

EVALUATING THE RELATIONSHIP BETWEEN MONEY MARKET INSTRUMENTS AND BANKING SOUNDNESS IN NIGERIA

Michael Chijioke Okwu

Department of Accounting and Finance, Joseph Sarwuan Tarka University, Makurdi, Benue State, Nigeria

Abstract

The study investigated the influence of banks' financing activities through money market investment and borrowing sources on the financial soundness of banks. Specifically, the study examined the relationship between aggregate money funds and credit to banks and liquidity-based soundness of Nigerian banking sector. The study also examined the relationship between the aggregate money market funds and credit to banks and assets-based soundness of Nigerian banking sector. The study adopted the ex-post facto research design. Data was sourced from World Bank data base, Central Bank of Nigeria Statistical Bulletin for the period 1984-2022. Descriptive statistics and correlations were used in the analysis of data. Multiple regression analysis was further adopted to test the hypotheses at 5% level of significance. Findings from the investigation revealed that; aggregate money funds and credit has a significant effect on liquidity-based soundness of Nigerian banking sector. The study also revealed that aggregate money market funds and credit had a significant effect on assets-based soundness of Nigerian banking sector. The study thus concluded that money market instrument has weak although significant effect on banking soundness in Nigeria. The study therefore recommended among others that the CBN should strengthen regulatory frameworks and ensure strict compliance to mitigate risks associated with money market instruments. Regular audits and compliance checks can help maintain stability. Also, Implement advanced surveillance systems to monitor transactions and detect anomalies in real-time, thereby preventing fraudulent activities and ensuring transparency.

Keywords: Bank Asset, Bank Credit, Bank Liquidity, Money Market

Introduction

The quest to balance the financial disequilibrium that exist within an economy remains the basis for the existence of financial markets (Ndugbu, Duruechi & Ojiegbe, 2016). Financial markets are institution or arrangements which facilitates the exchange of financial assets such as deposit and loans, stock and government securities (Ajekwe, Yua, Epor, Okaja & Utor, 2024 and Martin, 2014). The market is classified into money markets and capital markets, and money market involves investing and trading in short-term financial securities with maturity less than one year (Pavtar, 2016). There as many money market instruments as there are money market components.

In Nigeria, the major and most utilized money market instruments include Treasury Bills (TB), Treasury Certificate (TC), Certificate of Deposit (CD), Commercial Papers (CP) and Banker Acceptances (BA), call money and interbank market, among others.

As part of fund and liquidity management strategies, money market instruments enable banks to meet deposit and loan demands (Ekmekaoglu, 2013). Examples of such strategies include holding of short-term financial assets to maintain regulatory requirements, issuing short-term securities to meet depositors demands and make investment profits. A portfolio of short-term money market securities held by a bank can be easily sold or rediscounted for cash. When Central Bank actions and regulations restrict the profit-making activities and operations of banks, they search for alternative ways of making profit (Atanda & Ajayi, 2012). The effects of this alternative venture is in the patronage of money market investment.

The health and efficiency of banks are crucial to the growth and pace of the financial sector and the economy as a whole (Masud & Maq, 2016). Bank soundness according to Sere-Ejembi, *et al* (2014) translates to capital adequacy, liquidity adequacy, asset quality and sustainable profitability in the face of growing fund costs. Banking system soundness is a matter of concern to the monetary authorities, the government and attracts the attention of the multilateral financial institutions such as the International Monetary Fund (IMF) and the World Bank. The idea to develop banking system indicators was conceived by the International Monetary Fund after the Asian Financial Crises in 1990 (Sunday & Sani, 2014), to monitor and ensure bank resilience to environmental shocks. Conceptually, a sound banking system is a system where the individual banks accounting for the most of the system's transactions are solvent and meet capital adequacy requirements (Toby, 2006).

Financial soundness indicators (FSIs) provide insight into the financial health and soundness of a country's financial institutions as well as corporate and household sectors. Financial Soundness Indicators (FSIs) are indicators of the current financial health and soundness of the financial institutions in a country and of their corporate and household counterparts. They include both aggregated individual institutions data and indicators that are representative of the markets in which the institutions operate. FSIs are an initiative of the IMF compiled to support financial system stability analysis. They are used for the assessment and surveillance of the strengths and vulnerabilities of the financial systems with the objective of enhancing financial stability and in particular limiting the likelihood failure of the financial system. Statistics on the FSIs are a new body of economic statistics that takes into consideration the aggregate impact of different factors and overlaps a gap between macroeconomic statistics and micro prudential data (CBN, 2014). The Nigerian financial system, being made up of both formal and informal sub-sectors, has the formal sub-sector comprising of the regulatory authorities, money market, capital and

foreign exchange markets, insurance companies, brokerage firms, deposit money banks, development finance and other financial institutions. The major function of the Nigerian money market is to facilitate the raising of short-term funds from the surplus sectors to the deficit sectors of the economy (Yua, Epor, & Utor, 2023). The money market allows money available for short periods to be directed to those who can use it. In addition to facilitating the liquidity management of banks. Liquidity management is concerned with both sides of a bank's balance sheet (Mashamba & Kwenda, 2017). It involves the optimal mix of assets and liabilities that a bank needs to hold on an ongoing basis in order to remain liquid. Banks can ameliorate liquidity risk by financing themselves with fairly stable funding sources (mainly short-term funds) that are resilient, build liquidity buffers during good times, or hold highly liquid assets (Farag, Harland & Nixon, 2013). Holding short-term securities is significant to banks' liquidity management strategy because they can be liquidated when the need arises in order to cover liquidity shortfalls.

According to Nwosu and Hamman (2008), the existence of money markets facilitate trading in short-term debt instruments to meet short-term needs of large users of funds such as government, banks and similar institutions. Also, Okpe (2013) observed that the money market is essentially for the efficient distribution of liquidity in the financial system, allocation of capital as well as the hedging of short-term risks. The money market is the market where short-term financial assets are bought and sold. The market is essentially an intermediary, where short-term financial assets that are close substitute for money are usually traded.

Toby (2008) opined that the fundamental problems of the banks in Nigeria particularly those classified unsound have been identified to include illiquidity, poor asset quality, unprofitable banking activities, weak corporate governance, insider dealings and weak capital base. For instance, prior to the consolidation reform, Toby (2006) noted that Nigerian banks were pocket size banks as the total assets and liabilities of the 89 banks were not up to one bank in the United States. At the macro level, banking soundness depend on the macroeconomic and monetary policy. The banking sector crisis of the 1990s was traceable to macroeconomic shocks and monetary policy shocks such as the withdrawal of all public funds from the banking system to control excess liquidity in the economy (Ordue, Yua, Ityavyar, & Tarnongo, 2024). In light of the preceding, this study is set to examine the effects of money market financing activities on the financial soundness of banks.

