

Optimality in Nigerian Deposit Money Banks Loan Portfolio: Evidence from First Bank Nigeria Holdings Plc.

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Abstract

This study is concerned with the determination of optimal loan portfolio of deposit money banks in Nigeria. Specifically, the research is a case study of how optimal loan portfolio could have been achieved by First Bank Nigeria Holdings PLC (FBNH) for the year 2019. Data in respect of the bank's loan portfolio, interest rates and deposits were collected from the annual financial statements and accounts and analysed using linear programming modelling (LP). The resulting models were analysed using LINGO; an optimization software. The results of the analysis in this study show that FBNH (PLC) would have achieved optimal results if it had granted loans and advances as overdrafts and terms in the corporate loan class and overdraft in the retail loan class. This study therefore recommends that FBNH (PLC) strategically manage these loan types and classes in the face of Central Bank's statutory requirements to achieve maximum returns.

Keywords: Corporate Loan; Liquidity; Linear Programming; Optimization; Retail Loan.

1. Introduction

The importance of the banking industry in development of any country cannot be overemphasized. Essentially, economic growth is spurred by the credit granted to the different sectors of the economy by the banking sector. Kayode and Adaramola (2018) observed that the banking system plays an important intermediation role of mobilizing surplus fund from the lending unit and allocating same to borrowers in the deficit unit of the economy. Any study intended to make the banking system perform its intermediation role should be of interest to researchers on one hand as well as to bankers and other stakeholders in the economy on the other hand. Banks engaged in mobilization of savings and efficiently allocate the funds to strategic sectors in the economy in order to support the overall economic growth of the country (Dare, 2019). Otting (1998) opined that advancing credit forms the major business engagement of banks. Interest on loans and advances is the main source of revenue for banks just as loans and advances make a considerable part of their assets portfolio. The allocation of loanable fund to qualified borrowers is referred to as a loan portfolio. Loan portfolio management is the process through which banks manage their different lending outlets and borrowers to minimize risk and optimize performance at the same time (Otting, 1998; Tanwar, Vaish, & Rao, 2021). Mohagheghnia and Shirgholami (2013) posited that managing loans portfolio is the all-important business of banks and that the main goals are to maximize return and minimize risks.

However, maintaining an optimal loan portfolio has been a major challenge to bank managers, especially due to the conflicts that usually arise from the twin goals of maximizing shareholders value and maintaining adequate liquidity. The different classes of loan that bank gives are determined by the terms surrounding such loan. Elliot (1996) believes that, deposit money banks should be at advantage by efficiently managing their loan portfolio in an ever-increasing borrowers' economy. For banks to achieve their business goals, Tachia (1998); Kusi, Teku, Darteh and Acheampong (2019) believe that minimizing loan default risk and maximizing return should include a well-constructed and diversified loan portfolio. The challenge before bankers is how to form an optimal loan portfolio that will not only minimize risk of illiquidity and default, but also ensures maximum return. This is because fund available for lending is usually grossly limited in relation to the demand for loan and advances.

However, financial mathematicians, over the years have developed optimization models that help in determining optimally achievable returns in the face of resource constraints and one of such techniques is the linear programming optimization (LP) modelling (Oladejo, Abolarinwa & Salawu, 2020).

Optimization models have been used by authors to determine the optimal loan portfolio of some banks (Agarana, 2014; Agarana, Anake, & Adeleke, 2014; Ekwonwune & Edebatu, 2016; Kanu, Ozurumba & Emeroke, 2014). Also, some studies adopted LP to determine optimality at factory level (Papahristodoulou & Dotzauer, 2017; Ailobhio, Sulaiman & Akeyede, 2018; Oladejo, *et al.*, 2020;

Oluwaseyi, Elizabeth & Olaoluwa, 2020). However, to the best of this researcher's knowledge, no such study has been carried out on the application of optimization model to the loan portfolio of First Bank Nigeria Holdings PLC. First Bank Nigeria Holdings PLC was selected given the historical precedence of the bank in development of Nigerian banking sector. Also, the bank is one of the big five banks in Nigeria in terms of size, assets, branches, customer base and loan granting capacity. Thus, this paper applied linear programming optimization technique to ascertain the loan portfolio that First Bank of (Nigeria) should hold to ensure optimum returns and minimum risks/loss which is the main objective of the study.

