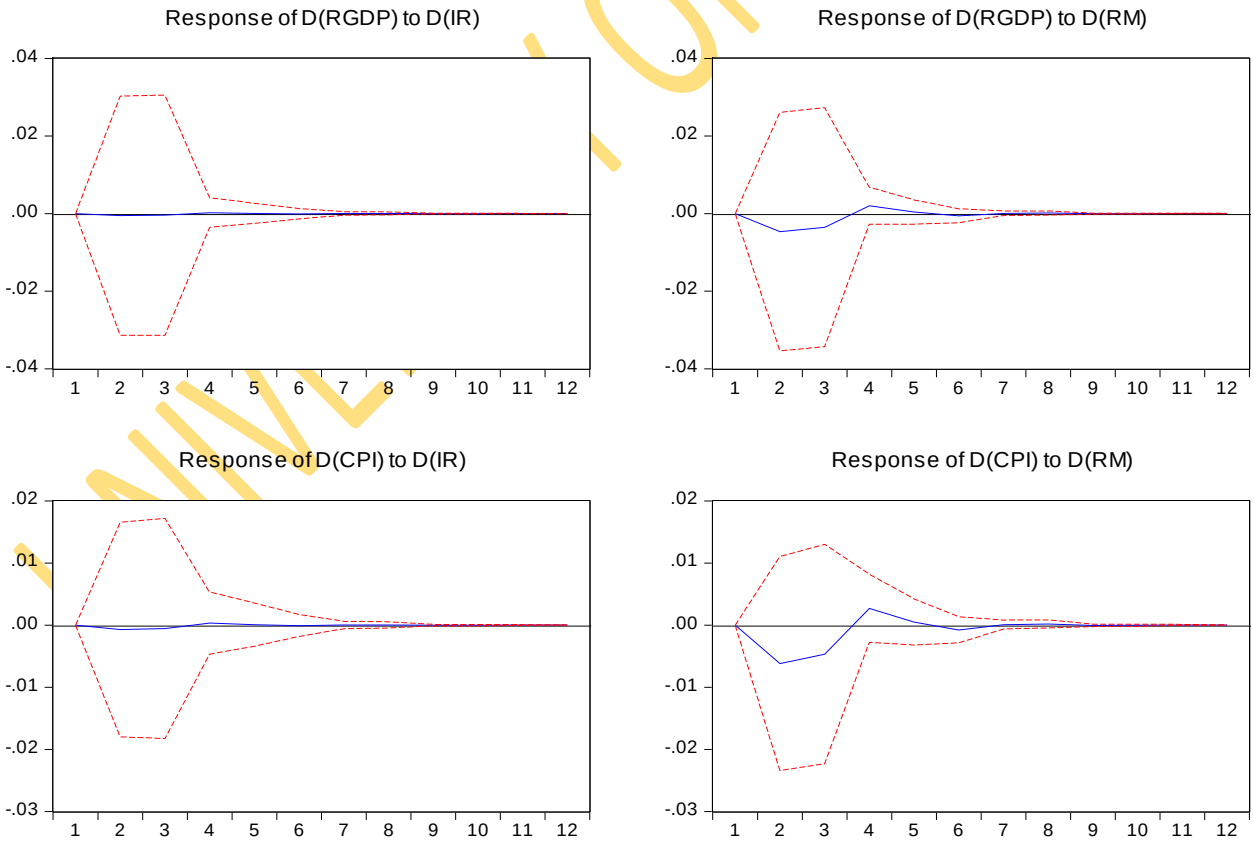
We begin our empirical analysis by looking at the response of the central bank to shocks in the policy goals. Figure 5.1 presents the impulse responses of the bank rate and reserve money to structural one standard deviation innovations in output and consumer prices over a three-year horizon. Impulse responses of output and consumer prices to own shocks are also presented in the same figure. The time scale measured on the primary horizontal axis is in quarters and the dashed red lines are analytic confidence intervals obtained from variance-covariance matrices after the final iteration.

**Figure 5.1: The Impulse Responses of Interest Rate and Reserve Money: The Generic Model**



An output shock corresponding to an unanticipated 0.18 percent variation in output and a supply shock equivalent to an unexpected 0.108 percent rise in consumer prices in the first quarter triggers significant responses by the central bank. This shows that the monetary authorities in Nigeria are concerned with both inflation and economic growth in accordance with its objectives as contained in the CBN Act of 2007. The monetary authority's response to output shock is to loosen monetary policy through a decrease in the bank rate so as to further boost the growth of output. In response to price shock, monetary policy is tightened by raising the bank rate to arrest the increase in the consumer prices. The central bank's response with regard to reserve money shows their determination to address any observed macroeconomic imbalance. Following the sudden decrease in output, as shown in Figure 5.1 above, reserve money declined by -0.11 percent while the unexpected rise in consumer prices triggered an increase in reserve money by 0.87 percent.

**Figure 5.2: The Impulse Responses of Output and Consumer Prices: The Generic Model**



Next, we analyse how monetary policy goals are affected by shocks to the operating targets. To do this, we plot the impulse responses of output and consumer prices to structural one standard deviation shocks in the bank rate and reserve money. Figure 5.2 above reveals that a monetary policy shock corresponding to an unanticipated increase in the bank rate of about 2.02 percent led to declined output in a permanent position on the baseline throughout the first four quarters. The response of price level to the monetary tightening of interest rate was found to be exactly similar to that of output maintaining a baseline position throughout the first eight quarters of the year.

Figure 5.2 above also shows that a contractionary monetary shock equivalent to a 0.105 percent sudden increase in reserve money in the first quarter causes a decrease in output from the baseline position in the first quarter to -0.02 percent in the second and third quarters. However, there was a 0.03 percent increase in output in the fourth quarter which returned to the baseline from the fifth quarter and remained even till the ninth quarter. Consumer prices response to a 0.105 percent unexpected increase in reserve money by the monetary authority is a -0.06 percent decrease in prices which only oscillated back to baseline and changed into a 0.03 percent rise in price in the fourth quarter. However, from the fifth quarter to the twelfth, it stabilised on the baseline. Overall, shocks to one of the monetary policy operating targets, reserve money, attract significant output and consumer price responses. The implication of this is that, though interest rate does not seem to have much impact, monetary factor via reserve money remains a primary determinant of price level and output in Nigeria. In essence, we can infer from this that reserve money remains the most effective policy instrument at the disposal of the monetary authority.

### 5.3.1 Variance Decomposition for The Generic Model

To determine the relative importance of each structural innovation in explaining fluctuations of the variables in the generic model, Tables 5.5 (A – D) presents variance decompositions for each variable in the model over a two-year forecast horizon. Given the two policy goals, fluctuations in both the bank rate and reserve money witnessed a mixed response from the target variables. Consumer prices as well as some magnitude of output seem to be more responsive to reserve money variation than interest rate, connoting that the former impacts more on our target variables than the latter. The observed response of consumer prices to reserve money can therefore be interpreted to mean that the principal objective of monetary policy in the country is price stability. Table 5.5(C) shows that shocks to both the consumer prices and output account for less than one percent of the bank rate fluctuations after the first four quarters of the first year but consumer prices account for approximately 1 percent throughout the four quarters of the second year. However, Table 5.5(D) shows that shocks to consumer prices account for 19 percent of the reserve money fluctuations after the first quarter, 19.4 percent after the second quarter, 19.8 and 20.1 percent after the third and fourth quarters respectively. Shocks to output, on the other hand, account for less than 1 percent of reserve money fluctuations throughout the four quarters of the first year but accounts for 6.4 percent throughout the four quarters of the second year. This indicates that price level and output are responsive to reserve money.

**Table 5.5A: VARIANCE DECOMPOSITION FOR THE GENERIC MODEL: RGDP**

| A | VARIANCE DECOMPOSITION OF RGDP | | | |
|---|---|---|---|---|
| QUARTER | D(RGDP) | D(CPI) | D(IR) | D(RM) |
| 1 | 100.0000 | 0.000000 | 0.000000 | 0.000000 |
| 2 | 99.87899 | 0.100709 | 0.000825 | 0.019475 |
| 3 | 99.78116 | 0.182125 | 0.001491 | 0.035219 |
| 4 | 99.70204 | 0.247974 | 0.002031 | 0.047952 |
| 5 | 93.80694 | 0.736720 | 0.085440 | 5.370904 |
| 6 | 93.63168 | 0.844534 | 0.085547 | 5.438235 |
| 7 | 93.48879 | 0.932654 | 0.085637 | 5.492917 |
| 8 | 93.37221 | 1.004722 | 0.085712 | 5.537354 |

**Table 5.5B: VARIANCE DECOMPOSITION FOR THE GENERIC MODEL: CPI**

| B | VARIANCE DECOMPOSITION OF CPI | | | |
|---|---|---|---|---|
| QUARTER | D(RGDP) | D(CPI) | D(IR) | D(RM) |
| 1 | 0.252269 | 99.74773 | 0.000000 | 0.000000 |
| 2 | 0.295289 | 99.62139 | 0.003385 | 0.079932 |
| 3 | 0.329811 | 99.52001 | 0.006101 | 0.144075 |
| 4 | 0.357566 | 99.43850 | 0.008285 | 0.195644 |
| 5 | 0.234557 | 84.77592 | 0.012724 | 14.97680 |
| 6 | 0.279652 | 84.56691 | 0.014783 | 15.13865 |
| 7 | 0.315948 | 84.39955 | 0.016446 | 15.26805 |
| 8 | 0.345253 | 84.26513 | 0.017792 | 15.37183 |

**Table 5.5C: VARIANCE DECOMPOSITION FOR THE GENERIC MODEL: IR**

| C | VARIANCE DECOMPOSITION OF IR | | | |
|---|---|---|---|---|
| QUARTER | D(RGDP) | D(CPI) | D(IR) | D(RM) |
| 1 | 0.067726 | 0.006849 | 99.92543 | 0.000000 |
| 2 | 0.067799 | 0.007531 | 99.92454 | 0.000132 |
| 3 | 0.067858 | 0.008083 | 99.92382 | 0.000239 |
| 4 | 0.067905 | 0.008531 | 99.92324 | 0.000325 |
| 5 | 0.092759 | 0.878481 | 97.07482 | 1.953941 |
| 6 | 0.092766 | 0.878498 | 97.07473 | 1.954009 |
| 7 | 0.092772 | 0.878510 | 97.07465 | 1.954064 |
| 8 | 0.092777 | 0.878520 | 97.07459 | 1.954110 |

