

Effect of Competition on the Performance of Microfinance Institutions in sub-Saharan Africa

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Abstract

This study aims to analyze the effect of competition on the profitability and outreach of SSA MFIs. To achieve this objective, data were extracted from a dynamic panel of 3,105 MFI observations from the MIX market and the World Bank for the period 2000 to 2017. Applying two-stage GMM, instrument-free inference for linear regression models with endogenous regressors, pooled fixed-effects OLS and pooled random-effects OLS on these data, our results showed that competition decreases profitability (ROA and ROE) of profit-oriented and non-profit MFIs. Our results also showed that competition exerts a mixed effect on the outreach (avloangni and NAB) of these institutions. However, it is important to point out the presence of a much more detrimental effect of competition on return on assets (ROA) and average loan per borrower (avloangni) for non-profit MFIs compared to that of profit-oriented MFIs. When return on equity (ROE) is taken into account, we observe instead a much more detrimental effect of competition on the ROE of profit-oriented MFIs compared to that of non-profit MFIs. The discovery of a positive effect of competition on the number of active borrowers (NAB) of profit-oriented and non-profit MFIs, suggest that in SSA, competition does not automatically lead to a drift in the social mission (avloangni) of MFIs, as it also enables these microfinances to increase their NAB. Given these results, policymakers in SSA countries need to improve the profitability and outreach of profit-oriented and non-profit MFIs by deploying a regulatory framework that reduces the lending rates charged in the microfinance sector.

Keywords: *competition, profitability, outreach, profit-oriented MFIs, non-profit MFIs*

JEL codes: L1, D40, G21

1. Introduction

In recent years, financial inclusion has been increasingly used to ensure access to and use of formal financial services and to achieve the sustainable development goals (Kanga et al., 2024). In Sub-Saharan Africa (SSA) countries, banking inclusion, and the financial inclusion of microfinance institutions (MFIs) have improved the living conditions of many households (Kanga et al., 2024). For low-income households, owning bank accounts implies high transaction costs, but the availability of digital financial services has reduced these costs. Despite the remarkable evolution experienced by digital financial services offered by commercial banks in SSA (Figure 3 in the appendix), they are still in the process of transformation and are unable to finance the socio-economic activities of a large number of low-income households. To serve market segments long neglected by mainstream commercial banks, the physical and digital services of MFIs have been of great importance in SSA (Figure 3 in the appendix). Fundamentally, MFIs are financial institutions that pursue the objective of poverty alleviation (Couchoro and Gbandi, 2018). They are also seen as effective levers for development, addressing financial constraints by widening the range of possibilities.

The first African MFIs date back to the 1980s. From the earliest stages of their experience, these institutions were dominated by non-profit microfinance institutions that granted small loans to poor people excluded from bank financing, without any concern for their financial profitability (Africa Finance Report, 2021). After a slight downturn in the activities of these microfinances in 2011 following the subprime crisis of 2008, the commercialization of the microfinance sector paved the way for the development of profit-oriented MFIs seeking to improve their financial performance without worrying about their social mission (Dannon et al., 2019). Generally, social performance differs from financial performance in microfinance, because social performance refers to a microfinance institution's ability to dispose micro-capital accessible to the smallest entrepreneurs, whereas financial performance is perceived as a mechanism that promotes the sustainable development of MFIs, enabling them to be viable while generating high financial revenues (Tchuigoua and Soumaré, 2019).

In most sub-regions of SSA, MFI financial services have evolved in oligopolistic markets (Figure 3 in the appendix). Generally, oligopolistic competition refers to a market situation in which several MFIs interact with each other by setting high and disparate lending rates (Figures 1 and 3 in the appendix).

Figure 1: Average lending rate in the microfinance sector between 2000 and 2017

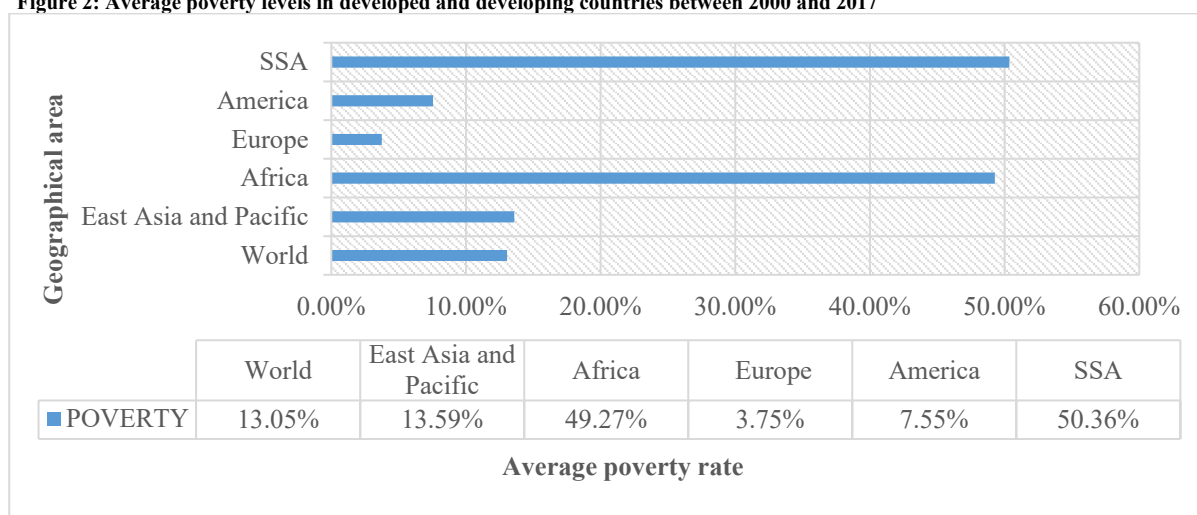


Source: author's construction based on Mixmarket data

Between 2000 and 2017, the average lending rate of SSA microfinance (15.19%) was higher than that of the African continent (14.92%) and the global average (14.22%). When comparing the average lending rates charged by microfinance institutions in developed and developing countries, the Mix Market recorded the presence of very high rates in America (16.38%) and SSA (15.19%), while the lowest rates were found in Asia and the Pacific (12.84%) and Europe (11.19%).

Even though American microfinance (16.38%) and SSA microfinance (15.19%) have the highest lending rates in the world, the poverty level of Africans remains higher than that of Americans (Figures 1 and 2).

Figure 2: Average poverty levels in developed and developing countries between 2000 and 2017



Source: author based on World Bank data

Between 2000 and 2017, the average poverty rate in SSA countries (50.36%) was higher than that of the African continent (49.27%) and the world average (13.05%). When comparing the average poverty rates of developed and developing countries, the World Bank recorded the presence of very high rates in SSA (50.36%), while the lowest rates were found in Asia and the Pacific (13.59%), America (7.55%), and Europe (3.75%).

To reduce these poverty rates, the physical and digital services of MFIs have been of great importance. In Asia, Europe and America, these services have contributed to sustainable development, in SSA, they have improved the living conditions of customers interacting with the microfinance sector. In Central African countries, the largest number of customers served by MFIs was in Cameroon, while in West Africa, East Africa and Southern Africa these customers were in Nigeria, Ethiopia and South Africa respectively (Figure 4 in the appendix). Despite the significant financial inclusion experienced by microfinance in SSA in recent years (Figure 4 in the appendix), the practice of exorbitant lending rates remains a major concern in this geographical area (Figure 1). Between 2000 and 2017, the average lending rate of non-profit MFIs in SSA and the rest of the world (14.45%) was higher than the global average (14.22%), as commercialization is a trend increasingly observed in many non-profit activities (Simo et al., 2023; Figure3). This trend is often attributed to declining government support for non-profit organizations and the concomitant difficulty of increasing private donations.

To expand the financial sphere of contemporary microfinance, the commercialization of non-profit MFIs has attracted the interest of commercial banks and investors seeking to diversify their asset portfolios. It has also increased the competitiveness of certain MFIs by forcing them to evolve from a non-profit to a profit-oriented

structure. This evolution in MFI competitiveness has led the microfinance sector to an excessive pursuit of profit and a deviation from its social mission (Simo et al., 2023).

Theoretically, the relationship between competition and MFI performance could be based on financial intermediation theory; structure-conduct-performance (SCP) theory, and the efficient structure hypothesis (ESH) (Tobin and Brainard, 1963; Mason, 1939; Peltzman, 1977). To better understand the likely effect of competition on the profitability and outreach of microfinance in SSA, our study will add to the existing literature by combining the theory of financial intermediation with the SCP and ESH theories. According to Tobin and Brainard (1963), the theory of financial intermediation stipulates that lenders and borrowers in the financial system interact in markets characterized by high and disparate lending rates. Starting from the observation relating to financial intermediation theory, the association of this theory with SCP theory will allow us to assume that in financial markets characterized by the practice of high and disparate lending rates, competition improves the profitability of microfinance (Dannon et al., 2019; Simpasa, 2013). Alternatively, combining financial intermediation theory with ESH theory will allow us to assume that in financial markets characterized by the practice of high and disparate lending rates, competition deteriorates microfinance outreach (Hossain et al., 2020).

Today, there are two types of formal financial institutions: microfinance and banks. Since the early 1980s, the commercialization of these financial institutions has increased the competitiveness of the banking sector. It has also increased the competitiveness of the microfinance sector. After a slight downturn in the activities of these financial institutions in 2011 following the 2008 subprime crisis, competition from the banking sector has largely influenced the performance of conventional commercial banks. Empirically, Sari et al. (2022) and Kanga et al. (2021) have shown the negative effect of competition on banking performance, while Lui and Li (2022) and Hamid and Ibrahim (2021) have shown a positive relationship between these variables.

Although commercialization is important for increasing the competitiveness of commercial banks, these banks are often reluctant to lend to the low-income poor (Hessou et al., 2021). To improve the living conditions of these poor people, MFIs have evolved in competitive markets that can influence their performance. Empirically, competition generally improves MFIs' operational self-sufficiency, return on assets, and return on equity (Wondirad, 2020). It can also hinder the profitability and average lending of these microfinances (Meraj, 2021).

Beyond the ambiguous relationship between competition and MFI performance, it is important to consider the heterogeneity of the financial services offered by these microfinance institutions, as profit-oriented MFIs (micro-banks and non-bank financial institutions (NBFIs)) generally opt for more conventional risk management and governance practices, whereas non-profit MFIs (credit unions/cooperatives and non-governmental organizations (NGOs)) manage their risk using deposit-centric business models. It is also important to analyze the effect of competition on the performance of different forms of MFI, as competition can have a varied influence on the performance of profit-oriented and non-profit MFIs in SSA.

The relevance of such a study in SSA stems from the fact that, in this geographical area, the financial sector is based on microfinance; in other words, the physical and digital services of MFIs are the main source of financing for businesses and households' poor (Figure 3). In such an environment, the practice of high and disparate lending rates (Figure 1) can lead to a deterioration in the performance of both profit-oriented and non-profit MFIs.

This study is also important for SSA countries, because although there is a substantial body of literature on the relationship between competition and MFI performance, there is yet no similar study in Africa. In order to fill this gap in the literature, we will check whether the results obtained in developed economies (America and Europe) and emerging economies (Asia) are similar to those observed in SSA. The main question arising from this objective is: what is the effect of competition on the profitability and outreach of MFIs in SSA? Specifically, our question is: what is the effect of competition on the performance of profit-oriented MFIs? And what is the effect of competition on the performance of non-profit MFIs?

This study contributes to the literature on the relationship between competition and MFI performance by focusing on the role played by the institutional form of these microfinances. In the literature on institutional form, two contradictory predictions are made to explain risk management mechanisms. The first is supported by market risk theory. This theory predicts the existence of limited risk management in non-profit MFIs, as these microfinances control their economic activities through deposit-centered business models (Hessou et al., 2021). The second prediction is supported by the theory of competitive forces. This theory predicts the existence of better risk management by profit-oriented MFIs, as regulation is a tool that enables these microfinances to homogenize their financial services (De Quidt et al., 2018). Considering the alternation in the literature that contrasts profit-oriented MFIs with non-profit MFIs, we will try to understand to what extent the way these microfinances operate can influence the relationship that links competition to the performance of SSA MFIs.

We also contribute to the literature on the relationship between competition and microfinance performance by considering the environment in which profit-oriented and non-profit MFIs operate. In the literature on this environment, two contradictory predictions explain the effect of competition on microfinance performance. The first is supported by the SCP theory (Mason, 1939). This theory states that competitive MFIs increase their spread margins to achieve high profits. The second is supported by the ESH theory (Demsetz, 1973). This theory states that competition creates a fragile, short-lived relationship between the customer and their financial institution. Considering this alternation in the literature, we will use the contextual framework of figure 1 to verify whether the SCP and ESH theories apply effectively to the competitive evolution of microfinance in SSA.

In our analysis, we measure microfinance profitability by return on assets (ROA) and return on equity (ROE). Outreach is measured by the average loan per borrower as a percentage of gross national income (Avloangni) and by the number of active borrowers (NAB) (Lensink et al., 2018; Kendo and Tchakounte, 2022). We measure microfinance competition using the Boone index. The choice of this index is preferred over other measures of competition because the Boone index is fluid over time and reflects the chronological evolution of competition. This index is also effective in measuring competition between MFIs, considering the financial services offered by the microfinance sector as close, low-cost substitutes (Boone et al., 2004). Despite the large number of problems solved by Boone's index, it is still likely that, in the presence of high and disparate lending rates, the heterogeneity of financial services offered by microfinance in SSA limits the effectiveness of Boone's index. To ensure the robustness of the results from this indicator, we will use the Lerner index. The choice of this index is preferable to other measures of competition, as the Lerner index does not consider the substitution of financial services (Boone, 2008). The data for our study were extracted from a dynamic panel of 3,105 MFI observations from the Mix Market and the World Bank for the period 2000 to 2017. Applying two-stage GMM, instrument-free inference for linear regression models with endogenous regressors, pooled fixed-effects OLS, and pooled random-effects OLS on these data, our results showed that in SSA, competition decreases the profitability of both profit-oriented and non-profit MFIs. Our results also showed the mixed influence of

competition on the outreach of profit-oriented and non-profit MFIs. Given these results, policymakers in SSA countries need to improve the profitability and outreach of profit-oriented and non-profit MFIs by deploying a regulatory framework that will reduce the lending rates charged by these microfinances. The rest of the paper is organized as follows. After presenting the literature review (Section 2), we explain the methodology and data (Section 3), then present and discuss the results (Section 4), and conclude by setting out the implications of economic policies (Section 5).

2. Literature review and hypotheses

Literature review on the relationship between competition and commercial bank performance

In the theoretical literature, Peltzman's (1977) Efficient Structure Hypothesis (ESH) is generally used to explain the negative relationship between competition (market power) and banking efficiency. This hypothesis states that the decline in the market power of commercial banks can be explained by the poor performance of this sector of activity. This theory also states that competition has a negative effect on banking efficiency when a high level of concentration increases this efficiency. Alternatively, Mason's (1939) structure-conduct-performance (SCP) theory explains the positive relationship between competition and banking efficiency. This theory states that market structure has a considerable influence on the competitive behavior of banks operating in highly concentrated markets. This theory also states that competition has a positive effect on banking efficiency when a high level of concentration reduces this efficiency. To date, the structural and non-structural approaches are the two approaches adopted to measure competition in mainstream commercial banks worldwide (Léon, 2015). These approaches generally measure competition using the following indices: The Herfindahl-Hirschman Index (HHI), the Panzar and Rosse statistics, the Lerner Index, and the Boone Index (Léon, 2015).

Empirically, Liu and Li (2022) used the Boone index to measure banking competition. Applying the instrumental variables method, their results showed the positive effect of competition on banking efficiency in Asia and the Pacific region between 2001 and 2016. Similar results were observed in the study by Hamid and Ibrahim (2021), which examined the effect of competition on the performance of commercial banks in 18 countries with dual banking systems over the period from 2000 to 2016. The study measured banking competition using the Lerner index. Applying estimation methods based on variance decomposition, the results showed that market power increases the profitability and stability of the banking system. Rahmayati (2021) also used the Lerner index to measure competition among Islamic banks. Applying the GMM method, the results showed that the competitive strategy of Islamic banking institutions positively and significantly influences the quality of financial services these banks offer their customers.

Shair et al. (2019), for their part, showed the negative effect of competition on the profitability of 35 Pakistani banks for the period from 2007 to 2017. Similar results were observed in the study by Sari et al. (2022), who examined the effect of competition on the efficiency of 38 Indonesian banks. The study measured competition among Indonesian banks using Panzar and Rosse statistics. Applying the Tobit method, the fixed-effect ordinary least squares method, and the random-effect ordinary least squares method, the results showed that stricter competition in the banking sector reduces the efficiency of commercial banks. Kanga et al. (2021) used the Lerner index and the Herfindahl-Hirschman index to measure banking competition in the countries of the West African Economic and Monetary Union (WAEMU). Applying the instrumental variable method, the results showed that bank profit is the main mechanism by which competition is associated with increased bank fragility in the WAEMU. Rakshit (2022) also used the Lerner index to measure banking competition for 70 Indian banks over the period from 1997 to 2017. Applying the two-stage GMM method, the empirical results

showed that a higher degree of banking competition leads to a contraction in the interest rate spread, which in turn reduces bank profitability.