1.2 Objectives of the Study

The broad objectives of this study is to examine the influence of money market instruments on the financial soundness of banks. To this end, the following subordinate objectives will be pursued:

- i. To determine the relationship between the aggregate money market funds to banks and liquidity-based soundness of the Nigerian banking sector.

- ii. To examine the extent to which the aggregate money market credits affect the liquiditybased soundness of the Nigerian banking sector.
- iii. To investigate the relationship between the aggregate money market funds to banks and asset-based soundness of the Nigerian banking sector.
- iv. To determine the extent to which the aggregate money market credits affect the asset-based soundness of the Nigerian banking sector.

1. Review of Related Literature

2.1 Conceptual Review

2.2.1 Money Market: Concepts, Instruments and Features

The money market is being a component of the financial market which allows firms and corporations to raise and trade financial instruments that are considered to be highly liquid with very short maturities. In the short term, it provides participants a window to borrow and lend for a period of overnight to one year. The securities traded in the money market are particularly IOU by large corporations, governments and financial institutions and are extremely safe and liquid (Pavtar, 2016). The money market is the market where securities of short term nature of not more than one year are bought and sold. Ndugbu, Duruechi and Ojiegbe (2016) further stressed that instruments floated and traded in the money market are short-term credit instruments of high quality which encompass treasury bills, treasury certificates, bankers' acceptances, commercial papers, eligible development funds, certificate of deposits, among others. It has no central location; businesses are usually transacted on telephone, fax, telex, and so on (Ikpefan & Osabuohien, 2012). The Nigerian money market is one of the key participants in the Nigerian financial market. Agbada and Odejimi (2015) opined that "money market is a market where investors source for short term funds for business expansion and development of the Nigerian economy. In this market, money can be borrowed or lent for a period as short as overnight e.g. call money, and for other short periods of one to two years.

The money market is the market where short-term financial assets are bought and sold. The market is essentially an intermediary, where short-term financial assets that are close substitute for money are usually traded. The money market is an integral part of the financial market as investors wishing to construct complete portfolios usually do so using a combination of both money market (short-term) and capital market (long-term) securities (Epor, Steve, Yua, & Ityavyar, 2023).

To fully conceptualize money market, Raja and Mahalakshmi, (2015) provides the following characteristics of money market and its instruments:

- i. **Liquidity:** Liquidity of an investment refers to how quickly, and easily investors can access their money. Money market instruments are relatively liquid by definition because the money is available in a year or less.

ii. Yield Returns: Money market instruments pay interest to the lender. Bank money market accounts, for example, add interest on each monthly statement. Other instruments, including Treasury bills, pay interest only at maturity.

iii. Relatively Safe: Money market investments are safer than most due to their liquidity. Their liquidity minimizes long - term uncertainties about companies and governments and helps protect against interest rate increases.

Other attributes include:

iv. Short tenure Instruments. The term of money market instruments are commonly between overnight to one year (Ndugbu, Duruechi & Ojiegbe, 2016; Agbada & Odejimi, 2015; Pavtar, 2016).

v. Wholesale in Nature. Money market transactions involves large amount of money moving from surplus to deficit units (Burton, Nesiba & Brown, 2010).

vi. Securities are Debt Instruments. Money market instruments are documents of short- term maturities evidencing claims and obligations among economic units, which are used to mobilize funds from the surplus units of the economy to the deficit units of the economy, thus promoting financial intermediation (Ndugbu, Duruechi & Ojiegbe, 2016).

vii. Flexibility of Market. The money market is not a fixed geographical location like the commodities market and stock exchange market transactions. The money markets are conducted online and executed via modern telecommunication platforms (Ikpefan & Osabuohien, 2012; Fapohunda, Ogbeide & Ogunniyi, 2019).

viii. Contains Risks. The various money market instruments have some risks in them, such as interest rate, credit and liquidity risk. Empirical literatures have classified risks associated to money market into funding and market risks (Demirguc-Kunt & Huizinga, 2009; Rajan, 2006).

2.2.2 Banking Soundness

Bank soundness has been defined as the health or financial condition of a bank either individually, or as a group or of the banking system (IMF, 2002). One of the most popular model for testing bank soundness is the CAMEL Rating System. The CAMEL Rating Framework is a system of rating for on-site examinations of banking institutions (Barr, Killgo, Siems & Zimmel, 2002). The Uniform Financial Institution Rating system, commonly referred to the acronym CAMEL rating, was adopted by the Federal Financial Institution Examination Council on 13th November, 1979, and then adopted by the National Credit Union Administration in October 1987 (The United States, Uniform Financial Institutions Rating System, 1997). It is recognized to be an effective internal supervisory tool for evaluating the soundness of financial firms especially banks. The CAMEL framework is an acronym for capital adequacy, asset quality, management efficiency, earnings and liquidity and can be represented by the metrics shown below:

Table 1: CAMEL Framework

CAMEL Parameters	Codes	Measurements	Descriptions
Capital Adequacy	C1	(Tire-1 Capital+ Tire-2 Capital) /Risk-weighted Assets	Capital Adequacy Ratio
	C2	Total Equity /Total Assets	Total Equity Ratio
	C3	Total Debt/Total Assets	Total Debt Ratio
	C4	Government Securities/Total Investment	Government Securities to Investment Ratio
Asset Quality	A1	Financial Assets/Total Assets	Financial Assets Ratio
	A2	Total Investment/Total Assets	Total Investment Ratio
	A3	Non-performing Loans/Total Loan	Non-performing Loans Ratio
	A4	Fixed Assets/Total Assets	Fixed Assets Ratio
	A5	Loan loss provision/Total Loan	Loan Loss Provision Ratio
	A6	Total Loan/ Total Assets	Total Loans Ratio
Management Efficiency	M1	Profit/Employee	Profit Per Employee
	M2	Business/Employee	Business Per Employee
	M3	Funds Borrowed/Total Asset	Borrowed Funds Ratio
	M4	Cost /Income	Cost-Income Ratio
	M5	Total Loan/Total Deposit	Loan to Deposit Ratio
Earnings	E1	Net Profit(Loss)/Total Assets	Return on Assets
	E2	Net Profit(Loss)/Total Equity	Return on Equity
	E3	EBIT/Total Assets	Operating Profit Ratio
	E4	Net Interest Income/Total Assets	Net Interest Margin
	E5	Non Interest Income/Total Assets	Non-Interest Income Ratio
Liquidity	L1	Liquid Assets/Total Assets	Liquid Asset Ratio