**Table 5.5D: VARIANCE DECOMPOSITION FOR THE GENERIC MODEL: RM**

| D | VARIANCE DECOMPOSITION OF RM | | | |
|---|---|---|---|---|
| QUARTER | D(RGDP) | D(CPI) | D(IR) | D(RM) |
| 1 | 0.211812 | 18.98898 | 1.034370 | 79.76483 |
| 2 | 0.273852 | 19.43464 | 1.031197 | 79.26031 |
| 3 | 0.323424 | 19.79074 | 1.028661 | 78.85717 |
| 4 | 0.363143 | 20.07606 | 1.026630 | 78.53417 |
| 5 | 6.388835 | 18.27278 | 1.049633 | 74.28875 |
| 6 | 6.369428 | 18.63976 | 1.041203 | 73.94961 |
| 7 | 6.353957 | 18.93570 | 1.034435 | 73.67591 |
| 8 | 6.341587 | 19.17511 | 1.028986 | 73.45432 |

Table 5.5 (A) also reveals that the difference in the proportion of fluctuations in output attributed separately to the bank rate and reserve money is not pronounced. The bank rate, however, accounts for an infinitesimally minute proportion of the fluctuations in consumer prices than reserve money. On the whole, the preliminary indication is that the bank rate is a less effective tool of monetary policy than reserve money. While bank rate shocks account for less than 1 percent of the fluctuations in output throughout the two years, reserve money shocks initially account for less than 1 percent of the output fluctuations in the first four quarters but later averaged of 5.4 percent for the four quarters of the second year. This shows that interest rate shocks account for a smaller proportion of the fluctuations in output for the two years while reserve money shocks only have impact on output variation after the first year.

Similar to earlier analysis, interest rate as shown in Table 5.5 (B) could not account for up to 0.1 percent of the shock in consumer prices throughout the period of eight quarters. However, after failing to account for shocks within the first four quarters of the first year, reserve money shocks account for as much as 14 percent of the fluctuations in consumer prices after the fifth quarter and remained consistently around 15 percent in the sixth, seventh and eighth quarters. This indicates that, given the two operating targets, reserve money accounts for more of the consumer price variations.

## 5.4 Channels of Monetary Transmission

In line with our outlined objective, we move the analysis further from the generic model to examination of more specific transmission channels for the purpose of establishing the monetary transmission process. The three channels deemed to exist in Nigeria are therefore considered, *viz.*, credit (bank lending), exchange rates and interest rate, with particular attention to measuring the importance of each channel in the transmission process.

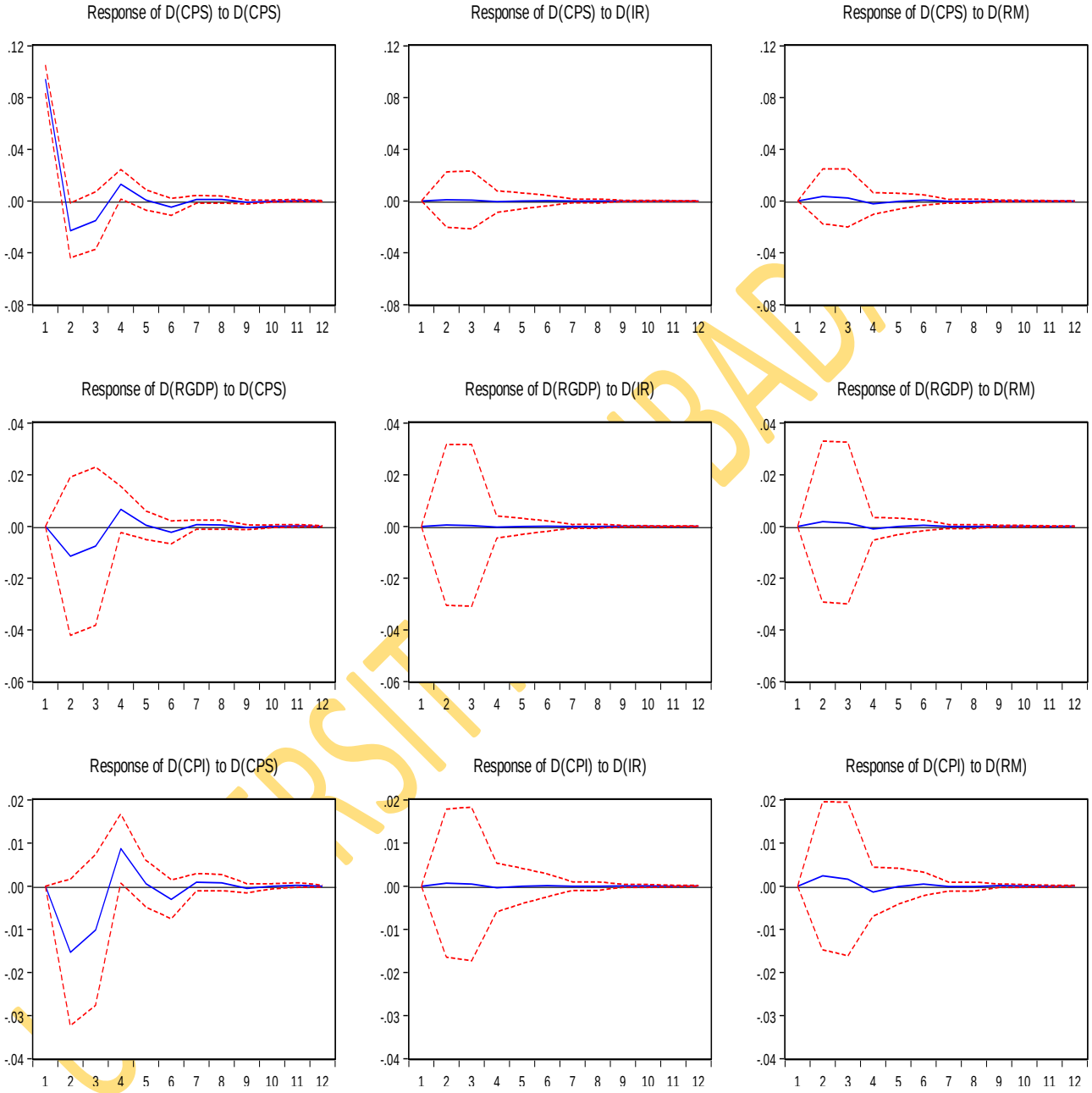
### 5.4.1 Bank Lending Model

The SVAR under investigation in equation 4.12 and 4.13 comprise of five variables, which are output, consumer prices, commercial bank loans to the private sector, bank interest rate and reserve money. Thus, Figure 5.3 presents impulse responses of output, consumer prices and bank loans to innovations in the bank rate, reserve money and bank lending.

Figure 5.3 below shows that a shock equivalent to an unanticipated marginal increase in the bank rate of about 0.001 percent and a 0.04 percent increase in the reserve money causes credit to the private sector to decline from 0.89 percent in the first quarter to negative 0.23 percent below baseline after the second quarter and remains significant even till the third quarter. The response of output to the shock in commercial bank lending shows a negative 0.12 percent reduction in output for the second quarter and negative 0.08 percent for the third quarter. Output response further shows some slight fluctuations, in tandem with bank lending variations, between the fifth and sixth quarters before returning to baseline in the seventh quarter.

The same Figure 5.3 also shows the response of consumer prices at a time corresponding to the period of variation in commercial bank lending. Following a shock in bank lending, consumer prices fall to -0.15 percent and -0.10 percent in the second and third quarters respectively, increasing slightly when bank lending returned to baseline before normalising from the seventh quarter. The inference from this is that variation in bank lending impacts both price levels and output in the economy.

