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DETERMINANTS OF MORTGAGE LOAN APPROVAL IN BANKS IN A DEVELOPING COUNTRY: EVIDENCE FROM NIGERIA

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Abstract: Green This article is aimed at investigating the determinants of mortgage loan approval in developing countries, employing the binary probit model. Loan approval was made the response variable while deposit, amount to borrow, lending rate, gratuity, capacity to pay the loan and character of the borrowers stood as the explanatory variables. Cross-sectional data were collected from the four top banks in Nigeria. The result showed that all the variables had the correct signs but only the capacity to pay the loan has a significant impact in determining the success of mortgage loan approval. Collectively, all the variables have significant power to determine mortgage loan approval. It is therefore suggested that prospective borrowers should ensure that they have all it takes to refund the loan they wish to obtain from commercial banks.

Keywords: Bank loan; Loan approval; Logit model; Probit model.

JEL Codes: B23, G19, G21.

1. Introduction

Mortgage finance is an important aspect of implementing housing scheme development in housing markets in Nigeria. The housing sector is very essential to the country's wealth of the citizenry and provides available shelter for individuals (CBN, 2013). The shelter is one of the basic provisions needs of life that everyone desires to get. However, since the early 1970s, the provision of housing development

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has attracted the attention of most developing countries, especially for quite several reasons. The reasons may include the provision of infrastructure, development of the housing market and job creation. In the last five years, the real estate and construction sector has contributed about 1.82 percent to the growth of the real Gross Domestic Product (CBN, 2013). The government at both the federal and state level has implemented various policies in a bid to improve the sector. However, with all the progress being made by both the government and private organization sectors to provide affordable accommodations, the potential of the Nigerian to benefit from this opportunity remains mostly unused due to several constrained by qualitative factors.

The term "mortgage" is a loan frequently related to real estate. The word has been dated back to the old French language meaning "death" (mort) "contract" or "pledge" (gage) (Adebamowo et al., 2012). A mortgage enables both firms and individuals to buy and possess real estate without immediately making payment for the full possession of the property from their income. It is also noted that a mortgage like any other loan required a fixed time to maturity, a definite loan to be fully repaid. In finance and economics, a mortgage is a contract in which a person or entity borrows money from a lender (financial institution) to buy a property and promises the same property to possess or repay the money.

The management theory of Abraham Maslow's theory of needs on shelter is globally recognized as one of the main provisions of human life and is an important main profitable asset in every nation. No doubt, accommodation is one of the necessities of man. It was ranked second after food in the hierarchy of man's needs in Abraham Maslow's theory of management (Agbada & Ekakitie-Emonena, 2016). Therefore, the importance of housing to human life led to the establishment of the Nigeria Building Society (NBS) in 1956 which was later transformed into the Federal Mortgage Bank of Nigeria (FMBN) in 1977 and Primary Mortgage Banks (PMBs) in 1989 was later changed to Primary Mortgage Institution (PMIs) (Uroko, 2012). Furthermore, the National Housing Fund (NHF) which is to date managed by the FMBN was set up to provide effective and affordable housing funding to low wages earners. In 2013, the Nigeria Mortgage Refinance Company (NMRC) was established to encourage the accessibility and affordability of housing to an individual in Nigeria by providing liquidity in the mortgage market via financial institutions (Adedokun, et al., 2011).

In Nigeria, the effectiveness of most mortgage finance policies rests on the shoulders of PMBs given the vital roles they play in providing mortgage lending facilities in the economy (Agbada & Ekakitie-Emonena, 2016). This is so because in the course of their operations, the PMBs just like other financial institutions are affected by credit and operational losses that eventually threaten and negatively affect shareholder funds, capital adequacy, and performance in turn threaten both customer

funds and mortgage lending activities of banks due to shortage of funds and their disposal leading to bank failure and crises.