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Management	L2	Liquid Assets/Short-term Liabilities	Liquid Assets to Shortterm Liabilities Ratio
	L3	Liquid Assets/Total Deposit	Liquid Assets to Deposit Ratio
	L4	Total Loan/Total Deposit	Loan to Deposit Ratio
	L5	Government Securities/Total Asset	Government Securities Ratio

Source: Rahman and Islam (2018)

Capital Adequacy (C), as one of the most significant measures of banking sector financial soundness, represents the capacity of the banking sector to absorb the eventual losses generated by the manifestation of certain risks or significant macroeconomic imbalances (Roman & Şargu, 2013). According to Roman and Şargu (2013), Capital adequacy (C) is a significant indicator of the financial health of the banking sector because it guarantees the capacity of this sector to absorb the eventual losses and risks. Capital Adequacy is important for a bank to maintain depositors' confidence to prevent the bank from going bankrupt. Capital is seen as a cushion to protect depositors and promote stability and efficiency of financial system. Lucky and Akani (2018) posits that capital adequacy is sine qua non to banking sector soundness, meaning that if the bank's capital adequacy ratios are high, the banking sector is said to be financially sound and strong. Consequently, low capital adequacy is an indispensable condition for possible failure (Kumar & Thamil, 2014).

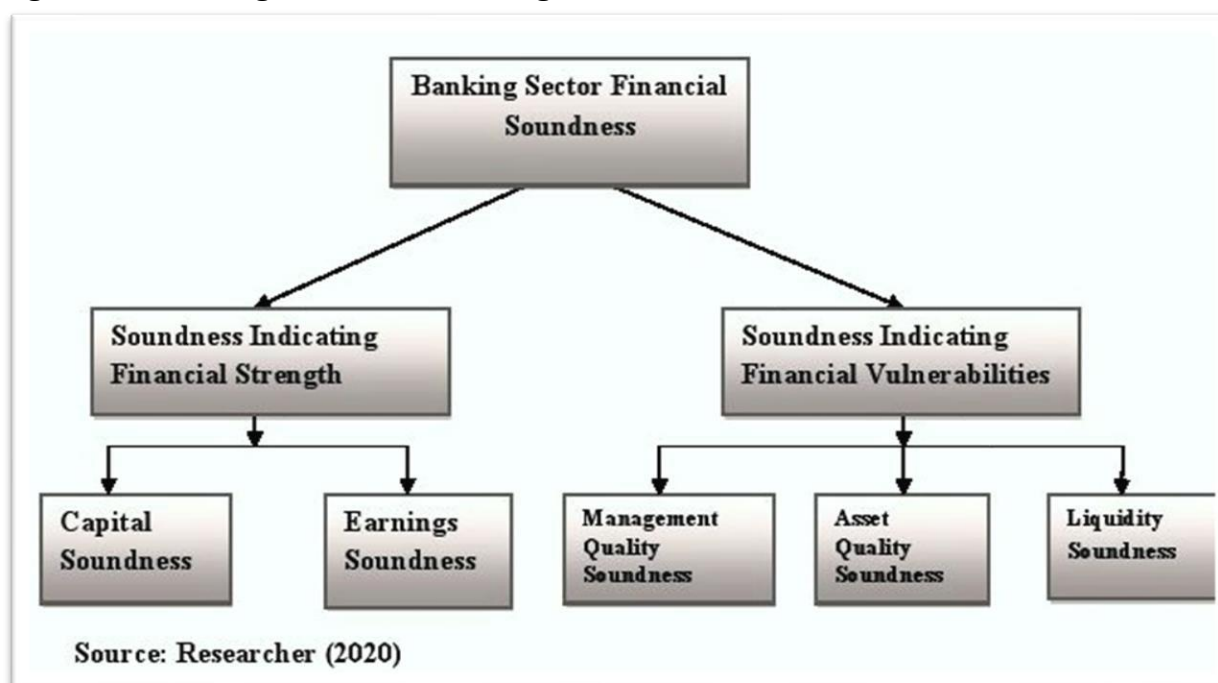
Asset Quality (A) is another important indicator bank soundness. Asset quality is a performance parameter to gauge the bank against asset risk exposures (Sundararajan, Enoch, San José, Hilbers, Krueger, Moretti & Slack, 2002). Indicators of asset quality also takes into cognizance credit risk assumed off-balance-sheet via guarantees, contingent lending arrangements, and derivatives. Poor asset quality is majorly responsible for most bank failures. The financial health and profitability of the institutions' borrowers, especially the nonfinancial enterprise sector directly determines the quality of banks' loan portfolios. According to Roman and Şargu (2013), the quality of the assets is determined especially by the quality of loans because loan assets represent a significant share in the overall balance sheet of banks.

Management quality is a significant aspect of bank performance that drives all the resources towards delivering on banks health and stability (Roman & Şargu, 2013). In some studies on bank performance, management quality is not taken into consideration because of the difficulty of measurement. Despite all these, more indicators can be used for the evaluation of the management soundness namely: the operating expense as a percentage of total

assets, deposit interest expense as a percentage of total deposits, non-interest expense to the sum of net interest income and noninterest income, personnel expenses to average assets, and the cost to income ratio (Avkiran & Cai, 2012). Operating cost efficiency is used as one of the measure of efficiency of management. It is measured using the formula that total operating expenses divided by total operating income. Basically operating cost should be lesser than the income from such operations. If so efficiency of the management would be increased.

Liquidity is the most important component for a bank and has a significant impact on its financial soundness (Roman & Şargu, 2013). It constitutes one of the vital elements that evaluates the operational performance of a bank because it indicates the capacity of a bank to pay its short term debts and face unexpected withdrawals of depositors. The indicators that measure the liquidity reflect the capacity of the banks to withstand shocks to cash flows (IMF & World Bank, 2005). The most used being: the ratio of liquid assets to total deposits and short term funding, the ratio of the liquid assets to total assets, the ratio of the net loans to total deposits and short term funding and the ratio between loans and deposits.

Figure 1: Categorization of Banking Soundness indicators from the CAMEL Framework



2.2.1 Role of Money Market in Banking Soundness

Money market financing activities, which are at the heart of liquidity management practices in the banking sector, cannot be free from risk (Adrian & Shin, 2010). Modern banking practices involve extensive risk management in money market investments (assets) from excess funds and/or borrowings with money facilities (liabilities). Maintaining the optimum amount of funds to minimize risk exposures becomes the focus of funds portfolio management (Osayi, Dibal & Ezuem, 2019). This however does not take away risks from the banking business environment. For instance, Rajan (2006) noted that banks' greater reliance on market liquidity makes their balance sheets more vulnerable, and Demirguc-Kunt and Huizinga (2009) found that a bank's reliance on non-deposit sources of funds increases its risk.