**Figure 5.3: Impulse Response for the Bank Lending Model**

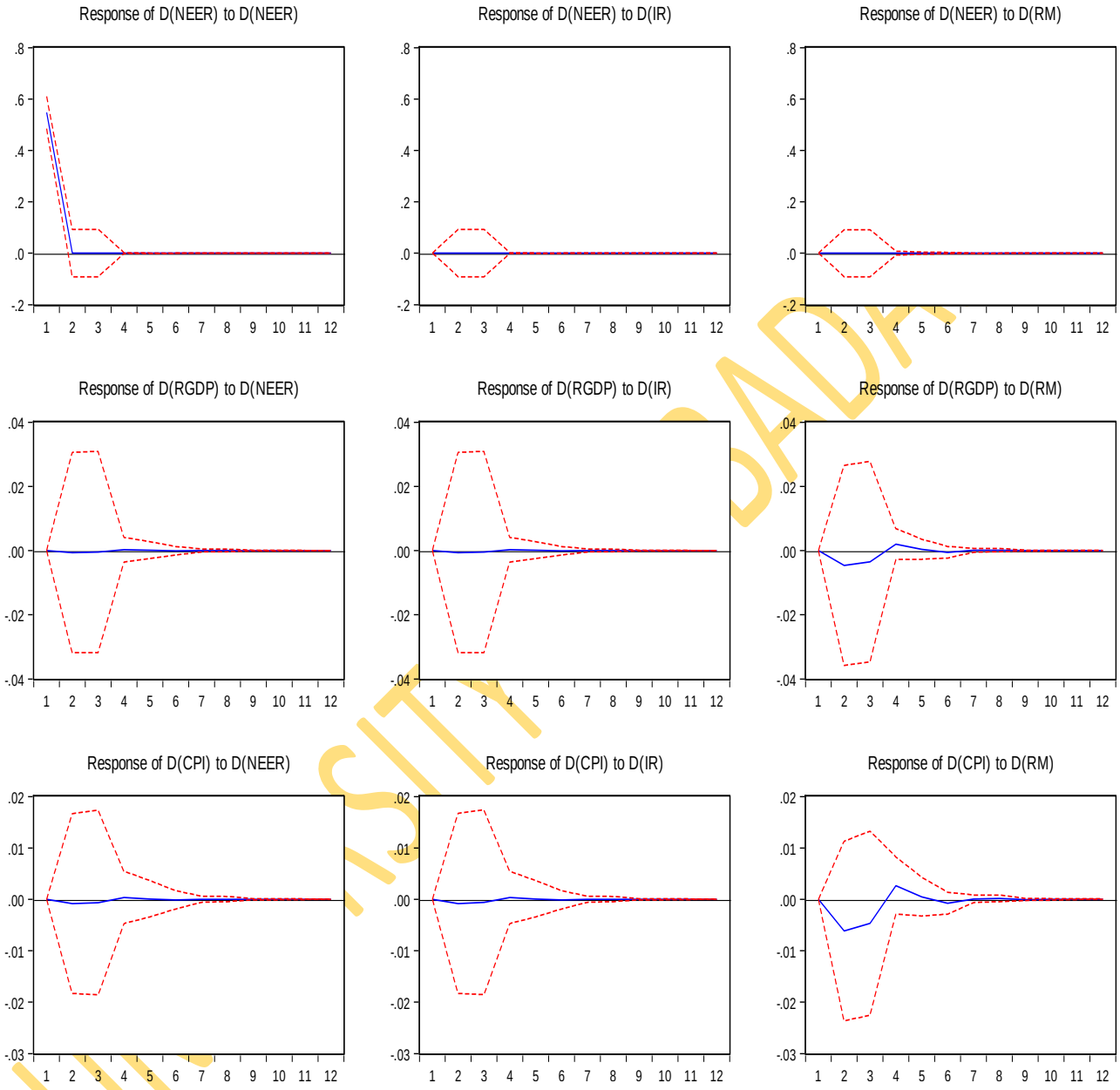


### 5.4.2 Exchange Rate Model

Investigating the exchange rate channel under the SVAR analysis as defined in equations 4.14 and 4.15 requires the five variables stated earlier which are output, consumer prices, nominal effective exchange rate, bank interest rate and reserve money. Following this, Figure 5.4 below presents impulse responses of exchange rate to own, bank interest rate and reserve money shocks and responses of output and consumer prices to innovations in exchange rate, bank lending rate and reserve money.

As shown in Figure 5.4 below, a monetary tightening corresponding to an unexpected 2.02 percent increase in the bank interest rate led to no change in the exchange rate causing it to remain on the baseline throughout the first to the twelfth quarter. In line with theoretical expectations, the exchange rate does not respond to shock in the reserve money equivalent to a 1.05 percent sudden increase hence, it also remained on the baseline throughout the twelve quarters. In the same light, an exchange rate shock equivalent to a depreciation of the domestic currency by 0.55 percent was found to attract no response in both the output in the domestic economy as well as the consumer price level. Consumer prices as well as output response remained stable on the baseline beginning from the first to the twelfth quarter. The implication of this result is that variations in exchange rate, precipitated by shock in the reserve money or interest rate, does not in any way affect the output and price levels in the domestic economy of Nigeria.

**Figure 5.4: Impulse Response for Exchange Rate Model**



### 5.4.3 Interest Rate Model

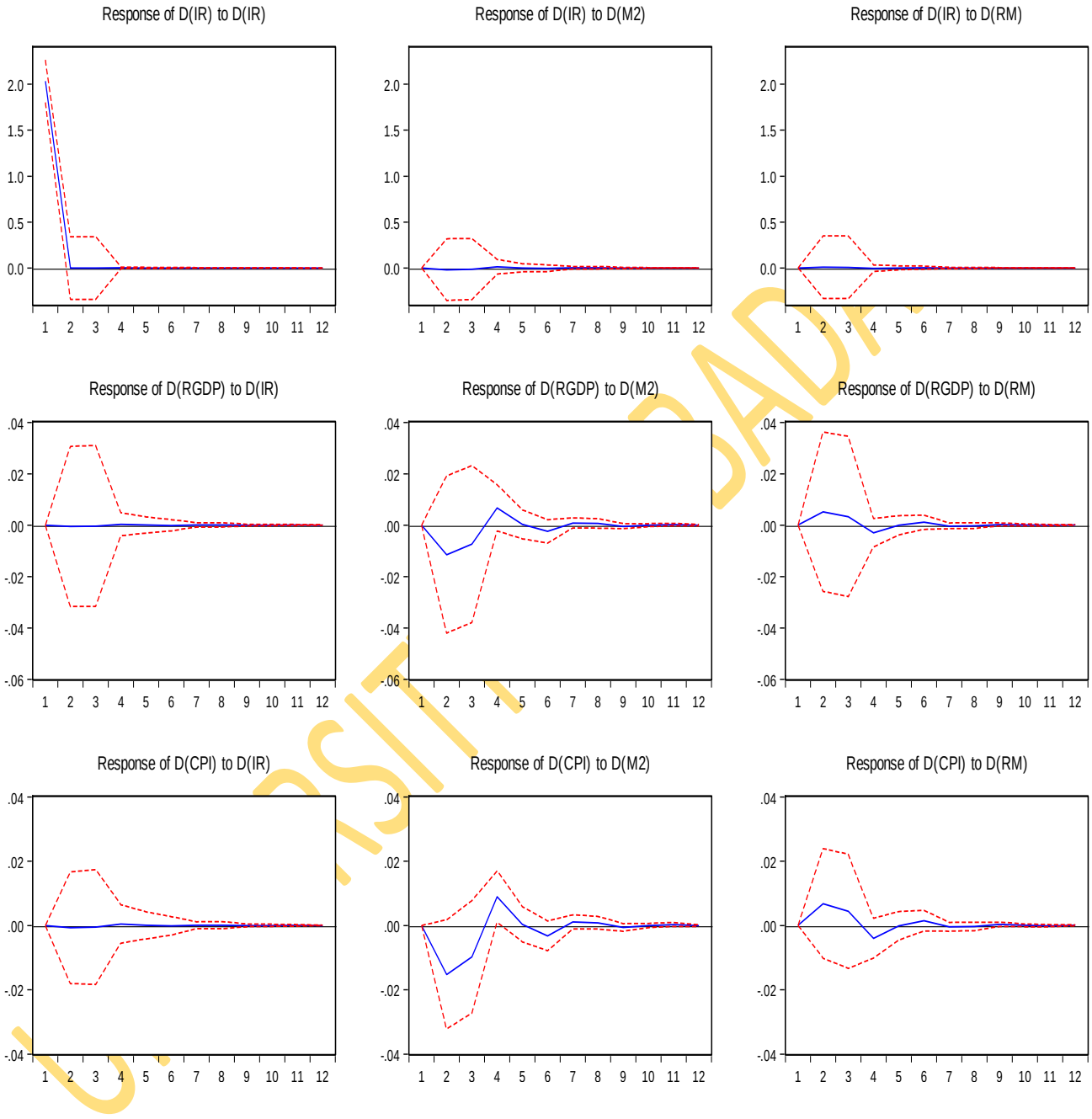
Investigating the Interest rate channel under the SVAR analysis as defined in equations 4.16 and 4.17 requires five variables, which are output, consumer prices, bank interest rate, broad money and reserve money. Based on this, Figure 5.5 presents impulse responses of bank interest rate to own, broad money and reserve money shocks and responses of output and consumer prices to bank interest rate shocks.

**Impulse Response for Interest Rate Model**

A marginal tightening in monetary policy equivalent to a 0.01 percent unexpected increase in the reserve money between the first and second quarter led to a significant increase in interest rate of 2.0 percent between the same period. However, this sudden innovation in the reserve money triggers an insignificant response in M2 of 0.001 percent. A possible explanation for this occurrence is the dominance of commercial banks in the trading of government securities. Variations in reserve money arising from OMO transactions change bank reserves proportionately without significantly affecting currency as well as term and demand deposits, except for the interest component in maturing securities. Accordingly, aggregate money supply is insignificantly affected by the reserve money shock.

Quite surprisingly, both output and consumer prices show no response to unexpected changes in interest rate. An unanticipated 2.03 percent increase in interest rate does not elicit any significant response in both output and consumer prices. However, both consumer prices and output show a significant response to innovations in broad money and reserve money. A shock in broad money supply from a positive value of 0.085 percent in the first quarter to -0.021 percent in the second quarter elicited a marginal decline in output from the baseline position in the first quarter to -0.011 percent in the second quarter. Also, a positive shock of 0.072 percent to reserve money resulted in an increase in consumer prices from the baseline position in the first quarter to 0.007 percent in the second quarter and declined to -0.004 in the fourth quarter and thereafter hovering around the baseline in the remaining quarters.

**Figure 5.5: Impulse Response for Interest Rate Model**



## 5.5 THE COMPOSITE MODEL

Preliminary indications from the preceding section suggest that bank lending, exchange rate and interest rate channels contain important additional information for the country's monetary transmission process. A composite model of monetary transmission in Nigeria is therefore drawn from the resulting vector of endogenous variables as shown in equation 4.18.

### 5.5.1 Impulse Response for the Composite Model

For the composite model, the impulse responses over a three year period are presented in Figure 5.6 below. The Figure illustrates that bank lending channel (credit to the private sector) is the most important channel of monetary transmission in Nigeria though appearing somewhat weak. Among the three intermediate policy targets, only bank lending channel responded marginally to reserve money shocks while the interest rate and exchange rate channels did not show significant response. The exchange rate and interest rate channels did not respond to a decrease in reserve money shock from 0.072 percent in the first quarter to 0.033 percent in the second quarter while the same shock elicited an increase of 0.011 percent in bank lending in the second quarter from the baseline position of the first quarter.

