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An Analysis of The Monetary Policy Transmission Mechanism and The Real Economy in Nigeria

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ABSTRACT

The study is an empirical analysis which seeks to explain the monetary policy transmission mechanism to the real economy in Nigeria. It examines the process by which the interest rate policy of the Central Bank of Nigeria actually affects the structure of interest rates, credit, aggregate demand and output production and, hence, changes in inflation rate. In the analysis, we review the paradigm of the channels of monetary policy transmission mechanism by studying over two-and-half dozen cases of empirical studies in the economic literature. By applying vector auto-regression (VAR) with dynamic logarithmic form and the ordinary least squares (OLS) methods, the empirical functional relationships of the macroeconomic variables in the process were captured. It is found that, of all the channels, the credit channel in the financial market for credit supply and accessibility to the private sector provide the effect of a linchpin in the process by which monetary policy transmits to the real economy. However, interest rate and exchange rate channels during the period (1981 – 2008) appeared to have had a weak effect on the real economy. It is, accordingly, suggested that credit supply and accessibility to the real productive sector of the economy in Nigeria should be radically reformed and strengthened with appropriate regulatory measures, while still maintaining the Monetary Policy Rate as the monetary policy anchor to effect changes in the interest rate structure, credit and exchange rate in the real economy.

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1. INTRODUCTION

A monetary policy shift tends, generally, to transmit a change for the future in the expected behaviour of macroeconomic variables from their initial position, alter in the process the behaviour of economic agents and, finally, create a new equilibrium position, hopefully, in the direction expected by the central bank in the fulfilment of its objectives. In a developing or emerging economy, monetary policy shift is often designed in response or reaction to undesirable shocks in the monetary system and macro-economy in order to restore equilibrium and achieve a set of objectives. For instance, in Nigeria in the fourth quarter of 2007, due to the challenges from autonomous private capital inflow resulting in the appreciation of the naira, the Monetary Policy Rate (MPR) was raised from 8 per cent to 9 per cent in October, probably aimed at a contraction of the system in order to choke off the likely excess liquidity and inflationary pressures of the undesired external shock. Such undesirable shocks generate effects which tend to challenge central banks as the shocks work contrary to their objectives and render monetary policy ineffective.

Central banks, as many studies (to be reviewed later in section 3) have shown, face the challenges of actually understanding the process by which their policy actions impact the objectives of monetary policy. It would be fair to say that central banks do not always know, *ex ante*, with a high degree of precision (despite their use of macroeconomic forecasting models) what the exact effect of their policy action would be when such policy is put in place. What is often unclear is whether or not the policy would actually achieve the desired objective, i.e., the probable effectiveness of the monetary policy. More importantly, when an outcome is achieved, there is the fundamental issue of the transmission channel through which such an outcome is achieved. Consequently, there is continuing debate about the transmission mechanism of monetary policy, namely, the process by which a change in a monetary policy input affects the desired policy objective.

In recent times, interest rate changes, such as the case mentioned above, have become generally accepted as the monetary policy instrument input and inflation as the monetary policy objective. For instance, the Monetary Policy Committee of the Bank of England has described the Monetary Policy Transmission Mechanism as "the process by which interest rate changes affect inflation". While the general acceptability of inflation as a monetary policy

object appears not in doubt, given that monetary stability is a fundamental functional objective of the monetary policy of central banks, the channel through which interest rate affects the economy and, hence, inflation is still very much up for debate. Accordingly, the subject of the optimum channel of the monetary policy transmission mechanism continues to generate much research. A good many of the studies on this economic concern are reviewed in the third section of this paper.

Arising from considerations of inflation as a monetary policy objective is the fundamental problem of how monetary policy input changes affect aggregate output and, hence, the real sector of the economy. A presumption here is the relation between inflation and output gap or, more generally, excess aggregate demand. In other words, in what way or how does a change in monetary policy input affect output in the real sector of the economy? This question is of a critical importance for at least two reasons. First, there is the empirical argument as to whether or not the nominal interest rate can affect the real output (as we shall see later in section 3). The second, a more fundamental issue in a developing or emerging market economy, is what form the transmission mechanism of a monetary policy takes when the central bank changes the interest rate in order to effect changes in aggregate output in the real economy to promote economic growth.

In Nigeria's economy, this issue is of a great importance to the Central Bank of Nigeria (CBN) for two principal reasons. First, the CBN has a foundational policy objective to contribute to the development and growth of the Nigerian economy while pursuing a central bank's universal objective of maintaining monetary stability. Second, the real sector of Nigeria's economy appears far separated from the monetary and financial sector, sometimes manifesting an elusive characteristic in monetary policy management. For example, it has been observed that while the financial services sector has grown robustly, especially since the regime of economic liberalization, the real sector, particularly the manufacturing sub-sector, has not grown correspondingly. At best, the real sector typically lags behind the financial services sector. This is not to suggest support for the McKinnon-Shaw model of financial intermediation growth process which implies that the financial system leads the economy. Such a view is opposed to the "structuralist" thesis that as the economy grows the demand for financial intermediation grows as a result. The concern of this paper is not to engage in such debate. Rather, it is that Nigeria's the real sector seems to be benignly delinked with the financial

sector. This may be explained by the asymmetry problem in financial intermediation. It may also be due to the consequence of the generally held view about the under-development of the financial system in the economy. Whatever view is held, there is the need to establish, empirically, the channel of monetary policy transmission mechanism in Nigeria's real economy. This would be done with a view to gauging how the real economy responds to CBN's monetary policy programming and, hopefully, lead to the strengthening of monetary policy effectiveness in Nigeria.

1.1 Purpose of the Paper

This study examines empirically the Central Bank of Nigeria's monetary policy transmission mechanism and the real economy in Nigeria. In order to do this, the paper is positioned on three principals. First, we review the monetary policy experiences of the CBN before and since the liberalization regime, including the post-Bank consolidation era. Second, we review the monetary policy transmission mechanism (MPTM) paradigm from which an analysis other economies' experiences is presented. Third, the empirical analysis of Nigeria's MPTM is carried out, using the MPTM paradigm as a framework, without exhausting the numerous research studies in economic literature on this issue. An attempt of a robust review of the paradigm is made by focusing on the relevant issues in our thematic analytical structure. The goal of the study is to determine, empirically, the effects of the channels of the monetary policy transmission to the real economy in Nigeria.

The study is guided by a fundamental proposition that the credit channel, both of supply and accessibility in the financial markets, is the quantity channel of monetary policy transmission to the Nigerian real economy. We argue that the two price channels of interest rate and exchange rate in the financial market domain are powerful in transmitting the monetary policy of a central bank to the real economy only through their effect on the credit channel. Thus, the study will attempt, empirically, to explore the monetary policy linkage with output, financial markets, and the exchange rate as it occurs in the Nigerian economy. We assume that financial markets are the domain of credit supply and accessibility. Intuitively at this juncture, therefore, it is not out of place to predict that bursts and booms in Nigeria's financial markets are capable of generating strong and opposing effects on credit and output in the real economy and, hence, on the effectiveness of CBN's monetary policy.

1.2 Structure of the Paper

In section 2, we analytically review the structure of Nigeria's monetary policy experiences. We focus essentially, not in detail, on the three regimes: (i) Pre-Structural Adjustment Programme (SAP) stabilization regime, (ii) SAP and the deregulation era, and (iii) the Bank Consolidation regime. This is followed, in section 3, by a critical review of the monetary policy transmission mechanism paradigm. In section 4, we empirically analyze the evidence of the effects of the channels of the monetary policy transmission mechanism and the real economy in Nigeria. Our approach is to briefly emphasize the theoretical underpinning of each applicable channel, specify linearly the functional relations, and empirically analyze the result of each of our experiments, using data from the Nigerian economy. The sources of data are largely the publications of the Central Bank of Nigeria and Nigeria's Bureau of Statistics. The methodology for the analysis is the vector auto-regression (VAR) model approach, modified with the dynamic logarithmic form, using ordinary least squares (OLS) to capture econometrically the effects of monetary policy inputs in each of the different cases. Thus, in section 4.1 we examine, first and foremost, interest rate effects on the structure of interest rates. This is followed, in 4.2, with an analysis of the behaviour of interest rate, credit and aggregate demand, especially private demand. In 4.3, we analyze the effects of interest rate, credit, exchange rate and output production. Inflation, interest rate, exchange rate, and output behaviour is examined in 4.4, while we explore the issue of the relation of output, financial markets and exchange rate in section 4.5. An assessment of the results of our analysis with our established graphical presentation of the monetary policy transmission (MPTM) links in Nigeria is carried out in section 5. A highlight of the theoretical and monetary policy implications drawn from our analysis is attempted in section 6. We conclude the analysis of the study in section 7.

2. A REVIEW OF THE STRUCTURE OF NIGERIA'S MONETARY POLICY EXPERIENCES

The Central Bank of Nigeria became actively involved in monetary policy in 1964 when it undertook "for the first time" a package of monetary policy initiatives to deal with the problems of inflationary pressures and a rundown of the country's external reserves (Ndekwu, 1990: 98). It is interesting to observe that the monetary policy instruments of the Central Bank of Nigeria, even at that time, were moral suasion, specifying a ceiling on the growth of commercial banks' loans and advances, and providing administrative compositional variation in the commercial banks' liquid assets, as well as changes in the level of the Central Bank's Minimum Rediscount Rate (MRR) (see CBN, 1979; Ndekwu, 1990: 100).

This historical snapshot, which is part of the analytical review of the structure of Nigeria's monetary experiences in this section, forms a coherent component of the initial conditions of our analysis of Nigeria's monetary policy transmission mechanism. It characterized the Central Bank of Nigeria's monetary policy from the regime preceding the epoch-making Federal Government's Structural Adjustment Programme (SAP) of 1986 to the Central Bank of Nigeria's radical Bank Consolidation regime. This structural review is decomposed into: (i) the pre-SAP regime, (ii) the post-SAP and deregulation era, and (iii) the bank consolidation regime.

2.1. Pre-SAP Regime

The structure of monetary policy in the period preceding the Structural Adjustment Programme (SAP) in Nigeria was essentially a stabilization policy regime during the nascent age of the CBN. A stronger policy posture was, however, taken during the Civil War period, 1967 – 1971 and in the "oil affluent" era of 1973 – 1980, with a series of CBN and banking amendment decrees designed to strengthen CBN's operations. Relying on administrative fiat dictated more or less by the Federal Government, monetary policy during this era was largely used to support the fiscal policy operations of government.

Accordingly, the essential characteristic of monetary management during this era was monetary control whereby monetary variables, namely, the lending rates of commercial banks (deposit money banks), deposit rates, credit growth and allocation were administered by fiat, while the exchange rate

was fixed and capital flows directly controlled. It was an era of administered prices in the monetary and financial system by the CBN operating largely as a department of Nigeria's Federal Ministry Finance.

Such monetary control regime, which could be described as a regime of "financial repression" in the Nigerian monetary and financial system was, in fact, characterized by fiscal dominance. Though monetary policy instruments such as interest rate, liquidity ratios of banks, and credit allocation were used, they were largely controlled to support the fiscal operations of the government of the day. Interest rate levels were fixed most of the time, with ceilings on loan rates through the Central Bank's Minimum Rediscount Rate (MRR). Credit allocation was in the form of directives in the sense that banks were directed to allocate specific proportions of credit to specified economic activities and sectors, with specified growth rates of bank credit. Interest rates were capped and credit allocated to preferred, presumably priority, sectors and sub-sectors of the economy. Target rates of the growth of credit and money supply were to be maintained as a rule. There were, accordingly, in this era, both monetary rule and monetary targets in the monetary policy process of the CBN. All the rules and targets were designed to ensure that monetary policy satisfied the fiscal operations of government and to contain inflationary pressures (see Ndekwu, 1983, 1990). Consequently, inflationary pressures were to be contained through the complementary role of monetary to fiscal policy. An exchange control regime was, for the most of the period, in operation for the control of capital movement, especially of scarce foreign exchange resources.

2.2. SAP and the Deregulation Era

A Structural Adjustment Programme (SAP) was introduced in June 1986. It was an innovative policy structure intended to remove the distortions occasioned by the erstwhile regime of monetary control and, thereby, institutes a market-driven regime. Monetary policy during this era experienced de-control and deregulation of prices and incomes which were aimed at enhancing some variability in the use of monetary policy inputs, especially the interest rate and exchange rate variability. SAP was supported occasionally with stabilization securities in the money and financial markets and was strongly bolstered by the decontrol of the foreign exchange market. The ensuing flexibility in banking sector portfolio management of assets and liabilities, through interest rates, was presumed to provide a fulcrum for CBN's monetary policy programming within a market-oriented deregulated economy.

During this deregulation regime, there was a massive entry and high growth of banking and financial institutions, both in structure and in numbers, thereby enhancing choices in financial intermediation. The result was considerable financial deepening. This was propitious to the stimulation of savings and investment in the economy. However, towards the late 1980s and early 1990s, the financial institutions experienced serious distress and insolvency. The consequence was a high rate of exit of financial institutions, especially finance houses as well as commercial banks and mortgage institutions. Non-performing loans, resulting from non-fulfilment of financial contracts, became a phenomenon of the financial system. This posed some challenges to the CBN, both from the perspective of monetary policy and the management of the financial system to ensure soundness and efficiency in the administration of financial operations.

The expected market-driven operations in the economy and financial services sector, embodied in the Structural Adjustment Programme and deregulation regime were not successfully delivered. As a result, financial disintermediation and flight to quality institutions by financial services consumers became the characteristic behaviour of users of the financial services.

It should be noted that the regime of deregulation of the economic and financial services nevertheless resulted in rapid structural changes in corporate governance of the financial institutions especially the banking institutions. Public sector divestment in banking and other financial institutions encouraged private entrepreneurial management and ownership of financial capital in the erstwhile public enterprises. The financial liberalization in this regime encouraged, as it were, a private sector, market-driven economy in Nigeria both in financial services delivery and the non-financial real economy. Innovation in financial services was stimulated in products and processes, especially among the banking sub-sector institutions. These developments seemed to have paved the way for a radical departure in banking operations which provided, so to say, an enabling environment for CBN's greater flexibility in its monetary policy operations. Thus, it could be argued that although the effects of the post-SAP and deregulation era had enormous diseconomies to the banking and financial services sector, by creating negative externalities to consumers of financial services, such as loss of deposit resources and significant loss of welfare, yet it provided some stimulant for a full-fledged radicalization of the sector by the CBN in its monetary policy and bank consolidation initiative.

2.3. The Bank Consolidation Regime

It appeared that by 2004, the banking sub-sector of Nigeria's financial services sector had matured to the point of being a global player. However, the fundamentals of the sector's operations needed a structural reform. The existence of many comparatively small- and medium-sized operating banking institutions was perceived as inadequate for the global banking competitive markets. The compartmentalized banking structure was no longer found adequate for global operations. As a result, the erstwhile structure had to give way to a new operational system, such as universal banking, e-banking, e-business, and e-commerce which had become a fruitful outcome of the nascent information and communication technology (ICT) developments in the Nigerian economy. These elements of financial innovation were needed in the new regime to obtain economies of scale in the banking industry. The resulting mergers and acquisitions in the banking services sub-sector, primarily to satisfy the new, enhanced minimum capital requirement, were meant to pursue these economies of scale for greater profitability, efficiency and effectiveness in the banks' service delivery in a globalized economy to the advantage of the CBN's monetary policy programming and effectiveness. The liberalization of the monetary and financial markets which had taken root from the deregulation regime needed strengthening for the effective monetary policy operations of the CBN.

During the bank consolidation regime, the CBN seemed to require a strong money and financial market system for an effective monetary policy to promote growth of the economy, not just the monetary system, in an environment of a rapidly changing global financial structure. The conduct of monetary policy during this regime was characterized by the use of interest rate as the principal policy input, supported with Open Market Operations (OMOs), stabilization monetary measures for liquidity optimization and exchange rate in the management of the securitized and collaterized finances. The Minimum Rediscount Rate (MRR), which had been the anchor for interest rate as a policy input, was replaced in December 2006 with the more market-based Monetary Policy Rate (MPR).