In the 2010 banking reforms, Primary Mortgage Institutions (PMIs) were classified as specialized financial intermediaries set up mainly for the provision of mortgage finances for the building of homes and likes. Sanusi (2003) confirmed that PMIs were to gather savings from the public and grant housing loans to individuals who intend to borrow for building a house. The agreement is based on the reality that the mortgagor will pay back his debt as stipulated but in the case of a default, the property will be taken over or seized from him.

Many Africans wish to have a house of their own but the money they have in their accounts may not be adequate to guarantee them such an opportunity, therefore, they aspire to obtain mortgage loans which would be spread over a period. Many customers wish to have this window granted to them but do not have enough ideas on the components that will make them have a successful loan approval for owning a house to themselves, thus, their loan requests are turned down. Some people, who have worked for thirty-five years of service, would be unable to own a building of their own, even though, they wished to. Therefore, the main questions that are raised are what are the determinants of mortgage loan approval in developing countries? Using the available metrics with commercial banks, are they significant factors to measure the success of loan applications for mortgage purposes? These are the paramount problems this study wishes to address. Some theories have been discussed but majorly, the factors that determine the success of loan approval could be very important to prospective borrowers.

The article is prepared as follows. Part two is earmarked to review the relevant literature. Variables, data and techniques of analysis are presented in Part Three, while Part Four is set aside to showcase the methodology of the study. Results got to come up in Part Five. Part six presents the conclusions.

2. Literature review

All Nigerian banks today offer mortgage loan facilities through their subsidiaries. Some mortgage institutions operating in Nigeria require that an applicant has a minimum salary requirement of N300,000 or N500,000 in a year to be considered eligible for the loan facility (Uroko, 2012). There are basic requirements for accessing a mortgage facility in Nigeria, these include an application from the mortgage, a letter of introduction from your employer to prove you are an employee of the company, a copy of various documents of property you want to buy, bank account statement for last 6 to 12 months e.t.c.

2.1. Theoretical review

In theoretical review, the main theory that underpins this study is the Agency theory of the Classicals in organizational economic literature originally proposed by Ross (1973). It describes a two-party connection whose aims are not compatible with each other. It aims at specifying the best agreements and the circumstances under which such agreements may help to reduce the consequence of goal mismatch. The main suppositions are that man is a self-centered individual, limitedly lucid and sensible and risk-averse, and the theory could be applicable at individual and organizational stages.

Lien theory is a financing standard that reserves a title deed from a lending banker (Mortgagee) via a mortgage contract. The theory states that the borrower holds the title of the said property until the total debt is paid off. This implies that the right of transfer of ownership remains with the owner until the debt is paid. This theory is indicating the ability or capacity to pay the loan since the borrower already has sufficient property to stand in for an amount borrowed in case he could not redeem his loan at the specified time.

Title Theory of Mortgage adopts that the deed of property does not stay with the mortgagor until the mortgage loan is completely refunded (Anidiobu et al., 2018). This theory also points at capacity in line with the Lien theory. The only difference is where the title deed will be kept while the debt is being settled.

The capacity to pay a loan is a very important factor that determines the success of a particular loan application (Ward, 2022). This, according to Ward, could consist of different variables considered by banks such as the capacity to pay at least two years of personal and business tax returns, personal financial statements personal or business profit and loss, and balance sheet statements, which would majorly support the capacity to pay back the loan.

The character of the borrower is apt. According to Small Business Resources under the Bank of America, the character of the borrower could also determine the success of loan approval (Ward, 2022). Such character the lender will consider could be the borrower's work experience, personal credit (deposit/savings) history, integrity and good standing.

2.2. Empirical review

Empirically, Muhammad et al. (2021) reviewed empirical literature concerning the association between loan size, interest rate, borrowers' attitude, loan tenure, among others, and loan repayment among small and medium enterprises in Nigeria, using the method of desk review. Their findings revealed that all the variables have a significant association with loan repayment in Nigeria (Muhammad et al., 2021).