Figure 5.6 also shows that aside from the marginal response of the bank lending channel, interest rate and exchange rate channels did not elicit any response to sudden shocks in broad money supply. A reduction in the shock to broad money from 0.058 percent in the first quarter down to 0.012 percent resulted in a marginal increase in bank lending from the baseline position in the first year to 0.009 percent in the second quarter. Further decrease in the shock to broad money supply within the precinct of positive and negative 0.005 percent from the third to sixth quarters however only resulted in 0.005 percent increase in bank lending within the same period after which it stabilised along the baseline.

## Figure 5.6: Impulse Response for the Composite Model

While output shows no response to sudden shocks in exchange and interest rate in Figure 5.6 above, we observed some marginal responses to bank lending within the first four quarters. An unanticipated decrease in the credit to the private sector from 0.102 percent in the first quarter to -0.023 percent in the second quarter caused output to fall from the baseline position in the first quarter to -0.002 percent in the second quarter. A further increase in the shock to 0.014 percent in the fourth quarter expectedly elicited a marginal response in output to 0.004 percent in the same quarter. However, consumer prices responded to shocks from bank lending with a decrease of -0.016 percent in the second quarter from the baseline position in the first quarter.

### 5.5.2 Variance Decomposition: Composite Model

In a bid to examine the interactions among all the variables over the impulse response horizon, the results of the forecast error variance decomposition is presented in this section. This helps to determine the proportion of fluctuations in a given variable caused by the different shocks to all the variables in the model. Table 5.6 below reports the variance decomposition of the first twelve period horizons into the future.

The output variance decomposition analysis in Table 5.6(A) above shows that in the first period, variations in output are wholly explained by own shocks. This implies that variations in output are hardly affected by other variables in the first quarter. The Table also shows that the contributions of other variables are insignificant throughout the other periods. In essence, beside own contributions, output fluctuations can only be attributed marginally to variations in the consumer prices beginning from the second quarter through to the twelfth quarter maintaining a seemingly constant trend. Collectively, bank lending, exchange rate and interest rate were found not to account for fluctuation in output until the second quarter when their aggregate contribution was observed to be less than 1 percent.

Table 5.6(A) VARIANCE DECOMPOSITION FOR THE COMPOSITE MODEL: RGDP

| | VARIANCE DECOMPOSITION OF D(RGDP) | | | | | | |
|---|---|---|---|---|---|---|---|
| **QUARTER** | **D(RGDP)** | **D(CPI)** | **D(CPS)** | **D(NEER)** | **D(IR)** | **D(M2)** | **D(RM)** |
| 1 | 100.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2 | 98.738 | 0.735 | 0.390 | 0.003 | 0.001 | 0.053 | 0.080 |
| 3 | 98.257 | 1.015 | 0.539 | 0.004 | 0.002 | 0.073 | 0.110 |
| 4 | 97.800 | 1.282 | 0.680 | 0.005 | 0.002 | 0.092 | 0.139 |
| 5 | 97.800 | 1.282 | 0.680 | 0.005 | 0.002 | 0.092 | 0.139 |
| 6 | 97.735 | 1.320 | 0.700 | 0.005 | 0.002 | 0.095 | 0.143 |
| 7 | 97.726 | 1.325 | 0.703 | 0.005 | 0.002 | 0.095 | 0.143 |
| 8 | 97.722 | 1.327 | 0.704 | 0.005 | 0.002 | 0.095 | 0.144 |
| 9 | 97.719 | 1.329 | 0.705 | 0.005 | 0.002 | 0.095 | 0.144 |
| 10 | 97.719 | 1.329 | 0.705 | 0.005 | 0.002 | 0.095 | 0.144 |
| 11 | 97.718 | 1.330 | 0.705 | 0.005 | 0.002 | 0.095 | 0.144 |
| 12 | 97.718 | 1.330 | 0.705 | 0.005 | 0.002 | 0.095 | 0.144 |

Table 5.6(B) VARIANCE DECOMPOSITION FOR THE COMPOSITE MODEL: CPI

| | VARIANCE DECOMPOSITION OF D(CPI) | | | | | | |
|---|---|---|---|---|---|---|---|
| **QUARTER** | **D(RGDP)** | **D(CPI)** | **D(CPS)** | **D(NEER)** | **D(IR)** | **D(M2)** | **D(RM)** |
| 1 | 2.662 | 97.338 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2 | 3.228 | 93.889 | 2.135 | 0.016 | 0.006 | 0.289 | 0.435 |
| 3 | 3.426 | 92.688 | 2.880 | 0.022 | 0.008 | 0.389 | 0.587 |
| 4 | 3.605 | 91.597 | 3.555 | 0.027 | 0.010 | 0.481 | 0.725 |
| 5 | 3.605 | 91.597 | 3.555 | 0.027 | 0.010 | 0.481 | 0.725 |
| 6 | 3.630 | 91.444 | 3.650 | 0.028 | 0.011 | 0.494 | 0.744 |
| 7 | 3.633 | 91.424 | 3.662 | 0.028 | 0.011 | 0.495 | 0.747 |
| 8 | 3.634 | 91.415 | 3.668 | 0.028 | 0.011 | 0.496 | 0.748 |
| 9 | 3.636 | 91.407 | 3.672 | 0.028 | 0.011 | 0.497 | 0.749 |
| 10 | 3.636 | 91.407 | 3.672 | 0.028 | 0.011 | 0.497 | 0.749 |
| 11 | 3.636 | 91.406 | 3.673 | 0.028 | 0.011 | 0.497 | 0.749 |
| 12 | 3.636 | 91.406 | 3.673 | 0.028 | 0.011 | 0.497 | 0.749 |

Table 5.6(B) above shows clearly that the forecast-error variance explained by own innovations (consumer prices) in the first quarter amount to 97.34 percent while the remaining 2.66 percent is explained by variations in the level of output. Over time, however, the variation in consumer prices accounted for by own shock diminished. Aside from own variation which accounted for 91.59 percent of the shock in the fourth quarter, the contribution of shock to output variation also increased to 3.61 percent while credit to the private sector joined to contribute 3.55 percent in the second quarter. Though own variations retained a high percentage of the explanations for variations in consumer prices, the contributions of output and bank lending to explaining the variations in price level increased over time and stabilized at an average of 3.6 percent from the fourth quarter to the twelfth. Variations to other variables in the model does not account for any significant percent in the variations to consumer prices.

Also, just like the addition of broad and reserve money, the collective contribution of the three channels was observed to be less than 1.0 percent implying that they do not account for variation in price level in the economy.

From the variance decomposition of bank lending (credit to the private sector) in Table 5.6(C) below, we observed that more than half of the variations to bank lending in the first quarter is attributed to own shock while consumer prices and output variations accounted for the remaining 36.7 and 7.6 percent respectively. The explanatory power of bank lending to own shock diminished to 52.71 and 51.72 in the second and third quarters respectively while that of consumer prices increased to 38.39 and 38.95 percents and that of output to 7.86 and 7.95 percents in the second and third quarters respectively. In the following quarters, variations in bank lending as accounted for by own shock stood approximately at 50.7 percent while variations in output and consumer prices also explained approximately 8.03 and 39.5 percent throughout the remaining nine quarters. Aside from variations in reserve money which accounted marginally for an average of 1.0 percent, all the other variables in the model provided no meaningful contribution to variation in bank lending.

Table 5.6(C) VARIANCE DECOMPOSITION FOR THE COMPOSITE MODEL: CPS

| | VARIANCE DECOMPOSITION OF D(CPS) | | | | | | |
|---|---|---|---|---|---|---|---|
| **QUARTER** | **D(RGDP)** | **D(CPI)** | **D(CPS)** | **D(NEER)** | **D(IR)** | **D(M2)** | **D(RM)** |
| 1 | 7.599 | 36.708 | 55.693 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2 | 7.860 | 38.390 | 52.709 | 0.023 | 0.009 | 0.403 | 0.607 |
| 3 | 7.947 | 38.950 | 51.715 | 0.030 | 0.012 | 0.537 | 0.809 |
| 4 | 8.024 | 39.448 | 50.832 | 0.037 | 0.014 | 0.656 | 0.989 |
| 5 | 8.024 | 39.448 | 50.832 | 0.037 | 0.014 | 0.656 | 0.989 |
| 6 | 8.035 | 39.517 | 50.710 | 0.038 | 0.015 | 0.672 | 1.014 |
| 7 | 8.036 | 39.526 | 50.693 | 0.038 | 0.015 | 0.675 | 1.017 |
| 8 | 8.037 | 39.530 | 50.687 | 0.038 | 0.015 | 0.676 | 1.018 |
| 9 | 8.037 | 39.534 | 50.680 | 0.038 | 0.015 | 0.676 | 1.020 |
| 10 | 8.037 | 39.534 | 50.680 | 0.038 | 0.015 | 0.676 | 1.020 |
| 11 | 8.037 | 39.534 | 50.679 | 0.038 | 0.015 | 0.676 | 1.020 |
| 12 | 8.037 | 39.534 | 50.679 | 0.038 | 0.015 | 0.676 | 1.020 |

Table 5.6(D) VARIANCE DECOMPOSITION FOR THE COMPOSITE MODEL: NEER

| | VARIANCE DECOMPOSITION OF D(NEER) | | | | | | |
|---|---|---|---|---|---|---|---|
| **QUARTER** | **D(RGDP)** | **D(CPI)** | **D(CPS)** | **D(NEER)** | **D(IR)** | **D(M2)** | **D(RM)** |
| 1 | 0.142 | 0.314 | 2.015 | 97.530 | 0.000 | 0.000 | 0.000 |
| 2 | 0.142 | 0.314 | 2.015 | 97.530 | 0.000 | 0.000 | 0.000 |
| 3 | 0.142 | 0.314 | 2.015 | 97.530 | 0.000 | 0.000 | 0.000 |
| 4 | 0.142 | 0.314 | 2.015 | 97.530 | 0.000 | 0.000 | 0.000 |
| 5 | 0.142 | 0.314 | 2.015 | 97.530 | 0.000 | 0.000 | 0.000 |
| 6 | 0.142 | 0.314 | 2.015 | 97.530 | 0.000 | 0.000 | 0.000 |
| 7 | 0.142 | 0.314 | 2.015 | 97.530 | 0.000 | 0.000 | 0.000 |
| 8 | 0.142 | 0.314 | 2.015 | 97.530 | 0.000 | 0.000 | 0.000 |
| 9 | 0.142 | 0.314 | 2.015 | 97.530 | 0.000 | 0.000 | 0.000 |
| 10 | 0.142 | 0.314 | 2.015 | 97.530 | 0.000 | 0.000 | 0.000 |
| 11 | 0.142 | 0.314 | 2.015 | 97.530 | 0.000 | 0.000 | 0.000 |
| 12 | 0.142 | 0.314 | 2.015 | 97.530 | 0.000 | 0.000 | 0.000 |

The variance decomposition of exchange rate as shown in Table 5.6 (D) above reveals that a significant percentage of the observed variance is accounted for by own variation which amount to 97.5 percent in the first quarter while bank lending accounted for 2.02 percent of the remaining variation. The Table also shows that all the other variables did not account for variation in the exchange rate. This pattern was maintained by all the variables in the model throughout the twelve quarters under observation.