Based on further premise that the proportion of borrowed funds far exceeds owners' equity further justifies riskiness of banking business (Owojori, Akintoye & Adidu, 2011). This position is further compounded by the intense competition in the banking sector. Banks do not just rely solely on receiving deposits and make loans; they also operate in a rapidly innovative money market segment of the financial system, all with the ultimate drives to satisfy shareholders and investors with profits as well funds for depositors. This why Osayi, Dibal & Ezuem (2019) infer that risks contains risks, implying that risks are complex and one single activity can involve several risks. Bank financing activities in the money market expose them to some inherent risks, just like other financial markets. These risks are capable of affecting the financial soundness of banks.

i. **Market Risk.** This type of risk is caused by the fluctuations of the prices of instruments in the money market. It emerges as the result of the short term mobility of market prices. ii. **Liquidity Risk.** Liquidity risk is normally characterized in two ways. (a) Asset liquidity risk, which includes the risk that money market assets cannot be converted into cash as well as any incurred losses when the money market assets are converted under the market price (Duffy & Germani, 2013); (b) Funding liquidity risk, which is a type of risk encountered due to the imbalance between money market input (funds sources) and money market outputs (money market assets) of bank's cash resulting in the inability to fund its payments (Gregory, 2010).

iii. **Operational Risk.** Operational risk is a status of avoiding uncertainty and arises from people, systems, internal and external events. It includes human error (such as trade entry mistakes), failed processes (such as settlement of trades), model risk (inaccurate or poorly calibrated models), fraud (such as rogue traders) and legal risk (such as the inability to enforce legal agreements).

iv. **Credit Risk.** Indicates the possibility of the failure of money market credit customers to fulfil the provisions of the contract in time and fail to pay the capital and/or interest payments (Duffy & Germani, 2013).

v. **Risk of Maturity Mismatch.** Bank liquidity can be viewed from two perspectives; cash liquidity (the ability to obtain funds from the market); and asset liquidity (the possibility to convert or realize assets to obtain

funds). The manifestation of these inabilities results to liquidity risks. Liquidity risk in a bank is the inability to meet current obligations to depositors or to fund increases in assets as at when due without incurring unacceptable costs or losses (Etale & Ujuju, 2018). Liquidity risk in the money market arises from maturity mismatches where money market liabilities (funds sources) have a shorter tenor than assets (funds uses). A sudden rise in the demand of borrowers above the expected level can lead to a shortage of cash or liquidation of marketable assets (Madhuwanthi & Morawakage, 2019). The liquidity crisis in a banking institution could lead to insolvency and bank runs. Consequently, minimising the liquidity risk is one of the most important aspects of asset and liability management of banks.

vi. **Financial Market Volatility Transmissions and Spillovers.** Increasing integration of financial markets leads to price co-movement, shocks and volatility transmission between markets (Emenike, 2014). The effect of stock market linkages or volatility transmission is an important issue that money market investors need to consider before making investment decision. This is because volatility is an unattractive feature that has adverse implications for decisions pertaining to the effective allocation of resources and investment (Nnachi, 2008). For instance, volatility transmission from the stock market makes investing banks more averse to holding money market instruments, and conditions them to demand higher risk premium in order to insure against the increased uncertainty (Emenike, 2010). This has a great effect on the magnitude of interest rate spreads. Financial assets and market returns are generally influenced by the portfolio decisions of investors who actively participate in more than one financial market. In turn, these decisions are usually influenced by a continuous flow of information that often results in market price volatility spillover within and across markets (Hurditt, 2004).

2.2 Review of Empirical Works

Table 2: Summary of Empirical Review

S/No.	Author/year	Topic	Methodology	Findings
1	Eze and Nera (2017)	Money Market and Economic Growth in Nigeria using Causality Analysis	Regression, unit root tests, cointegration tests, and parsimonious error correction	The results show that the money market has significant impact on the growth of the Nigerian economy

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2	Do and Phan (2018)	Effects of Booming Credit Growth on the Soundness of Commercial Banks: Empirical Research with the Case of Vietnam from 2007 to 2013	Quantitative method is reflected through a strong regression model	The findings shed lights on is that rapid credit growth weakens commercial banks on both sounder and less sound banks
3	Udoka and Anyingang (2012)	Analytical And Theoretical Determinants Of Deposit Money Bank's Investment in Treasury Bills in Nigeria (1970-2009).	Ordinary least square estimation procedures	Findings showed that the five variables used were able to explain 97 per cent of the total systemic variations in bank's investments in treasury bills.
4	Al-Afeef and Al-Ta'ani (2017)	Effect of Risks on Banking Safety: Applied Study on Jordanian Traditional Banks (2005-2016)	Ordinary least square estimation procedures	The results of the study showed that there is a statistically significant impact for each of liquidity risk and interest rate risk on the safety in the banking sector
5	Ndugbu, Duruechi and Ojiegbe (2016)	the relationship between Money Market Instruments and Bank Performance in Nigeria	The ordinary least square model estimation	Money market instruments (treasury bills, commercial papers, and federal government bond) have positive relationships and significant effects on bank performance in Nigeria

Research Article

6	Ajibola (2016)	the Effects of Assets and Liability Management on Financial Performance of Some Selected Nigerian Banks	Descriptive statistics and a panel data regression analysis	Findings showed that loans and advances are positively related to return on equity especially when profitability is measured as proxy of financial performance,
7	Pavtar (2016)	The nexus between money market instrument and Nigeria's economic growth with a time series analysis	Descriptive statistics and the ordinary least square (OLS) multiple regression techniques	The study found that Treasury bill, Treasury certificate, Commercial paper does not have any significant effect on the gross domestic product (GDP) of Nigeria
8	Okey, Precious and Onyema (2018)	Financial soundness of deposit money banks in Nigeria: the camels model approach	Camels model approach	the result showed that there are significant relationships in capital adequacy, asset quality, management quality, earnings,
				liquidity ratio and sensitivity among the banks
9	Isibor, Ikpefan and Okafor (2016)	the impact Of Money Market On The Liquidity of Some Selected Quoted Banks In Nigeria	multiple regression econometric technique	The study found that firms' working capital and profitability have a significant impact on the money market instrument.

