The Nigeria Inter-Bank and Monetary Policy Rates Nexus: Any Discernable Long-Run Relationship?

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Inter-bank markets are among the most important in the financial system. They are the focus of central banks' implementation of monetary policy and have a significant effect on the economy. Transactions in the inter-bank funds market provide signal of what obtains in the open credit market. To provide for stability in short-term interest rates, the Monetary Policy Rate (MPR) as the 'operating instrument' serves as an indicative rate for transactions in the inter-bank money market as well as other deposit money banks' (DMBs) interest rates. It is this relationship between the inter-bank and the monetary policy rates that this paper examined. The findings indicate that the rates are cointegrated and have a long-run relationship, judging from the significance of the unit root test for the residual and the coefficient of the error correction variable in the error correction model. It is, however, the submission of this paper that much more investigation is needed on a number of issues such as the effect of liquidity hoarding in the inter-bank market spread, and the impact of possible lending relationships between banks in the market on flow of funds and the inter-bank rate, among others. These issues may provide significant insight on the behaviour of the Nigerian inter-bank rate.

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I. Introduction

Interest rates play an important role in our economic lives. They are the cost of borrowing for those who need resources and reward for lending to those with savings. Higher interest rates tend to restrict the growth of credit, making it harder for businesses to get financing and for individuals to find or keep jobs. Yet, as important as interest rates are, a major concern of the monetary authority is their tendency to exhibit erratic behaviour i.e. to fluctuate too much. It is, therefore, the objective of every central bank to eliminate abrupt changes in interest rates (Bache and Barnhardsen, 2009). Though the objective could be considered a secondary goal relative to the monetary policy goals of low inflation, stable economic growth and financial stability, the reason for this hierarchy is that interest rate stability and, of course, exchange rate stability are means of achieving the ultimate goal of stabilizing the economy; they are not ends unto themselves.

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It is easy to see how interest rate volatility is a problem. First, most people respond to low interest rates by borrowing and spending more. Individuals take out loans to purchase cars, new appliances and the like, while corporations issue more bonds and use the proceeds to enlarge their operations. On the other hand, when interest rates rise, people save and spend less. So by raising expenditure when interest rates are low and reducing expenditure when interest rates are high, interest rates volatility makes output unstable.

Second, interest rates volatility means higher risk – and a higher risk premium – on long-term bonds. Risk makes financial decisions more difficult, lowering productivity and making the economy less efficient. Thus, since central banks control short-term interest rates, they are in a position to control this risk and stabilize the economy.

Prior to the reforms in the financial system and the liberalization of interest rates in Nigeria, interest rates were more or less specified or fixed by the central bank. In other words, rates were determined by fiat. But with the liberalization of interest rates, alongside other rates, (to be market determined), it became necessary that an indirect approach to influencing the movement, so as to moderate the fluctuation and, of course, the spread as a measure of the cost of intermediation, became necessary.

Among the most important players in financial markets throughout the world are central banks, which are government authorities in charge of monetary policy. Central banks' actions affect interest rates, amount of credit, money supply, output and inflation. Though history has it on record that central banks started out as the government's bank, they have over the years added various other functions. A modern central bank not only manages the government finances but, provides an array of services to deposit money banks which makes it a bankers' bank.

Discount lending policies are a critical part of a modern central bank's engagement. Central banks provide loans at a rate that is above their target interest rate, thereby guaranteeing commercial banks a supply of liquidity during times of crisis, and ensuring that the overnight inter-bank lending rates remain less than or equal to their lending rate. It is this price of funds transfer in the inter-bank fund market (mostly referred to in the analysis of cost of borrowing) and responsiveness of the rate to the central bank target rate, the monetary policy rate (*mpr*), that this paper attempts to examine. To do this, the paper is structured into six sections. Following the introduction is the theoretical and empirical issues

considered in section 2, which is followed by a brief review of monetary policy in Nigeria since 1986 in section 3. The methodology of the study is presented in section 4, while data and empirical results come up in section 5. The paper ends with some conclusions in section 6.

II. Theoretical and Empirical Issues

There are many factors that influence investment decision, but two can be considered outstanding. The first is the current level of economic activity and the outlook for the future (business confidence), such that the larger the volume of current sales and the more prosperous the future appears, the greater the incentive to expand productive capacity. The second is the cost of borrowing (i.e. the rate of interest). Naturally, the higher the rate of interest, the more likely it is that borrowing will be discouraged. Private sector demand for credit is, therefore, likely to vary inversely with the rate of interest, given the level of, and outlook of business activity.

While the economic and financial systems may be fairlystable most of the time, when left on their own, they are prone to episodes of extreme volatility. Central banks work to reduce the volatility of the economic and financial systems by pursuing five specific objectives namely; low and stable inflation; high and stable real growth, together with high employment; stable financial markets and institutions; stable interest rates; and a stable exchange rate.

Prices are central to everything that happens in a market-based economy. They provide the information individuals and firms need to ensure that resources are allocated to their most productive uses. Raising the price of a product, for instance, is a signal that demand has increased, so producing more is worthwhile. However, inflation degrades the information content of prices. When all prices are rising together, understanding the reason becomes difficult. Did consumers decide they liked an item, by shifting demand? Did the cost of producing the item rise, shifting supply? Or was inflation responsible for the jump? If the economy is to run efficiently, we must be able to tell the difference. Thus, the objective of price stability is analogous to keeping inflation low and stable.

With respect to ensuring high and stable real growth, central banks employ the tool of interest rates adjustment to moderate fluctuations in business cycles. Booms are popular but recessions are not. In recessions, people get laid off and businesses fail. Without steady income, individuals struggle to effect payments for transactions they enter into. Most times, consumers pull back, hurting businesses that rely on them to buy products as unplanned inventories grow, increasing

unused capacity, hence more and more layoffs. Thus, the use of interest rate adjustment tool is informed by the idea that there is some long-run sustainable level of production called potential output that depends on factors like technology, size of capital stock and labour force or the number of people who can work. Growth in these factors leads to growth in potential output.

There are also times when growth rises above sustainable rates, and the economy overheats. These periods may seem to bring prosperity, but they do not last forever, as they are followed by reduced spending, lower business investment and layoffs. In such periods, the policy action would be to raise interest rates and keep the economy from operating at unsustainable levels. Unstable growth creates risk for which investors need to be compensated in the form of higher interest rates. With higher interest rates, businesses borrow less, which means that they have fewer resources to invest and grow. Stability leads to higher growth in the long-run.

Financial stability is an integral part of every modern central bank's concern. As Cecchetti (2008) puts it;

> *"The financial system is like plumbing: when it works, we take it for granted, but when it doesn't work, watch out. If people lose faith in banks and financial markets, they will rush to low-risk alternatives, and intermediation will stop. Savers will not lend and borrowers will not be able to borrow..... When the financial system collapses, economic activities do, too". p 360*

As the government's bank, the central bank occupies a privileged position. It has a monopoly of issuance of currency. The ability to print currency means that the central bank can control the availability of money and credit in the economy and this is carried out by adjusting short-term interest rates. The adjustments are undertaken under the framework of monetary policy.

Again as a bankers' bank, its day-to-day role involve; (i) providing loans during times of financial stress, (ii) managing the payment system, and (iii) oversee deposit money banks and the financial system (Cecchetti, 2008). Every country needs a secure and efficient payments system. People require ways to pay each other, and financial institutions need a cheap and reliable way to transfer funds to one another. The fact that all banks have accounts with the central bank makes it the natural place to go for these *interbank* payments to be settled. In today's world, interbank payments are extremely important.

