FINANCIAL MARKET ENVIRONMENT AND EFFICIENCY OF MICROFINANCE BANKS IN NIGERIA

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Abstract
This study examines the efficiency of microfinance banks (MFBs) in Nigeria based on the financial market environment. The efficiency of MFBs is estimated using the DEA framework, while the market environment is considered with competition within the MFB sector and the entire financial system. The Tobit regression technique is used to estimate the impacts of a competitive financial environment on the efficiency of MFBs. The data used cover the period of 2010 to 2019 for 49 Nigerian Microfinance Banks. The study reveals a clear upward trend in the efficiency scores of the MFBs, although the gap between efficient and inefficient MFBs is found to be widening. Commercial-oriented MFBs are also found to be more efficient than social-oriented MFBs. Macroeconomic instability, external competition, and structural change in the economy are found to weaken the efficiency of MFBs, while the intra-sectoral competition, technology infrastructure, skills, and effective regulation boost efficiency. Also, factors that drive the efficiency of commercial-oriented MFBs are different from those that drive social-oriented MFBS. Policies that help to refocus MFBs towards the core social operations and improve their efficiency are recommended.

Introduction
Microfinance banks (hereafter referred to as MFBs) make up a small proportion of the financial sector in Nigeria. For instance, the share of MFB assets in total financial assets in the economy was 1.9 per cent in 2020 and 1.5 per cent in 2021. MFBs are however a crucial segment of the financial sector in Nigeria, given that their role extends beyond the traditional banking venture. This aspect of MFBs often negatively skews their operational space and efficiency in a complex financial environment in Nigeria. In the first place, the economic potential of the lower-class citizens (the largest proportion of MFBs' client base) tends to be diminishing due to macroeconomic shocks and instability (World Bank, 2017; Osakwe, 2019). This has shrunk the market for MFB services, especially in terms of loan administration in recent times. In the same vein, there is rising competition in the financial markets in recent years, with more innovative and technology-based financial services becoming more accessible to a wider spectrum of customers. The implication is an increase in the composition of factors that drive MFBs' efficiency.

There is a rising debate about the causes and consequences of the efficiency of MFBs given their unique functions and characteristics. In one direction, there is concern that increased efficiency may lead to MFBs receding from their crucial social goals and mission and focusing on attaining more commercial outcomes, especially in the long run (World Bank, 2017; Osakwe, 2019). On the other hand, there is the argument that increased efficiency within a competitive financial environment may act as a moderating factor in helping the MFBs to adjust and accommodate their social and financial goals more appropriately (Balkenhol, 2007; Thomas & Kumar, 2016; Wondirad, 2020).

The environment within which the MFBs operate has been dynamic and has constituted a major influence on the efficiency of these banks. For instance, Wondirad (2020) has shown that even for well-managed banks with effective supervisory frameworks, adverse developments in the macroeconomic environment can break down resilience with critical negative outcomes. This condition is more pronounced for MFBs since these banks are patronized by the poor or those with lesser capacity to withstand macroeconomic shocks (Mlachila et al, 2016). Moreover, the introduction of formal microfinance banking in Nigeria coincided with the era of a sharp upsurge in technological applications and uptake in the financial sector (CBN, 2019). This has forced the MFBs to embrace more technology-based innovations for performance enhancement and to remain competitive in the financial system. More recently, the emergence of financial technology companies (FINTECH) has revolutionalised the financial inclusion space in the country. Financial technology and digital banking services have expanded more rapidly within this period and have led to the evolution of more innovative avenues of distributing and delivering financial services. This has provided additional competition to the microfinance institutions in Nigeria.
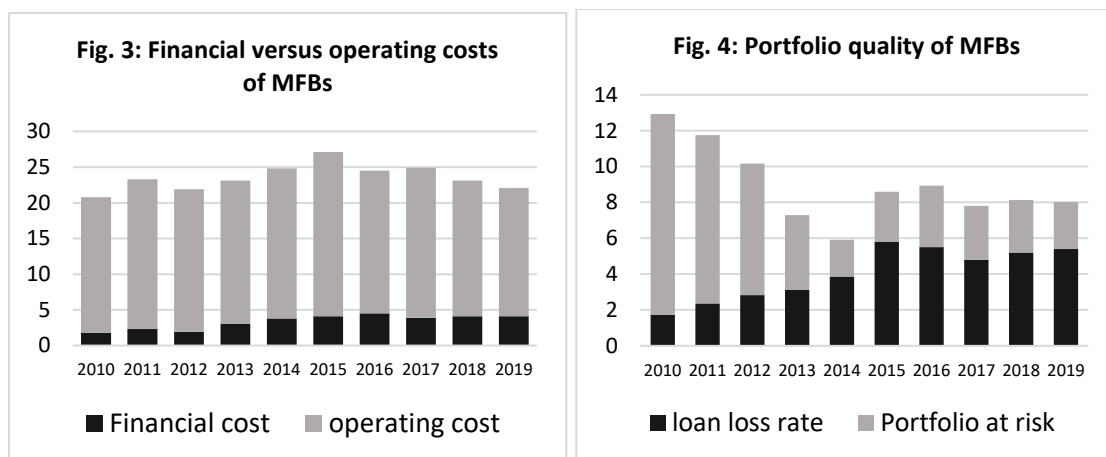
Essentially, the capability of MFBs to thrive in the financial environment in Nigeria and consistently perform their social and commercial functions requires considerable research. In this study, the effect of the financial market environment on the efficiency of MFBs is examined. The major question asked in this study is "How does a competitive financial environment affect the efficiency of MFBs in Nigeria?" In addressing these issues, the study initially highlights the characteristics of MFBs in Nigeria within the financial market, and then the measure of the efficiency of MFBs is presented and estimated. The factors that influence such efficiency are further estimated using a basic Tobit framework.