Ademosu and Morakinyo (2021) examined the correction among capital, monetary instruments, inflation and access to loans by small and medium enterprises in the

Nigerian economy. With a dataset from 1995 to 2019 and employing an ARDL technique, their findings revealed that all the variables displayed a significant influence on access to loans by these enterprises, however, the capital market has more influence. The main issue with this analysis is that the variables were not placed on equal measurement by taking their natural logarithm. Some variables like interest rate and inflation were in rates while some were in their real form like loans to small and medium enterprises and market capitalization.

Huan et al. (2020) studied bank-specific and macroeconomic factors' effect on credit risk in conventional banks in Malaysia. Using the Ordinary Least Squares technique, they found out that, among other variables, bank size and capital adequacy have a negative significant effect on credit risk but the rate of return and bank performance had no significant impact on credit risk (Huan et al., 2020). However, the work of Huan et al. does not address the factors that could determine loan approval in such developing countries.

In Nigeria, Sanni et al. (2020) scrutinize the factors that influence bank performance using data from seventeen banks from 2012 to 2018. They used the generalized method of moment to find out that macroeconomic variables have a significant impact on bank performance proxied with risk-neutral and risk-adjusted measures.

In an attempt to specifically study some variables that intuitively affect bank credit as a whole, Oyebowale (2020) scrutinized the effect of growth in loan-to-deposit ratio, growth in price level and money supply on bank lending with a data set between 161 and 2016, using the ARDL model and Granger Causality test. His finding showed that only growth in money supply causes growth in bank lending in Nigeria. It also showed that while all other variables used in the study have a significant effect on bank lending, only growth in bank capital could not have any significant influence (Oyebowale, 2020). However, this study is broad and not specific to mortgage loan approval and its success in developing nations.

To be more specific, Olawumi et al. (2019) examined the factors that determine the accessibility of mortgage finance in Lagos State of Nigeria. The data set employed factor analysis and the Mann-Whitney U test. Their results divulged that income, nature of the occupation, type of collateral, years of the banking relationship, loan duration and loan sector are factors affecting access to mortgage finance (Olawumi et al., 2019). The study of Olawumi et al. is quite similar, but the difference ranged from the method used in the work to the variables that stood as the explanatory variables.

In a study of another developing country, Emma (2019) used variables like the amount of loan, credit risk, bank size, the volume of deposits, interest rate and collateral offered as determinants of loan volumes among commercial banks in Kenya with a five-year data set from 2014 to 2018. Results confirmed that bank size, liquidity and volume of deposits had a direct significant effect on loan volumes.

However, credit risk and interest rates had a negative and insignificant effect on loan volumes (Emma, 2019). The study was on loan approval generally but not specific to mortgage loans.

In 2017, Hadyan et al. (2019) made researched the factors that affect the consumer credit of non-performing loans of Bank XYZ in Indonesia, using a logistic regression model on variables like gender, age, marital status, education, occupation, tenor and collateral value. Their finding revealed that gender, education, occupation and tenor affected the NPL of XYZ Bank's consumer credit at a 10% significant level (Hadyan et al., 2019). With the 10% level of significance, which is mostly not acceptable in management and social sciences, it could be interpreted as not being significant at the accepted 5% level.

In Tanzania, Ngonyani and Mapesa (2019) investigated the effect of credit collection policy on portfolio risk management by employing cross-sectional survey data in three regions of the country. Using a linear regression method, their findings showed that while interest rate changes have a direct influence on portfolio risk management, the grace period on loan and size have an inverse effect.

Anidiobu et al. (2018) considered the impact of mortgage institutions on housing investment in Nigeria between 1992 and 2016. Using Ordinary Least Square (OLS) and Johansen co-integration test, the finding also revealed that mortgage deposits had a direct and significant influence on housing delivery in Nigeria, however, mortgage loans indicated an inverse effect on housing delivery and the effect was not significant in Nigeria (Anidiobu et al., 2018).

In Malaysia, Adzis et al. (2018) examined the effect of macro-prudential policy quota on lending behaviors between 2005 and 2014. Using random effects estimation, the findings established that bank size and volume of deposits directly affect the lending behaviors of the commercial bank, while liquidity adversely affects the lending behaviors. Moreover, the results also revealed that the macro-prudential policy quota put in place to alleviate indebtedness was insignificant to lending activities in Malaysia (Adzis et al., 2018).