II.1 Transactions in the Inter-Bank Funds Market

The name inter-bank funds come from the fact that the funds banks trade with are their deposit balances with the central bank. On any given day, banks target the level of reserves they would like to hold at the close of business. But as the day goes by, the normal flow of business may leave them with more or less reserves than they want to hold. This discrepancy between actual and desired reserves gives rise to a market for reserves, with some banks lending out their excess funds and others borrowing to cover a shortfall. Without this market, banks would need to hold a substantial amount of excess reserves as insurance against shortfalls.

Inter-bank funds market, as the name connotes, is a market where banks undertake funds transaction to enable them meet the cash or liquidity needs of their customers. These transactions do become necessary because an individual bank can hardly maintain an equilibrium cash or liquidity holding (that matches the demand for and supply of liquidity/cash) at any given point in time. While transactions are often made through brokers, there are bilateral agreements between banks. Since there is no collateral to fall back on in the event of non-payment, which makes such loans unsecured, the borrowing bank must be credit worthy in the eyes of the lending bank, otherwise the loan cannot be made. Policy- makers believe that the interbank funds market provides valuable information about the health of individual banks. When a bank cannot get an overnight loan from any other bank, it is the first sign of the fact that something is wrong with that particular bank. The interbank funds market transacts on overnight, or term such as 7-days, 30-days and 90-days, placement of funds.

Generally, it is theoretically posited that transactions in the inter-bank funds market provide signal of what obtains in the open credit market. The average interest rate on overnight loans is the overnight rate, which is the shortest-term market interest rate, and as such it has a crucial role in term structure models. It also lies at the heart of monetary policy (Bernanke and Blinder, 1992). However, apart from the rate of interest (cost of transaction) in the market that influences the tempo of activities in the market, other determining factors are liquidity position of the banks, and change in the demand for foreign exchange which determines the frequency with which banks access the market for funds to cover their bids at the Autonomous Foreign Exchange Market (AFEM) or Wholesale Dutch Auction System (WDAS).

II.2 Inter-bank Rate and Monetary Policy Transmission

The monetary policy rate (*mpr*) is the Monetary Policy Committee's primary policy instrument. Financial market participants are constantly speculating about the movement in this rate, and whenever the Monetary Policy Committee meets, market participants eagerly await the announcement of either an increase or decrease in the monetary policy rate. It is important to note that while the monetary policy rate is set by the Central Bank's Monetary Policy Committee, the inter-bank funds rate is the rate at which transactions between banks take place.

The inter-bank money market rate (*ir*) stands at the shortest end of the yield curve, and is the operational target for the monetary policy rate (*mpr*). Therefore, understanding the factors behind the dynamics of the *ir* is relevant not only for participants in the inter-bank market, but also for private investors and monetary authorities. Indeed, the *ir* is a key benchmark for interest rates in the short term money market and its movement may have effects on the whole term structure (Taylor and Williams, 2008). Equally important is the fact that the inter-bank market represents the first stage of the monetary transmission channel, where monetary policy actions first come in contact with the rest of the financial system. An effective monetary policy requires that the overnight interest rate remains at an average around the *mpr* (Ahumada, et al, 2009).

II.3 Lending Relationships and the Inter-bank Market Operations

Lending relationship are an important feature of the inter-bank market, and these relationships allow banks to obtain insurance against liquidity shocks (Cocco, et al. 2009). Relationships can only exist if there are frequent and repeated interactions between banks, if borrowers and lenders may set terms for the loan that depend on the identity of the counterparty, or on the ongoing relationship (Boot, 2000). This is indeed the case for direct loans in the inter-bank market. Direct loans are the result of private negotiations between borrower and lender, who agrees on the amount, interest rate and maturity of the loan.

The inter-bank market is fragmented in nature. For direct loans which account for the vast majority of lending volume, the amount and the interest rate on each loan are agreed on a one-on-one basis between borrowing and lending institutions. Other banks do not have access to the same terms, and may not even know that the loan took place.

Relationship may be an important feature of behaviour in fragmented markets, particularly given that each agent chooses whom to interact with. Again, in as much as transactions are negotiated on a one-on-one basis, agents may

condition the terms of the transaction on the identity of the counterparty (Cocco, et al. 2009). Stigum (1990), quoted in Cocco (2005), further expound on the idea of the importance of relationship in the inter-bank market when he wrote,

> *'To cultivate correspondents that will sell funds to them, large banks stand ready to buy whatever sums these banks offer, whether they need all these funds or not. If they get more funds than they need, they sell off the surplus...' p 25.*

The study by Cocco, et al (2009) found that borrowers and lenders of fund in the Portuguese inter-bank market tend to rely, more than they usually do, on loans from, and to, banks with whom they have a close relationship when they have a larger imbalance of funds. In this way, lending relationships provide insurance against the risk of a shortage or excess of funds during the reserve maintenance period. With this, they opined that lending relationships play an important role in promoting the stability of the inter-bank market during periods of low liquidity and time of crisis.

We can identify two purposes why banks establish lending relationships in the inter-bank market;

(i) In inter-bank markets, financial institutions engage in unsecured borrowing and lending of funds. They do so to insure against idiosyncratic liquidity shocks arising from the behaviour of retail depositors (Freixas and Jorge, 2000). When a given bank is faced with unexpectedly large number of withdrawals from its retail customers, it may borrow the funds needed to meet these withdrawals from other banks in the inter-bank market.

(ii) Borrowing to satisfy the reserve requirements may be another purpose. Over a given time period, banks' reserves must be, at least, equal to a given proportion of their short-term liabilities. This is the reserve maintenance period or settlement period and it is a distinctive feature of the inter-bank market. This period vary from economy to economy.[1] In case a bank cannot meet its reserve requirements, it may use the discount window to borrow from the Central Bank, which acts as a lender - of - last resort. To resort to that, however, is not without costs; banks must pay an interest rate higher than the prevailing market interest rate on a loan of similar maturity, and most importantly, there are large implicit costs

[1] The reserve maintenance period for Nigeria banks was reviewed downward from 8 weeks in 2004 to 2 weeks and the computation of reserve requirement is based on each bank's total deposit liabilities.

associated with using the discount window, as the financial institution is seen by the central bank as not being able to properly manage its reserves (Stigum, 1990). For this, banks make every effort to avoid using the discount window.

Therefore, since banks must hold on average a minimum of reserves, shortages of liquidity at the end of the maintenance period will often lead to special behaviour of overnight rates during those days (Hartmann, et al. 2001), as banks that have not yet satisfied their reserve requirements will be in a weak position. This suggests that banks may wish to establish relationships for insurance purposes and, in particular, against risk of a shortage of funds at the end of the reserve maintenance period.[2]

II.4 Liquidity Effects on Inter-bank Rate

The liquidity of the market affects directly the amount of resources that commercial banks have at their disposal and which they will consequently be willing to lend in the inter-bank market. However, there are only scanty empirical studies that have considered the effect of daily liquidity conditions on the analysis of the *ir* (Hamilton, 1996 and Wurtz, 2003, among few). In fact, the literature generally analyzes the functioning of the inter-bank market using a general framework in which banks' reserve positions are affected by random shocks and where the inter-bank market allows banks to fulfill their monthly reserve requirement (e.g. Allen and Gale, 2000, among others).

Liquidity provision in the inter-bank market involves drainage and injection of funds through open market operations by the central bank usually at *mpr* (discretionary operations), and permanent credit lines through private depositors. An added liquidity source for the market comes through deposits from pension funds. The use of discretionary operations, instead of credit facilities, could be interpreted as a high degree of commitment of the central bank to take the *ir* close to the *mpr*, which could lead to the gap between these rates being closed faster.