Generally, MFBs in Nigeria have grappled with distinctive characteristics of the financial market in Nigeria, especially in terms of competition with other financial institutions. Figures 1 and 2 show the comparison between loan-to-deposit ratios and liquidity ratios between MFBs and Commercial Banks (CB). Loan to deposit ratio of MFBs has far exceeded those of CBs since 2006, highlighting the rapid growth in loan outreach of the MFBS in recent years. It also shows that the credit services of MFBs have far outpaced saving mobilization. This is however a more risky trend of the MFBs in Nigeria. On the contrary, the liquidity of MFBs is lower than those of CBs since 2013, further highlighting the solvency risks that MFBs face in Nigeria.

Fig 1: Loan-to-deposit ratio (MFBS vs CBs)

Fig. 2: Liquidity ratio (MFBs vs CBs)
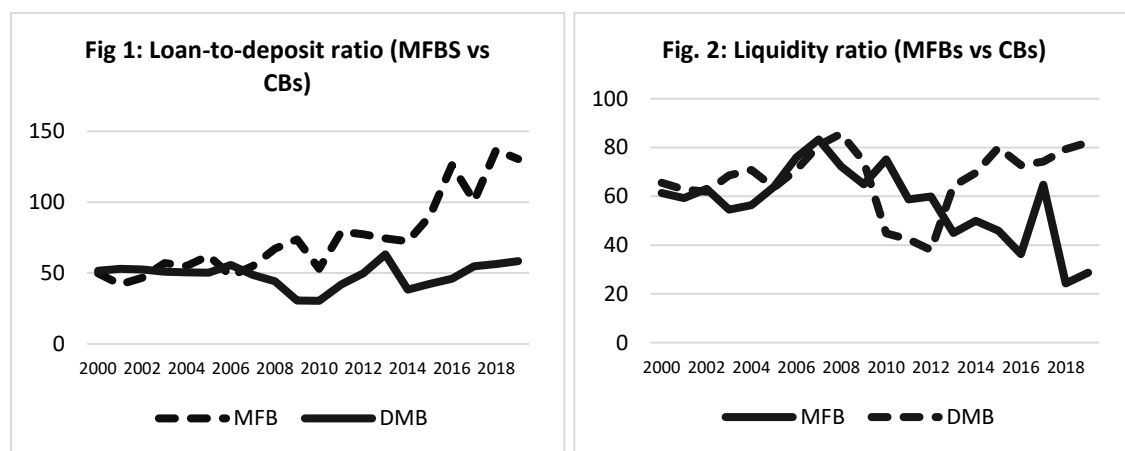
In terms of the financial sustainability of the MFBS, Figures 3 and 4 show the dimensions of costs and portfolio quality of the MFBs. Despite facing favourable financing costs (as noted in CBN, 2019), MFBs in Nigeria encounter higher operational expenses. This balance of expenses is largely driven by the lack of physical and financial market infrastructure for MFBs in the country. Figure 4 also shows the portfolio at-risk ratios of the MFBs, although the ratios have declined since 2014. Rather it is the loan loss ratios that have continued to increase for the MFBs. Although the banks appear to have succeeded in reducing the

portfolio at-risk ratios, the loan loss ratio appears to be on the increase. The declining loan portfolio quality of MFBs underscores emerging challenges in the sector.

Fig. 3: Financial versus operating costs of MFBs

■ Financial cost ■ operating cost

Fig. 4: Portfolio quality of MFBs

■ loan loss rate ■ Portfolio at risk

Literature Review

Theoretical literature

According to Mersland and Strøm (2014), MFB performance is measured according to two dimensions: the social mission – the level of outreach to the poor and vulnerable; and financial sustainability – ability to consistently meet financial obligations and goals, including profit outcomes. The outreach within the social mission involves the capacity to provide access to financial services for poor households. Thus, Thomas and Kumar (2016) have argued that the performance of MFIBs "should be measured by using not only financial but also non-financial or social measures". In this direction, the theoretical effects of the financial environment on the efficiency of MFBs may differ with their social or financial mission.

Explanations of the relationship between the nature of the financial environment and the efficiency of financial institutions (especially MFBs) often include postulations on market structure, degree of "contestability", and information access (Bikker & Spierdijk, 2009). The market structure argument suggests that the allocative and productive efficiency MFBs is diminished due to their small market share and that efficiency in these banks can only be maximised by focusing on their social objective. Similarly, the "contestability" theory, which focuses on the degree of absence of entry and exit barriers, concludes that the efficiency of MFBs is assured by focusing on the social mission and adopting a collusive strategy within the sub-sector. On the other hand, the information asymmetry theory argues that MFBs can operate as efficiently as traditional banks if they have similar assets to investment in efficiency accessories like technology, regulation, and customer orientation ((Bikker & Spierdijk, 2009; Claessens, 2009; Deb & Sinha, 2022). The information postulation, therefore, demonstrates that the efficiency and resilience of financial institutions are directly influenced by the pattern of information asymmetry in the entire financial market (Mishkin, 1992).

