Social Science Journal for Advanced Research
ISSN (Online): 2583-0074
Volume-2 Issue-4 || July 2022 || PP. 31-41 DOI: 10.54741/ssjar.2.4.5

The Impact of Monetary Policy on Interbank Market Rate: Evidence from the Nigerian Banking Industry

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Received: 04-06-2022	Revised: 17-06-2022	Accepted: 04-07-2022

ABSTRACT
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. However, apart from the rate of interest (cost of transaction) in the market that influences the tempo of activities, 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). The market rate on the other hand is influenced by a number of factors including monetary policy instruments such as: open market operations, reserve requirements, monetary policy rate and central banks standing facilities. The market rate is believed to determine the market liquidity and affects directly the amount of resources that commercial banks have at their disposal and which they are consequently willing to lend in the interbank market. It is therefore necessary to understand the factors behind the dynamics of the market rate. Consequently, this paper examines the impact of monetary policy on interbank market rate with evidence from the Nigerian banking industry.

Keywords: *banking industry, monetary policy, interbank, afem*

I. INTRODUCTION

The interbank market is a market for redistributing the fixed amount of reserves held within the banking system. Banks may face uncertainty regarding their need for liquid assets; the interbank market enable banks faced with distributional shocks to redistribute liquid assets among themselves (Freixas, Martin & Skeie, 2009). It provides a lending and borrowing mechanism for banks to cope with inter-temporal preference shocks affecting liability-holders' demands for early withdrawal of their invested funds (Bhattacharya and Fulghieri, 1994). The funds banks trade with are their deposit balances with the central bank (Quiros and Mendizabal, 2006; Bartolini, Bertola and Prati, 2002; Ho and Saunders, 1985); hence the name interbank market. On a daily basis, banks envisage the level of reserves they would like to maintain at the close of business. As transactions unfold, the normal flow of business may leave them with more or less reserves than they expect 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 (Bulus, 2010).

The transactions in the interbank market are necessitated by the impossibility of an individual bank to maintain an equilibrium cash or liquidity holding (that matches the demand for and supply of liquidity/cash) at any particular 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 default, which makes such loans unsecured, the borrowing bank must be credit worthy in the eyes of the lending bank, otherwise the loan transaction cannot be consummated. Banks lend significant amounts of money to one another every day in the market. These loans are both large and uncollateralized, and thus expose lending institutions to significant credit risk. Lending banks therefore have an incentive to monitor their counterparties and to price these loans as a function of, among other things, the credit risk of the borrowing bank (Furfine, 2001). Policy makers believe that the interbank funds market provides valuable information about the health of individual banks. When a bank cannot obtain 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 (Bulus, 2010). Generally, it is theoretically posited that transactions in the interbank 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). This is because the operating procedures of central banks are designed to affect the supply and demand of reserves among financial institutions. Along this line, Ahumada et al, (2009) maintain as follows:

> *The interbank market represents the first stage of the monetary transmission channel, where monetary policy actions first come into contact with the rest of the financial system. Indeed, an effective monetary policy requires that the overnight interest rate remains "at an average of around the monetary policy rate (MPR).*

However, apart from the rate of interest (cost of transaction) in the market that influences the tempo of activities, 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). The market rate on the other hand is affected by a number of factors including monetary policy instruments such as: open market operations, reserve requirements, monetary policy rate and central banks standing facilities (Quiros and Mendizabal, 2006).

Essentially, the market liquidity affects directly the amount of resources that commercial banks have at their disposal and which they will consequently be willing to lend in the interbank market. Theoretical literature has developed models along these lines, analyzing the functioning of the interbank market using a general framework in which banks' reserve positions are affected by random liquidity shocks and where the interbank market allows banks to fulfil their liquidity requirements (e.g Ho and Saunders, 1985; Freixas et al, 2000; Allen and Gale, 2000). Others study monetary policy impact on the market rate and factors behind its volatility (Ahumadu et al, 2009; Akram and Christopherson, 2010; Wurtz, 2003, Hamilton, 1996). As the market rate determines the market liquidity and affects directly the amount of resources that commercial banks have at their disposal and which they will consequently be willing to lend in the interbank market, therefore understanding the factors behind the dynamics of the market rate is relevant not only for participants in the interbank market, but also for private investors and monetary authorities. It is against this background that the examination of the impact of monetary policy on interbank market rate in Nigeria occupies the heart of this study. The paper has four sections with the introduction as section one. Section two reviews related literature while section three presents the methodology of the study. Section four presents and analyses the data with the results while section five concludes the paper.