A radical departure from the previous regimes in the conduct of monetary policy during the post-bank consolidation regime is embodied in the operation of the Monetary Policy Committee (MPC), which had been established by the *Central Bank of Nigeria Act, 2007* and chaired by the Governor of the CBN. The MPC has the responsibility of setting its MPR and

other monetary policy inputs after its periodic assessment of the country's macroeconomic situational report on monetary and economic conditions over its operational period in relation to the immediate preceding period. In 2007, for example, the MPC met five times and took decisions on the level of the MPR, which was changed three times in the year. MPC's decisions are also made public after each meeting of the Committee. The variability of the MPR and, hence, of the interest rate structure is the hallmark of the conduct of monetary policy during the post-bank consolidation regime, which is characterized by a market-driven, liberalized economy.

Major additional regular monetary policy inputs remain credit supply and allocation of banks, liquidity ratio, and exchange rate which is determined at the foreign exchange market. The Open Market Operations (OMOs) of the CBN, which had become a veritable instrument of monetary policy since the early 1990s, became a more regular instrument for the liquidity management of the deposit banking institutions, especially when excess liquidity of the banking system is reported. In this regard, CBN's discount windows, as well as the re-purchase agreement, enable the CBN to influence the liquidity management of the institutions in the financial markets, through the deposit money banks. The interest rates at the discount windows and for the re-purchase facilities provide some mechanism through which the interest rate structure in the financial markets is influenced by the CBN both as a result of its own innovation and in response to the development of liquidity management. For example, direct purchase by the CBN often occurs when there is need to stabilize liquidity in the financial system. This is especially so when the excess liquidity effect of government's fiscal operations occurs, such as when there is disbursement of funds to the three tiers of government, or when there is surplus revenue-sharing to governments from excess crude oil revenue. In each of such cases, there is the tendency for the financial system to be awash with excess liquidity, thereby prompting the CBN to carry out "mopping up" operations in the financial system, using stabilization securities. Such monetary challenges, notwithstanding, financial deepening and intermediation efficiency improved during this era. For example, M2/GDP rose to 38.1% in 2008, from 22.0% in 2004.

Very significant innovations have been put in place, especially during this post-bank consolidation era in the area of monetary policy framework. In 2006, for example, CBN's "standing facilities" was introduced to stabilize money market rates and optimize the liquidity management of financial

market operators. The "facilities" involve the deposit and lending rates which provide the rates corridor within which players dealing with securities in the financial markets are expected to operate. A very singular monetary policy innovation during this era was the replacement of the Minimum Rediscount Rate (MRR) with the Monetary Policy Rate (MPR). MPR became operational in December, 2006 as the nominal anchor for the structure of interest rates in the financial markets.

Monetary targeting has become an anchor of the monetary policy framework since the deregulation era, though it was not firmly established until the post-bank consolidation regime from 2006.[1] The monetary targeting framework hardly worked as the targets were never attained. Besides, in 2009, there was evidence that some deposit money banks' loan portfolios suffered non-performance characteristics, arising largely from inadequate supervision by the monetary authorities and information asymmetry in the banks' financial intermediation process in adverse selection and moral hazard effects. Non-fulfilment of loan contracts by large-scale borrowers became a major challenge to some of the banking institutions which these are also the principal players as lenders in the credit markets.

The phenomenon of non-performing loans among nine deposit money banks posed a big challenge to the CBN in 2009 in its pursuit of a stable monetary policy and a stable financial system. The CBN has nevertheless been able to contain the challenge, through its "bailout" initiative. For instance, in an interview with the *Financial Times of London*(December 18, 2009), the CBN Governor was quoted to have expressed his resolution to continue the fight to ensure that the Nigerian financial services sector, particularly the banking sub-sector, would be adequately strengthened for greater efficiency and effectiveness within the private sector, without necessarily resorting to nationalization of the financial institutions. The bail-out initiative of 2009 is essentially a credit option.

From the highlighted monetary policy episodes, thus far, we have learned at least four lessons for Nigeria's monetary policy transmission mechanism. First, the Central Bank of Nigeria has applied the traditional monetary policy inputs in its monetary policy experience. The second follows from the first: that virtually all the monetary policy transmission mechanism channels were

[1] See, CBN, 2008 **Proceedings of the One-Day Seminar** for excellent discussions on prospects of monetary and inflation targeting for the Bank

implicitly known to have been in operation in one form or the other without any empirical analysis being carried out to establish their existential functional relationship. Third, the CBN has functionally focused its monetary policy on the growth of output and, hence, the real economy, even though the financial markets have not robustly played their expected role in complementing CBN's growth objective of strengthening the real sector of the economy. Finally, the fiscal operations of government have negatively impacted CBN's monetary policy by undermining, in most cases, the monetary policy stance of the CBN. This author's comprehensive study of this subject has been published in three NISER publications (1983, 1990 and 2002). The major thesis of the analyses in these works was that the rate of government borrowing requirements (RGBR) to finance government deficits has had adverse effects on interest rates. The conclusion of these analyses remains essentially unchanged today. Nevertheless, government borrowings facilitate the production of the financial menu for the supply of financial securities and their securitization in the development of financial markets and the domestic debt profile in the Nigerian monetary economy. However, it must be noted that the domestic public debt profile, which has the effect of expanding the sovereign debt, tends to crowd out private borrowings in the credit markets.

3. ANALYTICAL REVIEW OF THE MONETARY POLICY TRANSMISSION MECHANISM PARADIGM

A study of two-and-half dozen cases of the monetary policy transmission mechanism (MPTM) of various economies provided the basis for our critical review of the MPTM paradigm. The objective is to appreciate the theoretical issues and empirical experiences of various economies' MPTM which have been reported in the economic literature. For operational convenience, a thematic structure of the analysis of the MPTM paradigm has been categorized into three. First, there is the general theoretical consideration of the MPTM. Secondly, we examine the economic, subject-specific or issue-specific cases. Thirdly, we analyse the region-specific and country-specific empirical cases. An interesting feature of all the cases is the fact that each case manifests two or more channels of monetary policy transmission.

3.1. The General Theoretical Consideration

We begin this review with what may be regarded as the general theoretical consideration of the MPTM paradigm with the position of the Monetary Policy Committee (MPC) of the Bank of England in its undated publication, The Transmission Mechanism of Monetary Policy**.** The Bank of England's defines the monetary policy transmission mechanism as "the process by which interest rate changes affect inflation". The Bank of England (BoE) identifies four "links" and three stages during which the initial decision of a change in the "official rate" impacts the ultimate goal of monetary policy, namely, inflation.

The four links (or what is generally described in literature as 'channels') are defined as follows:

First is the official interest rate which triggers the changes in market rates. This is the interest channel. It is argued that once a decision made on the official rate has been announced, "expectations about the future course of the economy" are affected concerning asset prices and the exchange rate. The second is the resulting changes arising from the official rate change on the spending, savings and investment behaviour of individuals and firms in the economy. In other words, interest rate changes affect the demand for goods and services produced in the domestic economy. The third link is "the level of demand relative to domestic supply capacity" which "is a key influence on domestic inflationary pressure". This is the output gap between domestic aggregate demand and aggregate supply, or better still, excess aggregate

demand or aggregate supply. Finally, the fourth link is the exchange rate whose movements "have a direct effect….on the domestic prices of imported goods and services…"

The Bank of England's graphic presentation provides the three stages through which the transmission mechanism passes. The first stage is from the official rate to market rates, asset prices, exchange rate and hence expectation and confidence. The second stage involves total demand, that is, domestic and external demand, which leads to the third stage at which domestic inflationary pressures, combined with import prices, affect inflation.

It would appear that the explicit channels in this paradigm are interest rate, asset prices in the financial markets through which consumer and investment spending is affected as well as the exchange rate. The BoE analysis ascribes no important channel role to the money supply in the MPTM paradigm. Itas such. It argues, "The money supply does play an important role in the transmission mechanism but it is not, under the United Kingdom's monetary arrangement, a policy instrument". It would appear, however, that the Bank's decision in 2009, through its MPC, to expand the money supply through "large-scale asset purchases" (i.e. "quantitative easing") has had the effect of shifting the Bank's monetary policy focus, as the Bank Rate was near zero. The BoE's paradigm recognizes the importance of the financial markets in the monetary policy transmission process. Hence, a pride of place is given to the "financial accelerator effect" which is described as a normal part of the monetary transmission mechanism whereby "firms' asset values impinge on the ability of firms to borrow". The financial accelerator effect is actually viewed not as the bank lending channel effect, but as part of the credit channel which also may be described as the balance sheet channel, since the net worth of firms arising from the change in their asset values in the balance sheet affects the ability of firms to borrow.

This notion of the role of asset values in the monetary policy transmission pardigm is similar to that of the broad credit channel, as developed by Bernanke and Gertler (1989), though differently, through the collateral value for borrowing. However, as noted by Guttner and Mosser (2002), in a "frictionless" credit market, a fall in the value of a borrower's collateral may not affect investment decisions. The BoE's position in this case, nevertheless, appears to be in line with the balance sheet effect which we shall discuss later in relation to the United States' position on the paradigm, as epitomized

by the views expressed in the Federal Reserve system, though not necessarily representing the official views of the United Sates as is the case with the position of the Bank of England.

The Bank of England 's theory, accordingly, is that if the official rate, that is, the interest rate, changes, then market rates, asset prices, and the exchange rate would change and thereby, generate changes in aggregate demand and aggregate supply which would trigger inflation. The effect of a change in the official rate would take some time before its effect on inflation is manifested in the economy.

There is quite a robust discussion and a generally debatable paradigm traceable to the United States' Federal Reserve System. The discussion has not necessarily been led by the System itself, but by the intellectuals and officials associated with the System. In a *Symposium on the Monetary Transmission Mechanism,* Mishkin (1995), in his schematic presentation, provides a synopsis of the *Symposium* and identifies four channels.[2] Mishkin says, "These transmission mechanisms include interest rate effects, exchange rate effects, other asset price effects and the so-called credit channel". Bernanke and Gertler (1995) acknowledge the significance of monetary policy in influencing the course of the real economy, but they observed that "how exactly monetary policy exerts its influence is still unsure empirically". Bernanke and Gertler (1995) then argue, "To a great extent, empirical analysis of the effects of monetary policy has treated monetary transmission mechanism itself as a 'black box'". This is largely because little was known empirically about the policy transmission mechanism, especially in regard to the credit channel.

Cottarelli and Konvetis (1994) had earlier attempted to analyze the effects of the financial structure, bank lending and the monetary policy transmission mechanism to support the credit channel, even though no empirical evidence had been produced to that effect. The view had been held (see, e.g. Romer and Romer (1990)), following the argument of Friedman and Schwartz (1963), that monetary policy actions, followed by movements in real output, might last for two years or more. Such view implicitly makes the effect of monetary policy on the real output doubtful within a short-term period. Iceland (2005) suggests that any theory or model of the monetary policy transmission mechanism must assume that there exist no privately-issued

[2] See a good summary of Mishkin's analysis in Omotor (2007: 49 – 52) and also in Ajayi (2007).

securities that substitute perfectly for the components of the monetary base. He then argues that under an assumed friction in the economy, changes in nominal prices would be slow to adjust the movement of nominal interest rates and to translate into movements in real interest rates to affect the real economy.

Iceland's (2005) analysis further postulates that in an open economy, additional real effects of a policy-induced change in short-term interest rate come about through the exchange rate channel. This is because any change in domestic nominal interest rate that rises above its foreign counterpart equilibrium in the foreign exchange market requires that the domestic currency gradually depreciate at a rate that serves to adjust the risk-adjusted debt instruments denominated in each of the two currencies, which would illustrate a case of uncovered interest parity. Thus, the interest rate link with the exchange rate is achieved through the financial markets. It is further argued, using Tobin's q-theory of investment, that a rise in interest rate, for instance, could make the replacement cost of physical capital owned by firms to become more expensive. On the other hand, in accordance with Ando-Modigliani's life-cycle theory of consumption, as interest rate rise, debt instruments become more attractive than equities from the investor's perspective, leading to a fall in equity prices.

A structural view of interest rate is contained in a paper presented at a Conference on Financial Innovation and Monetary Transmission by Kuttner and Mosser (2002). In the paper, the authors affirm that "the overall conclusion drawn from the research presented is that monetary policy appears to have less of an impact on real activity than it had – but the cause of that remains an open issue". Using financial innovation, changes in the conduct of monetary policy, and fundamental economic structural hypotheses to explain the weaknesses of monetary policy, the conference held that the key policy change instrument is the Open Market Operations (OMO). This affects reserves from which Federal Funds rate, in the United States, affects the monetary base more than money supply. The view is that the Federal Funds rate and the monetary base, rather than the money supply, affect market interest rates which, in turn, affect loans supply.

Thus, this structural view of interest rate holds that market interest rates, in turn, affect asset price levels, real interest rates and the exchange rate. But the anchor in the structure is the Fed funds rate through which the monetary base

and relative asset prices can be affected directly. It is correctly emphasized that the "monetary transmission mechanism is a complex and interesting issue because there is not one, but many, channels through which monetary policy operates". Therefore, no one channel or policy input is monotonically related to the real economy or output in a monetary policy function. Anyone arguing to the contrary would appear rather heretic.

A monetarist perspective (Meltzer, 1995) recognizes the interplay of relative prices with at least three assets, namely, money or base money which provides services as a medium of exchange; bonds or securities which yield a nominal return, the rate of interest; and the stock of real capital or claims to real capital. The monetarist perspective acknowledges that "The transmission process begins in the asset market". It does not say, however, what triggers it or how the process starts. It recognizes the open market operations by the central bank which, in this view, is "a simultaneous change in the stocks of base money and securities". In the "traditional quantity approach" (see, e.g., Ndekwu, 1990: 18 – 20), an open market operations purchase increases the base money and reduces the stock of debt held by banks or the public; the reverse case of open market sales decreases the base money and increases the public's debt holding.

As a result, the monetarist's supposed channel of monetary transmission, in the sense that it focuses "on the direct effect of changes in the relative quantities of assets rather than interest rates", was the concern of Kuttner and Mosser (2002). This perspective seems not to recognize that even in a portfolio of assets, the mechanism which triggers the relative choices in the quantities of asset holding is the relative prices of the assets which create a 'compositional variation effect', in obedience to what is termed "the law of compositional variation" in the portfolio of assets (Ndekwu, 1990: 207-211). The logic of the monetarist channel of monetary transmission, according to Kuttner and Mosser (2002), is that because various assets are imperfect substitutes in investors' portfolios, changes in asset composition outstanding, brought about by monetary policy would lead to relative price changes which, in turn, can have real quantity effects.

The effect of the monetarist perspective is the use of a rule championed by Milton Friedman as opposed to discretionary operations of central banks in monetary policy, even though the monetary policy transmission mechanism is not the same as the discretionary policy. It is true, as Friedman (1953) had

argued that there is the difficulty of stabilizing an economy by the use of the discretionary policy. Yet, as we shall demonstrate, and as it has been observed in Nigeria's monetary policy experiences, the use of a rule is no better in the conduct of monetary policy, nor has it produced greater effectiveness in monetary policy, as outcomes have often diverged grossly from targets.

An eminent offspring of the use of a rule in monetary policy is the notable Taylor rule (Taylor, 1989) whose grand-child is monetary or inflation targeting (see, Svensson. 1999). The two, in a way, are not the same, though both have similarities in their propositions on the monetary policy transmission mechanism. While the former is concerned with targeting monetary aggregates, such as money supply or credit growth, the latter specifically targets the rate of inflation. The original Taylor (1989) rule specifies how a central bank might adjust its interest rate target to try to maintain stability and employment. The proposed rule has been subjected to considerable extension and interpretations. (See e.g., McCallum (2002) where a numerical illustration was used to further demonstrate the implications of the Taylor rule. See also some discussions on the application of a similar rule as it applies to inflation targeting in Nigeria in: Central Bank of Nigeria (2008), especially O'Connel (2007), Hugman (2007) and Odusola (2007)).