Moreover, McIntosh and Wydick (2005) devised a theoretical model for the behaviour of MFBs, especially in markets that are similar to those of developing countries. The model indicates that MFBs that pursue social goals in terms of "client-maximizing objectives" often tend to cross-subsidize within their pool of borrowers. Given that competition tends to eliminate rents on profitable borrowers, MFBs that are social-oriented tend to operate within an equilibrium in which poor borrowers are worse off in their activities. In the model, competition is found to heighten the challenge of asymmetric information over borrower indebtedness. In this case, the most impatient borrowers' loan demand behaviour increasingly creates a negative externality in the loan market that leads to less favourable equilibrium loan contracts for all

borrowers. Thus, the theory demonstrates that a competitive environment is likely to reduce the efficiency of MFBs in the short run and diminish their sustainability in the long run.

Empirical literature
The empirical literature has highlighted numerous factors that promote the efficiency of financial institutions in developing countries, including macroeconomic stability, competition, regulatory and supervision activities, the structure of the economy, the internal structure of financial markets, governance mechanisms of financial institutions, eternal economic integration, capacity for risk management, technology adoption and use, among others (Balkenhol, 2007; Hermes et al, 2011; Mlachila et al, 2016; Wondirad, 2020; Isik & Urgur, 2021, Lee et al, 2021; Nourani, 2021; Zheng & Zhang, 2021). Some of these studies have also related some of the factors to microfinance institutions. In particular, Isik and Hassan (2003) found that factors that enhanced the efficiency of European banks were more macroeconomic. Also, Mia (2017) found that bank-specific factors, macroeconomic factors, and methods of funding were the most important drivers of the efficiency of MFBs in Bangladesh.

Early studies also indicated that the environment within which the MFBs operate matters significantly for efficiency improvement. In particular, the nature of the financial market has a direct link with the efficiency of both traditional and microfinance banks. For instance, Balkenhol (2009) established that the efficiency of MFBs can only be observed within the context of financial operations in the system. Thus, operating within a rural or urban area directly influences efficiency even if the bank operates at favourable financial margins. Also, Claessens (2009) found that competition among banks positively influenced their overall efficiency and stability in developing countries. On the contrary, Khandker et al (2013) found that although competition in the financial market (in the form of increased entrants or increased borrowing among households) increased the spread of MFBs in Bangladesh, it did not improve production efficiency. This finding suggests that MFBs with more social orientation are more efficient in the face of increased competition in the market. In this direction, Deb and Sinha (2022) found that both inter and intra-market competition significantly affects both the financial and social efficiency of MFBs in India and Bangladesh.

There has also been research on other bank-specific of sub-sectoral factors that drive the efficiency of MFBs. For example, the role of technology infrastructure and ICT facilities on MFB performance has been considered in the literature. In this regard, Kauffman and Riggins (2012) found that growth in the microfinance industry is more steadily facilitated by ICT practices among developing countries. This is because technology reduces the operating costs of providing microcredit and also facilitates effective management of an increasing number of microfinance participants (either as depositors or as debtors), thereby enhancing operational capacity, efficiency, and overall performance (European Microfinance Network, 2011; Sitorus et al, 2017). For Nigeria, Bala et al (2019) found that the application of digital and other ICT forms improved both the social and financial performance of the microfinance institutions. Similar findings were made for other African countries by Moya et al (2012) who found a direct link between ICT investment and the efficiency of MFBs in Uganda.

The effects of financial targets and other basic characteristics of MFBs have also been observed to influence efficiency. In this direction, Konietschke, Ongena and Marques (2022) found that for the European market, more regulated banks (in terms of participating in particular stress tests) are more efficient in credit management but less profitable. In the same vein, Gutierrez-Goiria et al (2016) found that, apart from the nature of the financial market, the legal status of an MFB also matters in explaining its efficiency. Ayayi and Wijesiri (2018) also found that new and younger MFBs were more efficient than matured ones, suggesting that older MFBs have tended to succumb to competition from younger peers.

As the theoretical literature suggests, the focus of MFBS (commercial-oriented or social-oriented) matters for the efficiency outcomes. In essence, the efficiency of MFBs is more properly examined when the goals of MFBs are taken into adequate cognisance. In this direction, Hermes (2011) examined the trade-off

between outreach to the poor (an indication of the social mission of MFBs) and the efficiency of MFBs and found that outreach in terms of high lending and a high proportion of women borrowers was negatively related to efficiency. Also, Nourani (2021) applied the network data envelopment analysis technique to estimate three efficiency dimensions related to the operational, financial and outreach (or social) efficiency of MFBs in India. The results indicated operational efficiency is linked with more regulated MFBs, while social efficiency is linked with less regulated MFBS. These studies provide grounds for examining efficiency determinants along the line of the main goals of MFBs.