The interbank money market plays a crucial role in the conduct of monetary policy. It is the starting point for the transmission mechanism of monetary policy impulses, and in most industrialized countries, the rate on these overnight loans is the central bank's operating target. Generally, it is theoretically posited that transactions in the interbank funds market provide a 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). This is because the operating procedures of central banks are designed to affect the supply and demand of reserves among financial institutions. Along this line, Ahumada et al, (2009) maintain as follows:

> *The interbank market represents the first stage of the monetary transmission channel, where monetary policy actions first come into contact with the rest of the financial system. Indeed, an effective monetary policy requires that the overnight interest rate remains "at an average of around the monetary policy rate (MPR).*

The interbank market equally allows for redistribution of liquidity for banks facing liquidity shocks in the financial system. The relevance of interbank market in this regard has received tremendous attention in the literature. The potency of the interbank market in enabling banks to cope with bank specific liquidity shocks and avoid unnecessary liquidation of long-term investments was first acknowledged in Bhattacharya and Gale (1987) who show that banks can optimally cope with idiosyncratic liquidity shocks by borrowing and lending; but tend to under-invest in liquidity reserves when moral hazard and adverse selection problems are present. However, the failure of the interbank market to provide adequate hedging opportunity and allocate liquidity efficiently due to frictions and identified inefficiencies requires further attention. Most especially, interbank market rate volatility, scarcity of funds, hoarding and utilization of market power by big banks which in most cases emanate from monetary policy review and implementation as witnessed in the Nigerian interbank market as a result of central banks' upward review of cash reserve ratio on public sector funds with the commercial banks.

The inefficiencies jeopardising the smooth functioning of the market justifies central banks' intervention at various times to restore normality in the market. The issue is on what platform should the required intervention be made? Again, market liquidity affects directly the amount of resources that commercial banks have at their disposal and which they will consequently be willing to lend in the interbank market. This requires formal analysis to ascertain factors underlying the dynamics of the market rate especially monetary policy review and implementation. Consequently, the examination of the impact of monetary policy review and implementation on the interbank market rate as well as the platform of the required central bank's intervention is at the heart of this study.

The objectives of the study include the following:

1) To ascertain the impact of Monetary Policy Rate (MPR) on interbank market liquidity.
2) To determine the impact of central bank's Open Market Operation (OMO) on interbank market liquidity.
3) To examine the impact of Cash Reserve Requirements (CRR) on interbank market liquidity.

To actualize the above stated objectives, the following research questions have been extracted to guide the researcher:

1) To what extent does Cash Reserve Requirements have positive and significant impact on interbank market liquidity?
2) How far does central bank's Open Market Operations have positive and significant impact on interbank market liquidity?
3) To what extent does monetary policy rate have positive and significant impact on interbank market liquidity.

In line with the objectives and research questions of this study, the following hypotheses have been formulated:

1) H_0: Monetary Policy Rate does not have a positive and significant impact on interbank market liquidity.
2) H_0: Central bank's Open Market Operations does not have a positive and significant impact on interbank market liquidity.
3) H_0: Cash Reserve Requirement does not have a positive and significant impact on interbank market liquidity

II. REVIEW OF RELATED LITERATURE

Monetary policy initiation, review and implementation have various impacts on the market rate and quantity dynamics as documented by various studies. Neyer and Weimers (2003) document that for the conduct of monetary policy it is important to know the functioning of the interbank money market and the determinants of the interbank money market rate. Developing a simple interbank money market model with a heterogenous banking sector, they show that besides balancing daily liquidity fluctuations or speculative purposes, banks participate in the interbank money market because they differ in marginal cost of borrowing funds from the central bank. These cost differences imply that banks with relatively low marginal costs act as intermediaries between the central bank and credit institutions with relatively high marginal costs. This results in a positive spread between the interbank market and central bank rate. According to them a number of factors determine the spread including: transaction costs and credit risk in the interbank market, total liquidity needs of the banking sector, collateral's opportunity costs, and the distribution of the latter across banks.

Bech and Monnet (2013) maintain that the modus operandi of central banks in terms of implementing monetary policy has changed materially over the last six years since the start of the global financial crisis. Further, they observe that prior to the crisis, many central banks implemented monetary policy by specifying a target for the rate on unsecured loans of overnight funds between banks. The target rate in turn influenced other interest rates and hence financing conditions in the wider economy. Accordingly, the stance of monetary policy was loosened (tightened) by lowering (increasing) the target for the overnight rate. Central banks guided the overnight rate through a combination of open market operations and standing facilities where banks could either deposit or borrow funds (against collateral). However, in response to the financial crisis and the ensuing economic downturn, central banks adapted monetary policy in unconventional ways. Central banks provided liquidity backstops to many parts of the financial system and cut policy rates aggressively to their effective lower bounds. Some central banks now even provide explicit guidance on how long policy rates will stay low. Moreover, several major central banks embarked on large-scale asset purchase programs or very long-term refinancing operations with a view to reducing either term premia or liquidity risk.