Beyond the ambiguous relationship between competition and the performance of commercial banks in Africa and the rest of the world, these banks are often reluctant to lend to the low-income poor (Hessou et al., 2021). In order to improve the living conditions of these poor people, MFIs have evolved in competitive markets that can influence their performance.

Review of theoretical literature on the relationship between competition and MFI performance

To better understand the relationship between competition and MFI performance, structural and non-structural approaches to competition are generally supported: financial intermediation theory (Tobin and Brainard, 1963); SCP theory (Mason, 1939); and ESH theory (Demsetz, 1973). The theory of financial intermediation stipulates that lenders and borrowers in the microfinance sector interact in markets characterized by the practice of high and disparate lending rates (Tobin and Brainard, 1963). The SCP theory (Mason, 1939), on the other hand, states that competition provides market power capable of improving MFI profits. When applied to institutional forms of microfinance, this theory predicts a positive relationship between competition and the performance of profit-oriented and non-profit MFIs, as highly competitive markets enable these microfinances to increase their spread margin and market power to reap abnormal profits. In contrast to SCP theory, Demsetz's (1973) ESH theory states that competition creates a fragile, short-lived relationship between the customer and their financial institution. In the microfinance sector, this theory stipulates that competition between MFIs is capable of causing loan losses that will weaken the trust between a customer and their MFI. Based on the findings of the theory of financial intermediation, our study will add to the existing literature by associating this theory with the SCP and ESH theories. The association of these different theories is important in SSA, because even if the financial inclusion of microfinance is still progressive in African sub-regions (figure 4 in the appendix), the practice of exorbitant lending rates remains a major concern in SSA (figure 1). In this context, it is important for policymakers in SSA countries to reduce the lending rates of profit-oriented MFIs because Hypothesis 1: if the exaggerated profit of these microfinances stems from market power (competition), it can degrade the welfare of customers who receive poor-quality financial services at high lending rates (Simo et al., 2023). It is also important for these policymakers to reduce the lending rates of non-profit MFIs because Hypothesis 2: if the exaggerated profit of these microfinances stems from market power (competition), this can lead to a drift away from their social mission (Simo et al., 2023).

Review of the empirical literature on the relationship between competition and MFI performance

In the empirical literature, Kar (2016) showed the positive effect of competition on the profitability of 521 MFIs in Bangladesh, India, Nepal, Indonesia, the Philippines, Bolivia, Ecuador, Nicaragua, Mexico, and Peru for the period from 2003 to 2010. Similar results were observed in the study by Wondirad (2020), which analyzed the effect of competition on the performance of 183 Indian MFIs for the period from 2005 to 2014. The study measured MFI competition using the Boone index. Applying GMM, the results showed that in competitive markets, the more MFIs deepen their reach, the more they contribute to their operational autonomy and profitability. Baquero et al. (2018) also measured MFI competition using the Boone index. Applying the instrumental variables method, the results showed that affordable pricing is a means by which MFI competition improves the living conditions of the poor excluded from bank financing. Dannon et al. (2019) measured MFI competition using the Panzar and Rosse statistics, the HHI index, and the Lerner index. Applying the instrumental variables method, the results showed that high interest rates enabled competitive MFIs to earn excessive profits.

Alternatively, Deb (2020) showed the existence of a negative relationship between competition and MFI performance. The study used a dynamic panel of 53 MFIs from India and 20 MFIs from Bangladesh for the period from 2009 to 2017. Applying the GMM method, the results showed that in the presence of significant information asymmetries, MFI competition hinders loan quality, increases borrower indebtedness, and reduces expected loan repayment. Similar results were observed in the study by Meraj (2021), which analyzed the effect of competition on the performance of 355 MFIs located in seven South Asian countries. The study measured competition among South Asian MFIs using the Boone index. Applying the instrumental variable method, the results showed that South Asian microfinance institutions are imperfectly competitive, and that the increase in their competitiveness following the global financial crisis of 2007 to 2008 forced them to adopt hostile lending behavior that led to a repayment crisis. Hossain et al. (2020) analyzed the effect of competition on the social and financial performance of 4,578 observations of MFIs operating in 59 countries for the period from 2005 to 2014. Applying the GMM method, the results showed that in the presence of declining repayment rates, competition deteriorates the NAB and financial profitability of microfinance.

Beyond the ambiguous relationship linking competition to MFI performance, it is important to analyze the effect of competition on the performance of different forms of MFIs, as competition can have varied influences on the performance of profit-oriented and non-profit MFIs. In the literature on microfinance, two predictions are made to explain risk management mechanisms. The first is supported by market risk theory, which predicts limited risk management in non-profit MFIs (Hessou et al., 2021). The second is supported by the theory of competitive forces, which predicts better risk management by profit-oriented MFIs (De Quidt et al., 2018). Considering the conflict in the literature contrasting profit-oriented MFIs with non-profit MFIs, we aim to understand to what extent the operating mode of these microfinances influences the relationship between competition and the performance of MFIs in SSA. This study is particularly important for SSA countries because, although there is a substantial body of literature on the relationship between competition and MFI performance, no similar study has been conducted in Africa. To fill this gap, we will assess whether the results obtained in developed economies (America and Europe) and emerging economies (Asia) align with those observed in SSA. Additionally, we will examine whether the SCP and ESH theories apply effectively to the competitive evolution of MFIs in SSA.

3. Methodology

Conceptual framework for competition in SSA

The study measures MFI competition through the Boone index. The calculation of this index is generally developed on several theoretical models by Boone et al. (2000, 2001, 2004,2008). The models of Boone et al. (2000, 2001, 2004,2008) are centered on the idea that the most efficient MFIs (with the highest profits) have the lowest marginal costs and the highest market shares. To calculate the level of competition between MFIs in SSA, we have developed a theoretical model inspired by Boone et al. (2004). This model considers a microfinance sector in which each MFI (in country i) provides a financial service (Q) to its customers. Let q_i be the quantity of financial service 'Q' offered by each MFI in country i , and let $p(Q)$ be the market price of this financial service. The profit maximization problem for each MFI in country i is as follows:

$$\max_{q_i} [p(Q) \times q_i - C(q_i, W_i)] \quad (1)$$

In this problem, W_i represents the vector of factor prices used by each MFI in country i , $p(Q) \times q_i$ represents the total output of each MFI in country i while $C(q_i, W_i)$ represents the total cost to be borne by each MFI in country i . This profit maximization problem can also be written as follows:

$$\max_{q_i} [P(q_i; q_{l \neq i}) - C(q_i, W_l)] \quad (2)$$

In equation 2, $P(q_i; q_{l \neq i})$ represents the total production of each MFI in country i. According to Boone et al. (2004), this output can be calculated through the following demand curve:

$$P(q_i; q_{j \neq i}) = a - b q_i - d \sum_{j \neq i} q_j \quad (3)$$

Optimum, solving equation 2 leads to the following equilibrium condition:

$$P'(q_i; q_{j \neq i}) - mc_i = 0 \quad (4)$$

In this equilibrium condition (equation 4), $P'(q_i; q_{j \neq i})$ represents the optimal output of each MFI in country i while mc_i is their marginal cost. Assuming that $a > mc_i$ and $0 < d \leq b$ equation 4 can still be written as follows:

$$a - 2b q_i - d \sum_{j \neq i} q_j - mc_i = 0 \quad (5)$$

This equation is obtained by using the first-order condition of a Cournot-Nash equilibrium to replace the optimal production equation 3 in equation 4. In this new equation, optimal production ($-2b q_i - d \sum_{j \neq i} q_j$) is linked to the marginal cost of each MFI in country i (mc_i). Equation 5 also shows that the profit of each MFI in country i depends quadratically on marginal cost. Under such conditions, market competition will increase if the financial services of each MFI in country i are close substitutes (i.e. d increases but remains lower b). Market competition will also increase if the entry costs decrease.

When N MFIs in the country (i) produce positive levels of financial services, we move from equation (5) to equation (6) using N first- order conditions of a Cournot-Nash equilibrium. This condition can be written as follows:

$$q_i(c_i) = \frac{[(2\frac{b}{a}-1)a - (2\frac{b}{a} + N-1)mc_i + \sum_i mc_i]}{[(2b + d(N-1))(2\frac{b}{a} - 1)]} \quad (6)$$

In this equation, $q_i(c_i)$ represents the optimal production of all MFIs in country i, $\frac{[(2\frac{b}{a}-1)a - (2\frac{b}{a} + N-1)mc_i + \sum_i mc_i]}{[(2b + d(N-1))(2\frac{b}{a} - 1)]}$ represents the marginal cost all MFIs in country i, so that mc_i represents the marginal cost of each MFI in country i.

We define the profit of all MFIs in country i, (Π_i equation 7) as a variable excluding entry costs (ϵ). Thus, all MFIs in SSA will be able to enter the market if, and only if $\Pi_i \geq \epsilon$. To calculate the level of competition between MFIs (the Boone index) in SSA, we were inspired by the work of Wondirad (2020). This study used the relationship between production (or marginal revenue) and marginal cost (equation 6) to arrive at the following definition of the Boone index:

$$\Pi_i = \alpha + \beta \ln MC_i \quad (7)$$

In this definition (equation 7), Boone's index (the value of β) considers MFI financial services as close and

homogeneous substitutes (Boone, 2008). However, in the presence of high and disparate lending rates, the heterogeneity of the financial services offered by microfinance in SSA can limit the effectiveness of Boone's index. To ensure the robustness of this indicator, we will use the Lerner index. The choice of this index is preferred over other measures of competition because the Lerner index does not consider the substitution of financial services (Boone, 2008). According to Lerner (1934) and Léon (2015), the definition of this index can be summarized in the following formula:

$$l_i = \frac{(P(Q) - C'_q(q_i, W_l))}{P(Q)} \quad (8)$$

Econometric models

Econometric models to measure MFI competition

Before calculating the Boone index and the Lerner index, we first estimate the translog cost (TC) function using the total costs of all MFIs in country i as the dependent variable and the aggregate values of the loan portfolio, the price of labor, the price of financial capital and the price of physical capital of all MFIs in country i as the explanatory variables (Van Leuvensteijn et al., 2011; Hossain et al., 2020). The equation for the total cost function is as follows:

$$\begin{aligned} \ln TC_{it} = & \delta + \gamma_1(\ln Y_{it}) + \omega_1(\ln \omega_{1it}) + \omega_2(\ln \omega_{2it}) + \omega_3(\ln \omega_{3it}) + \\ & \gamma_2 \ln(Y_{it})^2 + \gamma_3(\ln Y_{it})(\ln \omega_{1it}) + \gamma_4 \ln(Y_{it})(\ln \omega_{2it}) + \gamma_5(\ln Y_{it})(\ln \omega_{3it}) + \\ & \omega_4(\ln \omega_{1it})^2 + \omega_5(\ln \omega_{2it})^2 + \omega_6(\ln \omega_{3it})^2 + \omega_7(\ln \omega_{1it})(\ln \omega_{2it}) + \\ & \omega_8(\ln \omega_{2it})(\ln \omega_{3it}) + \omega_9(\ln \omega_{1it})(\ln \omega_{3it}) + \varepsilon_{it} \end{aligned} \quad (9)$$

In this equation, TC represents the logarithm of the total cost of all MFIs in country i during period t . Y_{it} represents the quality of production in terms of total assets. Three input prices ω_{1it} , ω_{2it} , and ω_{3it} are used to capture the price of funds, the price of labor and the price of fixed capital respectively (see Panel A of Table 6 in the appendix). To estimate equation (9), we use the stochastic frontier (SF) method (see Panel B of Table 6 in the appendix). Some coefficients (γ_1 , γ_2 , γ_3 , γ_4 and γ_5) obtained in equation (9) will subsequently be used in equation (10) to calculate the marginal cost (MC_{it}).

$$\begin{aligned} MC_{it} = & \frac{\partial TC_{it}}{\partial Y_{it}} = ((\gamma_1 + \gamma_2 \ln(Y_{it}) + \sum_{l=1}^3 \gamma_l \ln(\omega_{lit})) \frac{TC_{it}}{Y_{it}} \\ = & (\gamma_1 + \gamma_2 \ln(Y_{it}) + \gamma_3 \ln(\omega_{1it}) + \gamma_4 \ln(\omega_{2it}) + \gamma_5 \ln(\omega_{3it})) \frac{TC_{it}}{Y_{it}} \end{aligned} \quad (10)$$

After estimating the marginal cost, we calculate the profit (Π_{it}) of SSA MFIs by considering the proportion of their loan portfolio. The values of these two variables are then replaced in equation (11) to calculate the Boone indicator (β_t).

$$\ln \Pi_{it} = \alpha + \sum_{t=1}^T \beta_t d_t \ln(MC_{it}) + \sum_{t=1}^{T-1} \alpha_t d_t + \mu_{it} \quad (11)$$

The empirical model (11) is derived from the definition of the Boone index (equation 7). This model has previously been used by Hossain et al. (2020) and Tchakounté (2022) to calculate the competition (β_t) of MFIs. In equation 11, MC_{it} corresponds to the marginal cost of all MFIs in country i at time t , d_t corresponds to the

time variables; μ_{it} is the error term and β_t is Boone index at time t . Since the Boone index is calculated based on a negative relationship between market share and marginal cost, a negative Boone value ($\beta < 0$) will indicate the presence of strong competition in the microfinance market, while a positive Boone value will show the existence of strong collusion (Van Leuvensteijn et al., 2011). Over time, the gradual increase in positive or negative Boone values (β_t) is automatic, as the profit of the most efficient MFIs (i.e., with lower marginal costs) increases in the presence of strong homogeneity of financial services (Hossain et al., 2020). However, in the presence of high and disparate lending rates, the heterogeneity of financial services offered by microfinance can limit the effectiveness of Boone's index. To ensure the robustness of this indicator, we calculate the Lerner index. This indicator will be calculated using the following model:

$$L_{it} = \frac{(P_{it} - MC_{it})}{P_{it}} \quad (12)$$

This model is derived from the definition of the Lerner index (equation 8). In the empirical model (12), MC_{it} corresponds to the marginal cost of all MFIs in country i at time t (equation 10), L_{it} represents the Lerner index for country i at the time t , and P_{it} corresponds to the marginal profit of all MFIs in country i at time t . (See the description of Π_{it} in Tables 6 and 7 of the appendix).

Econometric models to analyze the effect of competition on MFI performance

The SCP or ESH approach generally uses dynamic panel models to justify the relationship linking concentration and the performance of American, European and Asian MFIs (Kar, 2016; Wondirad, 2020). The pro-centrism of this negative or positive relationship can be justified by this equation:

$$P_j = f(CR, X_j) \quad (13)$$

In this equation, P_j measures the performance of the microfinance j , CR captures the level of concentration in the microfinance sector and X_j designates the set of control variables. Although the concentration of the microfinance sector is progressive in Africa and the rest of the world, the interpretations and policy implications of this progression generally vary according to certain studies. Wondirad (2020) and Dannon et al (2019) have interpreted it as support for the SCP hypothesis, which asserts that in the presence of highly concentrated markets, competition improves microfinance performance. Deb (2020) and Meraj (2021) interpreted it as support for ESH hypothesis, which asserts that in the presence of highly concentrated markets, competition worsens the performance of MFIs.

