

Asset Structure and Profitability Nexus – Evidence from Commercial Banks In Nigeria

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INTRODUCTION

Commercial banks are generally established to mobilize resources/funds from the savings-surplus units and transform these funds into term liabilities for the use of the savings-deficit units. This intermediation between the savings-surplus units and savings-deficit units provide the banks the margin of profit and keeps them in business. However, the capacity to meet these objectives depends, to a greater extent, on the manner in which commercial banks structure their assets. In financial theory, a bank's assets are those resources from which it receives income and profit. These resources include both financial and real assets, such as loans and advances, treasury bills, shares and bonds. The combination of both financial and real assets of an entity is otherwise referred to as asset structure or asset portfolio.

The performance of a bank to a great extent depends on the management and the efficiency with which the assets of the bank are combined. A bank's performance is a function of its liquidity, profitability and growth overtime (Uremadu, 2015). Among the objectives of any business is the maximization of share holders wealth and the maintenance of adequate liquidity. The resources to achieve this objective, the size of the resources, their structure, the sources, and terms for procurement and utilization are also necessary. Hence a prerequisite for effective bank management is a thorough knowledge of the significance of the structure, terms and sources of banks funds and the structure, liquidity and profitability of banks assets.

Bank assets show the things either owned or used to acquire ownership of something such as cash and short term fund, investment loans and advances, fixed assets and other assets. The structure of these assets is very important in planning in that it does not only indicate the uses of bank funds but also measure the extent to which bank management has adhered to the principle of profitability and liquidity in banking. Thus the assets structure to a great extent reveals the position, strength and weaknesses of such a bank (Nzotta, 2014).

According to Hataj (2013), optimal asset structure of banks is a unique problem both from banks' management and regulatory perspective. Commercial banks acquire and dispose of financial and real assets in the course of their operations. These assets serve as value creation, and can affect their profitability, growth and survival (Nwankwo, 2012). Accordingly, changes in these assets affect the value maximization and goals attainment of the banks (Amadi & Eyo 2009; Onoh, 2012; Svetlana, 2011). This implies that the judicious allocation of funds among assets is one of the fundamental strategic management decisions a bank must take to ensure long term sustainability growth.

Commercial banks encounter a wide array of risks in their asset allocation decisions. They are exposed to financial risks since the variety of their assets are by definition, complex. Banks' assets are risky resources, which can be divided into high-risk, high-yield assets and low-risk, low-yield assets (Alexiou & Sofoklis, 2012). The main task in decision making relating to this type of assets is to compare the estimated risk differentials of various asset classes to ensure prudent mix. This is necessary in order to ensure a balance between liquidity, earnings and safety.

In commercial banks, asset and liability management is normally carried out by a committee of trained and experienced staff because it involves both operations management and treasury activities (Dauda & Abdulazeez, 2013). The committee functions involve setting policies and guidelines to establish the risk tolerance of the banks. The committee determines the asset structure of the bank and makes appropriate recommendations to the Board of Directors. In the event of the bank exceeding its risk limit in the course of operations, the committee intervenes to ensure that the level of risk is in line with expected returns, and consistent with broad objectives of the bank.

In the context of corporate financial management, Sinkey (2012) considered the objective of asset and liability management as reducing short-term and long-term interest rate risk, so that balance sheet management is in sync with interest rate risk management. However, Rose (2015) suggested an extensive perspective where the objective of asset and liability management is in line with strategic development and methods to link the structure of the balance sheet of the bank with its strategic plans.

Asset quality as an aspect of bank management entails the evaluation of a firm's asset in order to facilitate the measurement of the level and size of credit risk associated with its operation. It relates to the left-hand side of a bank balance sheet and focused on the quality of loans which provides earnings for a bank. Asset quality and loan quality are two terms with basically the same meaning while its management is considered extremely important by the banking sector. According to the Basle Committee on Banking Supervision, the core principles for effective banking supervision comprised twenty-five core principles out of which seven are designed to address the relevant issues of bank asset quality or credit risk management (Basle, 1997). This implies that asset quality is of general concern to financial supervisory authorities in every country throughout the world.

Research Context

For decades researchers have been trying to describe how banks decide about their asset and liability structures in order to optimally meet objectives of shareholders and management. There are various motivations for understanding this decision making process. From a bank perspective it is crucial to benchmark its asset and liability structure in an automated, algorithmic process, even though the ultimately applied strategy is usually an outcome of the board level debate. It can be part of the decision support system.

The approach of joint asset and liability management was also discussed by Johnson (1985) Reed et. al (1984) and Porter (1993). Maximizing asset profitability was perceived to be the main purpose of asset structure management by Sinkey (2012). Several studies by Markowitz (1952) as well as Tobin (1958) and Tobin (1969) made it clear that risk minimization is of similar importance as the profit maximization. The key contribution of portfolio theory to management of bank asset structure is based upon the idea that optimum bank asset structure depends on the profitability of assets relative to the levels of risk.