In view of the above development, the paper documents four stylised facts with respect to the impact of unconventional monetary policies on the price and quantity dynamics of the overnight money market. Looking at six markets in developed economies, the paper shows that the surge in excess reserves has driven overnight rates to the rate at which the central bank remunerates reserves. Furthermore, the authors illustrate how the expansion of excess reserves decreases market volume and reduces the volatility of the overnight rate. In addition, a prima facie evidence that counterparty risk affects the pricing of unsecured overnight loans between banks even when the market is flush with liquidity is provided. With the stylised facts the paper reviews the models in Poole (1968), Afonso and Lagos (2012) and Bech and Monnet (2013) within a common framework and compare how the predictions of the models stack up against the stylised facts. Based on the models, the paper finds that the observed dynamics in the overnight money market are in line with an expectation of a consequence of the observed market stresses and unconventional policies. Taken at face value, this suggests that once the unconventional policies and market stresses are reversed the unsecured overnight money market may; in fact, re-emerge and central banks will be able to resume their conventional modus operandi.

Ennis and Keister (2008) presents a simple analytical framework for understanding the process of monetary policy implementation and the factors that influence a central bank's ability to keep the market interest rate close to a target level. With a graphical framework, the paper focuses on how various features of the implementation process affect the sensitivity of the market interest rate to unanticipated changes in supply or demand. The current approach used by the Fed, including the use of reserve maintenance periods to decrease this sensitivity is also discussed. The paper equally shows how this framework can be used to study a wide range of issues related to monetary policy implementation. Essentially, the paper emphasises on reserve maintenance period and interest on reserve which involves interest corridor and a system with clearing bands as policy tools for limiting market interest rate volatility. Accordingly, the presence of a reserve maintenance period gives banks some flexibility in determining when they hold reserves to meet their requirement. In

general, banks will try to hold more reserves on days in which they expect the market interest rate to be lower and fewer reserves on days when they expect the rate to be higher. This flexibility implies that a bank's reserve holdings will tend to be more responsive to changes in the interest rate on any given day. In other words, having a reserve maintenance period tends to make the demand curve flatter, at least on days prior to the last day of the maintenance period. The ability to pay interest on reserves gives a central bank an additional policy tool that can be used to help minimize the volatility of the market interest rate and steer this rate to the target level. This tool can be especially useful during periods of financial distress. The ability to pay interest on reserves allows the central bank to effectively put a floor on the values of the interest rate that can be observed in the market. Such a floor reduces volatility and potentially increases the ability of the central bank to achieve its target rate.

Ahumada e tal (2009) utilise three detailed micro-datasets for the period June 2006 to August 2008 with an error correction model to understand the determinants of the dynamics of the interbank rate in Chile, which allows them to evaluate in detail the role of open market operations and private deposits. Regarding monetary policy, the paper considers discretionary operations that provide liquidity (repos) and those that reduce it (liquidity deposits), and non-discretionary instruments (permanent credit facilities). Also, the estimations control for calendar effects, which are quite relevant in explaining the dynamics of the interbank rate. The most relevant findings are related to the statistical and economic significance of speed of convergence, calendar effects and repos operations. The Central Bank plays a more important role injecting than draining liquidity through discretionary operations. However, there are not asymmetries in terms of the effectiveness of the discretionary injections and drainages operations depending on the liquidity market status. In terms of effect by class of bank, large- and medium-size banks are less receptive to monetary operations; by contrast small-size banks are the most responsive, which is consistent with its traditional position as a liquidity demander. Finally, private deposits do not play an important role on the dynamics of the interbank rate during the sample period.

Bulus (2010) maintains that the inter-bank markets are the focus of central banks' implementation of monetary policy and have a significant effect on the economy; that transactions in the inter-bank funds market provide signal of what obtains in the open credit market. He further maintain that 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. Using data obtained from the central bank of Nigeria's various reports including interbank market rates (ir), monetary policy rates (mpr) and other monetary operations variables for the period 1999 to 2009 with ordinary least square regression and error correction estimation models, the paper examine the relationship between the inter-bank and monetary policy rates. The papers' findings indicate that the rates are co-integrated and have a long-run relationship, and also affect the liquidity position of the market 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. Essentially the paper provides a parsimonious model of inter-bank fund rate determination using monthly data. This lies at the heart of monetary policy. Accordingly, the result-that the monetary policy rate and the Nigerian inter-bank rates are co-integrated 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.