The results of work by Ahumada, et al. (2009) on Chile indicates that the *ir* and the *mpr* move together very closely and, when these variables deviate from each other, the speed of convergence is around 30 percent per day. In terms of the

[2] Banks may also face the risk of excess of funds. This may also help explain the large trading volume observed in the interbank market. According to Lyons (1995), a large part of trading volume observed in fragmented markets is just due to borrowers acquiring funds that they do not really need and then selling them. But why do borrowers of funds accept funds they really have no need for? The answer is that borrowers of such funds accept them because they do not wish to jeopardize relationships.

explanatory variables, the calendar effects and open market operations – especially the discretionary operations - are the most relevant in explaining the dynamics of the *ir Regarding* the relevance of market liquidity provided by the central bank, they find that the central bank played an important role during the sample period, while private depositors do not help to significantly improve the explanation of the dynamics of the *ir*. The permanent credit lines are not statistically significant and this situation could be due to the fact that this instrument is available on a daily frequency and, therefore, the market has internalized its operation in the valuation of the *ir*.

A number of other studies have confirmed that monetary policy actions have predictable effects on short-term interest rate.[3] For example, the results of the study by Aziakpono, et al. (2007) show high responses of the overnight prime inter-bank lending rates (PIBR) and the three-month negotiable certificate of deposit (NCD) to monetary policy actions in South Africa between 1973 and 2004. Roley and Sellon (1995) show that short-term rates in the US follow the same trend as the federal funds rate. Dale (1993) measures the short-term response of the UK market rates to monetary policy actions by the Bank of England. The results of Dale' study show that policy actions by the Bank of England have significant positive effect on interest rates of all maturities. Nevertheless, these effects decline as maturity lengthens.

In Nigeria, there is dearth of works on the effect of monetary policy actions on interest rates. The work by Chuku (2009) only attempts to measure the effect of monetary policy innovations (both quantity and price based) on output and the general price level. While the result indicate the Minimum Rediscount Rate and Real Effective Exchange Rate as having a neutral and fleeting effect on output, the general objective of the work remain the same as those of Uchendu (1996), Nnanna (2001), Adamgbe (2004), Balogun (2007) and Omotor (2007). These studies were more concerned with the effect of monetary policy actions on growth-related variables such as output, investment, general price level and the likes.

The foregoing review has helped to explain the many characteristics of the interbank funds market and results of empirical studies on the effect of monetary policy action on money market rates.

[3] Monetary policy actions could either be through quantity-based nominal anchors as in the case of using Open Market Operations (OMO) to effect changes in money supply, or through price-based nominal anchors as in the case of changing the monetary policy rate (MPR) or the effective exchange rate (EER).

III. Brief Review of Nigeria's Monetary Policy Since 1986[4]

Direct controls, pervasive government intervention in the financial system resulting in the stifling of competition and resource misallocation, necessitated the introduction of the Structural Adjustment Programme (SAP) in 1986. SAP was a comprehensive economic restructuring programme which emphasized increased reliance on market forces. In line with this orientation, financial sector reforms were initiated to enhance competition, reduce distortion in investment decisions and evolve a sound and more efficient financial system. The reforms which focused on structural changes, monetary policy, interest rate administration and foreign exchange management, encompass both financial market liberalization and institutional building in the financial sector. The broad objectives of the financial sector reform include:

- Removal of controls on interest rates to increase the level of savings and improve allocative efficiency;
- Elimination of non-price rationing of credit to reduce misdirected credit and increase competition;
- Adoption of indirect monetary management in place of the direct control regime;
- Enhancing of institutional structure and supervision;
- Strengthening the money and capital markets through policy changes and distress resolution measures; and
- Improving the linkages between formal and informal financial sectors.

The objectives of monetary policy since 1986 remained the same as in the earlier period, namely: the stimulation of output and employment, and the promotion of domestic and external stability. In line with the general philosophy of economic management under SAP, monetary policy was aimed at inducing the emergence of a market-oriented financial system for effective mobilization of financial savings and efficient resource allocation. The main instrument of the market-based framework is the open market operations. This is complemented by reserve requirements and discount window operations. The adoption of a market-based framework such as OMO in an economy that had been under direct

[4] This section benefitted immensely from materials available on the Bank's website; www.cenbank.org/monetarypolicy/conduct.asp

control for long, required substantial improvement in the macroeconomic, legal and regulatory environment.

In order to improve macroeconomic stability, efforts were directed at the management of excess liquidity; thus a number of measures were introduced to reduce liquidity in the system. These included the reduction in the maximum ceiling on credit growth allowed for banks; the recall of the special deposits requirements against outstanding external payment arrears to CBN from banks, abolition of the use of foreign guarantees/currency deposits as collaterals for Naira loans and the withdrawal of public sector deposits from banks to the CBN. Also effective August 1990, the use of stabilization securities for the purposes of reducing the bulging size of excess liquidity in banks was re-introduced. Commercial banks' cash reserve requirements were increased in 1989, 1990, 1992, 1996 and 1999.

The rising level of fiscal deficits was identified as a major source of macroeconomic instability. Consequently, government agreed not only to reduce the size of its deficits but also to synchronize fiscal and monetary policies. By way of inducing efficiency and encouraging a good measure of flexibility in banks' credit operations, the regulatory environment has improved. Consequently, the sector-specific credit allocation targets were compressed into four sectors in 1986, and to only two in 1987. From October 1996, all mandatory credit allocation mechanisms were abolished. The commercial and merchant banks were subjected to equal treatment since their operations were found to produce similar effects on the monetary process. Areas of perceived disadvantages to merchant banks were harmonized in line with the need to create a conducive environment for their operations. The liquidity effect of large deficits financed mainly by the Bank led to an acceleration of monetary and credit aggregate in 1998, relative to stipulated targets and the performance in the preceding year. Outflow of funds through the CBN weekly foreign exchange transaction at the Autonomous Foreign Exchange Market (AFEM) and, to a lesser extent, at Open Market Operation (OMO) exerted some moderating effect.

The reintroduction of the Dutch Auction system (DAS) of foreign exchange management in July 2002 engendered relative stability, and stemmed further depletion of reserves during the second half of 2002. However, the financial system was typically marked by rapid expansion in monetary aggregates, particularly during the second half of 2000, influenced by the monetization of enhanced oil receipts. Consequently, monetary growth accelerated significantly, exceeding policy targets by substantial margins. Savings rate and the inter-bank

call rates fell generally due to the liquidity surfeit in the banking system though the spread between deposit and lending rates remained wide.

III.1 The Introduction of the Monetary Policy Rate (MPR)

Over time, the CBN has recognized that achieving stable prices would require continuous re-assessment and evaluation of its monetary policy implementation framework to enable it respond to the ever-changing economic and financial environment. It is against this background that the Bank introduced a new monetary policy implementation framework that took effect on 11th December, 2006. The ultimate goal of the new framework is to achieve a stable value of the domestic currency through stability in short-term interest rates around an "Operating Target", the interest rate, which is determined and operated by the CBN . The "Operating Target" rate i.e the "Monetary Policy Rate" (MPR), serves as an indicative rate for transaction in the inter-bank money market as well as other deposit money banks' (DMBs) interest rates.

The main operating principle guiding the new policy is to control the supply of settlement balances of banks and motivate the banking system to target zero balances at the CBN through an active inter-bank trading or transfer of balances at the CBN. This is aimed at engendering symmetric treatment of deficits and surpluses in the settlements accounts, so that for any bank, the cost of an overdraft at the Central Bank would be equal to the opportunity cost of holding a surplus with the bank.