2. Literature Review

2.1 Theoretical Framework

Undoubtedly, any theory on optimization of returns and minimization of risk can be applied to the derivation of optimal loan portfolio of banks. Robinson (1961) presents the "priority" theory of bank funds management. According to the Robinson (1961), four priorities underline the way banks use their funds: primary reserves, meeting customers' immediate withdrawal demands, loans and advances and investment in that order. While reserve is statutory and meant to serve as a protection for banks, investment is meant to generate income for the banks. Yong and Sheng-Yi (1988) supported Robinson's priority theory. Again, Robinson (1961) argues that banks should focus on strength, character and seasonality in their evaluation of loan applications.

Banks with seasonal loan demand should ensure good liquidity in their investment and allocate more funds to creditworthy loan applicants when demand for loan increase during economic boom and the other way round when loan demand fall in times of economic recession (Robinson, 1961). In maintaining a healthy balance between profitability and liquidity/safety in granting of loans, Robinson (1961) suggests that banks should lean towards liquidity and safety to continue to do business. Tobin (1965) believes banks can achieve optimal portfolio by applying the principle of portfolio theory and management. Tobin argues that banks should maximize portfolio returns vis-a-vis expected risk and liquidity demands. The general principle of portfolio theory is hinged on the allocation of funds based on the risk-return trade-off.

2.2 Empirical Evidences

Empirically, studies on optimality in banks' loan portfolios either confirm or refute the fact that banks are maximizing their returns. Most often, such studies are meant to test a single null hypothesis which states that banks do not maximize their returns based on available resources and constraints. Chambers and Charnes (1961) use LP model to answer the question of whether Singaporean banks maximize their returns for the period 1978 – 1983. The authors found out that, to a considerable extent, Singaporean banks do not maximize their returns from their loan portfolios given a set of constraints. Oladejo, *et al.*, (2020) applied linear programming to the

optimization of portfolio selections of firms and it was established that portfolio interests reduces by 5%; return on investments almost 15%. Papahristodoulou and Dotzauer (2017) seek to optimize portfolios using linear programming models and it was discovered that maximin formulation yields the highest return and risk, while the QP formulation provides the lowest risk and return. Ailobhio, *et al.*, (2018) carried out a study on optimal solution in Lace Baking Industry Lafia based on linear programming model. It was observed that Mini loaf, followed by family loaf contributed objectively to the profit. Oluwaseyi, *et al.*, (2020) adopted linear programming technique to decision making problem in university of Benin Bakery. The solution obtained from a single iteration showed that 667 units of extra- large bread should be produced daily for the firm to achieve a maximum daily profit of #100,000.

However, there is paucity of empirical literature on optimization (especially using linear programming models) in banks' loan portfolio in Nigeria. The reason is not far-fetched. Studies of this nature are individual firm based, the data for which banks especially will most likely not make readily available since such data are regarded as firm secrets. Agarana, Anake and Adeleke (2014) develop an LP model to examine unsecured loans portfolio and the control of bad debts by banks in Nigeria. The authors observed that when banks decided to cut the amount of loan without security to 2% of the total current loan, there was increase in returns and when banks decided to increase the percentage of unsecured loan to total current loan, the banks performed poorer. Ekwonwune and Edebatu (2016) used LP model to determine the maximum return that Golden Guinea Breweries (Nig) Plc should have in 2014 and 2015. Their results reveal that the star products of the company do not contribute to the maximization of its profitability. Tanwar, *et al.*, (2021) attempted to optimize assets and liabilities of banks through the adoption of goal programming technique of Allahabad bank from 2010 - 2019. It was discovered that in Allahabad bank that goal programming helps in achieving optimization and increase profitability. Also, Kusi, *et al.*, (2019), adopted linear programming to the allocation of fund to loan seekers in African Development Bank (ADB), Sunyani branch in the Brong Ahafo Region, it was discovered the banking would be maximizing higher profit if resources are adequately allocated using best lending model. Another optimization technique used by authors to determine the combination of loans in which banks can achieve maximum return is goal programming (Weham, 1976; White, 1990; Agarana, Bishops & Odetunmobi, 2014; Agarana, 2014 and Jain, Bhardwaji, Saxena & Choulbey, 2019).

3. Methodology

Data for this research were extracted from secondary sources as well as verbal information from insider sources. These data are sourced from the annual reports and financial statements of FBN Holdings (Nig) PLC, a holding company of which First Bank (Nig) PLC is a subsidiary for the year 2019. First Bank (Nig) PLC is one of the big five banks in Nigeria with strong assets and customer base.