The literature reviewed in this section highlights the important roles of the financial environment and other factors in explaining the performance and overall efficiency of financial institutions. However, while the theoretical postulations provide a strong background for determining the factors that drive performance (both social and financial) of MFBs as well as how these factors are channelled to their outcomes, the empirical literature has provided little insight in this regard, especially for developing countries and Nigeria. In particular, research in Nigeria has only considered specific factors that drive performance without taking into cognizance how these factors provide technical patterns of efficiency among MFBs. Moreover, previous studies in Nigeria have not demonstrated or delineated performance with the main goals of MFBS in the country.

These are the critical areas where this current study contributed to extant literature. First, this study estimated a theoretically sound measure of MFB efficiency. Second, the roles of the financial market environment and other factors were demonstrated by clearly indicating how these factors act as mechanisms for boosting or mitigating the efficiency of MFBs in Nigeria. By using bank-specific data from the Microfinance Information Exchange (MIX) database, this study further improves the analytical framework for MFB efficiency in Nigeria. Based on the foregoing, the study addressed the question of the financial conditions under which MFBs enhance efficiency which can serve as grounds for policy action on improving the microfinance market in Nigeria.

Methodology

Measuring the efficiency of MFBs
In general, efficiency serves as a quantitative and objective measure of management quality within the financial market (Balkenhol, 2007). In simple mathematical terms, the relative efficiency of the firm is the "ratio of the weighted sum of multiple outputs and the weighted sum of multiple inputs":

$$EFFICIENCY_m = \left. \sum_{y=1}^{k} u_{ym}\, OUTPUT_{ym} \middle/ \sum_{x=1}^{j} u_{xm}\, INPUT_{xm} \right. \qquad (1)$$

where u_{ym} and v_{xm} are the unit weights assigned to output y and input x, respectively, by the mth MFB in a population of MFBs; k and j represent the number of output and input variables, respectively. As demonstrated in Isik and Uygur (2021), the weights allotted to the input and output variables are chosen in a way to ensure Pareto optimality for each decision-making unit (DMU) – the respective MFBs in this case. Thus, this model identifies multiple outputs and inputs to capture the general and diverse roles of modern management. The efficiency approach to measuring performance is therefore an improvement over single traditional performance indicators such as financial ratios.

In this study, the non-parametric data envelopment analysis (DEA) technique is adopted in estimating the efficiency of the DMBs. DEA is a linear programming technique that converts multiple inputs and outputs into a scalar measure of efficiency (Hermes, 2011, Isik & Urgur, 2021). Essentially, the DEA estimates the technical efficiency of the firm in terms of the effectiveness of the firm in utilising inputs to maximize outputs (Hermes et al, 2014). In this study, the DEA analysis assumes constant returns to scale for the MFBs

to generate unique estimates for the *isocost* curve for the banks. In the DEA analysis, it is considered that the MFBs are multi-product/multi-input firms which are converting three (3) inputs into two (2) outputs.

Thus, in the DEA analysis of the efficiency of the MFBs, three input and two output variables are used. The input variables included in the DEA are fixed assets of the MFBS, the number of full-time employees, and total financial assets. These inputs are the most basic and critical inputs that the MFBs used in producing their output. For the output variables, the social and financial focus of the MFBs is taken into cognisance. Hence, the two output variables of the total loan disbursement and non-loan earnings are used to represent the commercial-oriented MFBs. On the other hand, total loan disbursement and total number of active borrowers are used to represent the output of social-oriented MFBs.

Model specification

The model specified in this study is adapted from that of Hermes et al (2011) and Isik and Urgur (2021) where bank efficiency is considered as a function of bank both internal and external factors in the form:

$$efficiency = (internal, external) \tag{2}$$

In adapting the model, the *internal* factors are considered at both firm and sub-sectoral levels (see Balkenhol, 2007; Nourani et al, 2021), while the *external* factors (Zheng & Zhang, 2021) are considered as those of the entire financial market as well as the macroeconomic variables. The model specified for this study is in the form:

$$efficiency_{it} = \alpha_i + \alpha_1 tech_{it} + \alpha_2 dmbe_{it} + \alpha_3 urbr_{it} + \alpha_4 infl_{it} + \alpha_5 exrt_{it} + \alpha_6 fintech_{it}$$
$$+ \alpha_7 mansh_{it} + \alpha_8 hedu_{it} + \alpha_9 competition_{it} + \alpha_{10} asset_{it} + \alpha_{11} geff_{it}$$
$$+ u_{it} \tag{3}$$

Where *efficiency* is the estimated efficiency score for MFB *i* in year *t* based on the DEA framework in Eqn. (1); *tech* is the level of technological adoption by the MFB. This variable is expected to have a positive impact on efficiency since it is one of the main "capacities" factors of the firm (in terms of innovation in operation. There are different applications of technologies that are being adopted by MFBs and they have directly enhanced business processes, controlled costs, created efficiency channels, and improved overall productivity. Moreover, technology use by MFBs improves MFBs' outreach to the poor. Hence, MFBs with better technologies are expected to be more efficient and capable of adapting to competitiveness in the business environment. The variable is measured as a dummy with 1 for MFBs that operate digital platforms and 0 for those that do not.