Mukhtarov et al. (2018) analyzed the impelling elements determining credit risk banks in Azerbaijan. Using yearly data between 2010 and 2015 and the Panel Logit method, findings showed that capital adequacy ratio, interest rate and total assets have an inverse impact on credit risk, while there was a direct relationship between the unemployment rate and the credit risk of banks in Azerbaijan (Mukhtarov et al., 2018). Mukhtarov et al. made use of time series data with evidence from Azerbaijan while this present study employed cross-sectional data with evidence from Nigeria.

Employing the OLS method, Yinusa et al. (2017) scrutinize the effect of mortgage financing on housing development in Nigeria from 1992 to 2015. The result of the study disclosed that the ratio of Microfinance Bank loans to mortgage has an inverse effect on housing development, but mortgage loans to mortgage have a significant

positive impact on housing development in Nigeria. Also, there was a non-significant positive effect of government allocation to housing on housing development in Nigeria (Yinusa et al., 2017). This study is also similar but quite different in many areas such as the data set, the main focus of the study and the technique of analysis.

In Vietnam, Nguyen and Wolfe (2016) employed OLS and Logit techniques to empirically examined factors influencing access to SME loans from a survey of 20 banks and 180 SMEs. Among other variables, the findings specified that collateral and relationship lending have positive impacts on successful access (Nguyen & Wolfe, 2016).

In Bosnia and Herzegovina, Sanela and Adisa (2016) explored the effect of macroeconomic forces on loan repayment between 2000 and 2014. Using a simple regression tool, they found out that macroeconomic variables like unemployment and consumer price index, among others, have a significant influence on loan repayment in the two countries. However, the authors used time series but did not check for stationary data before running the analysis. This could lead to spurious analysis and results.

Rodean and Baltes (2016) investigated the influence of inflation and exchange rates on bankruptcy rates in Romania, using the agriculture sector as a case study for a period of four years. Employing a multiple regression tool, they found out that inflation has a significant inverse influence on bankruptcy while the exchange rate has a direct effect and it was also significant. The result also revealed that both variables accounted for a 99.9% variation in bankruptcy rate. The main issue of the study is a spurious analysis which is very dangerous and misleading. The authors did not carry out any trend analysis to stationalise the data since they have used time series. The dataset was also small for proper analysis.

In Ghana, Adoah (2015) considered what determines lending rates in universal banks using a panel estimation tool. The outcome of the study revealed that policy rate, exchange rate, treasury bill rate, GDP, inflation, Bank size and HHI are the main factors affecting Ghana (Adoah, 2015).

Pham (2015) examined the factors contributing to bank credit facilities in a large data set covering 146 countries between 1990 and 2013 period. Employing the GMM technique, the results offered that the well-being of the local banking system plays a pertinent role in improving bank lending. The reliance on foreign capital inflows into a country could cause its domestic banking sector to be more vulnerable to external tremors (Pham, 2015).

Most similar work in developing countries is that of Kariuki (2015) who considered the determinants of mortgage approval in Kenya using a drawn population of forty-three registered banks and a sample of twenty mortgage lending institutions and commercial banks which have the most mortgage accounts in the country. Using the regression method, the findings disclosed that the several determinants of mortgage

approval including property prices, interest rates, level of income, the mortgage process, and the size of the bank, among others, have a significant impact on mortgage approval in Kenya (Kariuki, 2015). The technique of analysis is the main issue here and made it different from this present study.

Olumuyiwa et al. (2012) studied the causes of the lending behavior of commercial banks in Nigeria, employing a Co-integration analysis from 1975 to 2010. The findings of the study showed while loans and advances and volume of deposits, Foreign exchange, GDP and cash reserve have a positive relationship with lending behavior, Investment portfolio and lending rate have a negative relationship. The result also concluded that there existed a long-run association between the dependent and determinant variables (Olumuyiwa et al., 2012).