Research Article

10	Uruakpa (2019)	Impact of Money Market Reforms on Economic Growth Of Nigeria covering the period 1990-2017.	OLS regression econometric technique	money market value has positive and significant effect on GDP while treasury bill outstanding has positive but insignificant effect on GDP
11	Ibe (2013)	Impact of Liquidity Management on the Profitability of Banks in Nigeria	regression analysis	The result of this study has shown that liquidity management is indeed a crucial problem in the Nigerian banking industry
12	Edem (2013)	relationship between Liquidity Management and Performance of Deposit Money Banks in Nigeria between 1986 and 2011	descriptive, correlations and inferential statistics	Findings from the empirical analysis show that there is a significant relationship between liquidity management and the performance of Deposit Money Banks in Nigeria
13	Mashamba and Kwenda (2017)	Liquidity Management Practices of Banks in South Africa.	Generalized method of moments (GMM) estimator	South African listed banks have passively managed their liquidity and partially adjust their liquidity levels in an attempt to reach the optimal level
14	Agbada and Odejimi (2015)	The developments in Money Market	Multiple Regression technique parameters.	strong linear relationship between the explained and explanatory variables

Research Article

		Operations and Economic Viability in Nigeria.		
15	Kromtit and Umejiaku (2016)	Implications of Money Market Deepening for Financial Inclusion in Nigeria.	qualitative and descriptive methods	The study revealed that the Nigerian money market has not yet deepened enough to meet the financial inclusion target in the country;

Source: Researcher's Compilation, 2024

2.3 Theoretical Review

This study is anchored on the assets-liability management theory and liquidity preference theory

2.3.1 Asset-Liability Management Model

This model was developed in the 1960s by Kosmidou and Zopounidis. According to this model, there is no need for banks to grant self-liquidating loans and keep liquid assets because they can borrow reserve money in the money market in case of need. A bank can acquire reserves by creating additional liabilities against itself from different sources. These sources include the issuing of time certificates of deposit, borrowing from other commercial banks, borrowing from the central banks, raising of capital funds by issuing shares, and by ploughing back of profits.

2.3.2 Liquidity Preference Theory

Keynes (1937) Liquidity Theory was found to be valuable in explaining the effect of interest rate mechanism on economic development. According to this theory, the rate of interest is determined by the demand for and the supply of money. The theory is therefore characterized as the monetary theory of interest. The supply of money according to the theory is the total quantity of money in the country for all purposes at any time. The supply of money is a function of the rate of interest to a degree, but it is fixed by monetary authorities (perfectly inelastic supply curve) (Osadume, 2018) as presented below;

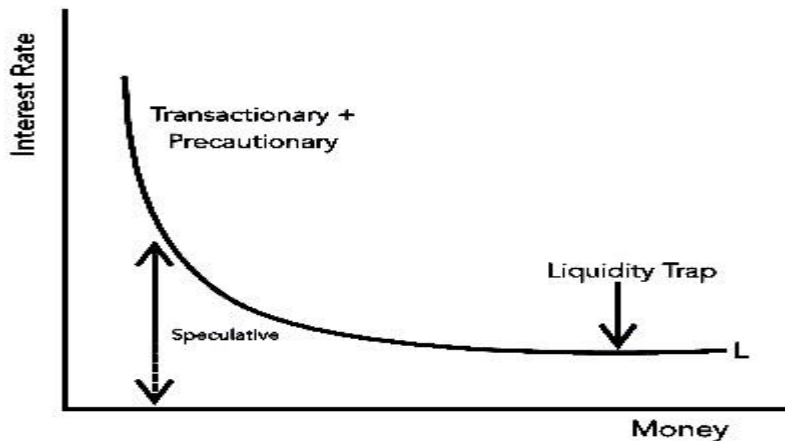


Figure 1: Money Supply Curve

The liquidity preference is the desire to hold cash, the rate of interest is the premium that can persuade or convince people to hold wealth instead of hoarding money (Osadume, 2018). Higher liquidity preference implies higher interest rates that will be paid to cash-holders to persuade them to forgo cash for liquid assets. And lower liquidity preference implies that lower interest rates will be required to get cash-holders forgo holding cash for liquid assets. Osadume (2018) availed that the Keynes's liquidity preference theory provides three motives for holding cash balances:

precautionary, speculative and transactionary motives.

3. Research Method

3.1 Variable/Model Specification

This study adapted the model of Eze and Mansi (2017) who modelled gross domestic product as a function of money market instruments like treasury certificates, treasury bills, and certificates of deposits and bankers acceptances. In this regard, and replacing GDP with banking soundness, the functional model of this research is given as:

$$BNK\ SOUNDNESS = f(\text{money market finances}) \dots\dots\dots \text{eqn 1}$$

However, in this study, all the total money market funds to banks (MMFB) will be aggregated as one variable. Same applies to all the money market credits by banks (MMCB), and then modelled as a function relating to banking soundness. This is because the study mainly focused on how money market liquidity facilities of banks affect banking soundness in Nigeria. So the model becomes:

$$BNK\ SOUNDNESS = f(MMFB, MMCB) \dots\dots\dots \text{eqn2}$$

Going by literature review, there four indicators of banking soundness: Liquidity-based soundness (LBS), asset-based soundness (ABS), capital-based soundness (CBS) and profitability-based soundness (PBS). This study adopts the banking soundness indicator for Nigeria as given by SereEjembi, et al (2014) and CBN (2017).

But due to the paucity of data, this study will adopt the Liquidity-based soundness (LBS) and assetbased soundness (ABS), and restated the model thus:

$$LBS = f(MMFB, MMCB)$$

$$ABS = f(MMFB, MMCB)$$

By expanding the above expression into an econometric form gives us:

$$LBS = \alpha + \beta_1 MMFB + \beta_2 MMCB + \mu \dots \dots \dots (3.1)$$

$$ABS = \alpha + \beta_1 MMFB + \beta_2 MMCB + \mu \dots \dots \dots (3.2)$$

Equation 3.1 and 3.2 shows the equation regression model which seek to explain the relationship between money market facilities and banking sector soundness for this study. Where,

- LBS - Liquidity-Based (LBS)
- ABS - Asset-Based (ABS)
- MMFB - aggregate money market funds to banks
- MMCB - aggregate money market credits by banks
- α - Intercept of the model
- $\beta_1 - \beta_2$ - Coefficient of variables
- μ - represents the residual.