Considering the altercation in the literature that pits the results of Wondirad (2020) and Dannon et al (2019) against the results of Deb (2020) and Meraj (2021), we model the effect of competition on the performance of SSA microfinances using a dynamic panel model. The choice of this model is preferred over fixed-effect models because dynamic panel models generally provide accurate estimates. These models also make it possible to consider the idiosyncratic characteristics of endogenous variables (Roodman, 2009a; Roodman, 2009b). To better understand the relationship between financial intermediation theory and SCP and ESH theories, our fourteenth equation was designed by linking competition, lending rate, and a set of explanatory variables to SSA microfinance performance indicators.

$$Y_{ijt} = C + nY_{ijt-1} + \sum_{k=1}^k \theta_k x_{ijt}^k + \sum_{n=1}^n \theta_n x_{it}^n + \sum_{m=1}^m \theta_m Z_{ijt}^m + \varepsilon_{ijt} \quad (14)$$

In this dynamic panel model, j represents the MFI, i represents the country and t refers to time expressed in years. n , θ and C are the parameters to be estimated. Y_{ijt} Represents the performance of MFI j operating in country i during year t . This performance is measured by the following indicators profitability (return on assets

(ROA) and return on equity (ROE)) and outreach (average loan per borrower as a percentage of gross national income (Avloangni) and number of active borrowers (NAB)). The lagged variable Y_{ijt-1} represents the idiosyncratic characteristics of microfinance j operating in country i . The coefficient of this lagged variable generally eliminates the universal time related shocks that can arise from the correlation between MFIs in the context of idiosyncratic disturbances (Roodman,2009a). The idiosyncratic variable Y_{ijt-1} will be used in the study, as the performance of microfinance in the next period depends on that of the previous period. x_{ijt}^k Represents the determinants specific to MFI j in country i (loan losses; Portfolio at Risk at 30 days; MFI capital-to-assets ratio and lending rate); x_{it}^n represents the macroeconomic variables of country i . These are: competition; inflation; bank capital-asset ratio; GDP; and region. ε_{it} Represents the error term and Z_{ijt}^m Represents the dummy and institutional variables of microfinance j in country i . These are: age of microfinance, regulatory status, types of profit-oriented and profit-oriented MFI. The age of microfinance is included in the study, as the operating mode of mature MFIs generally differs from that of new or young MFIs (see Table 2). Regulatory status is included in the study, as the regulation is a macroeconomic tool that can reduce the lending rate of microfinance. The types of profit-oriented and non-profit MFIs are also integrated into the study, as profit-oriented MFIs (micro banks and NBFIs) generally opt for more conventional risk management and governance practices, whereas non-profit microfinance (credit unions/cooperatives and NGOs) apply deposit-centric business model (see Table 2).

Before estimating our fourteenth equation, we will first calculate the Boone index (β_t from Equation 11) and the Lerner index (L_{it} from Equation 12) using Sections 3.1 and 3.2 a. After calculating these indices, we introduce Boone value into empirical Equation 14 to analyze the effect of competition on the performance of SSA MFIs. Subsequently, we introduce the Lerner value into the same equation to ensure the robustness of the results obtained with the Boone index.

In general, ordinary least squares (OLS) estimation of empirical equations provides attractive results when the model is homogeneous and when there is no autocorrelation. However, in the presence of the lagged endogenous variable (Y_{ijt-1}) in Equation 14, (OLS) results automatically become biased and inconsistent. To correct these biases, we use the generalized method of moments (GMM) of Arellano and Bover (1995) and Blundell and Bond (1998). In the presence of the lagged endogenous variable in Equation 14, OLS estimation can also provide biased and inconsistent results due to the endogeneity problem caused by the bidirectional relationship between competition and MFI performance (Wondirad,2020; Meraj,2021). This problem may also stem from the fact that, in calculating the Boone index, we did not take into account the principle that an MFI with a specific name in country i may also be operational in another country in the sample (Bartik,1991). To resolve the possible endogeneity of our analysis, we will also use the generalized method of moments. This method has been widely used in previous literature (Wondirad, 2020; Hossain et al., 2020), as GMM apply effectively to dynamic panel models that have a large individual dimension ($N=3,105$ SSA MFIs) and a small temporal dimension ($T=18$ years) (Tchakounté, 2022).

There are two versions of the dynamic panel data GMMs of Arellano and Bover (1995) and Blundell and Bond (1998), namely different GMM and system GMM. In the absence of residuals with no second-order serial correlation, difference GMM generally use lagged exogenous variables as instruments, while system GMM combine these lagged exogenous variables with additional instrumental variables. The addition of these instruments is necessary to avoid a potential loss of efficiency in models estimated in first differences. Considering this specificity, the choice of the GMM system is preferred to different GMM and other instrumental variable estimation methods for several reasons. Firstly, the GMM system of Arellano and Bover (1995) and Blundell and Bond (1998) more effectively solve the endogeneity problem that arises in panel data

estimation and correct possible inconsistencies and estimation biases in the presence of the lagged variable (Y_{ijt-1}). Secondly, the system-GMM estimator provides consistency and efficiency of estimates even in the presence of autocorrelation and model heteroscedasticity. Thirdly, the GMM system estimator solves problems of simultaneity or reverse causality. Fourthly, the estimator of difference GMMs and other instrumental variable methods can be inconsistent and biased, but the GMM system solves this problem because it combines first-difference and level regressions (Roodman,2009a,2009b). Given the advantages of this estimation method, our study will use the two-stage GMM system method to ensure the robustness of the Boone index (see Table 8). We will also use the two-stage GMM method to analyze the effect of competition on the performance of profit-oriented and non-profit MFIs in SSA (see Tables 9 and 10). Validation of the results of this estimation method will be effective: (i) if the number of instruments is less than the total number of corresponding groups; (ii) if the test of instrument over-identification is verified (Hansen test), if (iii) the test of instrument validity is verified (Sargan test); (iv) if the AR (1) is significant and if the hypothesis that the error term is not serially correlated (AR (2)) is verified.

In the fourteenth Equation, we solve the endogeneity problem by introducing instruments composed of the second and third lags of the exogenous variables (Soumaré et al.,2020). We also address this issue by introducing a Bartik instrument (Bartik,1991). To obtain the final value of this instrument, we calculated local competition by weighting each MFI's national competition with each MFI's market share (Dorn and Hanson,2013; Bartik,1991).

To validate or refute the hypotheses of our analysis, we decompose the fourteenth equation into two separate equations. Equation 15 presents the relationship between competition and the performance of profit-oriented MFIs.

$$Y_{ijt} = C + nY_{ijt-1} + \theta_1 Boone_{it} + \theta_2 Taux_{ijt} + \theta_3 loanloss_{ijt} + \theta_4 CAR_{ijt} + \theta_5 Par\ 30_{ijt} + \theta_6 Age_{ijt} + \theta_7 Profit - oriented_{ijt} + \theta_8 reglementation_{it} + \theta_9 region_{it} + \theta_{10} Inf_{it} + \theta_{11} kalass_{it} + \theta_{12} PIB_{it} + \epsilon_{ijt} \quad (15)$$

While equation 16 shows the relationship between competition and the performance of non-profit MFIs

$$Y_{ijt} = C + nY_{ijt-1} + \theta_1 Boone_{it} + \theta_2 Taux_{ijt} + \theta_3 loanloss_{ijt} + \theta_4 CAR_{ijt} + \theta_5 Par\ 30_{ijt} + \theta_6 Age_{ijt} + \theta_7 Non - profit_{ijt} + \theta_8 reglementation_{it} + \theta_9 region_{it} + \theta_{10} Inf_{it} + \theta_{11} kalass_{it} + \theta_{12} PIB_{it} + \epsilon_{ijt} \quad (16)$$

In these equations, profit-oriented represents the different types of profit-oriented MFIs, while non-profit represents the different types of non-profit MFIs (see Table 2 for details). To ensure the robustness of the results derived from our empirical models 15 and 16, we will check whether the results of the two-stage GMM system are similar to those of instrument-free inference for linear regression models with endogenous regressors and to those of pooled fixed-effects OLS and pooled random-effects OLS (Soumaré et al.,2020; Kripfganz and Kiviet,2021). In contrast to OLS, pooled fixed-effects OLS and pooled random-effects OLS apply effectively to dynamic panel models, as they consider the problems of heterogeneity and endogeneity that arise from the idiosyncratic characteristics of the endogenous variable (Y_{ijt-1}). We implement the Breusch-Pagan and Cook-Weisberg test to verify the homoscedasticity of empirical models 15 and 16. We also implement two other tests (Fisher's test and Hausman's test) to distinguish between OLS grouped in fixed-effects and random-effects models. The Fisher test will enable us to assess the joint significance of individual effects (random and fixed) about pooled OLS. The Hausman test (1978) will enable us to assess the distance between fixed and random effects (Soumaré et al., 2020). Despite the reliability of the results obtained by the pooled OLS method, the heteroscedasticity of the residuals and the endogeneity correlation of certain variables may limit the

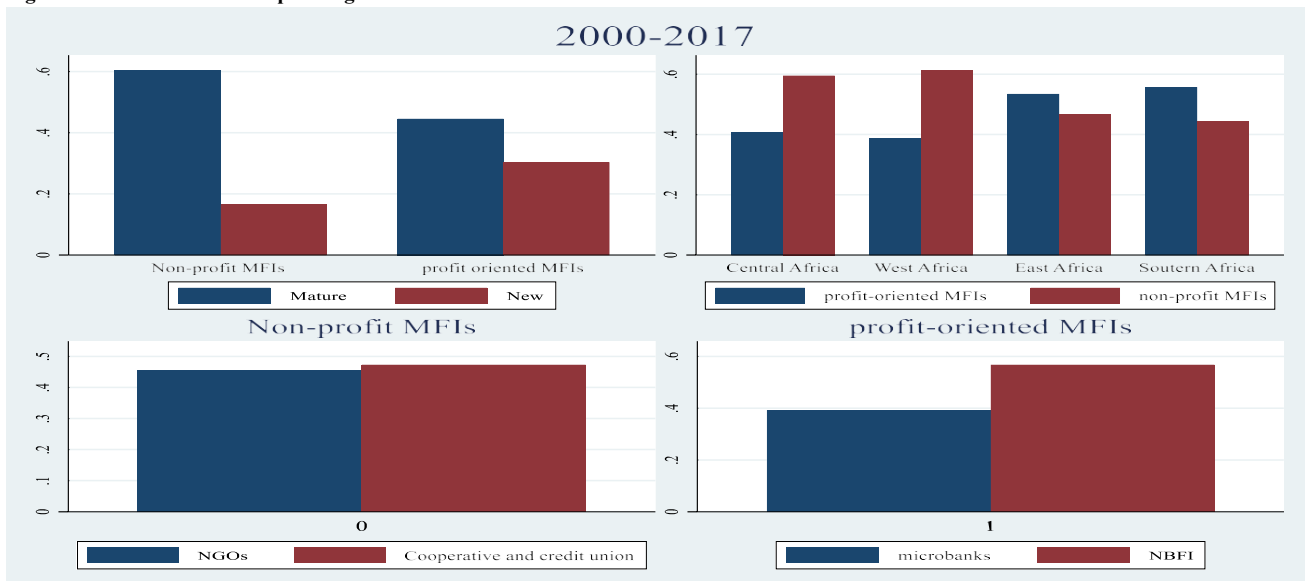
effectiveness of this estimation method. To overcome these limitations, we will use instrument-free inference for linear regression models with endogenous regressors (Kripfganz and Kiviet,2021). This new estimation method will also enable us ensure the robustness of equations 15 and 16, as the values of their confidence intervals are narrower than those of the two-stage GMM system. The method of instrument-free inference for linear regression models with endogenous regressors will also enable us to check the sensitivity of instrument-based procedures (Kripfganz and Kiviet, 2021). According to Kripfganz and Kiviet (2021), controlling this sensitivity is more effective with the instrument-free inference method, as the features that make the GMM system's instruments reliable may be a source of violation of the exogeneity condition.

Data sources and descriptive statistics

A) Data source

The 3,105 MFI observations used in the study come from the Microfinance Information Exchange (MIX market). The Mix market is a database covering thousands of financial service providers. It is also a non-profit organization responsible for compiling information on microfinance worldwide. Some additional data required for the analysis are extracted from the World Development Indicator. Panel A in Table 1 shows the sample breakdown by region, while Panel B in the same table shows the sample breakdown by MFI type and year. In Panel A, we used the MIX market data to create the following dummy variable: region. This variable was then used to obtain the number MFI observations in Central Africa (318 MFI observations); West Africa (1506 MFI observations); East Africa (1184 MFI observations) and Southern Africa (97 MFI observations). In panel B of table 1, we used MIX market data to divide microfinance into profit-oriented MFIs (45.02% of the total sample) and non-profit MFIs (54.98% of the total sample). These MFIs were all made up of old and new microfinance that operated in 37¹ SSA countries over the period from 2000 to 2017 (see Figure 5).

Figure 5: Evolution of MFIs operating in SSA



Source: author's construction based on mix market data

¹ Angola¹, Benin², Burkina Faso³, Burundi⁴, Cameroon⁵, Central African Republic⁶, Chad⁷, Congo⁸, Zimbabwe⁹, Democratic Republic of the Congo¹⁰, Ivory Coast¹¹, Ethiopia¹², Gabon¹³, Gambia¹⁴, Ghana¹⁵, Guinea¹⁶, Guinea-Bissau¹⁷, Kenya¹⁸, Liberia¹⁹, Madagascar²⁰, Malawi²¹, Mali²², Mozambique²³, Namibia²⁴, Niger²⁵, Nigeria²⁶, Rwanda²⁷, Senegal²⁸, Sierra Leone²⁹, South Africa³⁰, Zambia³¹, Swaziland³², Tanzania³³, Togo³⁴, Uganda³⁵; Comoros³⁶, Zimbabwe³⁷

Figure 5 shows the average evolution of MFIs operating in SSA. This figure shows that between 2000 and 2017, the largest number profit-oriented MFIs was in Southern Africa, while the largest number non-profit MFIs was in West Africa. The figure also shows that, over the same period, non-profit MFIs had the highest number of mature MFIs, while profit-oriented MFIs had the highest number of new MFIs. Comparing the average evolution of the types profit-oriented and non-profit MFIs operating in SSA, we see that between 2000 and 2017, profit-oriented MFIs had a larger number of NBFIs, while non-profit MFIs had a large number of credit unions and cooperatives.

B) study variables and descriptive statistics

Table 2: Variable definition and description

	Variable	Description	Source
MFI profitability indicators			
	-	-	-
Profitability 1	ROA	Return on assets	Mix market
Profitability 2	ROE	return on equity	Mix market
MFI outreach indicators			
	-	-	-
Breadth of outreach	NAB	Number of active borrowers	Mix market
Depth of outreach	Avloangni	average loan per borrower as a percentage of gross national income	Mix market
Main explanatory variables			
	-	-	-
Competition	Boone	The Boone Index measures MFI competition. A higher Boone indicates a higher level of competition.	Author's calculation
Competition	Lerner	The Lerner Index measures MFI competition (see sections 3.1 and 3.2 a for more details).	Author's calculation
Dummy and institutional variables			
	-	-	-
Age of microfinance			
	AGE	This dummy variable takes the value of 1 if the MFI is mature, 2 if the MFI is new and 3 if the MFI is young. To integrate age into the study, we have decomposed it into 3 dummy variables	Mix market
	New	This dummy variable takes the value of 1 if the MFI is new and 0 if it is not.	The author
	Young	This dummy variable takes the value of 1 if the MFI is young and 0 if not (in the study, the young MFI is the reference).	The author
	Mature	This Dummy Variable takes the value of 1 if the MFI is mature and 0 if not.	The author
Regulatory status			
	status	This dummy variable takes the value of 1 if the MFI is regulated and 2 if it is not. To integrate it into the study, we have decomposed it into 2 dummy variables	Mix market
	regulation	This dummy variable takes the values of 1 if the MFI is regulated and the value of 0 if it is not	The author
	Non-regulated	This dummy variable takes the values of 1 if the MFI is not regulated and the value of 0 if it is not (in the study, non-regulated is the reference)	The author
Types of profit-oriented MFIs			
	profit-oriented	This dummy variable takes the value of 1 if the MFI is profit-oriented and 2 if the MFI is non-profit. To integrate it into the study, we have decomposed it into 2 dummy variables	Mix market
	IFNB	This dummy variable takes the value of 1 if it is an NBFIs and the value of 0 if it is not (NBFIs are the reference in the study).	The author
	Micro-banks	This dummy variable takes the value of 1 if it is a micro bank and the value of 0 if it is not.	The author
Types of non-profit MFIs			
	Non-profit	This dummy variable takes the value of 2 if the MFI is non-profit and 1 if the MFI is profit oriented. To	Mix market

		integrate it into the study, we have decomposed it into 2 dummy variables	
	Credit unions / cooperatives	This dummy variable takes the value of 1 if it's a credit union or a cooperative, and the value of 0 if it's not (in the study, credit unions and cooperatives are the reference).	the author
	NGO	This dummy variable takes the value of 1 if it is an NGO and the value of 0 if it is not.	The author
Institutional variables	-	-	-
Loan losses	loanloss	Loan loss rate	Mix market
Loan portfolio risk	PAR30	(Outstanding arrears over 30 days + Total gross outstanding refinanced (restructured) portfolio)/Gross total portfolio	Mix market
Loan rates	Rate	the loan loss reserve divided by the gross loan portfolio	Mix market
Equity	CAR	Capital-to-assets ratio = shareholders' equity divided by total assets. Equity includes shareholders' equity as well as additional sources of capital, such as loan loss reserves, asset reserves and subordinated debt.	Mix market
Macroeconomic variables	-	-	-
Rising general price levels	Inflation	The GDP Deflator is used to assess the level of inflation in a country during an MFI's fiscal year.	WDI
Bank capital	Kalass	Bank 'capital to assets ratio	WDI
MFI region	Region	Dummy variable with the following modalities: 1 for Central Africa, 2 for West Africa, 3 for East Africa and 4 for Southern Africa (Southern Africa is the reference).	Author classification
	Central Africa	This dummy variable takes the value of 1 if Central African countries, and 0 if not.	The author
	West Africa	This dummy variable takes the value of 1 if West African countries, and 0 if not.	The author
	East Africa	This dummy variable takes the value of 1 if East African countries, and 0 if not.	The author
	Southern Africa	This dummy variable takes the value of 1 if it refers to Southern African countries and the value of 0 if not (In the study, the Southern African region is the reference).	The author
Economic growth	Gdpc	Annual growth rate of real GDP per capita	WDI

Note: *WDI* = World Development Indicators of the World Bank; *Avloangni*= average loan per borrower as a percentage of gross national income; *ROA*= return on assets. *ROE* = return on equity; *NAB*=number of active borrowers; *NBFI*= non-banking financial institutions; *NGO*= non-governmental organization, *loanloss*= Losses on loans, *kalass*= capital/asset ratio of banks, *Par 30*= 30- day portfolio at risk, *CAR*= capital per asset ratio, *Gdpc* = annual growth rate of real GDP per capita.