Also, *cbe* is the level of efficiency of commercial banks (CBs) and is measured as the interest rate spread of CBs (the difference between deposit rate and lending rate). According to OECD (2011), this variable captures the level of efficiency of the banking sector in an economy. A more efficient commercial bank system in a country will pose a higher level of competition to the MFBs. Hence, the higher efficiency of CBs is expected to result in lower performance of MFBs. From the model specification, a positive coefficient of *dmbe* indicates that a higher interest rate spread (less efficiency of DMBs) results in better efficiency performance of the MFBs. *urbr* is the rate of urbanization in the country and the expected coefficient is not certain. Specifically, MFBs are expected to focus more on rural bank public and a rise in urbanization may weaken the customer base of MFBs. The measure of the share of manufacturing in real GDP value added (*mansh*) is the other measure of modernization or structural change in the economy. A rise in this variable is also expected to reduce patronage of MFBs since customers may want to use more traditional banks. The impacts of both variables (*urbr* and *mansh*) suggest that structural shifts in the economy may deliver unwarranted effects on the efficiency of MFBs in Nigeria. There are two measures of macroeconomic stability in the model, inflation rate (*infl*) and exchange rate (*exrt*). A rise in either variable destabilises macroeconomic setups and renders banking activities more difficult. FINTECH are some financial technology companies which are also direct competitors with MFBs in Nigeria.

The level of competition among MFBs (*competition*) is also included in the model since such variables can improve the efficiency of the banks. The competition among MFBs is measured using a Herfindahl-Hirschman index of concentration. In this case, the entire market shares are weighted against individual MFB's market shares. This variable indicates the market structure dimension of the efficiency of the MFBs (EU, 2018). Along with technology, another aspect of capital upgrade that can affect efficiency is the level of skills of the employees. For this variable, we adopted the tertiary education enrolment rate (*hedu*) which is expected to have a positive impact on bank efficiency. A regulation index is also included to measure the role of regulations on MFBs' efficiency in Nigeria. Government effectiveness (*geff*) is used in this case: the higher the score of this index is, the tighter the regulations on investments and establishments in the MFB ecosystem, thereby leading to better efficiency sustainability rates. Thus, the *geff* variable is expected to have a positive coefficient. This variable is obtained from the World Bank's World Governance Index database. To control for the characteristics of the MFBs in efficiency determination, the measure of firm size (log of asset of MFBs) is included in the model.

The data and estimation technique

Our dataset (for the period of 2010 to 2019) on Nigerian Microfinance Banks was obtained from the Microfinance Information Exchange (MIX) database. It contains data on financial statements (income statement, balance sheet), operations, financial products, end clients, and social performance of MFBs in different countries, including Nigeria. These data were collected by the financial services providers and reported in the World Bank Database based on an inclusive finance framework. Data reported were for the period between June 1999 and September 2019. For this study, the data analysed are for the period 2010 to 2019 for which the MIX data for Nigeria include 45 MFBs in 2010, 39 in 2011, 21 in 2012, 20 in 2013, 20 in 2014, 18 in 2015, 17 in 2016, 17 in 2017, 17 in 2018, and 17 in 2019.

As highlighted in the models above, two stages of estimations are performed in this study. In the first stage, firm efficiency is estimated using the data envelopment analysis (DEA) bootstrapping technique. In the second stage of analysis, the truncated bootstrapping regression technique is employed to examine the influence of the financial market environment of MFBs on their efficiency. The second stage analysis is based on a panel Tobit estimation framework which explores the features of the MFBs across time and ensures different levels of variables are suitable for multilevel modelling. To improve the robustness of the estimation, the Feasible Generalized Least Squares (FGLS) technique is employed in a two-step procedure. This is because the dependent variable is estimated (i.e., efficiency scores) which implies the likely presence of cross-section-specific heteroskedasticity (Adegboye, 2020). The FGLS adjusts the standard errors on each of the regression coefficients to account for the sampling uncertainty and random errors are used to produce unbiased and consistent estimates.

Empirical Analysis

This section focuses on the estimation and interpretation of the two stages of models specified in the previous Section.

Analysis of efficiency

The results of the Data Envelopment Analysis (DEA) framework show the levels of efficiencies for MFBs based on the evaluation of average efficiency scores for each of the years in the sample (2010 – 2019). It is important to note that input-oriented efficiency measures address the question: "By how much can input quantities be proportionally reduced without altering the output quantities produced?" The scores of the CRS are taken in this study as the Technical Efficiency scores for the companies. Table 1 shows the number of efficient MFBs at the frontier for the years included in the analysis. For the efficiency determination using social target outputs, the proportion of frontier MFBs increased slightly towards 2014 but has declined steadily since 2016. For the efficiency determination using commercial targets as output, the proportion of MFBs at the frontier appears to be increasing steadily over the period. In general, the reference banks that

focus on commercial targets (in terms of efficiency) appeared to have improved more than those that focus on social targets over the years.

Table 1: Frontier-efficient companies per year

Year	DEA Output: social goal		DEA Output: financial goal	
	Number	%	Number	%
2010	7	15.3	3	6.7
2011	6	18.2	4	9.8
2012	8	24.8	4	10.0
2013	7	23.3	5	14.2
2014	3	14.3	7	20.0
2015	2	9.5	2	9.1
2016	4	20.0	2	9.5
2017	3	17.6	6	35.2
2018	2	11.8	6	35.2
2019	3	17.6	6	35.2

Source: Author's computation, 2023.

The trends in average efficiency scores for the period 2010 to 2019 are presented in Figures 5 and 6. The trend line also shows the average scores for inefficient MFBs (i.e., average efficiency scores excluding the frontier MFBs). It is seen that general efficiency scores for the MFBs when social goals are set as output factors are less than the scores when commercial goals are set as output variables. Also, there is a steady increase in the overall efficiency of MFBs in the commercial output setting scenario, which also emphasizes the point that many MFBs are beginning to allocate more efficient resources to attaining the commercial goals of the banks as against the social goals. The scores for inefficient MFBs have declined sharply since 2015 in both scenarios. Thus, while overall efficiency is improving among MFBs in Nigeria, the inefficient banks are performing worse. Essentially, the gap between efficient and inefficient MFBs in Nigeria appears to be widening significantly over time.

Fig. 5: DEA Output variable: social goal

Fig 6: DEA Output variable: Financial goal
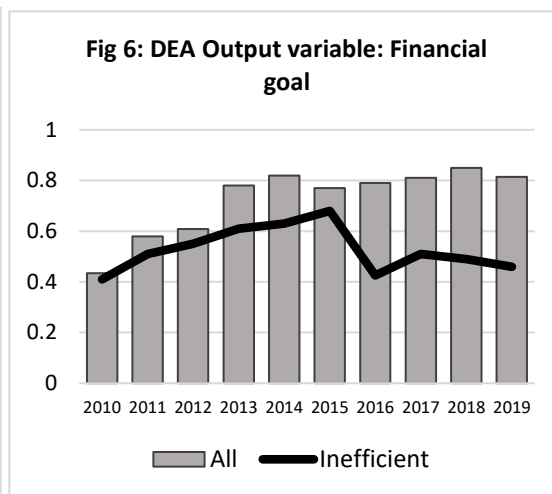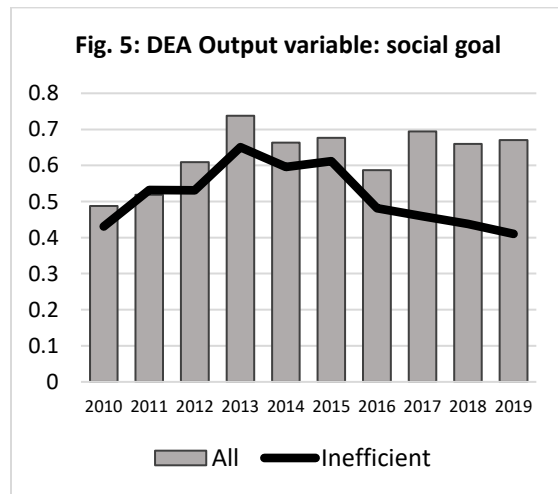
Regression analysis: Impact of financial environmental factors on MFB efficiency
As is the traditional case following estimates of efficiency, the estimation procedure follows a truncated or censored distribution framework using the Tobit estimation technique. The application of Tobit ensures that any value in the datasets that exceed the efficiency level (of one) can be sufficiently accounted for. This

means that the application of the Tobit technique ensures that any value in the datasets that exceed the efficiency level (of one) can be sufficiently accounted for. The results of the estimated relationships for the scenario where the output factors are social goals of MFBs are reported in Table 2. For both estimations, the diagnostic tests are generally impressive. First, the chi-square value of the likelihood ratio for each of the estimates has p-values that are all less than the 1 per cent level ($p < 0.01$). This shows that for each estimate, the complete models fit significantly and that the combined explanatory variables sufficiently explain the dependent variable (i.e., financial efficiency).

In the result, only the coefficients of inflation and manufacturing share in total GDP fail the significance tests. This indicates that changes in price level and structural transformation that favour the more modern sectors do not significantly influence the efficiency of MFBs. The coefficient of *tech* passes the significance test at the 1 per cent level and is positive, indicating that the level of technology use and application among MFBs promotes efficiency in the banks. Raising more innovative platforms that employ more digital applications is therefore shown to be a significant tool for boosting the efficiency and stability of the MFBs in Nigeria. As Bala et al (2019) and European Microfinance Network (2011) also found, this study has demonstrated that technological expansion within the MFBs raises their efficiency. This outcome is to be expected given that both commercial banks and other new fintech companies have leveraged the flexibility of digital technology to establish massive advantages. Our study has shown that digital technology also provides a useful means of gaining increased efficiency by MFBs.