Taylor and Williams (2009) document development in the US money market during the financial crisis of 2007.They maintain that the financial crisis saw a dramatic and persistent jump in interest rate spreads between overnight federal funds and longer term interbank loans. The Federal Reserve made several attempts to reduce the spread between term interbank lending rates and the overnight rate. It lowered the penalty on borrowing at the discount window bringing the discount rate below Libor, and strongly encouraged banks to borrow; but banks were reluctant to borrow from the discount window and there was little response. Then in December 2007, four months after the crisis began, the Fed introduced a major new lending facility, the Term Auction Facility (TAF), through which banks could borrow from the Fed without using the discount window. The Fed then increased the size of the TAF several times in the ensuing months. However, the paper maintains that the effectiveness of these policies depends on the cause of the increased spreads such as counterparty risk, liquidity, or other factors. With a framework of a no-arbitrage model of the term structure of interest rates which explicitly builds in both expectations of future short term rates and risk factors, the paper examines alternative explanations for these unusual developments in the money markets and evaluates the impact of policy actions taken to address them. The paper basically tests alternative hypotheses using a variety of market-based measures of expectations and risk that it draws from derivative securities markets before and after the crisis. The paper measures interest rate expectations using daily data on overnight index swaps (OIS); and measures risk using credit default swaps (CDS), spreads between interbank interest rates on unsecured lending (Libor) and interest rates on secured lending through repurchase agreements (Repo), and spreads between rates on the Tokyo interbank market (Tibor) and Libor. The paper uses daily data for the sample period from January 2, 2007 to August 8, 2008. The papers' empirical results show that expectations of future interest rates and counter party risk are the major factors in explaining the spread between interest rates on term lending and the overnight rate; with no robust evidence of a significant effect of the liquidity provision of the TAF on spreads.

Nautz and Offermanns (2006) maintain that for many central banks, including the European Central Bank (ECB) and the US Federal Reserve, the interbank money market for overnight lending is the key channel through which monetary policy is executed. Overnight rates are the operational target of monetary policy that anchors the term structure of interest rates; hence, understanding the determinants and the dynamics of the overnight rate is therefore of crucial importance for implementing monetary policy in an efficient way. Using daily data for the representative Euro overnight rate Eonia (i), the 3-month money market rate Euribor (i3), and a key policy rate (i) of the ECB from January 2, 1999 to March 9, 2004 with error correction model, the paper investigates how the dynamic adjustment of the European overnight rate Eonia to the term structure and the ECB's policy rate is affected by rate expectations and the operational framework of the ECB. Essentially, the paper's analysis of overnight rate dynamics starts with an error correction model for the Eonia that includes both, the policy spread and the term spread as error-correction terms. The authors observe that the relation between the Eonia and the policy spread might be affected by the way the policy rate is implemented by the central bank. For instance, according to them, in June 2000, the ECB switched from fixed rate to variable rate tenders in its main refinancing operations (MRO). If the fixed repo rate entails a stronger signal about the policy-intended interest rate level than a minimum bid rate, the introduction of variable rate tenders might have led to a partial loss of control over short-term interest rates. Therefore, the paper investigates how the dynamic adjustment of the Eonia to the policy rate depends on the MRO auction format. In particular, the period between January 1999 and June 2000 was compared with the period between July 2000 and March 2004. The paper's results indicate that the within-period dynamics of the Eonia depend on the auction format. Interestingly, the introduction of variable rate tenders with a minimum bid rate in June 2000 did not lead to a loss of control of the ECB over the Eonia. Since June 2000, the link between the Eonia and the ECB's policy rate is even strengthened when the policy spread tends to increase. For both auction formats, the Eonia adjustment is significantly stronger when the policy spread is relatively low. Making reference to Ayuso and Repullo (2003), the paper maintains that this pattern of the Eonia dynamics could be due to asymmetric preferences of the central bank with regard to the sign of the policy spread.

Thorton (2005) uses daily data compiled from the records of the Trading Desk of the Federal Reserve Bank of New York over the period March 1, 1984, through December 31, 1996, to analyze the Desk's use of its operating procedure in implementing monetary policy, and the extent to which open market operations affect the federal funds rate-the liquidity effect. In so doing, the paper provides some evidence on the relative importance of Fed operations in supplying liquidity to the federal funds market. The author finds that operating procedure was used to guide daily open market operations; however, there is little evidence of a liquidity effect at the daily frequency and even less evidence at lower frequencies. Consistent with the absence of a liquidity effect, open market operations appear to be a relatively unimportant source of liquidity to the federal funds market. One possible reason for this finding is that changes in the funds rate target were anticipated. Yet another explanation for this finding is that open market operations account for a very small proportion of the variation in the equilibrium quantities in the reserves and federal funds markets. This explanation is supported by the fact that open market operations explain relatively little of the maintenance-period variation in total reserves and an extremely small amount of the daily variation in daily volume of federal funds transactions.

Wurtz (2003) presents a comprehensive model on the spread between the euro overnight rate and the key policy rate of the ECB. With structural explanatory variables but also time series elements in the period from 26 April 1999 to 23 April 2002, covering a total of 767 trading days and 35 intact reserve maintenance periods, the paper shows that the most important variables driving the level and the volatility of this spread are expectations about changes of the key policy rate and the projected liquidity conditions at the end of the reserve maintenance period. The model allows for an assessment of how these variables impact differently on the spread according to the different open market operating procedures and the liquidity management policy of the ECB. It is found that a fixed rate tender procedure effectively limits the downward potential of the spread, while, however, no evidence is identified that it should be more effective than a variable rate tender procedure in keeping overall the overnight rate close to the key policy rate.