Source: author's construction based on Mix market and World Bank data

Table 2 shows the set of variables to be used in the study, while Table 3 presents the descriptive statistics for these variables. To manage outliers in our analysis, we have applied the proportionality ratio to the following quantitative variables: the number of active borrowers (NAB), the capital-to-asset ratio (CAR), the inflation and the annual growth rate of real GDP per capita (Gdpc).

Table 3: Descriptive statistics

Panel A: Descriptives statistics of the entire sample

Variable	Obs	Mean	Std. Dev.	Min	Max
roe	2029	-.054	.632	-9.852	4.138
roa	2036	-.019	.156	-2.467	.83

NAB	2733	.264	.859	0	25.61
avloangni	2667	1.369	11.044	0	557.728
Boone	3105	-.78	.266	-1	.675
lerner	3104	-1.216	4.37	-87.439	1
Rates	2012	15.19	9.454	4.737	82.334
loanloss	1792	.109	1.598	0	41.972
kalass	2862	.377	.433	0	12.149
Age (young MFI is the reference)					
New	3105	.227	.419	0	1
Mature	3105	.532	.499	0	1
Non-profit (credit unions and cooperatives are the main reference)					
NGO	3105	.254	.435	0	1
Profit-oriented (NBFIs are the reference)					
Micro-banks	3105	.181	.385	0	1
regulatory status (non-regulated MFIs are the reference)					
regulation	3105	.795	.403	0	1
PAR 30	2040	.1	.209	0	6.843
CAR	2873	.066	.358	0	9.491
Inflation	2877	.096	.279	-.358	10.967
Gdpc	2887	1.068	1.743	0	6.978
Region (Southern Africa is the reference)					
Central Africa	3105	.102	.303	0	1
West Africa	3105	.485	.5	0	1
East Africa	3105	.381	.486	0	1

Panel B: Descriptive statistics by legal status of MFIs

IMF	roa	roe	NAB	avloangni	Boone	Taux	loanloss	kalass	par30	CAR	Inflation	Gdpc
Profit-oriented	-.002	-.01	.359	1.352	-.786	18.129	.072	.361	.099	.112	.127	1.503
Non-profit	-.092	-.025	.188	1.382	-.775	12.9	.136	.39	.1	.029	.07	.699
Diff (mean comparison test)	-.015*	-.090**	-.171***	.0297	.0118	-5.22	.0638	.0294	.0013	-.083	-.057 ^{2***}	-.8037***

Panel C: Variance inflation factor

NAB	Mean	Boone	Taux	inflation	kalass	loanloss	par30	Gdpc	CAR
VIF	1.158	1.385	1.288	1.238	1.126	1.087	1.082	1.035	1.019
1/VIF		.722	.776	.808	.888	.92	.925	.966	.981

Note: VIF = Variance inflation factor; Avloangni= average loan per borrower as a percentage of gross national income; ROA= return on assets; ROE = return on equity; NAB=number of active borrowers; NBFi= non-banking financial institutions; NGO= non-governmental organization, loanloss= Losses on loans, kalass= capital/asset ratio of banks, Par 30= 30- day portfolio at risk, CAR= capital per asset ratio, Gdpc = annual growth rate of real GDP per capital.

Source: author's construction based on Mix market and World Bank data

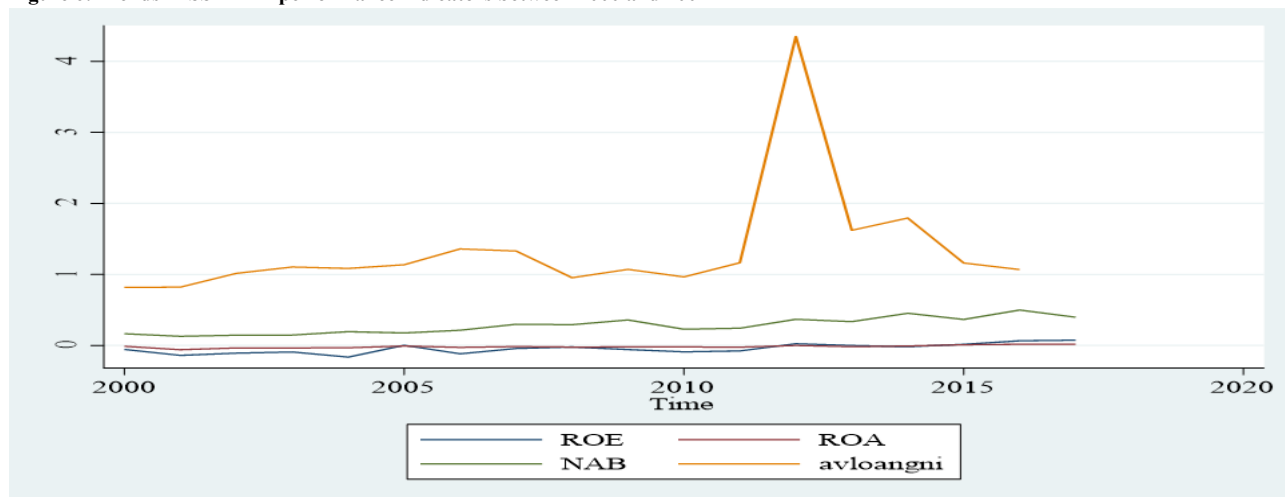
a) Dependent variables

In Tables 2 and 3, SSA microfinance outreach is measured by the following variables: average loan per borrower as a percentage of gross national income (Avloangni) and number of active borrowers (NAB) (Lensink et al.,2018; Tchougoua and Soumaré,2019; Tchougoua et al.,2020). Profitability, meanwhile, is measured by the following variables: return on assets (ROA) and return on equity (ROE) (Soumaré et al.,2020; Tchakounté,2022). Avloangni is our first outreach indicator. This indicator can be defined as the average coverage of an MFI serving its customers based on their socio-economic profiles. It is generally used to measure the depth of outreach of microfinance. The lower it is, the poorer an MFI's customers are, and vice versa (Lensink et al.,2018). Between 2000 and 2017, the Avloangni of non-profit MFIs of SSA (1.382) was higher than that of profit oriented MFIs (1.356) because NGOs, credit unions and cooperatives in these countries target wealthy borrowers, whereas micro banks and NBFIs in these countries are more oriented towards poor borrowers (see the Avloangni variation principle of Lensink et al.,2018). Our second outreach indicator is NAB. NAB is a variable that measures the breadth of microfinance outreach. It is generally used

to provide information on the profile of customers served by MFIs (Hessou et al.,2021). Between 2000 and 2017, the average NAB of MFIs in SSA was valued at 0.264.

ROA is our primary indicator of profitability. It can be defined as the MFI's net operating income divided by its assets. It is commonly used to measure profitability, as it enables us to assess an MFI's ability to generate income from its assets (Soumaré et al., 2020). ROA also provides an overview of MFI's performance by assessing profitability regardless of the funding structure. Our second profitability indicator is ROE (Tchakounté,2022).

Figure 6: Trends in SSA MFI performance indicators between 2000 and 2017



Source: author's construction based on Mix market data

ROE is a percentage ratio that indicates the return earned on a microfinance institution's equity capital, and it is particularly important for MFIs as it shows the investor's return on equity in the institution (Wondirad, 2020). It also demonstrates how effectively MFIs generate profits from their shareholders' funds. Figure 6, combined with the descriptive statistics in Table 3 (Panel A), shows that between 2000 and 2017, the profitability (ROA: -0.019 and ROE: -0.054) and outreach (NAB: 0.264; Avloangni: 1.369) of SSA microfinances progressively increased. Additionally, the association of Figure 6 with the descriptive statistics in Table 3 highlights a significant Avloangni in 2012, likely due to the commercialization of the microfinance sector, which prompted competitive microfinances to increase their average loan (Avloangni) to stay in the market.

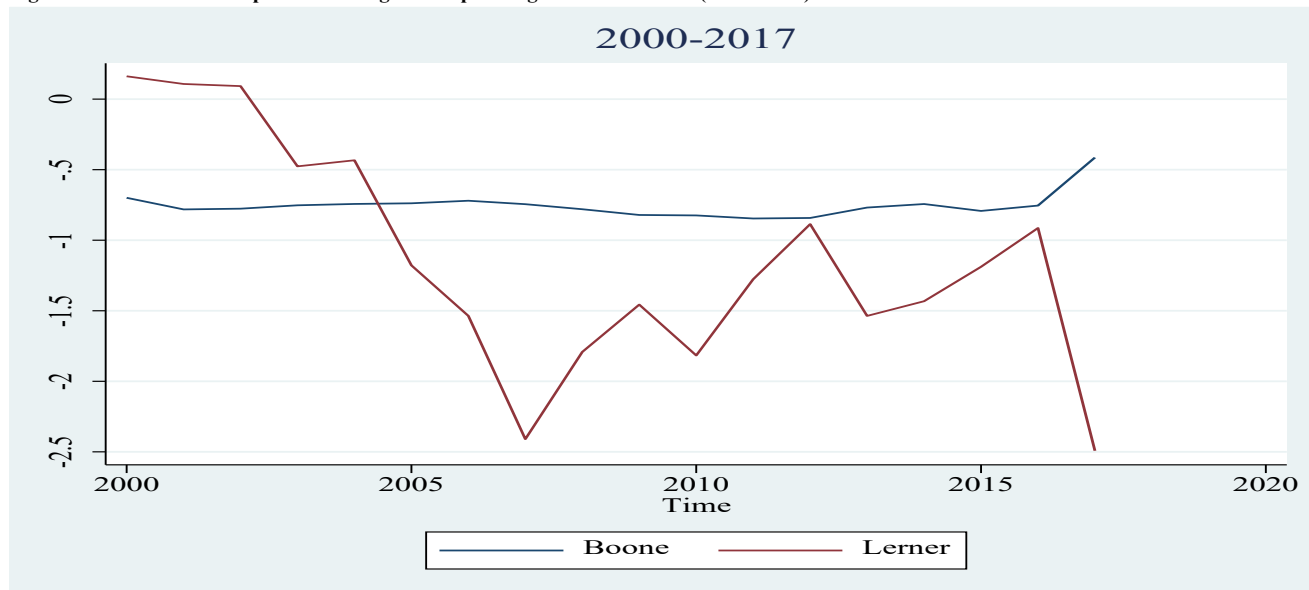
b) Main study variables

In most empirical analyses, banking competition is measured using both non-structural and structural approaches. The non-structural approach typically employs the Herfindahl-Hirschman Index (HHI) to measure market concentration. In contrast, the structural approach uses indicators like the Panzar and Rosse statistics, the Lerner index, and the Boone index. The HHI measures market concentration, while the Lerner index evaluates competition based on the ability of commercial banks to set prices above their marginal costs (Hamid and Ibrahim, 2021; Léon, 2015). The Panzar and Rosse (1987) H-statistic gauges' competition by assessing how input prices and marginal costs influence bank income. The Boone index, grounded in the idea that more efficient banks achieve higher profits due to lower marginal costs and larger market shares (van Leuvensteijn et al., 2011; Léon, 2015), suggests that a Boone value below zero indicates strong competition, whereas a value above zero indicates significant collusion within the banking sector (Léon, 2015).

Although numerous analyses have used the Herfindahl-Hirschman Index (HHI), the Panzar and Rosse (H) statistics, the Lerner index, and the Boone index to measure competition in the banking sector, very few empirical studies have applied these indices to the microfinance sector. Among these studies, Wondirad (2020) and Hossain et al. (2020) reported that the Boone index is the best indicator of MFI competition for several reasons. Firstly, the HHI is based on market concentration, which shows a causal relationship between market structure and microfinance performance, but concentration is not always correlated with the competitive level of financial institutions. Boone's index overcomes this limitation by measuring the market conduct of the MFI. Secondly, the Panzar and Rosse (1987) H-statistic is derived from the price and output determination equations, but it does not account for the chronological evolution of competition. The Boone index addresses this issue by providing a smoother temporal evolution. Thirdly, while the Lerner index measures competition at the firm level, it does not account for the substitution of financial services, unlike the Boone index, which assumes MFI financial services are homogeneous and close substitutes. Despite Boone's index solving many problems, the heterogeneity of financial services offered by MFIs in SSA can limit its effectiveness, especially in the presence of high and disparate lending rates. To account for these limitations and ensure robustness, we will also use the Lerner index, as it does not consider the substitution of financial services.

Table 3 shows the average competition value for microfinance in SSA between 2000 and 2017 (Boone: -.78; Lerner: -1.22). Since the Boone index was calculated based on a negative relationship between market share and marginal cost, the negative Boone values allow our analysis to assert that in SSA, the microfinance sector is highly competitive.

Figure 7: Evolution of competition among MFIs operating in SSA countries (2000 -2017)



Source: author's construction based on Mix market data

These values are presented in panels A and B of Table 3. In this table, competition levels for SSA MFIs (Boone: -0.78; Lerner: -1.22), profit oriented MFIs (Boone: -0.786) and non-profit MFIs (Boone: -.775) are very high.

The negative sign of competition (Boone: -.78; Lerner: -1.22) for SSA microfinance (Panel A in Table 3) is similar to the time trend observed in Figure 7. Considering this evolution, it is clear that the microfinance sector in SSA is highly competitive.

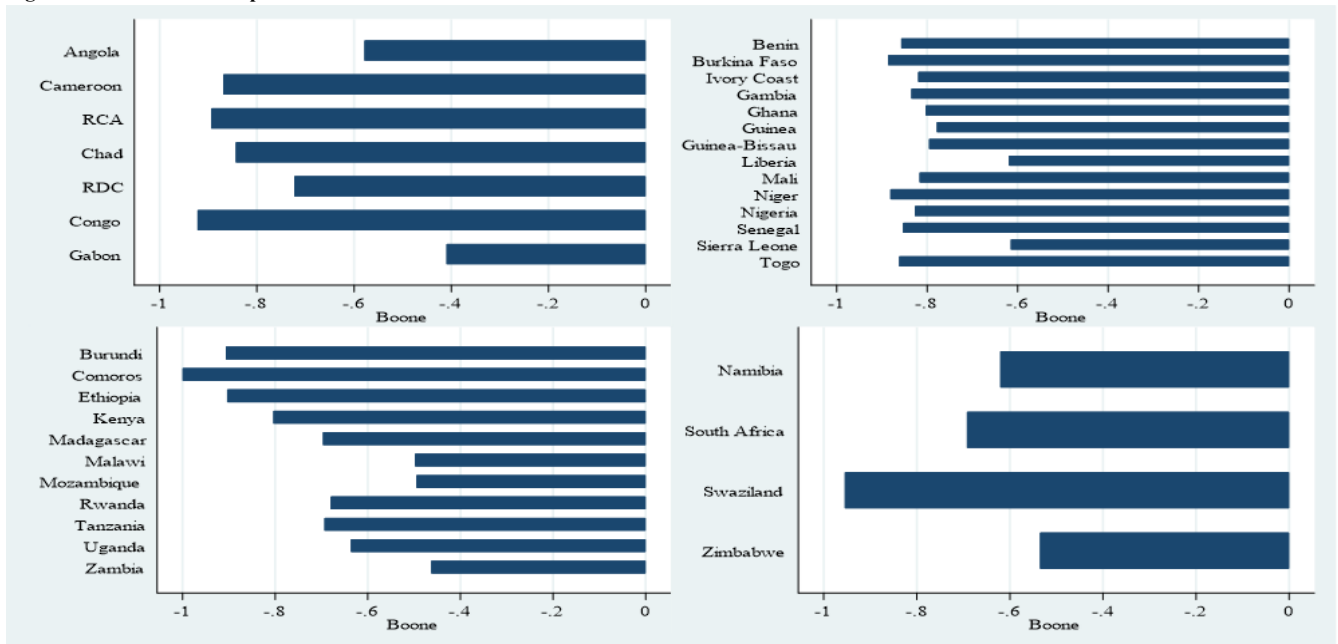
Table 4. Descriptive statistics for the competition index (Boone) by region

Variable	Obs	Mean	Std. Dev.	Min	Max
Central Africa	318	-.8115285	.2436198	-1	.0313752
West Africa	1506	-.8265784	.2250796	-1	.1894404
East Africa	1184	-.7204615	.2949887	-1	.6752689
Southern Africa	97	-.6777035	.3771624	-1	.435344
TOTAL	3105	-.7799217	.2665	-1	.6752689

Source : author’s calculations based on Mix market and World Bank data

Comparing the descriptive statistics in Table 4, Boone's mean values reveal a differentiated competitive environment across sub-regions, with the most significant difference observed in West African countries, where MFI competition is higher (-0.83) compared to other sub-regions. Figure 8 illustrates the competitive evolution of microfinance in SSA, highlighting that between 2000 and 2017, Comoros, Swaziland, Congo, RCA, and Cameroon were the five SSA countries where MFI competition was particularly intense. The figure also shows that during this period, competition among MFIs in Central Africa was highest in Congo, while in West, East, and Southern Africa, the highest competition was seen in Niger, Comoros, and Swaziland.

Figure 8: Evolution of competition in SSA countries



Source: author's construction based on Mix market data

c) Institutional control variables

The institutional variables of the study are loan losses, capital-to-asset ratio, lending rate, and loan portfolio risk. Loan losses represent our first institutional variable. This variable generally captures all non-refundable delinquencies recorded in MFIs' loan portfolios. Over the past two decades, these delinquencies have forced the microfinance sector to slow down its portfolio turnover, delay its interest, increase its collection costs, and degrade its financial viability (Kendo and Tchakounté, 2022). In line with the empirical work of Kendo and

Tchakounté (2022) and Tchakounté (2022), we measure loan losses by the loan loss rate and predict the possible adverse effect of this variable on the performance of SSA MFIs. Our second institutional variable is the capital-asset ratio (CAR). This ratio generally captures the capital adequacy (CAR) of a financial intermediary (Soumaré et al., 2020). In many financial institutions, it is often used to sum Tier 1 and Tier 2 capital. Since the market mix does not allow us to distinguish between the equity of these two categories, we will limit ourselves to the overall capital ratio (Soumaré et al., 2020). This ratio is very important in the financial sector, as it enables MFIs to increase their equity capital in order to improve their financial profitability (Soumaré et al., 2020). In line with the empirical work of Tchakounté (2022) and Soumaré et al. (2020), we predict the possibility of a positive effect of the CAR on the performance of SSA MFIs. Descriptive statistics for the first two institutional variables in our analysis are presented in Table 3. These reveal that between 2000 and 2017, the mean values of the loan loss rate and the capital-to-assets ratio were respectively valued at 0.109 and 0.066.

The lending rate is another institutional variable in the study (Kendo and Tchakounté, 2022). This variable generally captures the return on the capital lent, which is paid by the borrower to the lender. Since African microfinance has high and disparate lending rates (Figure 1), we consider the possibility of a positive relationship between this variable and the financial profitability of MFIs in SSA. We also consider the possibility of a negative relationship between this variable and the outreach of SSA microfinance. The mixed relationship between lending rates and the performance of the microfinance sector is in line with the findings of the synthesis report (2021). This report recently showed that, in the presence of significant information asymmetries, the lending rate forces MFIs to maximize their profit without taking into account their social mission. Descriptive statistics for our third institutional variable are presented in panels A and B of Table 3. These show that, in SSA, the average lending rate of profit-oriented MFIs (18.129) is higher than that of non-profit MFIs (12.905). These statistics also show that between 2000 and 2017, the average lending rate of MFIs in SSA was estimated at (15.19).

Loan portfolio risk is our final institutional variable. This determinant of microfinance performance can be defined as the proportion of the portfolio affected by delinquency, where there is a risk of non-repayment. It is very important for the activities of MFIs because increased competition can lead to imprudent lending, excessive borrowing, and multiple contracts, which will in turn reduce the performance of the microfinance sector (Soumaré et al., 2020). In line with the empirical work of Soumaré et al. (2020), we measure the risk of the loan portfolio by the 30-day portfolio at risk (PAR30) and predict the possible adverse effect of this variable on the performance of SSA MFIs. Descriptive statistics for this risk are presented in Table 3. These reveal that in SSA, the average value of loan portfolio risk corresponds to 10% of the gross portfolio of loans granted by MFIs.

d) Dummy control variables

The study's dummies are: Age, regulatory status, type of profit-oriented MFI, type of non-profit MFI, and region. According to MIX Market, the age of microfinance is defined as the number of years of activity an MFI needs to transition from the stage of a new MFI (0 to 4 years) to the stage of a young MFI (5 to 8 years) or mature MFI (more than 8 years). Following Soumaré et al. (2020), dummy variables were created for each of these stages, with young MFIs set as the reference variable. Consistent with previous empirical work (Soumaré et al., 2020; Kendo and Tchakounté, 2022), the study predicts the possibility of a positive relationship between age and the performance of SSA microfinance. The study also predicts the possibility of much higher performance in mature MFIs compared to new MFIs. Both of these possibilities are supported by institutional life-cycle theory, which states that, in the microfinance sector, mature MFIs perform better than newly created microfinances because their financing depends on traditional equity capital, whereas that of new microfinances depends on subsidized loans (Soumaré et al., 2020).

Our second dummy variable is the regulatory status of microfinance. This variable generally captures all the regulatory standards that MFIs use to improve their financial operations. To incorporate it into the study, we differentiated between regulated and non-regulated MFIs and then set non-regulated MFIs as the reference variable. Consistent with the empirical study by Soumaré et al. (2020), the study predicts the possibility of a positive relationship between regulation and the performance of SSA microfinances. This possibility is supported by the theory of competitive forces, which states that regulation is an excellent means of improving the performance and homogeneity of MFIs (De Quidt et al., 2018).

The third dummy variable in the study is the type of profit-oriented MFI. This variable is generally used to distinguish micro-banks from NBFIs (Hessou et al., 2021). To incorporate it into the analysis, dummy variables were created for each type of profit-oriented MFI, with NBFIs set as the reference variable. By measuring the type of profit-oriented MFI by micro-banks, the study anticipates the possibility of a positive effect of this variable on the performance of SSA microfinances. This positive relationship is expected because profit-oriented MFIs improve their performance thanks to practices such as risk management and governance.

Our fourth dummy variable is the type of non-profit MFI. This variable generally distinguishes credit unions and cooperatives from NGOs (Hessou et al., 2021). To integrate it into the analysis, dummy variables were created for each type of non-profit MFI, with credit unions and cooperatives set as the reference variable. Since non-profit MFIs compound their risk by deposit-centric business models (Hessou et al., 2021), we predict the possibility of a negative relationship between non-profit MFIs and their performance. Our final dummy variable is the region. This study used it to consider heterogeneity linked to the age of microfinance. This study also used it to consider heterogeneity related to the cultural differences of clients interacting with profit-oriented and non-profit MFIs (Soumaré et al., 2020). Based on Mix Market data, SSA countries were classified into four regions: Central Africa, West Africa, East Africa, and Southern Africa. Dummy variables were created for each of these regions, with the Southern Africa region set as the reference variable (Soumaré et al., 2020).

e) Macroeconomic control variables

In the literature, there are many macroeconomic variables that can influence the performance of MFIs. Among these variables, we use the bank capital adequacy ratio, inflation, and economic growth. The bank capital adequacy ratio is our first macroeconomic variable. This variable generally captures all direct and indirect investments made by banks in MFIs. Consistent with the empirical study by Kanga et al. (2020), we measure the bank equity ratio by the total equity/assets ratio and predict the possibility of a positive relationship between this variable and the performance of SSA MFIs. This possible relationship is supported by the empirical analysis of Simo et al. (2023), which showed the existence of a positive effect of bank equity on the performance of the microfinance sector, as the commercialization of this sector is increasingly attracting the interest of commercial banks wishing to diversify their asset portfolio. Our second macroeconomic variable is the rise in the price level (inflation). This variable is crucial, as its lack of anticipation can lead to higher costs, subsequently reducing the performance of financial institutions (Kanga et al., 2021). By measuring inflation through the growth rate of the consumer price index, the study predicts a negative effect of this variable on MFI performance. This negative relationship is expected because high inflation reduces the real interest rate and microfinance profits (Kanga et al., 2021). Our final macroeconomic variable is economic growth. Consistent with the empirical work of Lensink et al. (2018) and Kanga et al. (2024), we measure this variable by the annual growth rate of real GDP per capita and predict a positive relationship between economic growth and the performance of SSA MFIs. This positive relationship is expected because economic growth affects the stability of MFIs through its effect on capital accumulation and profits in the microfinance sector. Descriptive statistics for the bank capital adequacy ratio, the growth rate of the consumer price index, and the annual growth rate of real GDP per capita are presented in Table 3. These reveal that between 2000 and 2017, the bank capital ratio (kalass: 0.377) and economic growth (the annual growth rate of real GDP per capita: 1.068) increased the

development of business sectors in SSA, while inflation (the growth rate of the consumer price index: 0.096) increased the general price level of African economies.

Descriptive statistics for the mean comparison test are presented in Panel B of the Table 3. These statistics show that in SSA, profit-oriented MFIs are significantly different from non-profit MFIs when the following variables are taken into account: ROA (-0.015), ROE (-0.090), NAB (- 0.171), CAR (-.083), inflation (-.0572) and GDPC (-.8037).

Table 5: Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) roe	1.000												
(2) roa	0.628* (0.000)	1.000											
(3) NAB	0.114* (0.000)	0.138* (0.000)	1.000										
(4) avloangni	0.056* (0.017)	0.066* (0.005)	-0.016 (0.401)	1.000									
(5) Boone	-0.219* (0.000)	-0.280* (0.000)	-0.007 (0.719)	-0.041* (0.032)	1.000								
(6) lerner	-0.020 (0.361)	-0.047* (0.032)	-0.015 (0.428)	-0.010 (0.607)	0.117* (0.000)	1.000							
(7) rate	-0.014 (0.614)	-0.077* (0.005)	0.004 (0.868)	0.020 (0.418)	0.276* (0.000)	0.142* (0.000)	1.000						
(8) loanloss	-0.026 (0.280)	-0.020 (0.401)	-0.022 (0.366)	-0.016 (0.499)	0.039 (0.102)	0.021 (0.377)	0.020 (0.491)	1.000					
(9) kalass	0.018 (0.409)	-0.069* (0.002)	-0.065* (0.001)	-0.077* (0.000)	0.146* (0.000)	0.139* (0.000)	0.128* (0.000)	-0.001 (0.978)	1.000				
(10) par30	-0.152* (0.000)	-0.060* (0.018)	-0.070* (0.002)	0.016 (0.468)	-0.098* (0.000)	-0.014 (0.533)	-0.022 (0.434)	0.204* (0.000)	-0.050* (0.028)	1.000			
(11) CAR	0.068* (0.002)	0.067* (0.003)	0.511* (0.000)	0.061* (0.002)	-0.061* (0.001)	-0.064* (0.001)	-0.015 (0.531)	-0.009 (0.703)	-0.049* (0.009)	-0.021 (0.351)	1.000		
(12) inflation	0.014 (0.530)	0.011 (0.628)	0.009 (0.644)	-0.004 (0.840)	0.061* (0.001)	0.023 (0.214)	0.449* (0.000)	0.007 (0.782)	0.047* (0.015)	0.000 (0.996)	-0.010 (0.600)	1.000	
(13) Gdpc	0.125* (0.000)	0.124* (0.000)	0.073* (0.000)	0.026 (0.196)	-0.001 (0.956)	0.075* (0.000)	0.150* (0.000)	-0.008 (0.740)	0.013 (0.488)	0.059* (0.010)	0.026 (0.184)	-0.002 (0.897)	1.000

Note: *Avloangni*= average loan per borrower as a percentage of gross national income; *ROA*= return on asset, *ROE* = return on equity; *NAB*=number of active borrowers; *NBFI*= non-banking financial institutions; *NGO*= non-governmental organization, *loanloss*= Losses on loans, *kalass*= capital/asset ratio of banks, *Par 30*= 30- day portfolio at risk, *CAR*= capital per asset ratio, *Gdpc* = annual growth rate of real GDP per capita, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: author's calculations based on Mix market and World Bank data

Descriptive statistics of the correlation matrix are presented in Table 5. These statistics reveal that between 2000 and 2017, most of our explanatory variables were weakly correlated with the variables to be explained in the study, with the exception of CAR and NAB (0.511). In order to validate or refute the existence of multicollinearity in the empirical NAB model, we performed the Variance Inflation Factor (VIF) test on all quantitative variables in this model. The decision rules for this test are as follows: if the mean of the VIF test is equal to 1, there is no multicollinearity; if the mean of the VIF test is between 1 and 5, there is moderate multicollinearity; and if the mean of the VIF test is greater than five, there is high multicollinearity (Kanga, 2020). In our analysis, since the mean of the VIF test (1.158) is between 1 and 5, we can conclude that multicollinearity is moderate in the NAB empirical model (see panel C in Table 3).

Figure 9 presents descriptive statistics on the relationship between competition and microfinance performance in SSA. The trend in this figure predicts a possible positive effect of competition on the number of active borrowers in SSA microfinance. The trend in this figure also predicts a possible negative effect of competition on the profitability (ROA and ROE) and depth of outreach (Avloangni) of SSA microfinances.

4) Main results

Panel A of Table 6 describes the set of variables used to estimate the translog cost function. The annual averages of these variables are shown in Table 7. To find the Boone and Lerner values, we first estimated the translog cost function (Equation 9 in Section 3.2) using the stochastic frontier method. The results of our estimation are presented in Panel B of Table 6. Some coefficients ($\gamma_1 = 4.822461$; $\gamma_2 = -1.185207$; $\gamma_3 = 0.1550665$; $\gamma_4 = 0.0071094$ and $\gamma_5 = 0.1398964$) from these results (Panel B of table 6) were then introduced into Equation 10 to calculate the marginal cost of microfinance in SSA. The annual averages of this cost (MC) are presented in Table 7.

Having obtained the marginal cost, we calculated the profit (Π_{it}) of SSA microfinance institutions by considering the proportion of their loan portfolio. The annual averages of this variable are shown in Table 7. To obtain the level of competition (Boone: βt and Lerner: Lit) of SSA microfinance, we used the values of marginal cost and profit (Π_{it}) in empirical equations 11 and 12. The annual averages of competition (Boone: βt and de Lerner: Lit) are presented in Table 7. These averages were subsequently introduced into equation 14 to check the robustness of Boone's results. Looking at columns 1 to 8 of Table 8, our results confirm the robustness of Boone's results, as Boone's index and Lerner's index have similar effects on ROA (Boone: -0.170, Lerner: -0.000125), ROE (Boone: -0.813, Lerner: -0.0418), Avloangni (Boone: - 2.601, Lerner: -0.0626) and NAB (Boone: 0.241, Lerner: 0.0268) of SSA MFIs.

Table 8: Effect of competition on profitability and outreach of SSA MFIs

	Competition (Boone)	Competition (Boone)	Competition (Boone)	Competition (Boone)	Competition (Lerner)	Competition (Lerner)	Competition (Lerner)	Competition (Lerner)
	Profitability		Outreach		Profitability		Outreach	
	Profitability	Depth	Breadth	Profitability	Depth	Breadth	Profitability	Depth
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	GMM ROA	GMM ROE	GMM avloangni	GMM NAB	GMM ROA	GMM ROE	GMM avloangni	GMM NAB
L.roa	0.453*** (0.0773)				0.501*** (0.0672)			
Boone	-0.170 (0.0880)	-0.813*** (0.201)	-2.601*** (0.376)	0.241** (0.0886)				
rate	0.00183 (0.00115)	-0.0242 (0.0135)	0.0191** (0.00641)	0.00252 (0.00203)	0.00157 (0.00124)	0.00169 (0.0131)	-0.00011 (0.00515)	-0.0337* (0.0140)
loanloss	0.243 (0.165)	-0.723 (0.934)	0.688 (1.346)	1.283** (0.406)	0.147 (0.178)	-4.928** (1.627)	-0.450 (0.804)	-2.313 (2.074)
kalass	0.0713* (0.0279)	0.322* (0.160)	-0.247 (0.249)	-0.266*** (0.0740)	0.0533* (0.0207)	0.0771 (0.0685)	0.468 (0.775)	0.0224 (0.0667)
Age (the young MFI is the reference)								
New	0.0202 (0.0222)	-0.127 (0.152)	0.123 (0.172)	0.0614 (0.0510)	-0.000238 (0.0230)	0.181 (0.207)	0.0127 (0.103)	0.0126 (0.0621)
Mature	0.00828 (0.0172)	-0.226** (0.0830)	-0.00921 (0.107)	0.0611 (0.0388)	0.0182 (0.0124)	0.287 (0.274)	0.102 (0.0860)	0.0276 (0.0519)

Non-profit (credit unions and cooperatives are the reference)								
NGO	-0.00249 (0.0307)	0.0984 (0.154)	-0.322** (0.122)	-0.106* (0.0525)	-0.00687 (0.0138)	0.166 (0.279)	-0.271* (0.115)	0.0358 (0.0739)
Profit oriented (NBFIs are the reference)								
Micro-banks	0.0166 (0.0316)	-0.0547 (0.108)	0.301* (0.147)	-0.124* (0.0518)	0.0157 (0.0171)	-0.0544 (0.254)	0.175 (0.163)	0.0370 (0.156)
regulatory status (non are the reference)								
Regulation	-0.0382 (0.0841)	0.261 (0.179)	-0.128 (0.142)	-0.0758 (0.0699)	-0.0175 (0.0247)	0.567 (0.726)	0.0578 (0.130)	0.0592 (0.119)
par30	0.0454 (0.0549)	0.269 (0.234)	0.0501 (0.483)	-2.318*** (0.342)	0.0213 (0.0506)	0.343** (0.116)	-0.150 (0.193)	0.183 (0.228)
CAR	0.0103 (0.0115)	0.0672 (0.0528)	-0.409 (0.327)	0.118 (0.113)	0.0224** (0.00839)	-0.0492 (0.109)	0.0882 (0.0834)	0.419** (0.147)
Inflation	-0.271* (0.120)	1.828* (0.758)	1.126 (0.800)	0.0885 (0.420)	-0.404** (0.140)	0.810 (0.555)	-1.862 (1.023)	1.844*** (0.501)
Gdpc	0.00945 (0.00484)	0.0378 (0.0270)	-0.0423 (0.0343)	-0.0102 (0.0180)	0.00885* (0.00405)	0.0535 (0.0278)	-0.0262 (0.0246)	0.0499 (0.0688)
Region (Southern Africa is the reference)								
Central Africa	0.0607 (0.0726)	0.511 (0.327)	-0.575 (0.381)	-0.0799 (0.219)	0.100* (0.0480)	-0.0995 (0.361)	0.0647 (0.186)	0.221 (0.162)
West Africa	0.0862 (0.0597)	0.219 (0.233)	-0.0192 (0.337)	0.00939 (0.209)	0.108** (0.0402)	-0.0569 (0.291)	0.293* (0.142)	-0.0857 (0.206)
East Africa	0.0815** (0.0311)	0.619* (0.281)	0.180 (0.328)	-0.127 (0.213)	0.0796* (0.0359)	0.0769 (0.269)	0.425** (0.134)	0.262 (0.144)
L.roe		0.406*** (0.0547)				0.217** (0.0745)		
L.avloangni			0.521*** (0.0364)				0.422*** (0.0319)	
L.NAB				1.027*** (0.0420)				0.948*** (0.0746)
Lerner					-0.000125 (0.00117)	-0.0418* (0.0202)	-0.0626* (0.0309)	0.0268* (0.0117)
_cons	-0.216** (0.0786)	-0.880** (0.318)	-1.119** (0.419)	0.494* (0.240)	-0.123** (0.0411)	-0.824 (0.729)	0.0542 (0.346)	0.262 (0.239)
<i>N</i>	132	133	155	155	132	653	767	768
<i>No. of groups</i>	102	103	119	119	102	197	219	219
<i>Instruments</i>	30	31	32	32	32	29	33	31
<i>AR (1): pvalue</i>	0.037	0.044	0.036	0.028	0.031	0.021	0.043	0.022
<i>AR (2): pvalue</i>	0.252	0.449	0.280	0.711	0.341	0.434	0.636	0.649
<i>Sargan test</i>	0.052	0.061	0.144	0.109	0.030	0.972	0.000	0.153
<i>Hansen J test: pvalue</i>	0.293	0.447	0.260	0.116	0.369	0.711	0.875	0.767
<i>Wald (χ^2)</i>	553.41***	637.97***	11895.32***	2070.09***	701.64***	1.22e+06***	1623.52***	7995.80***

Note: : *Avloangni*= average loan per borrower as a percentage of gross national income; *ROA*= return on asset, *ROE* = return on equity; *NAB*=number of active borrowers; ; *NBFI*= non-banking financial institutions;*NGO*= non-governmental organization, *loan loss*= Losses on loans, *kalass*= capital/asset ratio of banks, *Par 30*= 30- day portfolio at risk, *CAR*= capital per asset ratio, *Gdpc* = annual growth rate of real GDP per capita,

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: author's calculations based on Mix market and World Bank data

In the dynamic panel models 15 and 16, lagged variables (Y_{ijt-1}) represent the idiosyncratic characteristics of microfinance j operating in country i during the period $t-1$. The coefficients of these variables enabled us to

eliminate the universal time-related shocks that can arise from the correlation between MFIs in a context of idiosyncratic disturbances (Roodman, 2009a). To analyze the effect of competition on the profitability and outreach of profit-oriented (equation 15) and non-profit (equation 16) microfinance, we estimated the empirical Equations 15 and 16 by: the two-stage GMM system, instrument-free inference for linear regression models with endogenous regressors, pooled fixed-effects OLS, and pooled random-effects OLS. The results of these estimation methods are presented in Tables 9, 10, and 11. These allow us to confirm the overall robustness of Equations 15 and 16, as the effect of competition on the performance of profit-oriented and non-profit MFIs does not change sign when the coefficients of the two-stage GMM system (columns 1 to 8 of Table 9), grouped OLS with fixed and random effects (columns 1, 2, 4, 5, 7, 8, 10 and 11 in Tables 10 and 11), and instrument-free inference from linear regression models with endogenous regressors (columns 3, 6, 9, and 12 in Tables 10 and 11) are significant.

In general, estimation by the two-stage GMM system provides reliable results (i) if the number of instruments is less than the total number of corresponding groups; (ii) if the instrument over-identification test is verified (Hansen test), (iii) if the instrument validity test is verified (Sargan test); (iv) if AR (1) is significant and if the hypothesis that the error term is not serially correlated (AR (2)) is verified. Applying these tests to empirical Equations 14, 15 and 16, we find that all the p-values of AR (2) are not significant, while those of AR (1) are. We also find that the number of instruments in each estimate is less than the number of corresponding groups. We also find that the Hansen and Sargan tests are validated, as most of our p-values fall within acceptable ranges (Tables 8 and 9). In view of these various findings, we can therefore conclude that by applying the GMM method to empirical Equations 14, 15, and 16, these equations have reliable instruments and valid results.

We implement the Breusch-Pagan and Cook-Weisberg tests to verify the homoscedasticity of Equations 15 and 16. The results of these tests are presented in Tables 10 and 11. These show that the standard errors are consistent with respect to heteroscedasticity. We also implement two other tests (Fisher's test and Hausman's test) to separate the pooled OLS of Equations 15 and 16 into fixed-effects and random-effects models. The Fisher test is used in our analysis to assess the joint significance of individual effects (random and fixed). The results of this test are presented in Tables 10 and 11. These results confirm the need to include individual effects, as all of our p-values are zero. Since all Fisher test statistics reject the null hypothesis, we turn to Hausman's (1978) specification test. The statistics of this test generally allow us to assess the distance between fixed and random effects. A high distance between these effects generally favors the use of fixed-effect models, while a lower distance favors the use of random-effect models. The results of Hausman's test are presented in Tables 10 and 11. They confirm the superiority of fixed-effect models over random-effect models. Despite the reliability of the results obtained by grouped fixed-effects and random-effects OLS, the heteroscedasticity of residuals and the endogeneity correlation of certain variables may limit the effectiveness of this estimation method. To overcome these limitations, we will use instrument-free inference for linear regression models with endogenous regressors (Columns 3, 6, 9, and 12 of Tables 10 and 11).

Let's recall that our global sample is made up a dynamic panel of 3,105 MFI observations from the mix market and World Bank for period 2000 to 2017. Despite the large number of observations in the global sample, we can expect that this number to vary from one table to another, as some MFIs lack data for certain variables (see the number of observations in Tables 3, 8, 9, 10 and 11). We can also expect that this number to decrease, since by shifting our endogenous variables by one period, we lose the microfinances that have data for a single year (Hessou et al., 2021).

To analyze the effect of competition on the profitability of profit-oriented and non-profit MFIs, we have presented the results of the two-stage GMM system in Columns 1, 2, 5, and 6 of Table 9. These results show that, in an environment characterized by high and disparate lending rates (Figure 1), competition worsens the

ROA and ROE of both profit-oriented and non-profit MFIs. However, it is important to point out the presence of a much more detrimental effect of competition on the return on assets (ROA) of non-profit MFIs (-0.233) compared to that of profit-oriented MFIs (-0.188). The existence of this disproportionate effect probably stems from the fact that in SSA, the reduction in PAR (-0.50) of profit-oriented MFIs did not enable them to achieve a higher return on assets than that of non-profit MFIs.

When return on equity (ROE) is taken into account, we observe instead the presence of a much more detrimental effect of competition on the ROE of profit-oriented MFIs (-0.896) compared to that of non-profit MFIs (-0.781). The existence of this disproportionate effect probably stems from the fact that between 2000 and 2017, the ROE of profit-oriented MFIs was lower than that of non-profit MFIs (see ROE in Table 3). This situation also stems from the fact that, over the same period, commercial banks' equity capital enabled non-profit MFIs to perform better (kalass:0.0350) than profit-oriented MFIs, as the marketing of non-profit MFIs has been increasingly attracting the interest of commercial banks wishing to diversify their asset portfolio (Simo et al., 2023). The negative relationship between competition and the profitability (ROA and ROE) of profit-oriented and non-profit MFIs corroborates with the work of Hossain et al. (2020), who showed the detrimental effect of competition on profitability in both developed and emerging economies. Although our results are similar to those of Hossain et al. (2020), they do not corroborate with the SCP theory (Mason, 1939), which states that competition provides market power capable of improving corporate profits. Combining the SCP theory with the theory of financial intermediation, we also find that our results do not corroborate with the first part of our two hypotheses. This part predicted that, in an environment characterized by high and disparate lending rates (Figure 1), competition would improve the profitability of both profit-oriented and non-profit MFIs.

Table 9: Effect of competition on profitability and outreach of profit-oriented and non-profit MFIs

	PROFIT-ORIENTED MFI				NON- PROFIT IMF			
	Profitability		Outreach		Profitability		Outreach	
	Profitability	Depth	Breadth		Profitability	Depth	Breadth	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	GMM roa	GMM roe	GMM avloangni	GMM NAB	GMM roa	GMM roe	GMM avloangni	GMM NAB
L.roa	0.169*** (0.0466)				0.594*** (0.0293)			
Boone	-0.188* (0.0779)	-0.896* (0.421)	-3.462*** (0.942)	0.481** (0.151)	-0.240*** (0.0454)	-0.781*** (0.187)	-4.740*** (0.548)	0.341* (0.151)
rate	0.00269** (0.000981)	0.0192 (0.0108)	0.00387 (0.00592)	0.00655 (0.00350)	0.000560 (0.000881)	-0.00114 (0.00364)	0.0509** (0.0166)	-0.00184 (0.00742)
loanloss	0.680** (0.219)	-0.201 (2.520)	-1.184 (1.422)	-0.122 (0.557)	0.140 (0.118)	-7.730* (3.423)	1.000 (1.496)	0.303 (0.616)
kalass	-0.0237 (0.0566)	-0.156 (0.336)	0.0902 (0.453)	-0.0965 (0.0929)	0.0350*** (0.00636)	0.160** (0.0496)	0.516*** (0.102)	-0.191 (0.133)
Age (the young MFI is the reference)								
New	0.141*** (0.0386)	0.498*** (0.147)	0.147 (0.215)	0.00781 (0.0811)	-0.0111 (0.0156)	-0.0896 (0.107)	-0.0601 (0.169)	0.0494 (0.0934)
Mature	0.0548** (0.0185)	0.0758 (0.140)	-0.280** (0.103)	0.0660 (0.0748)	0.00277 (0.00986)	-0.0270 (0.0770)	-0.175 (0.149)	-0.0122 (0.0742)
Profit oriented (NBFIs are the reference)								
Micro-banks	-0.0203 (0.0225)	-0.136 (0.114)	-0.170 (0.203)	0.125 (0.0678)				
Non-profit (credit unions and cooperatives are the reference)								
NGO					0.0183* (0.00888)	0.444* (0.173)	0.114 (0.158)	0.105 (0.0808)

regulatory status (non are the reference)								
Regulation	0.00552 (0.0327)	-0.0195 (0.275)	0.367 (0.235)	-0.288 (0.183)	-0.0114 (0.0118)	0.132 (0.108)	-0.278 (0.229)	1.019** (0.369)
par30	-0.501** (0.184)	-3.031 (2.431)	-0.752 (0.414)	0.255 (0.235)	0.00717 (0.0153)	0.644 (0.406)	-0.842 (0.497)	-0.158 (0.171)
CAR	0.00413 (0.0155)	-0.390 (0.419)	-0.116 (0.0758)	1.342*** (0.214)	-0.0233 (0.0213)	0.442* (0.177)	-1.186*** (0.330)	0.00163 (0.0933)
Inflation	-0.223 (0.175)	-0.400 (0.877)	0.329 (0.731)	-3.831*** (1.033)	-0.00830 (0.0684)	0.845 (1.223)	0.440 (0.721)	1.624** (0.523)
Gdpc	0.00785 (0.00509)	-0.0344 (0.0537)	-0.0114 (0.0413)	-0.00135 (0.0187)	0.0110*** (0.00199)		-0.0220 (0.0552)	0.136* (0.0616)
Region (Southern Africa is the reference)								
Central Africa	0.0392 (0.101)	-2.122 (2.415)	-0.767* (0.374)	-0.142 (0.111)	0.0445 (0.0301)	0.387 (0.229)	-1.017** (0.372)	-0.720 (0.404)
West Africa	0.0571 (0.0510)	-1.800 (1.982)	-0.531 (0.351)	0.153 (0.124)	0.0527* (0.0233)	0.493*** (0.149)		-0.779* (0.364)
East Africa	0.0494 (0.0628)	-1.900 (1.950)	0.295 (0.338)	-0.00223 (0.105)	0.0751*** (0.0214)	0.537*** (0.161)	0.130 (0.255)	-0.381* (0.183)
L.roe		0.462*** (0.0397)				0.176* (0.0788)		
L.avloangni			0.418*** (0.0589)				0.742*** (0.0442)	
L.NAB				0.825*** (0.0581)				0.978*** (0.0424)
_cons	-0.235* (0.0938)	1.308 (1.866)	-1.385 (0.830)	0.576** (0.181)	-0.249*** (0.0331)	-1.344*** (0.256)	-3.192*** (0.529)	0.0249 (0.215)
<i>N</i>	52	52	311	56	391	392	456	99
<i>No. of groups</i>	39	39	82	43	120	121	137	76
<i>Instruments</i>	23	24	32	27	45	29	30	29
<i>AR (1): pvalue</i>	0.050	0.044	0.022	0.043	0.040	0.05	0.049	0.008
<i>AR (2): pvalue</i>	0.938	0.561	0.410	0.227	0.387	0.651	0.516	0.329
<i>Sargan test</i>	0.000	0.100	0.001	0.537	0.202	0.9	0.001	0.465
<i>Hansen J test: pvalue</i>	0.020	0.447	0.812	0.586	0.491	0.742	0.593	0.365
<i>Wald (χ^2)</i>	714.50***	637.97***	1091.42***	2070.09***	2047.66***	143.87***	13099.8***	41813.7***

Note : *Avloangni*= average loan per borrower as a percentage of gross national income; *ROA*= return on asset, *ROE* = return on equity; *NAB*=number of active borrowers; ; *NBFI*= non-banking financial institutions; *NGO*= non-governmental organization, *loan loss*= Losses on loans, *kalass*= capital/asset ratio of banks, *Par 30*= 30- day portfolio at risk, *CAR*= capital per asset ratio, *Gdpc* = annual growth rate of real GDP per capita,

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source : author's calculations based on Mix market and World Bank data

To analyze the effect of competition on the outreach of profit-oriented and non-profit MFIs, we have presented the results of the two-stage GMM system in Columns 4 and 7 of Table 9. These results allow us to observe that, in an environment characterized by high and disparate lending rates (Figure 1), competition improves the NAB of both profit-oriented and non-profit MFIs. This is probably because in SSA, the elimination of universal time associated with shocks is an excellent way of increasing the reach of profit-oriented (L.NAB: 0.825) and non-profit (L.NAB: 0.978) MFIs. However, it is important to point out the presence of a much more beneficial effect of competition on the NAB of profit-oriented MFIs (0.481) compared to that of non-profit MFIs (0.341). The existence of this disproportionate effect probably stems from the fact that between 2000 and 2017, the regulatory framework for microfinance in SSA did not allow non-profit MFIs to outperform profit-oriented MFIs (see regulation in Table 9). The positive relationship between competition and social performance of

SSA MFIs corroborates the empirical work of Kar (2016), Baquero et al. (2018), and Wondirad (2020), which have shown the benefits of competition on the scope of reach of American, European, and Asian microfinances.

To analyze the effect of competition on the depth of outreach of profit-oriented and non-profit MFIs, we have presented the results of the two-stage GMM system in Columns 3 and 6 of Table 9. The results in these Columns show that, in an environment characterized by high and disparate lending rates (Figure 1), competition decreases the average loan per borrower of both profit-oriented and non-profit MFIs. However, it is important to point out that competition has a much more detrimental effect on the average loan per borrower (avloangni) of non-profit MFIs (-4,740) than on that of profit-oriented MFIs (-3,462). This is probably because, in SSA, non-profit MFIs (NGOs, credit unions, and cooperatives) target wealthier borrowers, whereas profit-oriented MFIs (micro banks and NBFIs) are more oriented toward poor borrowers (avloangni definition of Lensink et al. (2018). The negative relationship linking competition to avloangni of profit-oriented and non-profit MFIs is broadly consistent with the empirical work of Hossain et al. (2020) and Meraj (2021), who showed the detrimental effect of competition on loan quality, borrower indebtedness, and expected loan repayment. Our results also corroborate ESH theory, which states that competition between MFIs is capable of causing loan losses that will undermine the trust between a customer and his or her MFI (Peltzman,1977). By combining ESH theory with financial intermediation theory, our study adds to the theoretical literature by showing that, in SSA, when the social mission drift of profit-oriented (avloangni -3.462) and non-profit (-4.740) MFIs stems from market power, it can degrade the welfare of customers who receive poor-quality financial services (average loans per borrower as a percentage of gross national income) at high lending rates (Simo et al.,2023). Despite the negative influence of competition on the avloangni of these MFIs, it is nevertheless found that, in SSA, competition does not automatically lead to a drift in the social mission of profit-oriented and non-profit MFIs, as it also enables these MFIs to improve their NAB. Given these results, policymakers in SSA countries need to improve the profitability and outreach of profit-oriented and non-profit MFIs by deploying a regulatory framework that will reduce the lending rates charged in the microfinance sector.

5) Conclusion

In order to serve market segments long neglected by conventional commercial banks, MFIs' physical and digital services have evolved in competitive markets that can influence their performance. In the empirical literature, some studies have analyzed the effect of competition on the performance of MFIs in Europe, America, and Asia. Despite the relevance of these studies, they did not consider the heterogeneity of financial services offered by profit-oriented MFIs (micro banks and NBFIs) and non-profit MFIs (credit unions/cooperatives and NGOs). Furthermore, these previous empirical studies did not analyze the effect of competition on the performance of profit-oriented and non-profit MFIs. To fill these gaps in the literature, we analyzed the effect of competition on the performance of MFIs in 37 SSA countries.

Our data were extracted from a dynamic panel of 3,105 MFI observations from the Mix Market and the World Bank for the period 2000 to 2017. Applying two-stage GMM, instrument-free inference from linear regression models with endogenous regressors, pooled fixed-effects OLS, and pooled random-effects OLS to these data, our results showed the existence of a detrimental effect of competition on the depth of outreach (avloangni) and profitability (ROA and ROE) of both profit-oriented and non-profit MFIs. Our results also showed the existence of a beneficial effect of competition on the depth of outreach (NAB: 0.481) of profit-oriented MFIs compared to that of non-profit MFIs (NAB: 0.341). The negative relationship linking competition to profitability (ROA and ROE) of profit-oriented and non-profit MFIs corroborates the work of Hossain et al. (2020), which showed the detrimental effect of competition on profitability in both developed and emerging economies. Although our results are similar to those of Hossain et al. (2020), they do not corroborate with the SCP theory (Mason, 1939), which states that competition provides market power capable of improving corporate profits. By combining the

SCP theory with the theory of financial intermediation, we also find that our results do not corroborate the first part of our two hypotheses. That part predicted that, in an environment characterized by high and disparate lending rates (Figure 1), competition would improve the profitability of both profit-oriented and non-profit MFIs.

The negative relationship between competition and avloangni for both profit-oriented and non-profit MFIs is broadly consistent with the empirical work of Hossain et al. (2020) and Meraj (2021), who have shown the detrimental effect of competition on loan quality, borrower indebtedness, and expected repayment. Our results also corroborate ESH theory, which states that competition between MFIs can cause loan losses that undermine the trust between a customer and their MFI (Peltzman, 1977). By combining ESH theory with financial intermediation theory, our study adds to the theoretical literature by showing that in SSA, when the social mission drift of profit-oriented (avloangni: -3.462) and non-profit (-4.740) MFIs stems from market power (competition), it can degrade the welfare of customers who receive poor-quality financial services (average loans per borrower as a percentage of gross national income) at high lending rates (Simo et al., 2023). Despite the negative influence of competition on avloangni for these MFIs, our findings suggest that in SSA, competition does not automatically lead to a drift in the social mission of profit-oriented and non-profit MFIs, as it also enables these MFIs to improve their NAB. Given these results, policymakers in SSA countries need to enhance the profitability and outreach of profit-oriented and non-profit MFIs by implementing a regulatory framework that reduces lending rates in the microfinance sector

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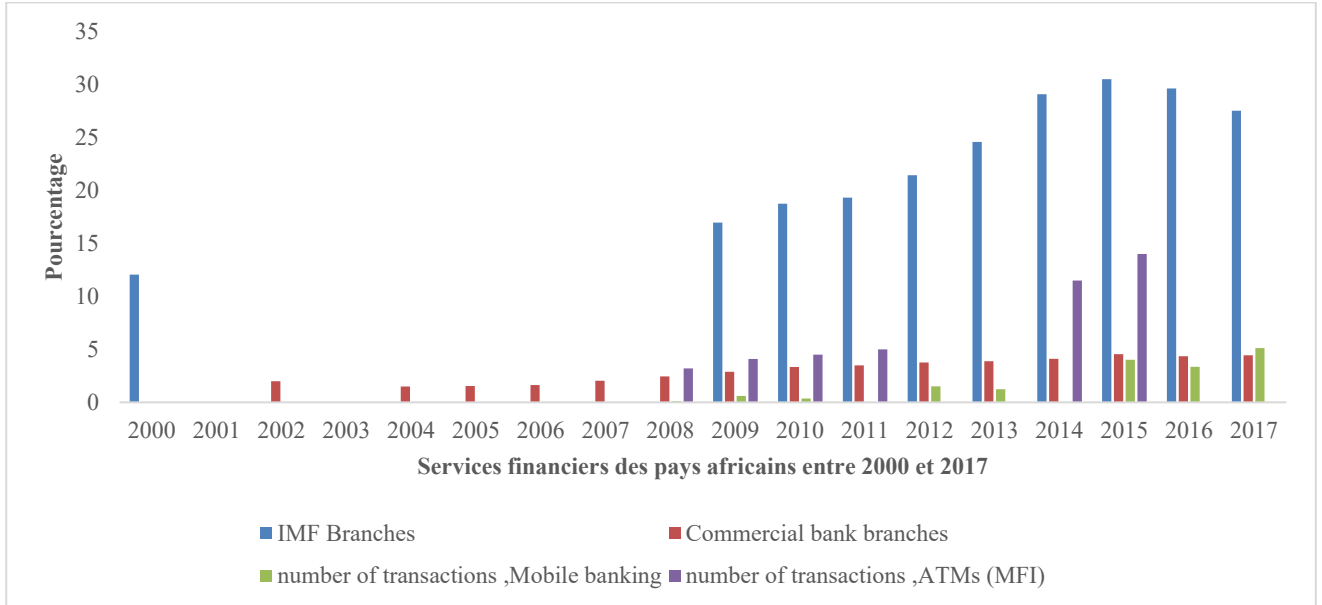
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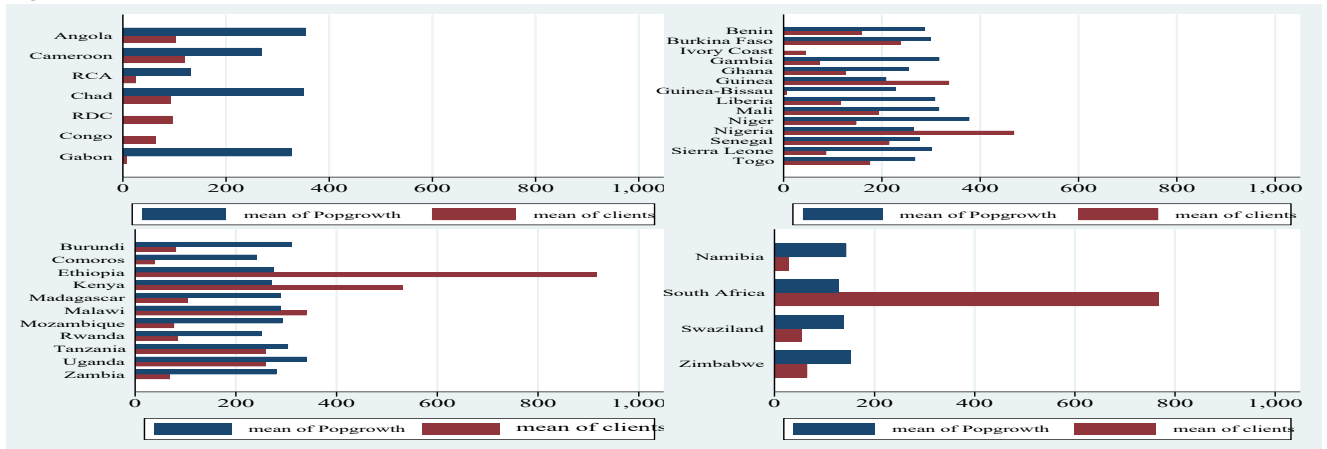
Appendix

Figure 3: formal and digital financial services provided by financial institutions (banks and MFIs) in SSA



Source: author's construction based on Mix market data and World Bank data.

Figure 4: Growth in the number of MFIs and customers in SSA



Source: author's construction based on Mix market data and World Bank data.

Table 1: Description of panel data

<i>Panel A : Distribution of MFIs by sub-region</i>		
<i>Region</i>	<i>Number of MFIs</i>	<i>% of the sample</i>
CENTRAL AFRICA	318	10.24%
WEST AFRICA	1506	48.50%
EAST AFRICA	1184	38.13%

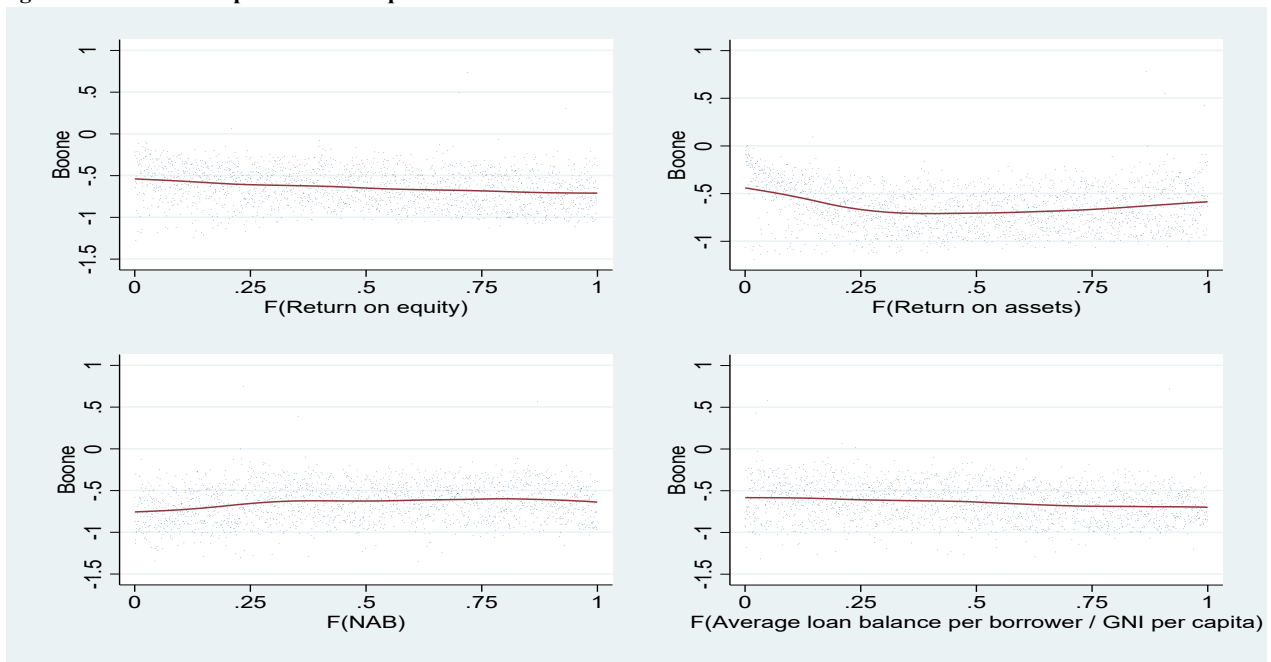
SOUTHERN AFRICA	97	3.12%
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Panel B: Distribution of MFI types by year

Years	Profit-oriented MFIs	Non-profit MFIs	Total MFIs
2000	23	30	53
2001	34	66	100
2002	47	109	156
2003	62	111	173
2004	62	106	168
2005	93	134	227
2006	101	129	230
2007	96	122	218
2008	102	120	222
2009	152	129	281
2010	137	124	261
2011	133	149	282
2012	100	129	229
2013	73	71	144
2014	63	64	127
2015	71	61	132
2016	44	51	95
2017	5	2	7
Number of observations	1398	1 707	3 105
Percentage (%)	45.02	54.98	100

Source: Author based on mix market data

Figure 9: Effect of competition on the performance of SSA MFIs



Source: author's construction based on Mix market data

Table 6: variables used to calculate the trans log cost function

Panel A: Description of the Variables used to calculate the trans log cost function of equation 7		
Variable	Notation	Measure
natural logarithm of total cost	TC it	TC it = total interest + excluding interest + administrative costs + other operating costs
the quality of the loan portfolio	Y it	Y it = total assets
3Input prices	W1 it	W1 it = labor price = Staff expenses/Total assets
	W2 it	W2 it = Fund Price = Interest Expense/Total Deposits
	W3 it	W3 it = Fixed capital price = Administrative and other operating expenses/Total assets

Panel B: Results of calculating the trans log cost function using the stochastic frontier method

independents	Variables	Ln (Total cost)
Ln Y		4.822*** (1.203)
Ln W1		-0.620 (0.407)
Ln W2		0.00383 (0.179)
Ln W3		-1.150*** (0.343)
Ln Y x Ln Y		-1.185*** (0.247)
Ln Y x Ln W1		0.155 (0.148)
Ln Y x Ln W2		0.00711 (0.0626)
Ln Y x Ln W3		0.140 (0.122)
Ln W1 x Ln W1		0.0609*** (0.0122)
Ln W2 x Ln W2		-0.000877 (0.00216)
Ln W3 x Ln W3		
Ln W1 x Ln W2		
Ln W2 x Ln W3		
Ln W1 x Ln W3		
_cons		
Sigma		
_cons		-0.927*** (0.0402)
Gamma		
_cons		-7.564 (0)
Mu		
_cons		-0.535 (0.310)
Eta		
_cons		0.481*** (0.0700)
N		1863

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ **Source:** author's construction based on Mix market data and World Bank data.

Table 7: Annual statistics for the variables used to arrive at Boone and Lerner

Years	TCit	Yit	W1 it	W2 it	W3 it	Π_{it}	MC	Boone	Lerner
2000	978250,8	13,95	1	1	1	100	83,79836	-0,69917	0,1620
2001	950852,4	13,681	1	1	1	100	89,2621	-0,78162	0,1074
2002	998696	13,77	1	1	1	100	90,76548	-0,77638	0,0923
2003	885930,6	14,13	19,9918	398,0176	66,076	89,52647	92,16601	-0,75248	-0,476
2004	1126875	14,42	26,9734	643,2351	79,98	90,31635	92,9295	-0,74301	-0,433
2005	1789274	14,28	27,8136	455,9117	111,55	83,85501	93,81177	-0,73828	-1,178
2006	1932381	14,39	50,2687	809,0347	154,79	78,02274	95,04337	-0,72007	-1,536
2007	3048710	14,83	48,2780	1263,802	204,05	73,51637	95,41695	-0,74461	-2,41
2008	3748770	15,02	71,6024	689644,4	280,20	70,98869	96,83119	-0,78039	-1,792
2009	4904585	14,72	49,1958	777,4334	224,32	78,63228	98,1828	-0,82104	-1,456
2010	4002682	14,67	48,1215	554,4079	207,19	77,58729	98,62165	-0,82424	-1,817
2011	4611964	15,13	33,5955	216,8081	170,27	80,45656	97,62051	-0,84608	-1,277
2012	5623291	15,25	34,0771	140,9375	159,60	82,60174	96,45468	-0,84215	-0,89
2013	6527683	16,01	60,7773	456,8678	273,59	70,31176	98,14374	-0,76855	-1,536
2014	7707113	16,10	89,6421	555,4657	337,83	67,85263	97,45159	-0,74345	-1,432
2015	6197775	16,40	63,3235	503,6978	228,29	74,26143	97,68368	-0,79232	-1,188
2016	6540679	16,80	70,5696	699,5218	239,76	76,22837	98,21142	-0,75455	-0,914
2017	7607881	16,75	119,5708	1007,228	435,41	74,40996	96,18988	-0,41392	-2,492

Source: Author based on mix market data.

Table 10: Robustness relative to the effect of competition on the profitability and outreach of profit oriented MFIs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	FE	RE	instrument-free inference	FE	RE	instrument-free inference	FE	RE	instrument-free inference	FE	RE	instrument-free inference
	Profitability						OUTREACH					
	Profitability			DEPTH OF OUTREACH			BREADTH OF OUTREACH					
	roa	roa	roa	Roe	Roe	roe	avloangni	avloangni	avloangni	NAB	NAB	NAB
L.roa	0.170*** (0.0464)	0.323*** (0.0403)	0.854*** (0.2150)									
Boone	-0.166*** (0.0467)	-0.0984*** (0.0292)	-0.114* (0.061)	-0.462*** (0.135)	-0.421*** (0.104)	-0.3581*** (0.1045)	-1.479*** (0.319)	-1.222*** (0.279)	-0.934*** (0.269)	0.142 (0.124)	0.112 (0.0619)	0.1702* (0.124)
rate	-0.00935*** (0.00229)	-0.000260 (0.000669)	0.0013 (0.0016)	-0.0295*** (0.00672)	-0.00446 (0.00299)	-0.0009 (0.002)	0.000355 (0.00927)	-0.000662 (0.00703)	-0.0049 (0.0056)	-0.00504 (0.00360)	-0.0015 (0.0012)	-0.002 (0.002)
loanloss	-0.273 (0.189)	-0.209 (0.130)	0.7225** (0.339)	-0.674 (0.559)	-0.861 (0.450)	-0.621 (0.4994)	-1.554 (0.998)	-0.898 (0.938)	0.536 (1.136)	-0.577 (0.389)	-0.398 (0.258)	-0.138 (0.406)
kalass	-0.0129 (0.0468)	0.0177 (0.0266)	0.0884 (0.0530)	0.0993 (0.139)	0.211* (0.102)	0.1102 (0.1021)	0.127 (0.280)	0.194 (0.253)	0.4479 (0.327)	-0.109 (0.110)	-0.0687 (0.0569)	-0.15** (0.068)
Age (the young MFI is the reference)												
New	0.0118 (0.0197)	0.000857 (0.0158)	-0.0011 (0.0197)	-0.0335 (0.034)	-0.0987 (0.0514)	-0.0542 (0.0602)	0.109 (0.113)	-0.0398 (0.154)	-0.183 (0.113)	0.0263 (0.0436)	0.00047 (0.0323)	0.048 (0.0334)
Mature	-0.00838 (0.0167)	0.00898 (0.0127)	0.0186 (0.0285)	-0.109* (0.0492)	-0.0379 (0.0436)	-0.109* (0.0495)	-0.0335 (0.103)	-0.063 (0.122)	0.0498 (0.103)	-0.0277 (0.0401)	0.00763 (0.0281)	-0.0401 (0.040)
Profit oriented (NBFIs are the reference)												

Micro-banks	0.0241 (0.0150)	-0.0015 (0.0284)		0.168* (0.0745)	0.0879* (0.0492)		0.0122 (0.220)	0.0122 (0.123)		0.0751** (0.0282)	-0.0148 (0.031)	
regulatory status (non-regulated MFI are the reference)												
Regulation	-0.00824 (0.0182)	-0.0354 (0.0312)		0.0434 (0.0886)	0.115* (0.062)		-0.0713 (0.256)	-0.013 (0.1498)		-0.0407 (0.0342)	-0.0195 (0.029)	
par30	0.0856 (0.0587)	0.0359 (0.0494)	-0.2047 (0.1398)	0.302 (0.174)	0.184 (0.159)	0.1377 (0.1883)	-0.572 (0.397)	-0.580 (0.376)	-0.802* (0.4595)	-0.152 (0.155)	-0.0017 (0.104)	0.114 (0.131)
CAR	-0.0224 (0.0155)	-0.00352 (0.0124)	-0.0058 (0.0155)	-0.0441 (0.0458)	-0.0144 (0.0413)	0.0016 (0.0458)	0.0695 (0.0464)	0.103 (0.131)	-0.02628 (0.1585)	0.342*** (0.0891)	0.305*** (0.0529)	0.490 (0.898)
Inflation	0.0737 (0.114)	-0.0344 (0.0954)	0.04596 (0.2845)	0.0554 (0.337)	-0.201 (0.307)	0.0898 (0.3584)	0.532 (0.775)	0.488 (0.783)	0.475 (0.9918)	0.302 (0.302)	0.0128 (0.221)	-0.477 (0.316)
Gdpc	0.0142 (0.0108)	0.00806* (0.00338)	-0.002 (0.008)	0.0703* (0.0319)	0.0407* (0.0160)	0.0129 (0.0128)	0.0577 (0.0786)	0.0286 (0.0452)	0.0141 (0.0290)	0.0231 (0.0313)	-0.0048 (0.0063)	-0.0162 (0.011)
Region (Southern Africa is the reference)												
Central Africa	-0.0294 (0.0418)	0.0380 (0.095)		-0.0143 (0.184)	-0.002 (0.1503)		-0.353 (0.540)	-0.2109 (0.3802)		-0.128 (0.0885)	-0.059 (0.103)	
West Africa	-0.0572 (0.0379)	0.0247 (0.0829)		-0.142 (0.164)	-0.0359 (0.1373)		-0.422 (0.483)	-0.298 (0.3448)		-0.113 (0.0793)	-0.074 (0.127)	
East Africa	-0.0485 (0.0371)	.0243759 (0.0836)		-0.0941 (0.160)	-0.0612 (0.1336)		0.0421 (0.472)	0.1534 (0.3382)		-0.170* (0.0781)	-0.067 (0.101)	
L.roe			0.00948 (0.0385)	0.0530* (0.0322)	0.36429*** (0.094)							
L.avloangni						0.991*** (0.0425)	0.769*** (0.0315)	.882*** (0.0425)				
L.NAB									0.918*** (0.0606)	1.089*** (0.0272)	1.147*** (0.257)	
_cons	0.0616 (0.0487)	-0.0202 (0.0471)	-0.11603 (.0989478)	0.207 (0.145)	-0.228 (0.194)	-0.2847 (0.172)	-0.996*** (0.295)	-0.426 (0.552)	-0.4581 (0.438)	0.249* (0.113)	0.293** (0.0969)	0.3086* (0.175)
<i>N</i>	263	263	263	261	261	261	311	311	311	311	311	
<i>Fisher Test</i>	F(11,175) = 5.32	Prob > F = 0.0000		F(11,174) = 3.69	Prob > F = 0.0001		F(11,218) = 52.90	Prob > F = 0.0000		F(11,218) = 110.17	Prob > F = 0.0000	
<i>Hauman Test</i>	chi2(11) = 60.49	Prob > chi2 = 0.0000		chi2(11) = 30.27	Prob > chi2 = 0.0014		chi2(11) = 48.13	Prob > chi2 = 0.0000		chi2(11) = 38.62	Prob > chi2 = 0.0001	
<i>Homoscedas- Ticity test</i>	chi2(1) = 88.50	Prob > chi 2 = 0.0000		chi2(1) = 28.78	Prob > chi2 = 0.0000		Chi2(1) = 2047.13	Prob > chi2 = 0.0000		chi2(1) = 1968.88	Prob > chi2 = 0.0000	

*Note: Avloangni= average loan per borrower as a percentage of gross national income; ROA= return on asset, ROE = return on equity; NAB=number of active borrowers; NBFi= non-banking financial institutions; loan loss= Losses on loans, kalass= capital/asset ratio of banks, Par 30= 30- day portfolio at risk, CAR= capital per asset ratio, Gdpc = annual growth rate of real GDP per capita, Standard errors in parentheses * p < 0.05, ** p < 0.01, *** p < 0.001 Source: author's calculations based on Mix market and World Bank data*

Tableau 11: Robustness relative to the effect of competition on the profitability and outreach of non-profit MFIs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	FE	RE	instrument-free inference	FE	RE	instrument-free inference	FE	RE	instrument-free inference	FE	RE	instrument-free inference
	Profitability						OUTREACH					
	Profitability			DEPTH OF OUTREACH			BREADTH OF OUTREACH					
	roa	roa	roa	Roe	roe	roe	avloangni	avloangni	avloangni	NAB	NAB	NAB
L.roa	0.370*** (0.0400)	0.482*** (0.0319)	0.8639*** (0.161)									
Boone	-0.238*** (0.0377)	-0.169*** (0.0255)	-0.0562 (0.053)	-1.223*** (0.188)	-0.991*** (0.134)	-0.576*** (0.172)	-1.621*** (0.328)	-0.865*** (0.192)	-0.659*** (0.241)	0.0831 (0.0553)	0.0423 (0.0297)	0.0184 (0.039)
rate	-0.00186 (0.00184)	0.000111 (0.000638)	-0.00012 (0.0006)	0.00273 (0.00919)	0.00518 (0.00374)	0.001 (0.00919)	0.0166 (0.0150)	0.00485 (0.00474)	0.0072 (0.005)	-0.00292 (0.00253)	0.00071 (0.0007)	0.0005 (0.001)

loanloss	0.0135 (0.186)	0.0449 (0.157)	0.331 (0.228)	-1.755 (0.913)	-1.609* (0.786)	-1.389 (0.954)	-1.021 (1.482)	0.111 (1.179)	0.458 (1.336)	0.113 (0.250)	-0.140 (0.183)	-0.1396 (0.227)
kalass	0.0390*** (0.00854)	0.0285*** (0.00681)	0.011 (0.010)	0.200*** (0.0426)	0.171*** (0.0351)	0.1038 (0.0426)	0.0529 (0.0433)	0.128* (0.0597)	0.0839 (0.0709)	-0.0117 (0.0132)	-0.0051 (0.0093)	0.035 (0.0127)
Age (the young MFI is the reference)												
New	-0.0513** (0.0185)	-0.0292 (0.0152)	-0.012 (0.0189)	-0.120 (0.0917)	-0.0684 (0.0775)	-0.0183 (0.0945)	-0.0455 (0.154)	0.0153 (0.120)	-0.0274 (0.136)	0.0351 (0.0265)	0.0110 (0.0186)	0.0352 (0.026)
Mature	0.0554*** (0.0162)	0.00668 (0.0108)	-0.0067 (0.012)	0.0914 (0.0796)	0.0265 (0.0576)	-0.0027 (0.0603)	-0.219 (0.135)	0.0188 (0.0919)	-0.134 (0.1306)	0.0181 (0.0229)	-0.0023 (0.0142)	-0.0268 (0.022)
Non Lucratif (les mutuelles et les coopératives sont la référence)												
ONG		0.0186 (0.0118)	-0.0002 (0.0113)		0.145* (0.0717)	0.1511** (0.0585)		-0.131 (0.0896)	0.0862 (0.152)		-0.0069 (0.0135)	-0.006 (0.017)
regulatory status (non-regulated MFI are the reference)												
Regulation		-0.00202 (0.0144)	0.0186 (0.0118)		-0.00605 (0.0870)	0.1043 (0.0729)		-0.0295 (0.103)	-0.0206 (0.116)		0.0149 (0.0161)	0.0234 (0.020)
par30	-0.108 (0.0686)	-0.00396 (0.0367)	0.0027 (0.0418)	-1.039** (0.344)	-0.528** (0.194)	-0.2470 (0.226)	-0.577 (0.435)	-0.640* (0.310)	-0.889* (0.371)	-0.188* (0.0736)	-0.0507 (0.0483)	0.0282 (0.0735)
CAR	-0.0479 (0.0930)	-0.0188 (0.0523)	-0.0479 (0.0529)	-0.420 (0.466)	-0.0666 (0.299)	0.0342 (0.2658)	1.160 (0.990)	-0.0239 (0.444)	-0.332 (0.524)	-0.165 (0.188)	-0.108 (0.0824)	-0.808 (0.391)
Inflation	0.0730 (0.115)	0.0245 (0.0950)	-0.0527 (0.115)	0.120 (0.574)	0.0703 (0.5517)	0.116 (0.574)	-0.852 (1.070)	-0.792 (0.831)	-1.026 (1.941)	0.0407 (0.181)	0.286* (0.130)	0.0235 (0.215)
Gdpc	-0.0311 (0.0179)	0.0111** (0.00411)	0.001 (0.006)	-0.0414 (0.0892)	0.034 (0.024)	-0.0414 (0.0892)	0.0317 (0.143)	-0.0109 (0.0291)	0.0165 (0.0356)	0.0331 (0.0255)	0.0254** (0.0051)	-0.012 (0.0211)
Region (Southern Africa is the reference)												
Central Africa		0.0903* (0.0440)	0.092 (0.0462)		0.170 (0.254)	0.0385 (0.236)		-0.425 (0.301)	-0.341 (0.340)		0.00480 (0.0467)	0.0167 (0.058)
West Africa		0.106*** (0.0301)	0.0186* (0.033)		0.239 (0.178)	0.210 (0.154)		-0.164 (0.223)	-0.270 (0.2567)		0.0234 (0.0346)	0.026 (0.043)
East Africa		0.118*** (0.0302)	0.0888* (0.031)		0.221 (0.180)	0.312* (0.152)		-0.0215 (0.221)	-0.0803 (0.249)		-0.0343 (0.0343)	-0.001 (0.046)
L.roe				0.0779* (0.0374)	0.122*** (0.0314)	0.468*** (0.0374)						
L.avloangni							-0.127 (0.0867)	0.779*** (0.0313)	1.11*** (0.178)			
L.NAB										1.101*** (0.0342)	1.129*** (0.0180)	1.408*** (0.0342)
_cons	-0.147*** (0.0376)	-0.252*** (0.0367)	-0.1130 (0.067)	-0.796*** (0.187)	-1.091*** (0.210)	-0.804*** (0.205)	-0.0412 (0.328)	-0.141 (0.262)	-0.2589 (0.3004)	0.0773 (0.0540)	-0.0099 (0.0407)	-0.0327 (0.0519)
<i>N</i>	391	391	391	392	392	392	456	456	456	457	457	457
<i>Fisher Test</i>	F ((11,260) = 19.00	Prob > F = 0.0000		F(11,260) = 6.81	Prob > F = 0.0000		F(9,348) = 4.70	Prob > F = 0.0000		F(9,352) = 282.20	Prob > F = 0.0000	
<i>Hauman Test</i>	chi2(11) = 46.48	Prob > chi2 = 0.0000		chi2(11) = 15.71	Prob > chi2 = 0.1522		chi2(9) = 165.72	Prob > chi2 = 0.0000		chi2(9) = 34.43	Prob > chi2 = 0.0001	
<i>Homoscédas-Ticity test</i>	chi2(1) = 327.53	Prob > chi2 = 0.0000		chi2(1) = 218.72	Prob > chi2 = 0.0000		chi2(1) = 5737.53	Prob > chi2 = 0.0000		chi2(1) = 579.12	Prob > chi2 = 0.0000	

Note: *Avloangni*= average loan per borrower as a percentage of gross national income; **ROA**= return on asset, **ROE** = return on equity; **NAB**=number of active borrowers; ; **NGO**= non-governmental organization; **loan loss**= Losses on loans, **kalass**= capital/asset ratio of banks, **Par 30**= 30- day portfolio at risk, **CAR**= capital per asset ratio, **Gdpc** = annual growth rate of real GDP per capita,

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source : author's calculations based on Mix market and World Bank data



Mission

To strengthen local capacity for conducting independent, rigorous inquiry into the problems facing the management of economies in sub-Saharan Africa.

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