In this study, we have adopted a regression approach to test a linear relationship of the variables in the Taylor rule.

The Taylor rule is expressed elegantly as:

$$R_t = R^* + \lambda\left(Y^e - Y^*\right) + \lambda\left(\pi^e - \pi^*\right), \qquad 3.1$$

R_t = central bank's current interest rate target,

R^* = equilibrium interest rate target, $Y_t^e - Y^*$ = expected output gap; $\pi_t^e - \pi^*$ = the expected inflation gap.

Thus, a central bank would set its interest target above the equilibrium level when the output gap is positive, i.e. $\left(Y_t^e - Y^e\right) > 0,$ where the expected output, Y_t^e exceeds potential output, Y^* or when the inflation gap is positive,

i.e. $\left(\pi_t^e - \pi^*\right) > 0$, where the expected inflation π^e exceeds the inflation objective. It is postulated that a negative interest rate is possible, especially if, for example, $\left(\pi_t^e - \pi^*\right) < 0.$

In an attempt to empirically examine this rule in Nigeria, using annual data for 1981 - 2006, we modified the equation (3.1) by assuming as follows:

$\Delta Y_t = Y_t^e - Y^e$ and $\Delta\pi_t^e = \pi_t^e - \pi*$; so that a linear relationship was established for the specification of the model. Accordingly, we transformed the rule equation into logarithm form to:

$$InR_t = R^* + \lambda_1 In\Delta Y_t + \lambda_2 In\Delta\pi_t.$$

The resulting estimate for $R^* = 1.682; \lambda_1 = 0.022; \lambda_2 = 0.068; R^2 = 0.210.$

There is a positive relationship between interest rate, R_t, output change and a change in the inflation rate as reflected by the positive signs of λ_1 and λ_2. This implies that, indeed, output change and a change in inflation rate could lead to a change in the current interest rate, with the equilibrium interest target being positive, too. The strength of the relationship is rather low though there is a fundamental theoretical implication of the relationship embodied in the empirical result, which is, a change in the inflation rate could as well be determined to be related to a change in interest rate and a change in output.

However, as Taylor (1995) argues, "the results of [his] research, while not leading to any single specific mainstream model of the monetary transmission mechanism, have a number of common structural characteristics and thereby constitute a general framework for discussion and analysis". Indeed, while we are not in any way certain of what his empirical results are, there is ample room, from our empirical results, for further analysis and discussion especially in any attempt to adopt the rule as a monetary policy approach. While acknowledging the progress being made in empirical research on this issue, Taylor (1995:24) expresses optimism on the need for the role of financial intermediaries in the monetary policy transmission mechanism. This, in a way, supports what is being attempted in this study.

Taylor (1995) all the same, acknowledges that there are many different views of the monetary transmission mechanism, depending on whether the emphasis is on money, credit, interest rate, exchange rates, asset prices, or the role of commercial banks and other financial institutions. Empirical research by many economists, such as the one reported in the review by Bryant, Hooper, and Mann (1993), and many others which we shall discuss in the next sub-section 3.2 have evolved in order to demonstrate the results of the application of those channels of transmission of monetary policy.

There is the general proposition, as expressed by Sellon Jr. (2004), that "In principle, the monetary policy transmission mechanism can be described rather simply: When the Federal Reserve raises its target for the federal funds rate, other rates also rise, reducing interest-sensitive spending and slowing the economy". [It is agued], "Conversely, when the federal funds rate target is lowered, other rates tend to fall - stimulating spending and spurring economic activity". Romer and Romer (1990: 197), however, could not find evidence to support the view that a tight monetary policy in the US "has a direct impact on bank lending, and credit market imperfections cause many bank borrowers not to have easy access to alternative sources of funds". They, accordingly, argue that they "find that the evidence is instead much more consistent with a conventional textbook account in which the Federal Reserve's influence over the economy stems from the impact of monetary policy on the stock of transactions balances". A review of the robust research on economic subject-specific or issue-specific, as well as region- or country-specific empirical analyses of the monetary policy transmission mechanism paradigm which follow will help us to appreciate the validity or otherwise the theoretical views on the MPTM issue.

3.2 Subject-specific or Issue-specific Studies

In this section, we review a number of empirical studies which have focused on the attempt to elucidate economic subject-specific or issue-specific research on the MPTM paradigm. The evolution of the empirical studies demonstrates the commitment of economists to advance our knowledge in this area for enhancing the effectiveness of monetary policy.

Gertler and Gilchrist (1993) analyze the role of credit market imperfections by examining the response to tight monetary policy of different forms of credit and different types of borrowers. They argue that "There is a striking difference in response of credit flows to small versus large borrowers". In their analysis,

they uphold the view: (i) of credit channel, and (ii) that the imperfections of the credit market "help propagate the impact of monetary policy". Kashup and Stein (2000), using a data set that includes quarterly observations of every insured US commercial bank, from 1976 to 1993, report that the impact of monetary policy on lending is stronger for banks with less liquid balance sheets. While this study supports the "bank lending channel", the critical variable is the liquidity position of the bank which favours a bank's ability to lend: the less liquid a bank is the more likely will be the monetary impact. Hence, from the study, it is held that banks with lower ratios of securities to assets, such as small-sized banks, would feel a greater impact than the large-sized banks. In a way, a bank's balance sheet quality, in terms of liquidity, is capable of generating appropriate responsiveness to monetary policy.

Walsh and Wilcox (1995), however, used a monthly data-based vector autoregression (VAR) analysis in which bank-loan supply shocks are identified with innovations in the prime lending rate. They show that loan-supply innovations are related to changes in bank capital ratios, changes in required reserves, and the imposition of credit controls. The results of this study appear quite similar to the experiences of banks, for example, in Nigeria, under its stabilization regime. Owing to administrative control conditions, banks were forced to become innovative in their loan-supply function which, by itself, weakens or undermines the effectiveness of monetary policy.

Expectation has been a controversial issue in monetary policy transmission mechanism. Sellon Jnr. (2004) of the Federal Reserve Bank of Kansas City zeroes in on financial markets' expectations in his model. The attempt is to capture the path of future policy actions, as well as explore which actions are regarded as the driving force in the determination of market interest rates. Relying on the expectations theory of the term structure of interest rate, he argues that the interest rate on any security can be viewed as an average "of today's federal funds rate target (in the US) and the entire series of future targets that are expected by financial markets over the life of the security". Furthermore, he argues, for instance, that:

2-year rate=1/2(1-year rate + expected 1-year rate in one year) + term premium.

The conceptual issue is to attempt to provide some practical operational usefulness to the Taylor rule we discussed earlier. However, it is added that

when expectations play a part in the monetary policy transmission mechanism, the information that the central bank provides to financial markets plays a crucial role in the transmission mechanism.

In an attempt to capture the role of household debt and the balance sheet in relation to MPTM, Benito, Waldron, Young and Zompolli (2007), summarize the conclusions from the research of the Bank of England on the issue. In a microeconomic foundation analysis, the paper argues that the extent to which the level of household debt affects the outlook of the economy has an important relation to monetary policy transmission. The analysis came on the heels of rapid growth of household mortgage debt, arising from the mortgage market downturn. Consequently, the circumstances of individual borrowers and lenders under such financial conditions, especially the household balance sheet profile, affect the responsiveness of the economy to unanticipated developments of economic conditions.

A profound empirical study of the monetary policy mechanism through the consumption-wealth channel was carried out by Ludvigson, Steindel and Lottan (2002). They focused on the response of real variables to unsystematic policy shocks as measured by innovations in the federal funds rate. Their preference was motivated by the view (Lucas, 1976) that systematic monetary policy would have no effect on the real economy if people formed expectations rationally. Using vector autoregression (VAR) methodology, with a baseline dynamic structural model embodying five variables in logarithm form as arguments, the study concluded that the wealth channel plays a minor role in MPTM to consumption. The authors, however, attributed the minor wealth effect to the transitory nature of the federal funds rate innovation on asset which has been of little effect on consumer spending.

We learn, from our review of studies on the role of economic-specific or issue-specific issues in the MPTM paradigm, three major lessons. First, interest rate is a central pivotal policy input of monetary policy, even though its effects appear not quite precise on the monetary policy object. And even when it does achieve the desired effect it does so with some time-lag. Secondly, there is as yet no general agreement on the power of the other channels of monetary transmission mechanism. Thirdly, empirical results reveal that the interest rate policy input is only capable of achieving monetary stability in combination with the other co-operant channels, namely, wealth effect, credit, bank lending, and the exchange rate. We cannot be categorical on these lessons

until we have reviewed region-specific or country-specific empirical studies on the MPTM paradigm.

3.3 Region-specific or Country-specific Empirical Studies

The region-specific or country-specific empirical studies attempt to investigate some particular aspects of the MPTM paradigm as they affect countries within a region or individual countries of interest to the researcher. We do not claim that our review would be exhaustive; we are only interested in highlighting the various channels of transmission with a view to preparing the ground for our empirical analysis of the evidence from Nigeria on the monetary policy transmission mechanism and the real economy.

Evidence from the balance sheets of European banks is the subject of the empirical work by Favero, Giavazzi, and Flabbi (1999). While admitting the existence of European studies on asymmetries in the monetary transmission mechanism which were based, largely, on macro-economic evidence, the authors based their analysis on micro-economic data contained in the balance sheets of banks. Thus, the analysis had two features. First, it examined the balance sheet channel. Secondly, it applied the micro-economic approach as against most studies on this issue which focus, largely, on the macro-economic approach.

The issue of information asymmetries, which is a strong case against using financial market failures in credit operations, as well as in effecting monetary policy efficacy, is of much interest in financial intermediation and monetary policy transmission mechanism. The authors systematically examined the effects of a credit squeeze on liquidity which they assumed to be the first link in the transmission mechanism when analyzing bank loan responses. They argued that the credit channel is the link through which the effect of the balance sheets of banks is observed and could also be an important source of asymmetries in the MPTM in Europe. Mirdala (2009), while investigating interest rates in the MPTM in selected EMU countries, holds the view that non-linearity between interest rates, which are significantly within the control of the monetary authorities and selected macroeconomic variables which constitute the objects of monetary policy, is a reflection of asymmetries in the MPTM. He argues, however, that an expansionary monetary policy has a less significant impact than a contraction-oriented monetary policy in the US, in particular, in the MPTM.

A similar empirical study was carried out on the financial systems and the role of banks in monetary policy transmission in the Euro area by a group of scholars led by Ehramann and Gambacorta, et.al. (2004). The study group attempted to "offer a comprehensive comparison" on the structure of banking and financial markets in the euro area in relation to MPTM. Hypothesizing that "many of the predictions that were proposed for the US are deemed unlikely to apply to Europe", they find that monetary policy does alter bank loan supply. This has effects on users of funds who most depend on the liquidity of individual banks. They further find that unlike the US banks, the size of a bank generally does not explain the lending reaction of euro banks.
In a slightly different but related study on Europe, Peersman and Smets (2001) used different data sets and applied the structural VAR models for the euro area and national economies. They found different responses by individual countries to the interest rate effect. Hoffmann and Holtemoller (2007) explored the impact of nominal exchange rate changes on goods (pass through) and trade flows in six non-EMU (European Monetary Union) countries. Their finding was that exchange rate pass-through in the countries was incomplete, in the sense that exchange rate changes led to variability in the firms' mark-ups. They argued that exchange rate pass-through, which depends on the elasticity of substitution, had varying welfare effects depending on the exchange rate regime. For example, welfare under flexible exchange regime is not monotonic in the degree of pass-through. However, in a fixed exchange rate regime in which the disliked variability in labour cost is dominant in the stabilizing effect of the regime on consumption, it would be preferred if the pass-through is rather small and, therefore, superior. This is because under such a condition, the elasticity of international substitution exceeds the household threshold elasticity value.

The issue of a link between output and inflation in the MPTM was examined in an unpublished study by Demery (2009), using ten OECD countries. It was an empirical analysis of the link between the dynamics of real house prices and key macroeconomic variables, namely, prices, output, and interest rate. It found that a monetary policy shock lowered real house prices in all the ten countries where the interest rate shock explained between 12 and 24 per cent of the cyclical variations in house prices, while between 12 and 20 per cent of output could be traced back to the housing demand shock, which is a key driver of money market rates. It was observed that the impulse response indicated that house prices rose after an output shock, in nine of the ten countries. The evidence suggests that real stable prices have a large impact

on key macroeconomic variables and thus are germane to the aggregate demand shock. Arguably, this is because a house price shock raises output and prices and leads to increasing market rates in all the ten OECD study countries.

A similar cross-country study by Cukierman (2004) explored the five channels of the MPTM in six countries. The author maintains that there are often substantial differences in the transmission mechanism across different countries. For example, the six countries studied had both the interest rate and exchange rate channels, while none had the asset channel. The credit channel was found to operate in Chile and Israel while the expectations channel was found only in the United Kingdom and Canada. The five channels of the MPTM examined are the traditional interest rate, the monetarist asset channel, the exchange rate, the credit channel, and the expectations channel.

In the emerging market economies, the study by the Bank for International Settlements (BIS) (2008) observed that the interest rate channel had become stronger and "the relative importance of the traditional channels such as the credit channel has declined, at least in normal times". This observation appears to be in contradiction to the findings of other cross-country studies. The study noted that by "January 2008, fiscal dominance has been largely overcome and monetary policy frameworks are now more credible". However, in most emerging markets economies (EMEs), lower and less volatile inflation has resulted from better monetary policies, reflecting a stronger link between the monetary policy transmission and inflation. The pass-through from exchange rate to domestic inflation has fallen since 2001, though the sensitivity of inflation to foreign price changes has increased.

The financial market pass-through was splendidly analyzed in regard to the economy of Iceland by Petursson (2001), using a structural VAR approach. Two stages were identified. The first stage was that of the interest rate channel, with the second stage explaining the "propagation of monetary policy" from the financial markets to the real economy. The results of the analysis indicate that an innovation to monetary policy by the use of the official interest rate has had a significant "within-the-month" effect on the money market rate. According to Petursson, the innovation is then propagated through the money market to the bond market and then to the bank loan market rate. He notes that this process involves the term structure,

through which short-term money market rates affect the longer-term interest rate structure. He suggests that the effect peaks within one to four months after the initial monetary policy shock, lasting for about eight to nine months. In the analysis, it is postulated that the bond rate is the most important determinant of the marginal cost of loan funding. The consequence of this is a mark-up of the pricing of loans over deposit rates.

In Japan, Fujiwara (2003) focused on output composition of the MPTM in order to investigate the view that whereas in the US, the predominant driver of output change is consumption, in the euro area it is the investment channel. The author, determined to understand which of the two is superior, challenged the extant views, using empirically the VAR model, and argued that the operation of the monetary policy mechanism in Japan relied on short-run divergence between the expected rate of inflation and the actual inflation rate. Under such a condition, monetary policy could be powerfully used to restore equilibrium by creating an adjustment stimulus on the expected rate of inflation. He noted that the expected rate of inflation varied with individuals or groups, depending on information availability: a banker's inflation expectation was very likely to be different from an industrialist's or a farmer's. Such a structure of inflation expectation would affect the composition of output, through the structure of consumption and investment, he argued.

This is not the case with the Jamaican MPTM as shown by the impressive empirical work of Allen and Robinson (2004) which found that there is a direct transmission from interest rates to exchange rates, through asset portfolio substitution reflected and reinforced by changes in domestic liquidity conditions. The authors, therefore, argued that inflation stabilization was achieved mainly through the impact of the channels on aggregate demand. They noted that the output gap played a minor role in terms of a direct impact on inflation. Rather, the credit channel, arising from the asset portfolio substitution and the exchange rate, played a more important role in the MPTM in Jamaica.