Similar to the observed pattern of exchange rate decomposition, interest rate variance decomposition as shown in Table 5.6 (E) below shows that a significant percentage of the observed variance is only accounted for by own variation. This amounts to 97.8 percent in the first quarter while exchange rate accounts for 1.23 percent of the remaining variation. Unlike the exchange rate decomposition, here, while broad and reserve money did not account for variation in interest rate, credit to the private sector accounted for less than 1.0 percent of the variation. The observed trend in the percentage of variation in interest rate accounted for by own and exchange rate was also shown in the Table and remained the same all through the twelve quarters. The other variables in the model were found, consistently, to have accounted for an insignificant percentage of the variation in interest rate.

Table 5.6(E) VARIANCE DECOMPOSITION FOR THE COMPOSITE MODEL: IR

| | VARIANCE DECOMPOSITION OF D(IR) | | | | | | |
|---|---|---|---|---|---|---|---|
| **QUARTER** | **D(RGDP)** | **D(CPI)** | **D(CPS)** | **D(NEER)** | **D(IR)** | **D(M2)** | **D(RM)** |
| 1 | 0.000 | 0.135 | 0.853 | 1.234 | 97.777 | 0.000 | 0.000 |
| 2 | 0.004 | 0.155 | 0.863 | 1.234 | 97.741 | 0.001 | 0.002 |
| 3 | 0.006 | 0.162 | 0.867 | 1.234 | 97.726 | 0.002 | 0.003 |
| 4 | 0.007 | 0.170 | 0.871 | 1.234 | 97.713 | 0.002 | 0.004 |
| 5 | 0.007 | 0.170 | 0.871 | 1.234 | 97.713 | 0.002 | 0.004 |
| 6 | 0.007 | 0.171 | 0.871 | 1.234 | 97.711 | 0.003 | 0.004 |
| 7 | 0.007 | 0.171 | 0.871 | 1.234 | 97.710 | 0.003 | 0.004 |
| 8 | 0.007 | 0.171 | 0.871 | 1.234 | 97.710 | 0.003 | 0.004 |
| 9 | 0.007 | 0.171 | 0.871 | 1.234 | 97.710 | 0.003 | 0.004 |
| 10 | 0.007 | 0.171 | 0.871 | 1.234 | 97.710 | 0.003 | 0.004 |
| 11 | 0.007 | 0.171 | 0.871 | 1.234 | 97.710 | 0.003 | 0.004 |
| 12 | 0.007 | 0.171 | 0.871 | 1.234 | 97.710 | 0.003 | 0.004 |

Looking at the variance decomposition of broad money in Table 5.6 (F) below, it is obvious that both consumer prices and credit to the private sector accounted for a greater percentage of the shock. In the first quarter, while variations to consumer prices and credit to the private sector accounted for 38.76 and 27.07 percent respectively, own shock of broad money only accounts for 24.43 percent. However, while credit to the private sector maintained the magnitude of its contribution in the subsequent quarters, the percentage of consumer prices explanation to broad money variation increased from 40 percent in the second and third quarter to approximately 41 percent throughout the remaining quarters. In all of these, own explanation to variation in broad money declined from 22 and 21 percents in the second and third quarters respectively to a stabilise at 20.7 percent in the following quarters.

Surprisingly, however, while output and interest rate shocks accounted for 6.66 and 2.96 percents of the variations in broad money in the first quarter, reserve money provided none. In the subsequent quarters, while output variation gained and maintained a marginal increase of 7.0 percent, interest rate variation maintained an average of 2.45 percent but variation in reserve money remained approximately 1.0 percent.

Table 5.6(F) VARIANCE DECOMPOSITION FOR THE COMPOSITE MODEL: M2

| | VARIANCE DECOMPOSITION OF D(M2) | | | | | | |
|---|---|---|---|---|---|---|---|
| **QUARTER** | **D(RGDP)** | **D(CPI)** | **D(CPS)** | **D(NEER)** | **D(IR)** | **D(M2)** | **D(RM)** |
| 1 | 6.660 | 38.760 | 27.070 | 0.121 | 2.964 | 24.426 | 0.000 |
| 2 | 7.014 | 40.193 | 27.148 | 0.130 | 2.661 | 22.259 | 0.595 |
| 3 | 7.132 | 40.672 | 27.175 | 0.134 | 2.560 | 21.534 | 0.794 |
| 4 | 7.238 | 41.098 | 27.198 | 0.136 | 2.470 | 20.889 | 0.971 |
| 5 | 7.238 | 41.098 | 27.198 | 0.136 | 2.470 | 20.889 | 0.971 |
| 6 | 7.252 | 41.157 | 27.201 | 0.137 | 2.458 | 20.800 | 0.995 |
| 7 | 7.254 | 41.165 | 27.201 | 0.137 | 2.456 | 20.788 | 0.998 |
| 8 | 7.255 | 41.168 | 27.202 | 0.137 | 2.456 | 20.783 | 1.000 |
| 9 | 7.256 | 41.171 | 27.202 | 0.137 | 2.455 | 20.779 | 1.001 |
| 10 | 7.256 | 41.171 | 27.202 | 0.137 | 2.455 | 20.779 | 1.001 |
| 11 | 7.256 | 41.172 | 27.202 | 0.137 | 2.455 | 20.778 | 1.001 |
| 12 | 7.256 | 41.172 | 27.202 | 0.137 | 2.455 | 20.778 | 1.001 |

Table 5.6(G) VARIANCE DECOMPOSITION FOR THE COMPOSITE MODEL: RM

| | VARIANCE DECOMPOSITION OF D(RM) | | | | | | |
|---|---|---|---|---|---|---|---|
| **QUARTER** | **D(RGDP)** | **D(CPI)** | **D(CPS)** | **D(NEER)** | **D(IR)** | **D(M2)** | **D(RM)** |
| 1 | 5.139 | 37.074 | 17.242 | 0.226 | 0.025 | 13.872 | 26.422 |
| 2 | 5.440 | 38.018 | 17.892 | 0.225 | 0.028 | 13.251 | 25.146 |
| 3 | 5.547 | 38.354 | 18.124 | 0.225 | 0.030 | 13.029 | 24.692 |
| 4 | 5.645 | 38.662 | 18.336 | 0.225 | 0.031 | 12.826 | 24.275 |
| 5 | 5.645 | 38.662 | 18.336 | 0.225 | 0.031 | 12.826 | 24.275 |
| 6 | 5.659 | 38.706 | 18.366 | 0.225 | 0.031 | 12.797 | 24.216 |
| 7 | 5.661 | 38.712 | 18.370 | 0.225 | 0.031 | 12.794 | 24.208 |
| 8 | 5.662 | 38.714 | 18.372 | 0.225 | 0.031 | 12.792 | 24.205 |
| 9 | 5.662 | 38.716 | 18.373 | 0.225 | 0.031 | 12.791 | 24.202 |
| 10 | 5.662 | 38.716 | 18.373 | 0.225 | 0.031 | 12.791 | 24.202 |
| 11 | 5.663 | 38.717 | 18.373 | 0.225 | 0.031 | 12.790 | 24.201 |
| 12 | 5.663 | 38.717 | 18.374 | 0.225 | 0.031 | 12.790 | 24.201 |

Variance decomposition of reserve money as shown in Table 5.6(G) reveals that all the variables in the model exhibited a uniform trend throughout the quarters following quarter one. The Table also shows that consumer prices provided more explanation (37 percent) to variation in reserve money than own shock (26 percent) and broad money (13.8 percent). Bank lending and output provided further explanation for variation in reserve money. All the variables in the model were found to retain the percentage of their explanatory power throughout the remaining quarters.

## 5.6 Contemporaneous Model Analysis

From the Structural VAR estimation, the restrictions placed on the models based on economic theory are as follows:

RGDP=@e1=C(1)*@u1
CPI=@e2=C(2)*@e1 + C(3)*@U2
CPS=@e3=C(4)*@e1 +C(5)*@e2 +C(6)*@u3
NEER=@e4=C(7)*@e1 +C(8)*@e2 +C(9)*@e3 + C(10)*@u4
IR=@e5=C(11)*@e1 + C(12)*@e2 + C(13)*@e3 + C(14)*@e4 + C(15)*@u5
M2=@e6=C(16)*@e1 + C(17)*@e2 + C(18)@e3 + C(19)*@e4 +C(20)*@e5 + C(21)*@u6
RM=@e7=C(22)*@e1+C(23)*@e2+C(24)*@e3+(25)*@e4+C(26)*@e5+C(27)*@e6+C(28)*@u7

Table 5.7 below provides the results of the contemporaneous model generated from using the restrictions from above economic theory. The log-likelihood ratio test statistic for null hypothesis of over-identifying restrictions did not reject the restrictions implying they are statistically valid.