3.2 Techniques of Data Analysis

The study adopted the ordinary least square (OLS) method in estimating the effects of money market liquidity facilities of banks on banking sector soundness in Nigeria. Before the model will be estimated, the properties of the variables will be examined to substantiate the stationarity and long run relationship of the variables. The econometric tools that will be employed for these verifications are sequentially presented below:

3.2.1 The Augmented Dickey-Fuller (ADF) test for Unit Root

This study adopts the Augmented Dickey-Fuller (ADF) unit root test procedure. The test specifies that:

$$\Delta y_t = \beta + \delta t + \theta y_{t-1} + \sum_{i=1}^q \gamma_i \Delta y_{t-i} + \varepsilon_t \dots \dots \dots (3.3)$$

$$\Delta \Delta y_t = \beta + \delta t + \theta \Delta y_{t-1} + \sum_{i=1}^q \gamma_i \Delta \Delta y_{t-i} + \varepsilon_t \dots \dots \dots (3.4)$$

Where q is the maximum lag length and it is determined automatically by the Akaike information criterion (AIC) lag order selection criterion.

The ADF test at level is denoted by equation 3.3 and that for first difference is denoted by equation 3.4. Conducting the ADF test for first difference is necessary if the variable is non-stationary at level.

3.2.2 Autoregressive Distributed Lag (ARDL) Estimation Techniques

The research utilized the ARDL model, also called bounds testing method as suggested by Pesaran, Shin and Smith (2001), to examine the relationship between money market liquidity financing and banking sector soundness. The presence, direction and extent of a long-run relationship between the dependent variable and the various independent variables are established as well (Giles, 2013). The model is autoregressive because the dependent variable is explained in part by the lagged values of itself and successive lags of the explanatory variables (Giles, 2013). The bounds test is a fundamental basis for conducting the ARDL model estimation. The bounds test method is preferred because it can be used with a mixture of $I(0)$ and $I(1)$ data. It also involves a single equation setup, making it simple to interpret and implement. Finally, different variables can be assigned different lag-lengths as they enter the model.

3.2.3 ARDL Bounds Test for Co-integration

Cointegration addresses the issue of integrating short-run dynamics with long-run equilibrium. Basically, it demonstrates that a linear combination of two non-stationary time series may be stationary in that case they are said to be co-integrated. If two variables are co-integrated, it implies that there is meaningful long-run relationship between them. Pesaran, Shin and Smith (2001) developed a flexible model for the test of cointegration known as the bounds testing technique or the Autoregressive Distributed Lag (ARDL) approach. Pesaran, Shin and Smith (2001) advocated that the use of the bounds technique is based on three validations: first, the use of the ARDL model for the estimation of level relationships; second, the bounds test allows a mixture of $I(1)$ and $I(0)$ variables as regressors; and third, this technique is suitable for small or finite sample size (Pesaran, Shin and Smith, 2001). The bounds testing approach involves estimating the following equation:

$$\Delta LBS_t = \alpha_0 + \alpha_1 LBS_{t-i} + \alpha_2 MMFB_{t-i} + \alpha_3 MMCB_{t-i} + \mu_t \dots \dots \dots (3.5)$$

and

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$$\Delta ABS_t = \alpha_0 + \alpha_1 ALBS_{t-i} + \alpha_2 MMFB_{t-i} + \alpha_3 MMCB_{t-i} + \mu_t \dots \dots \dots (3.6)$$

Equations 3.5 and 3.6 are the derived from the derived model earlier adopted for this study.

Where,

t	=	time
α_0	=	constant term
$\alpha_1 - \alpha_5$	=	long-run coefficients
$\beta_i, \partial_j, \varphi_k, \theta_l, \pi_m, \omega_n, \phi_n$	=	short-run coefficients white noise error term
μ_t	=	difference operator. respective lag lengths for the
$\square$	=	independent variables.
a, b, c, d, e	=	

Expressions without summation sign = Long-run relationship

Expressions with Summation signs = short-run dynamics

According to Pesaran, Shin and Smith (2001), there are three possible decisions that will be derived from the ARDL bounds test:

- If the computed F -statistic is smaller than the lower bound value, then the null hypothesis is not rejected and;
- If the computed F -statistic is greater than the upper bound value, then the variables share long-run relationship; but,
- If the computed F -statistic falls between the lower and upper bound values, then the results are inconclusive.

3.2.3 ARDL Long-Run Estimation

Once cointegration is established between bank-based factors and private sector credits, the conditional ARDL long-run model can be specified as:

$$LBS_t = \phi_0 + \phi_1 LBS_{t-i} + \phi_2 MMFB_{t-i} + \phi_3 MMCB_{t-i} + \epsilon_t \dots \dots \dots (3.7)$$

$$ABS_t = \phi_0 + \phi_1 ABS_{t-i} + \phi_2 MMFB_{t-i} + \phi_3 MMCB_{t-i} + \epsilon_t \dots \dots \dots (3.7)$$

Where,

ϕ_0	=	intercept
$\phi_1 - \phi_6$	=	coefficients of long-run estimates
ϵ_t	=	error term of long-run estimates

3.2.4 Short-Run and Error Correction Model Estimates

In the next step, we obtain the short-run dynamic parameters by estimating an error correction model associated with the long-run estimates. This is specified as follows:

$$\Delta LBS_t = \alpha_0 + \sum_{i=1}^a \beta_i \Delta LBS_{t-i} + \sum_{j=1}^b \partial_j \Delta MMFB_{t-j} + \sum_{k=1}^c \varphi_k \Delta MMCB_{t-k} + \omega ECT_{t-1} + \mu_t \dots \dots \dots (3.8)$$

$$\Delta ABS_t = \alpha_0 + \sum_{i=1}^a \beta_i \Delta ABS_{t-i} + \sum_{j=1}^b \partial_j \Delta MMFB_{t-j} + \sum_{k=1}^c \varphi_k \Delta MMCB_{t-k} + \omega ECT_{t-1} + \mu_t \dots \dots \dots (3.9)$$

Where,

ECT = error correction term derived from equation (3.7), and

ω = the speed of adjustment.

The error correction model shows the speed of adjustment needed to restore the long run equilibrium following a short run shock. The α_1 is the coefficient of the error correction term in the model and must be negative and significant for the return back to long-run equilibrium to hold (Pesara, Shin & Smith, 2001).

3.2.5 Diagnostic and Standard Tests

This involves testing the behaviour of the data pre and post estimation. This covers basic or descriptive statistics like mean, standard deviation, maximum, minimum, skewness, kurtosis, and normality.

3.2.5.1 Jaque-Bera Test for Normality

The Jaque-Bera test for normality was conducted to confirm that the data is normally distributed. According to Jaque and Bera (1980) the null hypothesis is a joint hypothesis of the skewness being zero and the excess kurtosis being zero.