The result of an undated study by Chang on Kenya's MPTM, using VAR analysis with data from 1997 to 2005, suggests that an exogenous increase in the short-term interest rate tends to be followed by a decline in prices and an appreciation in the nominal exchange rate, but has no significant impact on output. Thus, the analysis attributes significant variations in the nominal

exchange rate and prices in the Kenyan economy, following monetary policy innovation, to variations in the short-term interest rate.

In concluding this review of the MPTM paradigm, using cases from various studies, we make three propositions which underline our empirical analysis of the experience of Nigeria. First, the short-term interest rate autonomous change of the central bank triggers changes in the interest rates structure of the financial markets. Second, changes in the interest rate structure bring about changes in credit (in some countries), wealth (financial, arising from asset prices change in some economies), bank loans or lending from balance sheet changes, and nominal exchange rate. Third, the resulting changes from the financial markets, including the external markets of foreign exchange and the exchange rate, affect aggregate demand and output and, finally, inflation. The directional effect of interest rate changes is largely positive with the interest rate structure, but may not be so with all financial assets. That is to say, an autonomous rise in a central bank's interest rate raises other interest rates in the economy's structure of interest rates. Conversely, an autonomous reduction in a central bank's interest rate reduces the structure of interest rates in the economy. An unchanged central bank's short-term interest rate keeps other interest rates unchanged. The time response varies with different economies: some are shorter, while some are much longer.

4. ANALYSIS OF THE EVIDENCE OF NIGERIA'S MPTM AND THE REAL ECONOMY

In this section, we analyze the evidence of Nigeria's MPTM and the real economy, following on our propositional conclusions on the MPTM paradigm in the preceding section. Our approach is to specify the models in a modified VAR with the dynamic logarithmic form and using the OLS regression method to test the relationships with data sets of varying periods, depending on the variables in the analytical relationships and the quality of the available data. Hence, in some cases, quarterly data are used while annual data are used in some other cases.

The analysis is in five compartments; each model compartment focuses on the relevant link variable effect and its connection within a multivariate linear functional relation of the modified structural VAR in the MPTM process. The first is the interest rate structural effects. Second, we examine the interest rate and credit effects on aggregate demand. Third, we analyze the interest rate, credit, and exchange rate effects on total output production. The fourth is an analysis of the relationship between exchange rate, interest rate, output, and inflation. Finally, we explore the relationship between exchange rate, financial markets, and output. In each of the analyses, we conducted a series of experiments before settling on the result which we consider to be the "best-fit" explanatory relationship.

4.1 The Interest Rate Structural Effect

We have observed in section 3 of this paper the general view that when the official rate of interest changes, the other interest rates change, too, in the same way. In Nigeria, the official rate of interest rate is currently the Monetary Policy Rate (MPR). Before 2006, the official rate of interest of the Central Bank of Nigeria was the Minimum Rediscount Rate (MRR). Thus, for our statistical analysis over the period, we employ MRR/ MPR, even though for policy purposes the MPR is the official interest rate. Using quarterly data, it is observed that between Q1 1999 and Q4 2007 the MRR/MPR was changed 22 times, out of which the rate was raised seven times from the previous quarter level, it was reduced ten times from its previous quarter level, and kept unchanged from its previous quarter level seventeen times. The years 2004 and 2005 witnessed relative stability, whilst the year 2000 witnessed relative volatility in the rate.

In response, deposit money banks (formerly known as commercial banks), on the other hand, changed their prime lending rates from the previous level 31 times between Q1 1999 and Q4 2007. Apparently, banks' prime lending rates were more volatile than the MRR/MPR in the same period. Interestingly, the prime lending rates of banks were raised 14 times during the period and reduced 16 times from the previous level. The rates were kept unchanged only three times during the period. The volatility of the prime lending rates of the banks was, accordingly, more noticeable in 1999, 2001, 2002, 2003, 2004 and 2005. Evidently, therefore, the years preceding the bank consolidation exercise of 2006 and the immediate post-consolidation period of 2007 to date, have witnessed interest rate volatility, especially of the banks' prime lending rate.

What do we make of the movements of the interest rate structure following the MPR innovation? We have used only two rates here as a sample of interest rates for an illustration. We postulated like the MPC of BoE (undated) and Sellon (2004), that changes in MPR will have a positive correlation with changes in the term structure of interest rates. In order to capture this postulated relationship, we carried out two experiments. In the first experiment, we used the MPR and banks' rates only. For the second test, we expanded the rates to cover other short-term rates in the money markets, thereby taking into account varying tenors of Deposit Money Banks' rates and yields in the money market. It is instructive to note that we were constrained by data availability on interest rates hence the selected interest rates here.
A two-stage experimental relationship is tested with the first equation being a reduced form; the second has additional variables which are specified here as the extended version as follows:

$$In\Delta R = \beta_0 + \beta_1 In\Delta R_2 + \beta_2 In\Delta R_3 + \beta_3 In\Delta R_4 + \beta_4 In\Delta R_5 + \beta_5 In\Delta R_6 + \beta_6 In\Delta R_7 + \beta_7 In\Delta R_8 \quad 4.1$$

The notations are as follows:

R = Minimum Rediscount Rate/Monetary Policy Rate,

R_2 = Treasury Bills Rate,

R_3 = Savings Deposit Rate,

R_4 = Deposit Rate of 7-day Tenor,

R_5 = Deposit Rate of 12-month Tenor,

R_6 = Prime Lending Rate,

R_7 = Maximum Lending Rate, and

R_8 = Inter-bank Lending Rate.

The extended relation in the second experiment simply captures a broader spectrum of market interest rates.

The result of this second experiment, which includes in the system banks' Maximum Lending and Inter-banks' rates, reveals a somewhat marginally different picture. The evidence is revealed as follows:

$$In\Delta R = -1.373 + 0.552 In\Delta R_2 - 0.041 In\Delta R_3 - 0.315 In\Delta R_4 - 0.044 In\Delta R_5 + 1.023 In\Delta R_6$$
(0.775) (0.136) (0.137) (0.212) (0.246) (0.420)

$$+0.131 In\Delta R_7 + 0.014 In\Delta R_8 .$$
(0.230) (0.069); Correlation coefficient, R=0.931; D-W= 1.868.

In the above result, the Treasury Bills rate, R_2, and the Prime Lending rate, R_6, change positively with MPR, while the Savings Deposit rate, R_3, the Deposit rate of 7-day tenor, R_4, and the Deposit rate of 12-month tenor, R_5, change in the opposite direction. It does appear that the savings deposit rate, the 7-day deposit rate, and the deposit rate of 12-month tenor change inversely with the MPR.

Interestingly, therefore, the Treasury Bills rate, the banks' Prime Lending rate and the inter-bank lending rate are positively correlated with changes in the Monetary Policy Rate. Savings deposit rates do not move in the same direction with changes in the MPR. In the two experiments, the banks' prime lending rate is highly elastic with respect to changes in the MPR. We shall explore in the next sub-section 4.2., how this movement between changes in the MPR and the banks' prime lending rate affect credit.

What we have done is simply establishing a statistical correlation between MRR/MPR and other interest rates in the financial markets, which may not sufficiently reflect what actually happens. What is probably needed is to

understand the process by which the MRR/MPR (for convenience, we use only the MPR) makes other rates change in the same direction, especially the market rates. There is no legal framework which makes other rates to change in the same direction as the MPR. The first thing to note, therefore, is that, prior to the establishment of the Monetary Policy Rate, that is, during the operation of the Minimum Rediscount Rate or the Minimum Lending Rate of the CBN, when the CBN raised its official rate (MLR or MRR), the banks were faced with a higher cost of borrowing from the CBN. For instance, a 100-basis point in the CBN's MLR indicated to the banks that their cost of borrowing from the CBN would rise by a 100-basis point. The banks in response, maintained their profit margin by raising their rates, a kind of mark-up, otherwise they would have experienced a loss.

Therefore, in order to ensure that their margin remained unchanged, or in fact, improved, the banks also raised their rates on earning assets, especially loans and advances, in the same direction that the CBN's lending rate had changed. The reverse happens when the CBN reduces its Rate.

Thus, the evidence from the regression result confirms the fact that changes in the banks' interest rate structure follow in the same direction with the change in the CBN's rate. Therefore, a positive correlation would be expected between the CBN's MPR/MLR and the structure of interest rates in the financial markets. However, as we have observed, this is only true of bank loans and advances and, hence, credit, but not often of bank deposit liabilities. This, in effect, makes the interest rate differentials, or spreads, often to widen when the CBN's MPR is raised. Hence, whilst banks' loan rates appear monotonic of the MPR, the deposit rates appear not so. Besides, observation shows that it takes up to 30 to 90 days for banks to respond, especially when the MPR is reduced, but a much shorter time when the MPR is raised. In other words, the bank lending rate is quicker to respond to a raised MPR than to a reduced MPR. This may be explained by the asymmetries in the financial markets or by banks' attitude towards outstanding commitments, especially credit commitments.

4.2 Interest Rate, Credit, and Aggregate Demand

In order to capture the relationship between interest rate, credit and aggregate demand we proceeded in a sequential manner, using our VAR approach in three operations. Arguing that credit is an intermediate policy input in the link between MPR and aggregate demand, we first sought to

establish, empirically, the effect of interest rate on credit. Second, we extended the relationship to other macroeconomic variables in the credit function in order to finally link these variables with aggregate demand.

4.2.1 Interest Rate and Credit

We observed in section 4.1 that the market rates that changed in the same direction with a change in the MPR are banks' prime lending rates, the inter-bank rates and the Treasury Bills rate. All the three are on the lending outlets of banks and accordingly sources of credit supply to the economy. Since the three interest rates change in the same direction with a change in the MPR, it follows that a rise in the MPR will raise the rates and, inversely, with credit. But the level of outstanding credit may have an effect on credit availability to the private sector.

Thus, we postulated (see e.g., Romer and Romer, 1990: 174, for a similar methodology) for our experiment a specification as follows:

$$\Delta InCPS_t = \beta_0 + \beta_1 \Delta InCPS_{t-1} + \beta_2 \Delta InMPR_t ; \qquad 4.2$$

CPS is credit to the private sector; $t-1$ is the lagged variable for one period, MRR is Minimum Rediscount Rate/Monetary Policy Rate.

Using quarterly data for the period 2001 Q1 to 2007 Q4, the resulting relationship of the experiment is:

$$\Delta InCPS_t = 0.70 + 0.983\Delta InCPS_{t-1} - 0.136\Delta InMPR_t$$
$$\qquad\quad (0.989)\ \ (0.053) \qquad\qquad (0.096)$$

$R^2 = 0.992$; D-W =1.550.

The result confirms the fact that a change in the MPR has an inverse effect on credit to the private sector of the economy. The private sector here is defined using the CBN categorization, namely, the core private sector, non-financial public enterprises, and State and Local Governments (CBN, 2007). Thus, a reduction in the MPR increases credit availability and supply to the private sector of the Nigerian economy as is theoretically expected. The previous outstanding credit portfolio has a robust effect on the change in current

credit to the private sector. The issue of a negative interest rate effect on the change in credit will, however, be discussed further as this may not always be true. It may be instructive at this juncture to note that in the case of the relationship between, share prices and bank credit, we could not empirically investigate it due to lack of adequate data. However, we could speculate that as share prices rise, thereby generating increases in earnings from investment in the stock market, there would be an incentive to borrow, given the rate of interest. In the absence of any credit restrictions on loans to the stock market, credit to the stock market would rise. Thus, when the official rate rises, thereby increasing the yield on stocks and, hence, the incentive to borrow, credit for investment on stocks may rise, contrary to theory, rather than fall, like the case of margin loans in the Nigerian Stock Exchange. It does not matter whether the investor is a banker or a non-banker. The only implication for the bank is that credit to other sectors may fall in a given quantum of bank credit if there is a shift to more profitable and less risky bonds and stocks markets.

However, the use of an annual data set for the period, 1981 to 2008, with the same specification, produces a similar result in the observed relationship, with only a marginal difference with respect to the coefficients of the variables. This result reflects a long-term effect of the changes in the official policy interest rate on changes in credit. The result is shown as:

$$\Delta InCPS_t = \underset{(0.287)}{-0.037} + \underset{(0.014)}{1.037}\Delta InCPS_{t-1} - \underset{(0.100)}{0.058}\Delta InMRR_t ; R^2 = 0.996 \text{ .D-W = 1.661.}$$

There is no doubt that an increase in CBN's MRR/MPR tends to decrease credit to the private sector of the economy, with the outstanding credit portfolio effect being highly robust.

4.2.2 Interest Rate, Credit and Aggregate Demand

It is recognized that in the Nigerian economy, credit could be affected by other macroeconomic variables other than the interest rate. Some aspects of such effect may not necessarily relate to monetary policy input, but may nevertheless be important in the credit function and may be operative within financial intermediation activities in the financial markets. It is through a combined impact of these other macroeconomic variables with credit that the full impact of interest rate on aggregate demand can be assessed. That is

to say, when the MPR of the CBN is changed, its first impact is on the structure of interest rates through which financial market assets and, hence, credit is affected, and by a combined action with other macroeconomic variables aggregate demand is impacted.

In specific terms, private final consumption expenditure (PFCE), which in this analysis is denoted as C, is affected in the process thus described. It is the principal component, indeed, the macroeconomic variable of the aggregate demand largely affected in the described process.

The evidence shows that a change in aggregate private final consumption expenditure in the real sector of the Nigerian economy has a positive relationship, as theoretically expected, with changes in aggregate previous consumption, current aggregate income and current private sector credit but negative relationship with the interest rate differential or spread between the maximum lending rate and the prime lending rate. Borrowing for consumption expenditure appears highly sensitive to banks' interest rate differentials. However, the official policy rate of interest has a positive, rather than negative, relationship with the private aggregate final consumption expenditure, a pattern we had anticipated earlier. Apparently, aggregate consumption or demand, though it has a low interest rate elasticity, is invariant to the official policy interest rate, but negatively responsive to banking rate differentials. We need not discuss the implications of this behaviour until later when we have seen more evidence from the behavior of the real sector.

In an earlier experiment (whose result is not shown here), current aggregate income was shown as a robust variable in explaining private aggregate final consumption expenditure. Though it is not strictly a policy input in the MPTM process, except in respect of output in explaining inflationary pressures, it is nevertheless in conformity with Keynes' conventional aggregate consumption function, as we shall see later. Our reference to this variable in the relationship being established is to clearly emphasize the point that any monetary policy input which adversely affects aggregate income in the economy will have adverse effects on private final consumption expenditure.

Turning strictly now to the relationship between interest rate and credit to aggregate demand, that is, private final consumption expenditure, C, we specified a relationship of the type:

$$\Delta InC_t = \phi_0 + \phi_1 \Delta InC_{t-1} + \phi_2 \Delta InCPS_t + \phi_3 \Delta InDLR_t + \phi_4 \Delta InMRR_t \quad 4.3$$

The notations remain as before except DLR which is the differential between Maximum and Prime Lending Rates of deposit money banks.

Thus, in the above specified relationship, it is postulated that aggregate demand, namely, private final consumption expenditure, is influenced by credit and interest rates apart from the consumption in the previous period. This relationship attempts to capture the credit and interest rate effects of the transmission mechanism on aggregate demand.

The evidence from our experiment, using annual data sets from 1981 to 2008, reveals an interesting result. This result is given as:

$$\Delta InC_t = \underset{(0.532)}{-0.696} + \underset{(0.199)}{0.244}\Delta InC_{t-1} + \underset{(0.211)}{0.840}\Delta InCPS_t - \underset{(0.070)}{0.093}\Delta InDLR_t + \underset{(0.193)}{0.386}\Delta InMRR_t ;$$

$R^2 = 0.992$; $D-W = 1.753$.