Statement of the Problem

The 2007-08 global financial crisis which affected several banks around the world including banks in Nigeria highlighted the failure of many risk management techniques including those that was considered hitherto, sophisticated ones. For commercial banks which previously had competently managed their assets, profitability suffered, while losses were smaller for others having, to a certain degree more conservative asset structures. Hence, the problem with keeping a stable and high quality asset structure has to be constantly viewed because the characteristics of assets and liabilities of every commercial bank change rapidly depending on the macroeconomic and fiscal environment.

Furthermore, the crisis has also clarified important differences between the balance sheet management of non-financial and financial firms in addition to the macroeconomic effects. In nonfinancial firms the asset side of the balance sheet is considered to be the combination of investment projects having positive net present value, and the focus is to obtain an optimal proportion of debt and equity to finance these assets. In contrast, for financial firms equity is considered to be pre-determined variable and asset size is decided by the degree of leverage acceptable under usual market conditions (Adrian & Shin, 2011). The key macroeconomic consequence is that the sources of non-equity financing of assets matter and when market conditions deteriorate, liquidity management by banks can decrease credit supply (Cornett, et. al. 2011). Decrease in credit supply can negatively affect economic growth in small open economies (Brzoza & Makarski, 2011)

Indeed, the 2007-08 global financial crises which was triggered by sub-prime mortgage crisis in the United States of America, affected several financial institutions in various jurisdiction and exposed the vulnerabilities of several large banks and the inadequacy of risk management framework in most banks around the world. In Nigeria, the global crisis triggered an economy-wide bank stress audit which many of the banks failed; leading to the sacking of the management of many of the failed banks by the regulatory authorities, including the take-over of some of these distressed banks by regulatory agencies (CBN/NDIC).

Part of the problems identified by the regulatory agencies, notably, the Central Bank of Nigeria and Nigeria Deposit Insurance Corporation, for the failure of the distressed banks was poor asset structure. In all their reports, the CBN/NDIC harped on the need for banks to maintain good and adequate asset structure. Sadly, there is little, if any, empirical works that focused entirely on establishing the causal link between asset structure and profitability of banks in Nigeria. There is therefore, a compelling need for an empirical analysis to establish, if any, the causal relationship between asset structure and profitability of these financial institutions. This is the main focus of this study.

Objectives of the Study

The broad objective of the study is to evaluate the asset structure and profitability of banks in Nigeria. Specifically, the study sought to:

- a) Review the asset structure of banks in Nigeria
- b) Establish the causal link between asset structure and profitability of banks in Nigeria

Study Hypotheses

The study hypothesized that the asset structure of banks influences their profitability.

THEORETICAL AND EMPIRICAL REVIEWS

Asset Structure and Profitability

The concept of asset structure is central to the planning and evaluation of the relative magnitudes and quality of items (assets) in the statement of financial position of an entity. In the context of a commercial bank, the basic idea behind asset structure is that the quality of assets held in a bank constitutes one of the primary criteria for assessing the earnings capacity and its relative liquidity position.

Every bank operates a statement of financial position in which the assets of the bank are stated. These assets are classified into non-earning and earning assets. Non-earning bank assets, otherwise referred to as primary reserves, include special purpose deposits with the Central Bank of Nigeria, which may not earn any interest but must be set aside in line with the directives of the monetary authorities. They also include demand deposits with local and foreign correspondent banks, vault cash and cash on transit from other banks as well as other credit balances with other banks. It is desirable that a bank hold non-earning assets in addition to earning assets as a precautionary measure against illiquidity, and the need to strike a balance between liquidity, earnings and safety. In the contrast, banks would prefer holding only earning assets in their portfolio of assets as a probable way of maximizing profits. Earning bank assets on the other hand, are those that yield returns, and are classified into secondary reserves and loans and advances.

Secondary reserves include treasury bills and treasury certificates. They are interest bearing, with varying tenors and yields. Unlike non-earning assets, earning assets are profitable and tend to suffer little or no depreciation in value at maturity or at the point of being converted into cash. Loans and advances, on the other hand, relate to short, medium and long term facilities granted by the banks to their customers.

In terms of the relationship between asset structure and profitability of commercial banks the most frequently explored issues are the importance of profitability in the evaluation of firms' performance and how profitability can be affected by other economic factors (Lev, 1983; Davidson & Dutia, 1991; Ngerebo, 2002 and Ekpo, 2015). Profitability is one of the most important objectives of an entity because of the agency and trusteeship role it performs in organizations (Jensen & Meckling, 1976). Profitability is concerned with maintaining or increasing the firm's earnings through attention to cost control, pricing policy, turnover, asset management, and capital expenditures.

Every financing activity in an enterprise involves expected positive returns. The performance of a bank to a great extent depends on its management and the efficiency with which its investment in assets is structured; and performance is a function of profitability and growth overtime. Due to the importance of profitability, Burns (2001) stresses that the aim of a business is not only to generate sales, but also profits.