3.1. The Research Model

The research model employed in this study is adapted with modification from Mohagheghnia and Shirgholami (2013) in their application of linear programming to determine the optimal loan portfolio of banks in Iran. The linear programming technique which was developed by Dantzig (1947) as an optimization algorithm tool to counter the problem faced by the United States Air Force in the areas of assignments, resource allocation and transportation during the Second World War. In business world, LP is adopted by managers to maximize profit or minimize risk subject to constraints of resources (Mohagheghnia & Shirgholami, 2013).

Aniel (2011) posits that LP is a powerful optimization technique that forms the basis for decision making in portfolio management, financial planning/budgeting, work assignments, scheduling transportation, production management and many more. However, the general assumptions guiding the use of LP for optimization purpose will be applied in this study. These assumptions include: the certainty of all the data used are known and constant for the period of the study; that the goal (objective) and corresponding constraints are proportional; that the optimal solution can be expressed in whole or fractional form; that variables under study cannot take negative values and that the sum of all individual activities involved in the loan process will lead to the sum of activities in the loan process. The LP model for this study is formulated through the following process:

Generally, an LP model takes the form:

$$\text{Maximize } Z = \sum_{j=1}^n C_j X_j \dots\dots\dots (1)$$

Subject to:

$$\sum_{j=1}^m a_{ij} X_j (\leq, =, \geq) b_i, i = 1, 2, \dots m \dots\dots\dots (2)$$

$$X_j \geq 0, j = 1, 2, \dots n \dots\dots\dots (3)$$

Where C_j, a_{ij}, b_i are constants.

Equation (1) is the objective function, Equation (2) is the constraints function while Equation (3) is the non-negativity condition function. Table 1 contains the different types of loan classification, types and the decision variables for 2019 respectively.

Table 1: Loan classification, types and variables (2019)

S/ N	Classification	Type	Decision Variables
1	Corporate Loans	Overdrafts, Term loans, Project finance, Finance Lease	X_1, X_2, X_3, X_4
2	Retail	Overdrafts, Term loans, Credit cards, Mortgage finance	X_5, X_6, X_7, X_8

Source: Author's compilation (2021)

where:

X_1 = part of corporate loan portfolio granted as overdraft

X_2 = part of corporate loan portfolio granted as term loans

X_3 = part of corporate loan portfolio granted for project finance

X_4 = part of corporate loan portfolio granted for finance lease

- X_5 = part of retail loan portfolio granted as overdraft
- X_6 = part of retail loan portfolio granted as term loans
- X_7 = part of retail loan portfolio granted for credit cards
- X_8 = part of retail loan portfolio granted for mortgage finance

4. Presentation of Results and Discussions

4.1. The Loan Portfolio of First Bank Nigeria Holdings PLC

Table 2 is the summary of the loan portfolio of First Bank Nigeria Holdings PLC for 2019 in terms of loan class, type and amount.

Table 2: Summary of the loan portfolio of First Bank (Nig.) PLC for 2019

S/N	Loan Class	Loan Type	Amount (Nm)	Decision Variables
1	Corporate Loans (N) 1,866,798	Overdraft	251,969	X_1
		Term loans	1,137,567	X_2
		Project finance	476,525	X_3
		Finance lease	737	X_4
2	Retail Loans(N) 202,488	Overdraft	21,855	X_5
		Term loans	123,406	X_6
		Credit cards	2,003	X_7
		Mortgage finance	55,224	X_8
Total	N2,069,286m		N2,069,286m	

Source: Author's computation from First Bank Nigeria Holdings PLC Annual Reports for 2019 (2021)

4.2. Derivation of the Objective Function of FBNH loan portfolio for 2019

Table 1 provides the basis for the derivation of the objective function of FBNH loan portfolio. This is expressed as:

$$\text{Maximize } Z = aX_1 + bX_2 + cX_3 + dX_4 + eX_5 + fX_6 + gX_7 + hX_8 \dots \dots \dots (4)$$

Where:

- X_1 = Overdraft (corporate loans)
- X_2 = Term loans (corporate loans)
- X_3 = Project finance (corporate loans)
- X_4 = Finance lease (corporate loans)
- X_5 = Overdraft (retail loans)
- X_6 = Term loans (retail loans)
- X_7 = Credit cards (retail loans)
- X_8 = Mortgage finance (retail loans)

and,

- a = average Interest rate on overdraft (corporate loans)
- b = average Interest rate on term loans (corporate loans)
- c = average Interest rate on project finance (corporate loans)
- d = average Interest rate on finance lease (corporate loans)
- e = average Interest rate on overdraft (retail loans)
- f = average Interest rate on term loans (retail loans)
- g = average Interest rate on credit cards (retail loans)
- h = average Interest rate on mortgage finance (retail loans)
- Z = maximum returns on loans and advances

4.3. Derivation of the constraints

This study obtained the interest rates for different loan types from the Central Bank of Nigeria annual monetary and credit policy guidelines as well as the displays on the interest board of First Bank Holdings (Nig) Ltd as at the last operations day of December 2019 and insider information. Table 3 contains the different rates charged by FBN on loans in 2019.

Table 3: Interest rate charged by FBNH for 2019

S/N	Loan Class	Loan Type	Loan Tenor	Average interest rate %
1	Corporate Loans	Overdraft	Current	40
		Term loans	Non-current	35
		Project finance	Non-current	25
		Finance lease	Non-current	19
2	Retail Loans(Nm)	Overdraft	Current	37.5
		Term loans	Current	27.5
		Credit cards	Current	30**
		Mortgage finance	Non-current	20

Source: Author's compilation from First Bank Holdings PLC Annual Reports for 2019 and the CBN monetary policy guidelines (2019).

**Interest on credit card loans is 2.5% monthly summing up to 30% per annum

Return on loans is tied to the rate of interest charged on each loan type. Therefore, to determine the maximum return from First Bank loan portfolio for 2019, the following objective function is formed:

$$\text{Max } Z = 0.4X1 + 0.35X2 + 0.25X3 + 0.19X4 + 0.375X5 + 0.275X6 + 0.30X7 + 0.2X8 \dots (5)$$

4.4. Formulation of Constraints for 2019

The monetary and credit guidelines by the CBN for 2019 specified that deposit money banks in Nigeria cannot give out more than 80% of their total deposits as loans and advances. This is a major constraint to the ability of the deposit money banks to give loans. Also, FBNH insider information reveals that corporate and retail loans are to be on the ratio 60:40 respectively. In addition, banks are expected by the CBN to give out loans on the ratio 45:55 percent for current and non-current loan respectively. These three constraints are modelled below:

4.4.1. Available Fund Constraints.

Figures from the annual reports and accounts of FBNH reveal that for the year 2019, total deposits amounted to N4,236,006. This implies that the bank was constrained not to give out more than 80% of N4,236,006 (N3,388,804.80) for the year. When these loan limits are taken cognizance of, the functions for each constraint is expressed as:

$$X1 + X2 + X3 + X4 + X5 + X6 + X7 + X8 \leq 3,388,804.80 \dots (6);$$

(Allowable loan constraint for 2019)

4.4.2. Corporate/ Retail Loans Constraints

The ratio of corporate to retail loans that FBNH PLC could give out is 60:40 according to insider sources. This makes the maximum loan for corporate and retail purposes N2,033,282.88 and N1,355,521.90 respectively. Hence, corporate/retail loans constraints are expressed as:

$X1 + X2 + X3 + X4 \leq 2,033,282.88$(7): Corporate loan constraint

$X5 + X6 + X7 + X8 \leq 1,355,521.92$(8): Retail loan constraint

4.4.3. Current/ Non-Current Loan Constraints

The ratio of current to non-current loans that FBNH PLC could give out is 45:55 according to the Central Bank of Nigeria. This makes the maximum loan for current and non-current purposes N1,524,961.82 and N1,863,842.98 respectively. Hence, in accordance with the grouping of loans in Table 3, current and non-current loans constraints are expressed as:

$X1 + X5 + X6 + X7 \leq 1,524,961.82$ (9): Current loan constraint

$X2 + X3 + X4 + X8 \leq 1,863,842.98$ (10): Non-current loan constraint

Combining the objective function, constraints and non-negativity conditions of the variables, the LP model can be stated thus:

Max Z =

$0.4X1 + 0.35X2 + 0.25X3 + 0.19X4 + 0.375X5 + 0.275X6 + 0.30X7 + 0.2X8$(11):