A change in current credit to the private sector has a robust positive effect on a change in private final consumption expenditure, whilst a change in previous aggregate consumption expenditure also has a positive effect. A change in the interest rate differential between the maximum lending rate and the prime lending rate of deposit money banks tends to negatively affect aggregate demand of the private sector. The effect of a change in the MPR on the aggregate private final consumption expenditure from our empirical evidence is positive. This contradiction to the conventional theory can be explained, using the conventional IS-LM model. In the model, given the IS curve, an increase in the interest rate will elicit a fall in consumption expenditure. Thus, it is expected that the sign of the coefficient of MPR / MRR in the result presented above would be negative. However, if there is a shift in the IS curve in the north-east direction, implying an intervening increase, say, in fiscal operations of government which is very typical of the Nigerian economy, a rise in the official interest rate rather than reducing aggregate demand will spur it. In such a situation, private final consumption expenditure will be positively related to interest rate, as we have observed from empirical evidence. Besides, in the prevailing environment of electronic commerce, interest rate changes may not deter consumption, in

which case aggregate consumption expenditure may have a low or no responsiveness to interest rate.

The effect on a change in aggregate private final consumption expenditure by a change in the external sector pass-through, defined here as the ratio of external reserves to broad money is not significant and does not alter the evidence presented above. In the specified relationship presented below, we denote this ratio as $F = \left[\frac{EXR}{M2}\right]$ on the presupposition that $F > 1$ will stimulate demand in the economy. That is to say, in an open but small economy, external reserves accruals from current account surplus will enhance the external reserves of the central bank, relative to domestic credit which determines reserve money. In Nigeria, net foreign assets (NFA), that is, external reserves in our analysis, is an important principal determinant of reserve money.

We specified the relationship as follows:

$$\Delta InC_t = \sigma_0 + \sigma_1 \Delta InC_{t-1} + \sigma_2 \Delta In(CPS)_{t-1} + \sigma_3 \Delta InDLR_t + \sigma_4 \Delta InMRR_t + \sigma_5 \Delta InF_t \quad 4.4$$

The resulting evidence of the relationship specified above, using annual data sets for the period 1981 to 2008 is as follows:

$$\Delta InC_t = \underset{(1.262)}{-1.203} + \underset{(0.288)}{0.570}\Delta InC_{t-1} + \underset{(0.313)}{0.535}\Delta InCPS_{t-1} - \underset{(0.088)}{0.135}\Delta InDLR_t + \underset{(0.262)}{0.359}\Delta InMRR_t - \underset{(0.119)}{0.053}\Delta InF_t$$

$R^2 = 0.987$; D-W = 2.170.

Thus, not only is the influence of F negative, it is also not significant on private final consumption expenditure though, statistically, it marginally improved the result. This may not be so with the effect of exchange rate pass-through on total output production, as we shall see shortly. However, changes in external reserves shocks arising from changes in the current accounts balance have strong effects on the net foreign assets (NFA) of the Central Bank in Nigeria. This, in turn, may affect aggregate demand typified in the private final consumption expenditure through foreign exchange availability for imports. The effects of inflationary pressures cannot be over-emphasized if $F < 1$ since

this situation means the expansion of broad money, $M2$. The yearly values of F between 1981 and 2006 were greater than unity, i.e. $F > 1$, only in four years during the whole period. $F < 1$ in the remainder of the years implies that domestic money was generally expanded in the face of relative lower levels of external reserves in about four decades during, for example, the 1981 to 2006 period.

A change in private sector credit in the previous period has an important positive effect on the change in private final consumption expenditure, as reflected by the value of the coefficient of the variable in the evidence as observed in the result. The effect of credit on aggregate demand, exemplified by private final consumption expenditure as well as the interest rate effect, is not in doubt from the empirical evidence obtained from the Nigerian economy.

4.3 Interest Rate, Credit, Exchange Rate and Total Output Production

Output production is of critical importance in the relationship between MPTM and the real economy, just as private final consumption expenditure is equally important. However, because of the precarious relationship between the MPR and production activity in Nigeria's real economy, the effect of CBN's monetary policy on this sector has often been uncertain, despite the continued thrust of CBN's monetary policy to accelerate the growth of output. It is known, in theory, that output production appears far removed from the influence of short-term interest rates, the major policy input in the MPTM. Besides, there is the general view that the nominal interest rate has little or no influence on real output, especially given that output is determined by real variables which are not often within the control of the monetary policy of CBN. Nevertheless, CBN's determination to influence the real economy, through its monetary policy in a deregulated market-based economy, independent of administrative fiat that typified the years before deregulation regimes, requires an empirically-based understanding of the links in the process.

What we have done in order to capture the influence of monetary policy inputs on the aggregate output variable is, essentially, to focus on aggregate output production in the economy. In this respect, we attempted to examine the policy variables that are within the influence of the CBN. These are also the short-term monetary variables within the financial markets. As in the case of the aggregate demand function, we have argued that access to credit is

a major variable influencing the production of output. The real production activity takes place in manufacturing, agriculture, industries and in down-stream activities in the oil and services sectors. In small- and medium-scale enterprises as well as in the informal sector output production, the availability and accessibility of credit has a considerable influence in enabling production to take place. In investing in inventories in the industrial sector, credit plays a considerable role. We do not deny the fact that productivity, technology and infrastructure matter very much in output production. All these that take place in the private-sector production process can only be facilitated, enhanced and strengthened with the lubricating effect of credit. Even in public-sector activities, credit availability has also been known to matter considerably (see Ndekwu, 1983, 1990). Additionally, in an open economy model of the Nigeria's type, foreign exchange availability and the exchange rate greatly influence output production. We are not unmindful of the debate on real versus nominal variables in this issue, but we would not to be distracted in our focus, which is to empirically understand the link in the monetary policy transmission mechanism with the Nigerian real economy. Our argument is that the link in the monetary policy transmission mechanism in Nigeria's real economy is established by credit and interest rates in the domestic financial markets, as well as by foreign and nominal exchange rates in the external sector pass-through financial market.

Thus, in order to capture the effects of these monetary policy inputs' on output production, we carried out two experiments. First, the nominal aggregate output was tested against the policy inputs. Second, the real aggregate output was tested against the same policy inputs. The nominal aggregate output Y is the Gross Domestic Product at Current Basic Prices; the real aggregate output Y^* is the Gross Domestic Product at 1990 Constant Basic Prices. The annual data sets used for all these are as published by the Central Bank of Nigeria and the period covered is 1981 to 2008.

The specification for the nominal aggregate output model is:

$$\Delta InY_t = \gamma_0 + \gamma_1 \Delta InY_{t-1} + \gamma_2 \Delta InCPS_{t-1} + \gamma_3 \Delta InMRR_t + \gamma_4 \Delta InF_t + \gamma_5 \Delta InEXCRT_t$$

4.5

The evidence from our test of the specified relationship between nominal output and the policy inputs gives following result:

$$\Delta InY_t = -0.903 + 0.889\Delta InY_{t-1} - 0.103\Delta InCPS_{t-1} + 0.263\Delta InMRR_t - 0.308\Delta InF + 0.248\Delta InEXCRT$$
(0.817) (0.174) (0.282) (0.173) (0.254) (0.267)

$R^2 = 0.994$; D-W = 1.721.

The additional notation to the previous notations is $EXCRT$, which is exchange rate in nominal terms. It is interesting to observe that exchange rate has a positive sign though of insignificant effect on nominal output production; a change in credit in the previous period has a negative effect and a change in monetary policy rate has a positive influence. A change in the availability of foreign exchange, designated here by the ratio of NFA to broad money, i.e. F, has a negative though significant effect on output production. The previous output change has positive effects on the change in current aggregate output, but a change in credit in the previous period is negative and not significant. The evidence suggests that both domestic and foreign financial markets have some effects on changes in output production in the real economy, though credit in the previous period appears not to be of any significance, probably because large outstanding credit impedes new credit-taking for output change.

In the case of the real GDP, i.e., Y^*, as the policy object and testing against the same set of policy input variables, the evidence is given as:

$$\Delta InY_t^* = 8.998 + 0.225\Delta InY_{t-1}^* - 0.071\Delta InCPS_{t-1} - 0.032\Delta InMRR_t - 0.08\Delta InF + 0.156\Delta InEXCRT$$
(2.752) (0.228) (0.162) (0.109) (0.155) (0.169)

$R^2 = 0.911$; D-W = 2.038.

Evidently, our result suggests that change in credit to the private sector in the previous period CPS_{t-1} has not had much meaningful effect on change in current aggregate output production in the real sector of the economy. The evidence suggests that not much supportive role has been played in real output production by either the credit or interest rate (whose negative coefficient is theoretically correct). This tends to confirm that monetary policy has not significantly aided the real economy. Although private final consumption expenditure has been supported by both domestic and foreign financial markets, this has not been so to the production of real output in the

economy. Economic growth needs to be strongly supported by the financial markets in the economy. It is interesting, however, to observe that the effect of a change in the nominal exchange rate $EXCRT$ is positive on a change in real output production. This, of course, would be expected as exchange rate affects, as a cost, the imports of raw materials and other intermediate production inputs sourced from the foreign sector. There is no doubting the fact that the availability and procurement of foreign exchange to real output producers, especially in the industry sub-sector, even at a high rate, would impact on the change in output production. Of a particular interest, however, is the negative coefficient of F which is the ratio of external reserves to broad money, i.e., $F = EXR / M2$. Foreign exchange availability and utilization by output producers in the real sector of the economy, for the procurement of imported production inputs, is propitious to the production of output and as such has always been regarded by producers, especially manufacturers, as a major constraint in their production process. Hence, it would not be surprising that an external shock, say, a fall in oil prices leading to a reduced inflow of foreign exchange resources and capital inflow, as well as adjustment in the nominal exchange rate (depreciation under the current exchange rate regime), would negatively impact the production of output. Thus, the effect of exchange rate pass-through, unless mitigated by, say, fiscal policy operations, could have an inverse effect on the production of output in the real economy of Nigeria.

What we have observed from the results of our tests has a clear message for Nigeria's monetary policy transmission mechanism. First, there is a clear link between aggregate output production in the real economy and monetary policy. Second, the link between the real economy and monetary policy is established through credit, especially to the private sector, with its co-operant variables in the financial markets, namely, the interest rate, the external reserves-broad money ratio, and the exchange rate. Third, interest rate link with the real economy aggregate output production is by the financial markets, comprised of domestic credit markets and external financial assets, with the exchange rate pass-through in the foreign exchange market being captured in the net foreign assets (NFA) in Nigeria. Fourth, as evident, we have the observed links in the process as interest rate effect, credit effect and exchange rate effect which by itself enters the process through the net foreign assets. This in turn provides a major link in the financial markets for foreign money and domestic money base engineered by domestic credit. Finally, the evidence suggests that a change in aggregate output in Nigeria's

real economy is linked to the short-term nominal interest rate of the CBN (the MPR), operating through the financial markets for credit, the foreign exchange and the nominal exchange rate. In other words, interest rate works through these to the real economy.

It is instructive to note that we have not explicitly assigned the money supply or reserve money any role in the relationship captured between Nigeria's MPTM and the real economy. We have done this for two basic reasons. First, money supply or reserve money is determined by aggregate credit in Nigeria (see Ndekwu, 1983, 1990; CBN AR, 2006). Second, the implicit variable F which attempts to show the relation between external reserves or net foreign assets (NFA) and broad money is purported to capture the implicit influence, given that in a small open economy, such as Nigeria's, the NFA effect is largely on the monetary liabilities of the central bank and the banking system. Both of these, in the financial markets, institutionally define money supply or reserve money aggregate.

4.4 What about Inflation and MPTM?

We have posed a question regarding the monetary policy transmission mechanism and inflation. This is because though the control of inflationary pressures in the economy is regarded as the ultimate objective of monetary policy of central banks, since monetary stability is the avowed thrust of monetary policy, yet the functional relationship of inflation in the monetary transmission mechanism is not quite direct. Inflation is a distant relation in the link process of the monetary policy transmission mechanism and, therefore, is unlikely to be monotonically captured without co-operant variables, as we have attempted to do in our analyses.

Our the graphical presentation in section 5.2 of the links in Nigeria's monetary policy transmission mechanism, explains the process in detail. Here, we attempt to show the connection between inflation and the MPTM, using the approach we have deployed, so far. This we do by taking change in inflation rate as a policy objective and relating it to four specified variables, which we propose have an influence on changes in inflation rate. First, the previous rate of inflation is likely to have a strong effect on change in the current inflation rate. Second, the interest rate change effect of the official policy rate, in this case, the Monetary Policy Rate, may have a negative or a positive effect. Third, a change in the real output would have a negative influence on a change in the rate of inflation, to the extent that an increase in total output

would tend to depress change in inflation rate. However, output production may likely put pressures on changes in inflation rate, thereby resulting in a positive effect which, indeed, underlines Phillips' hypothesis and the need for a trade-off. Output volatility would, therefore, trigger volatility in the term structure of inflation rate. Finally, a change in the exchange rate pass-through would have a positive or a negative effect on change in the inflation rate. For example, if there is an external shock leading to, say, depreciation in the nominal exchange rate, then this would lead to a rise in inflation rate, often through import and production costs. However, dynamics of inflation and the exchange rate as noted in various empirical studies of the MPTM paradigm, are not always clear-cut, although, in most cases, the exchange rate pass-through tends to push up inflationary pressures when they have a significant showing, as was reported in section 3.3 of this paper in the IMF study of Kenya. Thus, in order to test the relationship between inflation rate changes and changes in interest rate, real output, and the exchange rate, we have specified a relation form as follows:

$$\Delta Ini_t = \rho_0 + \rho_1 \Delta Ini_{t-1} + \rho_2 \Delta InY_t^* + \rho_3 \Delta InMRR_t + \rho_4 \Delta In(EXCRT)_t + \varepsilon \qquad 4.6$$

The notations in the above specification are as follows:

i = inflation rate with one-year lagged inflation rate being, i_{t-1};

MRR = Monetary Policy Rate/Minimum Rediscount Rate;

Y^* = real GDP; $EXCRT$ = Exchange rate; ε = error term.

In order to empirically test the relationship specified above, we used the quarterly data of all the macroeconomic variables for the period, 1999 Q1 to 2008 Q4. The data for inflation are derived from the implicit price deflator from the publications of the CBN. The choice of our data for inflation is explained by the fact that other inflation indicators do not satisfy our need, especially the composite consumer price index. More fundamentally, the implicit price deflator captures both production and consumption price indices.

The estimated result of the test of the inflation relationship gives the following:

$$\Delta Ini_t = \underset{(0.947)}{-0.609} + \underset{(0.111)}{0.685}\Delta Ini_{t-1} + \underset{(0.122)}{0.331}\Delta InY_t^* - \underset{(0.117)}{0.152}\Delta InMRR_t - \underset{(0.218)}{0.09}\Delta In(EXCRT)_t$$

R^2 =0.962; D-W = 1.805.

The result is quite interesting, for four reasons. First, the signs of the coefficients are as theoretically expected. Second, the lagged value of the change in inflation rate is highly robust and significant, suggesting that the previous inflation rate has a strong effect on the change in the current inflation rate. Third, the domestic and foreign (pass-through) financial markets have important effects on inflationary pressures. These, both have a negative impact on inflation implied by the negative signed coefficients. The financial market variables are changes in the official short-term interest rate, MRR/MPR, and changes in the nominal exchange rate. The negative influence of the financial markets on the inflationary process is propitious to monetary policy in Nigeria, in the sense that both the short-term official interest rate and the nominal exchange rate in the foreign exchange market are capable of influencing change in the inflation rate of the economy by changes in the variables as captured in the regression result.

Finally, the positive and quite robust real output coefficient is remarkable. It suggests an increasing effect on inflationary pressures by a change in real output on the supply side. Output growth in the real economy, given the costs of production and aggregate demand, could have the effect of increasing pressures on change in inflation rate. This imply that a positive change in real output, for example, through mark-ups from the effect of exchange rate pass-through, in the production process would have an unfavourable effect of raising the inflation rate. Such a scenario would necessarily justify a choice between output growth (necessary for employment growth) and inflation rate increases in the traditional Phillips' problem. The empirical evidence from our result, nevertheless, suggests that changes in both nominal and real variables influence changes in inflation rate, given the previous rate of inflation.