The Central Bank intervention in the market takes the form of a standing lending facility that ensures orderly market operations or behaviour by alternating avoidable interest volatility. The standing lending facility is available as an overnight lending to banks with deficits, at a fixed interest rate, i.e the upper band of the CBN interest rate corridor. The Bank stands ready to supply any amount the banks may require at the lending rate. The Central Bank also set up a standing deposit facility that pays banks with surplus funds, a fixed interest rate in their deposit or reserves which they keep with the Bank. This arrangement allows the Bank to keep the overnight inter-bank interest rate in between the corridor with an upper and lower limit on interest rate.

MPR was set at 10 per cent, using the then rate of inflation rate and the expected inflation rate outcome of 9.0 per cent for fiscal 2006 as a guide to ensure that interest rates remain positive in real terms. There is a spread of 600 basis points around the rate, i.e 300 basis points below and 300 basis points above. This translates into a lower limit of 7 per cent, representing that rate at which CBN takes deposits from the bank.

A major advantage of the new framework is that the Central Bank is able to operate in the market daily and ensures adequate liquidity is provided to enable banks trading in the inter-bank market to complete settlement at interest rates around the MPR. Inter-bank rate is, therefore, maintained at a level between the lending and deposits rates at CBN. The maintenance of interest rates band has helped significantly to reduce the volatility in the market compared to the inter-bank rates experienced in the past.

The Wholesale Dutch Auction System (WDAS) replaced the Retail Dutch Auction System (DAS) in the first quarter of the year under review. In pursuant of further liberalization of the foreign exchange market the bureaux de change was admitted into the WDAS window during the second quarter of 2006. The admittance of the BDC's to the WDAS window led to the unification of the exchange rate between the official and parallel markets.

The objective of monetary policy in 2006 was sustaining price stability and non-inflationary growth, as enunciated in the National Economic Empowerment and Development Strategy (NEEDS). The target for single digit inflation was achieved as inflation rate stood at 8.5 per cent by December 2006.

Up to 2007, the framework for monetary policy management remained that of monetary targeting. The Central Bank of Nigeria (CBN) adopted various policy measures aimed at containing the growth of monetary aggregates in order to achieve monetary and price stability. Open Market Operations (OMO) remained the major tool of liquidity management. Other policy measures included increased issuance of treasury securities in the primary market to mop-up excess liquidity; use of deposit and lending facility to encourage inter-bank transactions as well as special sales of foreign exchange, including swap arrangements. NTBs of various tenors (91-, 182- and 364-day) were auctioned during the period.

The liquidity management efforts of the CBN yielded the expected results as the single-digit inflation rate was sustained during the year. In addition, the exit reserve money target under the Policy Support Instrument (PSI) was achieved in June 2007. Over the end-December 2006 level, provisional data indicate that broad money supply (M2) grew by 11.03 per cent in June 2007 and further by 21.3 and 25.31 per cent in September and October 2007, respectively. When annualized, the M2 grew by 28.44 and 30.25 per cent, in September and October 2007, respectively, compared with 33.3 and 39.6 per cent in the corresponding months of 2006. The growth of M2 was driven by the increase in foreign assets (net) of the banking system as well as the rapid rise in credit to the private sector

since the end of the second quarter. With the CBN's drive to contain excess liquidity in the banking system, both M2 and reserve money still remained outside the targets by the end of 2007. At the end of the second quarter, aggregate domestic credit (net) to the economy declined by 56.11 per cent, but increased by 98.99 per cent in October 2007. Also, credit to government (net) declined by 51.9 per cent in September compared to a decline of 56 per cent at the end of the second quarter. But credit to the private sector, which had maintained an upward trend for most of 2007, rose to 34.37 and 62.0 per cent in June and September, respectively.

As at November 2007, the economy achieved a commendable level of external reserves of about US$50.0 billion that was capable of supporting approximately 23 months of current foreign exchange disbursements. This represented an increase of 18.06 per cent when compared with the level of US$42.42 billion recorded in the corresponding period of 2006.

With the implementation of the new Monetary Policy Rate (MPR) and the adoption of the CBN standing facilities, volatility in inter-bank rates turned out to be moderate with rates hovering around the MPR. The MPR was reviewed thrice during the year. The first was in June 2007 when it was reviewed downward by 200 basis points, from 10.0 per cent to 8.0 per cent, with the width of the interest rate corridor reduced from +/- 300 to +/- 250 basis points. The second was in October 2007 when the MPR was raised by 100 basis points, from 8.0 to 9.0 per cent, with the interest rate corridor removed, in response to anticipated changes in economic and financial conditions. The MPR was then made to serve as the overnight (repo) rate. The last was in December 2007 when the MPR was increased by 50 basis points, from 9.0 to 9.5 per cent.

IV. Methodology of the study

The objective here is to estimate the deterministic relationship between the variables in line with the theoretical postulation and policy expectation. As mentioned, it is the general expectation that the monetary policy rates be the signal rate to deposit money banks' credit operations, such that when the monetary authority considers interest rates too high beyond what is judged appropriate to stimulate investment, a cut in monetary policy rate (which implies ease of accessing funds by DMBs through the Central Bank discount window) is expected to induce DMBs to lower the cost of lending. A case where a cause-effect relationship cannot be established, the implication is that changes in the MPR are exercises in futility as the credit market would have been operating outside the influencing factor of the Central Bank. In other words, such a lack of

cause-effect relationship implies that the effects of monetary policy are not transmitted to the rest of the economy. Furthermore, because we recognize the lack of sophistication in the Nigerian financial market, the paper considers it appropriate to assess the likely effect of some monetary variables on the cost of funds in the money market. Therefore, from a simple relationship of the form;

$$ir_t = \beta_0 + \beta_1 mpr_t + \beta_t X_t + e_t. \quad (1)$$

Where ir_t is the inter-bank rate, mpr_t is the monetary policy rate, X_t represents monetary operations variables theoretically adjudged to be capable of influencing the dependent variable, and e_t is the error term that is assumed to be white noise.

From a time series perspective, modelling economic variables requires evaluating if the series are stationary. Stationary variables and integrated series, demand completely different modelling strategies. However, in order to avoid the problem of spurious results, it is necessary to test the existence of unit roots.[5] We apply a battery of unit-root tests to both series, including the traditional Augmented Dickey-Fuller test and the Phillip-Perron tests. Once the series are found to be integrated or if the *ir* and the *mpr* move closely together and sporadically deviate from each other, we evaluate the presence of a long-run relationship between both series. Evaluating this hypothesis is equivalent to testing whether the residuals from an OLS regression between *ir, mpr* and X_t is non-stationary against the alternative that it is stationary. Thus, we can assess the unit root result of the residuals,

$$e_t = -ir_t - \beta_0 - \beta_1 mpr_{t,} - \beta_t X_t \quad (2)$$

in the form;

$$\Delta e_t = \lambda_1 e_{t-1} + \lambda_2 \Delta e_{t-i} \quad (3)$$

Note that while we included one lagged term, $\Delta e_{t-1,}$ in equation 3 to correct for autocorrelation, the lagged terms could also be more than one (i.e. Δe_{t-i}). The choice of the lag length is guided by the Akaike Information Criterion (AIC).

[5] Testing for unit root in the *mpr* is challenging because this rate changes discretely and its increments are irregularly spaced in time. An overwhelming majority of the literature fails to reject a unit root based on the low power of unit root test when dealing with series that present infrequent changes (Hamilton and Jorda, 2002). We take one of the stands in the literature testing for the presence of unit root in the *ir* and the target rate.

It is the *tau* statistic with respect to the coefficient of e_{t-1} in equation 2 that would help us establish the case for or otherwise of a cointegration between the variables *ir, mpr and* X_t. The decision rule is that, if the *tau* statistic (τ) obtained from equation 3 is less than or equal to τ_c (i.e. $\tau < \tau_c$), we reject the null hypothesis of no cointegration. However, if $\tau > \tau_c$, we accept the null hypothesis that the series are not cointegrated.