From the available extant literature reviewed, there is a paucity of literature on determinants of mortgage loan approval in developing countries especially with the use of the linear probability technique for analysis, using a cross-sectional data set.

3. Methodology and empirical data

For this study of investigating the determinants of mortgage loan approval in developing countries, the limited dependent variable model is adopted since the dependent variable (mortgage loan approval) is dichotomous and thus the most appropriate is the use of logit and probit regression analysis depending on the result of the descriptive statistics from the data set. Therefore, the dichotomous nature of the dependent variable motivated the use of the linear probability model as the technique of analysis.

Adapting the study of Nguyen and Wolfe (2016) and the limited probability model of Zitikyte (2022), this study has its specification with mortgage loan approval (Loan approval) as the dependent variable while the determinant variables are the deposit of borrow (Deposit), amount of capital to borrow (Amount), lending rate of the bank (Lending rate), access to gratuity by the borrower (Gratuity), capability to refund (Capacity) and character of the borrower (Character). Thus, the model is specified as:

$$Loan\ Approval = f(Deposit, Amount, Lending\ rate, Gratuity, Capacity, Character) \ldots\ldots\ldots(1)$$

$$P\left(\left(Loan\ Approval = \frac{1}{x}\right) = \alpha_0 + \alpha_1 x_{Deposit} + \alpha_2 x_{Amount} + \alpha_3 x_{Lending\ rate} + \alpha_4 x_{Gratuity} + \alpha_5 x_{Capacity} + \alpha_6 x_{Character} + \mu_i \ldots\ldots\ldots\

represents the amount of capital to borrow and $x_{Lending\ rate}$ is the lending rate of the bank. The variable $x_{Gratuity}$ stands for access to gratuity by the borrower which is a dummy, 1 if he has access to gratuity and 0 if not. $x_{Capacity}$ and $x_{Character}$ are also dummies with 1 if the borrower can refund the loan and if the borrower has excellent character and 0 if otherwise.

Thus, the logistic model is specified as:

$$L_i = \ln\left(\frac{P_i}{1-P_i}\right) = f(\alpha_0 + \alpha_1 x_{Deposit} + \alpha_2 x_{Amount} + \alpha_3 x_{Lending\ rate} + \alpha_4 x_{Gratuity} + \alpha_5 x_{Capacity} + \alpha_6 x_{Character}) \quad \text{.....(3)}$$

In a similar vein, the *probit* model is specified as:

$$L_i = f(\alpha_0 + \alpha_1 x_{Deposit} + \alpha_2 x_{Amount} + \alpha_3 x_{Lending\ rate} + \alpha_4 x_{Gratuity} + \alpha_5 x_{Capacity} + \alpha_6 x_{Character}) \quad \text{.....(4)}$$

For the two models, the a priori expectations are similar. The more the deposit (x_Deposit) a customer has with a bank that he wants to obtain a mortgage loan, the more the likelihood of his loan (L_i) being approved. Thus, it is expected to have a positive sign. When the amount (x_Amount) of money to borrow is small, the chance of loan approval is high since it is easier for the bank to give out the loan, therefore, it is expected to have a negative sign. When the lending rate (x_(Lending rate)) is low, it becomes unattractive to banks and so, a low likelihood of loan approval because of the low motivation to grant the loan. Hence, the sign is expected to be positive. When a customer has access to gratuity (x_Gratuity) in his workplace, he has more chance for his loan to be approved, thus, a positive sign is expected. If a borrower is capable (x_Capacity) to refund the mortgage loan, there will be a high chance for his loan application to be approved, hence, a positive sign is expected. Lastly, excellent character (x_Character) will drive mortgage loan approval, and so, a positive sign is expected for this variable as well.

4. Empirical results

4.1 Descriptive statistics

The analysis starts with descriptive statistics of the dependent variable, LOAN_APP in line with equation 1 of the model specification. The result is presented in Table 1.

Table 1 Result of descriptive statistics

	LOAN_APP
Mean	0.5217
Median	1.0000
Maximum	1.0000
Minimum	0.0000

Std. Dev.	0.5032
Skewness	-0.0871
Kurtosis	1.0076
Jarque-Bera	11.5002
Prob	0.0032
Sum	36.0000
SumSq. Dev.	17.2173
Observations	69

Source: Authors' Computation, 2023.

The concern is on the Kurtosis result which shows a value of 1.0076. The rule of thumb is that when the dependent variable is leptokurtic (more than approximately 3.0), the logit model is preferred, but when it is mesokurtic (3.0), the probit model is preferred. This rule is with the general background condition that the observations are unbalanced, i.e. the number of observations of Dep=0 is not the same as those of Dep=1, as shown in Tables 4 and 5. From Table 1, the kurtosis value is 1.0076 and could not be interpreted using this rule of thumb, therefore the other rule of lowest Akaike, Schwarz and Deviance criteria would be employed to make a selection after analyzing using the two models.

4.2 Correlation matrix

The pairwise correlation matrix is presented in Table 2. Being more particular in column 2 from the left, all the variables have a positive relationship with the LOAN_ APP application with CAPACITY having the highest correlation coefficient. Also, the DEPOSIT of customers and AMOUNT to borrow are highly correlated with a value above 0.8 (0.84).

Table 2 Results of the correlation matrix

	LOAN_ APP	DEPO SIT	AMO UNT	LENDING_ RATE	GRATU ITY	CAPAC ITY	CHARAC TER
LOAN_APP	1.0000						
DEPOSIT	0.3456	1.0000					
AMOUNT	0.2930	0.8424	1.0000				
LENDING_ RATE	0.3573	0.2949	0.2773	1.0000			
GRATUITY	0.3639	0.3367	0.1194	0.2250	1.0000		
CAPACITY	0.8006	0.3679	0.3094	0.3571	0.2692	1.0000	
CHARACT ER	0.6813	0.3901	0.3095	0.3705	0.3086	0.4794	1.0000

Source: Authors' Computation, 2023.

Since the probit/logit model is a nonlinear and not an Ordinary Least Squares method, the two variables could remain in the model without any fear of multicollinearity.

4.3 Principal component analysis (PCA)

The essence of PCA in this study is to reduce dimensionality in the model, where less valued variables are removed from the model before the main analysis is carried out. Table 3 presents the result of the Principal Component Analysis (PCA) through its eigenvalues, which revealed that CHARACTER has the list value. Gratuity is also low and could not be backed with enough theory in literature, and thus, the study decided to remove duo from the explanatory variables.

Table 3 Results of principal component analysis

Eigenvalues: (Sum = 7, Average = 1)					
Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion
1	3.377474	2.128655	0.4825	3.377474	0.4825
2	1.248819	0.418372	0.1784	4.626293	0.6609
3	0.830447	0.083093	0.1186	5.456741	0.7795
4	0.747355	0.225357	0.1068	6.204095	0.8863
5	0.521998	0.361644	0.0746	6.726093	0.9609
6	0.160354	0.046802	0.0229	6.886448	0.9838
7	0.113552	---	0.0162	7.000000	1.0000

Source: Authors' Computation, 2023.

The values and proportions of CHARACTER (0.11 & 0.02) and GRATUITY (0.52 & 0.07) as shown in Table 3 are quite low. More so, theories supporting these variables are scanty.

4.4 Binary probit analysis

Since the conditions for the choice of binary probit analysis could not be met as the descriptive statistics in Table 1 indicated, Tables 4 and 5 present the results of binary logit and probit analysis of equations 3 and 4 with only four explanatory variables. These analyses would be compared with the Akaike, Schwarz and Deviance criteria.