The coefficient in the consumer prices (CPI) specification with output (RGDP) shows that it has positive impact in the short run. This implies that any change in the price level will impact output along the same direction. Also, in line with theory, the credit to the private sector equation shows a positive sign to output (RGDP) and consumer prices (CPI). Here also, we interpret the result to mean that a positive variation in the amount of credit to the private sector will cause output as well as price level to increase. A plausible explanation for the increase in price level could be that the resultant increase in aggregate demand outstrips that of output.

In the exchange rate equation (NEER), the coefficient is both positive on output (RGDP) and the amount of credit to the private sector (CPS) while it is negative on consumer prices (CPI) specification. The impact of this on output and the amount of credit to the private sector could be interpreted to mean that an appreciation of the exchange rate will lead to increase in domestic production and the amount of credit to the private sector and result in a fall in price level.

**Table 5.7: Estimated Coefficients of Contemporaneous Variables**

| | Coefficient | Standard Error | z-Statistic | Prob. |
|---|---|---|---|---|
| C(2) | 0.089487 | 0.043745 | 2.045655 | 0.0408 |
| C(4) | 0.119354 | 0.041597 | 2.869280 | 0.0041 |
| C(5) | 0.761654 | 0.075846 | 10.04216 | 0.0000 |
| C(7) | 0.040116 | 0.246189 | 0.162947 | 0.8706 |
| C(8) | -0.937839 | 0.563240 | -1.665079 | 0.0959 |
| C(9) | 0.828603 | 0.466100 | 1.777738 | 0.0754 |
| C(11) | -0.313226 | 0.914382 | -0.342555 | 0.7319 |
| C(12) | -1.168021 | 2.110638 | -0.553397 | 0.5800 |
| C(13) | 2.345366 | 1.748795 | 1.341132 | 0.1799 |
| C(14) | -0.417256 | 0.300244 | -1.389721 | 0.1646 |
| C(16) | 0.017762 | 0.026114 | 0.680193 | 0.4964 |
| C(17) | 0.213657 | 0.060314 | 3.542381 | 0.0004 |
| C(18) | 0.672980 | 0.050217 | 13.40146 | 0.0000 |
| C(19) | -0.011596 | 0.008625 | -1.344455 | 0.1788 |
| C(20) | -0.009944 | 0.002308 | -4.308634 | 0.0000 |
| C(22) | 0.004450 | 0.032518 | 0.136845 | 0.8912 |
| C(23) | 0.194651 | 0.078007 | 2.495297 | 0.0126 |
| C(24) | 0.000105 | 0.092058 | 0.001142 | 0.9991 |
| C(25) | 0.022185 | 0.010787 | 2.056569 | 0.0397 |
| C(26) | 0.007867 | 0.003039 | 2.588942 | 0.0096 |
| C(27) | 0.900923 | 0.100520 | 8.962650 | 0.0000 |
| C(1) | 0.187861 | 0.010739 | 17.49286 | 0.0000 |
| C(3) | 0.101651 | 0.005811 | 17.49286 | 0.0000 |
| C(6) | 0.095364 | 0.005452 | 17.49286 | 0.0000 |
| C(10) | 0.549808 | 0.031430 | 17.49286 | 0.0000 |
| C(15) | 2.041885 | 0.116727 | 17.49286 | 0.0000 |
| C(21) | 0.058291 | 0.003332 | 17.49286 | 0.0000 |
| C(28) | 0.072477 | 0.004143 | 17.49286 | 0.0000 |

The coefficients of interest rate specification have heterogeneous signs with output, price level and exchange rate showing negative correlation while credit to the private sector has a positive sign. Expectedly, increase in the rate of interest will dampen investment as cost of production will increase thus impacting negatively on consumer prices and leaving its ripple effect on exchange rate.

In the broad money equation, the coefficients have varied signs. Output, price level and credit to the private sector have positive signs while exchange rate and interest rate have negative signs. The expected response of output, price level and private sector credit to increase in broad money supply is a corresponding increase while the response of exchange rate and interest rate were expected to fall with an increase in broad money supply.

Positive signs were noticed in the reserve money coefficients for all the variables. However, this sign was expected only for exchange and interest rates but not for output, consumer prices, private sector credit and broad money supply. The positive sign for interest and exchange rates means that an increase in the monetary authority's reserve money will cause both interest rate and exchange rate to increase. However, the expected signs for output, consumer prices, private sector credit and broad money supply are negative. In essence, we expect variation in reserve money to negatively impact output, consumer prices, bank lending and broad money.

## 5.7 Error Correction Model

Following the ECM specification in equation 4.19, the over-parameterised model was specified for the variables in the study's estimable model. To this end, the variables were differenced and lagged by three years while the error correction term was lagged once. The parsimonious model below was however arrived at after the lagged values of some variables were pruned as the result shows that their probability value were insignificant.

| | D(RGDP(-2)) | D(CPI(-1) | D(M2(-1)) | ECT(-1) |
|---|---|---|---|---|
| $\alpha$: 0.018 | -0.159 | -0.238 | 0.535 | -0.044 |
| (0.378) | (0.043) | (0.169) | (0.018) | (0.081) |

The coefficient of the ECT shown above provides the speed of adjustments of the target variables to policy variations. From this coefficient of the error correction term, we can infer that policy variations impact on target variables after twenty four (24) quarters (six years precisely).

## 5.8 A Synthesis of Empirical Results and the Study Objectives

Attempt is made in this section to relate the findings of the study with the specific objectives set forth at the beginning of the thesis.

**Objective 1: To determine which of the central bank monetary policy instrument(s) is the most effective.**

To achieve this objective, we analyse the impulse response function to determine the magnitude of output and price response to variation in interest rate and reserve money. The result shows that reserve money is a more effective policy instrument given that a 0.11 percent increase in reserve money led to a decline in output and prices declining, though marginally by 0.02 percent and 0.06 percent respectively. In contrast, an increase in bank interest rate of 2.02 percent did not elicit any significant response from output and prices.

**Objective 2: To identify the channel(s) through which monetary policy variation affects output and price levels in Nigeria.**

From the estimation of the generic model, the results from impulse response function show that after a marginal increase in bank interest rate and reserve money of about 0.001percent and 0.04 percent respectively, bank lending declined from 0.89 percent in the first quarter to - 0.23 percent after the second quarter. This reduction in bank lending caused output to decline to -0.12 percent and -0.15 percent while prices rose by 0.15 percent and 0.10 percent in the second and third quarters respectively. We conclude from this that bank lending channel wss a potent monetary transmission mechanism in Nigeria. Further findings show that an increase in interest rate of 2.02 percent and reserve money of 1.05 percent caused no change in exchange rate while a 2.03 percent increase in interest rate elicited no response in output and prices. This signified that both exchange and interest rates were impotent channels for transmitting monetary policy in Nigeria.

**Objective 3: To determine the time lag between monetary policy variations and the effect on domestic price level and output (i.e. the speed with which monetary impulses are transmitted)**

To ascertain the length of time it takes for monetary policy variation to have impact on prices and output in the Nigerian economy, the result from the estimation of the error correction model (ECM) of this study helps to realise this objective. The ECM estimation establishes that the time lag for policy impact on prices and output in the Nigerian economy is twenty four (24) quarters which translates into six (6) years.

# CHAPTER SIX
# SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS.

In this chapter, the key findings of this study are summarised followed by policy implications and recommendations. Conclusions are drawn and the limitations encountered during the study are also presented.

## 6.1 Summary of Findings

Recognising the important role played by monetary policy in a well-functioning economy, the Nigerian government established the Central Bank of Nigeria and saddled it with the responsibility of designing an appropriate monetary policy to maintain stable price level output growth among others. The impact of the policies designed by the central bank on the economy as a whole, especially the channels through which monetary policy variations affect prices and output among other macroeconomic variables, has over time attracted the attention of policymakers.

One startling revelation in the course of literature review is the large and widening disparity between monetary policy instruments and target variables on one hand and between monetary targets and actual accomplishment on the other. For instance, while broad money (M2) grew at an average of 37 percent between 1975 and 1979, the corresponding growth in GDP and inflation rate were 7 percent and 20 percent respectively. A similar trend was also observed between 1980 and 1984 when a 19 percent growth in broad money supply was matched correspondingly by a mere 4 percent growth in output and 12 percent growth in inflation. Another alarming discrepancy was also observed between desired policy targets and actual attainment. For instance, while the monetary authority targeted 5 percent, 31 percent, 7 percent, 12 percent and 11 percent inflation rate for the years 1992, 1995, 2002, 2004 and 2005 respectively, the resulting inflation rate stood as high as 45 percent, 73 percent, 12 percent, 22 percent and 24 percent respectively for the same period.

Thus, expediency requires that the CBN have a quick and proper understanding of the consequences of their actions on non-financial agents and macroeconomic aggregates for a successful policy design and implementation. However, the Central Bank of Nigeria's choice

of instruments for attaining any desired objective at a particular time should be determined mainly by the structure of the economy, the level of development in the money and capital markets among others.

Nigeria's adoption of the Structural Adjustment Programme (SAP) in 1986 ushered in a regime of financial sector reforms characterised by the free entry and exit of banks and the dominance of indirect instruments for monetary control. With the operational framework of market instrument, only the operating variables, the monetary base or its components are targeted while the market is left to determine interest rates and allocate credit. The unfolding poor performance of Nigeria's real sector after several measures remained a major challenge in the formulation and implementation of an appropriate policy by the Central Bank of Nigeria. It is against this backdrop that this study sought to provide answers to the following policy related questions:

(i) What is the appropriate monetary instrument for achieving the CBN's objective?
(ii) Which of the transmission channels of monetary policy is in existence in Nigeria?
(iii)How long does it take for a change in monetary policy to affect output and prices?

In attempting to provide answers to the above questions, the study employed the econometric tool of structural vector autoregressive (SVAR) model on quarterly data obtained from the CBN annual statistical bulletin from 1970 and 2008. Structural analysis of the monetary transmission mechanism was captured by the impulse response functions and the forecast error variance decomposition. They were both used to identify the dynamic interrelationships between policy variables/instruments and policy goals (e.g. price level and output). Impulse response functions allow the study of the time path of each endogenous variable in reaction to a structural shock (innovation) in a certain variable or group of variables and thus allow comparison of projected performance according to the estimated model with what the theory implies. Further, forecast error variance decomposition allows inference about the relative importance of the existing monetary policy transmission channels. In addition, contemporaneous model analysis of the restrictions placed on the models, based on economic theory, was interpreted while an error correction mechanism was estimated to establish the time lag of policy implementation.