Table 2: Results for Financial Environment and MFBs' Efficiency (Using the financial measure of DEA output)

theta	Tobit			FGLS		
	Coef.	t	P>t	Coef.	t	P>t
tech	0.041	5.91	0.00	0.034	3.99	0.00
cbe	0.422	2.17	0.03	-0.350	-1.25	0.35
urbr	-0.221	-2.46	0.02	-0.183	-1.66	0.38
infl	0.362	1.87	0.07	0.300	0.93	0.35
exrt	-0.952	-2.07	0.04	-0.011	0.34	0.61
fintech	-0.618	-4.11	0.00	-0.513	5.21	0.00
mansh	0.05	1.36	0.17	0.002	1.02	0.56
hedu	1.364	4.63	0.00	1.815	4.71	0.00
competition	0.091	2.16	0.03	0.006	0.92	0.36
asset (size)	-1.635	-3.09	0.00	-4.357	12.02	0.00
geff	1.282	7.34	0.00	0.064	-0.18	0.73
C	0.212	14.83	0.00	0.176	3.21	0.00
LR-Chi² (prob)	0.001			0.001		
Breusch-Pagan (prob)				0.262		

Source: Author's computation, 2023.

The coefficient of *cbe* (commercial banks' efficiency) is significant at the 5 per cent level and is also negative. This indicates that the more efficient the commercial banks become, the lower the efficiency of MFBs. Thus, with the interest rate policy of commercial banks, the efficiency between MFBs and commercial banks is mutually exclusive. Thus, competition between commercial banks and MFBs in terms

of interest rate fixing is more likely to favour commercial banks in Nigeria. This result supports the findings by Isik and Hassan (2003) and Wondirad (2020) that a more efficient interest rates system in the traditional financial sector helps to stabilize the social performance of microfinance institutions. The coefficient of the urban population rate is negative and significant at the 5 per cent level, which shows that a larger urban population tends to reduce the efficiency of the MFBs. This result supports the generally-held view that rural customers form the strong base for MFBs' activities in Nigeria. This result also poses serious issues for MFBs in adapting to a rapidly urbanising system in Nigeria.

The coefficient of the exchange rate is significant and negative, highlighting the capacity of macroeconomic instability in dampening the efficiency of MFBs in Nigeria. The coefficient of fintech companies is also negative, showing that, like commercial banks, the presence of fintech companies limits the capacity of MFBs to raise efficiency. These fintech companies have become direct competitors with MFBs, especially in reaching the less-included individuals in the informal and rural sectors. For intra-industry competition, the coefficient is positive and shows that a highly competitive microfinance sector is good for promoting efficiency within individual MFBs. This is also in line with findings by Assefa et al (2013) and suggests that competition within the microfinance sector is more cooperative rather than exclusive.

The skill level of employees in the workforce as proxied by tertiary education enrolment rate has a positive coefficient. This indicates that a well-trained workforce helps to raise efficiency among MFBs. This is a human component of the efficiency strategy and indicates that high-level training delivers direct positive externalities for the microfinance sector in Nigeria. Adegboye et al (2018) found similar results for SMEs in Nigeria. The coefficient of government effectiveness (which captures regulatory quality) is also significant and shows that better regulations help to enhance the efficiency of MFBs in Nigeria. Better regulation tends to reduce binding constraints of information asymmetry and also limits moral hazards for MFBs to promote efficiency (Balkenhol, 2007; Mlachila et al, 2016). The coefficient of bank size is negative and suggests that larger MFBs are less efficient on average.

The results of the robustness check on the aggregate data estimation are also shown in the second panel of Table 5. In the results, all the coefficients of the important explanatory variables exhibit similar signs with those of the Tobit estimates. Although some of the coefficients are not significant, the most important evaluation of the robustness checks is regarding the signs which are the same in both estimation procedures. This shows that the estimated Tobit results are highly robust to the estimation technique. The diagnostic test for the FGLS estimates is based on the test for heteroskedasticity using the Breusch-Pagan procedure. The p-value for the coefficient of the Breusch-Pagan test is 0.262, indicating that the null hypothesis of the presence of homoskedasticity in the estimates cannot be rejected. This shows that there is no heteroskedasticity in the estimates.

Table 3: Results for Financial Environment and MFBs' Efficiency (Using a social measure of Output)

theta	Tobit			FGLS		
	Coef.	T	P>t	Coef.	t	P>t
tech	0.081	6.22	0.00	0.031	1.99	0.05
cbe	0.016	0.98	0.29	0.001	0.61	0.41
urbr	0.093	2.77	0.02	0.007	1.96	0.05
infl	-0.408	-2.01	0.04	-0.001	-0.93	0.35
exrt	-0.952	-2.07	0.04	-0.188	2.45	0.03
fintech	-0.172	-4.58	0.00	-0.098	-5.21	0.00
mansh	0.059	6.00	0.00	0.091	7.83	0.00
hedu	2.038	1.54	0.19	1.827	1.13	0.19
competition	-0.837	-5.25	0.00	-0.736	-5.52	0.00
asset (size)	0.767	9.24	0.00	0.629	10.3	0.00
geff	2.211	0.82	0.36	-0.032	-0.98	0.43
C	6.015	5.46	0.00	4.394	3.21	0.00
LR-Chi^2 (prob)	0.001			0.001		
Breusch-Pagan (prob)				0.301		

Source: Author's computation, 2023.