Commercial banks are profit oriented, with assets in their books. Low profitability contributes to under-capitalization, because it leads to lower retained earnings, and heavy reliance on external capital. However, profitability has been said to be affected by many factors such as type of products (bank facilities), degree of competition and firm size (Burns, 2001). The judicious allocation of funds on a portfolio of bank assets to maximize the expected returns from each asset can be explained within the framework of modern portfolio theory or mean-variance analysis. The principal idea about portfolio theory is the assessment of risk and

return, such that the risk and returns evaluation are not carried out exclusively on a particular asset as against the relative contribution to the portfolio's overall risk-return payoff.

According to Markowitz (1952), it is possible for different portfolios to have varying levels of risk and return. But the decision maker must decide how much risk he can handle and then allocate (or diversify) his or her portfolio. Markowitz theory therefore, suggests that for a bank to ensure optimal allocation of funds among assets (financial and real assets), it should make an effort to reduce the portfolio risk by holding a combination of assets that are perfectly positively correlated. That is to say, banks can reduce their exposure to individual asset risk by holding diversified asset structure.

Asset Structure Management Techniques

There are asset management principles that can help management to successfully carry out asset transformation. Short term liability transformation into long-term assets is adequate only within the speculative portfolio and it cannot be permitted within conservative and moderate portfolios. This can be justified by the need to decrease the risk of asset loss for banks because in case of a significant outflow of liabilities, asset portfolios are being decreased in the following order: speculative asset portfolio, moderate asset portfolio, conservative asset portfolio and lastly fixed asset portfolio.

Bor (1997) considered profitability as the main objective of asset structure management. Banks have to perform asset transformation in a manner that results in profitability and asset preservation simultaneously. For example, if the profitability of some financial markets has a propensity to decline, moderate asset portfolio, with higher profitability can be increased in the place of the conservative asset portfolio.

On the other hand, if the profitability of some financial markets is expected to increase, banks can transfer portion of the moderate portfolio into conservative asset portfolio. It is important to mention that the concept of stable asset portfolios maintains that the size of conservative portfolio can be increased only on the account of liabilities with high time stability. Similarly the moderate asset portfolio can be increased only on the account of liabilities with high or moderate time stability. Thus asset transformation occurs by converting different asset portfolios, funded by liabilities with different time stability.

Banks have to continuously follow the changing aspects of liabilities with different time stability in order to implement their asset portfolio transformation measures for ensuring current liquidity. Different instruments are appropriate for different asset transformations. For example, if liabilities with high time stability decline, bank should lower their lending firstly the clients limits of unused credit lines to reduce the contingent liabilities. If asset portfolio profitability drops due to the increase in actual costs of funding, banks can pay off by increasing floating interest rates.

Every bank wants to optimize its asset structure to boost profitability. Sinkey (2002) argued that the profitability of bank asset structure can be safeguarded with gap management method that is based on sensitivity of operations against interest rate variations and comparing the terms of asset and liability maturity. Depending on asset and liability structure, interest rate fluctuations can affect interest income of the bank in different ways.

Assets and liabilities of any bank can be divided into sensitive to interest rate fluctuations and those that are not. Non-sensitive assets comprise of cash and cash equivalents, physical assets,

loans bearing fixed interest rate, credit card overdrafts, etc. Sensitive assets comprise of loans with floating interest rate, short-term liquid securities, open credit lines, interbank loans, etc.

Similarly, liabilities are also either sensitive to interest rate movements or not. Non-sensitive liabilities consist of equity, retained earnings, balance in client current accounts that does not earn any interest, etc. Sensitive liabilities are deposit certificates, with a maturity of one year, interbank loans, demand deposits, term deposits with floating interest rate and other similar arrangements.

If the difference between rate sensitive assets and rate sensitive liabilities (GAP) is positive, then a bank can earn additional profit if the standard interest rate just as the KIBOR to which the profitability of its instruments may be tied increases. Conversely, if a bank has a negative gap, i.e. it has more sensitive liabilities than sensitive assets the rise in interest rate will result in loss of bank's interest income. Surely, if the market interest rate decreases, the bank will earn additional income. Be-cause bank's balance sheet contains assets and liabilities of different maturities gap is needed to be analyzed for a specific maturity. Bank will be exposed to interest rate risk if there is a mismatch between assets and liabilities. For example if assets are financed mostly using short-term liabilities, an increase in interest rate may mean substantial interest rate losses for banks. This is because starting from the next year; it has to re-finance the issued loans from other deposits that have been obtained for a possibly higher price. To decrease the probability of suffering losses a bank can issue loans with floating interest rates.

A non-zero gap can point out a deficiency or surplus of resources within a specific time period. For example, a 30-day gap shows to what extent assets with maturity up to 30 days exceed or fall short of the liabilities with same maturity. The aim of this method is to structure an as-set portfolio, with maximum profitability and flexibility, identifying the as-sets and liabilities that are sensitive to interest rates.