Akram and Christophersen (2010) study overnight interbank interest rates paid by Norwegian banks from the period 2006 to 2009. They observe large variations in the rate across banks and over time. During financial crisis, the rates are found to be substantially below indicative quotes of interest rates provided by major banks. With econometric model, they attribute the interest rate variation partly to differences in banks' characteristics including relative size and connectedness, implying favourable terms for banks of systemic importance. Moreover, interest rates are also found to depend on overall liquidity and possibly on its distribution among banks suggesting exploitation of market power by banks with surplus liquidity. The paper equally investigates effect of aggregate liquidity on interbank rate in the market as it amplifies interest rate response to the central bank's liquidity supply measures. Arguably, a more even liquidity distribution may reduce liquidity risk as more banks can act as possible counterparts when in need of liquidity. This may equally reduce the scope for exploiting possible market power in liquidity supply. Along this line, the empirical analysis by McAndrews et al (2008) suggest that a more efficient allocation of liquidity helps reduce interbank interest rate, while Taylor and Williams (2009) do not find significant evidence of such effect.

A number of other studies have confirmed that monetary policy actions have predictable effects on short-term interest rate. For example, the results of the study by Aziakpono, et al. (2007) show high responses of the overnight prime interbank 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's 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.

III. DATA AND METHOD

The empirical analysis of this paper covers the period of 1992 to 2013; a period of twenty one years. Data was generated at annual level on all the variables of the study from the central bank of Nigeria's publications including: annual report and accounts, statistical bulletin as well as economic and financial report of relevant years. The study's data include: Interbank Market Rate (IR), Monetary Policy Rate (MPR), Open Market Operation (OMO) represented by Treasury bill rate and Cash Reserve Ratio (CRR). Ordinary Least square estimation model was utilised for the empirical estimation of the impact of monetary policy on interbank market rate in line with theoretical postulation and policy expectation. In pursuing the objectives stated in chapter one, various statistical tools such as tables and graphs were used for the presentation, explanation and analysis of the data of the study. The hypotheses of the study were restated in null and alternate forms and tested accordingly. The results obtained were critically analysed, while decisions were made after the analyses. The E-view statistical software was used in running the analysis.

3.1 Description of Research Variables

The variables utilised in this study comprised of dependent and independent variables. The dependent variable of the study is Interbank Market Rate (IR) while the independent variables are Monetary Policy Rate (MPR) and Monetary Policy Instrument proxies such as cash reserve ratio (CRR) and open market operations (OMO) represented by treasury bill rate. The study equally considered other monetary operation variables that significantly explain the variation of the dependent variable. This includes central banks' standing facility, institutional investor deposit (pension funds), regulatory capital requirements among others (Ahumada et al, 2009).

3.1.1 Dependent Variable (Interbank Market Rate-IR)

As the interbank market rate affects the liquidity of the market which determine 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, it is necessary to understand the dynamics of the interbank market and factors that affect the market's rate (Ashcraft et al, 2009 and Neyer and Wiemers, 2003).

3.1.2 Independent Variables

These are variables that affects the dependent variable but are mutually exclusive, that is they may not relate with one another (Onwumere, 2009). In view of this study, they are the variables that impact on interbank market liquidity through their various effects on the dynamics of the market rate which determine the tempo of transactions in the market. They include Monetary Policy Rate (MPR), and monetary policy instruments. The proxies for monetary policy instrument for this study include Open Market Operations (OMO) and Cash Reserve Ratio (CRR).

3.1.2.1 Monetary Policy Rate (MPR)

The Monetary Policy Rate (MPR) is the Monetary Policy Committee's primary policy instrument. Financial market participants constantly speculate about the movement in this rate, and whenever the Monetary Policy Committee meets, market participants eagerly await the announcement of either an upward or downward review of the monetary policy rate. It is the general expectation that the monetary policy rates be the signal rate to deposit money banks' (DMB) 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 access to funds by DMBs through the Central Bank discount window) is expected to induce DMBs to lower the cost of lending (Bulus, 2010). He further maintained that a case where a cause-effect relationship cannot be established implies 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. Similarly such a lack of cause-effect relationship indicates non transmission of monetary policy's impact to the rest of the economy.

3.1.2.2 Monetary Policy Instruments

For this study, the proxies for monetary policy instrument include Open Market Operations (OMO) represented by treasury bill rate and Cash Reserve Ratio (CRR). They are the instruments used by central banks to control the interbank rate in ensuring availability of funds in the market and implementation of monetary policy (Quiros and Mendizabal, 2006).

The relevance of open market operations in the analysis of the dynamics of Interbank market rate is underpinned by Goodfriend and King (1988) (see also Bordo 1990; Kaufman 1991; and Schwartz 1992) remark on Bagehot's doctrine of lender of last resort that it was elaborated at a time when financial markets were underdeveloped. They argue that open market operations can provide sufficient liquidity, which is then allocated by the interbank market. In other words, Goodfriend and King argue that, when interbank markets function well, a solvent institution cannot be illiquid. According to Rochet and Xavier (2004), banks can finance their assets with interbank funds, negotiable Certificates of Deposit (CDs), and Repurchase Agreements (repos). It is important to emphasize that central banks' treasury bill rate equally affects the quantity of bills in which commercial banks can obtain.

It is equally important to consider cash reserve ratio most especially in our jurisdiction (Nigeria). This in view of policy decisions by the regulators, essentially, the CBN's upward review of the CRR on public sector funds from 20% to 50% (Daily Newswatch, 2013), recently to 75% and the suspicion that CBN will implement the 5% impending deductions to the AMCON's sinking funds (Business Day, 2013). Essentially, these developments impacted adversely on the interbank market, such that interbank market rate increased steadily from 28% to 44% as at 18th September 2013 resulting to scarcity of funds in the market (Business Day, 2013).

3.2 Model Specification

The paper examines the likely effect of some monetary policy variables on the cost of funds and its availability in the interbank market. Consequently, the Interbank Market Rate(IR) is the dependent variable while monetary policy rate and monetary policy variables (cash reserve ratio (CRR) and open market operation (OMO)) are the independent variables. Treasury bill issued to deposit money banks (TBDMBS) is the proxy for OMO. The study covered the period, 1993 to 2012 (19years). Therefore, from a simple relationship of the form:

$$IR= \beta_0 + \beta_1 CRR + \beta_2 TBR + \beta_3 MPR + e_t.$$

Where:
IR= Inter-bank Market Rate
CRR= Cash Reserve Ratio
TBDMBS=Treasury Bills Rate
MPR= Monetary Policy Rate
e_t= Error Term
The hypotheses of the study were tested.
The model of the paper is in line with Ahumada e tal (2009).

3.3 Model Justification

Several modelling strategies in relation to studies on monetary policy and interbank market rate exist in the literature. However, the present study follows the modelling strategy of Ahumada et al, 2009. Essentially, the objective is the estimation of the impact of monetary policy on interbank market rate in line with theoretical postulation and policy expectation. As mentioned, the market liquidity affects directly the amount of resources that commercial banks have at their disposal and which they will consequently be willing to lend in the interbank market (Ahumada et al, 2009). It is equally the general expectation that the monetary policy rates be the signal rate to Deposit Money Banks' (DMB) 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 access to funds by DMBs through the Central Bank discount window) is expected to induce DMBs to lower the cost of lending (Bulus, 2010). He further maintained that a case where a cause-effect relationship cannot be established implies 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. Similarly such a lack of cause-effect relationship indicates non transmission of monetary policy's impact to the rest of the economy. Consequently, the present paper examines the likely effect of selected monetary policy variables on the cost (interbank market rate) of funds in the interbank market.

IV. DATA PRESENTATION AND ANALYSIS

This section presents and analyses the data obtained from the sources stated in section three. Various statistical tools including table and graph are deployed for ease of presentation and analysis. The collated values of the study's variables are presented in table 4.1 below. The data include the values of the variables (open market operation represented by treasury bills issued to deposit money banks and the rates, interbank market values and the rates, cash reserve requirements and the ratio as well as monetary policy rate) for the period 1993-20013. Below the table (4.1) are acronyms for the data variables.

Table 4.1: Presentation of model's data from 1993 to 2013

YEAR	IR(%)	CRR(%)	TBR (%)	MPR (%)
1993	57.5	6	26.9	26
1994	21	6	12.5	13.5
1995	20.5	6	12.5	13.5
1996	12.5	7.5	12.5	13.5

1997	18.2	7.8	12	13.5
1998	15.02	8.3	12.95	14.31
1999	16.1	11.7	17	18
2000	12.18	9.8	12	13.5
2001	12.7	10.8	12.95	14.31
2002	12.7	11.3	18.88	19
2003	21.11	10.5	15.02	15.75
2004	12.14	9.5	14.21	15
2005	7	9.5	7	13
2006	8.98	0.5	8.8	12.25
2007	8.99	0.3	6.91	8.75
2008	12.17	0.3	4.5	9.81
2009	4.68	1.3	6.13	7.44
2010	8.03	0.1	10.25	6.13
2011	15.5	0.8	16.75	12
2012	11.88	12	13.39	12
2013	10.75	12	12.50	12

Source: (CBN Annual Reports & Accounts and Statistical Bulletin of relevant years)

Note:

IR = Interbank Market Rate
CRR= Cash Reserve Ratio
TBR= Treasury Bill Rate
MPR= Monetary Policy Rate

The model variables are represented in percentages as can be observed on tables 4.1 and 4.2. For Interbank market rates, table 4.1 reveals that the highest rate was in1993 (57.5%). This was followed by 2003 (21.11%), 1994 (21%), 1995 (20.5%) , 1997 (18.2%) and 1999 (16.1%) respectively. However, interbank market maintains a steady rate from 2001 to 2006 within the bound of 12.7% and 12.18%.The lowest rate of fund transacted in the market was in 2009 (4.68%) followed by 2005 (7%), 2010 (8.03), 2006(8.98%) and 2007 (8.99%) respectively.

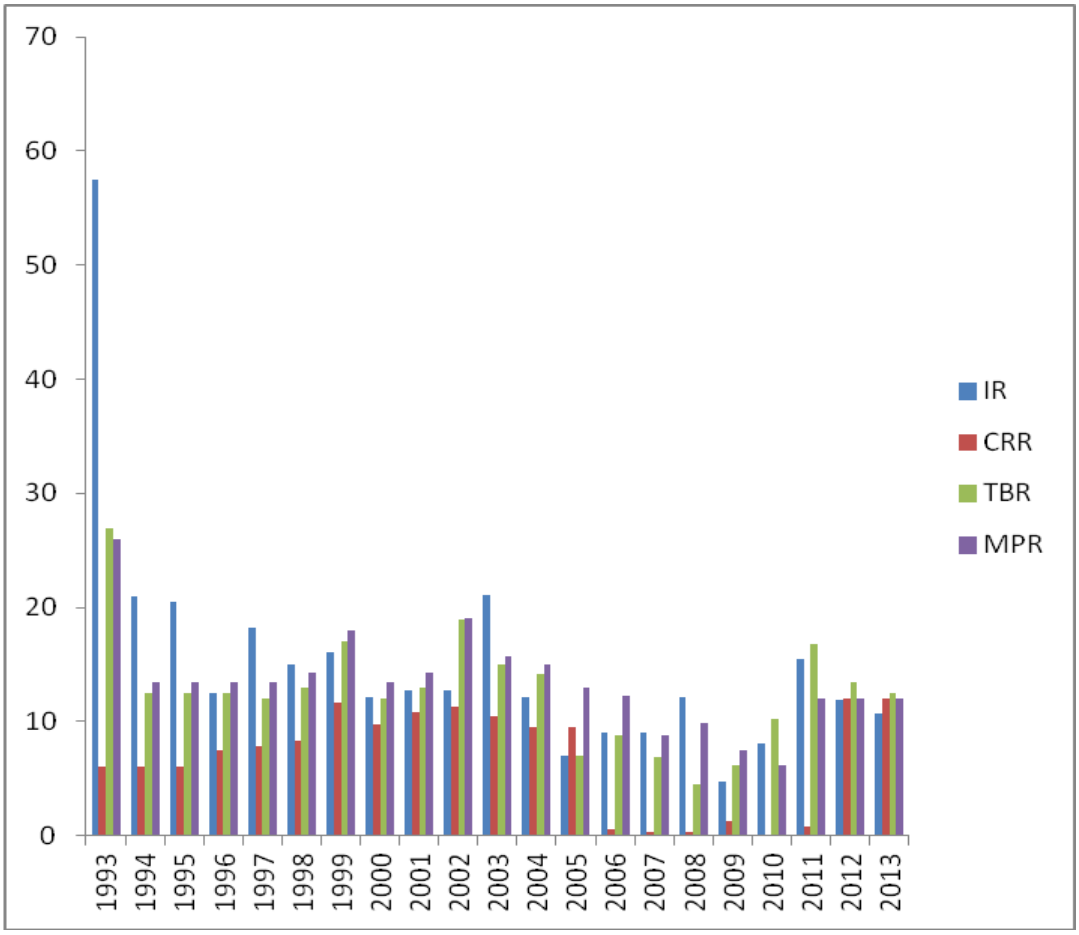
On cash reserve requirements, the highest ratio of 12% is observed to be in 2013 and 2012 respectively; followed by 1999 (11.7%), 2002 (11.3%). there was a gradual increase from 2000 to 2003; while a steady ratio of 9.5% and 6% are observed to occur in 2004, 2005, as well as 1993 to 1995. The least ratio of 0.1% was in 2010 followed by 0.3% in 2007 and 2008.

In respect of treasury bills rate variable, from table 4.1 the highest rate was made in 1993 (26.9%). This was followed by 2002 (18.88%), 1999 (17%) and 2011 (16.75%); while the least rate was made in 2008 (4.5%) 2009 (6.13%) 2007 (6.91%) 2005 (7%) respectively. However, there was a stable rate of 12.95% in 1998 and 2001 as well as 12.5% in 1994, 1995, 1996 and 2013 respectively.

On the monetary policy rate (MPR) variable, table 4.1 showed the highest rate of (26%) in 1993 followed by 2002 (19%), 1999 (18%), 2003 (15.75%), 2004 (15%), and (14.31) in 1998 and 2001 respectively; as well as (13.5%) in 1994, 1995, 1996, 1997 and 2000. The least MPR from the table was in 2010 (6.13%) followed by 2009 (7.44%), 2011 and 2012 (12%) and 2005 (13%).

To further enhance our data presentation, figure 4.1 depicts a diagrammatical representation of table 4.1.

Social Science Journal for Advanced Research
ISSN (Online): 2583-0074
Volume-2 Issue-4 || July 2022 || PP. 31-41 DOI: 10.54741/ssjar.2.4.5



Source: Author's Graphical Presentation

Table 4.2 Ordinary least square result of hypotheses

Dependent Variable: IR

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CRR	-0.998054	0.318133	-3.137218	0.0060
TBR	0.706791	0.488696	1.446280	0.1663
MPR	1.838484	0.607868	3.024477	0.0076
C	-11.76899	4.088922	-2.878262	0.0104
R-squared	0.783448	Mean dependent var		15.22048
Adjusted R-squared	0.745233	S.D. dependent var		10.67877
S.E. of regression	5.390047	Akaike info criterion		6.376628
Sum squared resid	493.8943	Schwarz criterion		6.575585
Log likelihood	-62.95460	F-statistic		20.50108
Durbin-Watson stat	1.0231628	Prob(F-statistic)		0.000007

Source: output results from Eview version 9.0

Model Equation IR= 11.7 + (0.99)CRR + 0.70TBR + 1.83MPR + 4.1

As observed in table 4.2 above, the result indicates that cash reserve requirements ratio has negative and non-significant impact on interbank market rate in Nigeria (coefficient of cash reserve requirements = (0.99), t-value =(0.31)). Thus, a one percent (1%) increase in cash reserve requirements ratio result in about 0.99% reduction in total value of the interbank market rate.

The result on table 4.2 also indicates that open market operation represented by treasury bills rate has positive and non-significant impact on interbank market rate of the Nigerian interbank market (coefficient of treasury bill rate = (0.70), t-value =1.44). This indicates that a one percent (1%) increase in treasury bills rate result in about 0.70% increase in total value of the interbank market rate.

Table 4.2 result equally indicates that monetary policy rate has positive and significant impact on interbank market rate of the Nigerian interbank market (coefficient of monetary policy rate = (1.83), t-value = 3.02). The result

implies that a one percent (1%) increase in monetary policy rate result in about 1.83% increase in interbank market rate in Nigeria. The coefficient of determination (R^2) is 78%, implying that 78% variation in the dependent variable (interbank market rate) is explained by the changes in the independent variables (cash reserve requirements ratio, treasury bills rate and monetary policy rate). The variation was properly adjusted by the adjusted R^2 of (70%). The Durbin Watson (d test statistic) was 1.02 which is less than the rule of thumb value of 2 implying that there was no sign of autocorrelation.

V. CONCLUSION

One of the major objectives of the Central bank of Nigeria (CBN) is the maintenance of monetary stability in the economy. To achieve this, the bank applies a number of monetary control tools including open market operations (OMO), monetary policy rate (MPR), cash reserve requirements (CRR), liquidity ratio, special deposits, selective credit controls and moral suasion (CBN, 1998). The results of the estimates indicate the significance of the variables in our interbank market equation. The results that cash reserve requirement ratio and open market operation represented by treasury bills rate and monetary policy rate, have negative and positive impact on interbank market rate have major economic implications. It means that when the Central Bank implements monetary policy by reviewing cash reserve requirements ratio, monetary policy rate and selling of treasury bills to commercial banks, the inter-bank market will also experience the effect of the policy changes especially on its' rate, thereby ensuring that the effects of monetary policy are transmitted to the rest of the economy. It is important to emphasize that the utilization of these variables depend principally on the objectives set out to be achieved by the monetary authority. In Nigeria, OMO has become the most important market-based tool used by the CBN to control the volume of money in the economy through the purchase or sale of government securities in the open market. Due to the prevalent liquidity surfeit in the economy, the purchase of securities, rather than sale has been predominant as evidenced in our models' results. The use of OMO is complemented by Cash Reserve Requirements (CRR) which is a specified ratio of a commercial bank's total deposit liabilities mandatorily maintained as cash deposit with the CBN. Section 15(1) of the Banks and Other Financial Institutions Decree [BOFID] 1991, as amended, empowers CBN to prescribe from time to time the cash reserve that banks are required to maintain. In line with the Decree, the CBN, through the Monetary Policy Circulars issued annually specified the minimum cash ratio for banks. The cash ratio is reviewed from time to time, depending on the policy thrust (CBN, 1998). This is equally evidenced in our models' results negative coefficient indicating upward review of the policy tool which impacted negatively on interbank market rate. Interestingly, it has been theoretically posited that the market rate among other factors determine the tempo of activities at the interbank market; hence policy articulation and implementation using these tools should be complemented by other measures to ensure that liquidity position of banks are not adversely affected as their weak liquidity position could also reduce the level of fund at the interbank market and hence, the market rate..

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