Given the large discrepancies between the efficiency scores for the MFBs based on the type of output variable used (either social output or financial output), the effects of the selected explanatory variables on these efficiencies may differ. This is the motivation for the estimation of the coefficients in Table 3. In the result, the coefficients of *cbe, hedu*, and *geff* fail the significance tests, showing that these variables do not contribute to the efficiency of the MFBs when the focused output is financial. Although these factors significantly influenced efficiency based on the social goals of the MFBs, this result shows that they do not influence efficiency based on financial goals. For *cbe* (which measures efficiency in commercial banks), the result shows that the improved efficiency of the commercial banks in terms of credit adjustment does not influence the efficiency of MFBs when the financial target is the output. This result relates to interest rate policies of the banking system and tends to support the concern that interest rates by MFBs have become more market-based in recent years (Mlachila et al, 2016). The coefficient of inflation, which was insignificant in the efficiency estimates for social goals, is now significant at the 5 per cent level. Along with the highly significant coefficient of *exrt*, the result of *infl* show that macroeconomic instability has a stronger debilitating impact on the efficiency of MFBs that are more focused on attaining financial outcomes. As shown in Table 3, the impact of such macroeconomic instability is tempered by the efficiency of MFBs that focus mostly on social outcomes.

Technological adoption by MFBs is also seen to have a significant positive impact on the efficiency of the institutions. This positive impact was also observed for the efficiency estimates with social performance, thus indicating that technology matters in improving the efficiency of MFBs irrespective of their current orientation to performance. These results were also found in other studies like Bala et al (2019) for Nigeria and Moya et al (2012) for other African countries. The coefficients of the *mansh* and *urbanr* are both positive and significant in this result (unlike in the social output-based efficiency estimates). This result tends to highlight the direction of business strategic, and operational movement among MFBs in Nigeria. Given that larger shares of manufacturing as well as larger urban sectors indicate modernization in the

economy, the result suggests that structural transformation can raise the efficiency of MFBs that focus more on financial outputs as also indicated by Khandker et al (2013). The result also shows that intra-industry competition among the MFBs tends to raise efficiency levels.

The coefficient of regulatory quality fails the significance test in this case. This outcome however suggests that regulations may be effectively evaded or weak in boosting the aspects of MFBs that help boost efficiency. Thus, the result demonstrates that while macroeconomic shocks heavily weaken the efficiency of the MFBs, regulations are weak in controlling such effects. In general, regulation is the initial external factor that helps to reduce the impact of macroeconomic shocks on MFBs. The results however show that the buffer that regulations provide towards appropriate response to macroeconomic instability may not be fully deployed when the efficiency strive of the MFBs is dominated by the desire to focus on financial outputs. Hence, MFBs that limit efficiency performance to social targets in the economy may be more resilient to macroeconomic shocks in Nigeria.

Conclusion
In this study, the efficiency of microfinance banks (MFBs) in Nigeria was examined based on the financial environment in which the institutions operate. The financial environment factors considered include macroeconomic stability, inter- and intra-sectoral interactions, as well as technology and social factors. The DEA efficiency estimates were used to determine the efficiency of the MFBs, while the Tobit regression technique was used to estimate the impacts of financial market environment competition factors on the efficiency of the MFBs. The data used was from 2010 to 2019 for Nigerian Microfinance Banks which was obtained from the Microfinance Information Exchange (MIX) database.

The study revealed a clear upward trend in the efficiency scores of MFBs throughout the study, although the gap between efficient and inefficient MFBs was also found to be widening. It was also found that MFBs that focus more on commercial performance have tended to be more efficient than those that focus more on social performance. In terms of the driving factors for the efficiency of MFBs, the study found that macroeconomic instability, external competition (inter-sub-sectoral competition in the financial sector) and structural change in the economy limit efficiency of MFBs, especially those that are socially oriented. On the other hand, intra-sectoral competition within the microfinance sub-sector, technology infrastructure, skills, and effective regulation contribute to the efficiency of those MFBs in Nigeria. It is however found that factors that drive the efficiency of MFBs that focus on social performance are not particularly the as those that drive the efficiency of MFBs that focus on commercial performance. In particular, external competition from commercial banks and regulations was found to have no significant effect on commercial-oriented MFBs, while structural transformation was found to directly improve the efficiency chances of these groups of MFBs.

It is therefore recommended that policies that help MFBs to redirect their business model towards social performance need to be enacted. In particular, incentives can be provided to those MFBs that devolve higher proportions of their resources to aiding financial inclusion and other social targets in Nigeria. Moreover, policies that aid smaller and less efficient MFBs need to be intensified in Nigeria. This can be done by providing adequate support for these MFBs and requiring them to be more socially inclined based on policy support. In the same vein, structural transformation in the economy must be made to also favour MFBs that focus on social performance. In this case, development must be brought close to the rural areas by providing both hard and soft infrastructure that aids financial participation. This will ensure that modernization in the economy does not inhibit efficiency in certain kinds of MFBs in Nigeria. Similarly, the effects of macroeconomic shocks on both MFBs and their customers need to be mitigated by further government provision of adequate safety nets. Finally, the legal and regulatory frameworks that aid flexible regulations in the microfinance sector need to be strengthened in Nigeria. Considerations of property rights and contract enforcement, ease of access to credit information systems, and overall non-credit costs need to be enhanced with microfinance participation in Nigeria. In the same vein, policies that promote "market contestability"

(ease of entry and exit) will also help to redirect financial competition in favour of MFBs' efficiency in Nigeria.

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