In actual fact gap management has a certain level of unpredictability. Gap analyses are usually of short-term nature and depositors and borrowers also have the freedom of choice. For example, early cancellation of deposit agreements, repayment of loans before term that can alter the size of the gap .When clients repay loans before maturity, bank becomes exposed to interest rate risk because, if the interest rates in the market fall, then it will have to issue new loans with lesser interest rate. If asset repayment terms are longer than liability repayment terms, banks are subject to risk of bearing losses in case interest rates rise. Even though it is less pertinent in the progressive economies, inflation is a key macroeconomic risk for gap practices.

Improving Profitability of the Asset Structure by Diversifying Assets and Liabilities

The following management techniques may work well to maximize profitability, while controlling risks:

- Lowering relative funding costs such as by increasing the percentage of equity, lowering dividends if possible. Because monetary authorities plays a key role in this process.
- Spreading profitable operations by financial innovation. Of course, these financial innovations were also the contributor to the 2008 financial crisis; therefore the question about how effective it is remains debatable. Among the implementation risks are the spreading of resources and not providing enough capital to conventional and profitable business lines.

The execution of these techniques needs to be complemented by high quality analysis of financial and macroeconomic indicators. Much attention has been devoted to these techniques, for example, data envelopment analysis (Zhang, 2003), stochastic frontier models (Guotai et al.2005), etc.

Theoretical and Empirical Reviews on Asset Structure and Profitability

There are several theories that can be used to underpin the asset structure and profitability matrix. Asset structure and profitability in the literature are usually explained in terms of macro models. According to Amadi and Eyo (1999), we can use the Pool-of-funds model, the Asset Allocation (or conversion of funds) model and the Management Science model to explain asset allocation patterns.

The Pool-of-funds model requires managers to pool all the funds of the bank from various sources such as demand, savings and time deposit, as capital funds. The pooled funds are allocated to the bank assets after identifying the liquidity and profitability requirements. The Asset Allocation Model (AAM) is premised on the need to allocate available funds to assets of the type and maturity appropriate to the velocity or turnover of these funds. The Management Science model employs sophisticated models to analyze the complex inter-relationships among various components of the balance sheet and income statements. It utilizes linear programming model which incorporates the asset management problem in its analysis. It also incorporates both profitability and liquidity constraints. Thus, the model can be used to test the sensitivity of management decisions to changes in the banking environments.

In all, the application of modern portfolio theory or asset allocation models in asset structure decisions does not replace the role of an informed asset management committee of banks or the bank manager's expertise; the models can best serve as complementary tools for decision making.

For several years researchers have tried to understand how banks manage their statement of financial position (otherwise referred to as balance sheet), and allocate funds to assets of various classes, otherwise known as asset structure (Stoughton and Zechner, 2007; Danielsson, Jorgensen, De-Vries and Yang, 2008; Thakor, Mehran and Acharya, 2010). The need for understanding this decision process has not been met and the quest is yet unending. Indeed, maximization of shareholders' value, which is at least in legal theory, the best objective a firm should pursue, could be considered an optimal criteria for optimal allocation of funds on corporate assets.

Other useful criteria have been suggested by eminent scholars, such as the maximization of income (Thakor, Mehran & Acharya, 2010); maximization of risk-adjusted profit (Stoughton & Zechner, 2007); and risk-constrained profit (Danielsson, Jorgensen, De-Vries & Yang, 2008).

According to Hataj (2013), optimization-based approach to banks' asset structure can be applied in various theoretical and practical contexts. It can be integrated as an integral part of asset-liability management decision process (Kusy & Ziemba, 1986; Adam, 2008). As observed by Paries, Halaj and Kok (2016), many optimization-based models incorporate income into their asset structure considerations.

Amadi and Eyo (1999), in their empirical examination of the relationship between the profits of merchant banks and the pattern of asset structure found that commercial and merchant banks in Nigeria shift funds to unspecified assets in order to enable them engage in activities which are at variance with stipulations of monetary authorities. The authors therefore,

concluded that considering the importance of Asset-Liability management in the realization of banks' objectives, bank managers, to whom the assets and liabilities are entrusted, ought to know the most optimal mix of such assets and the most efficient allocation of bank funds so as to increase their profits.

In a related study, Nwankwo (1991) outline certain factors that should guide bankers in allocating funds to the various asset categories. These are prudence and transactions demand, legal requirements, maintaining a high degree of liquidity, and the need to earn sufficient income. Also, based on Svetlana (2011) research, banks need to pay attention to their balance sheet for effective financial risks management. All financial institutions take risks to make money, but an effective risk management guarantees appropriate balance between risk and reward.

Alexiou and Sofoklis (2012) argued that asset-liability management requires that attention be paid to each asset category to address their peculiar problem for improved profits. As commercial banks diversify their funding sources, sound asset and liability management is critical to help them access and manage financial risk. The 2007-08 global financial crisis highlighted the importance of good asset and liability management. As funds become increasingly scarce and expensive, asset management becomes ever more important. While increased borrowing can help commercial banks increase their returns, it also exposes them to greater risk.

From the right sizing perspective of assets and liabilities, Rose (2001) claimed the need of bank's assets and liabilities management to ensure stable and profitable functioning of the bank. Bank's assets and liabilities should be connected in a unified management process to ensure a stable and high quality asset and liability structure. The quality and structure of bank's assets largely depends upon the quality and structure of it liabilities. The quality of a bank's balance sheet is influenced by its fund raising ability and sensitivity to the interest rate movements.

An appropriate strategy for the bank is to diversify its assets into various classes of portfolios such as fixed asset portfolio, conservative asset portfolio, moderate asset portfolio and speculative asset portfolio. The criteria for allocating assets to each type of portfolio should be based upon the time stability of asset creating liabilities. The time stability of liabilities is very important because it enables the bank management to create a stable asset portfolio without being exposed to funding risk.

In reviewing the size and structure of asset portfolios, possibilities of time transformation are very important. The most critical type of asset time transformation is the transformation of short-term deposits into medium-term and long-term loans. This transformation creates risks for the bank's ability to maintain sufficient liquidity. This risk can be partly reduced using short-term interbank loans and financial market derivatives such as swaps, futures, etc. However, such risks need to be examined and controlled carefully.

METHODOLOGY AND MODEL

The study followed the model proposed by Saksonova (2011) with some modification. Saksonova theorized that it is the task of every commercial bank to determine the optimal asset portfolio depending on the profitability of various asset classes and chosen constraints. The author proposes one of the instruments for achieving this purpose – the model of asset structure optimization.

To provide the input necessary for the model, it is first important to have a parsimonious description for the asset and liability structure in a typical commercial bank. Tables 1 and 2 in the appendix provide this summary together with the information on asset risks and profitability as well as the reserve norms and costs for different classes of liabilities. The numerical indicators are computed as rolling averages of the industry wide profitability and cost parameters over a ten-year period in Nigeria from 2008 to 2017.

The level of detail for asset and liability categories is chosen to create a suitably parsimonious model and to include the most important categories (by proportion in total assets and liabilities) in the model. The model abstracts from the income from commissions and non-interest expenditure. These categories are less likely to be important for commercial banks in Nigeria.

The most appropriate optimization criterion for the model is the maximization of the ratio of net interest income1 (P) to assets (A). This ratio shows the ability of the bank to generate net profit by placing funds into profitable assets and it also simplifies the derivations, because the solution of the model will be the optimal weight of different categories of assets and liabilities in the total structure. The model parameters are summarized in Table 3 in the appendix.

The objective function is given by the following:

$$\frac{P}{A} = \sum_{i=1}^M x_i^A l - \sum_{j=1}^N x_j^L l_j \dots\dots\dots(1)$$

One can consider the objective function (1) to be a logical conclusion to the banks' profit motive. The increase in net interest income is at the foundation of all strategic tasks such as development or increasing shareholder value. The chosen objective function is considered by many authors to be the best indicator for evaluating the efficiency of the bank's operation, because it describes the efficiency of resource utilization by the bank.

Implicit in the choice of the objective function is the assumption that non-interest expenditure can be completely covered with non-interest income and therefore can be abstracted from.

The objective function is maximized subject to the most important constraints. When determining constraints the author strives to achieve the most parsimonious formulation of the model that reflects the most important characteristics of the bank and ignores characteristics, which are secondary to the solution of the problem. In practice, of course, it is never possible to formalize all of the constraints that face such a complicated economic agent as a bank.

The present study therefore chooses to focus on the following constraints:

Maximize $\pi = c_1x_1 + c_2x_2 + \dots\dots\dots + c_nx_n$ (objective function)

Subject to $a_{11}x_1 + a_{12}x_2 + \dots\dots\dots + a_{1n}x_n \leq r_1$

$a_{21}x_1 + a_{22}x_2 + \dots\dots\dots + a_{2n}x_n \leq r_2. \dots\dots\dots a_{m1}x_1 + a_{m2}x_2 + \dots\dots\dots + a_{mn}x_n \leq r_m$

$x_i \geq 0$ ($i = 1,2,\dots\dots\dots n$) (non-negativity restrictions) where c_i , a_{ij} and r_i are given constants. The variables $x_1, x_2, \dots\dots\dots, x_n$ are decision or structural variables. The problem is to find the values of the decision variables (x_1, x_2, \dots, x_n) which maximize the objective function π subject to the m constraints and the non-negativity restriction on the x_j variable.

The objective function in the study is constrained by the following variables:

- 1) Balance sheet equality
- 2) Mandatory reserve requirements
- 3) Liquidity requirement
- 4) Capital adequacy requirement
- 5) Open currency position

Balance sheet equality: The balance sheet equality constraint is given by:

$$\sum_{i=1}^M x_i^A = \sum_{j=1}^n x_j^L = 1 \dots\dots\dots(2)$$

Since it is the proportion of particular categories of assets and liabilities to the total that are added up in (equation 2), they sum to one.