V. Data and Empirical Results

Data used in this study were obtained from the Central Bank of Nigeria: Major Economic, Financial and Banking Indicators and Bank Analysis System, Economic and Financial Review, and the Financial Market Dealers Association – Market Update. Monthly series covering the period 1999M01 -2009M09 were used.[6]

The summary statistics of the variables used in the study are presented in table 1 in the appendix. A glance of the plot (figure1) reveals that the series are correlated positively among a number of variables. Within the sample period, the *ir* has followed the *mpr*, though not as close as would be expected, particularly between 1999 and 2001, 2005 and 2006, and from the second half of 2008 to mid-2009 (see figure 2). These periods witnessed large fluctuations in the range of +/- 10-15 basis points. Going by this, the success of the CBN in steering the short-term interest rates toward the *mpr*, coupled with variations in the *mpr* and the financial fragility that necessitated the banking consolidation exercise, has been marginal. Except for most part of 1999, 2001 and from mid-2008 through 2009 when the inter-bank rate exceeds the *mpr*, for most part of the rest of the sample period, the *ir* was below the *mpr*, an indication that the interbank fund market has, for most times in the sample period, been liquid. In terms of spread, there is considerable heterogeneity of these variables across time. For example, while the average deviation between 1999 and mid-2001 was about 1000bps, it was only about 500 bps from mid-2001 to mid-2005.

Table 3 shows unit root tests on the order of integration of the variables – dependent and independent based on the Augmented Dickey-Fuller (ADF) and the Phillip-Perron (PP) classes of unit root tests.[7] The ADF and PP test the null hypothesis for variables of interest that are non-stationary and ascertain the number of times variables need to be differenced to arrive at stationarity. As

[6] The monthly series were obtained by interpolation of quarterly series for periods where monthly figures could not be obtained

[7] As observed in note 4 above, the price-related variables have been found to be stationary, albeit at first difference, compared to the quantity-related variables that are stationary at levels.

shown on the table, both the ADF and the PP tests strongly support the hypotheses that growth in banking system credit (BCRTGWT), foreign exchange net flow (FOREXNTFLOW) and growth in broad money supply (M2GRWT) are stationary at levels, while the inter-bank rate (IR), monetary policy rate (MPR) and the IR-MPR spread are stationary at first differenced judging by the McKinnon critical values of rejection of the hypothesis of unit root.

Since the unit root tests reveal that BCRTGWT, FOREXNTFLOW and M2GRWT are I(0), while IR, MPR and IR-MPR are I(1), we went further to ascertain the possible number of cointegrating equations. Result of the unrestricted rank test in table 4 indicates that there are 4 cointegrating equations, while the Max-eigenvalue test indicates that there are 3 cointegrating equations both at 5 percent levels. From the Johansen multivariate test result, the normalized cointegration equation is;

$$ir = + 0.98irmpr + 0.98mpr + 0.03m2grwt - 0.00013forexnetflow - 0.0092bcrtgwt, \quad (4)$$

All coefficients are significant going by values of their respective standard errors. However, except for the variable d (bcrtgwt), the adjustment coefficients in the equation for other variables are insignificant.

V.1 The Long-run Static Regression Model and Cointegration Test

Having established the stationarity levels of the variables and the possibility of cointegrating equations, we therefore, tested for the possible cointegration among the variables by adopting the Engle and Granger two-step method – testing the stationarity of the residuals generated from running a static regression model in levels. A case for cointegration is established when the residuals is found to be stationary. Table 4 reports result of the static regression model, while table 5 reports the result of the cointegration test.

Given the ADF and PP critical values, variables in the co-integration regression model are said to be co-integrated. Thus, monetary policy rate, growth in broad money supply, growth in banking system credit and net flow of foreign exchange co-integrate with inter-bank rate. In other words, the results reject the null hypothesis of unit-root for the residuals, confirming the presence of a fundamental long- run relationship among the variables.

Given the non-stationary behaviour of the *ir* and its co-integration with the *mpr* and X_t, the most natural approach is an error correction model (ECM) with the

mpr as the long term anchor.[8] This approach is not novel in the literature. In fact, it has been applied by Nautz and Offermanns (2006), and Sarno and Thornton (2002) for Euro zone and the federal funds rate in United States, respectively. The ECM we estimate is formulated as follows:

$$\Delta ir_t = \theta_1 \Delta\ (ir_t - mpr_t)_{t-i} + \theta_2 \Delta mpr_{t-i} + \theta_3 \Delta ir_{t-i} + \lambda \Delta X_{t-i} + \delta ECM_{t-1} + U_t \qquad (5)$$

where *ir* is the inter-bank rate, *mpr* the monetary policy rate, *X* a vector of other explanatory variables, Δ is the first-difference operator. The parameter θ_1 is the rate at which the deviations of *ir* from the *mpr* are closed to each other. The vector of other explanatory variables, *X*, involves several monetary operations variables, growth of money supply (to account for the liquidity effect in the inter-bank market), growth of deposit money banks credit (to account for the non-discretionary injection and drainage of funds through open market operations) and the foreign exchange net flow (to account for the possible impact of the demand for and supply of foreign currency in the inter-bank funds market).

Table 6 below shows the results of the over-parameterized model with all the variables lagged over three periods. The estimation is in line with Engle and Granger (1987). The model performed well in terms of elementary diagnostic tests: the coefficient of determination, the F and the DW Statistics. In terms of individual variables, however, some are found to have no significant effect/contribution to the regression model, thus, necessitating the estimation of a more parsimonious model, the result of which is in table 7.

The result in table 7 is preferred to that of table 6 since it has more robust significant regressors, lower Schwarz (SC) criterion. The result also reports a better and well-defined error correction term, ECM_{-1}, which is significant and carries the expected sign. The error correction term indicates a feedback of 159 percent of the previous month's disequillibra from the long-run regressors on the regressand (inter-bank rate).

V.2 Diagnostic Tests

To confirm the robustness of the model, we performed diagnostic tests and the results are as shown in table 8. The Jarque-Bera test for normality of residual assumption is not violated, therefore the inference is valid. The result showed that

[8] It is worth mentioning that an error correction specification could also be obtained from a more general specification where the *ir* is just modelled as a function of its own lags, lags from the *mpr* plus other controls.

the error process could be described as normal. Similarly, the B-G serial correlation LM test indicates that the null hypothesis of no first-order autocorrelation of the error term is accepted, just as on the basis of White test there is Heteroscedasticity. The specification error (going by Ramsey Reset test) suggests the acceptance of the additive model based on the *F*-statistic and a *P*-value of of 0.043440. The results suggest that the model is robust for policy analysis.

Structural stability test of the model was conducted using the Cumulative Sum (CUSUM) test and the CUSUM of squares test. This is necessary in view of the fact that stability of the model will determine the extent to which we can make forecast concerning behaviour of the variables in the model. Figure 4 shows the plot suggesting the model is correctly specified and structurally stable, since the CUSUM lies within the 5 percent significance bound. The CUSUM of squares test (see figure 5) equally shows the presence of structural stability, particularly from 2006 when the instrument of monetary policy rate was introduced by the Central Bank. This is an indication of moderation in the volatility of the interbank rate.

VI. Summary and Concluding Remarks

Inter-bank markets are among the most important in the financial system. They are the focus of central banks' implementation of monetary policy and have a significant effect on the whole economy. Transactions in the inter-bank funds market provides signal of what obtains in the open credit market. In this work, though our major concern is in examining the possibility of a cointegrating relationship between the inter-bank fund market rate and the monetary policy rate, the anchor rate for other rates in the money market, the *mpr* cannot be taken as the only determinant of the inter-bank rate. To that effect, a number of other monetary variables are taken into account in examining the behaviour of the inter-bank rate. In this paper, we provide a parsimonious model of inter-bank fund rate determination using monthly data. This lies at the heart of monetary policy.

Results of the estimates indicate the significance of the *mpr* in our inter-bank rate equation. The result - that the monetary policy rate and the Nigeria inter-bank rates are cointegrated – has major economic implications. It means that when the Central Bank implements monetary policy by changing the monetary policy rate, the inter-bank rate will also change thereby ensuring that the effects of monetary policy are transmitted to the rest of the economy. The variable measuring "spread" produced a strong and positive coefficient indicating that a rise in *ir-mpr* increases the cost of inter-bank intermediation, reflecting the risk-

aversive disposition of market operators. Similarly, though growth in money supply is found to be significant in both current and lagged periods, it failed in carrying the expected sign in the current period and when lagged two periods. It is only when lagged three periods that the coefficients conform to the apriori expectation. The variables measuring growth in bank credit and netflow of foreign exchange are found to be significant and carry the expected signs. In all, the result is robust with the model expalining 98 percent of the behaviour of the inter-bank rate, serial correlation free and low AIC and SC.

In conclusion, while these results are preliminary, as a number of issues pertinent in the inter-bank market are not fully accounted for in this work (issues such as the implication of the change in reserve maintenance period, the impact of the banking sector reform exercise on the funds market, Central Bank intervention through REPO, financial crisis and inter-bank rate behaviour, the effect of liquidity hoarding in the inter-bank market spread, and the impact of lending relationships between banks in the market on flow of funds and the inter-bank rate, among others), they nevertheless call our attention to the need for policy pro-activeness in a way that would strengthen the anchor role of the *mpr*, in particular, and, in general, influencing the pattern of movement of the other explanatory variables. These are promising areas worthy of attention in future research.

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APPENDIX

Figure 1: Line graphs of regression variables

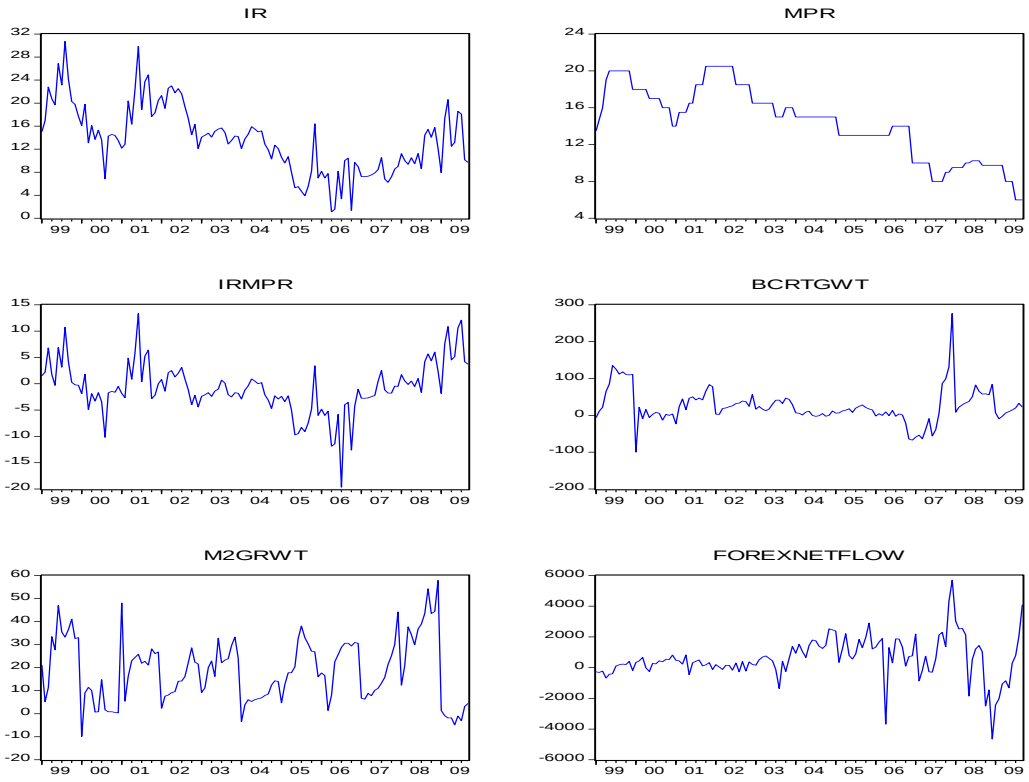


Figure2: Correlation of Explanatory Variables.