4.5 The Relationship between Output, Financial Markets and the Exchange Rate: An Exploratory Empirical Analysis

As the sub-title of this sub-section suggests, we attempt an empirical exploration of the relationship of output, financial markets and the exchange rate pass-through. There may not be a considerable difference in the outcome of this exploratory analysis from what we have done in the preceding sections of this paper. We do this analysis, however, in the strong belief that output is strongly influenced by the happenings in the financial markets, the vehicle for the transmission of monetary policy and the exchange rate. Since this is an exploratory analysis, we may not need to be conclusive in our results. It is, however, instructive to note that events in the so-

called "global economic meltdown" and recession even in the developed economies, which had their roots in the financial markets, encourage this type of analysis.

In Nigeria, there is no doubt that the events in the financial services sector, namely, deposit money banking and the operations of the stock market, micro-financial operations, to mention just a few, must have had a serious impact on Nigeria's real economy, and the exchange rate in 2008 and 2009. We are not examining the events of those years as such since this could constitute the subject of a detailed analysis by itself. On the contrary, our analysis here is to capture the effects of the selected variables representing the financial markets in Nigeria and the exchange rate on the real economy represented by total output. For this purpose, we represent the financial market with the three macroeconomic variables which have actually featured in the previous analyses in this paper. The variables are: credit to the private sector, the ratio of external reserves (net foreign asset, NFA,) to broad money, which we had designated, F, and the exchange rate. We have explained the theoretical rationale for these variables. Our proposition is a simple one, that is, a change in total output is influenced by changes in the financial markets, as already defined, and by the exchange rate. Indeed, a change in exchange rate affects the variable F which, in turn, may affect the financial markets and, hence, to total output. A policy shock by CBN's Monetary Policy Rate would have the effect of a change in credit to the private sector. Thus, an exploratory empirical test of our proposition, which we also consider very relevant to our study of Nigeria's MPTM, is specified as:

$$\Delta InY_t = \varphi_0 + \varphi_1 \Delta InY_{t-1} + \varphi_2 \Delta InCPS_t + \varphi_3 \Delta InMRR_t + \varphi_4 \Delta InF_t + \varphi_5 \Delta InEXCRT \quad 4.7$$

The notations are as previously defined. However, we should note that, for the purpose of this analysis, financial markets are presumed to comprise the following: CPS, $F = \frac{EXR}{M2}$, MRR representing interest rate, and $EXCRT$. These are, respectively, credit to the private sector, the ratio of external reserves represented in Nigeria by the Net Foreign Assets (NFA) to broad money, the market rate of interest (MPR), and the exchange rate. All these have been utilized in the preceding sections of this paper as variables in our analysis.

The evidence from the result of our test is shown as:

$$\Delta InY_t = -0.83 + 0.814\Delta InY_{t-1} + 0.292\Delta InCPS_t + 0.405\Delta InMRR_t + 0.021\Delta InF_t - 0.084\Delta InEXCRT_t$$
(0.807) (0.169) (0.156) (0.312) (0.311) (0.313)

$R^2 = 0.994$; D-W = 1.629.

Thus, there is a strong relationship between output, financial markets, and the exchange rate in the Nigerian economy. And since the CBN's innovation of monetary policy works through the financial markets, it becomes obvious that the effects of the interest rate, credit, and the exchange rate of the monetary policy transmission mechanism exert themselves on aggregate output in the real economy, through the operations of the financial markets. The concern of the monetary authorities with the soundness of the financial system is apparently well placed in order to create the enabling environment for the effectiveness of monetary policy. This issue of the soundness of the financial system and the effectiveness of monetary policy in Nigeria should constitute an entirely separate study of its own. It is important, however, to re-emphasize that soundness of the financial market is a necessary condition for the confidence of users of the financial services for a robust and sustained consumption of Nigeria's financial services. Therefore, to strengthen consumers' confidence in the use of Nigeria's financial intermediation services, and ensure the efficacy of the monetary policy as well, there is the need to raise confidence in the financial markets by radically enhancing the soundness and stability of the financial market system.

5. AN ASSESSMENT AND GRAPHICAL PRESENTATION OF THE LINK IN NIGERIA'S MPTM AND THE REAL ECONOMY

Before we conclude this paper we like to carry out two important assignments. First, we attempt to make some assessment of the results of our empirical analysis of the relation between the monetary policy transmission mechanism and Nigeria's real economy. In particular, we would like to subject our findings to economic theoretical forms and to relate the outcome to current events in CBN's monetary policy conduct. This is being done in view of the dynamics of financial markets and banking developments, especially developments related to the financial intermediation effects on monetary policy.

Our second task is to present, graphically, the link in the process of the monetary policy transmission mechanism and the real economy. This link is also based on the empirical evidence of the relationships we have attempted to establish in section 4 of this paper and as captured from various studies on the MPTM paradigm in section 3.

5.1 An Assessment

The empirical analysis of the monetary policy transmission mechanism and the real economy in Nigeria lends itself to discussion on issues of theory and policy. First, it should be borne in mind that the monetary policy transmission mechanism is a process of the link between variables. In this case, there is the fundamental issue of the functional relationships among the variables in the chain or link. For, unless the functional relationships are appreciated, there is no other way by which a link between the variables could be adequately established. Thus, our analysis has been based on capturing only the relationships among the variables that enter into the monetary policy transmission mechanism in Nigeria.

The evidence from our analysis shows that the responsiveness of Nigeria's real economy to monetary policy is through the financial markets. First, it should be stressed that monetary policy in this study has focused not on money supply, as is conventional in some text-books, but on CBN's official interest rate policy. When the official policy rate of interest changes, all other interest rates change in the same direction, not necessarily in the same magnitude, but definitively in the same direction.

The structure of interest rates, which responds to Central Bank's policy interest rate, can be categorized into three. The first is the money market, short-term interest rates. These are the Treasury Bills rates, commercial paper rates, deposit banks' lending rates, irrespective of the tenor structure of the lending, and other short-term lending by institutions, such as community banks, micro-finance banks, and similar institutional lending windows. The second category comprises the bond and stock markets whose tenor is much longer than the short-term interest rates. However, given the predominance of the public debt profile in this market category, the responsiveness tends to be less rapid than the interest rates of private borrowers and other lending facilities. This second category of interest rates is also influenced by the expected yield on the financial assets, governed primarily by the influence of changes in CBN's official policy short-term rate of interest.

In 2007 and 2008, for instance, the yield curve on securities in the financial markets, as reported by the CBN (CBN, 2008), has been found to be consistently pulled in the same direction by changes in CBN's Monetary Policy Rate (MPR). The implication of this pattern of movement in the term structure of interest rates in Nigeria is that changes in the official monetary policy input of short-term interest rates is capable of influencing, in the same direction, changes in short- to long- term interest rates on securities, and thus influence nominal rates in the real economy.

The third category is the equity market rates whose tenor and characteristics differ significantly from, but are related to, the other two categories. This is so, basically because the structure of yields on this category's debt instruments is influenced, not only by the financial intermediation properties of the assets, but also by real market intervening conditions. For example, the operational success or failure of the entities which profit from the external financing in these markets have an important influence on asset prices and, hence, yields on the assets. In Nigeria, it is observed that the deposit money banks, the predominant lending institutions, operate considerably in the three categories and, therefore, constitute a strong linchpin in the spectrum of the structure of market interest rates. This is a favourable characteristic of the and monetary policy transmission mechanism. It is also an important powerful element which is potentially capable of generating unstable financial and economic changes, as has been made evident in the global economic meltdown of 2007 – 2009 or, in the case of Nigeria, in the Nigerian Stock Exchange (NSE)

meltdown ("NSE meltdown") of 2008 when the All-Share Index fell sharply by 48.5 per cent.

In all of this interest rate structural categorization, credit to the private sector of the economy is second to the interest rate link in the financial market link to the real economy and, hence, of the link in the monetary policy transmission mechanism in Nigeria. We have focused on credit to the private sector rather than aggregate credit. In the aggregate credit category, public sector borrowing features prominently, but is often not critically affected by changes in interest rate due to the elasticity of the interest rate on government borrowing. The effect of the sovereign debt burden on future generations of Nigerians remains both a theoretical and practical challenge to the Nigerian society. Moreover, private sector credit is likely to be more relevant to output production in the real economy than public sector borrowing, even though it is recognized that the role of the public sector in facilitating the production process of the private sector of the economy would be critical. In addition, private sector credit is definitively interest-rate sensitive within the perspective of interest rate structure which connotes borrowing cost structure.

Thus, credit to the private sector in the financial market, which would be emboldened to participate actively in financial intermediation involving financial contracts, has an important link with aggregate output production and demand in the real economy. Such financial contracts in the external financing of businesses, intermediated through financial intermediaries, such as banks and the market, through, for instance, primary issues in the stock and equity markets, have an important connection with changes in CBN's interest rate policy. The non-fulfilment of such financial contracts, such as when loan non-performance occurs has an important effect on future supply and availability of credit and access to credit in the output production process. In 2009, the 'loan non-performance syndrome' in the banking sub-sector of the financial services sector of Nigeria's economy posed big challenges to the CBN as a financial regulatory institution, to monetary policy management, to banking institutions as major suppliers of credit, and to the credit consumers in the private sector. The aspect of the credit effect of the domestic financial market in Nigeria during the 1981-2008 period has been empirically shown to be less strong in its relationship with output production in the real economy, thereby weakening the credit effect of the MPTM link with the real economy. It is instructive to note that from the revelations in 2009 about bank credit in Nigeria's financial system, much of what was regarded as credit to the private

sector might not have been loans at all but mere "donations" or cash "hand-outs".

The second component of the financial market in the monetary policy transmission mechanism observed in Nigeria is the foreign exchange market. We tried to capture this foreign exchange market effect by using two variables in our regression in the belief that there is a relationship in the process. One of the variables is what we created as F which is a measure of the ratio of the external reserves, EXR to broad money, $M2$, i.e., $F = EXR / M2$.

Evidently, in Nigeria, external reserves constitute the Net Foreign Assets (NFA) which in Nigeria's open economy model is generated from the current account balance of the external sector pass-through. NFA comprises largely the foreign exchange holdings of the CBN and the deposit money banks. It is also a major source of the country's monetary base forming, as it were, the counterpart of the liabilities of the CBN and deposit money banks in the form of broad money, $M2$. The effect of the F variable, although not robust, has been significant, especially in regard to output production.

Similarly, the exchange rate effect of the external sector pass-through has had a significant inverse relationship with real output production, as well as with changes in inflation rate. Change in aggregate demand is also negatively impacted by the exchange rate pass-through effect, as expected. A relatively high exchange rate change tends to discourage both imports for consumption and production of output. Thus, in the case of aggregate demand, there seems to be some form of expenditure-switching in respect of consumption goods. However, we cannot be categorical about this conclusion without further empirical analysis.

Monetary policy shocks would be capable of producing an exchange rate effect on the real economy only if the effect on output production and aggregate demand can be controlled. Since there is an exchange rate effect, though negative and not significant, on inflation rate changes, that is, $\partial(\Delta Ini) / \partial(\Delta InEXCRT) = -0.09$, then, there is a case for making monetary policy to have an exchange rate effect on inflationary pressures and on the real economy. The capability of the CBN's MPR to exert influence on inflationary pressures is equally considerable, though with some time lag. Our

evidence shows that there is an inverse relationship between change in inflation rate and change in MPR, but with a low elasticity of inflation rate with respect to official policy interest rate, i.e., $\partial(\Delta Ini)/\partial(\Delta InMRR) = -0.152$.

One fact seems very clear from our discussion, so far. It is that the interest rate channel, the credit channel, and the exchange rate channel of the monetary policy transmission mechanism in Nigeria have considerable link with the real economy. But of the three channels, the credit channel is the connecting link in the chain of operations. If this link were weak, then the monetary policy process would have a weak effect on the real economy. If, on the other hand, the credit effect were strong, then the monetary policy process would have a strong effect on the real economy. The fundamental connector of CBN's interest rate policy to total output and inflation is the status of financial markets, which comprises the structure of interest rates, domestic credit markets, foreign exchange markets, and the exchange rate. Our analysis of the effect of the financial market in the transmission mechanism of monetary policy is embodied in both quantity variables, namely, credit and foreign exchange, and price variables, namely, interest rates and exchange rates. In our analysis, these variables are in some cases exogenous as they constitute monetary policy's focal inputs; in other cases, as we have observed, they are endogenous, especially in respect of credit.

The operations of banking institutions in all segments of Nigeria's financial markets can be viewed as propitious to the transmission of monetary policy to the real economy since credit supply and availability to the real economy is no longer restricted to the short-term end of the financial markets. Besides, the inter-bank interactions, involving micro-financing credit and institutions, add a new innovational strategy for the effective transmission of monetary policy to the real economy. The financial intermediation process in the financial markets which is characterized by the effects of interest rate, credit and foreign exchange market augur well for both modern urban banking and rural banking, especially the micro-finance schemes which tend to enhance monetary transmission to all segments of the financial markets. It is observed that there are increasing interactive operations of both modern banking institutions and micro-credit financing institutions for medium- and small-scale enterprises.

5.2 A Graphical Presentation of the MPTM Links and the Real Economy in Nigeria

On the basis of analysis, the links in the chain of the process in the monetary policy transmission mechanism and the real economy in Nigeria can now be graphically presented. This graph derives from our conceptualization of the MPTM framework to show how the various processes in the relationships developed in the previous sections are connected one to another. As a graphical illustration, we do not boast of providing a detailed picture of all the interlocking variables in the chain, from interest rate to inflation. It provides, nevertheless, a good simplified picture of the connecting links. A similar, graphical presentation has been provided by the Monetary Policy Committee (MPC) of the Bank of England, as discussed earlier in section 3 of this paper.

In our graphical presentation there are basically three stages in the process from MPR to inflation. The relationships underlying the process are what we have attempted to establish, through regression analysis in section 4. We discuss the relationships between the components of the chain later in section 6.

FIGURE 1
The Monetary Policy Transmission Mechanism Links in Nigeria

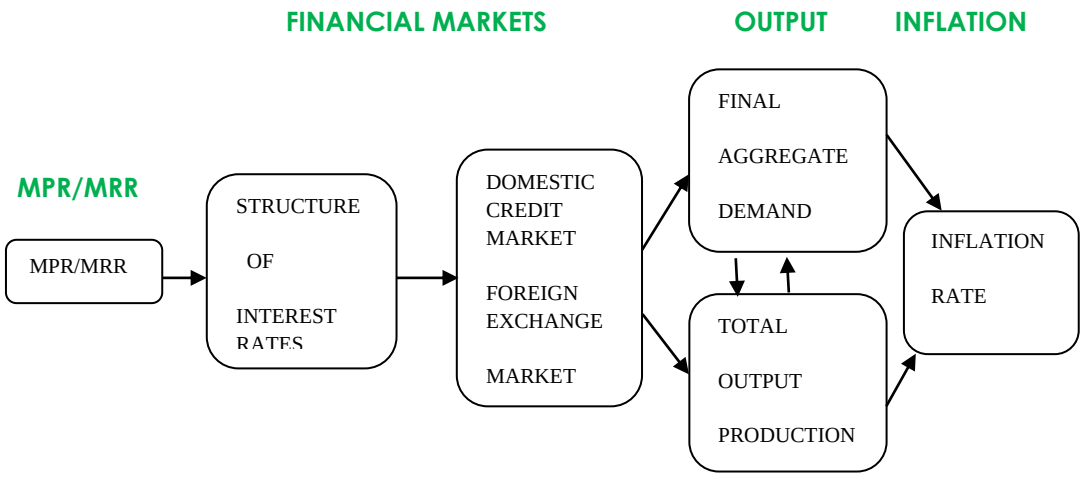

Figure 1 is based on the assumption that there is a smooth process from MPR to inflation rate. This means that the transmission is devoid of any inter-process breaks arising, for example, from a policy reversal or a sudden external shock to the system. However, even if there is a policy reversal owing to unexpected developments in the policy transmission process, whenever equilibrium is re-established, the link would be re-connected for the continuation of the process.

Figure 1 shows that there are three stages in the transmission process of the monetary policy mechanism in Nigeria, namely, (i) the interest rate structure, (ii) the financial markets, consisting of the domestic credit market and the foreign exchange market, and (iii) aggregate output. That is to say, when the CBN changes its official rate (i.e., the MPR, formerly the Minimum Rediscount Rate, by which it repurchases its debt instruments, especially Treasury Bills of the Federal Government of Nigeria), three basic stages are involved, from the policy action (MPR) to the final, presumably ultimate, policy goal, namely, a change in the inflation rate. The monetary policy action of the CBN follows the decision of the Monetary Policy Committee (MPC) of the Bank which is the final monetary policy authority which sets the Monetary Policy Rate in the current monetary policy regime.

In Figure 1, we have domiciled the interest rate structure in the financial markets where the structural changes in interest rate, arising from a change in MPR, actually take effect. The structure of interest rate here is a spectrum of interest rates, ranging from the over-night loan rate to rates on bonds and stocks of long-term maturity all of which constitute costs of borrowing, and, hence, the lending rates of lenders in the financial markets.

Similarly, there is also the structure of credit and private debt. These range from overnight loans to short-term credit and over-draft facilities, as well as trade credit in the money markets, to medium-term credit and long-term debt, such as bonds, stocks and equities, including margin loans offered by stock-brokers to borrowing individuals, corporate bodies and institutions for financing stock market instruments. It has been observed that this credit structure may not be for the domestic market only. Evidence from banking loan profiles in the Nigerian financial market has revealed that bank credit may be destined for foreign markets and businesses by Nigerian borrowers.

Thus, Nigeria's financial market, as depicted in Figure 1, has both a domestic credit component and a foreign exchange market component. As businesses borrow to finance domestic capital investment expenditures, they also borrow to finance imports of production inputs by which the procurement of foreign exchange becomes a critical variable in the two processes. The first is in the financial markets where the businesses operate in the borrowing activities of the credit market. The second is where borrowing in the domestic credit market is translated into the procurement of foreign exchange, through their financial intermediaries, particularly the deposit money banking institutions. Given the foreign exchange market profile in Nigeria, the CBN, the monetary policy maker, plays a central role in the foreign exchange market, as well as in the domestic credit market. Businesses interact on the two sides of the financial market for the purpose of output on the aggregate demand side and on the output production side. We are not even concerned here with the activities of arbitragers and portfolio investors in the financial market, though their activities would have consequences on credit demand, interest rate, and foreign exchange.

The responses of financial markets to changes in monetary policy instrument inputs, no doubt, act powerfully in the transmission of policy changes to the real output sector of the economy. In the process, the commitment to optimize returns on their financial input resource procurement, the real output sector operators on output production and output demand tend to push inflationary pressures which result in increases in inflation rates.

Monetary policy action may not necessarily be a cause of changes in inflation rate in the process depicted in Figure 1. Sometimes monetary policy action may remotely induce pressures on inflationary changes, through policy measures that lead to escalating costs. For instance, and as we have observed in our empirical analysis, a rise in the official interest rate, which is expected to reduce demand through structural changes in interest rate in the financial markets, may induce a rise rather than fall in output and, hence, increases in inflationary pressures as costs of the processes in the real output sector rise. In such a situation, official interest rate changes would be positively related, empirically, to output and, inflation rate. An explanation of such a perverse policy situation would be a wrong assessment of the market condition before a policy change. The second is the existence of an existing credit commitment which could not be reversed at the time of policy change, thereby leading to increased costs. The third is the prevalence of

some credit-type inelasticity to interest rate change, which may make costs to rise rather than fall. For example, credit for capital expenditure, projects and investment to raise output, based on some financial calculations that justify a positive expected return, even at the new level of interest rate, may be rather insensitive to a hike in interest rate until a threshold rate of return is reached. In such a high-risk case of borrowing for projects, for example, the cost of capital may push up credit demand, interest rate, and output. In any case, our empirical evidence shows that a change in private sector credit is in an inverse relation to CBN's MPR. This evidence indicates that the rate of interest could be a powerful policy instrument for effecting change in credit in an opposite direction.

6. THEORETICAL AND POLICY IMPLICATIONS

Theoretically as well as empirically as our evidence shows, a reduction, for example, in MPR by the CBN would reduce interest rates, raise credit, raise output demand and production and may raise inflationary pressures thereby increasing the inflation rate, independent of the exchange rate. However, pressure on foreign exchange, given increased credit supply and its accessibility in the financial market, would have the effect of raising exchange rate, i.e., depreciating the nominal exchange rate in the Nigeria's Dutch Auction System (DAS). The result would be increased costs of output production. However, since output growth is preferred to a fall in output, even at a higher cost with inflationary pressures, this scenario may still be an acceptable policy choice. These scenarios have implications for theory and policy. Thus, in this section, we discuss: (i) theoretical issues arising from our analysis, and (ii) the implications for policy in Nigeria's monetary policy management.

6.1 Theoretical Implications

The analysis in this paper raises some theoretical issues in the monetary policy transmission mechanism. Our review of the monetary policy transmission mechanism paradigm in section 3, shows that there is a general agreement on the theoretical views of the principal channels of transmission, as well as on our empirically established channels in Nigeria's monetary policy transmission mechanism. Additionally, attempts have been made to explore the relationship of the financial market on one hand, and output and the exchange rate on the other. It is argued that the credit channel in the financial market provides the effect of **a linchpin** by which the interest rate policy of the CBN impacts the real economy. If the credit channel is weak then the impact of monetary policy's official short-term interest rate will also be weak on aggregate demand and output production in the real economy. The exchange rate effect is achieved through the financial market. Thus, whether it is Tobin's **q-theory** on replacement cost of physical capital asset or Ando-Modigliani's life-cycle theory of consumption whereby a rise in interest rate raises demand for debt investment and reduces demand for equities, the credit effect in the financial markets makes this possible.

To us, Mishkin's "so-called credit channel" has become pivotal in our analysis and thus is in agreement with the Bernanke and Gertler view of the importance of credit in the monetary policy transmission mechanism. The

financial structure effect proposed by Cottarelli and Konvetis is apparently upheld by the evidence from our analysis, contrary to their lack of empirical evidence to support their proposition. The federal funds rate, which is the anchor in loans supply through its effect on the reserves of the banks in the Federal Reserve System in the United States, is somehow supportive of the conclusion of our analysis. This is so notwithstanding that our analysis does not attempt to explicitly examine the relationship of banks' reserves on credit in response to a change in CBN's Monetary Policy Rate. There is some affinity in the use of official short-term interest of central bank to impact the credit or lending behaviour of banks in the financial markets. There is thus, total agreement of our analysis with Sellon, Jr. on the effect of monetary policy rates on the structure of interest rates. Specifically, Sellon Jr. says: "When the Federal Reserve raises its target for the federal funds rate, other interest rates rise……when the federal funds rate target is lowered, other rates tend to fall.....". For the Central Bank of Nigeria policy, we can similarly say, "When the CBN raises its monetary policy rate, other rates rise; when the monetary policy rate is lowered, other rates tend to fall".

The Bank effect of the of England's interest rate on the structure of interest rates is, however, not quite the same, though it has a similar tone in the sense that changes in the market rates to asset prices and to expectations/confidence and to the exchange rate are set in motion by a change in the official interest rate. This is the interest rate channel. Of much greater importance is the "financial accelerator effect" which, though it largely has a lending channel effect, has some property of the quality of the balance sheet effect that enables firms to borrow as a result of asset value changes in response essentially to a change in official policy interest rate.
There is no complete agreement on the velocity of be the response of the ultimate monetary policy objective of reduced inflation to the short-term interest rates of a central bank. This could be largely explained by the structural characteristics and dynamics of changes in various economies. However, there is agreement on the fact that inflation is the avowed ultimate objective of the monetary policy of all central banks. Though our analysis reveals some variables that have a significant effect on changes in the inflation rate, namely, the previous period inflation rate, the official interest rate of CBN, real output, and the exchange rate, one cannot apply with certainty each variable's capability in an attempt to control the inflation rate. We can only rely, somehow, on the coefficients of the variables, as evident in section 4.4 of this analysis, as measures in the transmission mechanism of

monetary policy where they have relevance. It is no surprise, therefore, that Taylor's rule for linking interest rate and inflation has become a mere theoretical proposition. This is so in view of the fact that even with the application of the rule in developed economies, its inflation targeting prescriptions has not provided the panacea for inflation control. One could imagine what the plight of developing countries, such as Nigeria would be in applying the rule to study their MPTMs.

Thus, the outcome of a **Conference on Financial Innovation and Monetary Transmission,** concluded that "monetary transmission is a complex and interesting issue because there is not one, but many channels through [which] monetary [transmission] operates" (Kutter and Mosser, 2002). This makes monetary or inflation targeting of little or no relevance, but really an inflation sign-post, in the monetary policy transmission mechanism. The study of financial intermediation and their empirical supportive role to the monetary policy transmission mechanism, as pointed out by Taylor (1995), is essential, given the position of financial markets, comprising interest rate, credit, foreign exchange and the exchange rate, in effecting, as we have shown, the transmission of monetary policy to the real economy.

We are not unaware of the theoretical issues involved in the study of financial markets. One of such issues is the Efficient Market Hypothesis (EMH), based on the availability of full information in the financial market, which is an aspect of the neo-classical, perfect competition paradigm within the general equilibrium analysis. To MPTM analysts, this hypothesis is not of much relevance. The second is the "financial accelerator" issue which we examined in the BoE theory on MPTM. The original idea, whether it is of Fisher or of the original Keynesians, like Harrod and Hicks, argues that the declining value of financial assets, arising from declining price shocks and, hence, negative effects on firms' profitability, affect the firms' ability to borrow or lead them to insolvency. The truth is that the empirical analysis carried out here is not quite amenable to this standard, neo-classical, general equilibrium model which is not of much relevance to central bank economic management, as rightly argued by Quiggin (2009).

6.2 Monetary Policy Implications

The credit effect is most pronounced among the channels of the MPTM. Hence, in cooperation with the interest rate effect and the exchange rate effect, as well as foreign exchange availability, the credit effect in the MPTM

will achieve a much greater result in influencing changes in output production and aggregate demand, as well as an effective management of inflation rate changes in the real economy of Nigeria. It is instructive to observe that evidence from our analysis shows that of all the effects identified in the monetary policy transmission mechanism in Nigeria are embodied in the operations of the financial markets. An optimal monetary policy in this regard designed to support growth in real output production and, hence, promote the stabilization of inflation rate for real economic growth would enhance the availability and accessibility of credit to productive sectors of the economy, while keeping interest rate low and increasing foreign exchange availability in the foreign exchange market a at relatively low exchange rate.

Thus, arising from the results of this analysis and their policy implications in Nigeria's MPTM, the policy scenario for an expansionary monetary policy should be the lowering of the Monetary Policy Rate (MPR) to stimulate the economy and output. In such a policy change, a lowering of the MPR would pull down all other interest rates, especially the lending rates of the lending institutions. This would be followed by a positive change in credit supply. However, accessibility to increased credit may not wholesomely follow immediately due, probably, to outstanding previous credit commitments in the financial markets. In addition, accessibility to credit by certain categories of borrowers may be stalled, largely because of the challenges posed by the terms of the credit, such as collateral requirements, credit-worthiness of the borrowers, and similar constraining factors. A monetary policy contraction by raising MPR would reduce credit supply.

In principle, increases in credit supply would result from the lowering of interest rates. If the purpose of credit includes the importation of intermediate inputs and materials, then foreign exchange demand would add to the credit demand, especially if foreign exchange procurement is financed through the foreign exchange market, such as wDAS in Nigeria. An increase in foreign exchange demand, given increased supply, could put pressures on the exchange rate, thereby leading to depreciation of the exchange rate in the foreign exchange market and, hence, in the financial market. In such a scenario, the effect of the lowered interest rate and increased credit supply may stimulate output production in the real economy, but at the cost of increasing pressures on the inflation rate. The inflationary pressures could arise not necessarily from the interest rate change but from other production costs especially from a depreciated exchange rate, cost-push dynamics, the mark-

up pricing mechanism in the production process, and the phenomenon of imported inflation. However, stimulating output at the cost of inflation in a developing economy, characterized by less than full employment with excess capacity, would be preferred (so long as the inflation is moderate) to a fall in output at a low or declining cost since sustained output growth is a necessary condition for economic growth. The optimal policy mix in such a scenario for attaining non-inflationary output growth may not be entirely within the purview of monetary policy alone; it might require a monetary-fiscal policy mix, given the monetary and credit implications of government's fiscal operations in the Nigerian economy.

We have, nevertheless, for the purposes of monetary policy programming, placed great emphasis on the short-term interest rate of the CBN and the operations of the financial markets to bring about changes in aggregate output in the real economy. This emphasis implies that the financial markets encompassing both domestic credit and foreign exchange markets, should play a very prominent role in the stabilization of output changes and, hence, in the moderation of inflation rate in the economy.

Given the monetary policy shocks in the financial markets, the CBN should continue to employ the use of changes in its Monetary Policy Rate as a monetary policy trigger to effect changes in credit supply and its accessibility to the private sector in the productive real economy. Through such measures, there would be changes in credit market expectations and, hence, the behaviour of credit institutions. It is through such a mechanism that the interest rate and credit effects would positively impact other financial institutions in their financial intermediation operations, as well as the foreign exchange market, and the exchange rate pass-through in the economy.

External shocks affect the real economy through inflationary pressures, especially in a small, open and oil export-oriented economy such as Nigeria which generates capital inflows and outflows from the current account balances and, hence, net foreign assets (NFA) in the foreign exchange component of the financial markets. Additionally, imported inflation may put pressures on the domestic inflation rate, through their impact on aggregate demand as reflected in the private final consumption expenditure, the aggregate economy, and output production. Therefore, measures targeting the stabilization of changes in output to maintain a stable output growth in the real economy require not just monetary stability, but also financial stability,

given the interface of monetary and financial markets in the process of credit supply and its accessibility.

Thus, the dynamics of the monetary policy transmission mechanism require that CBN's monetary policy programming should have a broad focus on all forms of financial debt and all debt-creating financial institutions, both bank and non-bank, for effective financial stability. It is emphasized that credit is a heterogeneous financial asset in terms of its tenor, interest rate cost, risk, and uses. This characteristic of credit should be recognized during the design of monetary policy programming. Given this fact and evidence from our analysis, a change in CBN's short-term interest rate (MPR) would have a strong correlation with changes in the structure of interest rates in the financial markets, including the yield curve comprising debts of two years and over. We suggest, therefore, that as a policy option, the CBN's short-term policy interest rate (MPR) remains the monetary policy anchor for influencing the market rates of financial assets, as well as its supply of credit to credit institutions.

In terms of practical monetary policy programming, therefore, the CBN should lower its MPR to stimulate credit supply and its accessibility when there is a perceived down-turn in economic activity and raise it to reduce pressures on economic activity. Whenever necessary, such as when the fiscal operations component of macroeconomic policy appears a relatively stronger policy handle, as was the case during a recent bail-out or a quantitative easing initiative, the CBN should operate cooperatively with government and other stakeholders in accommodating monetary policy by keeping its MPR low and unchanged for a considerable period of time, depending on the severity of an economic down-turn. The thrust of CBN's monetary policy in such a situation should be to stimulate output growth, enhance employment growth (or reduce unemployment), and enhance the general well-being of the economy, without losing sight of its commitment to sustaining confidence in the monetary and financial system. Government should be vigilant in ensuring that producers, in their effort to maintain higher profit margins, do not cut jobs. On the issue of accessibility to credit by some categories of borrowers, the CBN should design appropriate credit structural facilities within the framework of the financial institutions, especially the money deposit banks and other banking institutions, to provide special credit windows for the low-creditworthy and vulnerable enterprises in the real economy. In this regard, the Small and Medium Enterprises (SME) scheme should be reviewed and re-structured, after a sound study of the scheme, to eliminate the hindrances to the scheme's

effective credit supply channel. In addition, the CBN should work out an appropriate mechanism for ensuring government guarantees of credit to such strategic productive real activities as energy, infrastructure and, possibly, manufacturing.