(Objective function)

subject to:

$X1 + X2 + X3 + X4 + X5 + X6 + X7 + X8 \leq 3,388,804.80$..(12); (Available fund constraint)

$X1 + X2 + X3 + X4 \leq 2,033,282.88$ (13): Corporate loan constraint

$X5 + X6 + X7 + X8 \leq 1,355,521.92$ (14): Retail loan constraint

$X1 + X5 + X6 + X7 \leq 1,524,961.82$ (15): Current loan constraint

$X2 + X3 + X4 + X8 \leq 1,863,842.98$ (16): Non-current loan constraint

Where: $X_{ij} \geq 0$; $i = 1 \dots 8$ and $j = 1 \dots 8$ (17): (Non-negativity conditions)

4.5. Determining the optimal loan portfolio

Operation researchers have, over the years, developed statistical packages to solve LP problems and generate optimal solutions. To determine the optimal loan portfolio of FBNH PLC for 2019, we shall format the LP model (equations 11-16) to make it examinable on LP analytical technique-LINGO. The formatted equations 11-16 comprising the objective function and the constraints will now be arranged thus:

$Max Z = 0.4X1 + 0.35X2 + 0.25X3 + 0.19X4 + 0.375X5 + 0.275X6 + .30X7 + 0.2X8$..18

Subject to:

$$X1 + X2 + X3 + X4 + X5 + X6 + X7 + X8 < 3388804.80 \dots\dots\dots 19$$

$$X1 + X2 + X3 + X4 < 2033282.88 \dots\dots\dots 20$$

$$X5 + X6 + X7 + X8 < 1355521.92 \dots\dots\dots 21$$

$$X1 + X5 + X6 + X7 < 1524961.82 \dots\dots\dots 22$$

$$X2 + X3 + X4 + X8 < 1863842.98 \dots\dots\dots 23$$

End

Using the LINGO simplex LP solution software to solve the model generates the results in Table 4:

Table 4: Results of Linear Programming Model

Global optimal solution found.			
Objective value:	1228442.		
Infeasibilities:	0.000000		
Total solver iterations:	3		
Elapsed runtime seconds:	0.09		
Model Class:	LP		
Total variables:	8		
Nonlinear variables:	0		
Integer variables:	0		
Total constraints:	6		
Nonlinear constraints:	0		
Total non zeros:	32		
Nonlinear non zeros:	0		
	Variable	Value	Reduced Cost
	X1	169439.9	0.000000
	X2	1863843.	0.000000
	X3	0.000000	0.1000000
	X4	0.000000	0.1600000
	X5	1355522.	0.000000
	X6	0.000000	0.1000000
	X7	0.000000	0.750000E-01
	X8	0.000000	0.1250000
	Row	Slack or Surplus	Dual Price
	1	1228442.	1.000000
	2	0.000000	0.3250000
	3	0.000000	0.250000E-01
	4	0.000000	0.000000
	5	0.000000	0.500000E-01
	6	0.000000	0.000000

Source: Author's computation via LINGO (2021)

Table 4 reveals the optimum feasible solution from the analysis of the LP model on FBNH loan portfolio for 2019. This solution shows that the bank should grant loans as follows to achieve maximum returns:

- $X1 = N169,439.9m$ (Overdraft, corporate class, current)
- $X2 = N1,863,843m$ (Term loans, corporate class, non – current)
- $X3 = N0.00$ (Project finance, corporate class, non – current)
- $X4 = N0.00$ (Finance lease, corporate class, non – current)
- $X5 = N1,355,522m$ (Overdraft, retail class, current)
- $X6 = N0.00$ (Term loans, retail class, current)
- $X7 = N0.00$ (Credit card loans, retail class, current)
- $X8 = N0.00$ (Mortgage finance, retail class, current)

From above, it is evident that only credit to three loan types/class and tenor will ensure optimality in the portfolio of FBNH for 2019. The combination of these loans will bring a maximum revenue of N1,228,442m. However, from the annual reports of the bank for the year 2019, FBNH still advanced loans for other purposes apart from these three. The optimal solution in Table 4.3 reveals that the bank reduced the optimal solution figure by N0.100m, N0.160m, N0.100m, N0.075m and N0.125m by giving loans for project finance (corporate customers), finance lease (corporate customers), term loans (retail customers), credit cards (retail customers) and mortgage finance (retail customers) respectively.