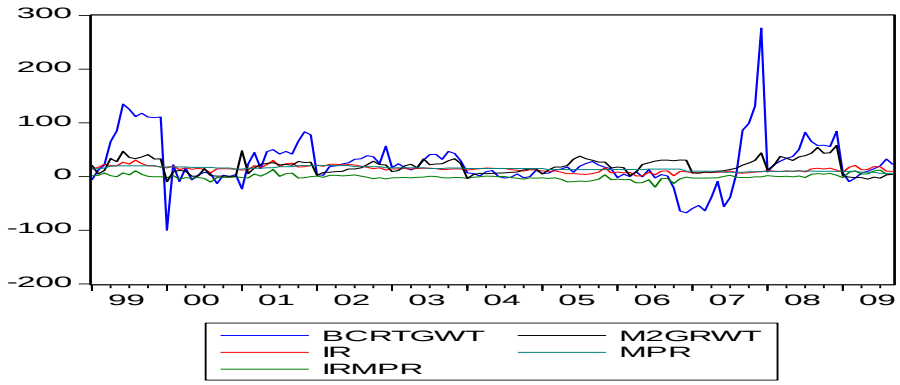


Figure3: Nigeria Interbank rate - Monetary Policy Rate Relationship and Spread

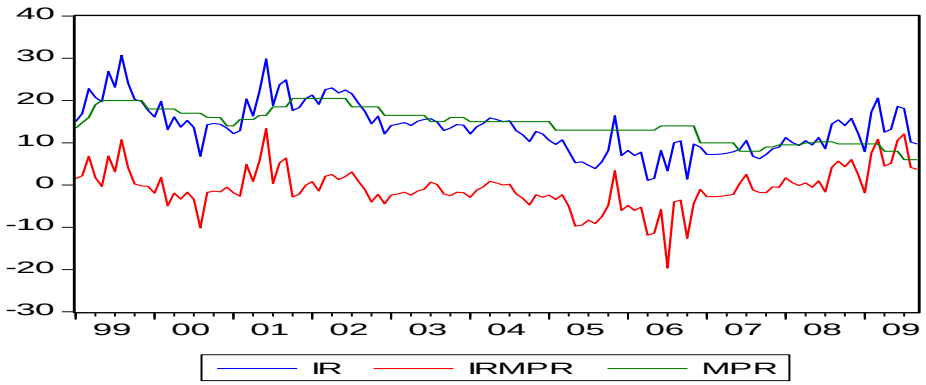


Figure 4: CUSUM Test on the Parsimonious Model

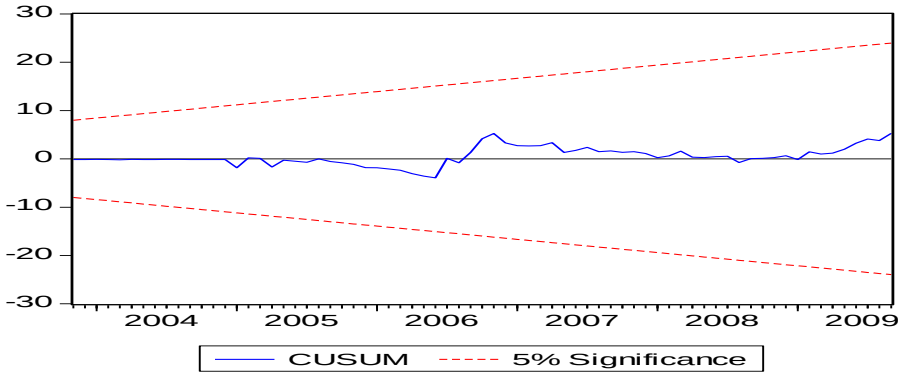


Figure 5: CUSUM of Squares test on the Parsimonious model

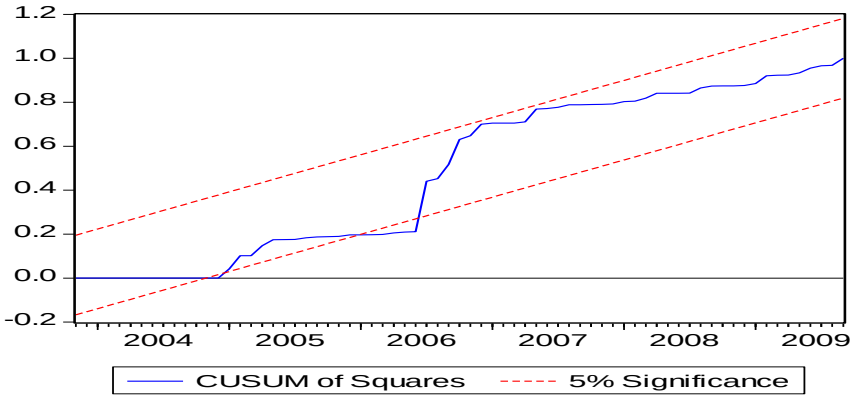


Table 1: Summary Statistics

	IR	IR-MPR	MPR	M2GRWT	FOREXNET FLOW	BCRTGWT
Mean	13.73426	-0.720388	14.37016	18.78023	603.4547	24.68364
Median	13.80000	-1.200000	15.00000	17.80000	447.3000	16.80000
Maximum	30.71000	13.34000	20.50000	57.80000	5696.500	276.4000
Minimum	1.130000	-19.63000	6.000000	-9.870000	-4643.800	-99.80000
Std. Dev.	5.815001	4.860192	3.865930	13.92419	1348.643	46.19195
Skewness	0.323096	-0.145133	-0.207452	0.342407	-0.104368	1.425666
Kurtosis	2.986186	5.043793	2.150971	2.535318	6.260934	9.392498
Jarque-Bera	2.245432	22.90474	4.799847	3.681331	57.39027	263.3434
Probability	0.325395	0.000011	0.090725	0.158712	0.000000	0.000000
Sum	1771.720	-92.93000	1853.750	2422.650	77845.66	3184.190
Sum Sq.Dev	4328.223	3023.548	1913.013	24817.04	2.33E+08	273113.1
Observations	129	129	129	129	129	129

Table 2: Correlation Matrix

	IR	IR-MPR	MPR	M2GRWT	FOREXNTFLOW	BCRTGWT
IR	1	0.741926	0.613534	0.013351	-0.262277	0.332880
IR-MPR	0.741926	1	-0.056938	-0.029133	-0.176993	0.260928
MPR	0.613534	-0.056938	1	0.035284	-0.184708	0.184115
M2GRWT	0.01335	-0.029133	0.035284	1	0.003696	0.560589
FOREXNTFLOW	-0.262277	-0.176993	-0.184708	0.003696	1	0.101329
BCRTGWT	0.332880	0.260928	0.184115	0.560589	0.101329	1

Table 3: Augmented Dickey-Fuller and Phillips-Perron Unit Root Test Results

Variable	BCRTGWT	FOREXNT FLOW	IR	IR-MPR	M2GRWT	MPR
ADF statistic	-4.066	-5.428	-13.098	-14.362	-5.213	-10.252
Phillip-Perron statistic	-5.581	-5.613	-17.654	-22.644	-5.369	-10.242
Order of Integration	I(0)	I(0)	I(1)	I(1)	I(0)	I(1)

MacKinnon (1996) Critical Values: 10% = -2.579; 5% = -2.884; 1% = -3.482

Table 3a: Cointegration Test Results

Sample (adjusted): 1999M06 2009M09
Included observations: 124 after adjustments
Trend assumption: Linear deterministic trend
Series: IR IRMPR MPR M2GRWT FOREXNETFLOW BCRTGWT
Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.422408	182.2705	95.75366	0.0000
At most 1 *	0.295522	114.2085	69.81889	0.0000
At most 2 *	0.268197	70.77145	47.85613	0.0001
At most 3 *	0.141619	32.05318	29.79707	0.0270
At most 4	0.098194	13.11747	15.49471	0.1106
At most 5	0.002427	0.301357	3.841466	0.5830

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.422408	68.06204	40.07757	0.0000
At most 1 *	0.295522	43.43703	33.87687	0.0027
At most 2 *	0.268197	38.71827	27.58434	0.0013
At most 3	0.141619	18.93571	21.13162	0.0987
At most 4	0.098194	12.81611	14.26460	0.0836
At most 5	0.002427	0.301357	3.841466	0.5830

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

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

IR	IRMPR	MPR	M2GRWT	FOREXNETFLOW	BCRTGWT
3.264719	-3.207414	-3.212641	-0.089361	0.000428	0.029978
0.987817	-0.687026	-0.818245	0.115330	0.001045	-0.022854
2.106440	-1.879749	-2.085576	0.046162	-7.22E-05	-0.031570
-0.443735	0.153102	0.335108	0.037252	-0.000811	0.021175
0.030842	-0.130980	-0.021050	0.022064	0.000638	-0.017088
-0.326844	0.237226	0.602206	0.021938	-0.000192	-0.007056

Unrestricted Adjustment Coefficients (alpha):

D(IR)	-0.283233	-0.647234	0.253119	0.634219	0.538747	-0.036839
D(IRMPR)	-0.004398	-0.564991	0.629000	0.709225	0.596371	-0.013545
D(MPR)	-0.058953	0.092601	-0.087235	-0.030550	0.010022	-0.027344
D(M2GRWT)	1.337939	-2.688212	-0.909229	-2.658233	1.393124	-0.020892
D(FOREXNET FLOW)	40.92789	-357.2927	236.8802	-2.291306	-153.3643	-18.45843
D(BCRTGWT)	-11.61777	-3.960428	7.591540	-8.559318	2.270617	-0.147107

1 Cointegrating Equation: Log likelihood -2614.439

Normalized cointegrating coefficients (standard error in parentheses)

IR	IRMPR	MPR	M2GRWT	FOREXNETFLOW	BCRTGWT
1.00000	-0.982447	-0.984048	-0.027372	0.000131	0.009182
	(0.01498)	(0.01214)	(0.00573)	(5.0E-05)	(0.00205)

Adjustment coefficients (standard error in parentheses)

D(IR)	D(IRMPR)	D(MPR)	D(M2GRWT)	D(FOREXNETFLOW)	D(BCRTGWT)
-0.924678	-0.014357	-0.192465	4.367997	133.6181	-37.92784
(0.93982)	(1.03264)	(0.20270)	(3.29496)	(333.626)	(10.5905)

Table 3b: Result of Johansen multivariate cointegration test

λ_{Max} ***Test Statistic***		λ_{Trace} ***Test Statistic***	
Ho: r =0		*Ho: r =0*	
Ha: r = 1		*Ha: r >1*	
Eigen value	= 0.422408	Eigen value	= 0.422408
Max Eigen stat.	= 68.06204	Trace stat.	= 182.2705
5% critical value	= 40.07757	5% critical value	= 95.75366

Test indicates presence of one cointegrating vector for the model. Thus, there is a long-run equilibrium relationship among the variables under consideration.

Table 4: Static Regression Model

Dependent Variable: IR

Method: Least Squares

Sample: 1999M01 2009M09

Included observations: 129

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IRMPR	0.930986	0.016063	57.95911	0.0000
MPR	0.986994	0.019338	51.03939	0.0000
M2GRWT	0.004632	0.006348	0.729718	0.4670
FOREXNETFLOW	-1.60E-05	5.57E-05	-0.287704	0.7741
BCRTGWT	0.000402	0.002068	0.194490	0.8461
C	0.134430	0.312717	0.429876	0.6680

R-squared	0.982080	Mean dependent var	13.73426
Adjusted R-squared	0.981352	S.D. dependent var	5.815001
S.E. of regression	0.794092	Akaike info criterion	2.422161
Sum squared resid	77.56164	Schwarz criterion	2.555175
Log likelihood	-150.2294	F-statistic	1348.170
Durbin-Watson stat	1.934206	Prob(F-statistic)	0.000000

Table 5: Unit Root test for the Residuals

Null Hypothesis: RESID01 has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.86161	0.0000
Test critical values:	1% level	-3.482035	
	5% level	-2.884109	
	10% level	-2.578884	

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

Table 6: Over-Parameterized Error Correction Model

Dependent Variable: D(IR,2)
Method: Least Squares
Sample (adjusted): 1999M06 2009M09
Included observations: 124 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(IRMPR,2)	0.889850	0.023042	38.61792	0.0000
D(IRMPR(-1),2)	-0.005323	0.034326	-0.155079	0.8771
D(IRMPR(-2),2)	-0.197347	0.071676	-2.753303	0.0070
D(IRMPR(-3),2)	-0.109827	0.061577	-1.783571	0.0775
D(IR(-2),2)	0.195898	0.067626	2.896788	0.0046
D(IR(-3),2)	0.121228	0.064288	1.885714	0.0622
D(MPR,2)	0.932661	0.109056	8.552095	0.0000
D(MPR(-1),2)	0.092385	0.133724	0.690863	0.4913
D(MPR(-2),2)	-0.189125	0.146195	-1.293654	0.1988
D(MPR(-3),2)	-0.070582	0.119337	-0.591449	0.5556
D(M2GRWT,2)	0.014701	0.007942	1.851013	0.0671
D(M2GRWT(-1),2)	0.001612	0.011238	0.143455	0.8862
D(M2GRWT(-2),2)	0.015018	0.010915	1.375947	0.1719
D(M2GRWT(-3),2)	0.002502	0.008049	0.310848	0.7566
D(FOREXNETFLOW,2)	1.81E-05	6.77E-05	0.267779	0.7894
D(FOREXNETFLOW(-1),2)	-1.62E-05	9.57E-05	-0.169636	0.8656
D(FOREXNETFLOW(-2),2)	0.000139	9.72E-05	1.425324	0.1572
D(FOREXNETFLOW(-3),2)	-0.000136	7.92E-05	-1.715413	0.0894
D(BCRTGWT,2)	-0.002011	0.002354	-0.854437	0.3949
D(BCRTGWT(-1),2)	-0.003340	0.003314	-1.007800	0.3160
D(BCRTGWT(-2),2)	-0.003093	0.003266	-0.947055	0.3459
D(BCRTGWT(-3),2)	-0.000796	0.002263	-0.351805	0.7257
RESID01(-1)	-1.575117	0.132173	-11.91711	0.0000
C	-0.009473	0.082037	-0.115469	0.9083

R-squared	0.982114	Mean dependent var	0.004839
Adjusted R-squared	0.978000	S.D. dependent var	6.126412
S.E. of regression	0.908695	Akaike info criterion	2.818372
Sum squared resid	82.57274	Schwarz criterion	3.364233
Log likelihood	-150.7391	F-statistic	238.7343
Durbin-Watson stat	1.920743	Prob(F-statistic)	0.000000

Table 7: Parsimonious Regression Model

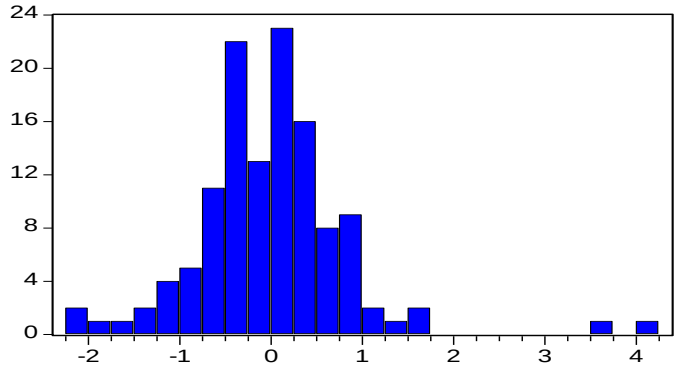
Dependent Variable: D(IR,2)
Method: Least Squares
Sample (adjusted): 1999M06 2009M09
Included observations: 124 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(IRMPR,2)	0.894147	0.013427	66.59418	0.0000
D(IRMPR(-2),2)	-0.167747	0.050470	-3.323693	0.0012
D(IRMPR(-3),2)	-0.071580	0.047186	-1.516980	0.1321
D(IR(-2),2)	0.167516	0.056554	2.962039	0.0037
D(IR(-3),2)	0.082649	0.052928	1.561555	0.1212
D(MPR,2)	0.874380	0.080656	10.84091	0.0000
D(MPR(-2),2)	-0.212318	0.085522	-2.482612	0.0145
D(M2GRWT,2)	0.014382	0.004426	3.249429	0.0015
D(M2GRWT(-2),2)	0.010392	0.004519	2.299647	0.0233
D(FOREXNETFLOW(-2),2)	0.000164	5.33E-05	3.067542	0.0027
D(FOREXNETFLOW(-3),2)	-0.000125	6.11E-05	-2.047161	0.0430
RESID01(-1)	-1.588040	0.122157	-13.00000	0.0000
C	-0.011956	0.078750	-0.151815	0.8796

R-squared	0.981533	Mean dependent var	0.004839
Adjusted R-squared	0.979537	S.D. dependent var	6.126412
S.E. of regression	0.876377	Akaike info criterion	2.672885
Sum squared resid	85.25206	Schwarz criterion	2.968560
Log likelihood	-152.7189	F-statistic	491.6538
Durbin-Watson stat	1.919135	Prob(F-statistic)	0.000000

Table 8: Results Diagnostic Tests

A. J-B test for normality



Series: Residuals	
Sample 1999M06 2009M09	
Observations 124	
Mean	5.19e-17
Median	0.022560
Maximum	4.023793
Minimum	-2.084486
Std. Dev.	0.832530
Skewness	1.279579
Kurtosis	9.193254
Jarque-Bera	232.0127
Probability	0.000000

B. Breusch-Godfrey Serial Correlation LM Test:

F-statistic	4.556776	Probability	0.012572
Obs*R-squared	9.567746	Probability	0.008364

C. White Heteroskedasticity Test:

F-statistic	14.26327	Probability	0.000000
Obs*R-squared	96.18336	Probability	0.000000

D. Ramsey RESET Test:

F-statistic	2.548545	Probability	0.043440
Log likelihood ratio	11.28442	Probability	0.023547