Table 4 Results of binary probit analysis

Included observations: 69				
Convergence achieved after 8 iterations				
Coefficient covariance computed using observed Hessian				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-1.3408	0.3590	-3.7347	0.0002
DEPOSIT	0.0749	0.1089	0.6882	0.4913
AMOUNT	0.0781	0.1090	0.7165	0.4737
LENDING_RATE	-0.0002	0.0210	-0.011	0.9911
CAPACITY	2.4321	0.4700	5.1747	0.0000
McFadden R^2	0.5696	Mean dependent var		0.5217
S.D. dependent var	0.5032	S.E. of regression		0.3098
Akaike info criterion	0.7407	Sum squared resid		6.1427
Schwarz criterion	0.9026	Log-likelihood		-20.5551
Hannan-Quinn criter.	0.8050	Deviance		41.1103
Restr. deviance	95.5238	Restr. log-likelihood		-47.7619
LR statistic	54.4136	Avg. log-likelihood		-0.2979
Prob(LR statistic)	0.0000			
Obs with Dep=0	33	Total obs		69
Obs with Dep=1	36			

Source: Authors' Computation, 2023.

4.5 Binary Logit analysis

As stated in 4.4, the results of binary logit analysis from equation 3 are presented in Table 5 for the sake of comparison and making choices.

Table 5 Results of binary logit analysis

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-2.262201	0.657864	-3.438706	0.0006
DEPOSIT	0.113227	0.173488	0.652652	0.5140
AMOUNT	0.111754	0.184843	0.604588	0.5455
LENDING_RATE	0.004936	0.041231	0.119717	0.9047
CAPACITY	4.156474	0.895447	4.641787	0.0000
McFadden R^2	0.566325	Mean dependent var		0.521739
S.D. dependent var	0.503187	S.E. of regression		0.309004
Akaike info criterion	0.745309	Sum squared resid		6.110950
Schwarz criterion	0.907201	Log-likelihood		-20.71316
Hannan-Quinn criter.	0.809537	Deviance		41.42632
Restr. deviance	95.52384	Restr. log-likelihood		-47.76192
LR statistic	54.09752	Avg. log-likelihood		-0.300191
Prob(LR statistic)	0.000000			

Obs with Dep=0	33	Total obs	69
Obs with Dep=1	36		

Source: Authors' Computation, 2023.

This is because the condition for the outright use of the logit model could not be met, i.e. that the dependent variable must have a leptokurtic distribution. Thus, there is a need for the presentation (in Tables 4 and 5) of both analyses and a decision taken for a better model.

Using a summary of the three criteria, the rule holds that the lower the criterion, the better, it is observed that, all the three criteria choose the Binary probit analysis of Table 4 as the Akaike (0.7407), the Schwarz (0.9026) and Deviance (41.1105) are less than those of Binary Logit analysis in Table 5 with Akaike (0.7453), the Schwarz (0.9072) and Deviance (41.4263). Therefore, the study interprets the Binary probit model of equation 4 as analyzed in Table 4.

In Table 4, the coefficients of all four variables (DEPOSIT, AMOUNT, LENDING_RATE and CAPACITY) have the correct signs in line with the study's a priori expectation. This means that a unit increase in DEPOSIT and AMOUNT, on average, is more likely to increase the likelihood of mortgage LOAN_APP by banks. However, the probabilities (0.49 and 0.47) indicate very high values of 49% and 47% which denote that the two variables are not significant, even at a 10% level of significance.

The LENDING_RATE has a negative sign meaning that a low lending rate on loans, on average, increases the chance of mortgage loan approval by commercial banks. Nevertheless, the probability (0.99) shows an insignificant impact on the success of loan approval in developing countries. This result is in line with the findings of Emma (2019) with a negative sign and insignificant impact on the Kenyan economy.

Finally, the CAPACITY of borrowers to pay the loan shows a positive sign which indicates that the more the capacity of borrowers to pay, the higher the likelihood of loan approval by commercial banks. The probability of CAPACITY is 0.0000, which indicates a strong significance at a 1% level. This finding is supported by the result of Olawunmi et al (2019) in the Lagos state of Nigeria but is contrary to the findings of Hadyan et al (2019) in the Indonesian economy.

Still, in Table 4, the McFadden R-squared (0.5696) shows the coefficient of discrimination of the explanatory power of the independent variables. It indicates how predictable the model is in explaining the response variable. This is appreciably high showing that the model has above-average explanatory power. The LR statistics (54.09) is also high with a probability (0.0000) that indicates significance as well.