Mandatory reserve requirements: The mandatory reserve requirement constraint is given by:

$$\sum_{i \in 1}^M x_i^A = 0.5 \times \sum_{i \in J}^M x_j^L \dots\dots\dots(3)$$

To find the liabilities of commercial banks subject to the mandatory reserve requirements, we sum the term deposits and deposits on demand as well as issued bonds and other debt securities and subtract liabilities to the state treasury (where they exist), deposits from foreign branches abroad and liabilities to other credit institutions. This sum is multiplied by the mandatory reserve percentage.

Liquidity requirement: Liquidity constraints arise due to the fact that banks have to fulfill customers' instructions for money transfers without delay and must stand ready to pay out customers' money on demand. This means that banks in order to ensure the servicing of current liabilities has to ensure sufficient liquidity or it has to be able to attract interbank loans. According to the Central Bank of Nigeria, liquid assets must not be less than 30 percent of the total volume of current liabilities.

The liquidity requirement constraint is given by:

$$\sum_{i \in 1}^M x_i^A \geq 0.3 \times \sum_{i \in 1}^M x_j^L \dots\dots\dots(4)$$

The liquidity requirement constraint is subject to change due to changes in monetary policy of the Central Bank of Nigeria.

Capital adequacy constraints: This constraint arises due to the Central Bank of Nigeria requirement that equity capital of commercial banks must not be less than 10 percent of the risk weighted assets. This is formulated as follows:

$$\sum_{j \in J}^M x_j^L \geq 0.1 (0.2 \times \sum_{i \in I_4}^M x_i^A + 0.5 \times \sum_{i \in I_5}^M x_i^A + \sum_{i \in I_6}^M x_i^A) \dots\dots\dots(5)$$

The left-hand side of (equation 5) represents equity and the right-hand side is the risk weighted assets (Table 1 in the appendix). The weights for the different risks are determined by the Central Bank of Nigeria in the Prudential Guidelines.

Open Currency position: This constraint arises due to the Central Bank of Nigeria requirement that mandates commercial banks to maintain a zero currency position in order to fully eliminate currency risk. This is formulated as follows:

$$\sum_{i \in I_7}^M x_i^A - \sum_{i \in I_4}^M x_i^A = 0 \dots\dots\dots(6)$$

The model parameters are explained in Table 4 in the appendix.

RESULTS AND DISCUSSIONS

The overarching objective of the study is to provide an empirical explanation on the effect of asset structure of Nigerian banks on profitability. The explanation is provided in the model and the solution of the model is an optimal structure of assets and liabilities, which ensures maximum ratio of the net interest income to assets, while satisfying all of the constraints.

Result of the analysis as shown in Table 4 in the appendix showed that claims to other banks had the highest asset allocation in Nigeria. This is understandable because in a high risk country like Nigeria lending to other banks on the interbank market is a less risky activity than lending directly to businesses. The result in the table referred above also showed that the proportion of loans in the optimal asset allocation edged up in 2011 in apparent reflection of the improved macroeconomic prospects in Nigeria especially after the global crisis of 2008/2009.

Again, as could be seen in Table V, the optimal liability structure of Nigerian banks reflects fairly low level of leverage. This is an indication of conservative posture adopted by the banks in the face of uncertain business environment in Nigeria.

On the aggregate, Tables IV and V in the appendix, provide only but a rough estimate on the actual optimal asset and liability structure of Nigerian banks. This is due to the fact that the profitability of assets i in Table I and the costs of liabilities in Table II are only weighted average rates in the industry at the end of the year and the generalized constraints imposed on all the banks might not be true in reality.

The intuitive appeal of this study is that every bank can utilize this model to plan its asset structure and use real asset profitabilities that it is facing. This is particularly relevant to such asset classes, where the overall profitability is hard to evaluate by using aggregated industry level data. Therefore the higher the precision of the available data, the more precise can be the model and the offered solutions, thus each bank can obtain exact and not the approximate solution obtained in this study.

CONCLUSION

In this study, the researcher adopted a model of asset structure optimization developed by Saksonova (2011) with some modification. This model is based on the regulatory requirements as well as industry practices in the Nigerian banking industry. This model was applied using data from commercial banks in Nigeria over a 10-year period from 2008 - 2017.

Although the model can be easily customized to meet the specific circumstances of individual banks, the study adopted an aggregate index of asset and performance parameters of the entire banking industry in the Nigeria for the period 2008 – 2017. The essence was to have a general overview of the influence of asset structure of entire banking sector on profitability. Further studies could be undertaken to infuse data on individual banks or a comparative study of banks within different defined parameters like healthy and unhealthy banks, small and big banks, domestic and foreign banks, old generation and new generation banks, etc.

Overall, the model has shown that asset structure of commercial banks in Nigeria reflects fairly low level of leverage and that the asset structure has implication for profitability in the industry.

Moreover, our null hypothesis is rejected and alternate hypothesis accepted. Thus, asset structure of Nigeria banks influences their profitability.

RECOMMENDATIONS

To improve on the asset structure and thus boost profitability, Nigerian banks should take the following measures:

- a. minimize cash holdings and claims to the central bank, which are not interest bearing and thus do not generate any income;
- b. place more funds on the interest bearing correspondent accounts and providing interbank loans to increase profitability;
- c. create a portfolio of highly liquid investment-grade securities from local and foreign issuers, which provides profitability that is higher than money market rates;
- d. place more funds in the short-term financial instruments on the international financial market with fixed income and risk parameters;

The above measures, coupled with stable macroeconomic environment, will ensure that banks maintain appropriate asset mix that will maximize their profitability.

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APPENDICES

Table 1
Weighted Average Profitability and Risks for Different Classes of Assets of Commercial Banks in Nigeria 2008 - 2017 (Percent)

WEIGHTED AVERAGE PROFITABILITY AND RISKS FOR DIFFERENT CLASSES OF ASSETS, PERCENT												
N	Asset Class	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Asset Risk
1	Reserves	0	0	0	0	0	0	0	0	0	0	0
2	Currency	0	0	0	0	0	0	0	0	0	0	0
3	Deposits with CBN	0	0	0	0	0	0	0	0	0	0	0
4	Reserve Requirement	0	0	0	0	0	0	0	0	0	0	0
5	Current Accounts	0	0	0	0	0	0	0	0	0	0	0
6	Stabilization Securities	0	0	0	0	0	0	0	0	0	0	0
	Foreign Assets											
7	Claims on foreign banks	4.2	5.3	2.6	3.5	2.2	2.5	3.2	3.5	3.9	4.3	20
8	Balances held with banks outside Nigeria	3.1	3.5	2.5	2.7	2.9	3.2	4.1	3.8	3.7	3.2	20
9	Balances held with offices and branches outside Nigeria	3.2	4.3	3.5	2.5	2.8	3.5	3.7	4.2	3.8	4.5	20
10	Loans and advances to banks outside Nigeria	12.5	15.2	12.8	10.8	10.5	11.6	12.2	12.5	14.2	12.8	50
11	Bills Discounted payable outside Nigeria	10.2	12	12	11	12	12	12	12	12	10	50
	Claims on Central Government											
12	Treasury Bills	6.5	6.7	7.2	6.5	6.2	6.5	6.5	7.1	5.5	6.5	0
13	Treasury Certificates	5.5	5.7	5.3	5.2	6.2	6.2	6.2	6.5	6.5	6.5	20
14	Development Stocks	7.5	7.7	7.2	7.1	6.5	6.5	7.5	7.5	7.5	7.5	50
15	Loans and advances to Central Government	13.2	12.5	11.5	11.5	12.1	10.5	11.5	11.5	12.5	11.3	50
16	Bankers Unit Fund	11.2	11.5	11.5	10.5	13.5	13.5	13.5	13.5	11.5	12.8	100
	Claims on State & Local Government											
17	Loans & Advances to State Government	13.3	13.5	15.2	15.5	15.5	16.8	15.8	15.8	15.8	16.2	50
18	Loans and advances to Local Government	15.5	15.5	15.5	16.2	16.5	16.5	13.5	13.8	13.5	13.5	50
	Claims on Other Private Sector											
19	Loans & Advances to Other Customers	6.5	6.3	7.2	5.5	3.8	3.5	3.5	3.7	4.5	3.2	50

20	Loans & Advances to Nigeria Banks Subsidiaries	6.7	6.5	3.5	4.5	4.8	3.8	3.5	5.5	3.5	4.5	50
21	Bills Discounted from non-bank Sources	6.8	6.8	5.5	5.8	5.5	3.8	3.8	3.5	4.5	3.8	50
22	Investments	3.2	2.7	2.7	3.3	3.5	3.6	3.8	4.2	3.8	3.5	50
	Claims on Other Financial Institutions											
23	Unclassified Assets	11.5	10.4	6.8	6.5	5.8	5.8	10.4	10.3	11.2	11.8	50
24	Fixed Assets	4	4	5	5	5	5	4	4	4	4	100
25	Domestic Interbank Claims	17.5	15.8	16.7	18.5	15.5	17.8	13.5	15.8	15.5	10.8	100
26	Money at call outside Banks	4.5	2.8	2.6	2.3	2.4	3.5	3.8	3.5	2.8	2.5	100
27	Certificates of Deposits	6.5	6.7	6.2	4.5	3.8	4.2	4.5	4.8	4.2	3.5	50
28	Placement with Discount Houses	7.5	6.5	6.2	3.8	3.5	3.2	4.5	5.7	5.8	5.5	100
29	Other Assets	4.5	4.8	3.8	3.8	3.5	3.2	3.3	4.2	4.2	3.5	100

Source: Computed from Asset and Liability of Commercial Banks in Nigeria, Central Bank of Nigeria Statistical Bulletin (Various Years)

Table 2
Weighted Average Cost and Reserve Requirement for Different Classes of Liabilities of Commercial Banks in Nigeria 2008 – 2017 (Percent)

N	Liability Class	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Reserve Requirement
1	Deposits (Foreign currency) on demand	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5
2	Short term deposits (Naira)	4.5	3.5	5.5	5.8	4.5	3.8	4.2	3.8	5.5	3.8	5
3	Short term deposits (Treasury Bills)	3.8	4.5	5.5	4.2	5.5	5.5	4.5	4.5	3.5	3.5	5
4	Long term deposits (CDs, etc)	5.8	5.5	6.2	7.5	7.5	6.5	6.8	6.5	7.5	7.8	5
5	Long term deposits (foreign currency)	6.5	6.8	6.2	5.8	5.5	4.8	5.5	6.5	6.8	7.5	5
6	Liability to the Central Bank of Nigeria	5.5	5.5	4.5	5.8	5.5	5.2	5.9	4.8	4.5	4.2	0
7	Placement in other banks in Nigeria	4.5	4.2	4.3	3.5	3.8	3.2	2.8	2.5	2.8	3.5	5
8	Bonds and other debt securities (maturing within a month)	6.8	6.5	7.5	7.5	6.5	7.8	7.2	7.5	6.5	6.8	5
9	Bonds and other debt securities (maturing longer than a month)	7.8	7.5	6.8	6.5	6.5	6.7	7.2	7.5	6.8	7.2	5
10	Inter-bank loans (Nigeria)	7.7	7.5	7.3	6.8	6.5	6.2	4.5	4.3	4.3	4.3	0
11	Equity	8.5	7.8	8.2	8.8	9.1	9.5	7.5	6.5	6.8	7.5	0

Source: Computed from Asset and Liability of Commercial Banks in Nigeria, Central Bank of Nigeria Statistical Bulletin (Various Years)

Table 3
Optimal Asset Structure of Commercial Banks in Nigeria (2008 – 2017)

Asset Class	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Cash holdings	4.7	4.4	4.7	3.8	3.1	3.2	2.8	2.8	2.5	2.2
Claims to the Central Bank of Nigeria	4.5	4.3	3.8	3.1	4.5	4.8	3.5	3.2	3.9	3.3
Claims to other Financial Institutions	65.2	68.2	68.2	64.2	58.5	58.8	55.8	55.5	57.8	62.5
Loans and Advances	19.1	16.6	17.3	22.4	24.1	26.7	31.6	32.2	29	24.8
Other Assets	6.5	6.5	6	6.5	9.8	6.5	6.3	6.3	6.8	7.2
Total	100	100	100	100	100	100	100	100	100	100
Net Interest Income on Assets, P/A	7.2	6.8	6.5	6.3	5.7	5.5	4.8	5.2	5.9	6.2

Table 4
Optimal Liability and Equity Structure of Commercial Banks in Nigeria (2008 – 2017)
(Percent)

Liability Class	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Customers Demand Deposits	76	72.3	70.5	68.2	62.8	60.5	62.8	65.8	68.2	72.5
Interbank Liabilities and to the Central Bank of Nigeria	18.5	21.9	23.7	26	31.6	33.3	31	28	25.3	21
Equity	5.5	5.8	5.8	5.8	5.6	6.2	6.2	6.2	6.5	6.5
Total	100	100	100	100	100	100	100	100	100	100

Table 5
Model Parameters

Parameter	Interpretation
P/A	The proportion of net interest income to assets
M	The number of asset positions, indexed by i , thus $i = 1 \dots M$. Assets are summarized in groups.
X_i^A	The proportion of the i -th asset to the total
I_i	The profitability of the i -th asset
$I_1 = \{1,3\}$	Total mandatory reserves, claims to the Central Bank of Nigeria and cash holdings in Nigeria
$I_2 = \{2\}$	Cash holdings in Nigeria
$I_3 = \{1,2,3,4,5,8\}$	Liquid Asset positions
$I_4 = \{4,7,10,15\}$	Asset position with a 20 percent risk level
$I_5 = \{6,9,16,17,18,19\}$	Asset position with a 50 percent risk level
$I_6 = \{5,11,12,13,14,20,21\}$	Asset position with a 100 percent risk level
$I_6 = \{2,4,5,7,8,10,11,13,18,19\}$	Asset position in a foreign currency
$I_7 = \{4 \dots 20\}$	Asset positions that can be utilized in risky transactions
$I_9 = \{1,2,3,4,5\}$	Primary reserves
$I_{10} = \{8\}$	Secondary reserves
$I_{11} = \{16,17,18,19\}$	Loans provided
$I_{12} = \{21\}$	Fixed assets