3.2.5.2 Test for Serial Correlation

The test for serial correlation will be done by the Breusch-Godfrey Serial Correlation LM Test. This is a joint test for autocorrelation that will allow examination of the relationship between the mean of the error term and its lagged values at the same time. In a time series model, series are said to be serially correlated where the data are correlated across time and the errors arise from adjacent time periods.

3.2.5.3 Test for Heteroskedasticity

The test for heteroskedasticity will be done with the Breusch-Pagan-Godfrey technique. Determining the heteroskedasticity is essential for determining whether typical regression models can be run or estimated on the data.

3.2.5.4 Model Stability Tests

The CUSUM and CUSUMSQ tests will be used to determine the stability of the ARDL model within the 5 % significant level.

4.0 RESULTS AND DISCUSSION 4.1 Descriptive Statistics

The descriptive statistics takes into consideration the mean, the standard deviation, the maximum and the minimum. The descriptive statistics is presented in Table 4:

Table 4: Descriptive Statistics

					Obs	Mean
		Dev.	Min	Max		
LBS	38	0.400	0.206	0.073		0.927
LEV	38	0.080	0.089	0.078		0.444
ABS	38	0.113	0.137	0.302		0.458
INF	38	15.868	1.2718	14.440		18.085
MMFB	38	0.310	0.378	6.010		0.213
MMCD	38	0.050	0.052	6.076		0.228

Source: STATA version 15

Table 4 above the result of the descriptive statistics indicates that the number of observations were 38 observations. The table further indicated a mean value of 0.400 for LBS which means that the average loans to deposit ratio was 40%. The deviation to this value was 0.206 which is about 20% and the maximum and minimum stood at 0.927 and 0.073 respectively.

In the same table, LEV has a mean of 0.80 with a deviation of 0.206 and maximum and minimum of 0.776 and 0.444. ABS has the average of 0.113 which indicates the average of asset based soundness. The deviation from the mean was 0.137 with a maximum and minimum of 0.458 and 0.302. INF had a mean of 15.868, the deviation

of 1.272 and the maximum and minimum of 18.86 and 14.440. MMFB had the mean of 0.320, the deviation of 0.378 and the maximum and minimum of 0.213 and 0.010 respectively. MNCB on the other hand had the mean of 0.050, the standard deviation of 0.52 with a minimum of 0.007 and maximum of 0.228.

4.1.2 Econometric Tests

The data set was subjected to some econometric tests like multicollinearity test, test of heteroscedasticity and test of correlation to avoid spurious results.

Multicollinearity test: The test of multicollinearity was done to ascertain the possibility of the independent variables to independently affect the dependent variable. The decision rule is that if the VIF (variance inflation factor test) value is above 10 then, the independent variables have high resemblances and cannot effectively predict the dependent variable independently. The VIF test is shown in the table below.

Table 5: Test of Multicollinearity

Variable	VIF	1/VIF
LEV	1.26	0.801
MNCB	2.36	0.903
MMFB	3.16	0.961
INF	1.26	0.860
Mean Value	2.01	

Source: STATA version 15

Table 5 above indicated that the means VIF was 2.01 which is an indication of the absence of multicollinearity. The table also indicated the reciprocal of the VIF to be less than 1 but very close to 1 which was an indication that the independent variables were significantly different from each other.

Test of Heteroscedasticity

The test of heteroscedasticity was done to ascertain if the error terms in the model were consistent. The probability of the heteroscedasticity test was 0.7905 which was an indication that the error terms in the model were consistent.

Test of Correlation

The test of correlation was conducted on the data set to ascertain the level of correlation between the independent variables. It was observed that the highest correlation among the independent variables was 0.1976 which was less than 10 that is considered as high correlation. The implication is that the independent variables are significantly different from each other.

Table 6: Correlation Results

	LEV	INF	MMFB	MNCB
LEV	1.000			

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INF	-0.0355	1.000		
MMFB	0.0963	-0.890	1.000	
MMCB	0.1976	0.0618	0.0921	1.000

Source: STATA version 15

Augmented Dickey Fuller Test

The augmented dickey fuller test was done to determine the stationarity of the data. If the data is stationary at a point, it means at that point the changes in the independent and the dependent variable are zero. The implication is that when data proves some level of stationarity, regression analysis is possible because stationarity is a major assumption for regression analysis. The table 7 presents the augmented dickey fuller test.

Table 7: Augmented Dickey Fuller Test

Var.	Lags	T-statistics	50% critical value	Prob-value
MMFB	0	-4.289	-3.556	0.0033
MMCB	0	-4.442	-3.556	0.0019
LEV	0	-4.320	-3.556	0.0029
ABS	0	-7.402	-3.556	0.0000
INF	0	-2.188	-3.556	0.4966

Source: STATA version 15

Table 7 above indicated that MMFB at the lag (0) has the t-value of -4.289 and the critical value of -3.556 at 5% levels of confidence. The calculated t-value of -4.289 greater than the critical value of -3.556 at 5% level of confidence. Also, the probability value was 0.0033 which is statistically significant at 5%. This means that the null hypothesis is rejected and the alternative hypothesis accepted that MMFB is stationary at 5% level of confidence. In a similar value, the null hypothesis was rejected for MNCB because the t-value was (-4.442) greater than the critical value (-3.556) at 5% level of confidence implying that MNCB was stationary. LEV was also stationary at 5% level of confidence because its t-value was -4.320 relative to the critical value of -3.556 which is an indication that ABS was also stationary at 5% level of confidence.

INF however was not stationary because the t-value was -2.188 with a critical value of -3.556, the critical value was higher than the calculated value in addition, the probability 0.4966 was greater than 0.05. This did not pose challenges in the analysis of data because the variable was used as a control variable.

Regression Results

Regression analysis was used was the major technique of data analysis because, the data met the major criteria for analysis using regression. The regression result is shown in the table below.

Table 8: Regression Results

	Var.	Coeff	t	p
ABS	MMFB	6.282	3.04	0.005
	MMCB	4.451	2.14	0.040
	INF	0.002	0.11	0.916
	LEV	-4.576	-2.77	0.009
	R2			0.331
	Prob			0.008
LBS	MMFB	10.821	3.38	0.002
	MMCB	7.316	2.27	0.030
	INF	-0.003	-0.11	0.912
	LEV	-8.536	-3.33	0.002
	R2			0.287
	Prob			0.022

Source: STATA version 15

Table 8 above shows the regression result that explains in the form of analysis the relationship between the dependent and the independent variables. The result indicated that there are two models in the study. In the first model, the probability of fitness of the model was 0.008 while the coefficient of determination of the model was 0.331. This implied that the model was fit for interpretation and generation of results. The R2 of 0.331 was an indication that both the aggregate money market credits by the banks effect the asset based soundness by 33%. The table further indicated a fitness P-value of 0.022 for LBS which showed that the model was also fit for interpretation using liquidity based soundness as a dependent variable. The R2 for the model was 0.287 meaning that MMFB and MMCB occasioned about 28.7% changes in the liquidity base soundness of the banks investigated.