4.6 Diagnostic tests

4.6.1 Goodness of Fit test

Table 6 showcases the results of the test of goodness of fit using the Andrew and Hosmer-Lemeshow (H-L) test statistics. With 10 groupings based upon the predicted risk, the overall H-L statistics (8.936) show a small value which is desirable and a probability chi-sq of 0.3477 which implies that the null hypothesis (the model has a good fit) is accepted. Thus, it is concluded that the overall binary probit model has a good fit.

Table 6 Results of Andrews and Hosmer-Lemeshow (H-L) test

	Quantile of Risk			Dep=0		Dep=1	Total	H-L
	Low	High	Actual	Expect	Actual	Expect	Obs	Value
1	0.089	0.090	6	5.461	0	0.539	6	0.592
2	0.090	0.090	7	6.370	0	0.630	7	0.692
3	0.090	0.090	7	6.370	0	0.630	7	0.692
4	0.118	0.139	5	6.091	2	0.910	7	1.501
5	0.141	0.321	4	5.513	3	1.487	7	1.955
6	0.361	0.893	2	1.791	5	5.209	7	0.033
7	0.893	0.907	2	0.695	5	6.305	7	2.719
8	0.909	0.948	0	0.506	7	6.494	7	0.545
9	0.949	0.999	0	0.199	7	6.801	7	0.204
10	0.999	1.000	0	0.001	7	6.999	7	0.001
		Total	33	32.996	36	36.003	69	8.936
H-L Statistic			8.94		Prob. Chi-Sq(8)		0.348	
Andrews Statistic			36.56		Prob. Chi-Sq(10)		0.0001	

Source: Authors' Computation, 2023.

4.6.2 Collective significant test

Table 7 presents another measure to ascertain the significance of the explanatory variables, individually and collectively, using the Wald statistics test.

Table 7 Results of the Wald test

Test Statistic	Value	df	Probability
F-statistic	6.233906	(5, 64)	0.0001
Chi-square	31.16953	5	0.0000
Null Hypothesis: the C = 0			
	Value		Standard Error
C(1) loan approval	-1.3408		0.3590
C(2) deposit	0.0749		0.1089
C(3) amount	0.0781		0.1090

C(4) lending rate	-0.0002	0.0210
C(5) capacity	2.4321	0.4700

Source: Authors' Computation, 2023.

From the results in Table 7, the individual significance status of the variables, using the standard error, only capacity has a standard error lower than half its value and therefore, only capacity has a significant impact on the success of loan approval, while others do not have as indicated in their large standard errors.
However, the collective significant result of the F-statistics (6.234) and Chi-square (31.17) implies that the explanatory variables are significant at a 1% level as evident from their probability values (0.0001 and 0.0000).

5. Conclusions

This article is aimed at investigating the determinants of mortgage loan approval in developing countries, employing the binary probit model. Loan approval was made the response variable while deposit, amount to borrow, lending rate, gratuity, capacity to pay the loan and character of the borrowers stood as the explanatory variables. Cross-sectional data were collected from the four top banks in Nigeria. The result shows that all the variables had the correct signs but only the capacity to pay the loan has a significant impact in determining the success of mortgage loan approval.
This study concludes that the main determinant of mortgage loan approval by commercial banks in developing countries is the capacity of the borrower to pay back the loan while having savings (deposit), the amount to obtain as loan, the character of the borrower, interest rate and access to gratuity are not important (significant). However, the collective result showed that they are significant.
It is therefore suggested that prospective borrowers should ensure that they have the capacity to refund the loan they wish to obtain from commercial banks.

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Author Contributions

Abdurrauf Babalola and Suraj Ajagbe conceived the study and were responsible for the design and development of the data analysis. Abdurrauf Babalola was responsible for data collection and analysis and also for data interpretation. Suraj Ajagbe was responsible for the literature review section.

Disclosure statement

The authors have not any competing financial, professional, or personal interests from other parties.

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