For optimal solution to subsist, the slack or surplus values must not have negative values, and it is evident from Table 4 that there are no negative surplus values. This also implies that all the variables satisfy the equality constraints.

4.4. Interpretation of Results

The findings from the analysis of the LP model in section 4.4 confirm that FBNH could have maximized its revenue from its loan portfolio if it had granted loans as shown in Table 5.

Table 5: Optimal Loan Portfolio of FBNH for 2019

S/N	Loan Class	Loan Type	Loan Tenor	Loan Amount (Nm)
1	Corporate Loans	Overdraft	Current	169,439.9
		Term loans	Non-current	1,863,843
		Project finance	Non-current	0
		Finance lease	Non-current	0
2	Retail Loans(N)	Overdraft	Current	1,355,522
		Term loans	Current	0
		Credit cards	Current	0
		Mortgage finance	Non-current	0
	Total			N3,388804.90

Source: Author's compilation (2021)

We shall now insert the optimal solution into the original objective function to estimate the revenue of FBNH from loans and advances for 2019 thus; inserting these optimal solutions into the objective function, we have:

$$Z = 0.4(169,439.9) + 0.35(1,863,843) + 0.25(0) + 0.19(0) + 0.375(1,355,522) + 0.275(0) + 0.30(0) + 0.2(0) = N1,228,442 \dots\dots\dots(24)$$

Hence, the maximum revenue of FBNH from loan and advances in 2019 should have been N1,228,442. Even if we assume that all the gross earnings available to FBNH in 2019 were from loans and advances (which was not true) the gross earnings recorded in the FBNH financial statements for 2019 (N583,477) is far behind the optimal solution value of N1,228,442. It should however be noted that the bank only advanced about N2,069,286 (Table 2) of the total available fund for loan for the year (N3,38804.90m), which was about 61%. This actually implies that the bank did not achieve optimal solution in its 2019 loan portfolio management.

5. Conclusions and Research Limitations

This study analysed the data of First Bank Nigeria Holdings PLC (FBNH) for the year 2019 using linear programming models to determine the optimal loan portfolio that will ensure maximum returns. The holding company operated a loan portfolio comprising of corporate and retail loans on one hand and current and non-current loans on the other. The loan types include overdraft, term loans, project finance, finance lease, credit cards and mortgage finance. The study obtained the interest rates charged on these different loan types from the Central Bank of Nigeria annual policy guidelines for 2019, Annual reports of FBNH as well as the bank's insider sources. A linear programming model that includes the objective function and the constraints were developed for the purpose of determining the bank's optimal loan portfolio for the year.

Findings from the analysis revealed that in the year 2019, FBNH operated a loan portfolio that returned far below the optimal level probably because it granted loans and advances below the statutory loan-deposit ratio of 80% for the year. This study concludes that FBNH could still have performed better. However, the sub-optimal performance of FBNH can be attributable to the legal frameworks that regulate the Nigerian banking industry. Nigerian deposit money banks are subject to rigid regulations that limit how and where loans and advances can be granted. For instance, there are statutory policies that guide volume, cost and direction (sector) of loans.

However, this study is limited by the underlying assumptions that form the basis for deriving optimal feasible solution for FBNH loan portfolio for 2019. Many of the assumptions underlining linear programming are unrealistic and impracticable. It is essential to know that institutional, social and human factors affect decisions in firms and some of these factors may be difficult to express quantitatively because they cannot be linearly stated. Another limitation of the study is the secrecy that surrounds

banks' operations, especially with respect to interest rates they charge on loans and advances. Information regarding actual interest rates on loans is usually regarded as firm secrets which are highly protected and there exists no means to authenticate that the rates specified by insider information can be generalized. This study therefore suggest that further studies be conducted on current or expected figures to determine optimal loan portfolio for the current or future period rather than on historic figures. This study is limited in that it only analysed historical data of a period that decisions have already been made.

The study therefore recommended that in order for banks to be able to prepare for optimality in their loan portfolios given some constraints, banks should be able to make reliable forecasts based on linear programming models. Also, more efforts should be put in place by the management of Nigerian deposit money banks in order to achieve the desired optimal loan portfolio so that the banks can further consolidate their liquidity position. In all, the directors of the Nigerian deposit money banks should strive to attain a reasonable balance between their loan risk and returns garnered from lending in order to maximize their shareholders value which is a core objective of every firm.

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