Further details proved that within the study period, MMFB has positive (6.282) and significant effect (0.005) on ABS. this means that a unit increase in MMFB will increase ABS by 6.282 units. Also, MMCB has positive (4.451) and significant effect on ABS implying that a unit increase in MMFB holding all other variables constant would increase ABS by 4.451 units. INF which represent inflation was used as a control variable. The results indicated that INF has insignificant effect on the ABS of the Banks. LEV on the other hand was shown to have negative and significant effect on ABS. This means that if LEV is not controlled within the study period, a unit

increase in LEV will reduce ABS by 4.576 unit, however, LEV has been controlled to allow the free interaction of the variable.

The second model where LBS is the dependent variable indicates that, a unit increase in MMFB will increase (10.821) LBS by 10.821 units if all other variables are held constant. The result further posit that within the study period, a unit increase in MNCB will increase (7.316) LBS by 7.316 units. The result further showed that if INF and LEV are not controlled, they will insignificantly and significantly reduce LBS by (0.003) and (0.536) units respectively.

4.2 Test of Hypotheses

The hypothesis of the study were tested using the t-scores in table 8. The decision rule is to accept the null hypothesis if the t-value is less than or equal to +1.96 otherwise to reject the null hypothesis. Based on this criteria, the hypotheses are restated and tested as shown below.

H0₁: Aggregate money market funds to banks do not significantly impact on the liquidity based soundness of the Nigeria banking sector.

This hypothesis was rejected because the t-value of MMFB was 3.38 which was above the critical value of +1.96. The alternative hypothesis was accepted that aggregate money market funds to banks have significant effect on liquidity based soundness of the banks investigated.

H0₂: Aggregate money market credits do not significantly impact on the liquidity based soundness of the Nigeria banking sector.

The t-value for the test of this hypothesis was 2.27 which was higher than the critical value of +1.96. The hypothesis was therefore rejected and the alternative hypothesis accepted that aggregate money market credits has significant effect on liquidity based soundness of the banks studied.

H0₃: Aggregate money market funds to banks do not have significant effect on asset-based soundness of the Nigeria banks.

This hypothesis was also rejected because the t-value for the hypothesis was 3.04 which is greater than the critical value of +1.96. The alternative hypothesis was therefore accepted that aggregate money market funds to banks has significant effect on asset based soundness of the banks studied.

H0₄: Aggregate money market credit has no significant impact on asset based soundness of the Nigeria banking sector.

This hypothesis was rejected because the calculated t-value was 2.14 which fall under the region of rejection of the null hypothesis. The hypothesis was restated that money market credit have significant effect on asset based soundness.

4.3 Discussion of Findings

4.3.1 Aggregate money market funds and liquidity based soundness

Aggregate money market fund in this study has significant effect on liquidity based soundness. This finding is consistent with the study of Do and Phan (2018); Deyoung (2016) who also found significant positive effect between these variables. The positive and significant effect may be attribute to the fact that the more banks receives deposit, the more they are able to give out loans. Liquidity based soundness measured as the ratio of the loans to total deposits is an indication of the fact that the loans are a product of the deposits collected by the banks. The study recommends that banks should make more favourable policies on deposits as the higher the deposits, the more the liquidity based soundness.

4.3.2 Aggregate Money Market Credits and Liquidity Based Soundness

The positive and significant effect between aggregate money market credits and liquidity based soundness witnessed in this study was earlier found in the study conducted by Eze and Nera (2017); Al-Afeef and Al-Ta'ani (2017); Ajibola (2016) and Pavtar (2016). The significant effect man be connected to the fact that the total loans a bank gives which represents MNCB may motivate more deposits in the banks. This study recommends that banks should continue with the loan policies in order to continuously improve their liquidity based assets.

4.3.3 Aggregate money market funds and asset based soundness.

Aggregate money market funds has significant effect on asset based soundness. The same findings were made by Das (2014); Nakorji, Ekeocha, Nwosu ad Obikaonu (2017); Yossef (2016) and Ndugbu, Duraechi and Ojiegbe (2016) the positive and significant effect between the variables was connected to the fact that the money market funds promoted non-profit loans and increased the total loans. This created high patronage for the loans to boost production. It is recommended that the Central Bank of Nigeria should continue with the money market fund policies as this improves the asset based soundness of the banks.

4.3.4 Aggregate money market funds and liquidity based soundness

Aggregate money market funds has significant effect on asset based soundness in this study. Similar findings were made by Ajibola (2016); Armantier, Cihysels, Sarkar and Sharader (2015). The significant effect between money market funds and asset based soundness may not be unconnected to the fact that when the money market pushes more funds through the central bank of Nigeria, there would be more funds in circulation. The presence

of the funds may enhance more borrowings while may increase the asset base soundness of the banks. Banks are therefore encouraged to give out more loans from the money market funds.

5.0 SUMMARY, CONCLUSION AND RECOMMENDATION

This study examined the effect of money market liquidity facilities on banking soundness. It was observed that money market liquidity had weak effect on both asset based soundness and liquidity based soundness as seen from the coefficients of determinant of 0.331 and 0.287 respectively.

5.1 Summary of Findings

- i. Aggregate money market funds had significant effect on liquidity based soundness of bases in Nigeria.
- ii. Aggregate money market credits had significant effect on liquidity based soundness of the banks investigated.
- iii. Aggregate money market funds had significant effect on asset-based soundness of the banks studied.
- iv. Aggregate money market credits had significant effect on asset based soundness of the banks studied.

5.2 Conclusion

Based on the findings of the study, it was concluded that money market liquidity facilities investigated has weak although significant effect on banking soundness in Nigeria. It was further concluded specifically that within the study period, both aggregate money market fund and aggregate money market credits have significant effect on banking soundness.

5.3 Recommendations

The recommendations in this study are based on the findings arising from the result of the analysis. It has been recommended that:

- i. Banks should make more favourable policies on deposits as the higher the deposits the more the liquidity based soundness of the banks.
- ii. Banks should continue with the loan policies in order to continually improve their liquidity based assets.
- iii. It was recommended that the Central Bank of Nigeria should continue with the money market fund policies as this improves the asset based soundness of the banks.
- iv. Banks are encouraged to give out more loans. This is because the more the loans are given the greater the liquidity based soundness.

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