A number of salient findings were obtained during the course of this research. The generic model clearly established that, above all other goals, the monetary authorities in Nigeria are concerned with both inflation and economic growth in accordance with its objectives. Also, that the CBN employs a hybrid of monetary policy instruments to achieve its desired goal of price stability and output growth in the economy. It also established further that, of the two instruments, namely; reserve money and interest rate, the former is a more effective policy instrument deployed by the CBN. However, the core finding of the model is that price level and output responded to monetary policy variation though output seems to respond more to shocks that emanated from reserve money.

The study, expectedly, observed that the monetary authority's response to output shock was to loosen monetary policy through a decrease in the bank rate to further boost the growth of output. However, the authority responded to price shock via a monetary policy tightening by raising the bank rate to arrest the increase in consumer prices. The central bank's response with regard to reserve money shows its determination to address any observed macroeconomic imbalance.

The study also found that output will decrease in response to a contractionary monetary shock especially via an increase in reserve money. Also, that shocks to one of the monetary policy operating targets, reserve money, attracted significant response from output and consumer price. This implies that, though interest rate does not seem to have much impact, monetary factor via reserve money remains a primary determinant of price level and output in Nigeria, suggesting that reserve money remains the most effective policy instrument at the disposal of the monetary authority.

Variance decompositions for each variable in the model to determine the relative importance of each structural innovation reveal that consumer prices as well as some magnitude of output are more responsive to reserve money variation than interest rate. The contention from this is that the former impacted more on target variables than the latter. Hence, we interpreted the observed response of consumer prices to reserve money to mean that price stability is the principal objective of monetary policy in the country. In essence, the observed magnitude of explanation by prices and output to variation in reserve money shows

that price level and output are responsive to reserve money. On the whole, we found bank rate a less effective tool of monetary policy than reserve money.

Further findings from the study, while analysing the separate SVAR models under the bank lending, shows that contractionary monetary policy via a marginal increase in the reserve money caused credit to the private sector to decline. Output response shows some fluctuations in tandem with bank lending variation while prices declined significantly. This affirmed further that variation in bank lending impacts both price level and output in the economy.

The study also noted that under the exchange rate model, exchange rate had an insignificant response to variations in both bank rate and reserve money. Consequently, exchange rate shocks precipitated by variations in bank rate and reserve money had no effect on output and price levels. A plausible explanation to justify this is the "round –tripping" activities of the operators in the financial sector. Findings under the interest rate model were not significantly different as a monetary policy tightening via an increase in reserve money and not broad money, explained the observed significant increase in interest rate. And similar to our finding under the exchange rate model, output and consumer prices show no response to unexpected changes in interest rate.

The finding of the study from the impulse response of the composite model comprising both the generic and separate models affirms the above result. The forecast error variance decomposition shows no significant difference from what obtained under the generic model. Variations in output, interest rate and exchange rate are found not to be affected by other variables in the model throughout the quarters as their collective impact accounted for less than three percent. Price level also accounted for a very high percentage of own variations while the combined explanation of output and bank credit is marginal.

From the bank lending variance decomposition, we found own explanatory power accounted for an average of 50 percent throughout the period under review while price level provided an average of 40 percent of the variations. This we interpreted to mean that variations in prices significantly influenced the amount of bank lending to the private sector.

One significant result from reserve money and broad money (M2) forecast error variance decomposition is the fact that, price level remains the major determining factor of their variations. In the case of broad money; bank credit to the private sector and own explanation, in that order, accounted for variation while in the case of reserve money; own explanation, bank credit to the private sector and broad money accounted for its variation.

Upon analysing the contemporaneous model, our findings conform with a priori expectation that any change in price level will impact output along the same direction. Further findings reveal that the positive sign of variation in the amount of credit to the private sector on output and prices could be interpreted to mean an increase in the level of output and prices. While the positive coefficient of exchange rate on output and private sector credit was taken to mean an increase in domestic production and bank lending, the negative coefficient of consumer prices was assumed to imply a fall in price level. We found the interest rate coefficient on output, prices and exchange rate to have a dampening effect on investment due to its incremental impact on the cost of production.

## 6.2 Policy Implication of Findings and Recommendations

Several policy lessons can be drawn from the findings of this study. Following the findings that monetary target variables responded more to variations in reserve money than interest rate, the monetary authority in Nigeria need to shift from hybrid operating procedures to a scalar indicator of policy. The recommendation is for the Central Bank of Nigeria to embrace the use of reserve money as a measure of monetary policy rather than the less effective bank rate. Flowing from the evidence in our findings that the Central Bank of Nigeria also targets output growth alongside price stability, we suggest that the authority concentrates primarily on the latter as this has the propensity of fostering output growth in the economy.

The findings indicate that the capability of monetary policy to influence economic activity and prices are still limited, as important channels of monetary transmission are not effective. In particular, the interest rate and exchange rate channels remained weak. To the extent that supervising and monitoring Nigeria's financial sector activity remained weak,

monetary policy effectiveness will remain marginal and illusory. Thus, we suggest the financial sector's supervisory and regulatory authorities device a superior investigative method of auditing deposit money banks' financial report and enforcing compliance.

While empirical evidence shows that the central bank's means of influencing economic activity remains the bank lending channel, a major challenge to this channel having any meaningful impact is the large activity of the informal (lending) sector and the shadow economy which are yet to be fully integrated into the formal economy. Apart from firms and individuals who majorly rely on cash for transactions, Nigeria has a large shadow economy that does not rely on the formal financial sector. This significantly diminishes the potential deposit base of the banking system and the market for products offered by banks and other financial institutions—thereby precluding any effects of monetary policy on economic activities and prices in the informal economy. In order to foster the assimilation of the informal sector into the formal economy, the authorities need to create incentives for formalisation so as to deepen financial intermediation and financial sector efficiency.

## 6.3 Conclusions

This study provides a description of monetary policy transmission mechanisms concerned with the relationships between changes in the money supply and the level of real income (output and prices). Several channels through which the changes in money supply affect output exist, prominent among which are the interest rate, credit (bank lending) and exchange rate. This study investigates the channels through which monetary policy shocks are propagated in Nigeria so that policymakers can interpret movements in financial variables with precision and make accurate predictions from their choice instruments.

Reserve money rather than interest rate was found to be a more potent monetary policy instrument of the CBN as both prices and output responded to shocks that emanated therefrom hence, we recommend its use rather than a hybrid of reserve money and interest rate. Among the perceived channels of monetary transmission mechanism in the less developed countries, bank lending was found to be the existing channel of monetary policy in Nigeria. To this end, bank lending channel should be bolstered by tightening creditworthiness standards; strengthening accounting standards, corporate governance and creditor rights;

improving bank credit assessment capabilities and strengthening the judicial system to improve banks' ability to enforce on collateral. A number of legislative and judicial reforms designed to simplify and reduce the cost of foreclosure and strengthen creditor rights should also be put in place by the financial sector supervisory and regulatory authorities.

## 6.4 Limitations of the Study and Suggestions for Further Research

The model estimated in this study offered a sufficient framework within which the effects of monetary policy on some target variables can be analysed. Notwithstanding this, there is still room for further research. The data on the key variables of the model employed are not available in higher frequency. This has implication for the result of our study as some palpable impacts of monetary policy shocks on macroeconomic variables are better studied with monthly data.

Similar to the above constrain, any study on the response of the real sector to monetary impulse should consider it expedient to include data on employment as this signify the absorption and utilisation capacity in the entire economy. Notwithstanding the identified shortcomings, the information in this thesis remains valid, reliable and can be used for generalisation.

For the purpose of future research, the role of the non-bank financial institutions in the supply of domestic credit and in the transmission channel should be looked into as this constitutes a veritable source of credit in the informal sector. Further insights into the channels through which the effects of monetary policy are transmitted to the real sector may be provided when non-bank financial institutions are included in the monetary transmission mechanism.