The quality of credit supply to the financial intermediation process by the principal credit suppliers and the deposit money banks requires improvement. Such improvement should contain basically three elements: (i) adequate risk assessment and management, (ii) avoidance of adverse selection in supplying credit to borrowers, and (iii) elimination or drastic reduction of moral hazard, whereby lending institutions expose themselves to high-risk projects. The quality improvement being recommended should also be much more vigorously monitored by the regulatory authorities than hitherto, with the goal of minimizing the phenomenon of the risk of non-fulfilment of loan contracts, especially the high-risk exposures and the loan "non-performance syndrome" experienced in late 2009, despite the fact that the non-performing assets had been carried in the books of the institutions before that date. Incidents of bank failure and insolvency would be minimized as a result of such measures. Such action would also enhance intermediation efficiency and financial deepening in the financial system.

Financial markets cannot achieve on its own for effectiveness and efficiency in the delivery of their services without the regulating and guiding hand of government (see, Smaghi, 2010). This is the main reason why credit quality improvement in the financial market requires that the reporting financial institutions supply adequate and quality information to the regulatory authorities for a much more timely, systematic and vigorous examination of their operations than hitherto. The CBN and the Nigeria Deposit Insurance Corporation (NDIC) as specified in the *Banks and Other Financial Institutions Act (BOFIA)* are clearly the two most important financial regulatory authorities in Nigeria. It is, accordingly, suggested here that an **eagle-eyed surveillance** of credit portfolios of deposit money banks should be intensified by the regulatory authorities in their monitoring and institutional arrangements. This is particularly necessary in respect of large-scale loans which needed to be secured with stringent procedures similar to the ones used in the monitoring of the end-use of foreign exchange procured from the wDAS component of the financial markets.

We recognize that other monetary policy instruments, such as Open Market Operation (OMO), liquidity ratios, and the repurchase and buy-back windows being used for the management of the liquidity profiles of banking institutions are integrally embodied in the interest rate and credit channels of the monetary policy transmission mechanism in Nigeria. Accordingly, there is need to fine-tune and structurally integrate these monetary policy instruments into the credit channel of the monetary policy transmission mechanism for the overall effectiveness and efficiency of its monetary policy.

7. CONCLUSION

The monetary policy transmission mechanism to Nigeria's real economy is through the financial markets, which embody the operations of the interest rate channel, the credit channel, and the exchange rate channel. The credit channel, the most permeating of the three, provides the effect of a linchpin in the process by which CBN's interest rate policy impacts the real economy. There is, therefore, no other efficacious channel through which CBN's monetary policy is transmissible to the real sector of Nigeria's economy than through the credit channel in the monetary and financial operations of the financial markets. This statement may appear to be a truism. It needs, however, to be re-emphasized, given the fact that often times several channels of the MPTM are analyzed without giving sufficient recognition to the robust inter-connectivity between the CBN's monetary policy and the real economy, through credit in the financial markets. The interest rate effect as we have argued, transmit to the real economy and, the inflation rate with some time lag. This effect, nevertheless, is accomplished through the credit effect on the productive sector of the economy.

Our view of the crucial impact of the credit channel within the financial markets appears more robust than the "financial accelerator" view of the MPC of the Bank of England in the MPTM, which emphasizes the ability of firms to borrow due to a shock occasioned by a change in the official short-term interest rate. The properties of the "financial accelerator" are adequately covered in our analysis. Moreover, the assets price channel, the bank lending channel, and the liquidity channel have all been shown to be various elements of the credit channel in the financial markets.

In view of the relatively low level of development of the financial markets in Nigeria, it may be argued that the thrust of this paper is far-fetched. Such a position would not be a true reflection of reality, although considerable limitations and challenges exit in Nigeria's financial markets. The profile of Nigeria's emerging market is a healthy one, reflected in such features as the broadening of its financial assets market, the growing financial intermediation capacity and the deepening of the interactions of financial institutions with the real sector of the economy. These positive developments certainly help to strengthen the view that Nigeria's real economy and credit are linked for the operational effectiveness of monetary policy.

It is our view in this paper, therefore, that the credit effect is a crucial mechanism by which monetary policy is linked to the real economy in Nigeria. Secondly, the CBN's short-term interest rate, that is, the Monetary Policy Rate, is capable of positively impacting the real economy and the real activities of output production and aggregate demand, as well as changes in the inflation rate, through a radical reform and efficient management of credit supply and its accessibility, the foreign exchange market and the nominal exchange rate. Thirdly, in view of the centrality of the financial markets in the monetary policy transmission mechanism in Nigeria, there should be put in place a more directional regulation of the financial market. Finally, the regulatory authorities should be more focused in their regular examination and reporting operations and continue to maintain an eagle-eyed surveillance of the deposit money banks as the principal credit-creating and credit-supplying financial institutions in the Nigerian economy.

Nigeria's political economy and the dysfunctional behaviour often observed in the 'politics of debt instruments' in Nigeria's financial markets, and the inefficient management of credit in the Nigerian economy, especially the misallocation of deposit money banks' loan portfolio resources, may be a debilitating factor on the efficiency of Nigeria's financial system and, hence, the real economy. This is why there is serious need for a vigorous and steadfast pursuit of radical reforms at the Central Bank of Nigeria. The reforms are absolutely necessary for the soundness of Nigeria's financial system, the strengthening of the country's financial intermediation efficiency, as well as reduction to the minimum of the existence of externalities which could weaken consumers' confidence in Nigeria's financial services sector.

We are of the view that changes in Nigeria's financial structure and markets, especially changes in interest rates, credit, foreign exchange and exchange rate, affect real economic outcomes, through the mechanism of financial contracts embodied in the external financing strategies of productive firms. Such contracts are an embodiment of lending and borrowing operations for investment (and even consumption spending), output production, and employment. In the spirit of Keynes, it is recognized that the financial system is sufficiently flexible to generate as much credit as would make the quantity of investment greater than the quantity of savings in an economy, as well as satisfy the demands of borrowers. Therefore, the reform of Nigeria's financial system should be a continuous process in order to keep the financial markets at a high level of operational efficiency, in congruence with the dynamics of

a growing economy, and thereby enhance credit supply and its accessibility to the productive sector of the economy.

APPENDIX

[This APPENDIX contains the regression results using E-View package reported in Section 4].

(All notations are as in the equations in Section 4).

Table 1: $R = \alpha(R_2, R_3, R_4, R_5, R_6, R_7, R_8)$

Dependent Variable: (LOG)D(R1)
Method: Least Squares
Date: 01/29/10 Time: 19:08
Sample: 2001:1 2007:4
Included observations: 28

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.372984	0.774696	-1.772289	0.0916
(LOG)D(R2)	0.522140	0.135899	3.842125	0.0010
(LOG)D(R3)	-0.041390	0.136696	-0.302791	0.7652
(LOG)D(R4)	-0.315450	0.212052	-1.487610	0.1525
(LOG)D(R5)	-0.043617	0.246037	-0.177277	0.8611
(LOG)D(R6)	1.023367	0.419943	2.436917	0.0243
(LOG)D(R7)	0.131291	0.230002	0.570827	0.5745
(LOG)D(R8)	0.013979	0.069274	0.201796	0.8421

R-squared	0.865661	Mean dependent var	2.658381
Adjusted R-squared	0.818643	S.D. dependent var	0.263675
S.E. of regression	0.112289	Akaike info criterion	-1.300527
Sum squared resid	0.252176	Schwarz criterion	-0.919898
Log likelihood	26.20738	F-statistic	18.41109
Durbin-Watson stat	1.867741	Prob(F-statistic)	0.000000

Table 2: $CPS_t = f(CPS_{t-1}, MRR_t)$

Dependent Variable: D(LOG)(CPS)

Method: Least Squares

Date: 01/29/10 Time: 18:51

Sample(adjusted): 1982 2008

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.036996	0.287486	-0.128687	0.8987
D(LOG)(CPS(-1))	1.036827	0.014262	72.69645	0.0000
D(LOG)(MRR)	-0.057935	0.100195	-0.578220	0.5685

R-squared	0.995585	Mean dependent var	12.09743
Adjusted R-squared	0.995217	S.D. dependent var	2.024120
S.E. of regression	0.139984	Akaike info criterion	-0.990139
Sum squared resid	0.470292	Schwarz criterion	-0.846157
Log likelihood	16.36687	F-statistic	2706.063
Durbin-Watson stat	1.660697	Prob(F-statistic)	0.000000

Table 3: $C_t = \phi(C_{t-1}, CPS_t, DLR_t, MRR_t)$

Dependent Variable: D(LOG)(PFCE)

Method: Least Squares

Date: 01/29/10 Time: 18:57

Sample(adjusted): 1982 2008

Included observations: 25

Excluded observations: 2 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.696256	0.531690	-1.309515	0.2052
D(LOG)(PFCE(-1))	0.243800	0.198557	1.227858	0.2338
D(LOG)(CPS)	0.840266	0.211726	3.968638	0.0008
D(LOG)(DLR)	-0.093003	0.070105	-1.326634	0.1996
D(LOG)(MRR)	0.385618	0.193493	1.992924	0.0601

R-squared	0.991550	Mean dependent var	13.74440
Adjusted R-squared	0.989860	S.D. dependent var	2.297144
S.E. of regression	0.231316	Akaike info criterion	0.086789
Sum squared resid	1.070138	Schwarz criterion	0.330564
Log likelihood	3.915137	F-statistic	586.7220
Durbin-Watson stat	1.753154	Prob(F-statistic)	0.000000

Table 4: $C_t = \sigma(C_{t-1}, CPS_{t-1}, DLR_t, MRR_t, F_t)$

Dependent Variable: D(LOG)(PFCE)

Method: Least Squares

Date: 01/29/10 Time: 19:01

Sample(adjusted): 1982 2008

Included observations: 25

Excluded observations: 2 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.203438	1.262029	-0.953574	0.3523
D(LOG)(PFCE(-1))	0.570141	0.288235	1.978040	0.0626
D(LOG)(CPS(-1))	0.535012	0.313342	1.707435	0.1040
D(LOG)(DLR)	-0.134638	0.088085	-1.528506	0.1429
D(LOG)(MRR)	0.359117	0.262285	1.369188	0.1869
D(LOG)(EXR/MS2)	-0.052544	0.119142	-0.441020	0.6642

R-squared	0.987054	Mean dependent var	13.74440
Adjusted R-squared	0.983647	S.D. dependent var	2.297144
S.E. of regression	0.293759	Akaike info criterion	0.593449
Sum squared resid	1.639592	Schwarz criterion	0.885979
Log likelihood	-1.418112	F-statistic	289.7183
Durbin-Watson stat	2.170496	Prob(F-statistic)	0.000000

NOTE: $F = (EXR / MS2)$.

Table 5: $Y_t = \gamma(Y_{t-1}, CPS_{t-1}, MRR_t, F_t, EXCRT_t)$

Dependent Variable: D(LOG)(NGDP)

Method: Least Squares

Date: 01/29/10 Time: 19:09

Sample(adjusted): 1982 2008

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.903325	0.817485	-1.105005	0.2817
D(LOG)(NGDP(-1))	0.888814	0.173900	5.111064	0.0000
D(LOG)(CPS(-1))	-0.102890	0.281905	-0.364983	0.7188
D(LOG)(MRR)	0.263220	0.173178	1.519936	0.1434
D(LOG)(EXR/MS2)	-0.308049	0.253815	-1.213679	0.2383
D(LOG)(EXCRT)	0.248181	0.266974	0.929608	0.3631

R-squared	0.993843	Mean dependent var	13.90434
Adjusted R-squared	0.992377	S.D. dependent var	2.079928
S.E. of regression	0.181600	Akaike info criterion	-0.380889
Sum squared resid	0.692551	Schwarz criterion	-0.092925
Log likelihood	11.14200	F-statistic	677.9307
Durbin-Watson stat	1.721378	Prob(F-statistic)	0.000000

NOTE: $F = (EXR / MS2)$.

Table 6: $Y_t^* = \chi(Y_{t-1}^*, CPS_{t-1}, MRR_t, F_t, EXCRT_t)$

Dependent Variable: D(LOG)(RGDP)

Method: Least Squares

Date: 01/29/10 Time: 18:19

Sample(adjusted): 1982 2008

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.997782	2.752297	3.269190	0.0037
D(LOG)(RGDP(-1))	0.225498	0.227791	0.989932	0.3335
D(LOG)(CPS(-1))	-0.070649	0.161891	-0.436399	0.6670
D(LOG)(MRR)	-0.032447	0.109109	-0.297377	0.7691
D(LOG)(EXR/MS2)	-0.079722	0.155440	-0.512880	0.6134
D(LOG)(EXCRT)	0.155531	0.168718	0.921845	0.3671

R-squared	0.911312	Mean dependent var	12.82524
Adjusted R-squared	0.890196	S.D. dependent var	0.317266
S.E. of regression	0.105132	Akaike info criterion	-1.474077
Sum squared resid	0.232106	Schwarz criterion	-1.186114
Log likelihood	25.90005	F-statistic	43.15701
Durbin-Watson stat	2.038119	Prob(F-statistic)	0.000000

NOTE: $F = (EXR / MS2)$.

Table 7: $i_t = \rho(i_{t-1}, Y_t^*, MRR_t, EXCRT_t)$

Dependent Variable: D(LOG)(IPD)

Method: Least Squares

Date: 03/03/10 Time: 17:47

Sample(adjusted): 1999:2 2008:4

Included observations: 39 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.609268	0.947205	-0.643227	0.5244
D(LOG)(IPD(-1))	0.684806	0.111048	6.166747	0.0000
D(LOG)(RGDP)	0.330921	0.122406	2.703470	0.0106
D(LOG)(MRR)	-0.152230	0.117052	-1.300530	0.2022
D(LOG)(EXCRT)	-0.089612	0.217805	-0.411430	0.6833

R-squared	0.962374	Mean dependent var	7.626013
Adjusted R-squared	0.957947	S.D. dependent var	0.402533
S.E. of regression	0.082546	Akaike info criterion	-2.031703
Sum squared resid	0.231673	Schwarz criterion	-1.818426
Log likelihood	44.61822	F-statistic	217.4073
Durbin-Watson stat	1.804572	Prob(F-statistic)	0.000000

Table 8: $Y_t = \varphi(Y_{t-1}, CPS_t, MRR_t, F_t, EXCRT_t)$

Dependent Variable: D(LOG)(NGDP)

Method: Least Squares

Date: 01/29/10 Time: 18:35

Sample(adjusted): 1982 2008

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.830404	0.807834	-1.027939	0.3157
D(LOG)(NGDP(-1))	0.814012	0.168988	4.816984	0.0001
D(LOG)(CPS)	0.292182	0.311858	0.936909	0.3595
D(LOG)(MRR)	0.405253	0.183069	2.213660	0.0381
D(LOG)(EXR/MS2)	0.021384	0.310782	0.068808	0.9458
D(LOG)(EXCRT)	-0.084028	0.312692	-0.268724	0.7908

R-squared	0.994052	Mean dependent var	13.90434
Adjusted R-squared	0.992636	S.D. dependent var	2.079928
S.E. of regression	0.178483	Akaike info criterion	-0.415515
Sum squared resid	0.668981	Schwarz criterion	-0.127552
Log likelihood	11.60946	F-statistic	701.9642
Durbin-Watson stat	1.629142	Prob(F-statistic)	0.000000

NOTE: $F = (EXR / MS2)$.

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