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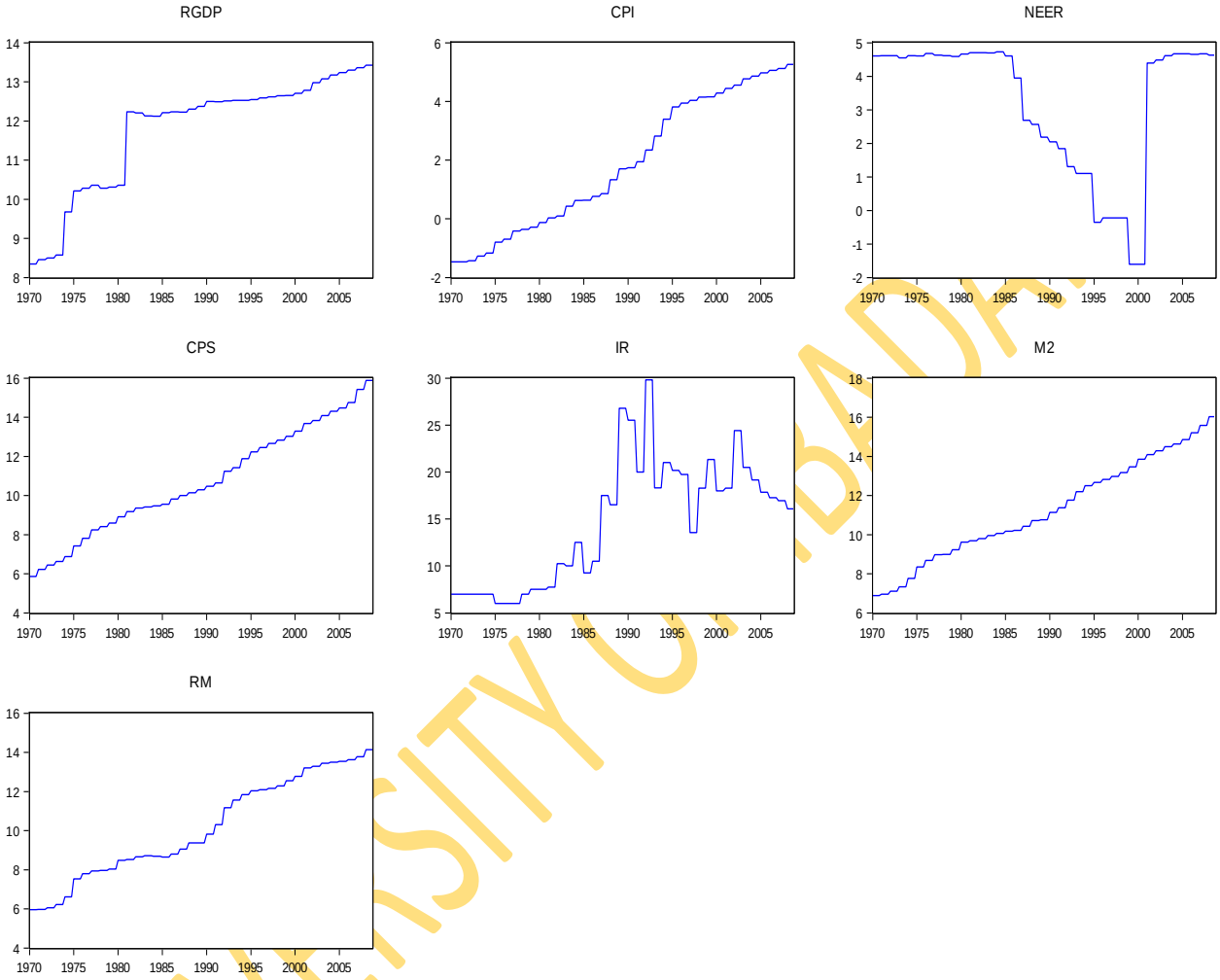
| Author(s) | Country / Data Type | Methodology/ Channel | Variables Used | Findings |
|---|---|---|---|---|
| Kuijs (2002) | Slovak Republic / Monthly data (1993-2000) | VAR/ Interest Rate channel | Price level, Real Interest Rate, GDP, M2, Real Effective Exchange Rate, Unit of labour costs. | The main direct determinants of inflation are exchange rate, foreign prices, aggregate demand and wage cost but no direct impact of either monetary aggregates or interest rate. |
| Dabla-Norris and Floerkemeier (2006) | Armenia / Monthly data (2000:5-2005:12) | VAR/ Exchange rate channel | M1, repo rate (for short term interest rate), real GDP, CPI and nominal effective exchange rate. | Exchange rate channel has a strong impact on the inflation rate and that the capability of monetary policy to influence economic activity and inflation is limited, as important channels of monetary transmission are not fully functional. |
| Hovarth and Maino (2006) | Belarus / Monthly data (1995:12-2005:10) | VAR/ Exchange rate channel | RGDP, CPI, real effective exchange rate, M1, interbank rate and US Fed. Fund Rate (for interest rate parity). | There exists a significant exchange rate pass-through to prices. Interest rate policy is following, rather than leading, financial market developments. |
| Poddar, Sab and Khachatryan (2006) | Jordan/ Quarterly data (1996:1-2005:1) | VAR/ Not Stated | RGDP, foreign reserve, spread btw 3months CD rates, US Fed. Fund rate, Real effective exchange rate, real credit and real lending rates. | That monetary policy has been successful in influencing reserves as well as driving bank deposit and lending rates. However, they do not find any evidence of monetary policy significantly affecting economic activity. |
| Brooks (2007) | Turkey / Quarterly data | Small macro-econometrics model. Bank Lending channel | Liquidity, size, capitalisation and dummies for ownership status and stock market participation. | Bank liquidity has a significant effect on loan supply. This suggests that the effect of monetary policy can be propagated by the banking sector, depending on its liquidity position. |
| Borys and Horvarth (2007) | Czech Republic / Monthly data (1981:1-2006:5) | VAR and SVAR / Not stated | GDP, real-time output gap, net price index, nominal exchange rate, interbank interest rate and CPI | That a contractionary monetary policy shock has a negative effect on the degree of economic activity and the price level, both with a peak response after one year or so. |

| | | | | |
|---|---|---|---|---|
| Saizar and Chalk (2008) | Asia and Latin America / Monthly data (1996-2007) | VAR/ Exchange Rate channel | Change in industrial production, consumer price inflation, wholesale food and oil price inflation, interest rate, growth of m1 and nominal effective exchange rate. | When controlling for the exchange rate regime it is clear that allowing for exchange rates to move flexibly is an important factor in ensuring that monetary policy can influence domestic inflation. Countries with floating exchange rates have no evidence that the level of private sector credit meaningfully impact economic aggregate. |
| Sims (1992) | France, Germany, Japan, the USA and the UK/ Monthly data (1957:1-1964:1 | VAR/ Interest rate channel | Industrial production, M1, interest rate, consumer price, commodity price and exchange rate indexes | That the interest rate variable potentially affects other variables contemporaneously while the interest rate is not affected by innovations in any of the other variables. |
| Bernanke and Blinder (1992) | USA/ Monthly data (1959:7 – 1989:12) | VAR/ Credit channel | US Federal Funds rate, monetary aggregates, industrial productions, CPI, CP Bill, loans and securities | A positive shock to the federal funds rate reduces the volume of deposits held by institutions immediately after shock and peaks after nine months That their findings support the operation of a credit channel. |
| Christiano, Eichenbaum and Evans (1996) | U.S.A./ Quarterly data (1960:Q1 – 1992: Q4) | VAR/ Cash Flow channel | GDP deflator, commodity prices, Federal Fund rate, total reserves, non-borrowed reserves, RGDP, and aggregate production activity. | The initial effect of a positive shock to the federal funds rate is to increase net funds raised by the business sector for almost a year and thereafter decline. |
| Clements, Kontolemis and Levy (2001) | 10 Euro area / Quarterly data (1983:1-1988:4) | Macro-econometrics model and VAR/ Interest rate channel | Real GDP, CPI, short term domestic interest rate, M2, effective exchange rate, and credit to private sector. | That interest rate channel rather than the credit and exchange rate channels explains large proportion of the observed differences. |
| Weber, Gerke and Worms (2009) | Euro area /Quarterly data (1980:1 - 2006:4) | VAR/ Not stated | RGDP, GDP deflator, real housing wealth, domestic nominal short term IR. | Changes in the transmission process have not altered the long run responses of real output and inflation to monetary policy. |

| | | | | |
|---|---|---|---|---|
| Ahmed, Shah, Agha and Mubarik (2005) | Pakistan/<br><br>Monthly data (1996:July-2004:March) | VAR /<br><br>Bank Lending Channel | TB rate, Private Sector credit, real effective exchange rate, consumer price index, industrial production index as proxy for GDP | Monetary tightening leads to a fall in investment demand financed by bank lending, which translates into a gradual reduction in price pressures that eventually reduces the overall price level with a significant lag. |
| Cheng (2006) | Kenya /Monthly data (1997-2005) | SVAR/<br><br>Interest rate | Nominal effective exchange rate, GDP, short term interest rate, CPI, M2, oil price and federal Funds rate. | Increase in interest rate leads to a fall in prices and an appreciation of exchange rate, but accounting little for output fluctuation. |
| Mugume (2009) | Uganda /<br><br>Monthly data 1993:6-2009:3 | SVAR/<br><br>Interest rate channel | GDP, M2, CPI, interest rate, nominal effective exchange rate, lending rate and credit to the private sector. | The capability of monetary policy to influence economic activity and inflation is still limited. Also, the interest rate channel remains weak, even though there is some evidence of transmission to prices of changes in the TB rate. |
| Uanguta and Ikhide (2002) | Namibia/ Monthly data 1997:1-1998:12 | VAR/ Credit and Interest rate channels. | M2, credit to private sector, lending rate, private investment and CPI | Both credit and interest rate channels are effective. However, the intensity of both channels is difficult to gauge from the results. |
| Ngalawa (2009) | Malawi /<br><br>Monthly data (1988:1 – 2005:12) | SVAR/<br><br>Not stated | GDP, M2, CPI, bank rate, exchange rate, reserve money and credit to private sector. | Exchange rates role became conspicuous than before with weakened impact. The importance of aggregate money supply and bank lending in transmitting monetary impulses was enhanced. |
| Tarawalie (2008) | Sierra Leone/Quarterly data (1990:1 – 2006:4) | Small Macro-econometric model /Bank lending channel | Real exchange rate, inflation, real GDP, interest rate, M2, TB rate, private sector credit, | Bank lending channel was found to be the most effective channel through which MP actions affected inflation and output. |
| Oyaromade (2004) | Nigeria/<br><br>Quarterly data (1970:1 – 1999:4) | VAR/<br><br>Interest rate and Credit channels | Real GDP, M2, lending rate, private sector credit, TB rate, real exchange rate, expected rate of inflation, interest rate, real investment and demand deposit. | Ccredit rationing significantly exist and financial deepening has the tendency of reducing its propensity to persist. Interest rate and credit channels play a significant role in the transmission of monetary impulse to the real sector in Nigeria. |

APPENDICES

APPENDIX 2: Trend Graph of Estimable Variables




APPENDIX 3

| Variables | RGDP | CPI | CPS | NEER | IR | M2 | RM |
|---|---|---|---|---|---|---|---|
| RGDP | CI | | | | | | |
| CPI | C2 | C3 | | | | | |
| CPS | C4 | C5 | C6 | | | | |
| NEER | C7 | C8 | C9 | C10 | | | |
| IR | C11 | C12 | C13 | C14 | C15 | | |
| M2 | C16 | C17 | C18 | C19 | C20 | C21 | |
| RM | C22 | C23 | C24 | C25 | C26 | C27 | C28 |

APPENDIX 4: